Safety technique

DOLD

Product range

Safety technique

- Safety switching devices
- Standstill / speed monitoring
- Multifunctional safety devices
- Wireless Safety System
- Safety switches
- Guard locks
- Key transfer

Monitoring technique

- Residual current monitors
- Insulation monitors
- Insulation fault location system
- Measuring and monitoring relays
- Fault annunciators and fault annunciator systems
- SMS-Telecontrol module

Power electronics

- Solid-state relays /- contactors
- Reversing contactors
- Softstarters
- Motor brake relays
- Speed and phase controllers
- Multifunctional motor control units

Control technique

- Latching / interface / switching relays
- Interface modules
- Power supply units
- I / O modules
- CANopen PLC
- CANopen I / O modules

Time control technique

- Multifunction relays
- Flasher relays
- Cyclic timers
- Fleeting action relays
- Pulse extender
- Star delta timers
- Timers
  - on delayed
  - off delayed

Installation technique

- Time switches
- Remote switches
- Specific installation electronics

- Machinery and plant
- Power generation/distribution
- Oil and gas industry
- Automation
- Transport and material handling systems
- Rail technology
- Aviation/marine industry
- Paper and printing industry
- Food industry
- Rubber/plastics industry
- Heating and refrigeration
- Automotive
- Mining/metal working
- Chemical/pharmaceutical applications
- Medical technology
- Water/waste water treatment
- Cable cars/ski lifts

… and wherever safety has high priority.
We can cover your industrial applications as well!

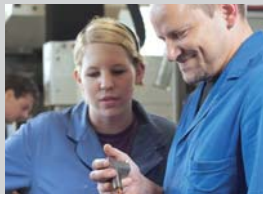
DOLD –
Solutions for you









The DOLD philosophy, “Our experience. Your safety” constitutes our program: Offering solutions based on over 80 years of experience with a workforce of more than 400 employees, we manufacture high quality products using state-of-the-art production plant at our Furtwangen facility in Germany.

The comprehensive product range includes relay modules, safety relays with positively-driven contacts and electronic housings with virtually unparalleled production detail. The combination of know-how, innovation and experience makes us one of the leading worldwide manufacturers.

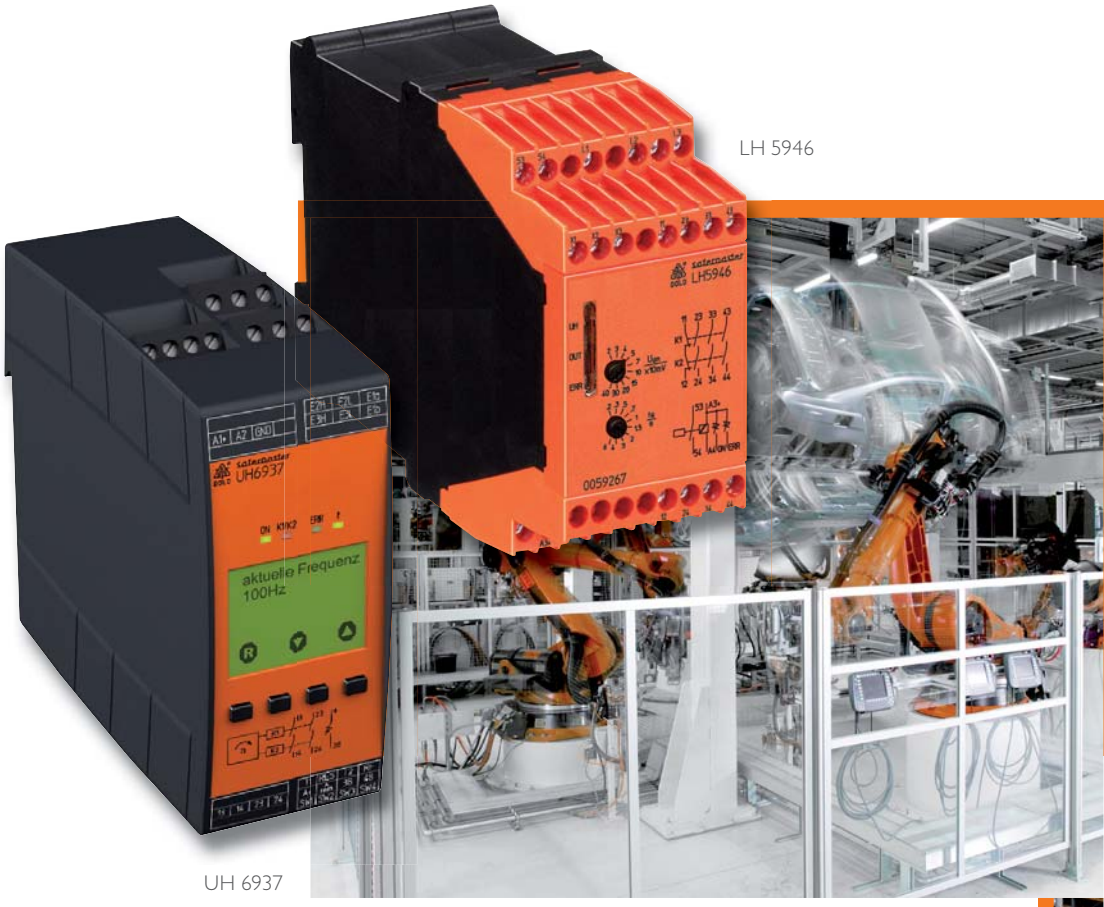
Apart from standard solutions, we are also the right partner when individual industrial solutions with that special touch are required.

Staying in close contact with our customers is very important to us. We listen, analyze and act by offering flexible, custom high-tech solutions, from a single source.

Thanks to our own development laboratory, highly automated production facilities with a modern tool & die shop in addition to injection moulding facility togehter with a well organized sales and marketing department, we guarantee high quality and short delivery times. Your benefits: Increased plant and machine availability, planning reliability and low production costs.

SAFEMASTER S
– Safe drive monitoring

The new speed monitors of the SAFEMASTER S series recognize and signal downtimes and machine and system speeds in both automatic and set-up modes. With these devices, DOLD is offering efficient, economical solutions for safe monitoring drives without sensors and for monitoring speed using initiators.



LH 5946

UH 6937

UF 6925

SAFEMASTER
– Safety relay modules from 17.5 mm

The only 17.5 mm wide emergency stop module monitors safety functions such as emergency stop or safety door safely and simply in nearly every application and is characterised by maximum safety for man and machine with minimum space requirement. It allows time-saving wiring through the integrated front-side Push-In cage clamp terminals.

The modular and configurable safety system SAFEMASTER PRO monitors all safety circuits of your machines and installations – in a simple, flexible and safe manner.

Functional Safety Solutions

Safety relay modules of the SAFEMASTER family monitor a variety of safety functions such as emergency-stop, two-hand controls, safety mats, and light barriers. From monofunctional safety switching devices to multifunctional modular safety system with field bus connection, all products serve a single purpose: the uncompromising protection of people and machinery. Manufacturers and operators of machines and systems are faced with the challenge of developing and/or operating safety-oriented switching devices that must meet numerous regulations. DOLD supports its customers with type-tested safety relay devices for safety applications up to Cat. 4 / PL e and SIL 3, with which you can implement solutions optimized for functionality and cost.

UH 6900

The radio controlled safety module of the SAFEMASTER W series for the safety-oriented transmission of e-stop and control functions offers more flexibility in the protection of hazardous areas. By implementing the latest radio controlled technologies, a high degree of availability and safety is achieved. Safety zones can be connected wirelessly to each other over a considerable distance.

UH 6900

SAFEMASTER W
– Radio controlled safety system

SAFEMASTER STS combines the advantages of safety switches, guard locks, key transfer and command functions in a single system. The new fibre reinforced polymer (FRP) variant will convince you by its ambitious design and it offers the possibility to be combined with the established stainless steel components. You can easily select the FRP variant for the control panel while you prefer using the very robust stainless steel version in rough environmental conditions.

SAFEMASTER STS – Modular safety switch and key transfer system

SAFEMASTER STS is tested and approved according to statutory requirements, and as an individual system is suitable for use in safety applications up to Cat. 4 / PL e in accordance with EN ISO 13849-1.

Table of contents

Alphabetical index

Alphabetical index

Function index

Function index

Product selection

Safety switch and key interlock system SAFEMASTER STS / K
Fibre-reinforced polymer version (FRP)

The basic units

Function	Mechanical	Electro-mechanical	2 contacts C/O, 1 contact NC	2 contacts C/O, 1 contact NC 2 contacts NC, 1 contact C/O	Locking function	Forded key entry	Forced key extraction	Optional key extraction	Separate actuator	24 V DC/AC	Type
Mechanical guard locking	x				x	x			x		**M10BM/K**
Mechanical guard locking	x				x	x	x		x		**M11BM/K**
Mechanical guard locking	x				x	x		x	x		**M10B01M/K**
Key exchange	x					x	x				**M12M/K**
Safety switch			x						x	x	**SXBM/K**
Safety switch			x		x		x		x	x	**SX01BM/K**
Safety switch			x					x	x	x	**SXB01M/K**
Safety switch			x				x			x	**SX01M/K**
Safety switch with locking		x		x	x				x	x	**ZRHBM/K**
Safety switch with locking		x		x	x		x		x	x	**ZRH01BM/K**
Safety switch with locking		x		x	x			x	x	x	**ZRHB01M/K**
Safety switch with blocked key		x		x			x			x	**ZRH01M/K**


STS/K-M10BM


STS/K-M11BM


STS/K-M10B01M


STS/K-M12M


STS/K-SXBM


STS/K-SX01BM


STS/K-SXB01M


STS/K-SX01M


STS/K-ZRHBM


STS/K-ZRH01BM


STS/K-ZRHB01M


STS/K-ZRH01M

Product selection

Safety switch and trapped key interlock system SAFEMASTER STS
Stainless steel version

The basic units

Function	Mechanical	Electro-mechanical	2 contacts C/O, 1 contact NC	2 contacts C/O, 1 contact NC 2 contacts NC, 1 contact C/O	Locking function	Forded key entry	Forced key extraction	Optional key extraction	Separate actuator	24 V DC/AC	Type
Mechanical guard locking	x				x	x			x		**M10A**
Mechanical guard locking	x				x	x	x		x		**M11A**
Mechanical guard locking	x				x	x		x	x		**M10B01M**
Key exchange	x					x	x				**M12M**
Safety switch			x						x	x	**SXA**
Safety switch			x		x		x		x	x	**SX01A**
Safety switch			x					x	x	x	**SXB01M**
Safety switch			x				x			x	**SX01M**
Safety switch with locking		x		x	x				x	x	**ZRHA**
Safety switch with locking		x		x	x		x		x	x	**ZRH01A**
Safety switch with locking		x		x	x			x	x	x	**ZRHB01M**
Safety switch with blocked key		x		x			x			x	**ZRH01M**


STS-M10A


STS-M11A


STS-M10B01M


STS-M12M


STS-SXA


STS-SX01A


STS-SXB01M


STS-SX01M


STS-ZRHA


STS-ZRH01A


STS-ZRHB01M


STS-ZRH01M

Product selection

Emergency stop modules SAFEMASTER

Function	Also suited as safety gate monitor	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Output contacts max.	Thermal current Ith max.	Cross fault detection	Nominal voltage DC	Nominal voltage AC	Nominal voltage Ac / DC	Connection	Width [mm]	Type	Page
Emergency stop module, most compact design		4/e	3	1; 2	1 NO	5		+			S/ PC/ PT	17,5	**RK 5942**	41
Emergency stop module	+	4/e	3	2	3 NO	8	+	+			PC	17,5	**UF 6925**	49
Emergency stop module		4/e	3	1; 2	4 NO	5		+	+	+	PS	22,5	**BG 5924**	57
Emergency stop module	+	4/e	3	1; 2	4 NO	5	+	+		+	PS	22,5	**BG 5925**	64
Emergency stop module		4/e	3	1; 2	4 NO	5		+	+		S/ PS/ PC	22,5	**LG 5924**	72
Emergency stop module	+	4/e	3	1; 2	4 NO	8	+		+	+	S/ PS/ PC	22,5	**LG 5925**	79
Safety module for elevator control		4/e	3	1;2	3 NO; 1 NC	5	+			+	S/ PS/ PC	22,5	**LG 5925/034**	88
Emergency stop module with delay up to 300s	+	4/e	3	1; 2	2 NO; 1 NOv	8	+	+			S/ PS/ PC	22,5	**LG 5928**	95
Emergency stop module	+	4/e	3	1; 2	3 NO; 1 NC	10	+	+	+		PS	45	**BD 5935**	103
Emergency stop module	+	4/e	3	1; 2	2 NO	10	+	+	+		S	45	**BD 5987**	110
Emergency stop module with power failure detection		4/e	3	1; 2	3 NO	5	+	+			PS	45	**BH 5903**	117
Emergency stop module with delay up to 300s	+	4/e	3	1; 2	3 NO; 3 NOv	5	+	+		+	PS	45	**BH 5928**	121
Emergency stop module with delay up to 300s	+	4/e	3	1; 2	3 NO; 3 NOv	5	+	+		+	PS	67,5	**BI 5928**	121
Emergency stop module		4/e	3	1; 2	4 NO	5			+	+	PS	70	**IP 5924**	57
Emergency stop module with power failure detection		4/e	3	1; 2	3 NO	5	+		+		PS	90	**BL 5903**	117
Emergency stop module	+	4/e	3	1; 2	3 NO; 1 NC	10	+	+	+		PS	100	**BN 5930.48/203**	130
Emergency stop module	+	4/e	3	1; 2	3 NO; 1 NC	10	+	+	+		PS	100	**BN 5930.48/204**	130
Emergency stop module	+	4/e	3	1; 2	3 NO; 1 NC	10		+	+		PS	100	**BN 5983**	136

NO = normally open contact; NC = normally closed contact; NOv = contact delayed
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals;
PS = removable terminal blocks, with screw terminals; PT = plug-in twin spring terminal
For multiple monitored emergency-stop buttons in combination with further safety functions see **SAFEMASTER C** and **SAFEMASTER M**

Product selection

Safety gate monitors SAFEMASTER

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Output contacts max.	Thermal current Ith I_{th} max. [A]	Cross fault detection	Nominal voltage DC	Nominal voltage AC	Connection	Width [mm]	Type	Page
Switch gear for safety switch	4/e	3	2	3 NO	5	+	+		PS	22,5	**BG 5925/920**	142
Safety module for safety switches	4/e	3	1; 2	4 NO	8	+	+		S/ PS/ PC	22,5	**LG 5925/920**	149
Emergency stop module / safety gate monitor	4/e	3	1; 2	3 NO; 1 NC	5		+	+	PS	100	**BN 5930.48**	156
Emergency stop module with time delay up to 600s / safety gate monitor	4/e	3	1; 2	3 NO; 1 NC; 1 NOv	10	+	+	+	PS	100	**BO 5988.47**	162
Emergency stop module / safety gate monitor	4/e	3	1; 2	6 NO; 1 NC	10	+	+	+	PS	100	**BO 5988.61**	162

NO = normally open contact; NC = normally closed contact; NOv = contact delayed
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals; PS = removable terminal blocks, with screw terminals
For multiple monitored safety gate monitors in combination with further safety functions see **SAFEMASTER C** and **SAFEMASTER M**

Light curtain controllers SAFEMASTER

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Output contacts max.	Nominal voltage DC	Thermal current Ith max.	Removable terminals	Width [mm]	Type	Page
Light curtain controller	4/e	3	1; 2	3 NO	+	5	PS	22,5	**BG 5925/900**	171
Light curtain controller	4/e	3	1; 2	4 NO	+	8	S/ PS/ PC	22,5	**LG 5925/900**	178
Light curtain controller	4/e	3	1; 2	3 NO	+	5	PS	45	**BH 5902/01MF2**	185

NO = normally open contact; NC = normally closed contact
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals; PS = removable terminal blocks, with screw terminals
For multiple monitored light barriers in combination with further safety functions see **SAFEMASTER C** and **SAFEMASTER M**

Product selection

Two-hand controllers SAFEMASTER

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	Safety integrity level according to EN 574	Output contacts max.	Nominal voltage DC	Nominal voltage AC	Thermal current I_{th} max.	Removable terminals	Width [mm]	Type	Page
Two-hand safety relay	4/e	3	III C	2 NO; 1 NC	+	+	5	PS	22,5	**BG 5933**	199
Two-hand safety relay with var. Terminals	4/e	3	III C	3 NO; 1 NC	+	+	5	S/ PS/ PC	22,5	**LG 5933**	207
Two-hand safety relay	1/c	1	III A	2 NO	+	+	5	S	45	**BD 5980N**	214
Two-hand safety relay	4/e	3	III C	3 NO; 1 NC	+	+	5	PS	45	**BH 5933**	199

NO = normally open contact; NC = normally closed contact
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals; PS = removable terminal blocks, with screw terminals

Safety mat controllers SAFEMASTER

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Output contacts max.	Nominal voltage DC	Nominal voltage AC / DC	Thermal current I_{th} max.	Removable terminals	Width [mm]	Type	Page
Safety-mat switch gear	4/e	3	2	3 NO	+		5	PS	22,5	**BG 5925/910**	219
Safety edge module	4/e	3	2	2 NO		+	5	PS	22,5	**LG 5944**	226

NO = normally open contact; NC = normally closed contact
PS = removable terminal blocks, with screw terminals

Product selection

Extension modules

Function	Cat. / PL according to EN INOO 13849-1	NOIL CL according to IEC/EN 62061	Output contactNO max.	Nominal voltage DC	Nominal voltage AC	Thermal current I_{th} max.	Removable terminalNO	Width [mm]	Type	Page	NOeite
ExtenNOion module	4/e	3	5 NO; 1 NC			+	5	PS	22,5	**BG 5929**	233
ExtenNOion module	4/e	3	5 NO; 1 NC	+	+	+	5	S/ PS/ PC	22,5	**LG 5929**	236
ExtenNOion module	4/e	3	7 NO; 1 NC		+	+	8	PS/ PT/ PC	22,5	**UG 6929**	243
ExtenNOion module	4/e	3	7 NO; 1 NC	+	+	+	10	PS	100	**BN 3081**	251

NO = normally open contact; NC = normally closed contact
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals;
PS = removable terminal blocks, with screw terminals; PT = plug-in twin spring terminal

Delay modules

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Output contacts max.	Nominal voltage DC	Nominal voltage AC	Nominal voltage AC/DC	Thermal current $I_{/}$ max. [A]	Time delay max. [s]	Connection	Width [mm]	Type	Page
Release delayed, adjustable time range	2/d	2	1	3 NO; 1 NC		+	+	5	10	PS	22,5	**BG 7925**	255
Release delayed, fixed	2/d	2	1	5 NO; 1 NC			+	5	3	PS	22,5	**BG 7926**	262
On delayed, fixed or adjustable time range	3/d	2	1	4 NO; 1 NC			+	5	300	S/ PS/ PC	22,5	**LG 7927**	265
Release delayed, fixed or adjustable time range	3/d	2	1; 2	4 NO; 1 NC			+	5	300	S/ PS/ PC	22,5	**LG 7928**	272
Release delayed, fixed or adjustable time range	2/c	2	1	1 NO; 1 NC	+			8	10	S	35	**IL 7824**	279
Release delayed, fixed or adjustable time range	2/c	2	1	1 NO; 1 NC	+	+		8	30	S	45	**BA 7924**	279
Release delayed, fixed or adjustable time range	2/d	2	1	3 NO; 1 NC		+	+	5	10	S	45	**BH 7925**	255
Release delayed, fixed or adjustable time range	2/c	2	1	1 NO; 1 NC	+			8	10	S	52,5	**IN 7824**	279

NO = normally open contact; NC = normally closed contact
S = screw terminal fixed; PC = removable terminal blocks, with cage clamp terminals; PS = removable terminal blocks, with screw terminals
For multiple monitored delay modules in combination with further safety functions see **SAFEMASTER M**

Product selection

Interface modules, forcibly guided

1-channel, optionally also suited for low loads. Coil voltages partly possible up to 240 V AC/DC

Function	Output contacts max.	Thermal current Ith max. [A]	Enclosure design	Width [mm]	Type	Page
Interface module, with plug-type socket	1 NO; 1 NC	5	Switch cabinet	15,8	**HC 3098**	285
Interface module	1 NO; 1 NC	8	Distribution board	17,5	**IK 3079**	289
Interface module, with plug-type socket	3 NO; 1 NC	3 x 5	Switch cabinet	18	**HC 3096N**	291
Interface module	5 NO; 1 NC	5	Switch cabinet	22,5	**LG 3096**	295
Interface module	5 NO; 1 NC	5	Switch cabinet	22,5	**MK 3096N**	295
Interface module	4 NO; 4 NC	6	Switch cabinet	22,5	**UG 3096**	298
Interface module	6 NO; 2 NC	2,5	Switch cabinet	22,5	**UG 3088**	302
Interface module	1 NO; 1 NC	25	Switch cabinet	22,5	**HK 3087N**	305
Interface module, with plug-type socket	4 NO; 2 NC	4 x 5	Switch cabinet	36	**HL 3096N**	291
Interface module, with plug-type socket	2 NO; 2 NC	3 x 8	Switch cabinet	38	**HL 3094**	310
Interface module	8 NO; 8 NC	6	Switch cabinet	45	**UH 3096**	298
Interface module	2 NO; 2 NC	8	Distribution board	70	**IP 3078**	308
Interface module	2 NO; 2 NC	8	Switch cabinet	70	**SP 3078**	308
Interface module, with plug-type socket	3 NO; 3 NC	3 x 8	Switch cabinet	73,3	**HO 3094**	310
Interface module, with plug-type socket	4 NO; 4 NC	3 x 8	Switch cabinet	73,3	**HO 3095**	310

NO = normally open contact; NC = normally closed contact

Speed and standstill monitoring SAFEMASTER S

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	1- / 2-channel	Forcibly guided output contacts max.	Indicator contacts	Nominal voltage DC	Nominal voltage AC/DC	Nominal voltage AC	Thermal current I_{th} max.	Measuring-/ Motor Voltage max.	Width [mm]	Type	Page
Speed or standstill monitor	3/e	3	2	2 NO; 1 NC			+	+	4		45	**BH 5932**	314
Standstill monitor	4/e	3	2	3 NO; 1 NC	2 hl; 1 s	+		+	5	690	45	**LH 5946**	322
Speed monitor	4/e	3	2	4 NO	2 hl	+	+		5		45	**UH 5947**	335
Speed monitor	4/e	3	2	2 NO	2 hl	+			8		45	**UH 6932**	350
Frequency monitor	4/e	3	2	2 NO	2 hl	+			8	690	45	**UH 6937**	361

NO = normally open contact; NC = normally closed contact; hl = semiconductor

Product selection

Multifunctional safety modules SAFEMASTER C

Function	Application emergency stop	Application light barrier	Application safety gate	Application two-hand	Application safety mat	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	Safe output contacts, redundant NO contacts max.	Auxiliary contacts	Feedback for external monitoring	Width [mm]	Type	Page
Multifunctional safety timer with instantaneous contacts	+	+	+	+	+	4/e	3	4			22,5	**UG 6960**	373
Multifunctional safety timer	+	+	+	+	+	4/e	3	2			22,5	**UG 6961**	384
Multifunctional safety module	+	+	+	+	+	4/e	3	4			22,5	**UG 6970**	395
Multifunctional safety module	+	+	+	+	+	4/e	3	2			22,5	**UG 6980**	405
Multifunction safety module	+	+	+	+		4/e	3	3	1	+	45	**BH 5910**	414

For more complex applications see **SAFEMASTER PRO**

Software free safety system SAFEMASTER M

Function	Application emergency stop	Application light barrier	Application safety gate	Application two-hand	Application start	Application stop	Cat. / PL according to EN ISO 13849-1	Safety integrity level according to EN 574	Safe output contacts, redundant NO contacts	Safe output contacts, time delay	Auxiliary contacts	Feedback for external monitoring	Width [mm]	Type	Page
Diagnostic Module for CANopen													22,5	**BG 5551**	438
Output module							4/e		4			+	22,5	**BG 5912.04**	450
Output module							4/e		3		1	+	22,5	**BG 5912.48**	450
Output module							4/e			3		+	22,5	**BG 5912.86**	450
Output module							4/e			2	1	+	22,5	**BG 5912.95**	450
Input module	+	+	+	+			4/e	III A / III C					22,5	**BG 5913.08/_0___**	456
Input module	+	+	+	+			4/e	III C					22,5	**BG 5913.08/_1___**	468
Input module	+	+	+	+			4/e	III C					22,5	**BG 5913.08/_2___**	477
Input module	+	+		+			4/e	III C					22,5	**BG 5913.08/_3___**	489
Input module	+	+					2/d						22,5	**BG 5914.08/_0___**	497
Input module	+	+	+				4/e						22,5	**BG 5915.08/_1___**	504
Diagnostic Module for Profibus DP													45	**BH 5552**	444
Control unit	+	+			+	+	4/e		3			+	45	**BH 5911.03**	516
Control unit	+	+			+	+	4/e		3		1	+	45	**BH 5911.22**	516
Input module with isolated inputs	+	+	+	+			4/e	III A / III C					45	**BH 5913.08/_0___**	456
Input module with isolated inputs	+	+					2/d						45	**BH 5914.08/_0___**	497
Input module with isolated inputs	+	+	+				4/e						45	**BH 5915.08/_1___**	504

Product selection

Multifunctional safety system SAFEMASTER PRO

Function	Emergency stop	Light curtain	Safety gate	Two-hand	Safety mat	Cat. / PL according to EN ISO 13849,1	SIL CL acc. to IEC/EN 62061	Safety inputs max.	Safety NO contacts	NC contact max.	Safety dual-channel OSSD oututs max.	Width [mm]	Type
Control unit	+	+	+	+	+	4/e	3	8			2	22,5	**UG 6911.10**
Output module OSSD						4/e	3				4	22,5	**UG 6912.02**
Output module Relay expansion						4/e	3		4	2		22,5	**UG 6912.14**
Output module Relay expansion						4/e	3		4	2		22,5	**UG 6912.28**
Input module	+	+	+	+	+	4/e	3	16			2	22,5	**UG 6913**
Input / output module	+	+	+	+	+	4/e	3	8				22,5	**UG 6916.10**
Bus Extender						4/e	3					22,5	**UG 6918**
Fieldbus module CANopen						4/e	3					22,5	**UG 6951**
Fieldbus module PROFIBUS-DP						4/e	3					22,5	**UG 6952**
Fieldbus module PROFINET						4/e	3					22,5	**UG 6954**
Fieldbus module Ethernet/IP						4/e	3					22,5	**UG 6955**
Fieldbus module EtherCAT						4/e	3					22,5	**UG 6956**
Fieldbus module USB						4/e	3					22,5	**UG 6957**

Speed monitor modules SAFEMASTER PRO

Function	Cat. / PL according to EN ISO 13849-1	SIL CL according to IEC/EN 62061	Alarm buzzer encoder TTL	Alarm buzzer encoder HTL	Alarm buzzer encoder sinCos	Alarm buzzer proximity sensor	Width [mm]	Type
Speed monitor module	4/e	3				2	22,5	**UG 6917/002**
Speed monitor module	4/e	3	1			2	22,5	**UG 6917/102**
Speed monitor module	4/e	3		1		2	22,5	**UG 6917/202**
Speed monitor module	4/e	3			1	2	22,5	**UG 6917/302**
Speed monitor module	4/e	3	2			2	22,5	**UG 6917/112**
Speed monitor module	4/e	3		2		2	22,5	**UG 6917/222**
Speed monitor module	4/e	3			2	2	22,5	**UG 6917/332**

Product selection

Radio controlled safety system SAFEMASTER W - Pair mode

Function	Frequency band (MHz)	Safety inputs max.	Safety NO contacts max.	NC contact max.	Semiconductor inputs max.	Semiconductor outputs max.	Connection	Cat. / PL according to EN ISO 13849-1	SIL CL acc. to IEC/EN 62061	SIL acc. to IEC/EN 61508	SIL acc. IEC/EN 61511	Width [mm]	Type	Page
Radio controlled safety module	433/ 434; 869	3	2[1)] 3[1)]	1 0	8	8	PS/ PC/ PT	4/e	3	3	3	45	**UH 6900**	524

[1)] Forcibly guided contacts
PS = removable terminal blocks, with screw terminal; PC = Removable terminal blocks, with cage clamp terminals;
PT = removable terminal blocks, with cage clamp terminals 2 wire

Radio controlled safety system SAFEMASTER W - Group mode

Function	Frequency band (MHz)	Safety inputs max.	Safety NO contacts max.	NC contact max.	Semiconductor inputs max.	Semiconductor outputs max.	Connection	Cat. / PL according to EN ISO 13849-1	SIL CL acc. to IEC/EN 62061	SIL acc. to IEC/EN 61508	SIL acc. IEC/EN 61511	Width [mm]	Type	Page
Radio controlled safety module (Group Controller)	433/ 434; 869	3	2 3	1 0	8	8	PS/ PC/ PT	4/e	3	3	3	45	**UH 6900**	533
Radio controlled safety module (Group Receiver)	433/ 434; 869	3	2[1)] 3[1)]	1 0	8	8	PS/ PC/ PT	4/e	3	3	3	45	**UH 6900**	542

[1)] Forcibly guided contacts
PS = removable terminal blocks, with screw terminal; PC = Removable terminal blocks, with cage clamp terminals;
PT = removable terminal blocks, with cage clamp terminals 2 wire

Product selection

Wireless enabling switch SAFEMASTER W

Function	Application emergency stop	Application light barrier	Application safety gate	Application start	Application wireless	Cat. / PL according to EN ISO 13849-1	Safe output contacts, redundant NO contacts	NC contact max.	Feedback for external monitoring	Solid state outputs not safe (radio)	Width [mm]	Type	Page
Radio controlled safety module	+	+	+	+	+	4/e	3	1	+	6	67,5	**BI 6910**	553
Radio controlled enabling switch												**RE 6910**	557

Wireless emergency stop SAFEMASTER W

Function	Application emergency stop	Application light barrier	Application safety gate	Application start	Application wireless	Cat. / PL according to EN ISO 13849-1	Safe output contacts, redundant NO contacts	NC contact max.	Feedback for external monitoring	Solid state outputs not safe (radio)	Width [mm]	Type	Page
Radio controlled safety module	+	+	+	+	+	4/e	3	1	+	6	67,5	**BI 5910**	561
Remote control for e-stop												**RE 5910**	565
Power supply for AC 230 V												**RE 5910/011, RE 5910/013**	567
Power supply for DC 24 V												**RE 5910/012**	568

Special devices SAFEMASTER

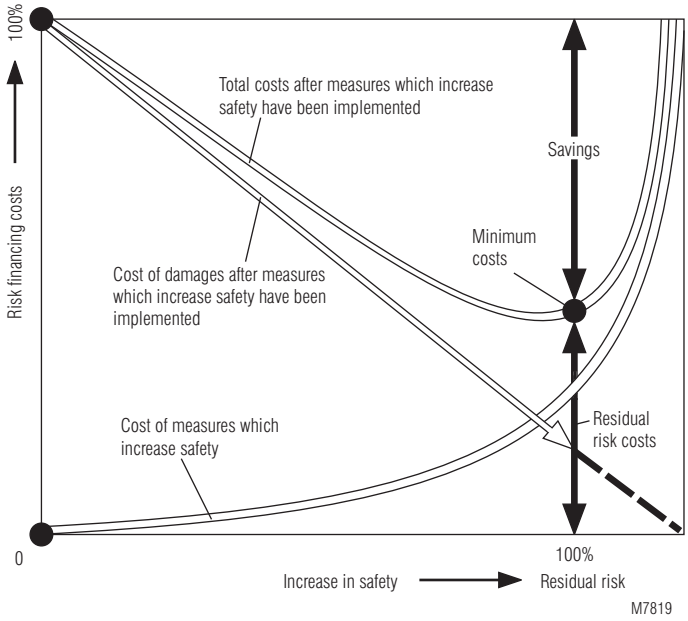
Function	Cat. / PL according to EN ISO 13849-1	1- / 2-channel	Output contacts max.	Thermal current I_{th} max. [A]	Nominal voltage DC	Inputs max.	Compatible evaluators	Width [mm]	Type	Page
Valve monitoring module	4/e	1;2	3 NC	8	+			22,5	**BH 5904/00MF2**	569
Emergency stop device			1 NO; 2 NC	4				42	**NI 5061**	578
Emergency stop monitor		1; 2			+	8		45	**BH 5922**	580
Safety switch magnetic coded	4/e	2	2 NO; 1 NC		+		all Dold control units	88	**NE 5021**	592
Emergency stop monitor		1; 2			+	16		90	**BL 5922**	580
Safety switch magnetic coded	4/e	2	2 NO		+		BG 5925/920	92	**NE 5020**	598

NO = normally open contact; NC = normally closed contact

1. Preface

It is the aim of every business to improve the operational return by increasing productivity. Among others, this is achieved by evermore automation on work places and shortening of cycle times. Accident research has proved that this increases the risk potential on work places, which finally led to an increased safety awareness and found expression in national and international standards.

Besides the human aspect, safety-improving measures can also be justified from the business point of view. Assuming that there is no absolute safety also in technology there will always remain non-excludable residual risks. The diagram below illustrates the relationship between safety improvement and risk financing costs. It can be seen from the business aspect that the residual risk is determined by the minimum of total costs



after safety-improving measures.

Fig. 1
Financing costs of a risk after implementation of safety-improving measures as a function of the desired extent of safety. Source: Eberhard Franck, Risikobewertung in der Technik, Labor 2000-1991

On the basis of accident research results, standards and regulations require a minimum extent of safety. An ultimate decision on what residual risk can be allowed always requires a risk assessment with an evaluation of the danger potential and depends on the type and severity of damages as well as the probability of occurence. If the minimum requirements cannot be met, required measures have to be defined together with industry-specific authorities for health and safety at work such as employers' liability insurance associations or TÜV. Within the scope of product liability (see also the law for safety of equipment and products - GPSG), the German Federal Supreme Court has considerably extended the scope of liability for consequential damages of faulty products. In future, this scope of liability cannot be limited by a contractually restricted warranty in the general terms of delivery. Moreover, the conformity with the requirements of the European Directive on Machinery is a prerequisite for the distribution of machinery on the European market. This directive requires a high safety standard.

For manufacturers and users of machinery and plants, it is not always easy to implement circuitry that meets the abundance of regulations.
To support users in implementing safety-related circuits DOLD offers switching devices that allow modular solutions tailored to the relevant application with respect to functionality and costs.

These include:
- Emergency stop circuits
- Safety gate monitors
- Safety switch and key transfer systems
- Two-hand circuits
- Evaluators for safety switches
- Speed/zero-speed monitors
- Coupling modules
- Light grid modules
- Light barrier and evaluator modules
- Multi-functional safety modules and modular safety systems
- Valve monitoring modules
- Delay modules
- Motor braking units

These modules wired ready for connection comply with applicable national and international standards and regulations and are tested by authorities responsible for their enforcement if required. DOLD considers new standards coming into force already during the preliminary stages.

2. Standards and directives

The implementation of the European Union's domestic market requires a further cutback of technical trade barriers by standardization of approval requirements.

To this end, the Council of the European Union has encated the European Directive on Machinery 98/37/EC, in which the occupational safety is given a high priority. To account for latest developments and technical progress the new Directive on Machinery 2006/42/EC came into force on 29.12.2009.

However, the Directive on Machinery only defines global safety standards. How to realize the safety requirements in detail is recommended in standards that have been worked out on the basis of international standards, e.g. by the European Committee for Electrotechnical Standardization (CENELEC) New successor standards substantiate the increasing requirements with respect to complexity and especially quality. Products from DOLD have always met the most stringent requirements.

2.1 The most important standards

Directive on Machinery 98/37/EC; from 29.12.2009: 2006/42/EC

- **Type A: Basic safety standards**
  - **DIN EN ISO 12100** "Safety of machinery" (former DIN EN 292)
  - **DIN EN ISO 14121** "Principles of risk assessment" (former DIN EN 1050)

- **Type B: Safety group standards**
  - **DIN EN 60204-1** "Electrical equipment of machinery"
  - **DIN EN ISO 13857** "Safety of machinery - Safety distances to prevent harzard zones being reached by upper and lower limbs (former DIN EN 294 and DIN EN 811)

- **Type B1: General overriding safety aspects**
  - **DIN EN ISO 13849** "Safety-related parts of control systems" (former DIN EN 954-1)
  - **DIN EN 62061** "Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems"
  - **DIN EN ISO 13850** "Emergency stop - Principles of design" (former DIN EN 418)

- **Type B2: Specifications of protection devices**
  - **DIN EN 574** "Two-hand control devices" (see also ISO 13851)
  - **DIN EN 61496** "Electro-sensitive protective equipment (ESPE)"
  - **DIN EN 1088** "Interlocking devices associated with guards"

- **Type C: Specific safety requirements for specific machine types**
  - **DIN EN 692** "Mechanical brakes"
  - **DIN EN 693** "Hydraulic presses"
  - **DIN EN 201** "Injection moulding machines"
  - **DIN EN 12415** "Small numerically controlled turning machines and turning centres"
  - **DIN EN 12417** "Machining centres"
  - **DIN EN 13218** "Stationary grinding machines"
  - **DIN EN 12478** "Large numerically controlled turning machines and turning centres"

2.2 New standards

DIN EN 61508
Functional safety of electrical/electronic/programmable electronic safety-related systems
The standard DIN EN 61508 considers safety-related functions over the whole life cycle of a product/system from design to decommissioning (probabilistic aspects).
It is a basic safety standard from which industry-specific or sector-specific standards are derived, including DIN EN 61511 for process industry, DIN EN 61513 for nuclear power plants or DIN EN 62061 for the mechanical engineering industry.

DIN EN 62061
Safety of machinery
Functional safety of safety-related electrical, electronic and programmable electrical control systems
Application-specific sector standard for the mechanical engineering industry.
The requirements on safety-related performance in the DIN EN 61508 relevant for the safety of machinery field are substantiated in the DIN EN 62061 with respect to significant hazards on machinery.

DIN EN ISO 13849
Safety of machinery - Safety-related parts of control systems
Part 1: General principles of design
Part 2: Validation

Revised EN 954-1 that extends the deterministic perspective of EN 954-1 by probabilistic aspects as can be found in DIN EN 61508, i.e. the safety-related performance is considered over the whole life cycle of a product/system from design to decommissioning.

In this standard, the deterministic (safety) categories are further included, but are evaluated by additional weighting by characteristic values such as MTTFd (Mean time to dangerous failure), DC (Diagnostic coverage) and CCF (Common Cause Failure) and result in a so called PL (Performance Level).

The Performance Level (PL) defines the range of probability of a dangerous failure per hour (probilistic; so called PFH_d), which is the bridge to the SIL classifications of the DIN EN 62061.
In short, a safety function is assessed in its existing category and additionally by its quality (EN 954-1 → EN ISO 13849-1) or generally by its quality (EN 62061). If the outcome corresponds to the class required by the risk assessment, the required safety-related perfomance will be reached. It becomes clear that an existing category of the EN 951 can no longer be simply mapped in a Performance Level. The required safety-related performance of the relevant safety function is still determined and defined from the defined risks of an application. (Risk graph →PL_r Performance Level required in DIN EN ISO 13849, SIL class DIN EN 62061).

Both the DIN EN ISO 13849 and also the DIN EN 62061 are equally applicable to electrical systems. The DIN EN ISO 13849 additionally covers mechanical, hydraulical and pneumatic systems. The EN 954-1 is only allowed to be used alternatively to the DIN EN ISO 13849 until November 2009.

2.3 Scope

The scope of the European Directive on Machinery 98/37/EC (2006/42/Ec from 29.12.2009) is not only restricted to industrial machines, as was the case to date, but covers almost all machines for use in the fields
- Industry
- Trade
- Private industry

Machines in terms of this directive include:

- Single machines
- Complex plants (interlinked machines)
- Interchangeable equipment for changing the functionality of a machine
- Equipment with drive system and movable devices
- Mobile machinery (e.g. industrial trucks)
- Machinery for lifting loads (cranes, lifting devices)
- Machinery for lifting or transporting persons (e.g. mobile working platforms)
- etc.

Following equipment is excluded:
- Machinery and facilities that are covered by other European Directives
- Military equipment
- etc.

3. Definitions according to ZVEI TA SI

Switching off in an emergency
→ Shutting down in an emergency

Actuator
Actuator, e.g. motor, valve, relay, motor contactors, etc.

Requirement class
According to DIN 19250, assignment of requirements for the implementation of a safety device with the aim to achieve a safety-related performance of the device that is adequate for the risk. It is mainly the product from the extent of damage and the probability of occurrence.

Restart inhibit
Device that prevents an automatic machine start if the power supply of the → safety-related evaluation device is applied or interrupted and restored.

Test when starting
Manual or automatic test of the → safety-related evaluation unit after the supply voltage has been applied to it. A manual opening and closing of guard after application of the supply voltage is one example.

Test when starting, safety-related

Single-channel control:
Control via one signal transmitter output

Two-channel control:
Control via two signal transmitter outputs

Output expansion module
→ safety-related evaluation unit that can only be used in connection with a → basic device for purpose of output multiplication.

Switching off in emergency
Action in emergency for purpose of cutting off the supply with electric energy for the whole installation or a part of it if there is a risk of electric shock or another risk of electrical origin.
[DIN EN 60204-1:2006 Annex E].

The objective of it is to prevent or reduce upcoming or existing risks for persons and damages to machinery, products or environment.

Evaluation unit, safety-related
Generates a safety-related output signal as a function of the state of connected signal transmitters either according to a fixed assignment or according to programmed instructions. → safety-related evaluation unit

B_{10d}
Number of cycles until 10 % of the components have dangerously failed (for pneumatic and electromechanical components).
[DIN EN ISO 13849-1]

Basic device
of an evaluation unit that includes all basic functions which are required in safety systems as a minimum to generate a safety-related output signal.
→ expansion unit

Command device
→ Signal transmitter

BWP
Contactless position switch → PDF

BWS
Electro-sensitive protective equipment (ESPE)

Mainly a sensor function and the associated control/monitoring function with output switching element (→ OSSD) [IEC / DIN EN 61496]

CCF
Common **C**ause **F**ailure
Failures of different units due to a single event, with the failures being not due to each other.

DC
Diagnostic coverage
Ratio between the failure rate of detected dangerous failures and the failure rate of all dangerous failures

Discrepancy monitoring
Tolerates the lack of synchronization of related signals over a defined time window.
REMARK 1: Also the term “Simultaneity monitoring” is used.
REMARK 2: The monitoring of signal transmitters is used to increase the functional safety. It is done by checking the signal transmitters’s signal change within a specified time.
If this time is exceeded, no enable signal will be output. Such a monitoring is required for some safety systems (→ two-hand operation).

Diversity
Diverse redundancy

System design with different measures for the same objective to avoid systematic errors.

Speed monitoring, safety-related
Safety-related monitoring of a defined rotational speed.

NOTE 1: The drive is turned off or an alarm is issued when this speed is overun or underrun.

Dynamic testing
→ Testing

Earth-fault detection
When an earth fault is detected the device goes to the agreed safe state either immediately or in the course of a cyclic self-monitoring.

Expansion unit
An expansion unit is a
→ safety-related evaluation unite that can only be used in connection with a → basic unit for purpose of contact or input multiplication.
→ Output expansion units are incorporated in the → cyclic self-monitoring.

Distinction:
→**Output expansion unit** for multiplication of safety outputs
→**Input expansion unit** for multiplication of safety inputs

Fault response time

First fault occurrence time:
This is the time interval in which the probability that a safety-critical first fault occurs for the requirement class involved is sufficiently low. The time interval starts with the last instant in time at which the system involved was in a state that can be assumed as being fault-free for the requirement class being considered.
NOTE: Fault-controlling measures are not taken into account.

Occurrence time for multiple faults:
This is the time interval in which the probability that combined safety-critical multiple faults occur is sufficiently low for the requirement class involved. The time interval starts with the last instant in time at which the system involved was in a state that can be assumed as being fault-free for the requirement class being considered.

Fault tolerance time
Time interval in which the process can receive incorrect control signals without a hazardous state occurring.

FIT
Failure **i**n **T**ime
Describes the failure rate of technical components, in particular electronic components. The unit FIT indicates the number of components that fail within 10^9 hours. Statistically, components having a high FIT value fail more frequently than those having a lower FIT value. Failure rate at a FIT value $\lambda = 1/10^9$ h, that means once in approx. 114 000 years.

λ
Failure rate of a component in → FIT

λ_{total}
Failure rate
Failure rate of the device in → FIT.

FMEDA
Failure **M**odes, **E**ffects and **D**iagnostic **A**nalysis

Enable circuit
Generates a safety-related output signal.

NOTE:
To the outside, enable circuits act as NO contact (→ OSSD).

Function test
Testing of the expected function of a device.

NOTE:
The function test can either be realized automatically using the control system or manually by monitoring or testing - when operational and at defined time intervals or as a combination depending on the requirement [DIN EN 60204-1, paragraph 9.4.2.4].

Controlled stopping
→ Stop function

Simultaneity monitoring
The simultaneity monitoring of signal transmitters by the safety-related evaluation unit is used to increase the functional safety of the protective safety device. The monitoring function is realized by checking the signal change of the signal transmitters within the specified time - the synchronous monitoring time. If this time is exceeded, no enable signal will be output. A simultaneity monitoring is required for several safety devices (→ two-hand circuit).

Basic device
→ Basic unit

Category
Classification of safety-related parts of a control system with respect to their resilience against and behaviour during faults (B, 1, 2, 3, and 4) that is reached by the structural arrangement of the parts and/or their reliability. [DIN EN 954-1, see also DIN EN ISO 13849-1].

Magnetically-operated switch
→ Signal transmitter, PDF

Occurrence time for multiple faults
→ Fault response time
→ Occurrence time for multiple faults

Signaling output
→ Signaling circuit

Signaling circuit
A signaling circuit is used to generate a non safety-related output signal.

$MTTF_d$
Mean Time To Failure dangerous

Muting
The safety-related function is correctly and deliberately disabled using additional sensors for a limited time (a type of bypass function).
[IEC / DIN EN 61496-1].

NOTE: These sensors are used to make a differentiation between persons and objects.

Muting sensors
→ Signal transmitter

Proximity switch
→ Signal transmitter

Emergency stop
→ Switching off in an emergency

Emergency stop device
An emergency stop device is an arrangement of components for the realization of the emergency stop function.
(EN 13850/EN 60947-5-5 / EN 60204-1)

Emergency stop button
→ Signal transmitter

Emergency stop
→ Shutting down in an emergency

OSSD
Output **S**witching **S**ignal **D**evice [IEC/ DIN EN 61496] - part of the ESPE (electro-sensitive protective equipment)/PDF that goes into the OFF state if the → safety-related evaluation unit or monitoring devices respond.

PDF
→ Signal transmitter

PDS(SR)
Electrically-powered drive system with adjustble speed suited for use in safety-related applications. [DIN EN 61800-5-2]

Performance Level
Discrete level of safety-related capability.
PL a is the lowest and PL e the highest level [DIN EN ISO 13849].

Periodical test
The periodical test of electro-sensitive protective equipment type 2 simulates the operation of the sensor part to detect a dangerous failure. It is specified for the function proof of electro-sensitive protective equipment type 2 according to EN 61496-1 and is realized by the → safety-related evaluation unit.

PFD
Probability of Failure on Demand or mean probability of failure when a safety function is demanded.

PFH_d
Probability of Failure dangerous per Hour or probability of dangerous failure per hour.
The failure limit PFD is used for small demand rates, while the failure limit PFH is used for large or continuous demand rates.

PL
→ **P**erformance **L**evel

PL_r
Performance **L**evel **r**equired
Applied PL to fulfill the expected risk minimization for each safety function.

Position switch
→ Signal transmitter

Proof Test (repeat test)
Repeated test that is executed to detect faults in a safety-related system so that - if necessary - the system can be brought into an “as new state”, or as close as is practically possible to this state.

Cross-circuit fault
A conductive connection / short-circuit between the input channels of an emergency stop module.
NOTE: A cross-circuit can only occur for multi-channel control circuits.

Cross-circuit fault detection
This is the ability of a → safety-related evaluation unit to detect cross-circuit faults either immediately or as a part of a cyclic monitoring routine - whereby the unit goes into a defined safe condition after the fault has been detected.

Redundancy
The availability of more devices or systems than necessary for a function.
NOTE: Several functional groups are used for the same function (e.g. multi-channel structure). In particular in safety engineering, this means the duplication of critical components [EN ISO 12100-2].

Reset
Resetting to a defined condition
→ Start

Reset button
→ Signal transmitter

Risk
The combination of probability that damage will occur and the extent of the damage. [EN ISO 12100-1]
NOTE: The severity of the damage, the exposure to a hazard, the probability of occurrence and the lack of fallback procedures are influencing factors [EN ISO 14121].
→ Risk assessment

Risk assessment
This is the evaluation of safety-related requirements under consideration of the extent of damage, probability of occurrence and risk classification.
NOTE: As a rule, the hazard consequence is the damage extent element of the risk. Either the limit of probability or frequency of occurrence has to be estimated or a permissible limit to be defined for each risk.

The hazard consequence connects the recognized hazards with the risk assessment.
The hazard consequence connects hazards and dangerous events that may cause an accident. Hazard weighting is made by allocation of a → category,
→ requirement class of a → Safety Integrity Level (SIL) or Performance Level (PL).
EN ISO 14121 includes methods required for a risk assessment. According to this, the risk assessment includes at first a risk analysis and a subsequent risk evaluation.

Feedback circuit
Monitors controlled actuators.
NOTE: The → safety-related evaluation unit can only be activated when the feedback circuit is closed. A safe feedback of relays or contactors, for example, is realized with positively driven contacts. Normally closed contacts are connected in series and integrated in the feedback circuit of the safety-related evaluation device. If a contact welds in the enable circuit, then it will be no longer possible to re-activate the safety-related evaluation unit because the feedback circuit remains open.

Safety Integrity Level (SIL)
→ Safety Integrity Level

Safety-related evaluation unit
A safety-related evaluation unit, e.g. safety control, safety module, safety switching device, evaluation unit.

Pressure sensitive mats, safety switching strips, switching edges
→ Signal transmitter

Protective door monitors
Monitors the position of position switches on a guard. It generates a safety-related output signal when this protective door is closed.

Cable-operated switch
→ Signal transmitter

Self-monitoring
The correct functioning of a component is automatically and cyclically monitored.
→ Testing

SFF
Safe **F**ailure **F**raction
Portion of harmless failures

Safely reduced speed
Safety monitoring of the speed of drives
NOTE:
The function allows an axis or spindle to be monitored for a specified speed. When setting-up, e.g. the speed limits should be applied corresponding to the valid C Standard, e.g. 2 m/min for axes. In many machines, the safely monitored speed is also used during automatic processing and machining. In order to prevent damage to the machine or to the production materials, it is possible to safely prevent maximum rotational speeds and velocities from being exceeded.

The drive manufacturer must provide appropriate protective measures that allow only the machine manufacturer to change the speed limit values. Further, whenever the speed/velocity limit values are re-set or modified, an acceptance test must be carried out. During this acceptance test, the commissioning engineer must accelerate the drive up to the speed/velocity limit value and document the perfect safety-related response on a form provided by the drive manufacturer.

Safe operating stop
The drive is kept at standstill which is monitored by its control system.
NOTE 1:
The higher-level → safety-related evaluation unit initiates the safety-related response when the drive moves away from the standstill position.
NOTE 2:
The safe operating stop function is always used where frequent interventions in the process are required and an isolation from the power supply by hardware is not practicable. Application examples include setting-up operation and running-in CNC programs.

Safe standstill (safe torque off)
Safe interruption of the energy supply to the drive so that no torque can be generated and thus no dangerous movement occurs.
NOTE:
It is not necessary to monitor the standstill state. The energy supply can be disconnected using contacts, but this is not compulsory.

Safe stopping process
Stopping of the drive corresponding to the hazardous situation (stop function).
NOTE:
Electrical, electronic and electromechanical equipment that is required to decelerate the drive must be incorporated in the safety considerations.
Measures include:
- Controlled stopping with safely monitored deceleration time / standstill
- Controlled stopping with safely monitored braking ramp
- Uncontrolled stopping using mechanical brakes

Protective device
Technical means used to prevent hazards/damages for man, production materials and environment.

Safety combination
→ Evaluation unit, safety-related

Safety Integrity Level (SIL)
Level used to define the requirements for the safety integrity of the safety functions. SIL 3 is the highest level, SIL 1 the lowest = target for the probability of failure for the design of the risk-reduced function [DIN EN 62061].

Light grid
→ Light curtain

Light barrier
→ Signal transmitter

Light curtain
→Signal transmitter

Relay combination
→ Evaluation unit, safety-related

Safety switching device
→ Evaluation unit, safety-related

Signal transmitter
- **Magnetically-operated switch,** consisting of one or more reed contacts the switching state of which changes under the influence of a magnetic field.

- **Muting sensor** is used for muting operation (→ Muting) to detect objects for which an → ESPE should not shut down.

- **Proximity switches** (inductive, optical or capacitive) change their switching state when objects or liquids approach. They are mainly equipped with semiconductor (solid-state) outputs.

- **Emergency stop command devices** for actuation in hazardous situations to cause a stop of a process, machine or plant. These devices must have positively-opening contacts, should be easily accessible and tamper-proof [DIN EN 13850; DIN EN 60204].

- **Position switch** is part of the interlocking device of a guard. It changes its switching state as a function of a mechanically issued control command. There are position switches without and with mechanism (→ locking mechanism).

- **PDF** (**P**roximity **D**evices with defined behaviour under **F**ault conditions) are proximity switches for safety functions. Changing optical, magnetical, electrostatic, acoustic or other fields cause a switching operation. The switching signal can be used for safety-related machine controls.
  NOTE:
  Proximity switches for safety functions include a sensor unit (active part), an evaluation device including safety outputs and an actuator (defined object).

- **Reset button** in a → safety-related evaluation unit is a → Restart inhibit which can only be removed by an actuation.

- **Laser scanner** - These are optical area scanners working contactlessly by periodically transmitting pulses of light. An integrated rotating mirror deflects these light pulses into the working zone. Objects that enter the defined protective zone reflect the light pulses - which means that they are detected. The coordinates of the “obstructions” are calculated from the light propagation time. If the “obstruction” is located in a defined protective zone, a stop function will be initiated via safety-related outputs (→ OSSD).

- **Pressure sensitive mats, safety switching plates, strips, edges** change their switching state when they are stepped on (pressure sensitive mat) or deformed (safety switching strips or edges) [EN 1760-1/-2].

- **Cable-operated switches** cause a stop category 0 when the pull cable is pulled or the cable breaks.

- **Safety light grids** or **light curtains** change their switching state when one or more light beams are interrupted.

- **Safety light barriers (SL)** change their switching state when their light beam is interrupted.

- **Enabling switches** must be manually operated to remove the protective function of protective equipment. It can not initiate hazardous conditions alone. For this, a “second deliberate” command is necessary.

SIL (Safety Integrity Level)
→ Safety Integrity Level (SIL)

SIL CL
→ SIL claim limit;
Max. SIL for a subsystem [DIN EN 62061]

SLS
Safely-**l**imited **s**peed
The SLS function prevents that a motor exceeds a defined speed limit. [DIN EN 61800-5-2]

SOS
Safe **o**perating **S**top
The SOS function prevents the motor from deviating from the stop position by more than a defined value. The → PDS(SR) provides the energy for the motor that enables it to withstand external forces. [DIN EN 61800-5-2]

SSM
Safe speed monitor
The SSM function provides a safety output signal to indicate whether the motor speed is below a defined limit value. [DIN EN 61800-5-2]

Start
- **Automatic start:**
  An enable signal is generated without manual enabling after a check of the input replica and positive test by the → safety-related evaluation unit.
  NOTE:
  This function is also referred to as dynamic operation and is not allowed for emergency stop equipment.

- **Manual start:**
  An enable signal is generated by operating the → Reset button and after a test of the input replica and successful testing by the → safety-related evaluation unit.
  NOTE:
  This function is also referred to as static operation and is required for emergency stop equipment (→ Stop function) [IEC / DIN EN 60204-1].

Position monitoring
Monitoring of a guard (e.g. protective door) using a suited → Signal transmitter and → evaluation unit.

Stopping in an emergency
This is an operation in an emergency used to stop a process or movement that became hazardous [DIN EN 60204-1:2006 Annex E].

Standstill monitoring
→ Speed monitoring

STO
Safe **T**orque **O**ff
No energy that could cause a rotation (or movement for a linear motor) is supplied to the motor. The → PDS(SR) does not provide energy to the motor that could cause a torque (or force in case of a linear motor). [DIN EN 61800-5-2]

Stop function
[EN 60204-1]

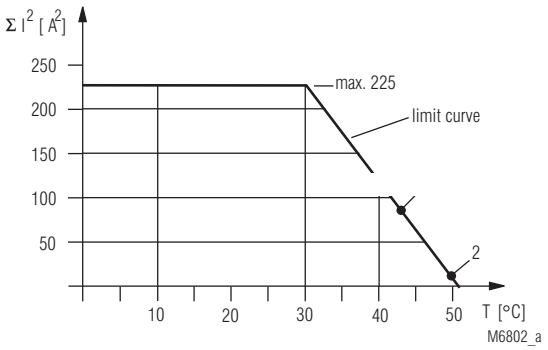
- **Stop category 0**
  Uncontrolled stopping by immediately disconnecting the energy feed to machine drive elements

- **Stop category 1**
  Controlled stopping where the energy feed is only interrupted once the standstill has been reached.

- **Stop category 2**
  Controlled stopping where the energy feed is still maintained even at standstill

STS
Key Transfer **S**ystem (see system overview SAFEMASTER® STS)

Quadratic total current limit curve
The squared current value must be used to calculate a linear limit curve.



General formula for determination of the max. environmental temperature
A) Sum of currents² for each safety contact = value on the scale Σ I² (A²)
B) Max. environmental temperature T = intersection of the scale value Σ I² (A²) with the limit curve

Example 1
A) $(4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 = 96\ A^2$ (scale Σ I²)
B) Max. environmental temperature T = 43 °C (point 1)

Example 2
A) $(0.5\ A)^2 + (1\ A)^2 + (2\ A)^2 + (1\ A)^2 = 6.25\ A^2$ (scale Σ I²)
B) Max. environmental temperature T = 49 °C (point 2)

Note:
The squared total current can be still 1.5 A² at 50 °C, i.e. 0.5 A for each safety contact.

A) $(0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 = 1.5\ A^2$
B) Max. environmental temperature = 50 °C

Synchronous monitoring time
This is the time during which a simultaneous actuation must occur in order to generate an output signal.
→ Discrepancy time monitoring
→ Two-hand circuit

T_1 (Proof Test Interval)
Interval of repeat test

Pushbutton monitoring
The function of the pushbutton is monitored by a dynamic signal change when the pushbutton is released.
NOTE: By this, a system is prevented from being powered up by a short-circuited pushbutton (e.g. by manipulation or tampering), for example.

Testing
→ Periodical test
→ Cyclic test

Guard
Mechanical separation between a dangerous area and the environment
NOTE:
The separation can be designed as protective grid, protective door, enclosure, cover, fence, shield, etc. It can be autonomous or a part of the machine.

Uncontrolled stopping
→ Stop function

Interlocking equipment
This is a mechanical, electrical or another device the purpose of which is to prevent the operation of a machine component under certain conditions (usually as long as a guard is not closed). [DIN EN 1088] (see system overview of safety switches and key transfer system SAFEMASTER® STS)

Restart inhibit
The restart inhibit prevents a → safety-related evaluation unit from issuing an enable signal after a shutdown, change of machine operating mode or change of the actuation type.
NOTE:
The restart inhibit is only removed by an external command (e.g. → Reset pushbutton).

Locking
→ Locking mechanism

Locking mechanism
The purpose of a locking mechanism is to maintain a → guard in its closed position. It is also connected to the control so that the machine cannot start if the guard is not closed and locked and the guard is kept closed until the risk of injury is no longer present. [DIN EN 1088]
(see system overview of SAFEMASTER® STS key transfer system)

Consent switch
→ Signal transmitter

Positively driven contacts
Positively driven means for contacts that no NC contact may close if any NO contact does not open. Also, no NO contact may close when an NC contact does not open. This applies to relays/contactors over the complete life cycle and also to a faulty state [DIN EN 50205].
Example: If an NO contact is welded, all the other NC contacts of the relay/contactor concerned remain open no matter whether the relay/contactor is energized or not.

Positively opening
Contact opening as a direct result of a defined motion of a switch's operating element using non-sprung parts. [DIN EN 60204-1]
NOTE 1:
For the electrical equipment of machinery, the positively opening of NC contacts is expressly required for all safety circuits.
NOTE 2:
According to DIN EN 60947-5-1-k, positively opening is designated by the symbol (arrow in a circle) (function to protect persons).

Two-hand circuit
This is a device which requires at least an action with both hands to start and maintain the operation of a machine as long as a hazard is present. Its purpose is to protect the operating person in this way [DIN EN 574].
NOTE: In order to initiate the hazardous operation, both operating elements must be simultaneously actuated (→ Discrepancy time monitoring). The enable signal is withdrawn when one of the two operating elements is released during the potentially dangerous motion. The dangerous operation can only be re-initiated if both operating elements have returned to their initial position and are then actuated again.

Cyclic self-monitoring → Testing

Cyclic test
A fault is automatically detected before or during the next request for the safety function, i.e. at each starting cycle of the → evaluation unit at the latest.

4. Safety-related switching functions
The standards mendioned in chapter 2 describe main requirements for safety-related switching circuits. The following is an extract from them.

4.1 Emergency stop circuits
In order to achieve a quick stop of a dangerous motion in emergency situations the reliable function of the emergency stop device is crucial. Therefore, appropriate circuits must prevent failures of devices downstream of an emergency stop command device or a properly functioning protective device.

DIN EN 60204-1 Safety of machinery
Electrical equipment

Actions in an emergency (emergency stop)
DIN EN ISO 13850 describes the design principles for emergency stop equipment.
Emergency stop and emergency switching off are complementary protective measures for minimizing risks on machines (see DIN EN ISO 12100). Emergency stop is related to the actual operation of a machine, while emergency switching off is directly related to switching on/off. They are initiated by a single main action and must be maintained effective up to a manual reset action on the location where the emergency was initiated, as the control commands initiated by them. Resetting may only enable, but not execute the restarting or switching on.

Emergency stop [DIN EN ISO 13850]
Emergency stop must be work in compliance with the stop categories 0 or 1 depending on the carried out risk assessment for the machine. The following applies in addition to the requirements for stopping:
- Priority above all other functions and operations in all operating modes
- An interruption of the energy supply to machine drives that may cause a hazardous situation must occur without further risks either immediately (stop category 0) or in a controlled way as quick as possible (stop category 1).

Emergency switching off
Emergency switching off is the disconnection of the corresponding energy feed using electro-mechanical switching devices (stop category 0). If the stop category 0 is not allowed for the machine, other measures such as protection against direct touching may be required. Emergency switching off should be planned when dangers or damages are possible and the protection against direct touching is only realized by distances or obstacles.

Stop functions
There are the following stop categories:

- **Stop category 0:**
  Stopping by immediate interruption of the energy suuply (to drive elements / uncontrolled stopping)

- **Stop category 1:**
  Controlled stopping, the energy supply is maintained to accomplish stopping and is then interrupted.

- **Stop category 2:**
  Controlled stopping, with the energy supply maintained.

4.2 Stop
Stop functions of the above categories must be taken into account as a result of risk assessment and requirements for the machine.
If required, facilities for connecting guards and interlocks must be provided (see SAFEMASTER® STS key transfer system).
A reset of the stop function must not initiate a hazardous situation. If required according to the risk assessment, stop commands must be effective for each control station.

Combined start-stop controls
The use of pushbuttons and similar control devices that alternatingly start or stop a motion when actuated is only allowed for functions that cannot result in dangerous situations.

4.3 Control functions in fault situations

General requirements
Depending on the risk level of the concerned application, suited measures must be taken when failures or malfunction may cause hazardous situations or damages to the machine or production materials.
Electrical control circuits must be realized with adequate safety-relevant performance level that was determined by a risk assessment of the machine. The requirements of DIN EN 62061 and/or DIN EN ISO 13849 must be met.

Risk minimizing is possible by (not limited to):
- Protective equipment on the machine (e.g. SAFEMASTER® STS, emergency stop/switching off equipment, etc.)
- Safety interlocking of the electric circuit
- Providing of redundancy or diversity in part or completely
- Providing of function tests

Hazardous situations due to failure or removal of memory contents, e.g. removing batteries, must be prevented.
Unauthorized and accidental change of memory contents must be prevented by suited means, e.g. use of a key, etc.

Use of partial or complete redundancy
The use of redundancy can minimize the probability that a single fault can result in a dangerous situation. When it is effective in normal operation it is referred to as online redundance. A conception where specific circuits undertake the safety function only when the operational function fails is referred to as offline redundancy.
When offline redundancy is provided, which is not effective during operation, precautions must be taken to ensure that these control circuits will be effective when demanded.

Use of diversity
Control circuits with different function principles or the use of different components and devices can reduce the probability of hazards due to faults and/or failures. These include, but are not limited to:
- NC-NO combinations, actuated by interlocked safety devices
- Use of control components of different design
- Combination of electro-mechanical and electrical equipment in redundant systems

A combination of electrical and non-electrical systems (e.g. mechanical, hydraulical, pneumatical) can perform the redundant function and provide for diversity.

4.4 Two-hand circuits
In ISO 13851, three types of two-hand circuits are defined that can be used depending on the risk assessment:

- **Type I:**
  (not suited for the initiation of dangerous operations)
  - Two control devices, simultaneous actuation by both hands
  - Continuous and simultaneous actuation during the dangerous operation
  - Stopping of machine operation when one or both control devices are released and the dangerous situation is still present

- **Type II:**
  As type I, but both control devices must be released before the machine operation can be restarted.

- **Type III:**
  As type II, but the simultaneous actuation must be as follows:
  - Actuation of the control devices within a time of 0.5 sec.
  - If this time is exceeded, both control devices must be released before the machine operation can be initiated again.

4.5 DIN EN 13850: Safety of machinery Emergency stop, design principles

Emergency stop, emergency stop function
- Prevent emerging dangers (dangers to persons, damages to machines and production materials) or minimize already existing risks
- Must be initiated by a single action of one person.

Emergency stop device
- Manually actuated control device for initiating an emergency stop function

General requirements
Emergency stop must be available and functioning at any time and must have priority over other functions and operations in all operating modes of the machine, but without affecting devices that are provided for the rescue of trapped persons.
Any start commands must not be able to affect an initiated emergency stop function until the emergency stop function is manually reset.
The emergency stop function should be designed as a complementary protective measure and must not be a substitute for protective measures or other safety functions or affect them in their effectiveness.

Depending on the risk assessment, the emergency stop function must be designed so that - after actuation of the emergency stop device - dangerous movements and the machine operations are stopped in a suited way without causing further hazards and without any intervention by any person.

“Suited way” may include:
- Selection of an optimal deceleration rate
- Selection of the stop category
- Application of a defined stopping sequence

An emergency stop must be designed so that the decision for actuation does not demand from a person considerations with respect to the effects resulting from this.
After operation of an emergency stop device/command, the effect of such a command must be maintained until it is manually reset. A reset must only be done on the location where the emergency stop command has been issued. A restarting must only be possible after a manual reset on this location.

The stop category must be selected according to the risk assessment for the machine:

- **Stop category 0:**
  Stopping by
  - Immediate interruption of the energy feed to driving components of the machine
  - Mechanical separation (decoupling) between dangerous parts and their driving component (by braking if necessary)

- **Stop category 1:**
  Controlled stopping with energy supply to driving components of the machine to achieve a stop, then - after standstill - interruption of the energy supply.
  Interruption of the energy supply may include:
  - Disconnecting the energy supply to electric motors of the machine
  - Disconnecting movable parts of the machine from the source of mechanical energy
  - Cutting off hydraulic/pneumatical energy sources to a piston/plunger

5 Functional safety - principles of design

DIN EN 954-1
Up to November 2009, the standard DIN EN 954-1 could be used parallel with the successor standard DIN EN ISO 13849-1. After that, the standard DIN EN 954 becomes invalid.

Required safety-related performance
The required safety-related performance is implemented by the use of the standards DIN EN ISO 13849 or DIN EN 62061 and determined and defined in form of a system and risk analysis. For each detected danger, a safety function including validation must be specified. These standards provide supporting tools for defining the required safety integrity.

Application of DIN EN 62061 or DIN EN ISO 13849

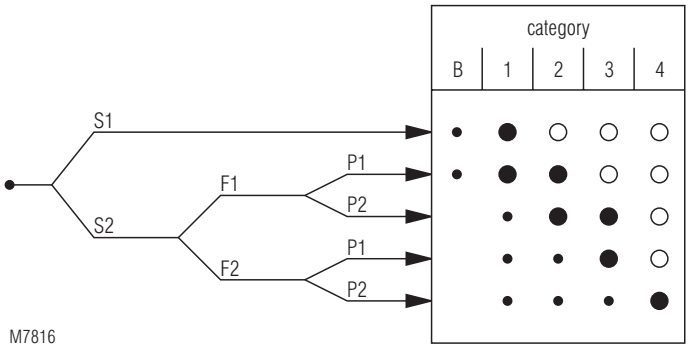
- DIN EN ISO 13849:
  - Also for non-electric systems, e.g. mechanical, hydraulic, etc.
  - For specified architectures
  - Categories (→ DIN EN 954-1) are maintained, additional probabilistic component results in the PL (Performance Level) in the given category, thus different performance levels are possible for each category

- DIN EN 62061:
  - All electrical and electronic systems
  - All architectures
  - "Breaking down" of the safety-related electrical control system into safety-related control functions and evaluation of them → (Safety Integrity Level) SIL classification

Tools in DIN EN ISO 13849 and DIN EN 62061

Determination of the required safety integrity
Result of the risk analysis = required safety of the system
Safety functions with associated Safety Performance:
- DIN EN ISO 13849:
  Risk graph, result = PL_r per safety function
- DIN EN 62061:
  Form "Risk assessment and safety measures",
  Result = SIL of the safety measure per risk

Risk assessment and selection of an adequate category



Risk graph in EN 954-1: 1997, Annex B

Risk parameter
S - Severity of injury
S1 - minor (usually reversible) injury
S2 - severe (usually irreversible) injury including death

F - Frequency and/or exposure duration (exposure to a risk)
F1 - rare to more often and/or short time of risk exposure
F2 - often to continuous and/or long time of risk exposure

P - Possibility to prevent risks or to restrict damages
P1 - possible under certain conditions
P2 - hardly possible

● Preferred category for reference points

• Possible categories that require additional measures

❍ Measures that may be overdimensioned for the concerned risk

DIN EN ISO 13849-1

The PL is determined by an estimate of following aspects:
- Quantifiable:
  - $MTTF_d$
  - DC
  - CCF
  - Structure of the safety-related part of the control system → further parameters can have an influence, e.g. demand rate, test cycles, etc.
- Qualitative:
  - Behaviour of safety functions under fault conditions
  - Capability to perform safety functions under foreseeable environmental conditions, etc.

Overview on advanced category definitions

- **Category B (PL a,b):**
  - Usually single-channel
  - CCF not relevant
  - A single failure results in the loss of the safety function

- **Category 1 (PL c):**
  - Meets category B
  - A single failure results in the loss of the safety function, but the probability for this is lower than for category B

- **Category 2 (PL a,b,c,d)**
  - Meets category B
  - Test of the functionality in adequate time intervals
  - In case of failure, initiation of a safe condition, at least warning on danger
  - Measures against CCF (e.g. diversity, etc.)
  - Test itself must not cause a danger
  - A failure between the tests may result to the loss of the safety function, but is detected during the test.

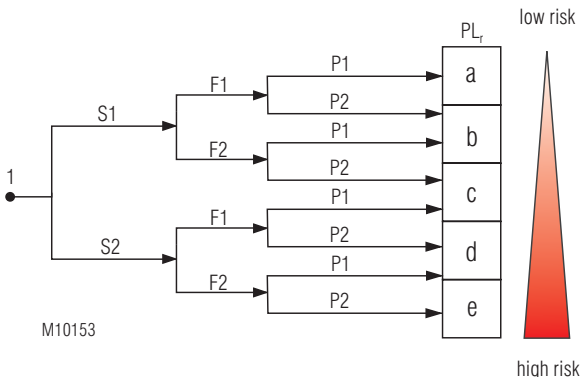
- **Category 3 (PL b,c,d):**
  - Meets category B
  - Measures against CCF
  - A single failure does not result in the loss of the safety function and must be detected before a new demand if possible.
  - An accumulation of non-detected failures can result in the loss of the safety function.

- **Category 4 (PL e):**
  - Meets category B
  - Measures against CCF
  - A single failure does not result in the loss of the safety function. It must be detected before a new demand or the accumulation of non-detected failures does not result in the loss of the safety function.
  - Failures are detected in good time to prevent the loss of the safety function.
  - Accumulation of unknown failures are considered.

Note:
For high-quality products, also a PL e for a category-3 structure is possible due to reliability, for example.

DOLD provides necessary new safety characteristic values for all products (on request if required), and for calculation we recommend the Sistema program which is provided free on the website of the employer's liability insurance association.

New risk graph in DIN EN ISO 13849



Risk parameters

S - Severity of injury
- S1 - minor (usually reversible) injury
- S2 - severe (usually irreversible) injury including death

F - Frequency and/or exposure duration (of the exposure to a risk)
- F1 - rare to more often and/or short time of risk exposure
- F2 - often to continuous and/or long time of risk exposure

P - Possibility to prevent risks or to restrict damages
- P1 - possible under certain conditions
- P2 - hardly possible

a,b,c,d,e,f
Objectives of the safety-related Performance Level

The risk assessment allows the designer to optimally adjust safety-related requirements to the machine-specific conditions depending on the application environment of the machine.

Both, the designer and the user are responsible for a correct risk evaluation.
The quantitative determination of the risk is difficult. So, the acceptable risk can be determined within a wide range when it comes to the selection of the category.

This becomes clear when selecting “F2 - frequently to continuously” rather than “F1 - rarely to more often” for the risk parameter “F - frequency and exposure duration” in the risk graph (see figure).
There is a wide range of safety levels between the assessments “more often” and “frequently”.

6. Further safety measures

Emergency switches
According to TRD 411 - 414, an emergency switch must be provided for the electrical switching off of the electrical parts of firing systems.

This emergency switch must directly or indirectly switch the circuits of electrical equipment of a firing system that must be switched off in an emergency situation.

According to EN 50156, two monitored switching off elements with function and device diversity are required for the safety cut-off of the whole fuel supply to the fire chamber.

Cutout delay
For a controlled stopping according to the stop category 1, a delayed cut-out may be desired, e.g. to have a motor braking function run for purpose of a quick stopping of a dangerous movement.

Timers

Timing relays used to limit minimum and maximum operating times of firing installations must meet the special requirements on the electrical equipment of firing installations on boilers specified by responsible professional associations and TÜV.

Such timing relays can be used to measure the operating times that must not be overrun and underrun, e.g. to measure the pre-ventilation time or to limit the safety time. Testing mainly occurs on the basis of the standard EN 50156 “Electrical equipment of firing installations”.

Suited timing relays:
AA 7512
AA 7562
AA 7610
AA 7616
EC 7610
EC 7616
EH 7610
EH 7616

Motor braking units
A frequent cause of industrial accidents is due to accidental reaching in running machines by operating persons or makeshift braking of machines with long coasting times. To respond effectively to these dangers of accident and thus to increase the safety at work, the Technical Committee for wood of the employer’s liability insurance associations has defined in their test guideline GS-HO-01 the requirements for an automatically acting brake and the requirements for these brakes when no machine-specific standard exists. According to this, machines where the tool can be touched during their coasting must have an automatic brake if the unbraked coasting time is longer than 10 sec. For this, DOLD’s comprehensive motor brake range offers both “simple” and also “complex” solutions.

For the completion of technical safety products for the safety of machinery DOLD offers further innovative devices such as zero-speed monitors, wireless emergency stop equipment or the safety switch and key transfer system SAFEMASTER® STS.

SAFEMASTER STS/K
Safety switch- and key interlock system
System overview

0276512

Your advantages

Cost Saving:
- Reduced wiring
- Cost saving simple installation

Robust Design:
- Fibre Reinforced Polymer-Version (FRP)
- Robust composite made of stainless steel and FRP
- All modules of a unit can be mounted separately

Optimised Ergonomics:
- Key and actuator modules can be mounted in 4 directions
- Plug-in keys for fast and easy operation
- Sophisticated design, high signal effect and easy handling

High Flexibility:
- Very flexible in concept, optimum adaptation to your process
- Easy to redesign when expanding systems
- Can be used for many applications, e. g. valves, gates, covers
- Compatible with the stainless steel version

Functionality and Safety:
- Protects against being locked in
- Over 46000 key codes
- Up to cat. 4, PL e (EN ISO 13849-1)

Approvals and marking

CE TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 C TÜVRheinland US

Additional information about this topic

- Datasheets, short description and system description about SAFEMASTER STS/K products on request or at **www.dold.com**

Applications

Safety should not be difficult. The SAFEMASTER STS/K has been developed to offer efficient operation and optimum protection for dangerous areas protected by fences with gates access to the operator. In addition it protects against being locked inside the dangerous area during repair and maintenance.

The Idea
The safety concept adapts to specific customer demands with respect to the individual processes and not vice versa. Therefore it can be used in nearly all applications using safety fences and covers that are operated in rugged ambient conditions.

The Solution
SAFEMASTER STS/K is a modular, most flexible system solution of safety switches, interlocks, trapped key and command function combining the advantages of all 4 systems: the mechanical units can be integrated without wiring into the machine and plant concept and provide a cost effective protection solution for large applications to secure maintenance gates. It is also suitable for ATEX and high temperature applications. Electromechanical units are used to enable mechanical units and to protect frequently used entry points. In conjunction with safety controllers (e.g. SAFEMASTER series) dangerous movements are stopped when the gate to a dangerous area is opended, or the gate access is only enabled after the dangerous movement is stopped. The 46000 different key codes allow a forced or partly forced access sequence.

The Components

The modular design of SAFEMASTER STS/K allows individual adaptation to the actual application. Using only few different basic modules a great number of functional units can be built by joining them via bayonet junctions. The function of a unit is dependant on the type of module and the mounting position. The combination of the different units define the function of the complete safety system.

Key modules

10/K 01/K

Actuator module (LOTO)

V/K W/K

Actuator modules

B, D, K, E/K

Accessories

Key Bayonet ring End modul

Actuator

CW CS J C T

Guard lock modules

ZRX/K ZRH/K ZRN/K ZAX/K ZAN/K

Switch modules

SX/K RX/K

Guard lock with command function

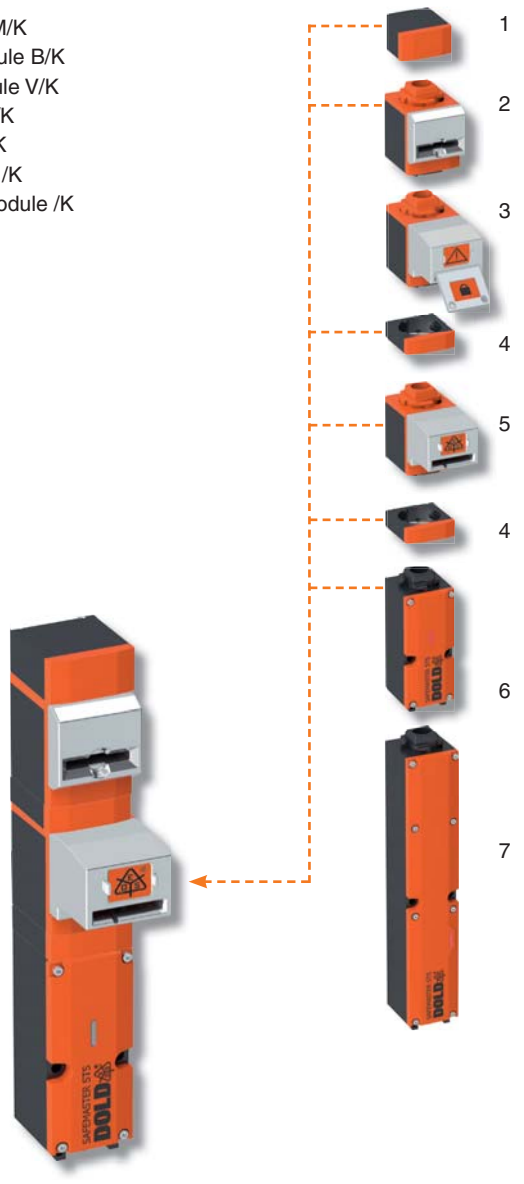
The System

The SAFEMASTER STS/K system offers far more than just the combination of safety switches and a key interlock system. It adds the advantages of both systems by the integration of wiringfree mechanical components and electrical safeguards. It is very flexible and is easily adapted to user requirements.

The system offers maximum safety and takes the requirements of the user concerning robustness, long life and user ergonomics into account. Special features are a robust composite made of stainless steel and FRP with ergonomic linear keys. It is flexible, can be easily extended and guarantees a safe and interruption free process, offering an intelligent and cost saving solution for industrial applications of all kinds.

With only a few single components, a number of individual interlock units can be assembled. Extensive equipment allows a simple mounting.

1 End module M/K
2 Actuator module B/K
3 Padlock module V/K
4 Bayonet ring /K
5 Key module /K
6 Switch modul /K
7 Guard lock module /K



Example: SX01BM/K

Example

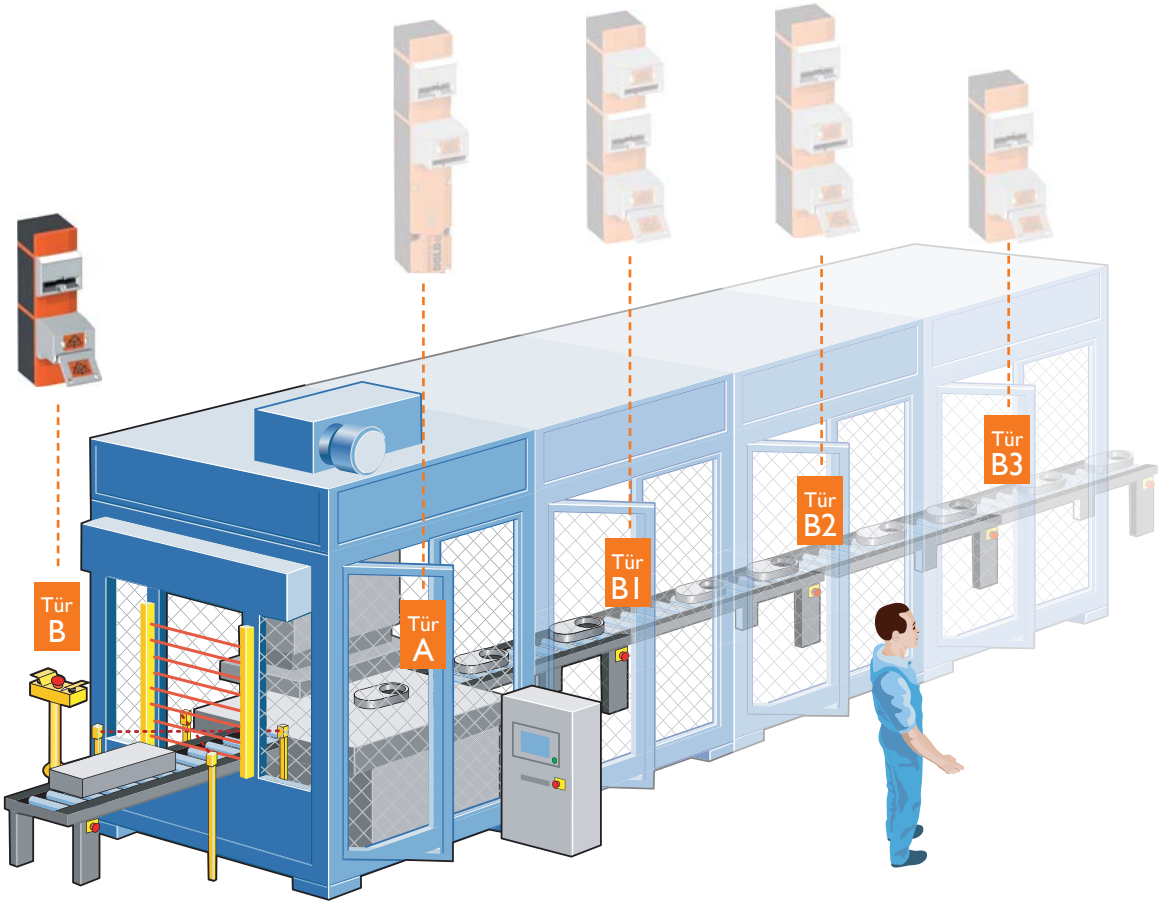
The SAFEMASTER STS/KProgram consists of modules that can be individually combined and adapted to your application. They combine the advantages of safety switches, interlock, key transfer and command function in one system.

The modular design allows systems to be assembled out of several units, or to modify and expand existing systems as required. All mechanical interlocks can be utilised in machine and plant concepts without wiring. They provide an economic and reliable proctection in wide applications.

The picture shows a press with several access gates. When opening the main entry gate A during operation, the machine stops immediately. To open the maintenance gates B the following sequence has to be followed: Open gate A, take out coded key, insert key in gate B, open gate B. After reversing the procedure the production may be started again.

Further doors (e. g. B1, B2, B3) can be added later without wiring.

Advantage: The maintenance gates are made safe without wiring.



SAFEMASTER STS
Safety switch- and key interlock system
System overview

0261528

Your advantages

Cost Saving:
- Reduced wiring
- Cost saving simple installation
- Mechanical (part) solutions save wiring cost

Robust Design:
- Stainless steel
- All modules of one unit can be mounted separate
- For harsh ambient conditions, e. g. vibration, extreme temperature, dust, moisture, dirt

Optimised Ergonomics:
- Key and actuator modules can be mounted in 4 directions
- Plug-in keys for fast and easy operation

High Flexibility:
- Very flexible in concept, optimum adaptation to your process
- Easy to redesign when expanding systems
- Can be used for many applications, e. g. valves, gates, covers
- Compatible with the lighter fibre reinforced polymer-version (FRP)

Functionality and Safety:
- Protects against being locked in
- Over 46000 key codes
- Up to Cat. 4, PL e (EN ISO 13849-1)

Approvals and marking

CE TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 TÜVRheinland C US

Additional information about this topic

- Datasheets, short description and system description about SAFEMASTER STS products on request or at **www.dold.com**

Applications

Safety should not be difficult. The SAFEMASTER STS has been developed to offer efficient operation and optimum protection for dangerous areas protected by fences with gates access to the operator. In addition it protects against being locked inside the dangerous area during repair and maintenance.

The Idea
The safety concept adapts to specific customer demands with respect to the individual processes and not vice versa. Therefore it can be used in nearly all applications using safety fences and covers that are operated in rugged ambient conditions.

The Solution
SAFEMASTER STS is a modular, most flexible system solution of safety switches, interlocks, trapped key and command function combining the advantages of all 4 systems: the mechanical units can be integrated without wiring into the machine and plant concept and provide a cost effective protection solution for large applications to secure maintenance gates. It is also suitable for ATEX and high temperature applications. Electromechanical units are used to enable mechanical units and to protect frequently used entry points. In conjunction with safety controllers (e.g. SAFEMASTER series) dangerous movements are stopped when the gate to a dangerous area is opended, or the gate access is only enabled after the dangerous movement is stopped. The 46000 different key codes allow a forced or partly forced access sequence.

The Components

The modular design of SAFEMASTER STS allows individual adaptation to the actual application. Using only few different basic modules a great number of functional units can be built by joining them via bayonet junctions. The function of a unit is dependant on the type of module and the mounting position. The combination of the different units define the function of the complete safety system.

Key modules

10

01

Actuator modules

A

B

Padlock modules (LOTO)

V

W

Accessoires

Key

Bajonet

M

Actuators

CW

CS

J

C

T

Switch modules

SX

SV

RX

RV

Solenoid locking modules

ZRX

ZRH

ZRN

ZRF

ZAX

ZAN

Command devices

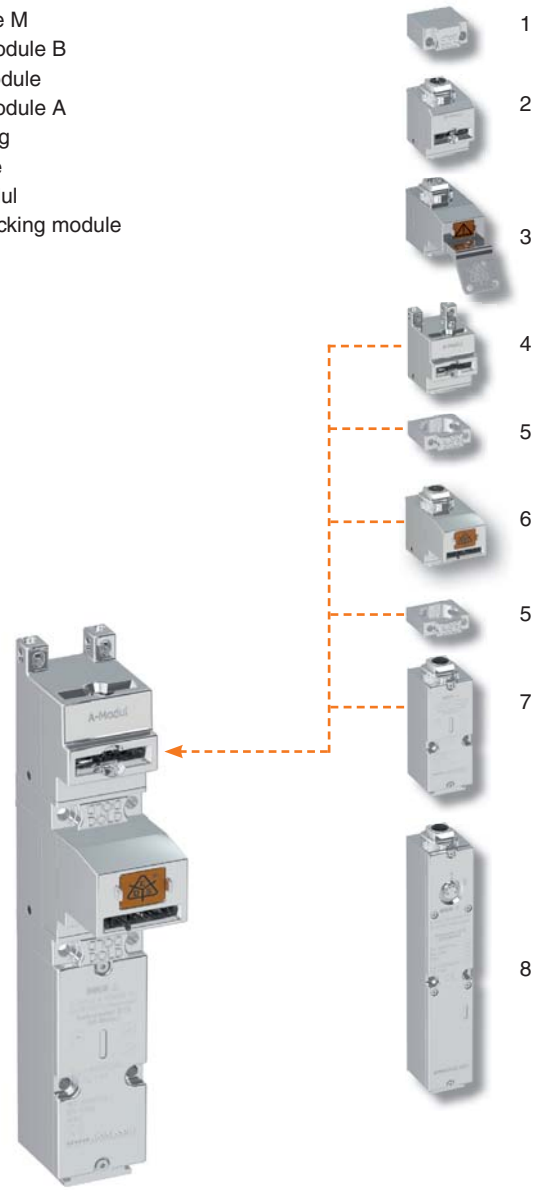
The System

The SAFEMASTER STS system offers far more than just the combination of safety switches and a key interlock system. It adds the advantages of both systems by the integration of wiringfree mechanical components and electrical safeguards. It is very flexible and is easily adapted to user requirements.

The system offers maximum safety and takes the requirements of the user concerning robustness, long life and user ergonomics into account. Special features are stainless steel units with ergonomic linear keys. It is flexible, can be easily extended and guarantees a safe and interruption free process, offering an intelligent and cost saving solution for industrial applications of all kinds.

With only a few single components, a number of individual interlock units can be assembled. The stainless steel units guarantee good stability. Extensive equipment allows a simple mounting.

1 End module M
2 Actuator module B
3 Padlock module
4 Actuator module A
5 Bayonet ring
6 Key module
7 Switch modul
8 Solenoid locking module



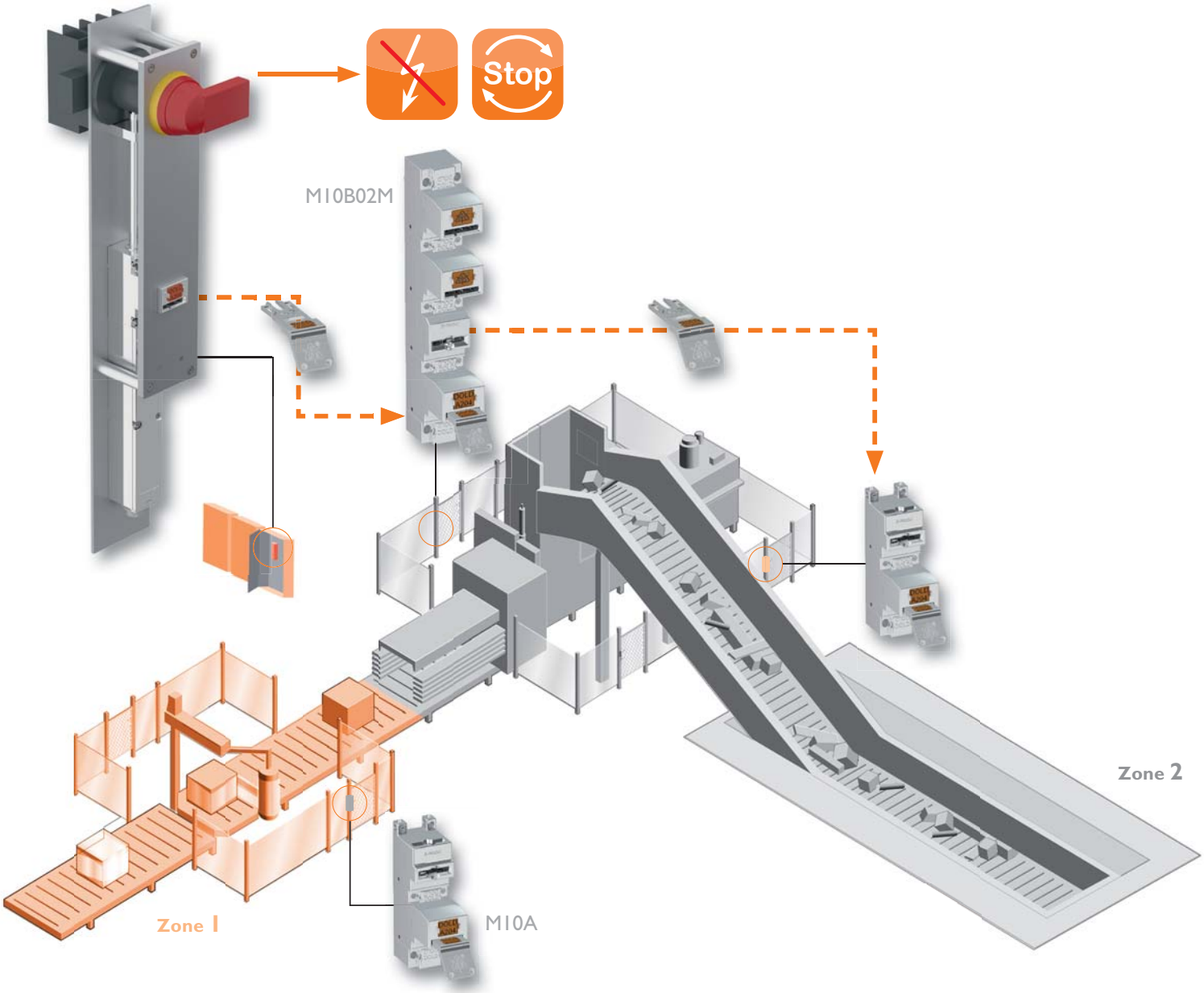
Example: SX01A

Example

The SAFEMASTER STS Program consists of modules that can be individually combined and adapted to your application. They combine the advantages of safety switches, interlock, key transfer and command function in one system.

The modular design allows systems to be assembled out of several units, or to modify and expand existing systems as required. All mechanical interlocks can be utilised in machine and plant concepts without wiring. They provide an economic and reliable proctection in wide applications.

The application example shows a baling press with additional packaging unit, combined with SAFEMASTER STS Power Interlocking. After the complete system has been switched off using the load-break switch, the key can be removed and other keys can be released as needed. The key can be used to open the various safety doors on the system, for example to perform maintenance. The system can only be restarted after all keys are returned to their initial positions.

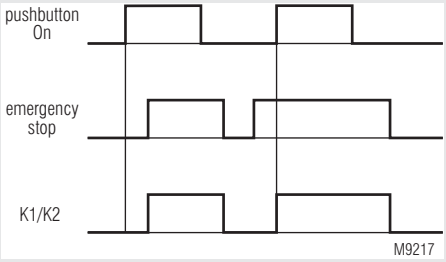


SAFEMASTER
Emergency Stop Module, Extremly Small
RK 5942

RK 5942._ _ RK 5942.01PC RK 5942.01PCA

- **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**
- 1- or 2-channel operation
- Output: 1 NO contact and 1 semiconductor monitoring output
- LED-indicator for relay 1 / 2 and supply voltage
- Width 17.5 mm and 64 mm depth

Function Diagramm



Approvals and Markings

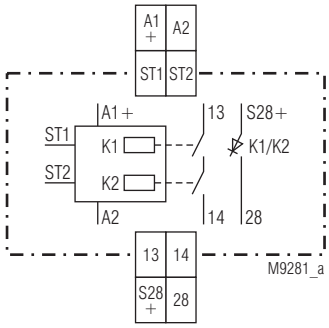
Applications

- Protection of people and machines
- Emergency stop circuits on machines

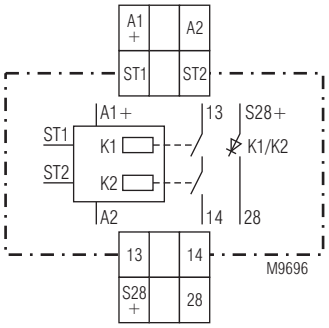
Indicators

LED Power: on, when supply connected
LED K1/K2: on, when relay K1 and K2 energized

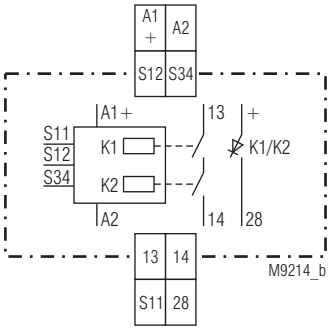
Circuit Diagrams



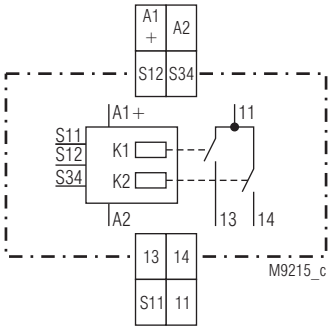
RK 5942.01



RK 5942.01PC
RK 5942.01PCA



RK 5942.02

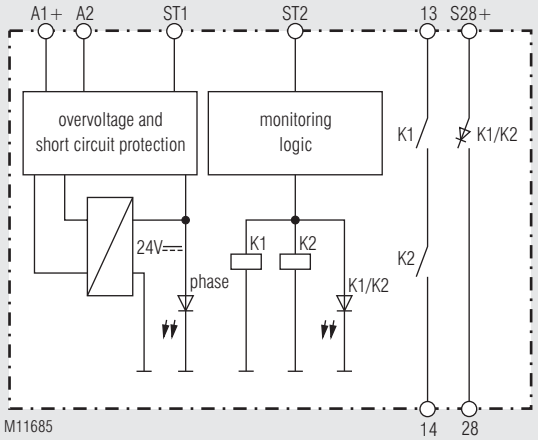


RK 5942.03

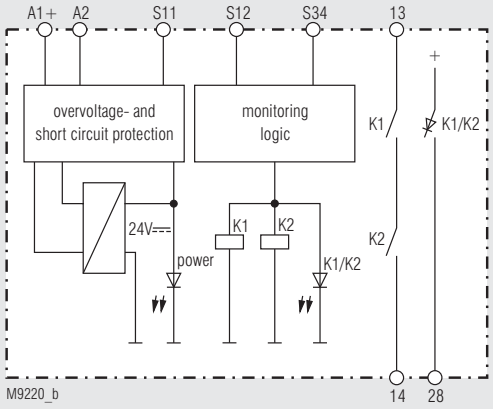
Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
ST2, S12, S34	Steuereingang
ST1, S11	Steuerausgang
11, 13, 14	Schließer zwangsgeführt für Freigabekreis
S28+	Versorgungsspannung für Halbleiterausgang
28	Halbleiter-Meldeausgang

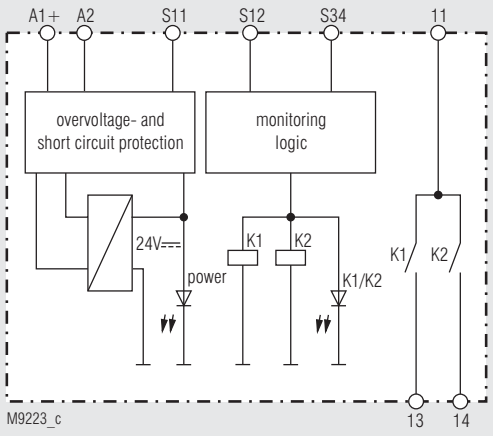
Block Diagrams



RK 5942.01



RK 5942.02



RK 5942.03

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range	
at 10 % residual ripple:	DC 0.9 ... 1.1 U_N
Nominal consumption:	2.2 W
Control voltage on ST1 or S11:	typ. DC 22,5 V
Control current:	typ. 95 mA
Recovery time:	0.5 s

Output

Contacts	
RK 5942.01, RK 5942.02:	1 NO contact, 1 semiconductor monitoring output
RK 5942.03:	2 NO contacts, with common source terminal

The semiconductor output can only be used for monitoring. The contact S28+ must not be connected after the e-stop contact e.g. to A1 of the e-stop module.

Operate delay:	typ. 80 ms	
Release delay:	typ. 70 ms	
Contact type:	Forcibly guided	
Thermal current I_{th}:	max. 5 A (see continouos current limit curve)	
Nominal output voltage:	AC 250 V	
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 / 24 V	IEC/EN 60 947-5-1
Electrical life		
at 5 A, AC 230 V cos φ = 1:	> 10^5 switching cycles	
according to DC 13		
semiconductor output:	DC 24 V, 100 mA, short circuit strong (see continouos current limit curve)	
Output voltage		
at 100 mA:	21.5 V	
Permissable operating frequency:	600 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
line circuit braker:	B 6	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
nterference 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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	110 g	

Dimensions

Width x height x depth	
RK 5942.01; .02; .03:	17,5 x 90 x 71 mm
RK 5942.01PC:	17,5 x 122 x 71 mm
RK 5942.01PCA:	17,5 x 124 x 71 mm
Mounting depth:	64 mm

Standard Type

RK 5942.01 DC 24 V

Article number:	0058689
• Output:	1 Schließer, 1 Halbleiter
• Nominal voltage U_N:	DC 24 V
• Width:	17.5 mm

RK 5942.02 DC 24 V

Article number:	0058690
• Output:	1 Schließer, 1 Halbleiter
• Nominal voltage U_N:	DC 24 V
• Width:	17.5 mm

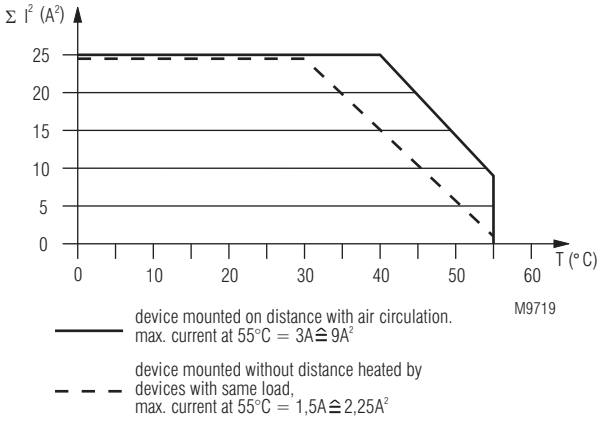
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
Device cannot be activated	- Start button defective e. g. ST1-ST2 or S12-S34 not bridged - A safety relay is welded (replace device)

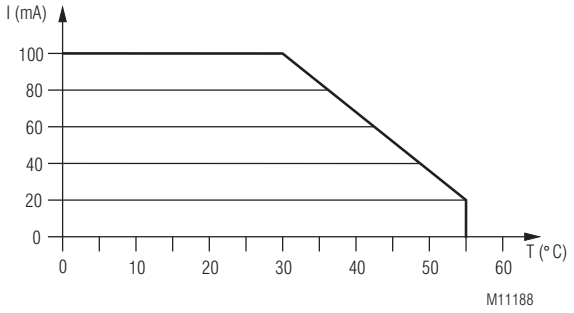
Maintenance and repairs

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

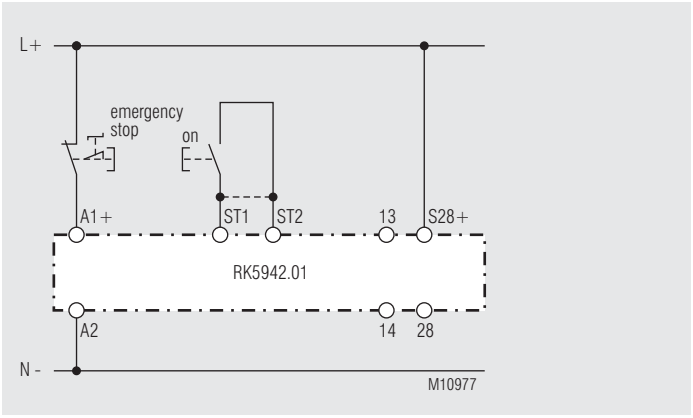
Characteristics



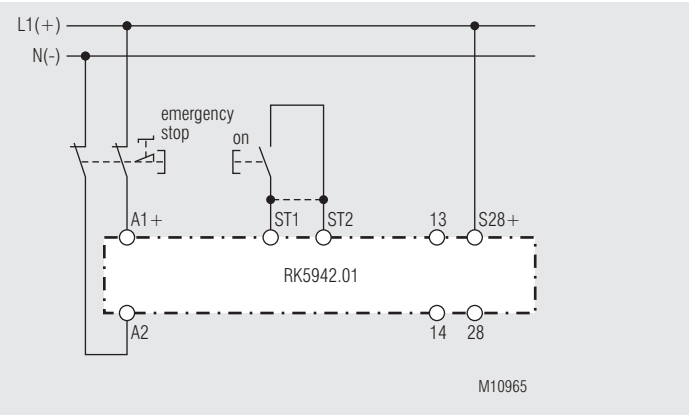
Continouos current limit curve output contacts



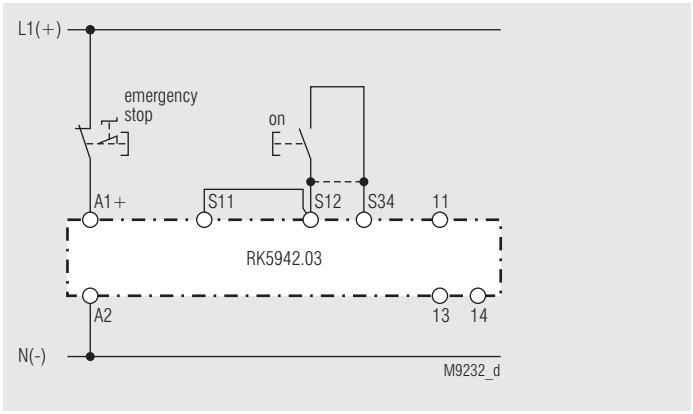
Continouos current limit curve semiconductor outputs



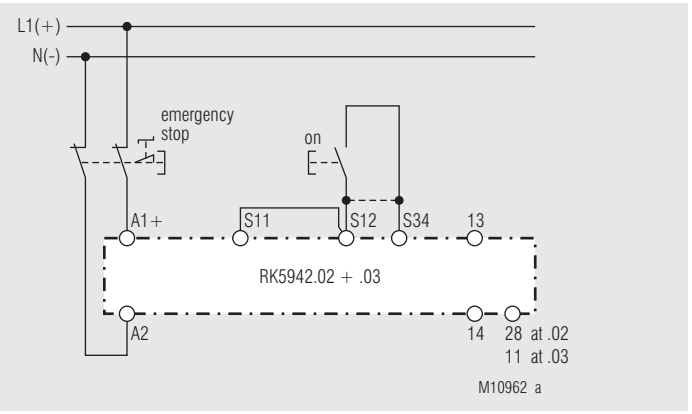
Single channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals S12 - S34 must be linked.
No ON-pushbutton necessary.
Suited up to SIL2, Performance Level d, Cat. 3*)



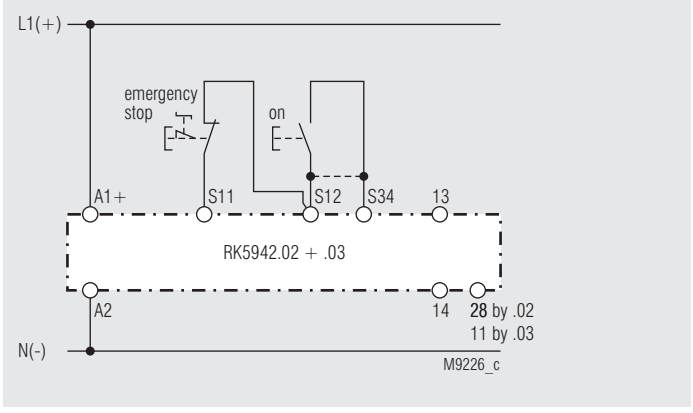
2-channel emergency-stop circuit without feed back loop, as option with or without automatic restart.
For automatic restart terminals S12 - S34 must be linked.
No ON-pushbutton necessary.
Suited up to SIL3, Performance Level e, Cat. 4



Single channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals S12 - S34 must be linked.
No ON-pushbutton necessary.
Suited up to SIL2, Performance Level d, Cat. 3*)

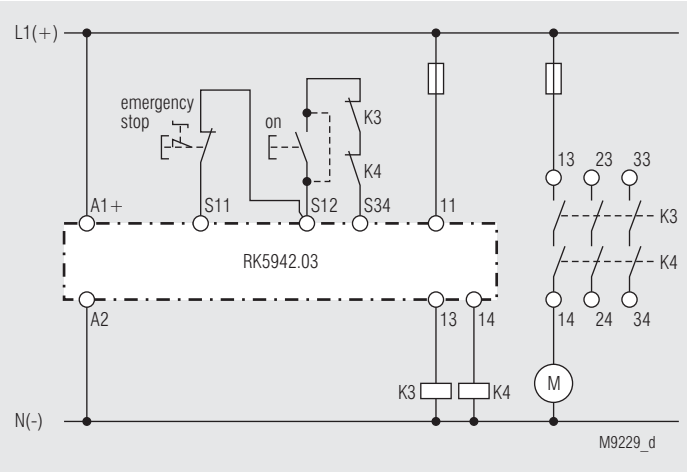


2-channel emergency-stop circuit without feed back loop, as option with or without automatic restart.
For automatic restart terminals S12 - S34 must be linked.
No ON-pushbutton necessary.
ATTENTION ! When this application is used with RK5942.02, it must be guarateed that the external circuit on contact 28 has no feedback influence. I.e. no external voltage must be connected to contact 28.
Suited up to SIL3, Performance Level e, Cat. 4

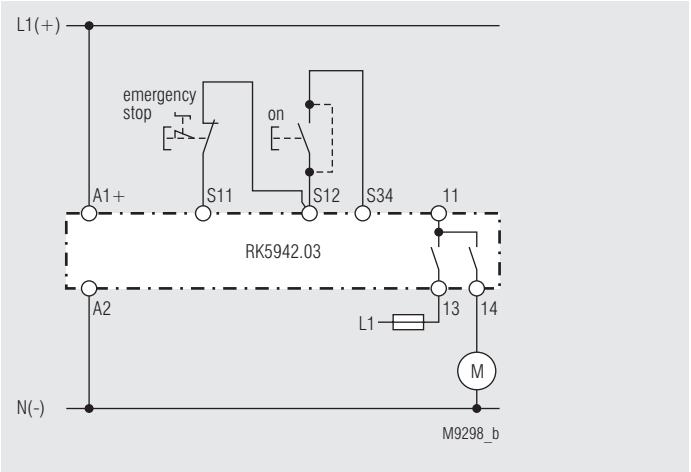


Single channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals S12 - S34 must be linked.
No ON-pushbutton necessary.
Suited up to SIL2, Performance Level d, Cat. 3*)

*) Suited up to SIL3, Performance Level e, Cat. 4, when the complete e-stop circuit is within the same cabinet.



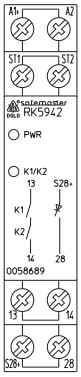
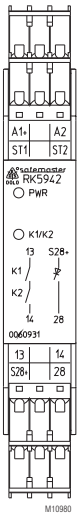
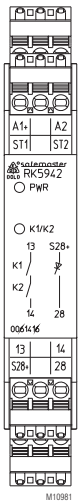
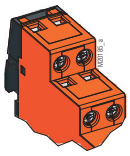
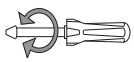
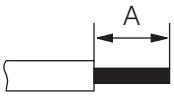
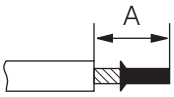
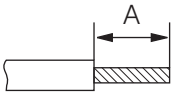
Contact reinforcement by external contactors.
At a thermal current I_{th} > 5 A the output contacts can be reinforced by external contactors with forcibly guided contacts.
Functioning of the external contactors is monitored by looping the NC contacts into the start circuit (S12 - S34).
ATTENTION ! For applications of safety stops the load must be connected to the contacts in series with 2 NO contacts.
Suited up to SIL2, Performance Level d, Cat. 3*)



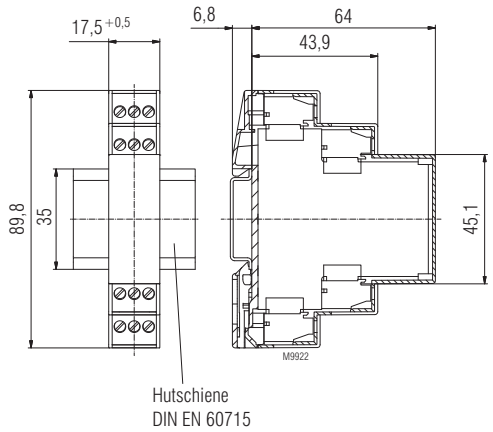
ATTENTION ! For applications of safety stops the load must be connected to the contacts in series with 2 NO contacts.
Suited up to SIL2, Performance Level d, Cat. 3*)

*) Suited up to SIL3, Performance Level e, Cat. 4, when the complete e-stop circuit is within the same cabinet.

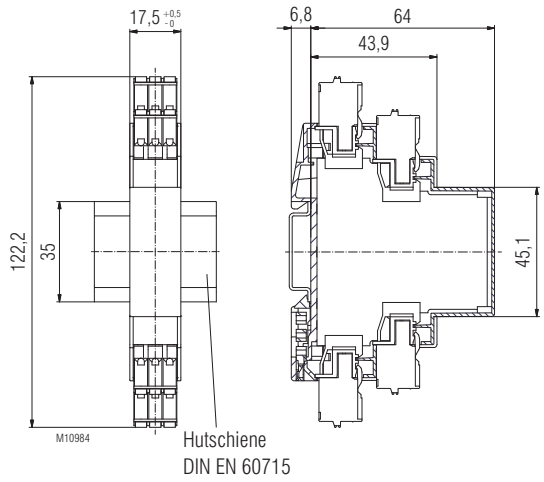
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M10291	 M10980	 M10981
			
	ø 4 mm / PZ 1 1,2 Nm 10,6 LB. IN	DIN 5264-A; 0,6 x 3,5	
 M10248	A = 10 mm 1 x 0,5 ... 6 mm² 1 x AWG 20 to 10	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	
 M10249	A = 10 mm 1 x 0,5 ... 6 mm² 1 x AWG 20 to 10	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,5 ... 1,5 mm² mit TWIN-Aderendhülse	
 M10250		A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	

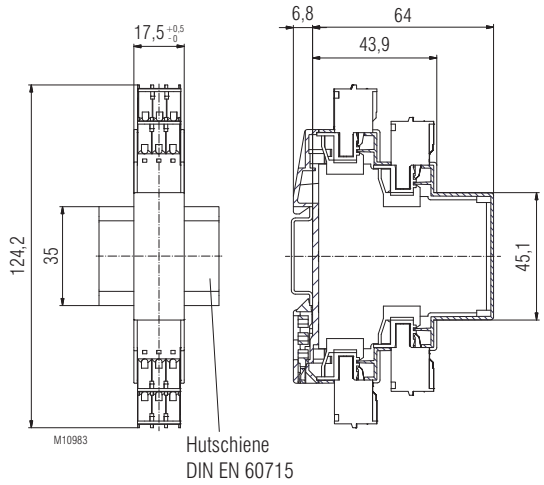
DE	**Maßbilder (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



RK5942.01



RK5942.01PC



RK5942.01PCA

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	1442,5	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)

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:	99,0	%
PFH_D:	3,21E-10	h^{-1}
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Emergency Stop Module
UF 6925

0275136

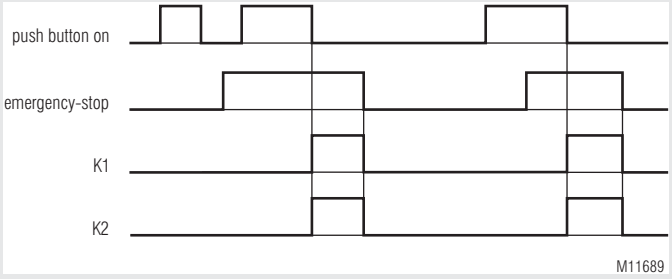
Product Description

The Emergency-Stop-Module UF 6925 is suitable to protect men and machine by safety related enabling or disabling of a safety circuit. It is used in applications with e-stop buttons and safety gates.

Your Advantages
- For safety applications up to PL e / Cat. 4 e.g. SIL 3
- Space saving
- Connection front side
- Manual or automatic start
- Can be used also for safety gate
- Line fault detection on On-button

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**
- According to EN 50156-1 for furnaces
- 2-channel operation
- Forcibly guided output contacts
- With or without cross fault monitoring in the E-stop loop, switch S1
- Manual restart or automatic restart, switch S2
- LED indicator for channel 1, 2 and Netz
- Width 17,5 mm

Function Diagram



Approvals and Markings

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

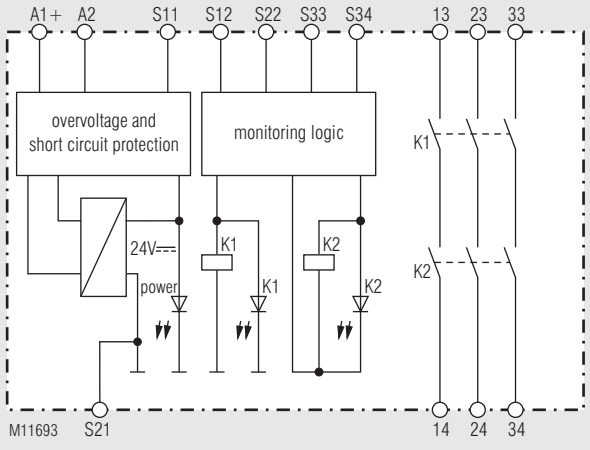
Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of position switches on a safety gate

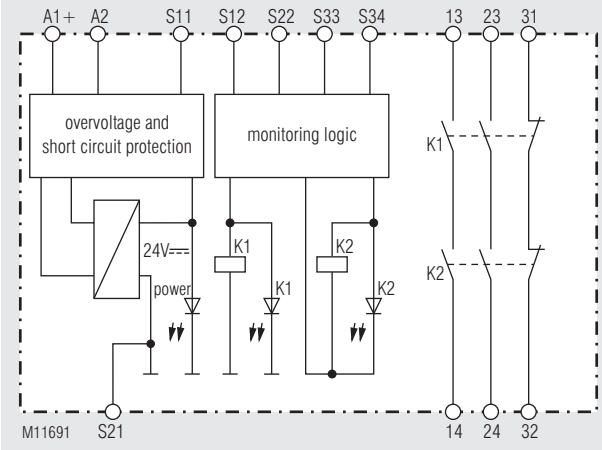
Indicators

green LED Netz:	on when supply connected
green LED K1:	on when relay K1 energized
green LED K2:	on when relay K2 energized

Block Diagrams

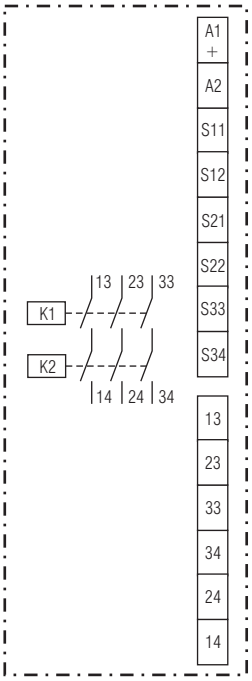


UF 6925.03



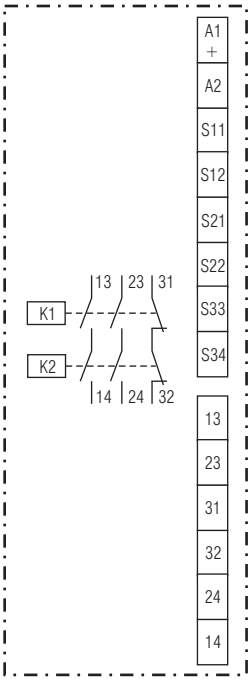
UF 6925.22

Circuit Diagrams



M11315

UF 6925.03



M11314

UF 6925.22

Connection Terminals

Terminal designation	Signal description
A1+	+
A2	-
S12, S22, S34	Control inputs
S11, S21, S33	Control outputs
13, 14, 23, 24, 33,34	Forcibly guided NO contacts for release circuit
31, 32	Forcibly guided indicator output

Notes

Setting Cross fault detection
Switch S1 is for selecting with or without cross fault detection at the e-stop button resp. on safety gate.
For connection please see application examples.

ATTENTION! The setting of S1 has to be made before starting the device.

Setting Start-Mode
S2 is used to change between automatic and manual restart. On automatic start also the terminals S33 - S34 have to be linked.
With the function manual start a start button has to be connected to terminals S33-S34. The unit starts up with the negative edge of the start button signal.
For connection please see application examples.

ATTENTION! The setting of S2 has to be made before starting the device.

Line fault detection on On-button
A line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close. A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

ATTENTION! If a line fault is removed while the unit is powered up, the unit switches on.

Technical Data

Input

Nominal Voltage U_N:	DC 24 V, DC 8 ... 36 V The power supply shall meet the requirements of SELV / PELV	
Voltage range		
DC 24 V:	0.8 ... 1.1 U_N	
Nominal consumption at		
DC 24 V:	< 1.6 W	
DC 8 ... 36 V:	< 2.2 W	
Min. Off-time:	150 ms	
Control voltage on S11 at not activated device:	DC 23 V at U_N	
Control current typ. over S12, S22:	30 mA at U_N	
Min. voltage on terminal S12 at not activated device:	DC 19 V	
Short-circuit protection:	Internal PTC	
Overvoltage protection:	Internal VDR	

Output

Contacts		
UF 6925.03:	3 NO contacts	
UF 6925.22:	2 NO contacts, 1 NC contact	
The NO contacts are safety contacts.		
The NC contacts 31-32 can only be used for monitoring.		
Operating time at U_N:	< 350 ms	
Release delay at U_N:		
in case of break of supply voltage:		
DC 24 V:	< 20 ms	
DC 8 ... 36 V:	< 90 ms	
in case of break of S12, S22:	< 25 ms	
Contact type:	Relay, forcibly guided	
Thermal current I_{th}:	max. 8 A (see limit curve for arc-free operation)	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	2 A / 24 V	IEC/EN 60 947-5-1
NC contact:	2 A / 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
NC contact:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
Electrical life		
at AC 230 V, 8 A, cos φ = 1:	> 1.0 x 10^5 switching cycles (at 1 s On, 1s Off)	
Permissible operating frequency:	max. 1 200 Schaltspiele / h	
Short circuit strength		
max. fuse rating:	8 A gL	IEC/EN 60 947-5-1
line circuit breaker:	B 6 A	
Mechanical life:	> 40 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 55 °C	
Storage:	- 25 ... + 85 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
Rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC:	IEC/EN 61 326-3-1	
Interference suppression		
DC 24 V:	Limit value class B	EN 55 011
DC 8 ... 36 V:	Limit value class A*)	EN 55 011

*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Technical Data

Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm Frequenz 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	140 g	

Dimensions

Width x height x depth: 17.5 x 110 x 120 mm

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL60947, "general use applications"

Standards:
- ANSI/UL 60947-1, 5th Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-5-1, 3th Edition (Low-Voltage Switchgear and Controlgear Part5-1: Control circuit Devices an Switching Elements - Electro-mechanical Control Circuits Devices)
- CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition (Low-Voltage Switch-gear and Controlgear - Part1: General rules)
- CAN/CSA-C22.2 No. 60947-1-14, 1st Edition (Low-Voltage Switch-gear and Controlgear - Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)

Switching capacity:	
UF 6925.03:	Pilot duty B300, Q300 6A 250Vac Resistive 6A 24Vdc Resistive
UF 6925.22:	Pilot duty B300, Q300 8A 250Vac Resistive 8A 24Vdc Resistive
Wire connection:	min. 60°C copper conductors AWG 28 - 14

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

Standard Type

UF 6925.03/61 DC 8 ... 36 V

Article number:	0067556
• Output:	3 NO contacts
• Nominal voltage U_N:	DC 8 ... 36 V
• Width:	17.5 mm

Variants

UF 6925._ _ /1 _ _:
For switching small loads of 10 mVA ... 12 VA bzw. 10 mW ... 12 W in the ranges 2 ... 60 V und 2 ... 300 mA.
The device is also suitable for switching the maximum switching current. However, this will burn off the gold plating of the contacts, so that switching of small loads is no longer possible afterwards.

Ordering example for variants

UF 6925 .03 /_ _ _ /61 DC 8 ... 36 V

- DC 8 ... 36 V: Nominal voltage (DC 24V; DC 8 ... 36V)
- /61: UL-approval
- /_ _ _: Cross fault detection (0 = adjustable); Start-Mode (0 = adjustable); Switching capacity (0 = Standard; 1 = for small loads (2 ...60 V, 2...300 mA) (on request))
- .03: Contacts (.03 = 3 NO contacts; .22 = 2 NO contacts, 1 NC contact)
- UF 6925: Type

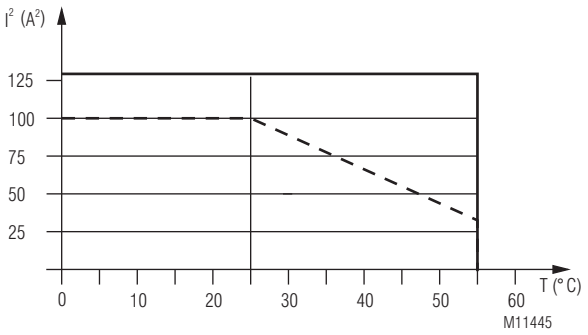
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	- A safety relay is welded (replace device) - Incorrect setting of switch S1 Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged

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



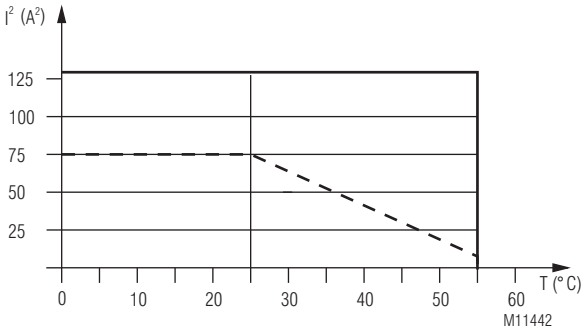
device free-standing
max. current at 55°C over
2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

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

Quadratic total current limit curve DC 24 V



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

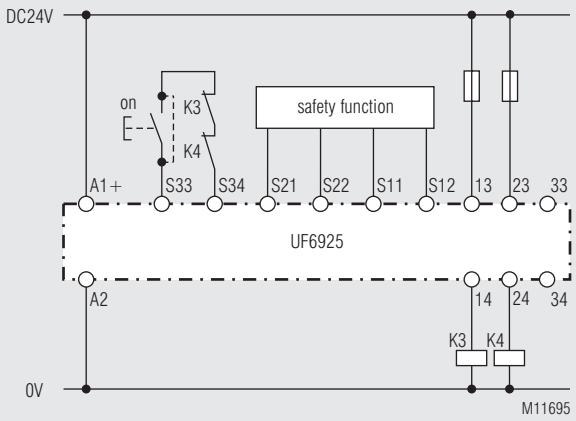
device mounted without distance heated by
devices with same load,
max. current at 55°C over
2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

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

I_1, I_2 - current in contact paths

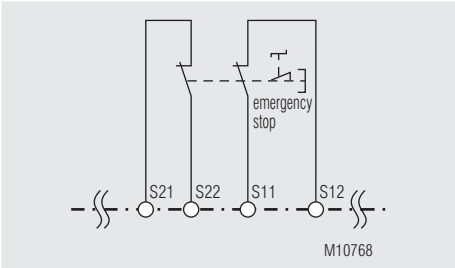
Quadratic total current limit curve DC 8 - 36 V

Application Examples

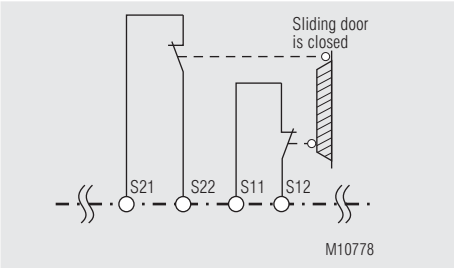


A jumper must be fitted S33 - S34 for the automatic On function. The On pushbutton is not required. The required start function has to be selected on switch S1 before starting the device. (see "Unit Programming").
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S33 - S34).

Safety function for units with cross fault detection (pay attention to "Unit Programming"!)

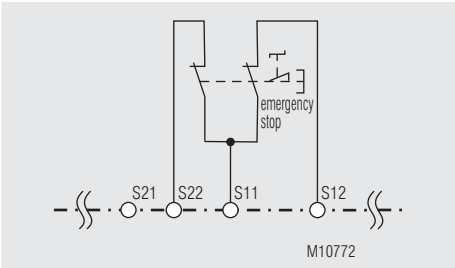


Fct.: E-stop
SIL 3, PL e, Cat. 4

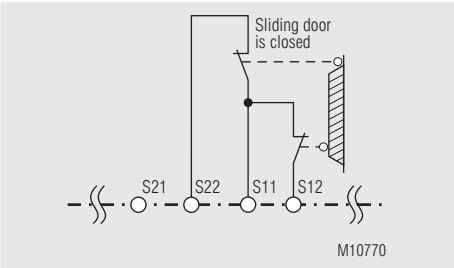


Fct.: Safety gate
SIL 3, PL e, Kat. 4

Safety function for units without cross fault detection (pay attention to "Unit Programming"!)



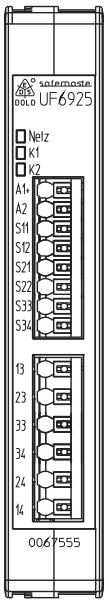
Fct.: E-stop
SIL 3, PL e, Cat. 4 [1)]

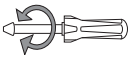
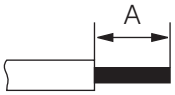
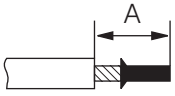
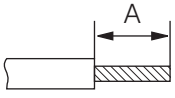


Fkt.: Safety gate
SIL 3, PL e, Cat. 4 [1)]

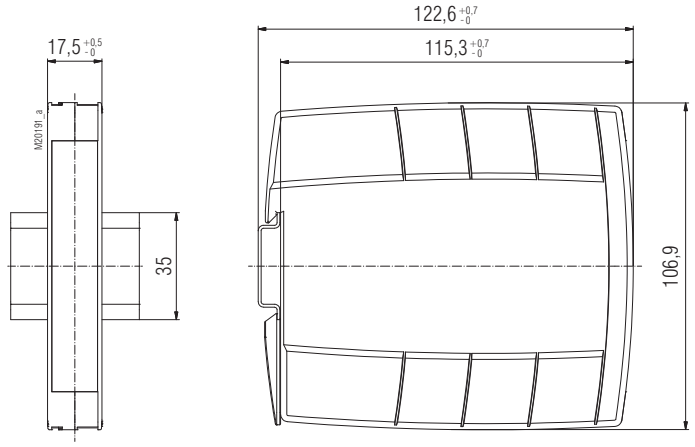
[1)] To achieve the safety classifications a crossfault safe wiring has to be installed.

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

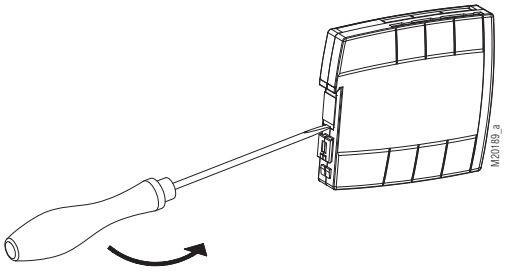


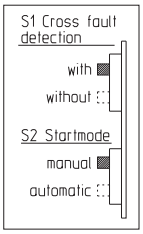
	DIN 5264-A; 0,5 x 3
 M10248	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 8 mm 1 x 0,25 ... 0,75 mm² 1 x AWG 24 to 16
 M10250	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**





M11589_a

DE	S1 Querschlußerkennung ■ mit ☐ ohne
FR	S1 Transversal ■ avec ☐ sans

DE	S2 Start ■ Hand ☐ Auto
FR	S2 Reset ■ Manu ☐ Auto

DE	Zur Einstellung der Funktionen Automatischer Start, Hand-Start und mit oder ohne Querschlusserkennung sind die Schalter S1 und S2 vorgesehen. Diese Schalter befinden sich hinter der Abdeckplatte auf der Unterseite des Gerätes. Die Schalter S1 und S2 dürfen nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	The selection of the functions auto start, manual start, with or without cross fault monitoring is done with switches S1 and S2. These switches are located behind a cover at the bottom of the device. The setting of S1 and S2 has to be made before starting the device. Disconnect unit before setting of S1 and S2! Drawing shows setting at the state of delivery.
FR	Pour les choix d'options (démarrage automatique, démarrage manuel et arrêt d'urgence avec ou sans détection des courts-circuits transversaux), on dispose des interrupteurs S1 et S2 situés derrière la plaque de dessous de l'appareil. Commutation de S1et S2 uniquement hors tension! Appareil livré tel que sur le schéma.

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	284,6	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)

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:	99,0	%
PFH_D:	8,30E-11	h^{-1}
PFD_{AVG}:	9,10E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode		Intervall for cyclic test of the safety function
Consigne résultante de la fonction sécuritaire de l'appareil au High Demand Mode		Intervale du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Emergency Stop Module
BG 5924, IP 5924

0225592

BG 5924

IP 5924

Your Advantages

- For safety application up to PL e / Cat. 4 e.g. SIL 3
- Manual or automatic start

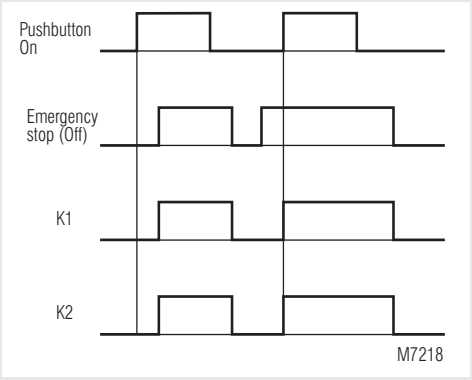
Features

- **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**
- According to EN 50156-1 for furnaces
- Single channel or two-channel operation
- Output: max. 4 NO contacts
- AC 230 V model with galvanic separation
- LED indicator for channel 1 / 2 and state of operation
- Short circuit detection between terminal Y1 and common
- BG 5924 with:
  - Removable terminal strips
  - Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- BG 5924: width 22.5 mm
- IP 5924: width 70 mm

Product Description

The emergency stop modules BG 5924 and IP 5924 can be used to protect people and machines by interrupting a safety circuit in a safe way.

Function Diagram



Approvals and Markings

Product Safety Functional Safety
TÜVRheinland CERTIFIED
www.tuv.com ID 0600000000
Canada / USA
Canada
A025518

* see variants 1) for BG 5924 only

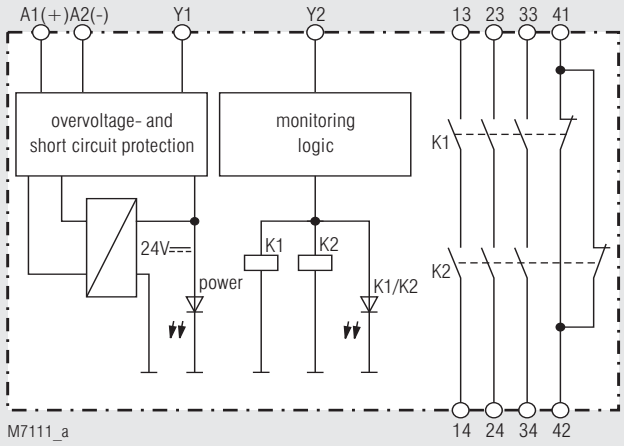
Applications

- Protection of people and machines
- Emergency stop circuits on machines

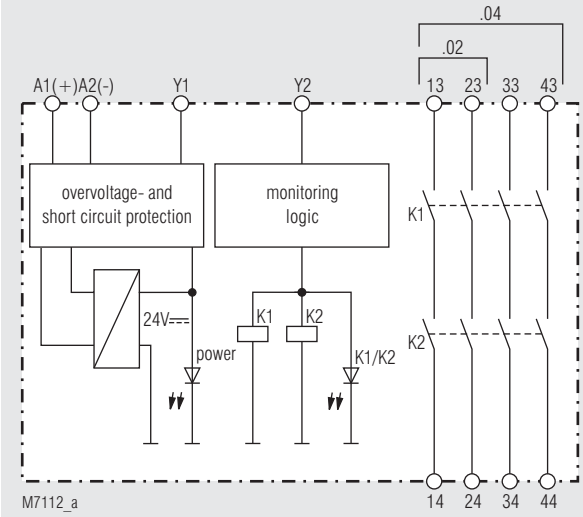
Indicators

LED Phase:	on, when supply connected
LED K1/K2:	on, when relay K1 and K2 energized

Block Diagrams

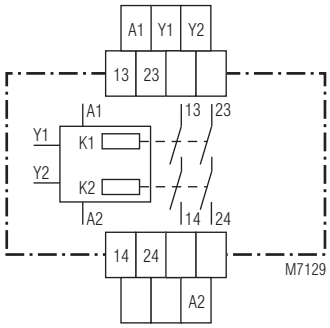


BG 5924.48, IP 5924.48

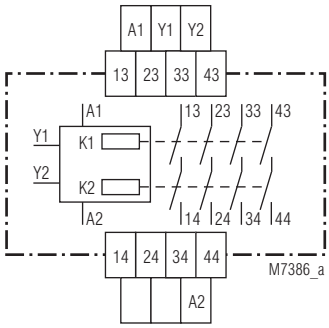


BG 5924.02, BG 5924.02/110,
BG 5924.04, BG 5924.04/100,
IP 5924.02, IP 5924.04

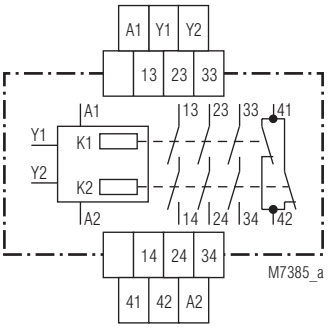
Circuit Diagrams



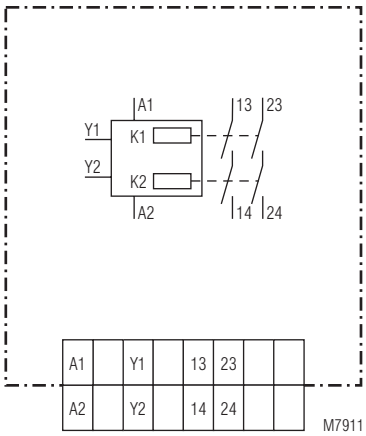
BG 5924.02, BG 5924.02/110



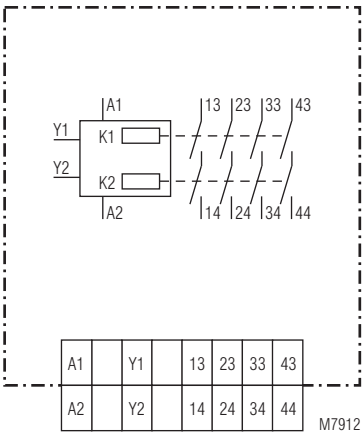
BG 5924.04, BG 5924.04/100



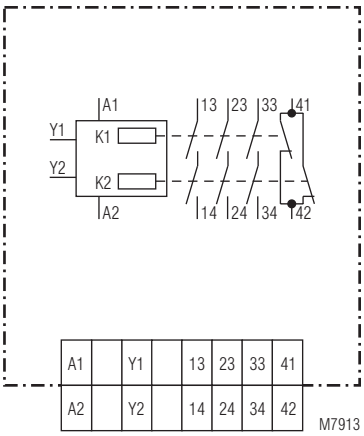
BG 5924.48



IP 5924.02



IP 5924.04



IP 5924.48

Connection Terminals

Terminal designation	Signal description
A1(+)	+ / L
A2 (-)	- / N
Y1, Y2	Inputs
13, 14, 23, 24, 33, 34, 43, 44	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Technical Data

Input

Nominal voltage U_N:		
BG 5924:	DC 24 V (only for variant /110)	
	AC/DC 24, 48 V	
	AC 110, 115, 230 V	
IP 5924:	AC/DC 24, 48 V	
	AC 110, 230 V	
Nominal frequency:	50 / 60 Hz	
Voltage range:	AC 0.8 ... 1.1 U_N	
at 10 % residual ripple:	DC 0.9 ... 1.1 U_N	
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N	
Nominal consumption		
AC/DC 24 V:	DC 1.2 W	AC 2 VA
AC 230 V:	3.5 VA	
Control voltage on Y1		
AC/DC 24 V:	typ. DC 23 V	
AC 230 V:	max. 45 V short pulse	
Control current:	typ. DC 45 mA	
Recovery time:	0.5 s	

Output

Contacts		
BG 5924.02, IP 5924.02:	2 NO contacts	
BG 5924.04, IP 5924.04:	4 NO contacts	
BG 5924.48, IP 5924.48:	3 NO, 1 NC contacts	

The NO contacts are safety contacts.

The NC contacts 41-42 can only be used for monitoring.

Operate delay:	max. 100 ms	
Release delay:	max. 35 ms	
Contact type:	forcibly guided	
Thermal current I_{th}:	max. 5 A (see limit curve)	
Nominal output voltage:	AC 250 V	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
NC contact:	4 A / 24 V at 0.1 Hz	
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	600 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
line circuit breaker:	B 6 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 25 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
Interference suppression	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1

Technical Data

Terminal designation:	EN 50 005	
Wire connection:		
Wire fixing:	Box terminal wih wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BG 5924:	210 g	
IP 5924:	206 g	

Dimensions

Width x height x depth:	
BG 5924:	22.5 x 84 x 121 mm
IP 5924:	70 x 90 x 59 mm

UL-Data

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

Nominal voltage U_N:	AC/DC 24 V
Ambient temperature:	-15 … +55°C
Switching capacity:	
NO contact:	Pilot duty B300
	5A 250Vac G.P.
	5A 24Vdc
NC contact::	5A 250Vac G.P.
	5A 24Vdc
Wire connection:	60°C / 75°C copper conductors only
	AWG 20 - 12 Sol Torque 0.8 Nm
	AWG 20 - 14 Str Torque 0.8 Nm

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

CSA-Data

Nominal voltage U_N:	AC/DC 24, AC/DC48V, AC110V, AC230V
Ambient temperature:	-15 … +55°C
Switching capacity:	3A 230Vac
Wire connection:	60°C / 75°C copper conductors only
	AWG 20 - 12 Sol Torque 0.8 Nm
	AWG 20 - 14 Str Torque 0.8 Nm

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

Troubleshooting

Failure	Potential cause
LED "Netz" does not light up	Power supply not connected
Device cannot be activated	- Safety relay is welded (replace device) - Start circuit Y1-Y2 not connected

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.

Standard Types

BG 5924.48 AC/DC 24 V

Article number:	0050982
• Output:	3 NO, 1 NC contacts
• Nominal voltage U_N:	AC/DC 24 V
• Width:	22.5 mm

IP 5924.48 AC/DC 24 V 50/60 Hz

Article number:	0053262
• Output:	3 NO, 1 NC contacts
• Nominal voltage U_N:	AC/DC 24 V
• Width:	70 mm

Variants

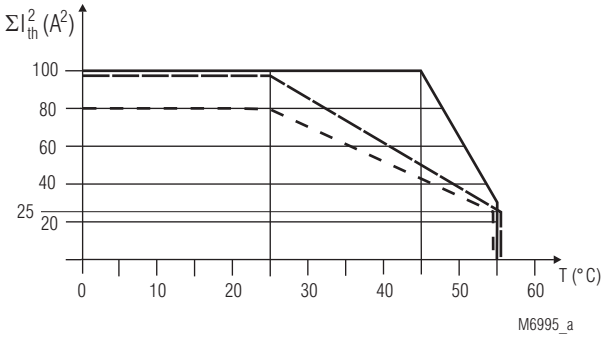
BG 5924._ _/60:	with CSA approval
BG 5924._ _/61:	with UL approval
BG 5924._ _/100:	with fast auto-start
BG 5924._ _/110:	voltage range with expandable tolerance 0.85 ... 1.15 U_N

Ordering example for Variant

BG 5924 .48 /_ _ _ AC/DC 24 V
- Nominal voltage
- Variant, if required
- Contact
- Type

IP 5924 .48 AC 230 V
- Nominal voltage
- Contact
- Type

Characteristics



AC / DC 24 V	device mounted on distance with aircondition
AC 230 V	device mounted on distance with aircondition
AC / DC 24 V und AC 230 V	device mounted without distances heated by devices with same load

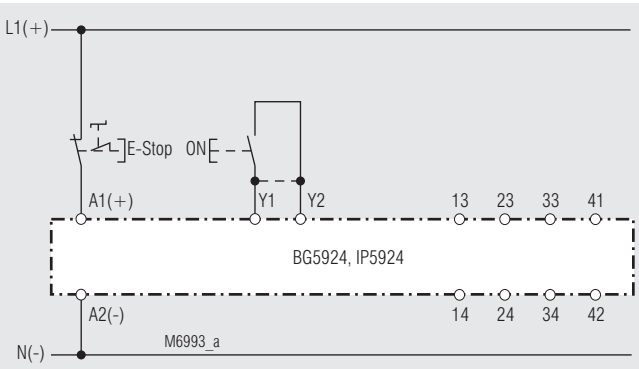
quadratic total current

$\Sigma I^2_{th} = I^2_{th1} + I^2_{th2} + I^2_{th3} + I^2_{th4}$

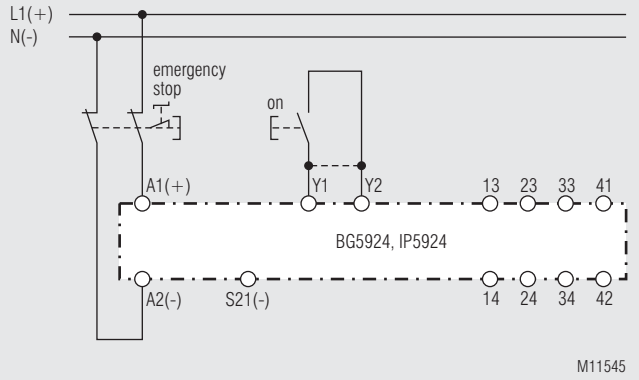
I_{th1} , I_{th2} , I_{th3} , I_{th4} : thermal current I_{th} on contact rows

Total current limit curve

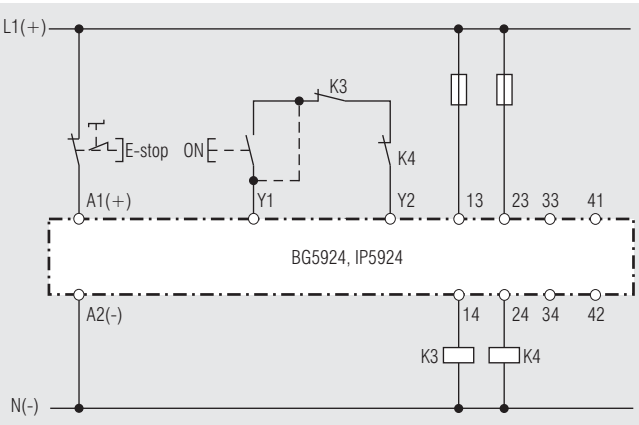
Application Examples



Single channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals Y1-Y2 must be linked.
No ON-push button necessary.
Suited up to SIL2, Performance Level d, Cat. 3*



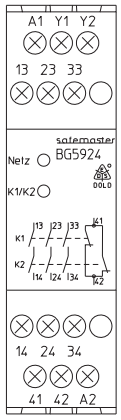
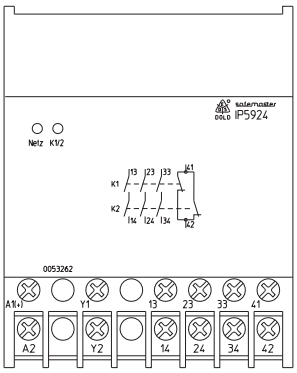
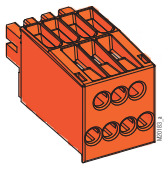
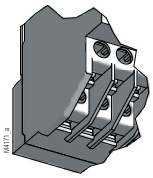
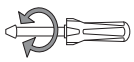
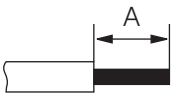
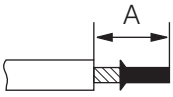
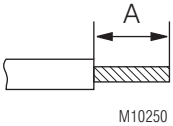
Two-channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals Y1-Y2 must be linked.
No ON-push button necessary.
Suited up to SIL3, Performance Level e, Cat. 4



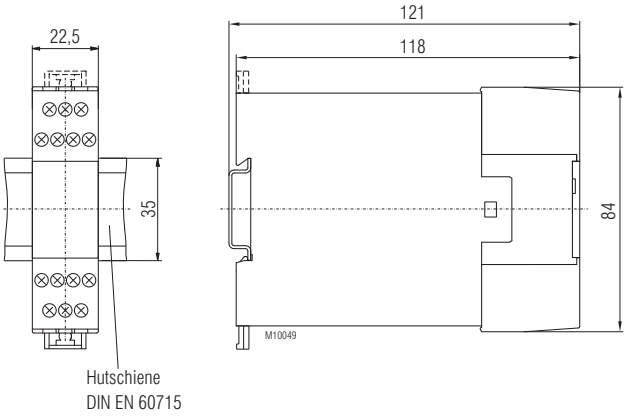
Contact reinforcement by external contactors, 2-channel controlled. For currents > 5 A the output contacts can be reinforced by external contactors. Functioning of the external contactors is monitored by looping the NC contacts into the start circuit (Y1-Y2).
Suited up to SIL2, Performance Level d, Cat. 3*

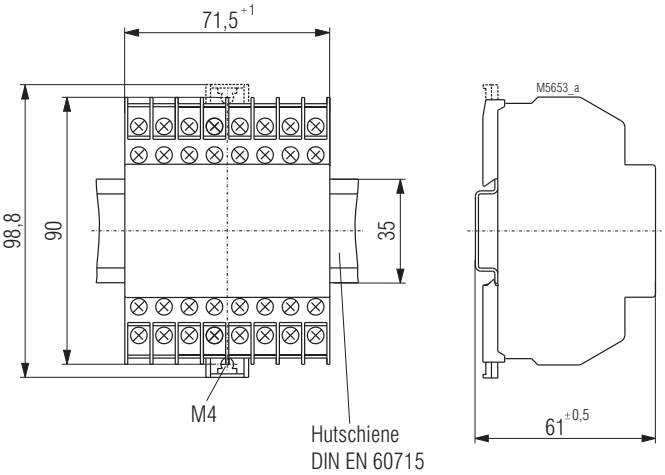
* Suited up to SIL3, Performance Level e, Cat. 4 for E-stop systems according to IEC 60947-5-5, under the following conditions:
- A maximum number of operations for the E-stop button is observed
- The E-stop button and the E-stop module are installed in the same cabinet

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

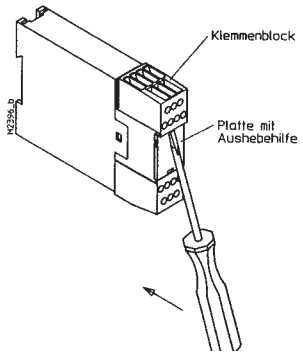
	 M10294	 M10293
		
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 6 mm / PZ 2 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14 min. ø 0,1 mm = AWG 26
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**





DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	220,9	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)

IEC EN 62061 IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,1E-10	h^{-1}
PFH_{AVG}:	5,8E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil au High Demande Mode		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione a High Demande Mode		Intervall per test ciclico della funzione di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

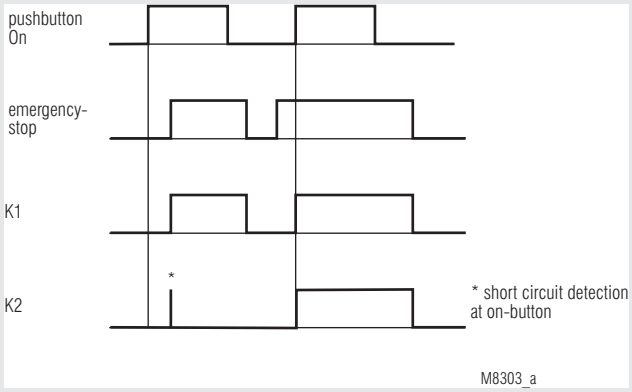
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Emergency Stop Module
BG 5925

0224208

- **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**
- Output: max. 3 NO contacts, see contacts
- Single and 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- With or without cross fault monitoring in the E-stop loop, switch S1
- LED indicator for channel 1 and 2 and Power
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 22.5 mm

Function Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 · c UL us LISTED * Canada / USA · C US * Canada / USA · A025518

* see variants

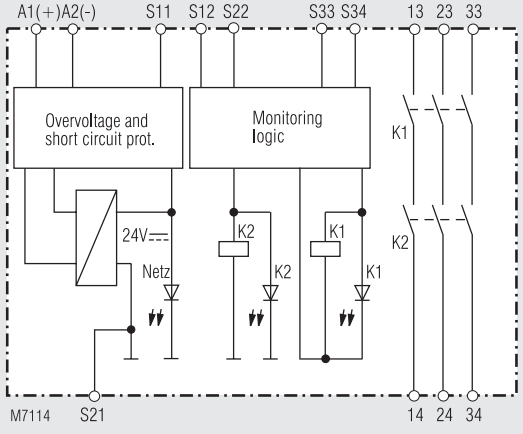
Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of safety gates

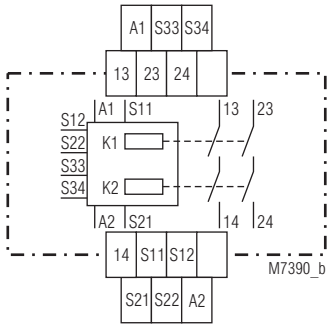
Indicators

LED Power:	on when supply connected
LED K1/K2:	on when relay K1/K2 energized

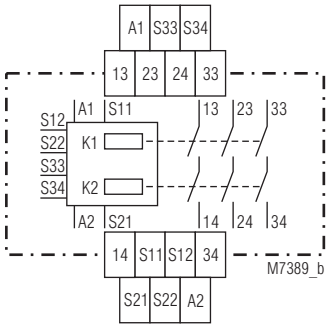
Block Diagram



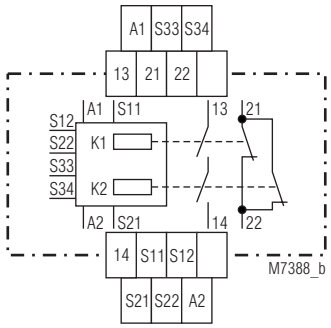
Circuit Diagrams



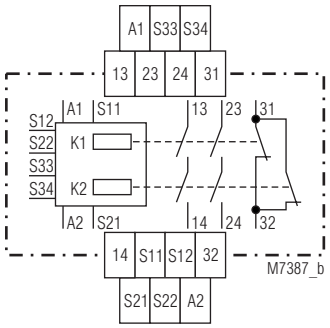
BG 5925.02



BG 5925.03



BG 5925.16

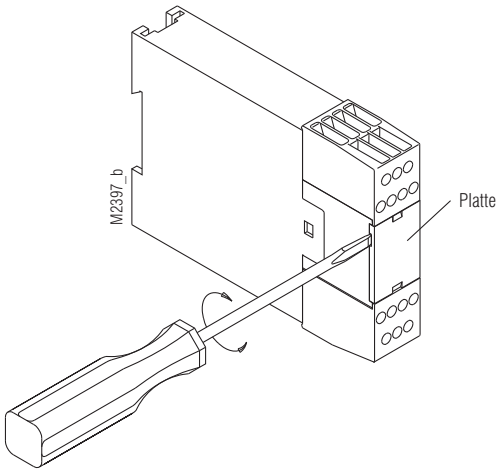


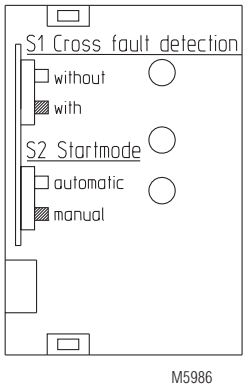
BG 5925.22

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S22, S33, S34	Inputs
S11, S21	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
21, 22, 31, 32	Forcibly guided indicator output

Unit programming





	S1	S2	Function
	available in unti		
BG 5925	yes	yes	
BG 5925._ _/101	yes	yes	
BG 5925._ _/102	no	no	automatic + without
BG 5925._ _/103	no	no	manual + with
BG 5925._ _/104	no	no	automatic + with

Disconnect unit before setting of S1
Drawing shows setting at the state of delivery

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S22, the unit will be activated because this line fault is similar to the normal On-function. The gold plated contacts of the BG 5925 mean that this module is also suitable for switching small loads of 1 mVA - 7 VA, 1 mW - 7 W in the range 0.1 - 60 V, 1 - 300 mA. The contacts also permit the maximum switching current. However since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this (not for variant BG 5925.22/102).
The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the E-stop loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2 (-). The short-circuit protection of line A1 (+) remains active.
To alter the functions automatic start - manual start and with or without cross fault monitoring, the switches S1 and S2 are used. These are located behind the front cover (see unit programming).
The setting with or without cross fault monitoring on E-stop buttons is made with S1. S2 is used to change between automatic an manual restart. On automatic start also the terminals S33 - S34 have to be linked. For connection please see application examples.

Technical Data

Input circuit

Nominal Voltage U_N:	DC 24 V, AC/DC 24 V	
Voltage range	DC	AC/DC
at 10% residual ripple:	0.9 ... 1.1 U_N	0.95 ... 1.1 U_N
at 48% Rresidual ripple:	0.8 ... 1.1 U_N	0.8 ... 1.1 U_N
Nominal consumption:	DC approx. 2 W	
Min. Off-time:	250 ms	
Control voltage on S11:	DC 23 V at U_N	
Control current over S12, S22:	40 mA at U_N	
Min. voltage between terminals S12, S22 and S21:	DC 21 V when relay activated and U_N on A1 - A2	
Short-circuit protection:	Internal PTC	
Overvoltage protection:	Internal VDR	

Output

Contacts

BG 5925.02:	2 NO contacts
BG 5925.03:	3 NO contact
BG 5925.16:	1 NO, 1 NC contact
BG 5925.22:	2 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 21-22 or 31-32 can only be used for monitoring.

Operate delay typ. at U_N:		
Manual start:	40 ms	
automatic start:	250 ms	
BG 5925._ _ /101:	100 ms	
Release delay typ. at U_N:		
Disconnecting the supply:	50 ms	
Disconnecting S12, S22:	15 ms	
Contact type:	forcibly guided	
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation	
Switching of low loads:	≥ 100 mV	
(contact 5 µ Au)	≥ 1 mA	
(contact AgNi)	≥ 10 mA / DC 24 V	
Thermal current I_{th}:		
on 1 contact path:	max. 5 A see current limit curve	
Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 1 A, DC 24 V:	> 1.5 x 10^5 switching cycles	
Permissible operating frequency:	max. 1 200 operating cycles / h	
Short circuit strength		
max. fuse rating:	6 A general-purpose	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

Technische Daten

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

Dimensions

Width x height x depth:	22.5 x 84 x 121 mm

UL-Data

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

Nominal voltage U_N:
BG 5925, /101, /102, /103, /104: DC 24 V
AC/DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity:
Ambient temperature 45°C: Pilot duty B300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.

Ambient temperature 55°C: Pilot duty B300
4A 250Vac Resistive
4A 24Vdc Resistive or G.P.

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

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

CSA-Data

Nominal voltage U_N:
BG 5925/113, /114: DC 24 V
AC/DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity: 5A 230Vac

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

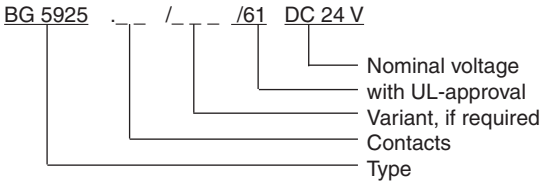
BG 5925.03/61 AC/DC 24 V

Article number:	0049169
• Output:	3 NO contacts
• Nominal voltage U_N:	AC / DC 24 V
• Width:	22.5 mm

Variants

BG 5925._ _/60:	CSA-approval
BG 5925._ _/61:	UL-approval
BG 5925._ _ /101:	E-stop with fast automatic start without line fault detection on the ON-button
BG 5925._ _ /102:	Automatic-restart, without crossfault monitoring
BG 5925.02/103:	Manual restart, with crossfault monitoring for DC 24 V Switching capacity to AC 15: 5 A / 230 V Contact fuse 6 A fast / 4 A slow without internal switches S1 and S2
BG 5925.02/104:	Automatic restart, with cross fault monitoring for DC 24 V Switching capacity to AC 15: 5 A / 230 V Contact fuse 6 A fast / 4 A slow without internal switches S1 and S2

Ordering example for variants



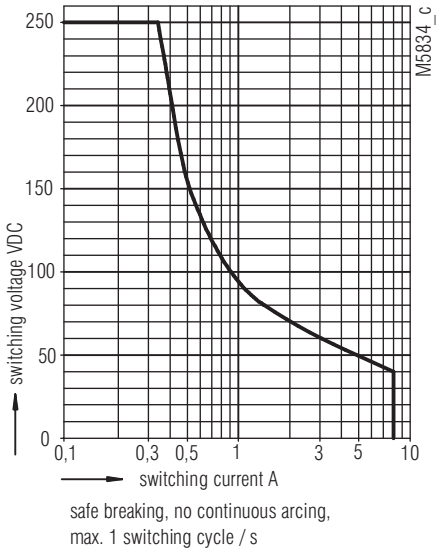
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

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.

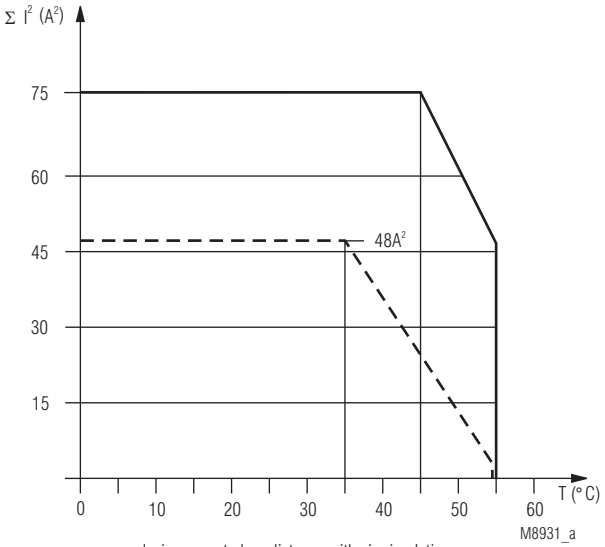
Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load

Characteristics



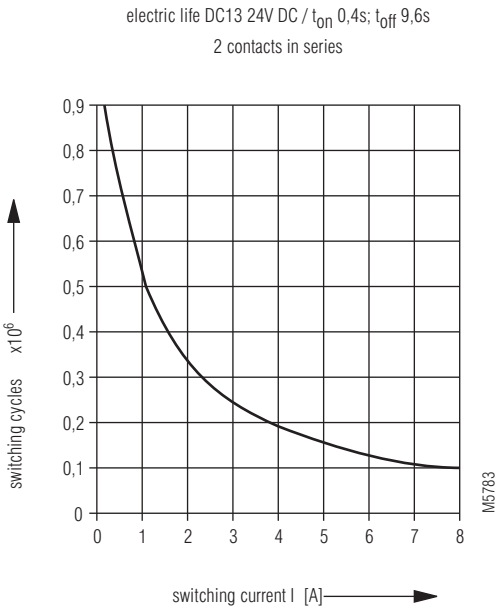
device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = 4A ≙ 3x4²A²=48A²

device mounted without distance heated by devices with same load,
max current at 55°C over
3 contactrows = 1A ≙ 3x1²A²=3A²

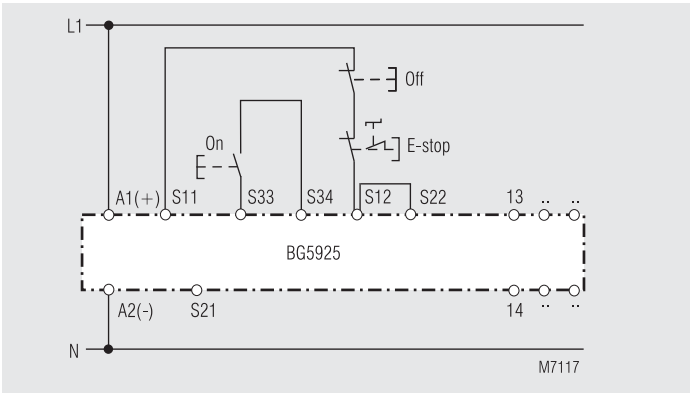
$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2$

I_1, I_2, I_3 - current in contactrows

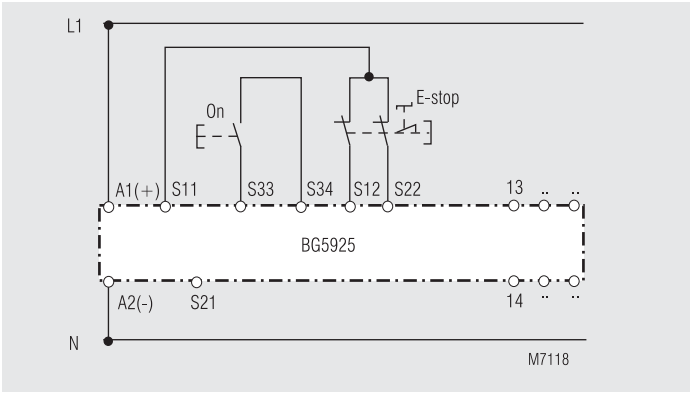
Quadratic total current limit curve



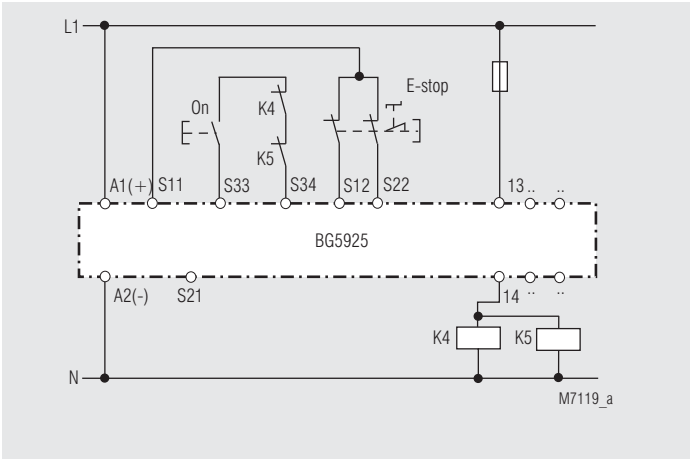
Contact service life



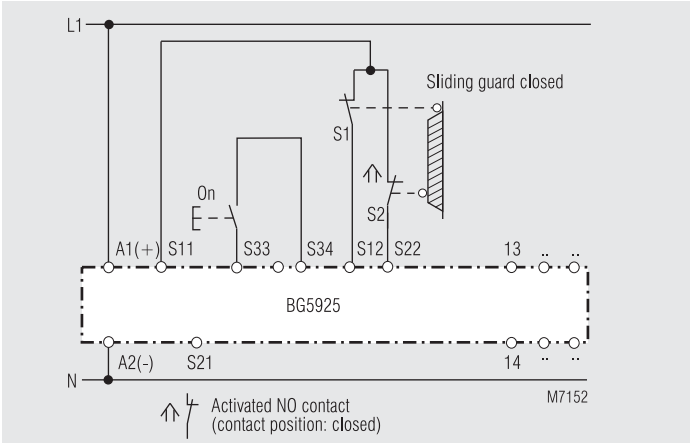
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit.
Note: Refer to „Unit programming“!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL2, Performance Level d, Cat. 3



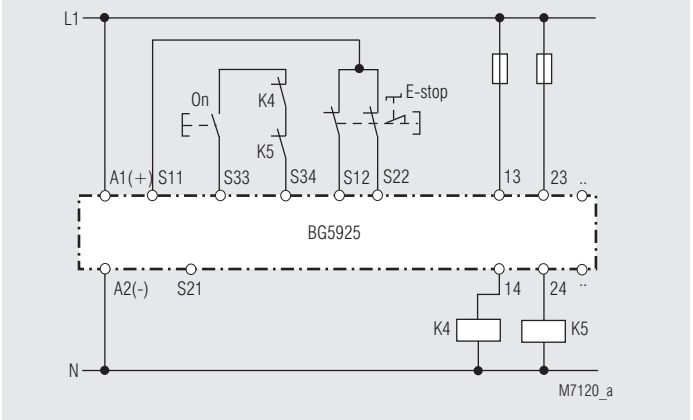
2-channel emergency stop circuit without cross fault monitoring.
Note: Refer to „Unit programming“!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



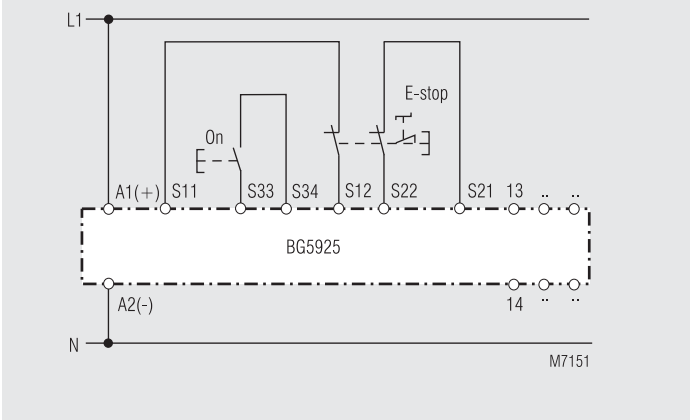
Contact reinforcement by external contactors controlled by one contact path.
Note: Refer to „Unit programming“!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



2-channel safety gate monitoring.
Note: Refer to „Unit programming“!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

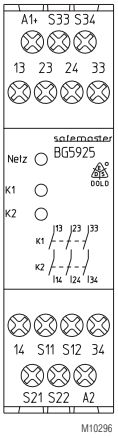


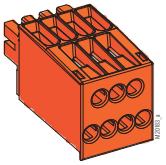
Contact reinforcement by external contactors, 2-channel controlled.
The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 8 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S33-S34).
Note: Refer to „Unit programming“!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

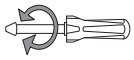
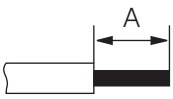
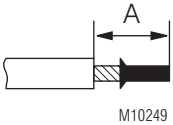
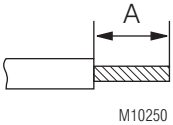


2-channel emergency stop circuit with cross fault detection
Note: Refer to „Unit programming“!
Switches in pos.: S1 cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

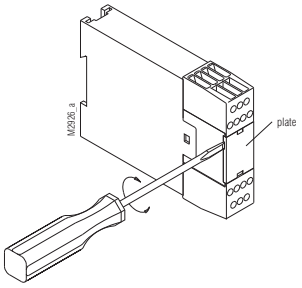
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

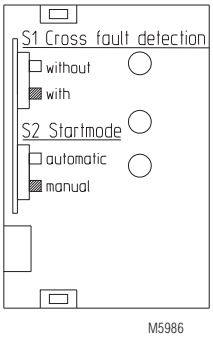




	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**
IT	**Impostazione del modulo**





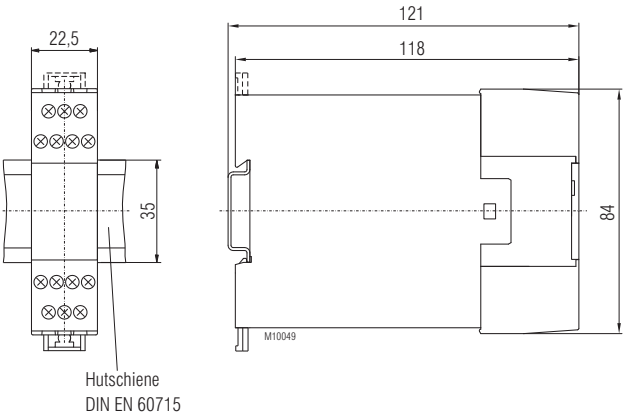
DE	S1 Querschlusserkennung ☐ nicht sicher ■ sicher S2 Start ☐ Auto ■ Hand
FR	S1 Transversal ☐ sans ■ avec S2 Reset ☐ Auto ■ Manu

IT	S1 Controllo del corto-circuito trasversale ☐ non è sicuro ■ sicuro S2 Start ☐ automatico ■ manuale

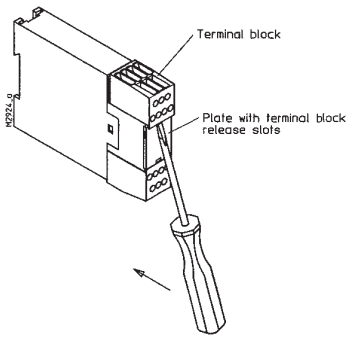
	S1	S2	Funktion Function Fonction Funzione
	Im Gerät available in unit intégré nei modelli		
BG 5925	ja yes oui si	ja yes oui si	
BG 5925._ _/101	ja yes oui si	ja yes oui si	
BG 5925._ _/102	nein no non no	nein no non no	Auto + nicht sicher automatic + without Auto + sans automatico + non è sicuro
BG 5925._ _/103	nein no non no	nein no non no	Hand + sicher manual + with Manu + avec manuale + sicuro
BG 5925._ _/104	nein no non no	nein no non no	Auto + sicher automatic + with Auto + avec automatico + sicuro

DE	S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma.
IT	Scollegare il modulo prima di impostare S1. La figura mostra l'impostazione al momento della consegna.

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**



DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	236,3	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)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,97E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

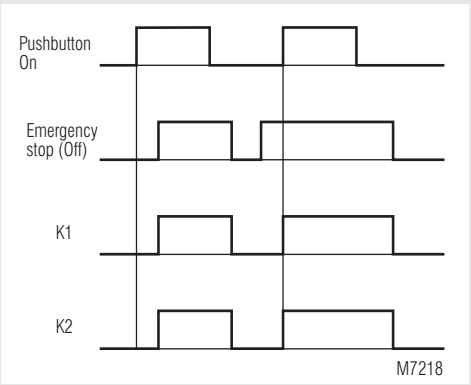
SAFEMASTER
Emergency Stop Module
LG 5924

0249759

Product Description

The emergency stop modules LG 5924 can be used to protect people and machines by interrupting a safety circuit in a safe way.

Function Diagram



Your Advantages
- For safety application up to PL e / Cat. 4 resp. SIL 3
- Manual or automatic start

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**
- According to EN 50156-1 for furnaces
- Single channel or two-channel operation
- Output: max. 4 NO contacts
- AC 230 V model with galvanic separation
- LED indicator for channel 1 / 2 and state of operation
- Short circuit detection between terminal Y1 and common
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- 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 Product Safety Functional Safety www.tuv.com ID 0600000000 · c UL us LISTED Canada / USA · A025518

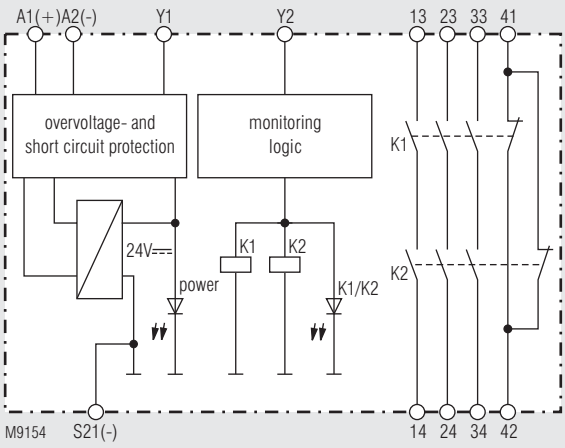
Applications

- Protection of people and machines
- Emergency stop circuits on machines

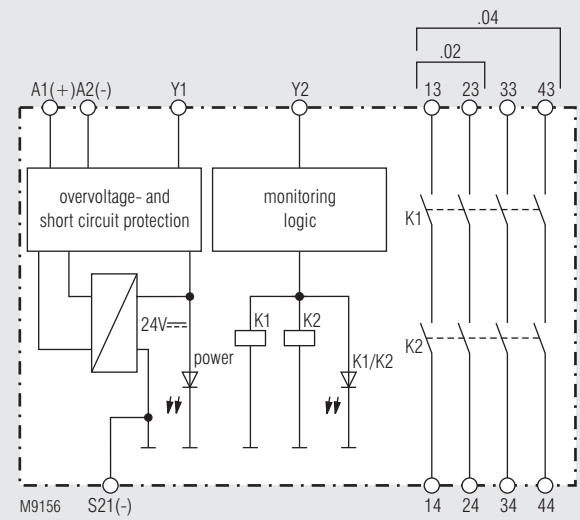
Indicators

LED Phase:	on, when supply connected
LED K1/K2:	on, when relay K1 and K2 energized

Block Diagrams

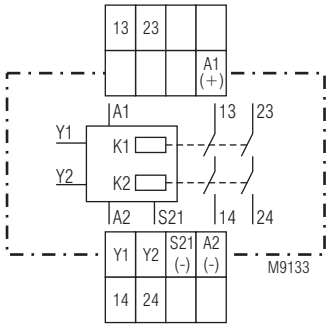


LG 5924.48

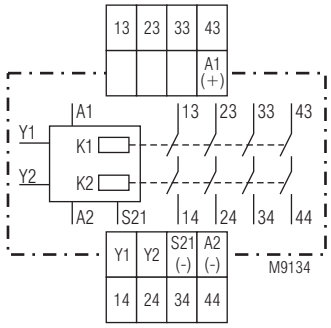


LG 5924.02, LG 5924.04

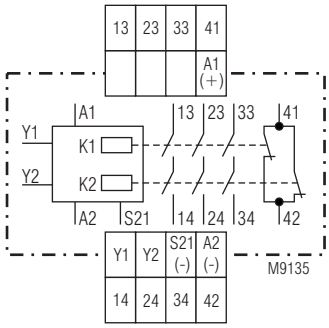
Circuit Diagrams



LG 5924.02



LG 5924.04



LG 5924.48

Connection Terminals

Terminal designation	Signal description
A1(+)	+ / L
A2 (-)	- / N
Y2	Inputs
S21(-), Y1	Outputs
13, 14, 23, 24, 33, 34, 43, 44	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Technical Data

Input

Nominal voltage U_N: DC 24 V
AC 110, 230 V
Nominal frequency: 50 / 60 Hz
Voltage range: AC 0.85 ... 1.1 U_N
at 10 % residual ripple: DC 0.9 ... 1.1 U_N
at 48 % residual ripple: DC 0.85 ... 1.1 U_N
Nominal consumption
DC: DC 1.5 W
AC: 3.5 VA
Control voltage on Y1
DC: typ. DC 22 V
AC: typ. DC 45 V
Control current
DC: typ. DC 65 mA
AC: typ. AC 16 mA
Recovery time: 0.5 s

Output

Contacts
LG 5924.02: 2 NO contacts
LG 5924.04: 4 NO contacts
LG 5924.48: 3 NO, 1 NC contacts

The NO contacts are safety contacts.
The NC contacts 41-42 can only be used for monitoring.

Operate delay
DC: typ. DC 40 ms
AC: typ. AC 200 ms
Release delay
DC: typ. DC 70 ms
AC: typ. AC 35 ms
Contact type: forcibly guided

Technical Data

Thermal current I_{th}: max. 5 A
(see quadratic total current limit curve)
Nominal output voltage: AC 250 V
Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13
NO contact: 2 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 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
Permissible operating frequency: 600 switching cycles / h
Short circuit strength
max. fuse rating: 10 A gL IEC/EN 60 947-5-1
line circuit breaker: B 6 A
Mechanical life: 10 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
operation: - 25 ... + 55 °C
storage : - 25 ... + 85 °C
altitude: < 2.000 m
Clearance and creepage distances
rated impuls voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC IEC/EN 62 061
Interference suppression Limit value class B EN 55011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 25 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire fixing: Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting: DIN rail IEC/EN 60 715
Weight
LG 5924, DC 24 V: 200 g
LG 5924, AC 230 V: 270 g

Dimensions

Width x height x depth
LG 5924: 22.5 x 90 x 121 mm
LG 5924 PC: 22.5 x 111 x 121 mm
LG 5924 PS: 22.5 x 104 x 121 mm

UL-Data

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

Nominal voltage U_N: DC 24 V
AC 110, 230 V
Ambient temperature: -15 … +55°C
Switching capacity:
Ambient temperature 45°C: Pilot duty B300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.
Ambient temperature 55°C: Pilot duty B300
4A 250Vac Resistive
4A 24Vdc Resistive or G.P.
Wire connection: 60°C / 75°C copper conductors only
Screw terminals fixed: AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw: AWG 20 - 14 Sol Torque 0.8 Nm
AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp: AWG 20 - 12 Sol/Str

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

Standard Type

LG 5924.48/61 DC 24 V

Article number:	0061916
• Output:	3 NO, 1 NC contacts
• Nominal voltage U_N:	DC 24 V
• Width:	22.5 mm

Ordering Example

LG 5924 .48 _ _ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: UL approval
- _ _: Type of terminals
  without indication:
  terminal blocks fixed, with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks with screw terminals
- .48: Contacts
- LG 5924: Type

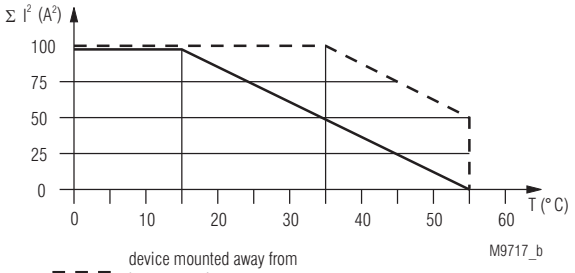
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1/K2" does not light up	Relay K1 and K2 not energized
Device cannot be activated	- Supply voltage is not present - Defective On-button e.g. no bridge at Y1 and Y2 - K1 or K2 are welded

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



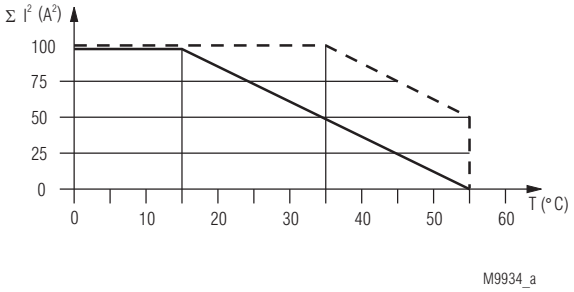
device mounted away from heat generation components.
max. current at 55°C over
4 contactrows = 3,5A ≙ 4x3,5²A²=49A²

device mounted without distance heated by devices with same load,
max current at 55°C over
4 contactrows = 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 contactrows

Quadratic total current limit curve LG 5924 DC 24 V



device mounted away from heat generation components.
max. current at 55°C over
4 contactrows = 3,5A ≙ 4x3,5²A²=49A²

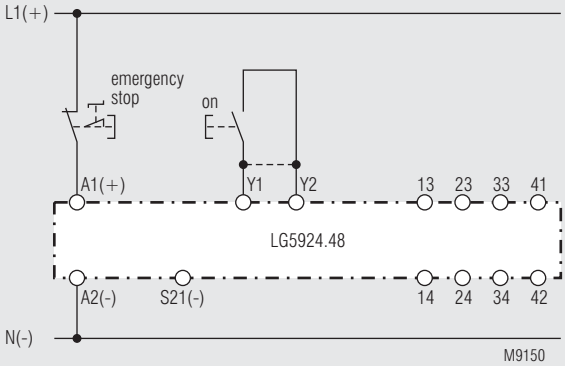
device mounted with 5mm distance
max current at 55°C over
4 contactrows = 1A ≙ 4x1²A²=4A²

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

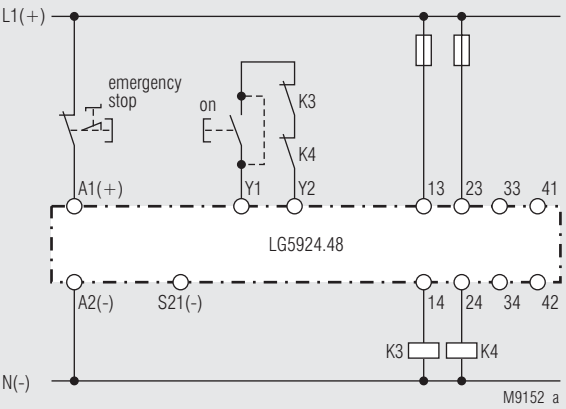
I_1, I_2, I_3, I_4 - current in contactrows

Quadratic total current limit curve LG 5924 AC 110 V, AC 230 V

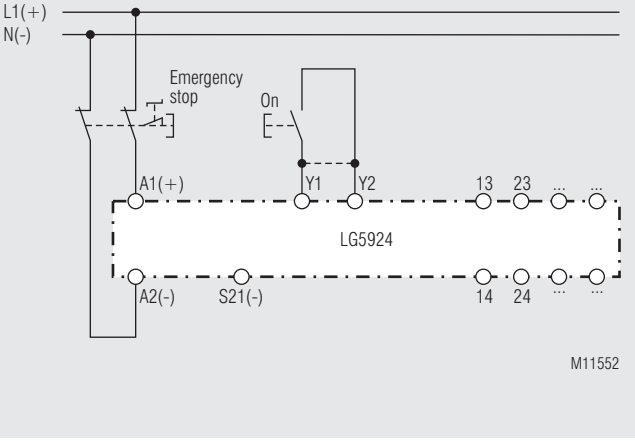
Application Examples



Single channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals Y1-Y2 must be linked.
No ON-pushbutton necessary.
Suited up to SIL2, Performance Level d, Cat. 3*



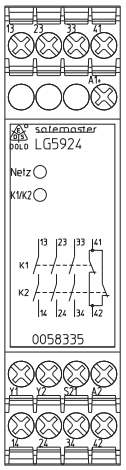
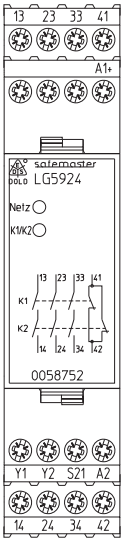
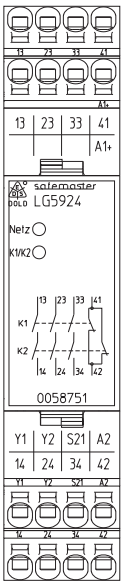
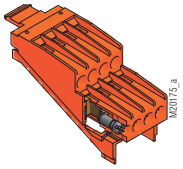
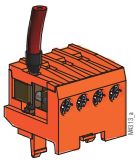
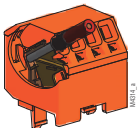
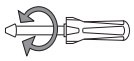
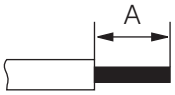
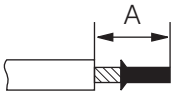
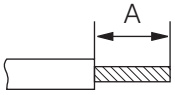
Contact reinforcement by external contactors, 2-channel controlled. For currents > 5 A the output contacts can be reinforced by external contactors. Functioning of the external contactors is monitored by looping the NC contacts into the start circuit (Y1-Y2).
Suited up to SIL2, Performance Level d, Cat. 3*



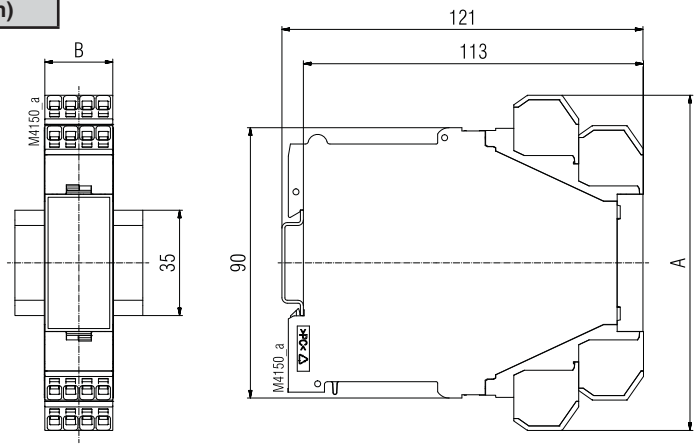
Two-channel emergency-stop circuit without feed back loop, with or without automatic restart.
For automatic restart terminals Y1-Y2 must be linked.
No ON-push button necessary.
Suited up to SIL3, Performance Level e, Cat. 4

* Suited up to SIL3, Performance Level e, Cat. 4 for E-stop systems according to IEC 60947-5-5, under the following conditions:
- A maximum number of operations for the E-stop button is observed
- The E-stop button and the E-stop module are installed in the same cabinet

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

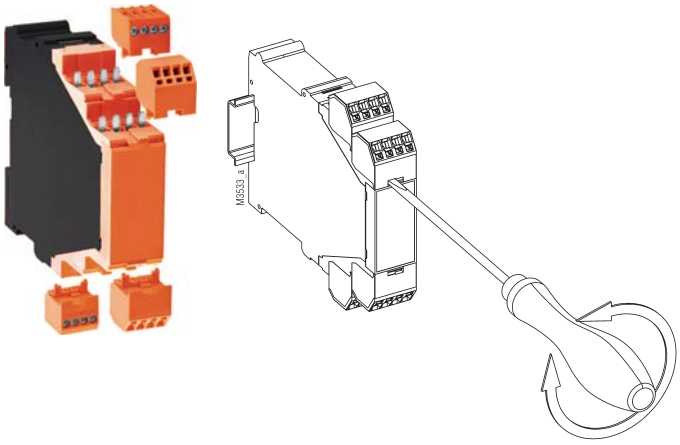
	 M10273	 M10275	 M10274	
		 PS	 PC	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**



	A	B
LG 5924	90	22,5
LG 5924 PS	104	22,5
LG 5924 PC	111	22,5

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**
IT	**Montaggio / Smontaggio di morsetti estraibili PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée
IT	**Smontaggio di morsetti estraibili (spina)** 1. Togliere tensione 2. Inserire il cacciavite nella rientranza del connettore sul pannello frontale e spingere. 3. Ruotare il cacciavite. 4. Assicurarsi del fatto che le morsettiere possono essere montate solo sullo SLOT

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	220,9	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)

IEC EN 62061 IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,1E-10	h^{-1}
PFD_{AVG}:	5,8E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

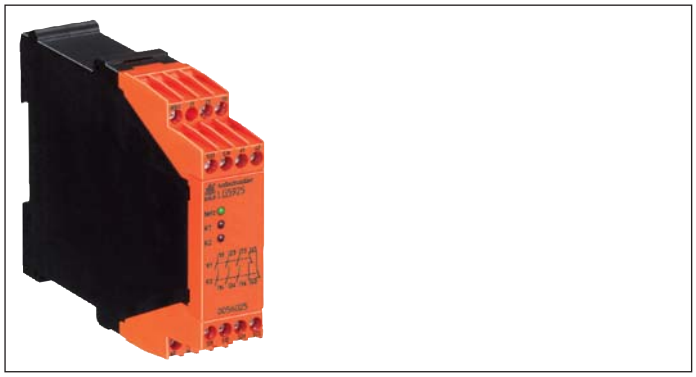
Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil au High Demand Mode		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione a High Demand Mode		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d mit Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

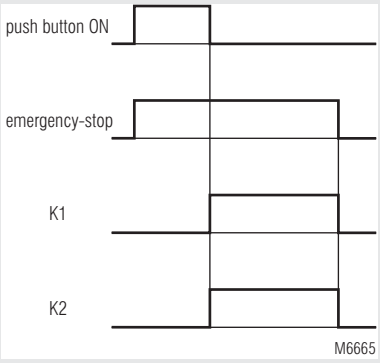
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Emergency Stop Module
LG 5925

0243372



Function Diagram



- **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**
- According to EN 50156-2 for furnaces
- Output: max. 4 NO contacts, see contacts
- LG 5925.54: 1 semiconductor output
- Single and 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- With or without cross fault monitoring in the E-stop loop, switch S1
- LG 5925.54: with cross fault monitoring in the E-stop loop
- LED indicator for state of operation
- LED indicator for channel 1 and 2
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm^2 stranded ferruled, or 2 x 2.5 mm^2 solid DIN 46 228-1/-2/-3/-4
- 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 · c UL us LISTED Canada / USA · A025518

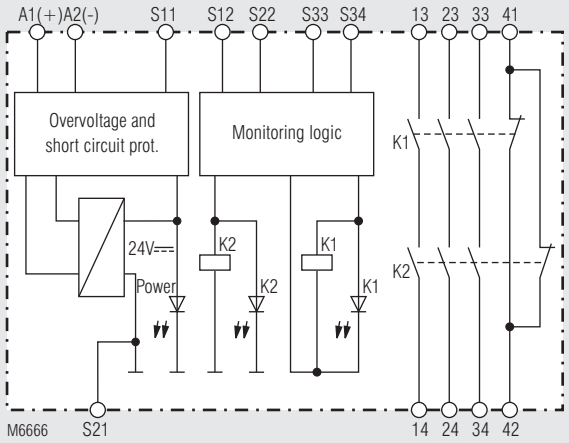
Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of safety gates
- Usage in furnace application in continuous operation acc. to EN 50156-1
- Safe disconnection of the complete fuel supply in furnace applications according to EN 50156-1 section 10.5.5.2

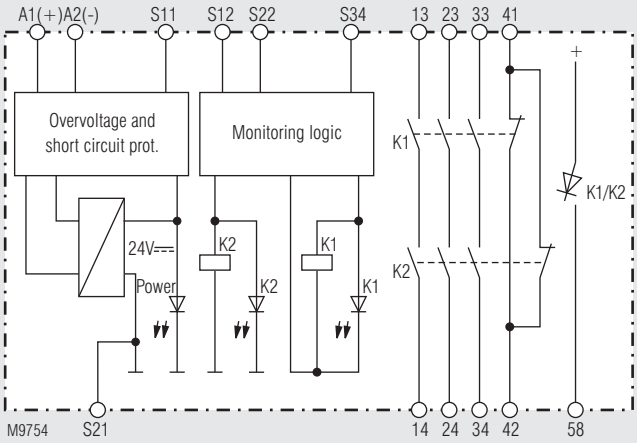
Indicators

LED "Netz":	on when supply connected
LED K1/K2:	on when relay K1 and K2 energized

Block Diagrams

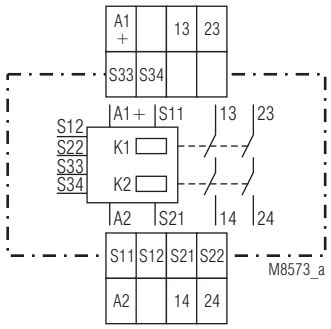


LG 5925

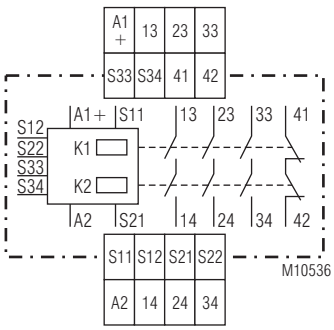


LG 5925.54

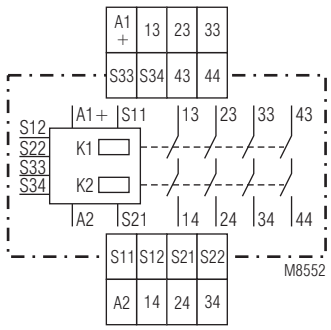
Circuit Diagrams



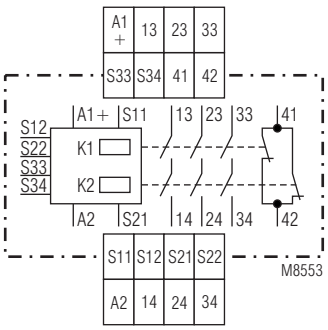
LG 5925.02



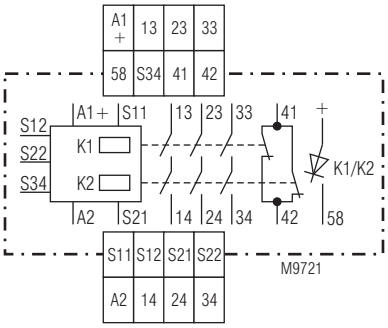
LG 5925.03



LG 5925.04



LG 5925.48



LG 5925.54

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S22, S33, S34	Inputs
S11, S21	Outputs
13, 14, 23, 24, 33, 34, 43, 44	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close. A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the E-stop loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2 (-). The short-circuit protection of line A1 (+) remains active.

To alter the functions automatic start - manual start and with or without cross fault monitoring, the switches S1 and S2 are used. These are located behind the front cover (see unit programming).
The setting with or without cross fault monitoring on E-stop buttons is made with S1 (not for LG 5925.54). The LG 5925.54 has always cross fault monitoring.

S2 is used to change between automatic an manual restart. On automatic start also the terminals S33 - S34 have to be linked. For connection please see application examples.

Technical Data

Input circuit

Nominal Voltage U_N:
LG 5925: AC/DC 24 V, AC 110 ... 115 V, AC 230 V
LG 5925.54: AC/DC 24 V
Voltage range
AC / DC
at 10% residual ripple: 0.9 ... 1.1 U_N
AC: 0.85 ... 1.1 U_N
Nominal consumption at U_N: DC approx. 1.5 W
AC approx. 3.7 VA
Min. Off-time: 250 ms
Control voltage on S11 at U_N: DC 22 V at AC/DC units
DC 24 V at AC units

Control current typ. over S12, S22:
LG 5925: 30 mA at U_N
LG 5925.54: 25 mA at U_N
Min. voltage on S12, S22 when relay activated: DC 20 V at AC/DC units
DC 19 V at AC units
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR

Output

Contacts
LG 5925.02: 2 NO contacts
LG 5925.04: 4 NO contact
LG 5925.03 ,
LG 5925.48, LG 5925.54: 3 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 41-42 can only be used for monitoring.

Operate delay typ. at U_N:
Manual start: 30 ms
automatic start: 350 ms
Release delay typ. at U_N:
Disconnecting the supply: 150 ms at AC units
50 ms at DC units
Disconnecting S12, S22: 130 ms at AC units
50 ms at DC units
Contact type: forcibly guided
Nominal output voltage: AC 250 V
DC see limit curve for arc-free operation
Thermal current I_{th}: max. 8 A per contact
see current limit curve

Technical Data

Switching capacity

to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 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
NC contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to 5 A, AC 230 V cos φ = 1:	> 2.2 x 10^5 switching cycles	
Permissible operating frequency:	max. 1 200 operating cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
line circuit breaker:	B 6 A	
Mechanical life:	> 20 x 10^6 switching cycles	
Semiconductor output:	DC 24 V 100 mA, plus switching	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 55 °C	
Storage :	- 40 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
Rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
LG 5925, AC/DC 24 V:	210 g	
LG 5925.54, AC/DC 24 V:	220 g	
LG 5925, AC 230 V:	275 g	
LH 5925, AC/DC 24 V:	375 g	

Dimensions

Width x height x depth	
LG 5925:	22.5 x 90 x 121 mm
LG 5925 PC:	22.5 x 111 x 121 mm
LG 5925 PS:	22.5 x 104 x 121 mm

UL-Data

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

Nominal voltage U_N:
LG 5925: AC/DC 24 V, AC 110 ... 115 V
AC 230 V

Ambient temperature
LG 5925 -15 … +55°C,

Switching capacity:
LG 5925.04
Ambient temperature 35°C: Pilot duty B300
8A 250Vac Resistive
8A 24Vdc Resistive or G.P.

LG 5925.04
Ambient temperature 55°C: Pilot duty B300
4A 250Vac Resistive
4A 24Vdc Resistive or G.P.

Switching capacity:
LG 5925.02, .48, .54
Ambient temperature 45°C: Pilot duty B300
8A 250Vac Resistive
8A 24Vdc Resistive or G.P.

LG 5925.02, .48, .54
Ambient temperature 55°C: Pilot duty B300
6A 250Vac Resistive
6A 24Vdc Resistive or G.P.

Wire connection:	60°C / 75°C copper conductors only
Screw terminals fixed:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw:	AWG 20 - 14 Sol Torque 0.8 Nm
	AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp:	AWG 20 - 12 Sol/Str

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

Standard Type

LG 5925.48/61 AC/DC 24 V
Article number: 0061919
LG 5925.54/61 AC/DC 24 V
Article number: 0064882
- Output: 3 NO contacts, 1 NC contact
- Nominal voltage U_N: AC/DC 24 V
- Width: 22.5 mm

Ordering Example

LG 5925 . _ _ _ _ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: UL-approval
- _ _ _ _: Type of terminals
  without indication:
  terminal blocks fixed
  with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks
  with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks
  with screw terminals
- _ _: Contacts
- LG 5925 . : Type

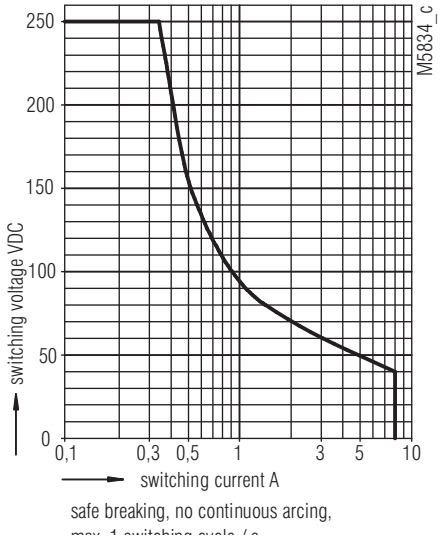
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

Maintenance and repairs

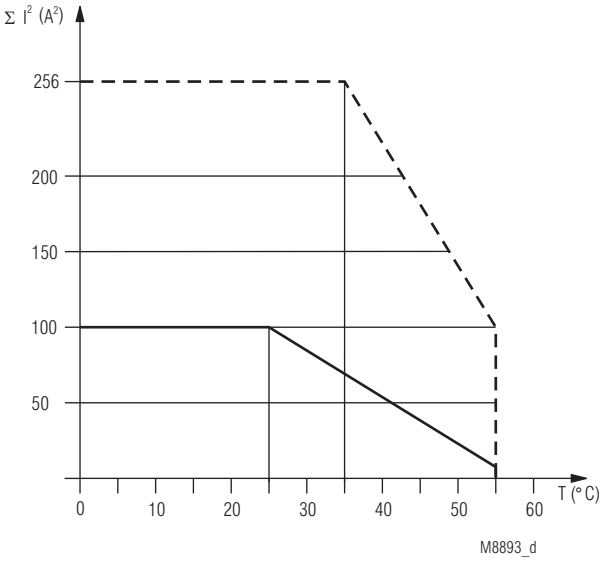
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



Arc limit curve under resistive load

Characteristics



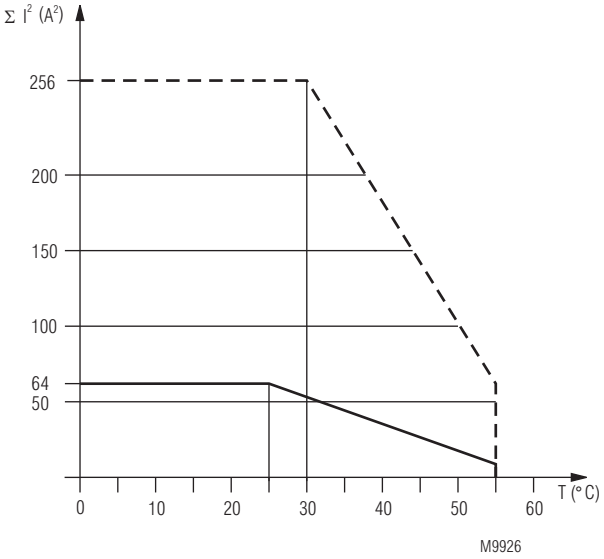
device mounted away from heat generation components.
Max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

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

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

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

Quadratic total current limit curve LG 5925; AC/DC 24 V



device mounted away from heat generation components.
Max. current at 55°C over
4 contact path = 1A ≙ $4x4^2A^2 = 64A^2$

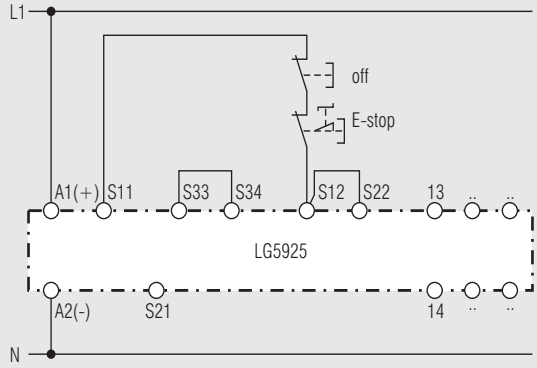
device mounted with 5mm distance
Max. current at 55°C over
4 contact path = 1A ≙ $4x1^2A^2 = 4A^2$

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

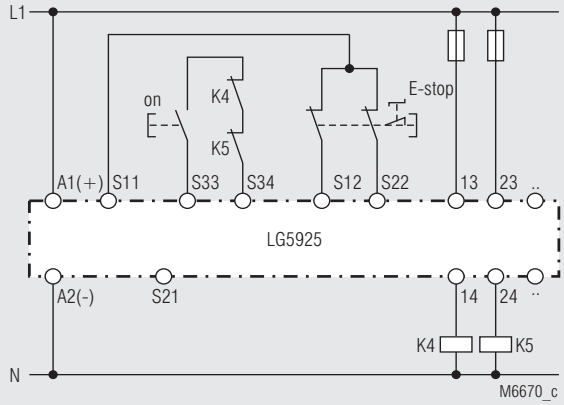
I_1, I_2, I_3, I_4 - current in contact paths

Quadratic total current limit curve LG 5925; AC 110 ... 115 V, AC 230 V

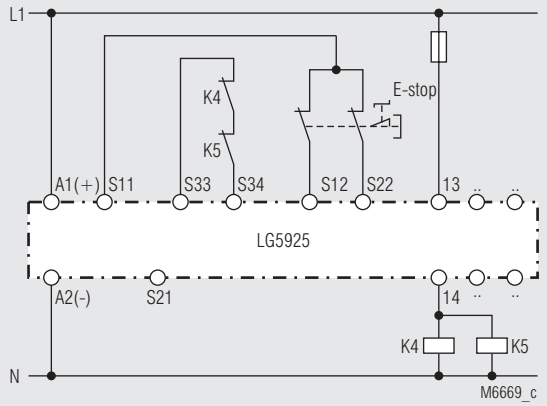
Application Examples



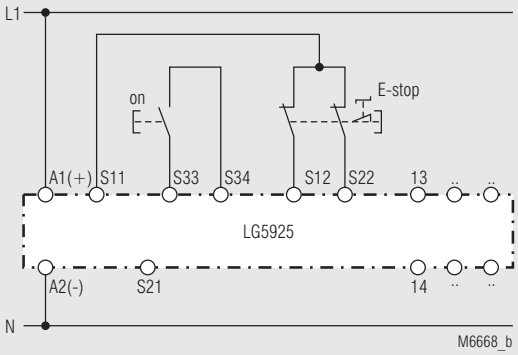
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit.
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 automatic start
Suited up to SIL2, Performance Level d, Cat. 3



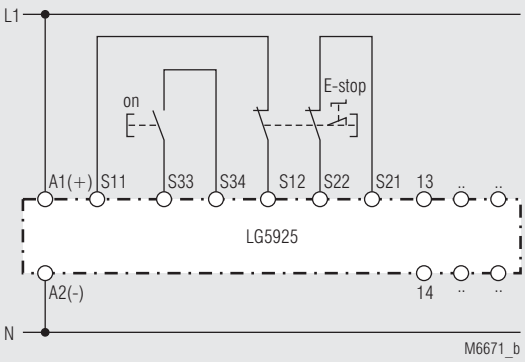
Contact reinforcement by external contactors, 2-channel controlled.
The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 8 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S33-S34).
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



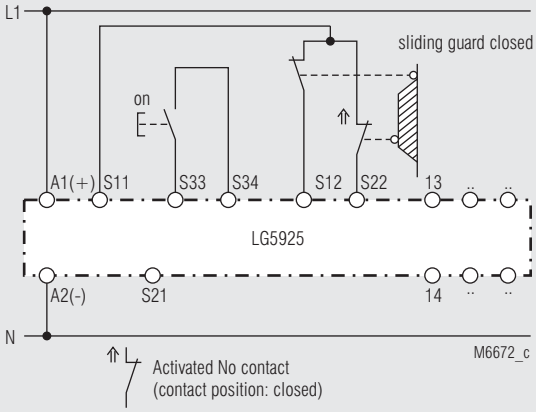
Contact reinforcement by external contactors controlled by one contact path.
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 automatic start
Suited up to SIL3, Performance Level e, Cat. 4



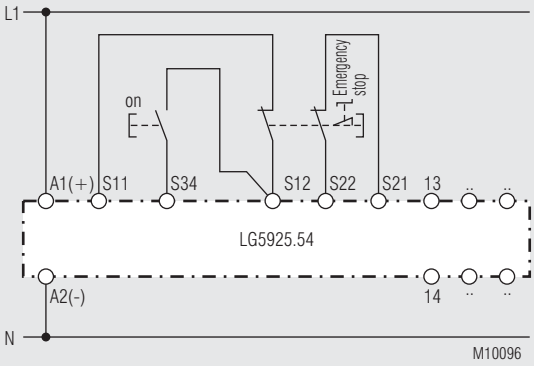
2-channel emergency stop circuit without cross fault monitoring.
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



2-channel emergency stop circuit with cross fault detection
Note: Refer to "Unit programming"!
Switches in pos.: S1 cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

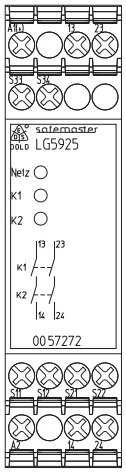
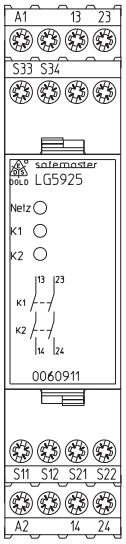
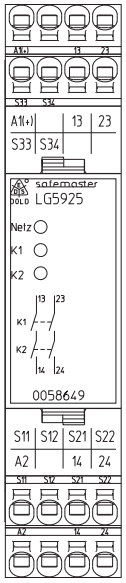
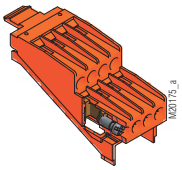
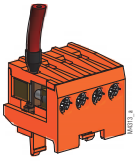
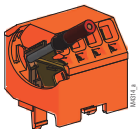
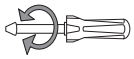
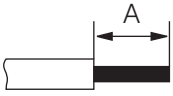
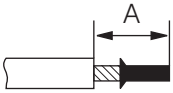
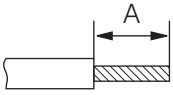


2-channel safety gate monitoring.
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

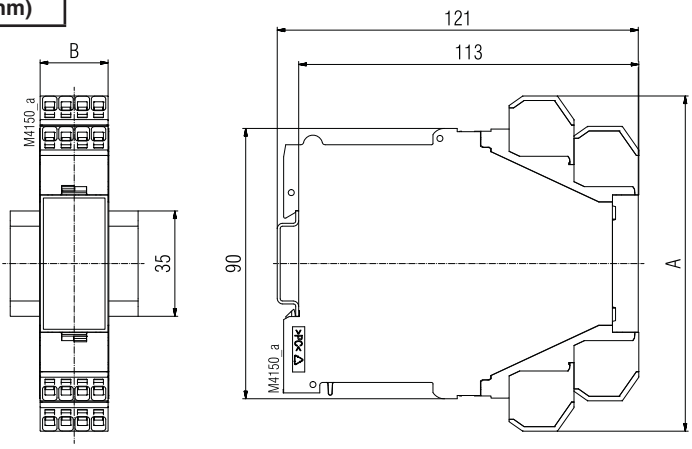


2-channel emergency stop circuit with cross fault detection
Note: Refer to "Unit programming"!
Switches in pos.: S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

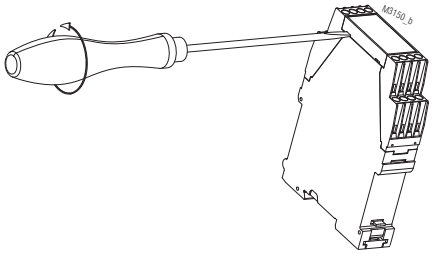
	 M10254	 M10256	 M10255	
		 PS	 PC	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

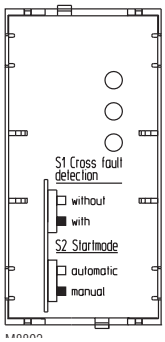
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5925	90	22,5
LG 5925 PS	104	22,5
LG 5925 PC	111	22,5

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**

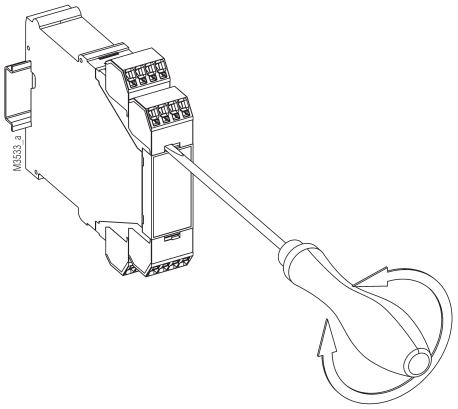




DE	S1 Querschlusserkennung ☐ nicht sicher ■ sicher
FR	S1 Transversal ☐ sans ■ avec

DE	S2 Start ☐ Auto ■ Hand
FR	S2 Reset ☐ Auto ■ Manu

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand. Die Variante LG 5925.54 mit Halbleiter-Meldeausgang hat immer Querschlusserkennung
EN	Disconnect unit before setting of S1 Drawing shows setting at the state of delivery The variant LG 5925.54 with semiconductor monitoring output has always cross fault detection
FR	Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma. La variante LG 5925.54 avec sortie transistor de visualisation a toujours la reconnaissance de court-circuit transversal.

DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	216,7	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)

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:	99,0	%
PFH_D:	1,1E-10	h^{-1}
PFD_{AVG}:	8,2E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

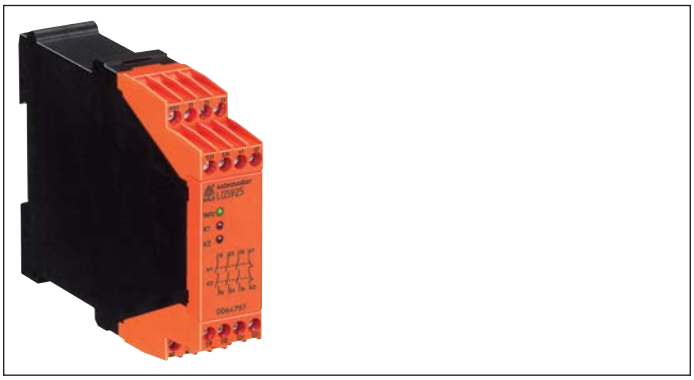
Anforderung seitens der Sicherheitsfunktion an das Gerät im High Demand Mode Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode Consigne résultant de la fonction sécuritaire de l'appareil au High Demande Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Safety Module for Elevator Controls
LG 5925.03/034

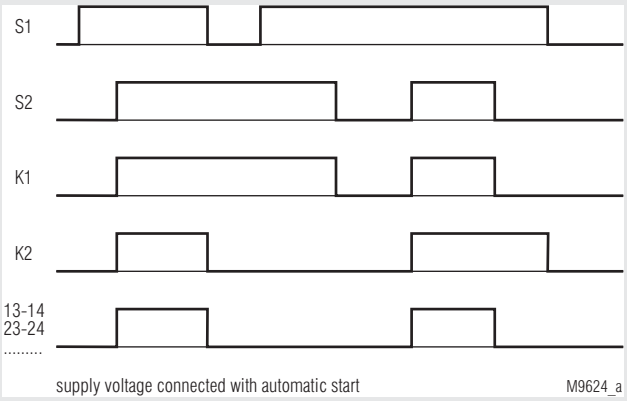
DOLD



Your Advantages
- For elevators according to EN 81-20/-50

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**
  - **Directive 2014/33/EU for elevators**
- Output: 3 NO contacts, 1 NC contact
- Single or 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- With or without cross fault monitoring in the loop, switch S1
- LED indicator for state of operation
- LED indicator for channel 1 and 2
- Degree of protection IP40; can be mounted in cabinets and installations with lower degree of protection without additional measures (depending on ambient conditions)
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

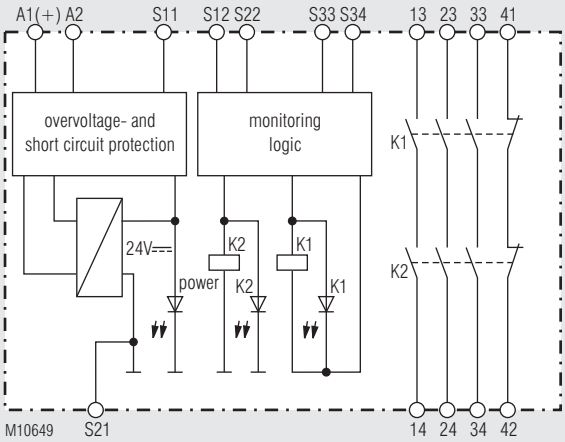
Function Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED · Product Safety Functional Safety · www.tuv.com ID 0600000000 · A025518

Block Diagram



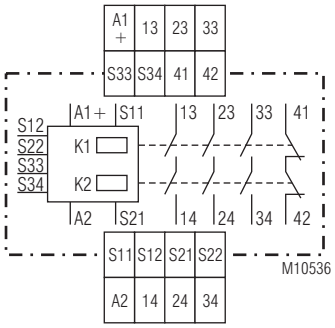
Applications

Bridging of the door and locking switches while moving the elevator in the unlocking zone with open doors according to EN81-20/-50 for elevators for people and loads.

Indicators

LED Netz:	on when supply connected
LED K1/K2:	on when relay K1 and K2 energized

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S22, S33, S34	Inputs
S11, S21	Outputs
13, 14, 23, 24, 33, 34	Positive driven NO contacts for release circuit
41, 42	Positive guided indicator output

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close. A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2 (-). The short-circuit protection of line A1 (+) remains active.

To alter the functions automatic start - manual start and with or without cross fault monitoring, the switches S1 and S2 are used. These are located behind the front cover (see unit programming).
The setting with or without cross fault monitoring is made with S1.

Switch S2 is used to select automatic or manual restart. Additionally, for the function "automatic restart", terminals S33 and S34 have to be bridged. Connect the device according to application examples.

Technical Data

Input circuit

Nominal Voltage U_N:	
LG 5925:	AC/DC 24 V
Voltage range:	0.9 ... 1.1 U_N
Nominal consumption at U_N:	DC ca. 1.5 W
Min. Off-time:	250 ms
Control voltage on S11 at U_N:	DC 22 V
Control current typ. over S12, S22	30 mA at U_N
Min. voltage on S12, S22 when relay activated	DC 20 V
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR

Output

Contacts: 3 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 41-42 can only be used for monitoring.

Operate delay typ. at U_N:		
Manual start:	30 ms	
Automatic start:	350 ms	
Release delay typ. at U_N:		
Disconnecting the supply:	typ. 20 ms	
Disconnecting S12, S22:	typ. 15 ms	
Contact type:	forcibly guided	
Nominal output voltage:	AC 250 V DC see limit curve for arc-free operation	
Thermal current I_{th}:	max. 5 A per contact (see quadratic total current limit curve)	
Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 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
NC contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to 5 A, AC 230 V cos φ = 1:	> 2.2 x 10^5 switching cycles	
Permissible operating frequency:	max. 1 200 operating cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
line circuit breaker:	B 6 A	
Mechanical life:	> 20 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 40 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
Rated impuls voltage / pollution degree:	4 kV / 3 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 61326-3-1, EN 12016	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	210 g	

Dimensions

Width x height x depth	
LG 5925:	22.5 x 90 x 121 mm
LG 5925 PC:	22.5 x 111 x 121 mm
LG 5925 PS:	22.5 x 104 x 121 mm

Standard Type

LG 5925.03/034 AC / DC 24 V

Article number:	0064797
• Output:	3 Schließer, 1 Öffner
• Nominal voltage U_N:	AC/DC 24 V
• Width:	22,5 mm

Ordering Example

LG 5925.03 _ _ /034 AC / DC 24 V

- Nominal voltage
- Type of terminals
  without indication:
  terminal blocks fixed
  with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks
  with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks
  with screw terminals
- Contacts
- Type

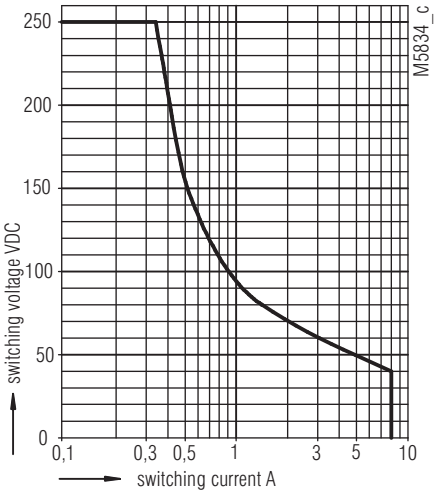
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

Maintenance and Repairs

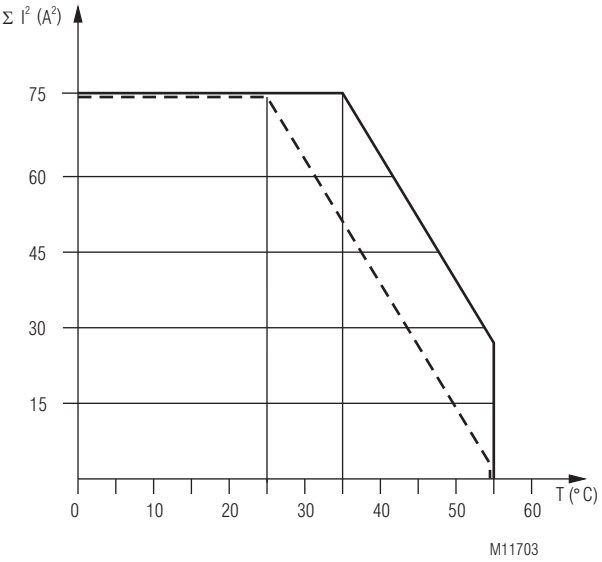
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load



device mounted away from heat generation components.
max. current at 55°C over
3 contact path = 3A ≙ $3x3^2A^2 = 27A^2$

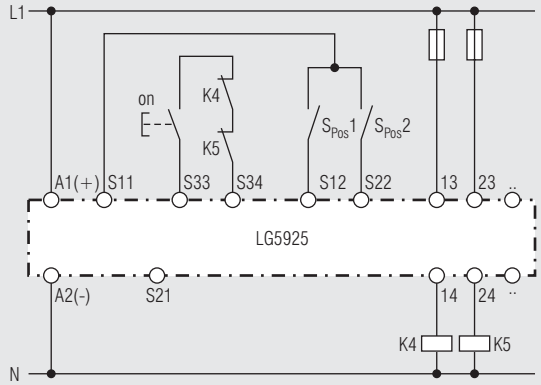
device mounted without distance heated by devices with same load.
max. current at 55°C over
3 contact path = 1A ≙ $3x1^2A^2 = 3A^2$

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

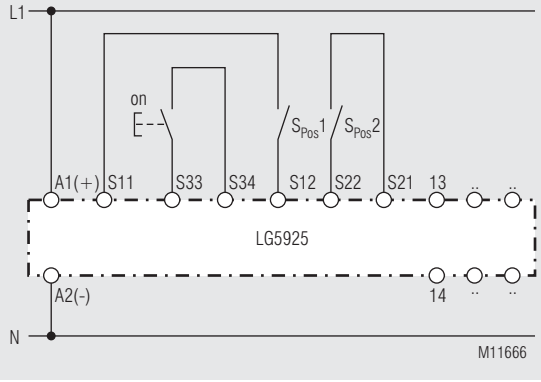
I_1, I_2, I_3 - current in contact paths

Quadratic total current limit curve

Application Examples

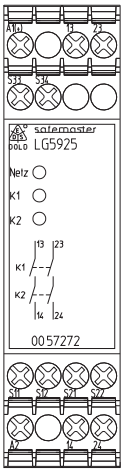


Contact reinforcement by external contactors, 2-channel controlled.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S33-S34).
Note: Refer to "Unit programming"!
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

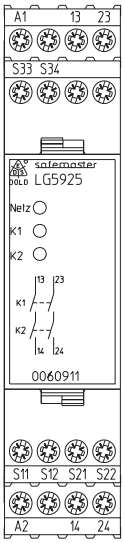


2-channel circuit with cross fault detection
Note: Refer to "Unit programming"!
Switches in pos.: S1 cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

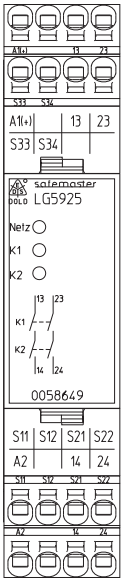
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



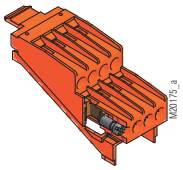
M10254

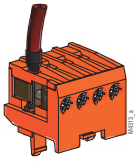


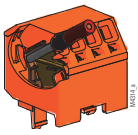
M10256

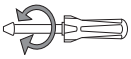
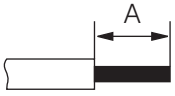
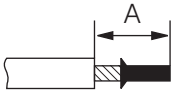
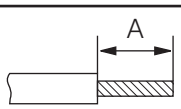


M10255

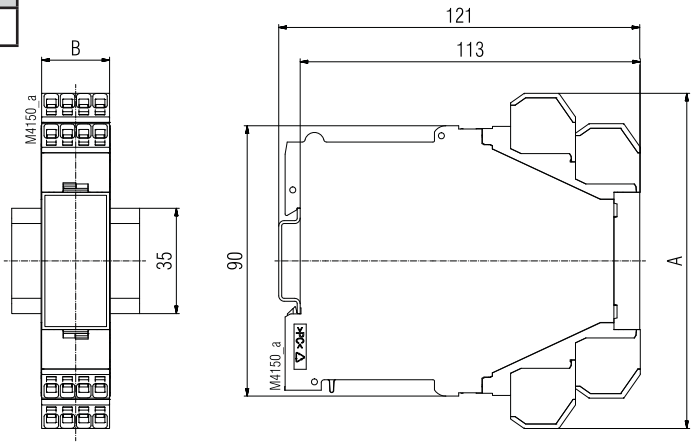



PS


PC

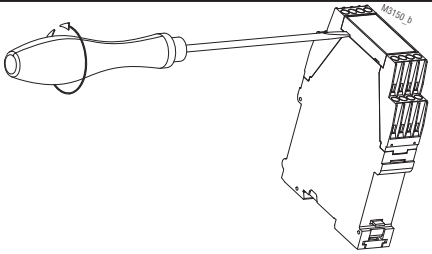
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

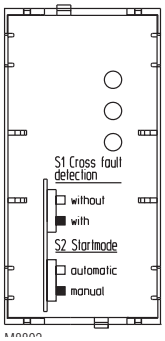
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5925	90	22,5
LG 5925 PS	104	22,5
LG 5925 PC	111	22,5

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**



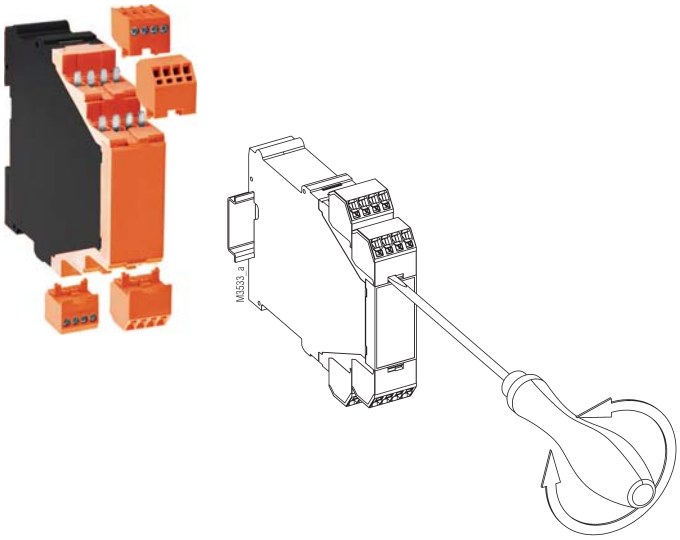


DE	S1 Querschlusserkennung ☐nicht sicher ■sicher
FR	S1 Transversal ☐sans ■avec

DE	S2 Start ☐Auto ■Hand
FR	S2 Reset ☐Auto ■Manu

DE	S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma.

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	176,2	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)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	2,66E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

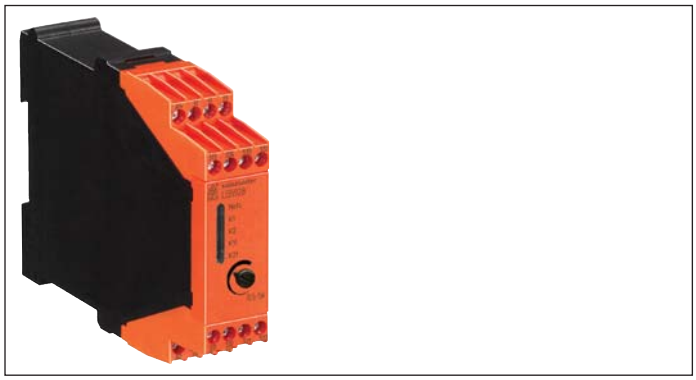
Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

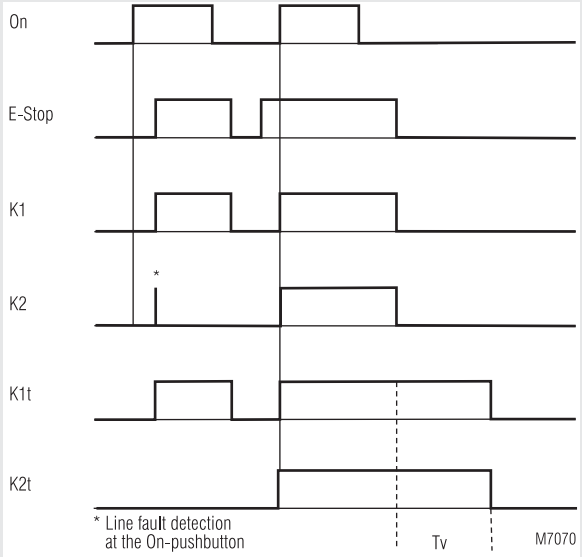
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Emergency Stop Module With Time Delay
LG 5928

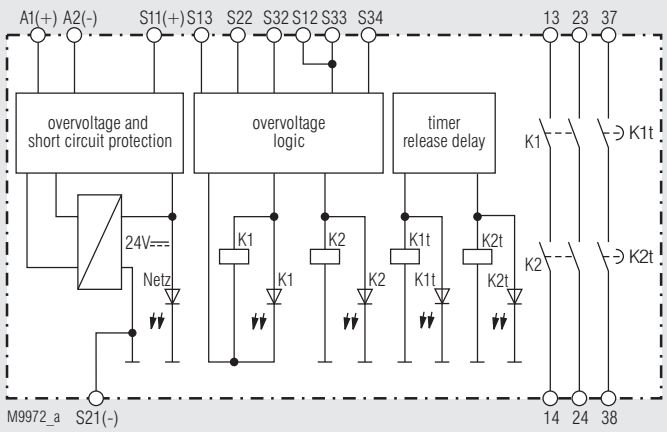
0258918



Function Diagram



Block Diagram



Your advantage
- Compact, flexible and safe
- Short response time
- Ideal for designs according to the new safety standards

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**
- Output: 2 NO instantaneous contacts and 1 release delay contact
- 1- or 2-channel connection
- Line fault detection at the ON pushbuttons at connection on terminals S33-S34
- Manual restart with button on S33-S34 or automatic restart with bridge between S13-S34
- With or without cross fault monitoring in the E-stop loop
- Indication for released time circuit
- LED indication for supply, channel 1/2 and release delayed contacts
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- 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

Canada / USA
A025518

*) see variants

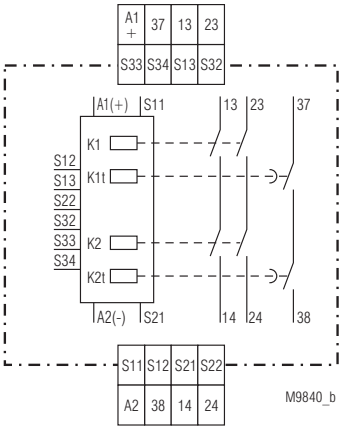
Application

Protection of people and machines
- Emergency stop circuits on machines, Stop category 1 can be realised
- Monitoring of safety gates

Indicators

upper LED:	on when supply connected
lower LEDs:	on, when relay K1 and K2 resp. $K1_t$ and $K2_t$ energized

Circuit Diagram



LG 5928.41

Connection Terminals

Terminal designation	Signal description
A1(+)	+ / L
A2 (-)	- / N
S11, S21, S13, S33	Inputs
S12, S22, S32, S34	Outputs
13, 14, 23, 24	Positive driven NO contacts for release circuit
37, 38	Positive guided No contacts for release delay circuit

Notes

To select automatic restart terminals S13 - S34 must be bridged, S33 - S34 must be opened. Open terminals S13 - S34 select manual restart, the On-button must then be connected to S33 - S34.

Line fault detection on On-button:
The line fault detection is only active when the time delayed relais $K1_t$ and $K2_t$ have released and then S12 (channel A) and S32 (channel B) are switched simultaneously. If the On-button is closed before S12, S32 is connected to voltage (also when line fault across On-button), the output contacts will not close. The unit will not restart before the time delay is finished.

A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S32, the unit will be activated because this line fault is similar to the normal On-function.
The unit can be operated with single channel and 2-channel operation with cross fault monitoring. For connection please refer to application examples.

The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the E-stop loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2(-). The short-circuit protection of line A1(+) remains active.

Technical Data

Input

Nominal voltage U_N: DC 24 V
Voltage range: 0.9 ... 1.1 U_N
Nominal consumption: approx. 3.5 W
Min. Off-time: 1 s
Control voltage S11: DC 23 V at U_N device not activated
Control current via S12, S32: each 40 mA at U_N
Min. voltage to terminals S12, S32: DC 19 V device not activated
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR

Output

Contacs: 2 NO contacts instantaneous, and 1 contact release delay
Operating time typ. at U_N:
manual start: 25 ms
automatic start at U_N: 100 ms
Release delay typ. at U_N:
in case of break of supply voltage: 20 ms
in case of break of S12, S22 and S32: 10 ms

Technical Data

Time delay tv
(release delayed): Auxilary supply must be connected for time delay
Time ranges:

0.1 ... 1 s	3.0 ... 30 s
0.3 ... 3 s	6.0 ... 60 s
0.5 ... 5 s	30 ... 300 s
1.0 ... 10 s	

Other ranges or values on request
Repeat accuracy: ± 1 % of setting value
Contact type: forcibly guided
Nominal output voltage: AC 250 V
DC: see limit curve for arc-free operation
Max switching current: DC: see limit curve for arc-free operation
Thermal current I_{th}:
in 1 contact path:
13 / 14 or 23 / 24: max. 8 A (see quadratic total current limit curve)
37 / 38: max. 6 A (see quadratic total current limit curve)
Switching capacity
to AC 15
NO contact: 3 A / AC 230V IEC/EN 60 947-5-1
to DC 13
NO contacts: 2 A / DC 24 V
Electrical life
to AC 15 at 2 A, AC 230 V: 10^5 switching cycles IEC/EN 60 947-5-1
Permissible operating frequency: max. 360 switching cycles / h with short release delay time

Short circuit strength
max. fuse rating
13 / 14 or 23 / 24: 10 A gL IEC/EN 60 947-5-1
37 / 38: 4 A gL IEC/EN 60 947-5-1
Line circuit breaker: B 6 A (max. short circuit current + 300 A)
Mechanical life: 10 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 25 ... + 55 °C
Storage: - 25 ... + 85 °C
Altitude: < 2.000 m
Clearance and creepage distances
rated impuls voltage / pollution degree: 4 kV / 2 IEC 60 664-1
EMC IEC/EN 61 326-3-1, IEC/EN 62 061
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 V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 25 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005

Wire fixing: Plus-minus terminal screws M3.5 box terminals with wire protection
Mounting: DIN rail IEC/EN 60 715
Weight: approx. 210 g

Dimensions

Width x height x depth:
LG 5928: 22.5 x 90 x 121 mm
LG 5928PC: 22.5 x 111 x 121 mm
LG 5928PS: 22.5 x 104 x 121 mm

UL-Data

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

Nominal voltage U_N: DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity:

Ambient temperature 45°C
Contact 13/14 and 23/24:
Pilot duty R300
6A 250Vac Resistive
6A 24Vdc Resistive or G.P.
Contact 37/38:
8A 250Vac Resistive
8A 24Vdc Resistive or G.P.

Ambient temperature 55°C:
Contact 13/14 and 23/24:
Pilot duty R300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.
Contact 37/38:
7A 250Vac Resistive
7A 24Vdc Resistive or G.P.

Wire connection: 60°C / 75°C copper conductors only
Screw terminals fixed: AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw: AWG 20 - 14 Sol Torque 0.8 Nm
AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp: AWG 20 - 12 Sol/Str

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

Standard Type

LG 5928.41/61 DC 24 V 1 ... 10 s
Article number: 0061683
- Output: 2 NO contacts instantaneous and
- 1 NO contacts release delayed
- Nominal voltage U_N: DC 24 V
- Time delay tv: 1 ... 10 s
- Width: 22.5 mm

Variants

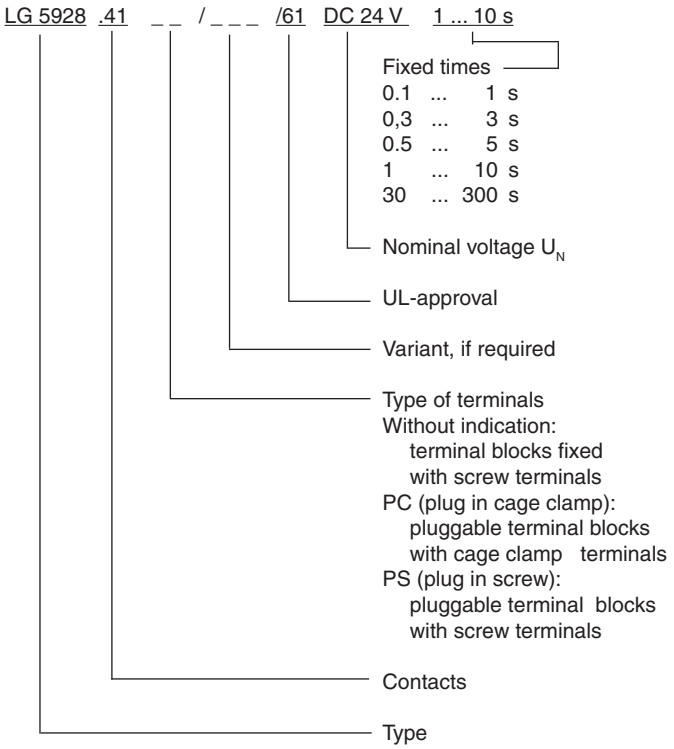
LG 5928.41/61: with redundant time circuits to disconnect K1t and K2t, adjustable time. Each time circuit operats one output relay

LG 5928.41/001/61: as LG 5928.41/61, but with fixed time delay
Fixed times: 1 s, 3 s, 5 s, 10 s, 300 s
other values on request

LG 5928.41/100/61: as LG 5928.41/61, but deactivation of the first time relay deactivates the second time relay i. e. both relays switch off simultaneously

LG 5928.41/101/61: as LG 5928.41/100/61, but with fix time delay
Fixed times: 1 s, 3 s, 5 s, 10 s, 300 s
other times on request

Ordering example for variants:



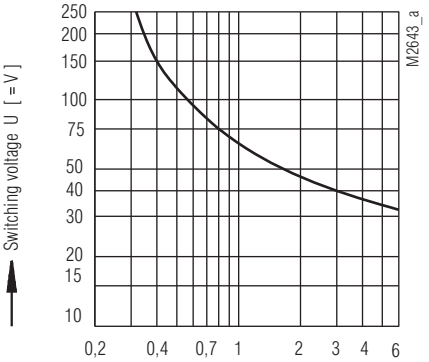
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply A1/A2 not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22 e. g S32)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device)) - A 1-channel switch-off occurred on S22 e. g. S32 (switch channel off on S12)
Device cannot be activated	- The delayed contacts are not yet switched off - Safety relay is welded (replace device) - Min. one of this connection is not present (S11-S12, S11-S32, S21-S22) Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S13-S34 are not bridged

Maintenance and repairs

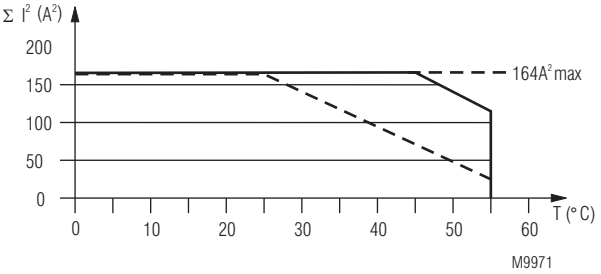
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



safe switch-off, no standing arc
max. 1 switching cycle/s

Limit curve for arc-free operatio



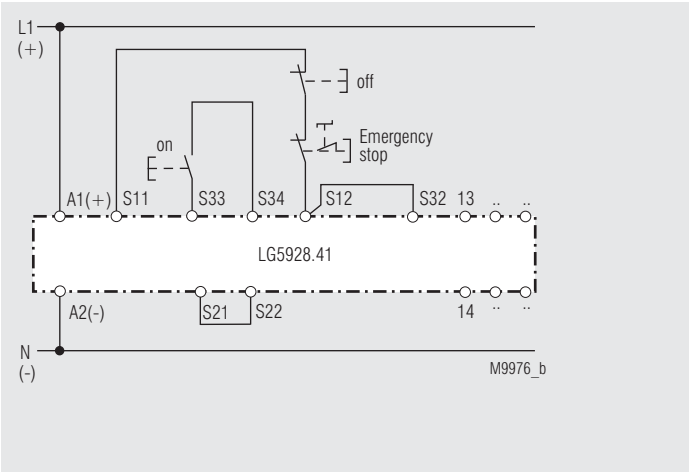
device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = $2x(7A)^2 + (5A)^2 = 123A^2$

device mounted without distance heated by devices with same load,
max current at 55°C over
3 contactrows = $3x\ (3A)^2 = 27A^2$

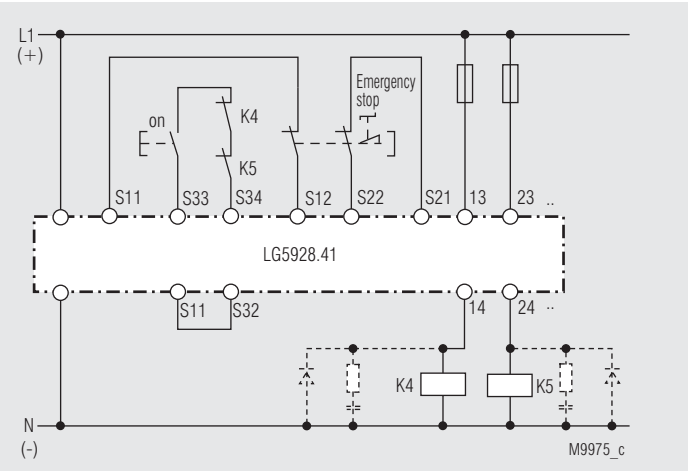
$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2$$

I_1, I_2, I_3 - current in contactrows

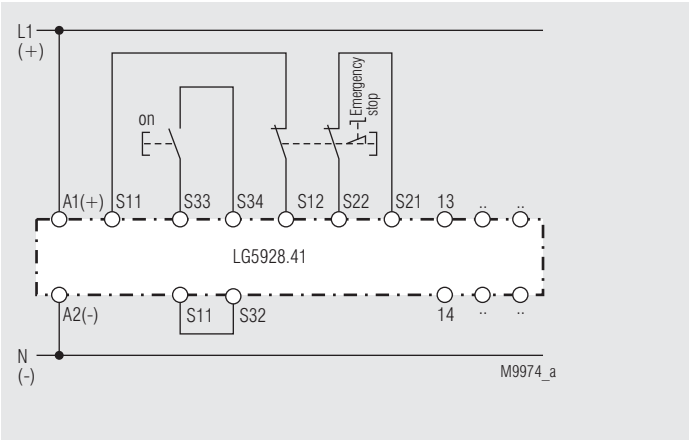
Quadratic total current limit curve



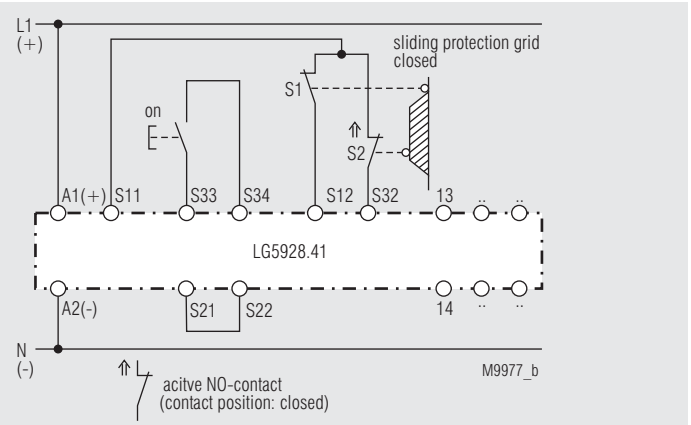
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit.
Suited up to SIL2, Performance Level d, Cat. 3



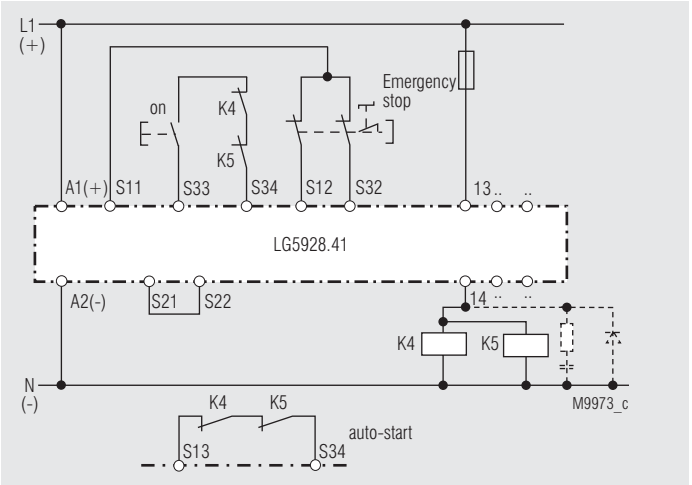
Contact reinforcement by external contactors, 2-channel controlled. The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 8 A e.g. 6 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S13-S34 or S33-S34).
Suited up to SIL3, Performance Level e, Cat. 4



2-channel emergency stop circuit with cross fault monitoring.
Suited up to SIL3, Performance Level e, Cat. 4

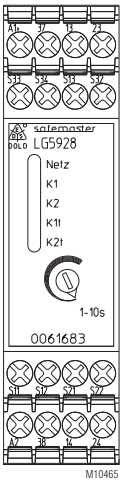


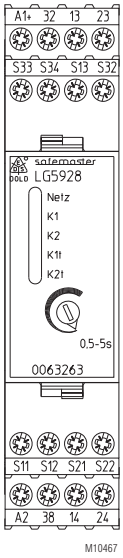
2-channel safety gate monitoring.
Suited up to SIL3, Performance Level e, Cat. 4

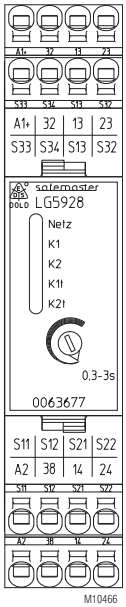


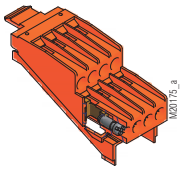
Contact reinforcement by external contactors controlled by one contact path. S33 - S34 must stay open on auto start.
Suited up to SIL3, Performance Level e, Cat 4, if the external contactors are in the same cabinet and the wiring is short circuit and crossfault prove.

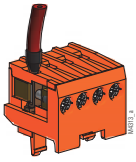
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



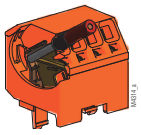




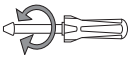
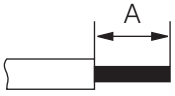
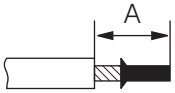
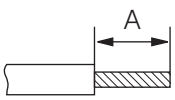




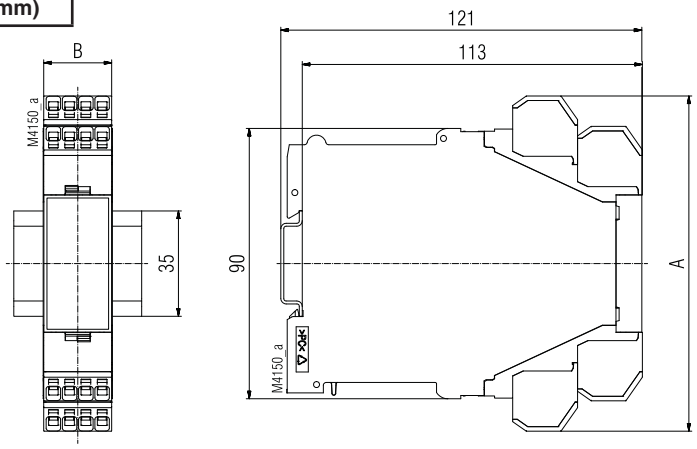
PS



PC

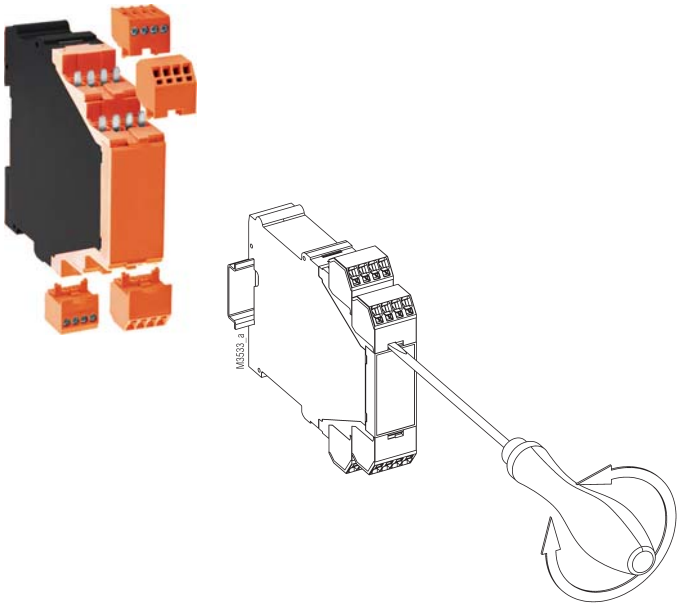
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5928	90	22,5
LG 5928 PS	104	22,5
LG 5928 PC	111	22,5

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten (nur Sofortkontakte)**
EN	**Safety related data (only instantaneous contacts)**
FR	**Données techniques sécuritaires (contact instantané)**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	351,8	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)

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:	99,0	%
PFH_D:	1,37E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

DE	**Sicherheitstechnische Kenndaten (nur verzögerte Kontakte)**
EN	**Safety related data (only delayed contacts)**
FR	**Données techniques sécuritaires (contact retardée)**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	495,4	a (year)
DC_{avg}:	97,3	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	1	
DC:	97,3	%
PFH_D:	2,76E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

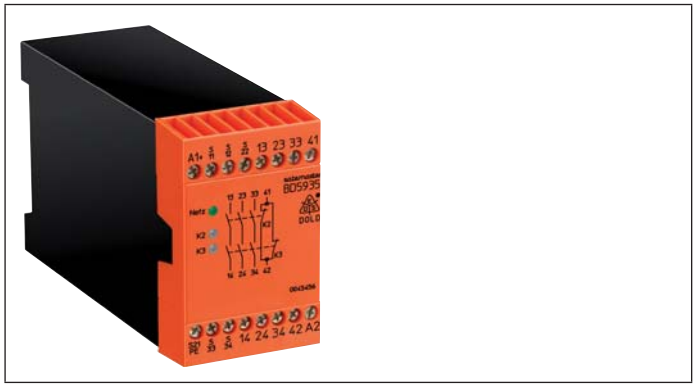
Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511	SIL 3	einmal pro Jahr once per year annuel

SAFEMASTER
Emergency Stop Module
BD 5935

0221548



Product Description

The BD 5935 is used to interrupt a safety circuit in a safe way. It can be used to protect people and machines in applications with e-stop buttons and safety gates.

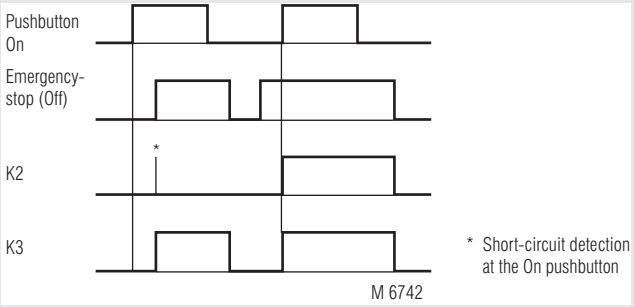
Your Advantages

- Safe disconnection of electrical circuits
- Line fault detection on ON pushbutton
- Gold plated contacts to switch low loads (signal to PLC)
- Optionally cross fault detection in emergency stop circuit
- Easy exchange of devices by removable terminal strips

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**
- 1- or 2-channel connection
- Operating state display
- LED display for channels 1 and 2
- Overvoltage and short circuit protection
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Output: optionally 1 NO / 1 NC or 3 NO / 1 NC contacts
- Optionally automatic ON function or activation via the ON pushbutton
- With fast auto start as option
- Width 45 mm

Function Diagram



Approvals and Markings

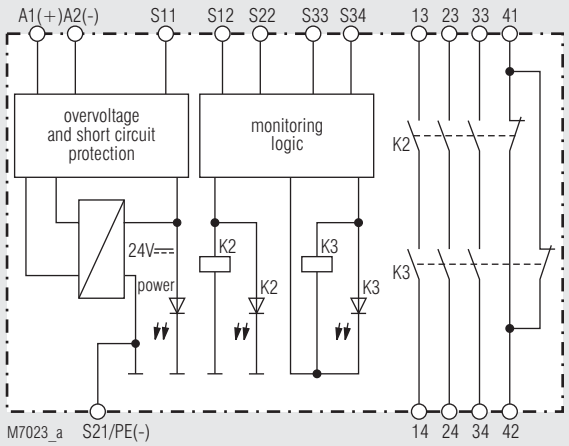
Product Safety Functional Safety
TÜVRheinland CERTIFIED
www.tuv.com ID 0600000000
Canada / USA
A025518

* see variants

Applications

Protection of persons and machines
- Emergency-stop circuits on machines
- Monitoring of safety gates

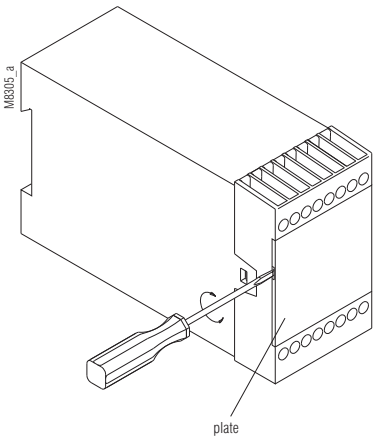
Block Diagram

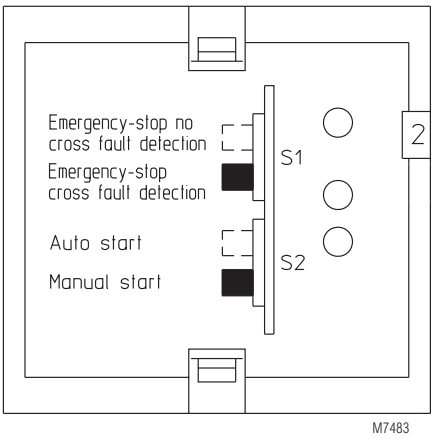


Indication

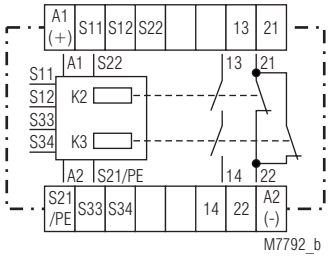
upper LED:	on when supply voltage connected
lower LEDs:	on when relay K2 and K3 active

Unit Programming

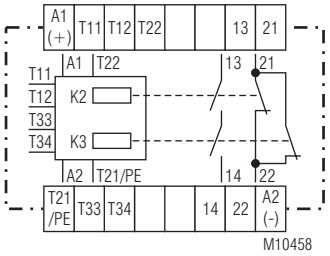




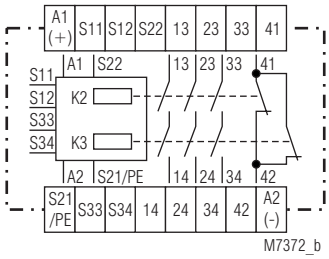
Circuit Diagrams



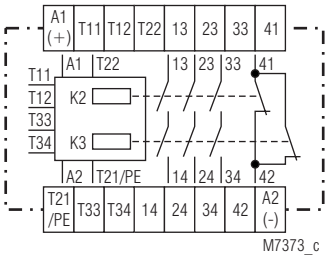
BD 5935.16



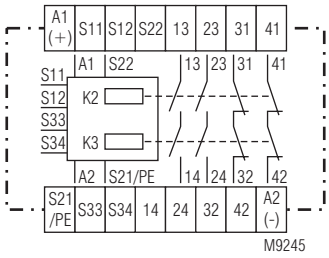
BD 5935.16/200



BD 5935.48



BD 5935.48/200



BD 5935.52

Connection Terminals

Terminal designation	Signal description
A1(+)	+ / L
A2 (-)	- / N
S12, S22, S33, S34, T12, T22, T33, T34	Inputs
S11, S21/PE, T11, T21/PE,	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
21, 22, 31, 32, 41, 42	Forcibly guided indicator output

Notes

If the ON pushbutton was already closed before the voltage was applied at S12, S22 (also in the case of line fault via the ON pushbutton), the output contacts cannot be switched on.
A line fault at the ON pushbutton which occured after activation of the unit is recognized when switching on takes place again and switching-on of the output contacts is prevented. If a line fault occurs at the ON pushbutton after the voltage has already been applied at S12 and S22, unwanted activation occures because this line fault can not be distinguished from the regular switching-on function. The PE testing terminal allows the units to be also operated in IT networks with insulation monitoring. It also serves as a reference point for checking the control voltage and as a connection contact in the event of an emergency-stop with cross fault detection.

Because of the gold-plated contacts the BD 5935 can be used to switch small loads 1 mVA ... 7 VA, 1 mW ... 7 W in the range of 0.1 ... 60 V, 1 ... 300 mA. The gold-plated contacts allow also to switch the maximum current but the gold plating will be burnt off. After that the contacts cannot be used any more to switch the small loads.

One or more extension modules BN 3081 or external contactors with forcibly guided contacts can be used to multiply the number of contacts of the emergency-stop module BD 5935.
The switches S1 and S2 are provided for the following selection possibilities: Automatic-start, manual-start and emergency-stop with or without cross fault detection. These switches are located behind the front cover panel (see unit programming diagrams).
Switch S2 is for selecting automatic or manual Start. In addition, terminals S33 and S34 must be jumpered for "automatic start function".
Selection of the operating mode with or without cross fault detection at the emergency-stop pushbutton is performed via the switch S1. The unit must be connected as shown in the application example.

Technical Data

Input

Nominal voltage U_N:	AC 24, 42, 48, 110, 115, 120, 127, 230, 240 V DC 24 V
Voltage range:	AC 0.85 ... 1.1 U_N
at 10% residual ripple:	DC 0.9 ... 1.2 U_N
at 48% residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	AC approx. 4 VA, DC approx. 2 W
Nominal frequency:	50 / 60 Hz
Recovery time:	0.5 s after activating the emergency-stop button. If the line fault detection of the ON-button is be active, the device must stay off for approx. 5 sec.
Control voltage at S11:	DC 22 V
Control current via S12, S22:	approx. 35 mA ± 25 % at U_N
Minimum voltage at terminal S12, S22:	DC 21 V when unit is activated

Output

Contacts
Contacts

BD 5935.16:	1 NO / 1 NC contacts
BD 5935.48:	3 NO / 1 NC contacts
BD 5935.52:	2 NO contacts / 2 NC contacts

The NO contacts are safety contacts.
The NC contacts 21-22, 31-32 and 41-42 can only be used for monitoring.

Operate time	
activation via ON pushbutton:	50 ms - 25 % + 50 %
automatic ON function:	1 s - 25 % + 50 %, as option also with shorter on-delay (see variants)
Release time	
at 2-channel disconnecting opening in secondary circuit (S12 and S22):	25 ms - 25 % + 50 %
at disconnecting in supply circuit:	50 ms - 25 % + 50 %
Fault detection time at U_N	
at 1-channel interruption	
at S12:	typ. 290 ms
at S22:	25 ms - 25 % + 50 %
Contact type:	relay, forcibly guided
Rated output voltage:	AC 250 V DC: see arc limit curve
Thermal current I_{th}:	see quadratic total current limit curve (max. 10 A in one contact path)
Switching capacity	
to AC 15	
NO contact:	5 A / AC 250 V IEC/EN 60 947-5-1
NC contact:	2 A / AC 250 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	2 A / DC 24 V IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	6 A / DC 24 V at 0.1 Hz
NC contact:	6 A / DC 24 V at 0.1 Hz
Electrical life	
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles IEC/EN 60 947-5-1
Permissible operating frequency:	600 switching cycles / h
Short circuit strength	
max. fuse rating:	
NO contact:	10 A gL IEC/EN 60 947-5-1
NC contact:	6 A gL IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 15 ... + 55 °C at max. 90% humidity
Storage :	- 25 ... + 85 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1
EMC:	IEC/EN 62 061
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 * when front plate is removed to set switches, protection class IP 40 is not valid
Housing:	Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance:	Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance:	15 / 055 / 04 IEC/EN 60 068-1
Terminal designation:	EN 50 005
Wire fixing:	Plus-minus terminal screws M3.5, box terminal with wire protection
Mounting:	DIN rail IEC/EN 60 715
Weight:	450 g

Dimensions

Width x height x depth:	45 x 74 x 121 mm

CCC-Data

Nominal voltage U_N:	AC 24, 42, 48, 110, 115, 120, 127, 230 V DC 24 V
Thermal current I_{th}:	see quadratic total current limit curve (max. 5 A in one contact path)
Switching capacity	
to AC 15	
NO contact:	2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	1 A / DC 24 V IEC/EN 60 947-5-1

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

Standard Type

BD 5935.48 DC 24 V

Article number:	0045456
• Output:	3 NO / 1 NC contacts
• Nominal voltage U_N:	DC 24 V
• Width:	45 mm

Variants

BD 5935._ _/61:	with UL-approval
BD 5935.48/200:	special terminal arrangement see diagram
BD 5935.48/324:	with fast auto start: typ. 500 ms, without line fault detection on ON-button
BD 5935.48/824:	with fast auto start: typ. 110 ms, without line fault detection on ON-button

Ordering example of Variants

BD 5935 .48 /_ _ _ AC 230 V 50/60 Hz

- 50/60 Hz: Nominal frequency
- AC 230 V: Nominal voltage
- /_ _ _: Variant, if required
- .48: Contacts
- BD 5935: Type

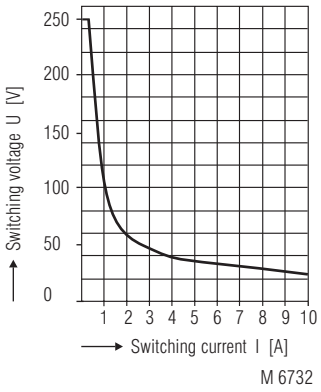
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K2" lights up, but "K3" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
LED "K3" lights up, but "K2" remains off	- Safety relay K3 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
Device cannot be activated	Manual start mode - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 are not bridged - Safety relay is welded (replace device) - Incorrect setting of switch S1

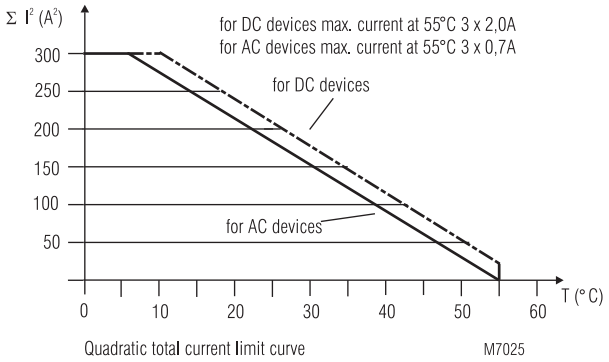
Maintenance and repairs

- 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

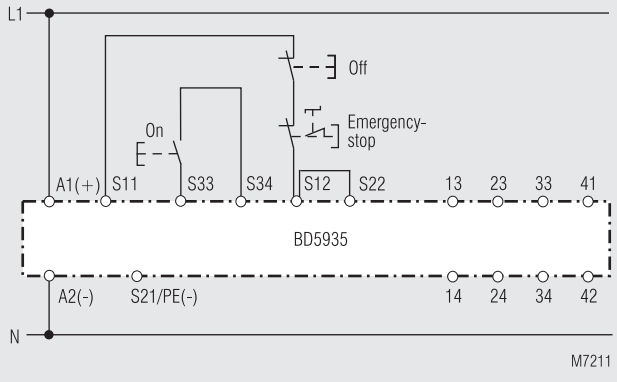


Arc limit curve under resistive load

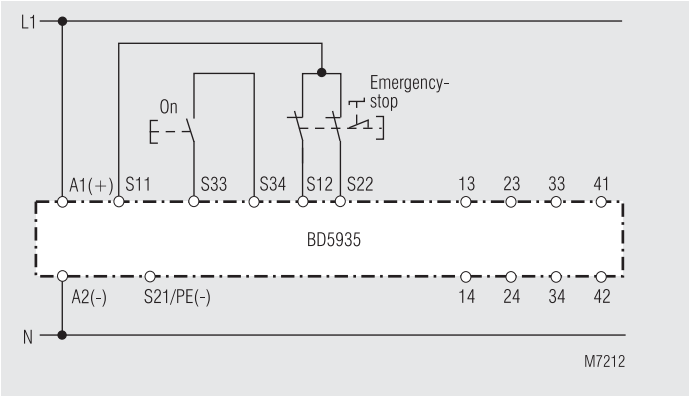


Quadratic total current limit curve

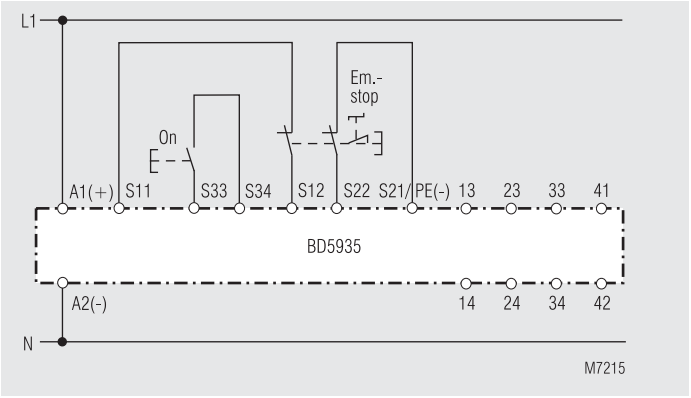
Application Example



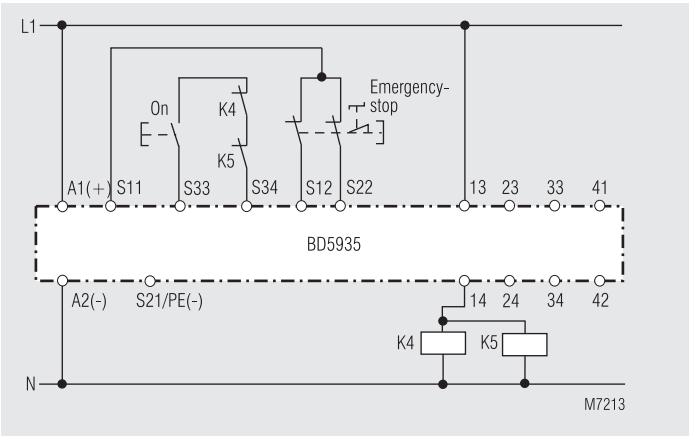
Single-channel emergency-stop circuit. This circuit has no redundancy in the emergency-stop control circuit.
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up tos SIL2, Performance Level d, Cat. 3



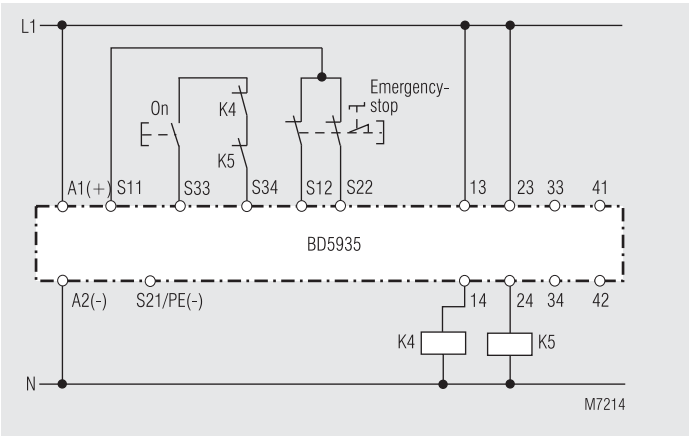
Two-channel emergency-stop circuit without cross fault detection.
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



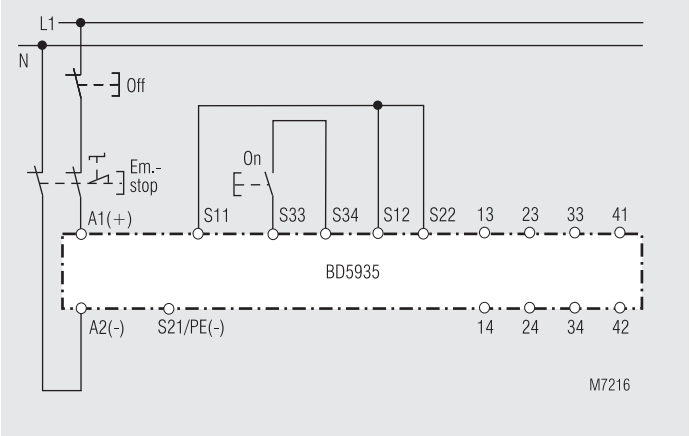
Two-channel emergency-stop circuit with cross fault detection.
Please note "Unit programming" !
Switches in pos.: S1 cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



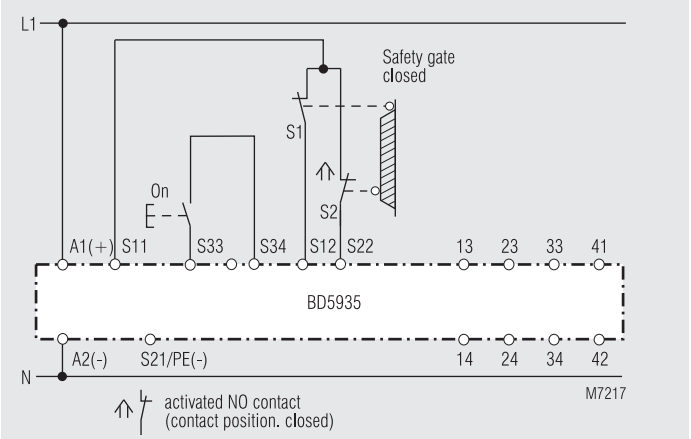
Contact reinforcement with external contactors, controlled with one contact path.
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



Contact reinforcement by external contators, controlled with 2 contact paths. With switching current > 10 A, the output contacts can be reinforced by external contactors with forcibly guided contacts. The function of the external contactors is monitored by looping the NC contacts into the making circuit (terminals S33-S34).
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

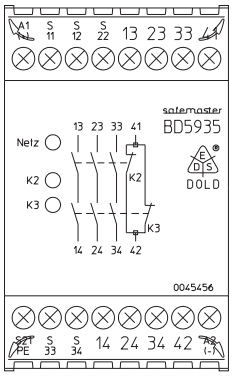


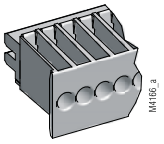
Two-pole emergency-stop with emergency-stop control device in the supply circuit.
Application for long emergency-stop loops in which the control voltage dropped below the minimum voltage of 21 V.
Important:
Single faults (line shorts over the emergency-stop control device) are not identified with this external circuit.
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

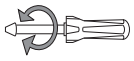
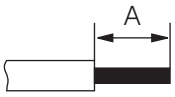
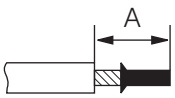
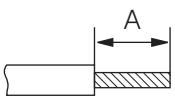


Two-channel monitoring of a safety gate.
The switch of S12 must close simultaneously with S22 or later.
Please note "Unit programming" !
Switches in pos.: S1 no cross fault detection
S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

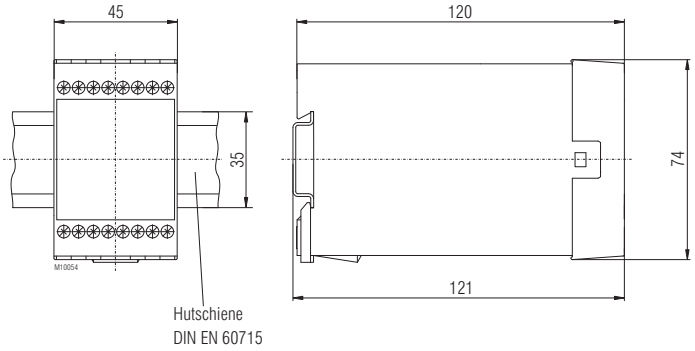
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



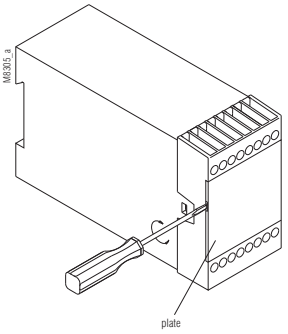


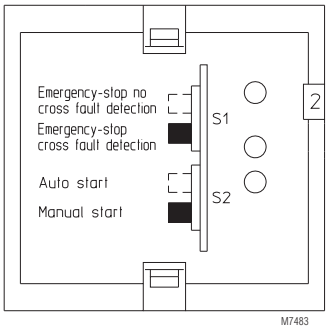
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**

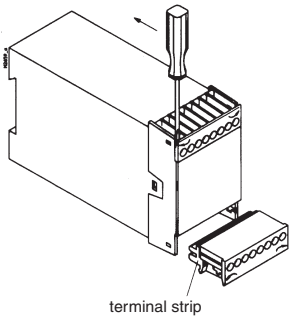


DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**





DE	**Montage / Demontage Klemmenleiste**
EN	**Mounting / disassembly of the terminal strip**
FR	**Montage / Démontage de bornier**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	238,4	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)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,95E-10	h^{-1}
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

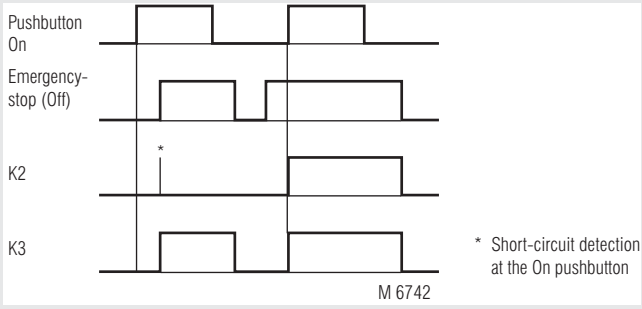
SAFEMASTER
Emergency Stop Module
BD 5987

0221553

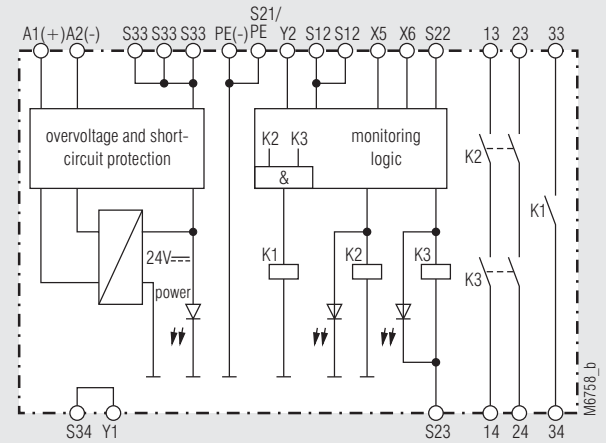
Product Description

The BD 5987 is used to interrupt a safety circuit in a safe way. It can be used to protect people and machines in applications with e-stop buttons and safety gates. The BD 5987.02/301 can be used as electronic replacement of a safety switch according to EN 81-1/-2, section 14.1.2.2.

Fucntion Diagram



Block Diagram



Your Advantages

- Safe disconnection of electrical circuits
- Line fault detection at On pushbutton
- Gold-plated contacts to switch small loads (input for PLC)
- Optionally cross fault detection in emergency stop circuit

Features BD 5987._ _:

- **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**
- Output: 2 NO contacts for AC 250 V
- 1-channel or 2-channel connection
- LED displays for channels 1 and 2
- Overvoltage and short circuit protection
- Wire connection: also 2 x 1,5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 45 mm

BD 5987._ _/001: same as BD 5987._ _ but

- Optionally automatic On function or after activation by the On pushbutton
- Optionally cross fault detection in emergency stop circuit

BD 5987.02/301: same as BD 5987.02/001 but

- Suitable also for elevators according to EN 81-1/-2
- Complies to the requirements of the directive 95/16/EG for elevators
- **According to**
  - **Performance Level (PL) d and category 3 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 2 to IEC/EN 61508**
- Shorter release time when opening the supply circuit
- Single-channel e-stop circuit

Approvals and Markings

CE TÜVRheinland CERTIFIED Product Safety Functional Safety www.tuv.com ID 0600000000 c UL us * Canada / USA

* see variants

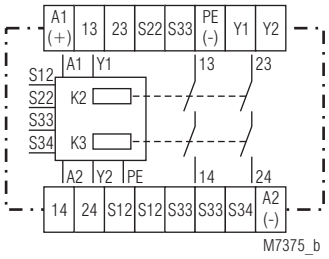
Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of safety gates

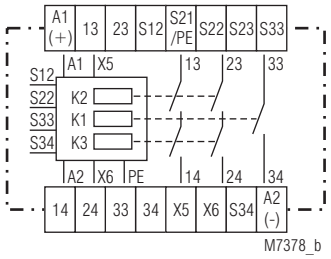
Indication

LED power supply:	on when operating voltage present
LED K2:	on when supply on K2
LED K3:	on when supply on K3

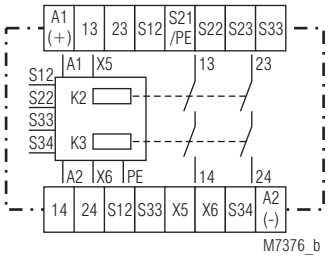
Circuit Diagrams



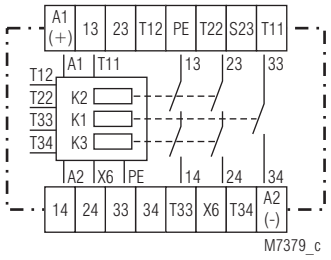
BD 5987.02



BD 5987.03/001



BD 5987.02/001 + /301



BD 5987.03/201

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S23, S34, X6, Y2 T12, T22, T34	Inputs
PE (-), S21/PE, S33, X5, Y1 T11, T12, T33	Outputs
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
33, 34	Indicator output

Notes

Line fault detection at the On pushbutton:
The output contacts cannot be closed if the On pushbutton is already closed before the voltage is applied to S12, S22 (also in the event of a line fault at the On pushbutton).
A line fault at the On pushbutton which occurs after activation of the device is recognized when switching- on takes place again and closing of the output contacts is then prevented.
If a line fault occurs at the On pushbutton after the voltage is already present at S12, S22 undesired activation will take place, because this line fault does not differ from the normal closing function.
The gold-plated contacts of the BD 5987 mean that this module is also suitable for switching small loads of 1 mVA ... 7 VA, 1 mW ... 7 W in the range 0.1 ... 60 V, 1 ... 300 mA. The contacts also permit the maximum switching current. However, since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.
The PE terminal permits operation of the device in IT systems with insulation monitoring and also serves as a reference point for testing the control voltage. The internal short-circuit protection will be bridged on DC devices, if the protective ground is connected to terminal PE.
One or more extension modules BN 5989 or external contactors with forcibly guided contacts may be used to multiply the number of contacts of the emergency stop module BD 5987.
For automatic restart:
S22 must be connected before S12. S12 initiates the automatic restart. With manual restart it is not necessary to follow this order.

Technical Data

Input

Nominal voltage U_N:	AC 24, 42, 48, 110, 127, 230, 240 V [1)] DC 24 V
Voltage range:	AC 0.8 ... 1.1 U_N
at 10% residual ripple:	DC 0.9 ... 1.2 U_N
at 48% residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	approx. 5.5 VA
Nominal frequency:	50 / 60 Hz
Control voltage at S33:	DC 24 V
Control current	
BD 5987.02:	typ. DC 55 mA
BD 5987.02/001 + /301:	typ. DC 45 mA
Minimum voltage at terminals S12, S22:	DC 21 V with activated device
Recovery time:	0.5 s after release of the emergency stop pushbutton

Output

Contacts	
BD 5987.02:	2 NO contacts
BD 5987.03:	2 NO contacts, 1 NO contact used for monitoring

The NO contact 33-34 can only be used for monitoring.

Operate time:	max. 100 ms
BD 5987.02/001 + /301:	with automatic restart approx. 1 s
Release time	
2-channel disconnecting in secondary circuit (S12, S22 and S23):	50 ms ± 25 %
Opening in supply circuit	
BD 5987.02:	350 ms ± 50 %
BD 5987.02/001:	120 ms ± 50 %
BD 5987.02/301:	40 ms ± 50 %
Fault detection time at U_N:	
at 1-channel interruption	
at S12:	
BD 5987:	typ. 430 ms
BD 5987/001+/201:	typ. 85 ms
at S22 and S23:	50 ms ± 25 %
Contact type:	relay, forcibly guided
Nominal output voltage:	AC 250 V [1)] DC: see limit curve for arc-free operation
Thermal current I_{th}:	see continuous current limit curve (max. 10 A in one contact path)

Switching capacity		
contacts 13/14, 23/24:		
to AC 15:	5 A / AC 230 V [1)]	IEC/EN 60 947-5-1
to DC 13:	4 A / DC 24 V	IEC/EN 60 947-5-1
contacts 33/34:		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	600 switching cycles / h	

[1)] max. AC 160 V or DC 160V for the variant BD 5987.02/301 when used in an elevator control according to elevator directive 95/16/EG, if the BD 5987.02/301 is not installed in a cabinet with protection degree IP 54 or better.

Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55°C at max. 90 % humidity	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 62 061	
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

Technical Data

Housing: Thermoplastic with V0 behaviour according to UI subject 94
Vibration resistance: Amplitude 0,35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance: 15 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 4 mm² solid or
1 x 2,5 mm² stranded ferruled (isolated) or
2 x 1,5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or
2 x 2,5 mm² stranded ferruled DIN 46 228-1/-2/-3
Wire fixing: Plus-minus terminal scews M3.5 box terminal with wire protection
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight: 450 g

Dimensions

Width x height x depth: 45 x 74 x 121 mm

UL-Data

Nominal voltage U_N: AC 24, 42, 48, 110, 127, 230, 240 V
DC 24 V

Ambient temperature: - 15 … + 55 °C

Switching capacity: 6 A, 250 Vac G.P.

Wire connection: 60°C / 75°C copper conductors only AWG 18 - 16 Torque 7 lb in

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

Standard Type

BD 5987.02/001 DC 24 V
Article number: 0040954
- Output: 2 NO contacts
- Nominal voltage U_N: DC 24 V
- Width: 45 mm

Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K2" lights up, but "K3" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22, T22 e.g. S23 (switch channel off on S12 e.g. T12)
LED "K3" lights up, but "K2" remains off	- Safety relay K3 is welded (replace device) - A 1-channel switch-off occurred on S12 e.g. T12 (switch channel off on S22, T22 e.g. S23)
Device cannot be activated	- Safety relay is welded (replace device) - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: X5 - X6 e.g. T33 - X6 are not bridged

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.

Variants

BD 5987.02/61: with UL approval (Canada/USA)
BD 5987.02/001: Optionally cross fault monitoring on the emergency stop loop (see application M6749)
Optionally automatic On function when operating voltage is applied or after activation by the On pushbutton.

Jumper asignment for functions:
Activation via On pushbutton / or automatic On function:

On pushbutton S12-S34 or S33-S34	Jumper X5 - X6	Function
		The output contacts are switched only after operation of the On pushbutton. Line fault monitoring at the On push-button.
		Automatic On function for operating voltage Off/On or after emergency-stop release

BD 5987.03/001: with 2 NO contacts,
1 signalling contact AC/DC 0,1 ... 1 A / 10 ...120 V

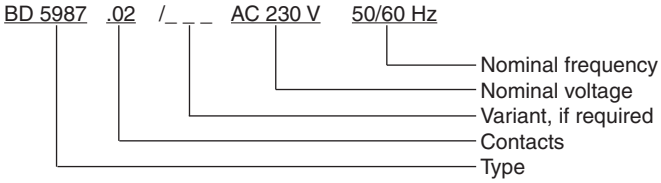
BD 5987.03/201: see BD 5987.03/001,
but with special terminal designation

Jumper asignment for functions:
Activation via On pushbutton / or automatic On function

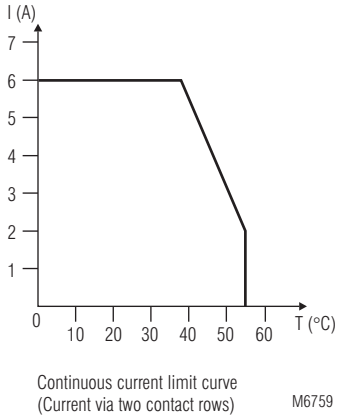
On pushbutton T11-T34 or T12-T34	Jumper T33 - X6	Function
		The output contacts are switched only after operation of the On pushbutton. Line fault monitoring at the On push-button.
M8687		Automatic On function for operating voltage Off/On or after emergency-stop release

BD 5987.02/301: Starting behaviour as with BD 5987.02/001, shorter release time when opening the supply circuit, Suitable also for elevators according to EN 81-1/-2, Complies to the requirements of the directive 95/16/EG for elevators.

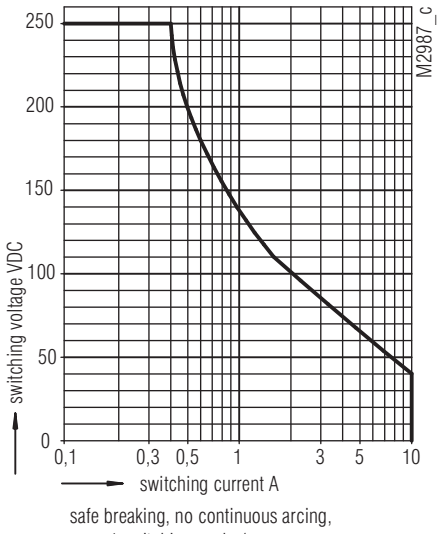
Ordering example for variants



Characteristics

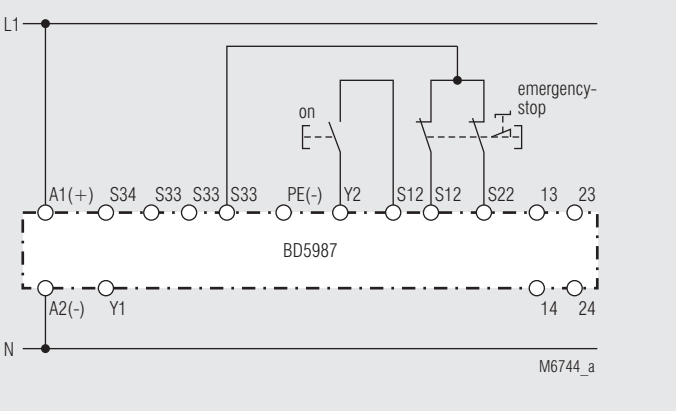


Continouos current limit curve

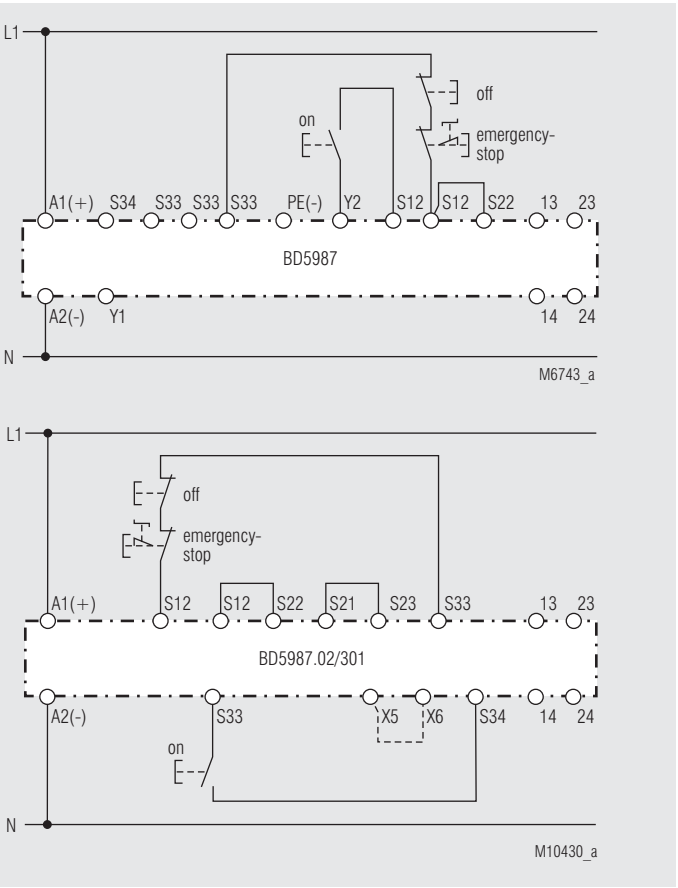


Limit curve for arc-free operation with resistive load

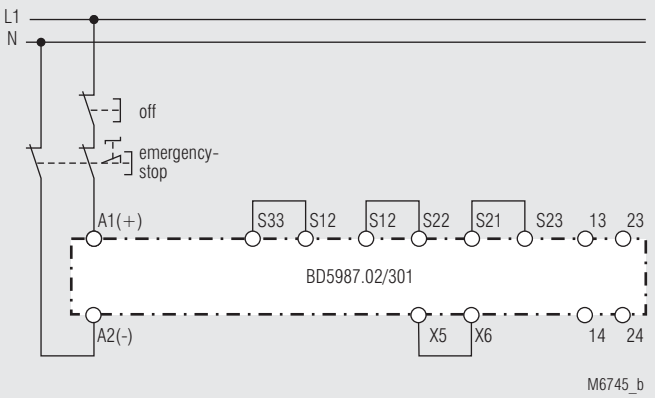
Application Examples



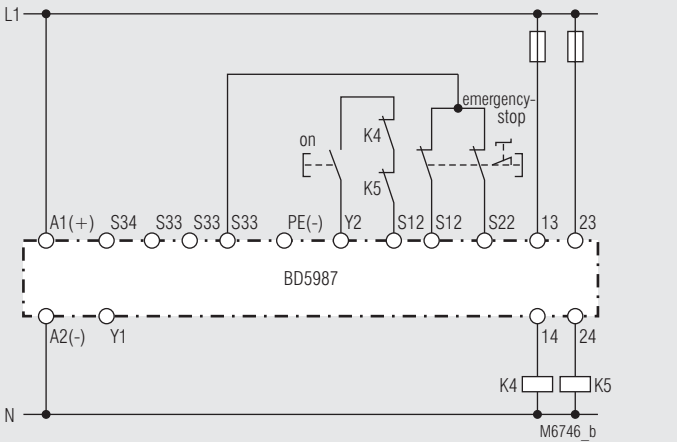
Two-channel emergeny stop circuit.
Suited up to SIL3, Performance Level e, Cat. 4



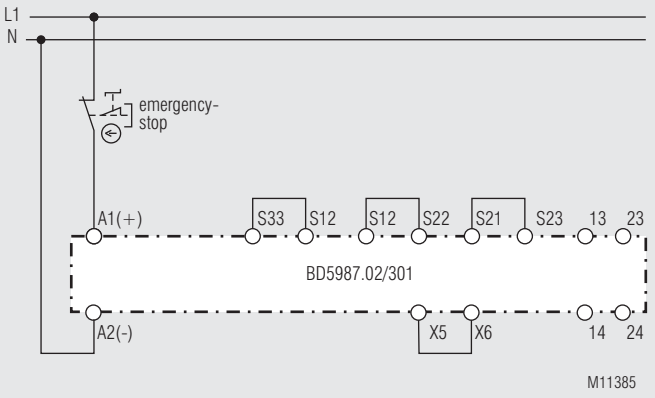
Single-channel emergency stop circuit. This circuit does not have any redundancy in the emergency stop control circuit.
Suited up to SIL2, Performance Level d, Cat. 3



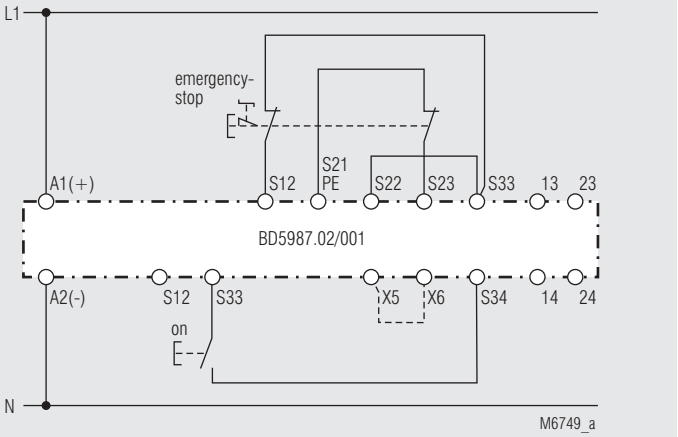
Two-pole emergency stop circuit with emergency stop control device in supply circuit with automatic ON-function.
Application for long emergency stop loops where the control voltage drops below the minimum voltage of 21 V.
Attention:
Single faults (e.g. line faults at the emergency stop control device) are not detected with this external circuit configuration.
Suited up to SIL2, Performance Level d, Cat. 3



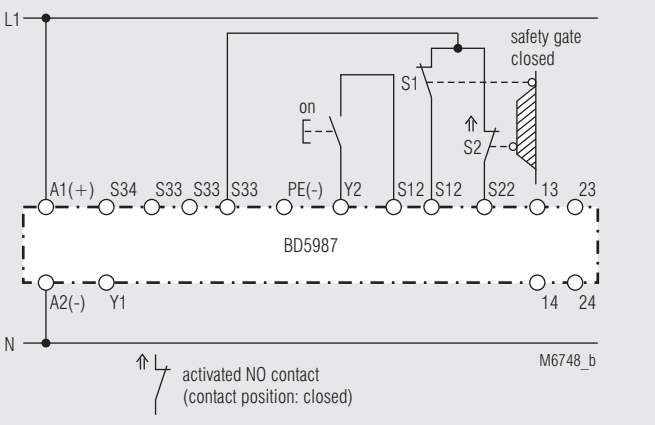
Contact reinforcement by external contactors, 2-channel.
The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 10 A. Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals Y2 - S12).
Suited up to SIL3, Performance Level e, Cat. 4



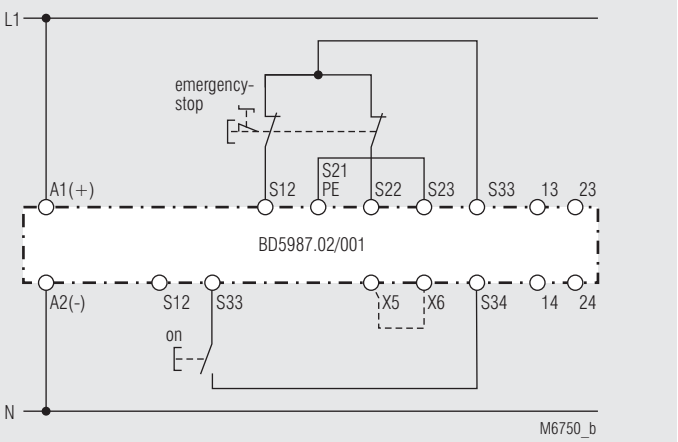
Single-channel emergency stop circuit. This circuit does not have any redundancy in the emergency stop control circuit
Suited up to SIL2, Performance Level d, Cat. 3



Two-channel emergency stop circuit with cross fault detection.
Activation via On pushbutton. ---- Jumper X5 -X6:
Jumper X5 - X6 must be fitted for the automatic On function.
The On pushbutton is not required.
Suited up to SIL3, Performance Level e, Cat. 4



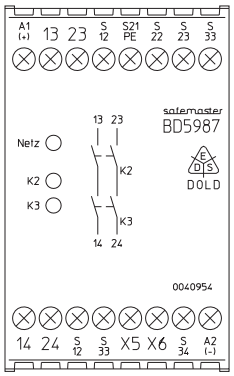
Two-channel monitoring of a safety gate.
Suited up to SIL3, Performance Level e, Cat. 4

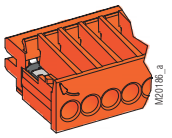


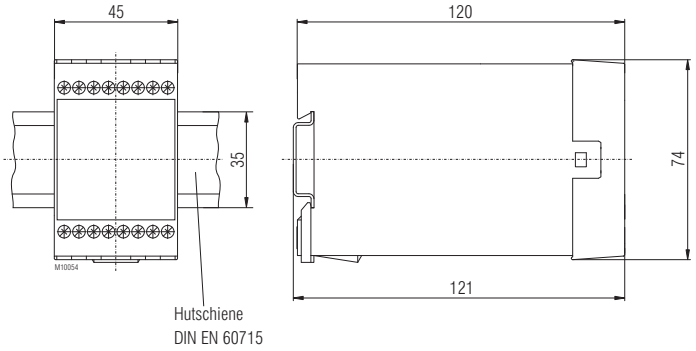
Two-channel emergency-stop circuit without cross fault detection.
Activation via On pushbutton. ---- Jumper X5 - X6:
Jumper X5 - X6 must be fitted for the automatic On function.
The On pushbutton is not required.
Suited up to SIL3, Performance Level e, Cat. 4

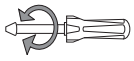
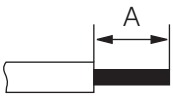
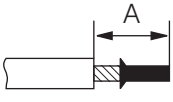
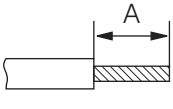
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**







	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

	BD 5987.02		
	/001	/301	
EN ISO 13849-1:			
Kategorie / Category:	4	3	
PL:	e	d	
$MTTF_d$:	353,1		a (year)
DC_{avg}:	98,9		%
d_{op}:	365		d/a (days/year)
h_{op}:	24		h/d (hours/day)
t_{cycle}:	3600		s/cycle
	≙ 1		/h (hour)

	BD 5987.02		
	/001	/301	
IEC/EN 62061 IEC/EN 61508:			
SIL CL:	3	2	IEC/EN 62061
SIL	3	2	IEC/EN 61508
HFT*):	1		
DC:	98,9		%
PFH_D:	1,57E-10		h^{-1}
T_1:	20		a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzione di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Emergency Stop Module With Voltage Failure Detection
BH 5903, BL 5903

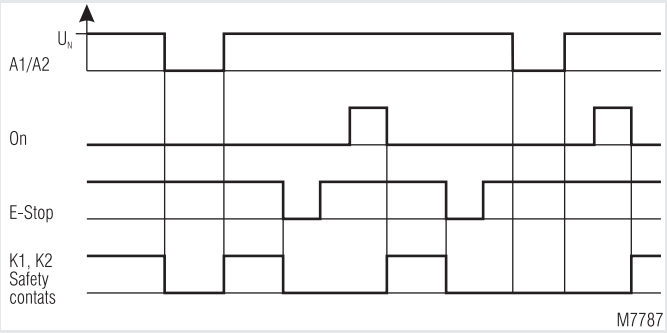
0235200

BH 5903.03

BL 5903

- **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**
  - **Category 4 to EN 954-1**
- **E-stop with latching function**
- **Automatic start when voltage returns after phase failure when no E-Stop was operated before phase failure.**
- Reset after E-stop with push button
- Output max. 3 NO contacts, see contacts
- B_ 5903._ _ /00000: 1 E-stop loop 2-channel operated
- B_ 5903._ _ /00020: 2 E-stop loops single channel operated
- Cross fault monitoring
- Feedback loop for external contact reinforcement
- Short circuit and broken wire detection on all inputs
- LED indication for channel 1 and 2 and for diagnostics
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or
- 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- BH 5903: width 45 mm
  BL 5903: width 90 mm

Function Diagram



Approvals and Markings

Functional Safety Type Approved
TÜVRheinland
FS
c UL us LISTED
Canada / USA
*

* see variants

Indicators

upper yellow LEDs
run 1, run 2: on when unit works correct, fault signal via flashing code

lower green LEDs
K1, K2: on when K1, K2 energized

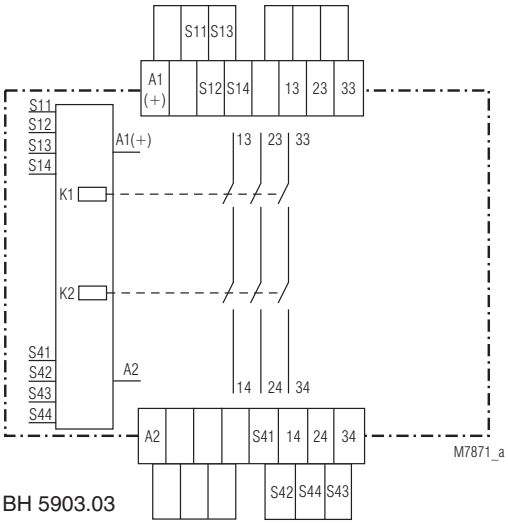
Applications

- For plants, that should start automatically at return of voltage after phase failure. E.g. Compressor plants, water and sewage water plants.

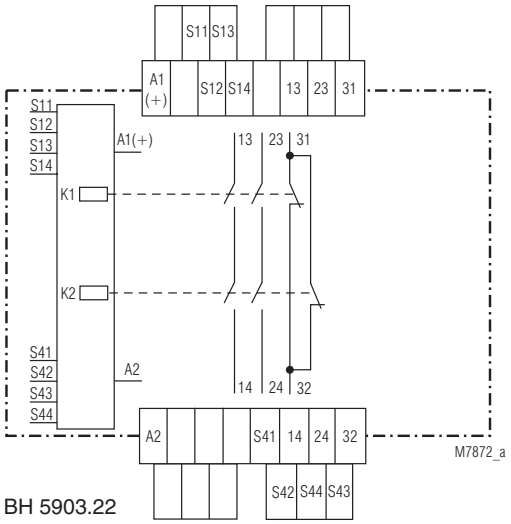
Notes

- **The BH 5903 e.g. BL 5903 stores the state of emergency stop. After pressing and releasing the e-stop button the unit can only be reset by pressing the button. If the unit switches off because of phase failure it resets automatically when the voltage returns**
- The unit monitors how long the on button is pressed. Is the duration longer then 3 sec it does not switch on.
- The NC contact 31-32 (BH 5903.22 e.g. BL 5903.22) is only a monitoring contact.

Circuit Diagrams

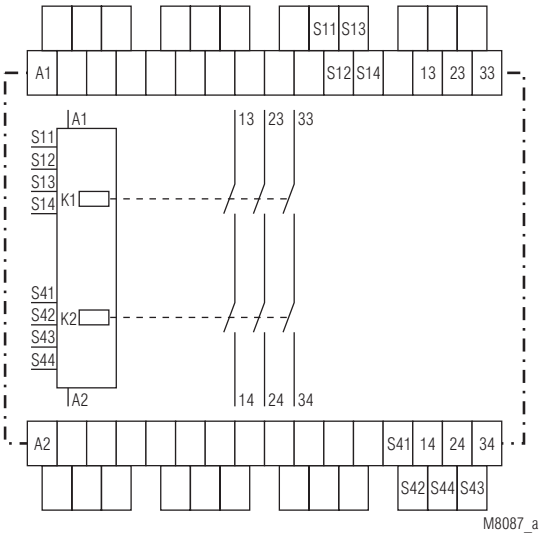


BH 5903.03

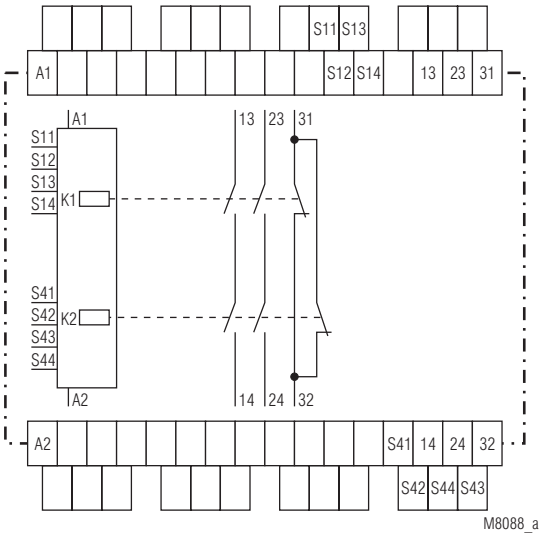


BH 5903.22

Circuit Diagrams



BL 5903.03



BL 5903.22

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S14, S42, S44	Inputs
S11, S13, S41, S43	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
31,32	Forcibly guided NO contacts for indicator signal

Technical Data

Input

	BH 5903	BL 5903
Nominal voltage U_N:	DC 24 V	AC 24, 110, 230 V
Voltage range:	-	0.8 ... 1.1 U_N
at max. 5 % residual ripple:	0.85 ... 1.15 U_N	-
Nominal consumption:	max. 170 mA	max. 7 VA
Nennfrequenz:	-	50 / 60 Hz
Control voltage over S11, S13, S41, S43:	pulses max. 23 V at U_N	
Control current over S12, S14, S42, S44:	je 4.5 mA bei U_N	
Min. voltage at terminals S12, S14, S42 S44:	DC 16 V	
Short circuit protection:	internal with PTC	

Output

Contact	
BH 5903.03:	3 NO contacts
BH 5903.22:	2 NO, 1 NC contacts (only to be used as monitoring contact)
Operate delay typ. at U_N:	
Manual start:	max. 45 ms
Automatic start:	max. 800 ms, if voltage failure > approx. 150 ms max. 7 s, if voltage failure < approx. 150 ms
Release delay typ. at U_N:	
Disconnecting the supply:	max. 18 ms
Disconnecting S12, S22:	15 ms
Contact type:	Relay, forcibly guided
Output rated voltage:	AC 250 V DC: see continuous limit curve
Switching of low loads:	≥ 100 mV
Thermal current I_{th}:	5 A

Technical Data

Switching capacity		
to AC 15:		
NO contact:	AC 3 A / 230 V	IEC/EN 60 947-5-1
NC contact:	AC 2 A / 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible switching frequency:	max. 1 200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	± 0 ... + 50 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	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 voltages 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	IEC/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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Shock resistance:		
Acceleration:	10 g	
Duration of impuls:	16 ms	
Number of shocks:	1000 per axis on all three axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	320 g	

Dimensions

Width x height x depth

BH 5903:	45 x 84 x 121 mm
BL 5903:	90 x 84 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	180.9	a
DC_{avg}:	97.9	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	97.9	%
SFF	99.4	%
PFH_D:	5.57E-10	h^{-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"

Nominal voltage U_N:	DC 24 V
Ambient temperature:	0 … +50°C
Switching capacity:	
Ambient temperature 50°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Semiconductor outputs:	24Vdc, 100 mA
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BL 5903.03/00000 AC 230 V

Article number:	0053510
• Output:	3 NO contacts
• for 1 E-stop loop, 2 channel operated	
• Nominal voltage U_N:	AC 230 V
• Width:	45 mm

Variants

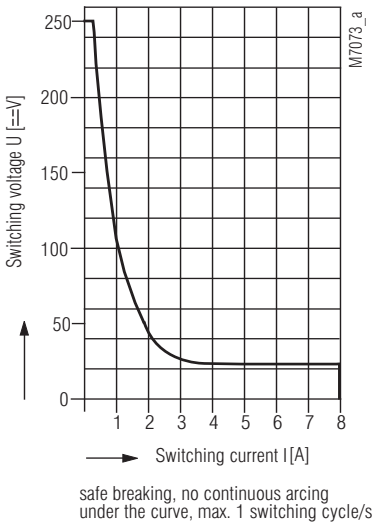
B_ 5903._ _/00000:	for 1 E-stop loop 2- channel operated
B_ 5903._ _/00020:	for 2 E-Stop loops singel channel operated
BH 5903._ _/_ _ _ _ _/61:	with UL-approval

Ordering example for variant

B_ 5903. _ _ /_ _ _ _ _ _ _ _ _ _ V

- Nominal voltage:
  - DC 24 V (BH 5903)
  - AC 24 V (BH 5903)
  - AC 110 V (BL 5903)
  - AC 230 V (BL 5903)
- Variant
- Contacts:
  - .03 3 NO contacts
  - .22 2 NO contacts, 1 NC contact
- Type:
  - BH: width 45 mm
  - BL: width 90 mm

Characteristic



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Continuous limit curve

Fault Indication By Flashing Code

The failure codes are displayed by a flashing sequence of the upper yellow LEDs run 1, run 2. Flashing frequence: env. 0.5 s on, 0.05 s off, end od the sequence: env. 2 s off. It is possible that the two processors show different failure codes. If a failure is displayed, the relays K1 and K2 are switched off.
The module BH 5904 shows 2 types of failure codes:

1. FAILURE type 1:
These failures are serious and do not allow further operation of the module. The module can only be reset by switching the power supply off and on again.

2. FAILURE type 2:
This failure is concerning the function faults in conjunction with the safety controller. The module can be reset by pressing the reset button.

Failure type 1

No*)	Description	Mesures et conseils
0	Internal module failure (LEDs are continuously off)	If both LEDs stay off, the module is defective and has tobe repaired.
6	Undervoltage detection or Overvoltage detection	1) Left LED is flashing: The supply voltage dropped below the permitted value (< approx.0.85 U_N) 2) Right LED is flashing: The supply voltage went over the permitted value (> approx.1.15 U_N + 5 % residual ripple)
7	Input failure	A short circuit has been detected on the inputs ofthe unit ou the 2 signals of a 2-channel sensor (feed backcircuit, start signal ofcontroller, valve) do not correspond (short circuit,broken wire or other fault)
8	Failure on relay output	Output relay defective 1) Check circuit and current. 2) The relay service life is crossing
9 10 11	Internal module failure	Please try to evaluate the circumstances that lead to this10 fault and check with the supplier or manufacturer.
12 13 14	Internal module failure	The module has to be repaired

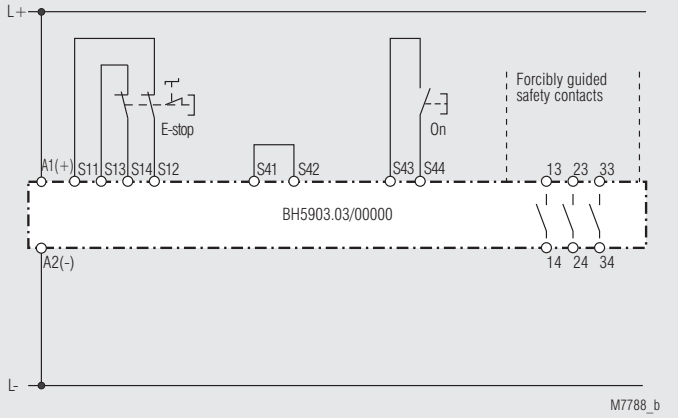
*) No.: Number of flash pulses in a series

Failure type 2

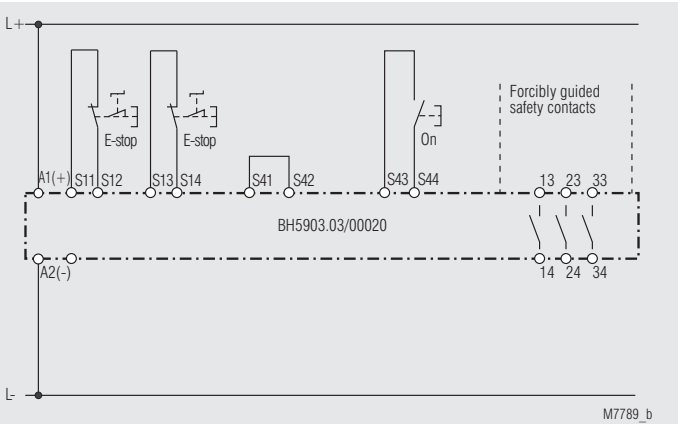
No*)	Description	Mesures et conseils
1	E-stop acitvated	
2	Fault on reset button	1) The start button must no be pressed longer then 3 sec. 2) During start up of the unit and initialising the start button must not be pressed
4	Switch off fault	The unit showed already a fault before switching off
6	Feedback failure	Both LED are flashing Feedback on S41/S42 not closed

*) No.: Number of flash pulses in a series

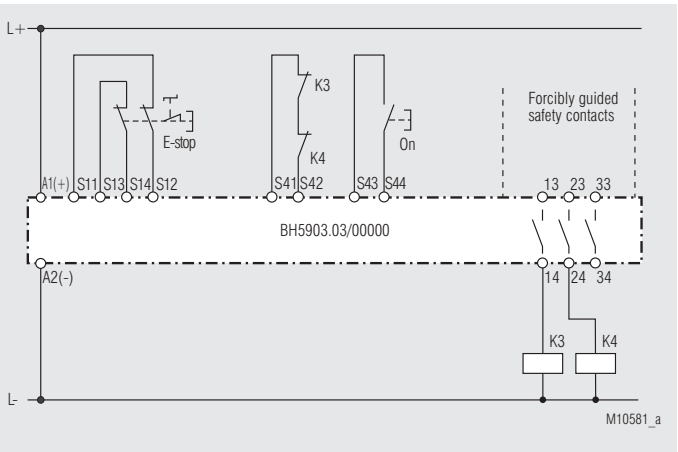
Application Examples



BH 5903.03/00000 with one E-Stop loop (2-channel), automatic restart after phase failure and manual restart after E-stop.
Automatic reset ist only active when no E-Stop was operated before phase failure.



BH 5903.03/00020 with two E-Stop loops (single-channel), automatic restart after phase failure and manual restart after E-stop.
Automatic reset ist only active when no E-Stop was operated before phase failure.
Max. Cat. 3, PL d because of faullt exclusion in the wiring.



BH 5903 with external contact reinforcement

SAFEMASTER
Emergency Stop Module With Time Delay
BH 5928, BI 5928

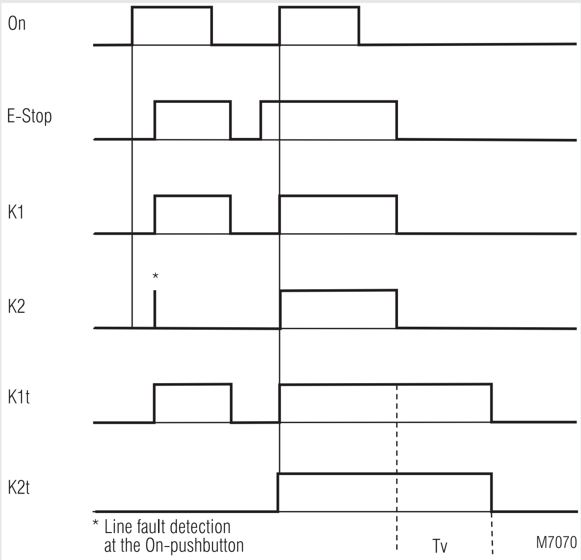
DOLD

0226419

BH 5928 BI 5928

- **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**
- Output: 3 NO or 2 NO, 1 NC instantaneous contacts and 3 NO release delayed contacts
- Single and 2-channel operation
- Line fault detection on On-button, when On-button is connected to S33-S34
- Manual restart with button on S33-S34 or automatic restart with bridge between S13-S14
- With or without cross fault monitoring in the E-stop loop
- LED indication for supply, channel 1/2 and release delayed contacts
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width
  BH 5928: 45 mm
  BI 5928: 67.5 mm

Function Diagram



Approvals and Markings

Canada / USA A025518

* see variants

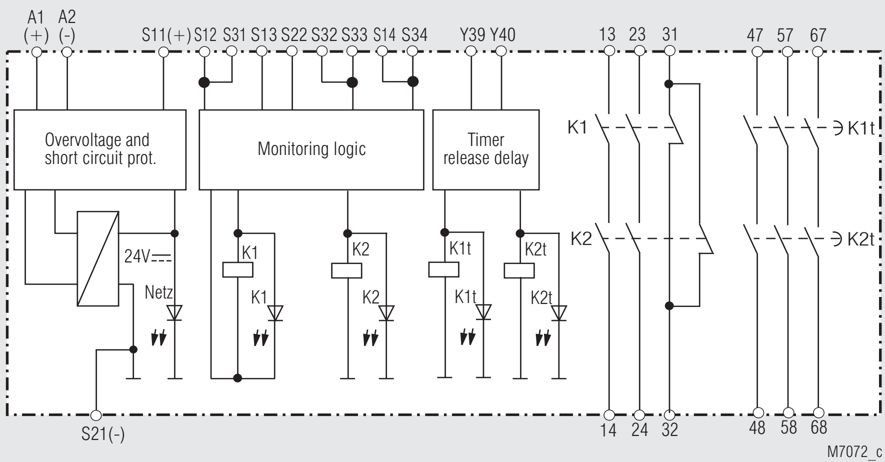
ApplicationS

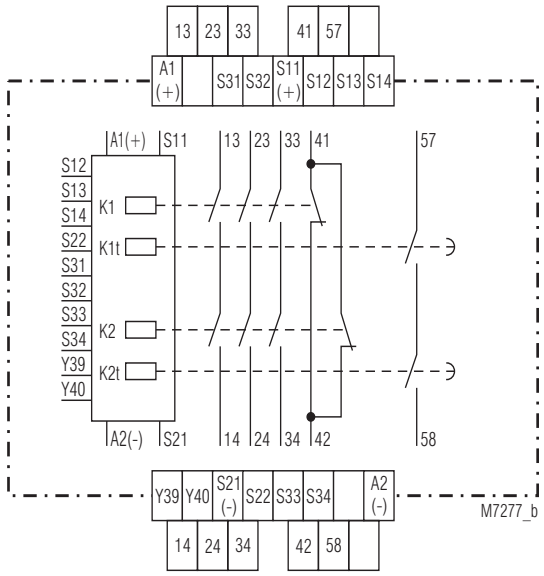
Protection of people and machines
- Emergency stop circuits on machines, stop category 1 can be realised
- Monitoring of safety gates

Indicators

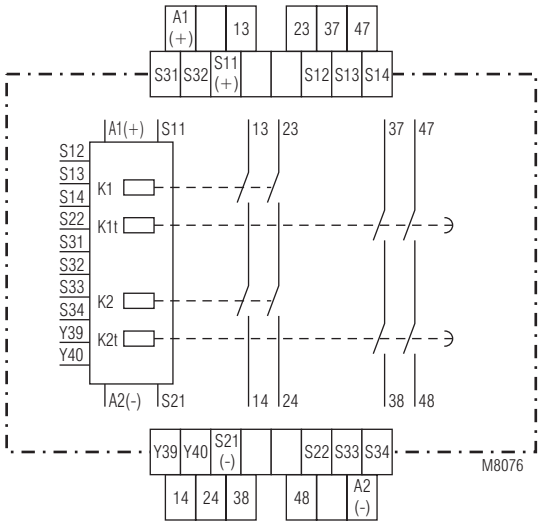
LED power:	on, when supply connected
LEDs K1, K2:	on, when relay K1 and K2 resp. $K1_t$ and $K2_t$ energized

Block Diagram

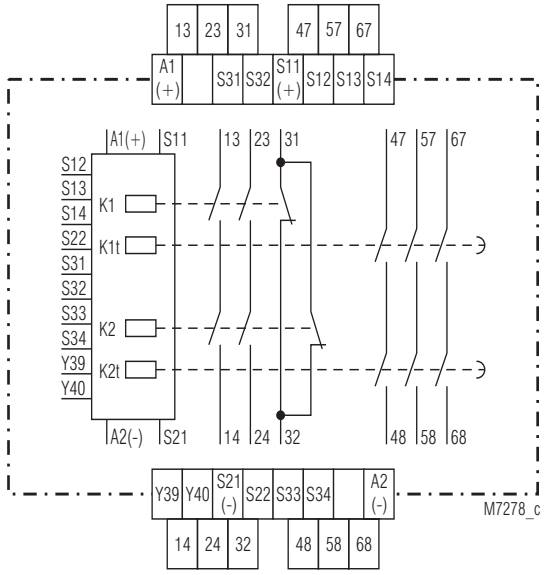




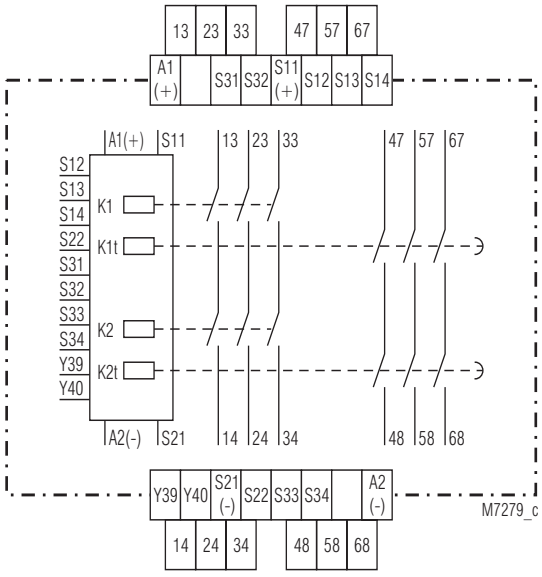
BH 5928.47



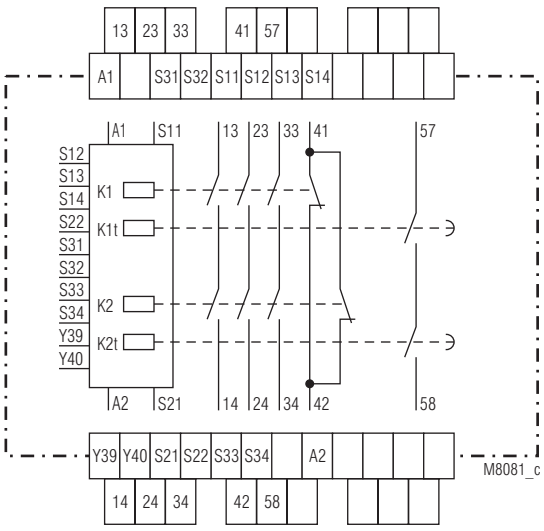
BH 5928.91



BH 5928.92



BH 5928.93



BI 5928.47/100

Connection Terminals

Terminal designation	Signal description
A1(+)	+ / L
A2 (-)	- / N
S12, S14, S22, S31, S32, S34, Y39	Inputs
S11, S13, S21, S33, Y40	Outputs
13, 14, 23, 24, 33, 34	Positive driven NO contacts for release circuit
37, 38, 47, 48, 57, 58, 67, 68	NO contacts, delay
31, 32, 41, 42	Positive guided indicator output

Notes

To select automatic restart terminals S13 - S14 must be bridged, S33 - S34 must be opened. Open terminals S13 - S14 select manual restart, the On-button must then be connected to S33 - S34.
Line fault detection on On-button:
The line fault detection is only active when the time delayed relais $K1_t$ and $K2_t$ have released and then S12 (channel A) and S32 (channel B) are switched simultaneously. If the On-button is closed before S12, S31, S32 is connected to voltage (also when line fault across On-button), the output contacts will not close. The unit will not restart before the time delay is finished.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S31, S32, the unit will be activated because this line fault is similar to the normal On-function.
The unit can be operated with single channel and 2-channel operation with cross fault monitoring. For connection please refer to application examples.

The gold plated contacts of the BH 5928 mean that this module is also suitable for switching small loads of 1 mVA - 7 VA, 1 mW - 7 W in the range 0.1 - 60 V, 1 - 300 mA. The contacts also permit the maximum switching current. However since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.
The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the E-stop loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2(-). The short-circuit protection of line A1(+) remains active.

Y39 - Y40 must be closed to have timed outputs. By opening the bridge between Y39 and Y40 the time delay can be interrupted immediately. Without bridge the contacts switch without delay.
The time setting has to be sealed by the user after test.

Technical Data

Input

Nominal voltage U_N:
BH 5928: DC 24 V, AC/DC 24 V
BH 5928.92/900,
BI 5928.47/100: DC 24 V

Voltage range:	DC	AC/DC
at 10% residual ripple:	0.9 ... 1.1 U_N	0.95 ... 1.1 U_N
at 48% residual ripple:	0.8 ... 1.1 U_N	0.8 ... 1.1 U_N

Nominal consumption: AC approx. 6.0 VA
DC approx. 3.5 W
Nominal frequency: 50 / 60 Hz
Min. Off-time: 1 s
Control voltage on S11: DC 23 V at U_N
Control current over S12, S32: 40 mA at U_N each
Min. voltage on S12, S32: DC 21 V when relay activated
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR

Output

Contacts
BH 5928.47, BI 5928.47/100: 3 NO, 1 NC contacts instantaneous and 1 NO contact release delayed
BH 5928.91: 2 NO contacts instantaneous, and 2 NO contacts release delayed
BH 5928.92 2 NO, 1 NC contacts instantaneous and 3 NO contacts release delayed
BH 5928.93: 3 NO contacts instantaneous and 3 NO contacts release delayed

The NC contacts 31-32 or 41-42 can only be used for monitoring.

Operate delay typ. at U_N:
Manual start: 40 ms
Automatic start: 500 ms
Release delay typ. at U_N:
Disconnecting the supply: 40 ms
2-channel disconnecting
S12, S22, S31 and S32: 15 ms
Fault detection time typ. at U_N:
at 1-channel interruption
at S12, S22, and S31: 15 ms
at S32: 520 ms
Time delay tv
(release delayed): Auxilary supply must be connected for time delay
Time ranges:

0.1 ... 1 s	3.0 ... 30 s
0.3 ... 3 s	6.0 ... 60 s
0.5 ... 5 s	30 ... 300 s
1.0 ... 10 s	

Other ranges or values on request
Fixed values: 1 s, 3 s, 5 s, 10 s, 300 s
Repeat accuracy: ± 1 % of setting value
Contact type: forcibly guided
Nominal output voltage: AC 250 V
DC: see limit curve for arc-free operation
Max switching current: DC: see limit curve for arc-free operation
Switching of low loads: ≥ 100 mV
(Contact 5 µ Au) ≥ 1 mA
Thermal current I_{th}:
in 1 contact path: max. 5 A
(see quadratic total current limit curve)

Switching capacity

to AC 15		
NO contact:	3 A / AC 230V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
BH 5928.47		
NO contact 57/58:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	5 A / 24 V at 0.1 Hz	
NC contact:	5 A / 24 V at 0.1 Hz	

Electrical life
to AC 15 at 2 A, AC 230 V: 10^5 switching cycles IEC/EN 60 947-5-1
Permissible operating frequency: max. 1200 switching cycles / h with manual restart and short release delay time

Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
Mechanical life: 10 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 25 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BH 5928:	400 g	
BI 5928.47/100:	440 g	

Dimensions

Width x height x depth:	
BH 5928:	45 x 84 x 121 mm
BI 5928.47/100:	67.5 x 84 x 121 mm

Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S32 (switch channel off on S12 , S22 e.g. S31)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S12, S22 e.g. S31 (switch channel off on S32)
LEDs "K1" and "K2" lights up, but "K1t" and "K2t" remains off	Y39-Y40 are not bridged
Device cannot be activated	- The delay contacts are not yet switched off - Safety relay is welded (replace device) - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S13-S14 are not bridged

UL-Data

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

Nominal voltage U_N	
BH 5928:	DC 24 V; AC/DC 24 V
Ambient temperature:	-15 … +55°C
Switching capacity:	
Ambient temperature 25°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Ambient temperature 55°C:	Pilot duty B300 0,5A 250Vac G.P. 0,5A 24Vdc
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

CCC-Data

Thermal current I_{th}:	max. 4 A (see quadratic total current limit curve)
Switching capacity	
to DC 13	
BH5928.47	
NO contact 57/58:	1 A / DC 24 V IEC/EN 60 947-5-1

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

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.

Standard Type

BH 5928.92/61 DC 24 V 0.5 ... 5 s

Article number:	0060264
• Output:	2 NO contacts, 1 NC contact instantaneous and 3 NO contacts release delayed
• Nominal voltage U_N:	DC 24 V
• Time delay tv:	0.5 ... 5 s
• Width:	45 mm

Variant

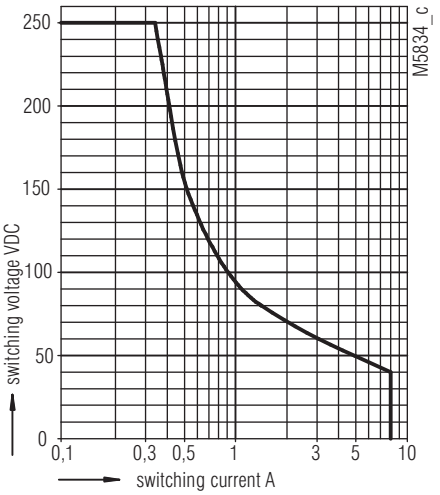
BH 5928._ _/_ _ _ /61:	with UL approval
BH 5928._ _/001:	with fix time delay fixed times: 1 s, 3 s, 5 s, 10 s, 300s other times on request
BH 5928._ _/900:	with adjustable time delay suitable for light curtains and reed contacts switches
BI 5928.47/100:	with adjustable time delay tolerates voltage drop up to 6 V in e-stop circuit

Ordering example for variants:

B_ 5928. _ _ / _ _ _ DC 24 V 50/60 Hz 1 ... 10 s

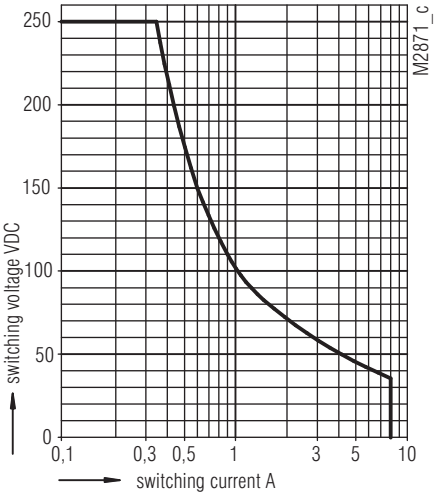
- 1 ... 10 s
  - 0.1 ... 1 s
  - 0.3 ... 3 s
  - 0.5 ... 5 s
  - 1 ... 10 s
  - 30 ... 300 s
  - for fixed time end of scale value, other ranges on request
- 50/60 Hz: Nominal frequency
- DC 24 V: Nominal voltage
- _ _ _: Variant, if required
- _ _: Contacts
  - .47 = 3 NO contacts, 1 NC contact instantaneous and 1 NO contact release delayed
  - .91 = 2 NO contacts instantaneous and 2 NO contacts release delayed (only at BH 5928)
  - .92 = 2 NO contacts, 1 NC contact instantaneous and 3 NO contacts release delayed
  - .93 = 3 NO contacts instantaneous and 3 NO contacts release delayed
- B_: H: width 45 mm, I: width 67.5 mm

Characteristics



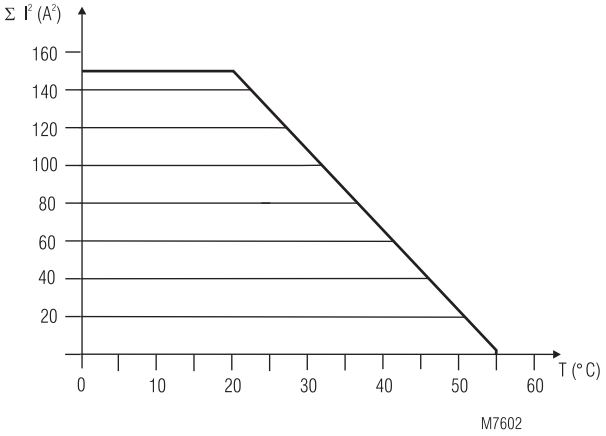
safe breaking, no continuous arcing, max. 1 switching cycle / s

Arc limit curve for resistive load (instantaneous contact)



safe breaking, no continuous arcing, max. 1 switching cycle / s

Arc limit curve for resistive load (delayed contact)

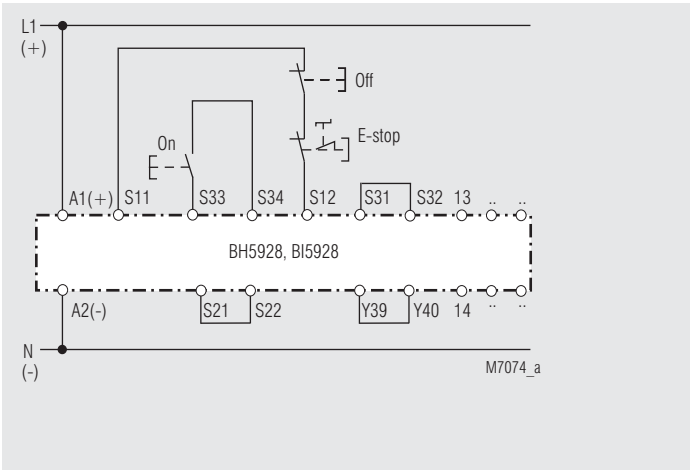


$\Sigma I^2 = I_1^2 + I_{2...}^2 + I_6^2$

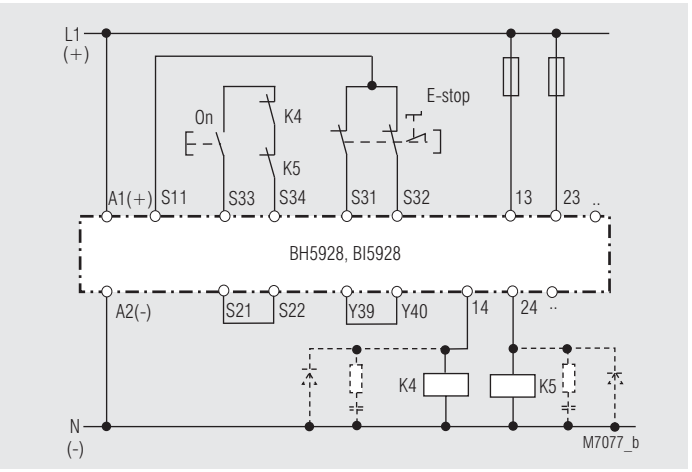
$I_1 \div I_6$ - Current in contact paths

Max. current at 55°C over 3 contact paths = 0,5 A ≙ $0{,}5^2$ x 6 = 1,5 A^2

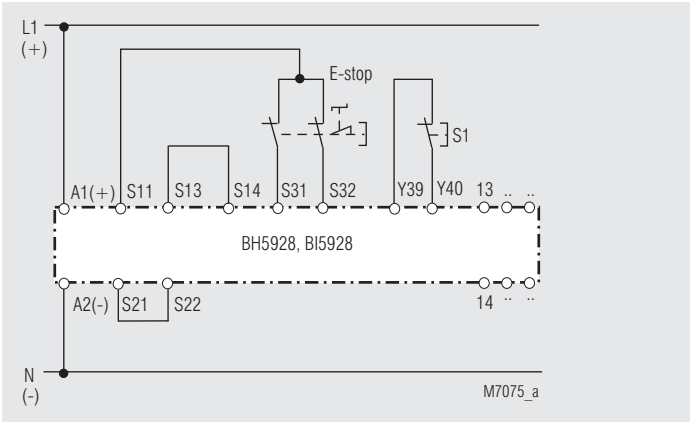
Quadratic total current limit curve



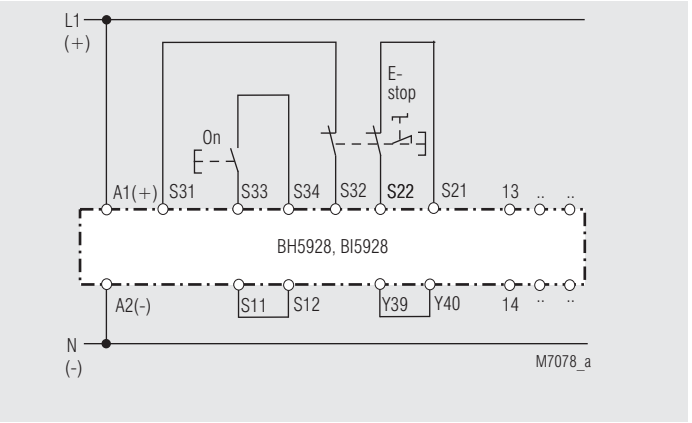
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit
Suited up to SIL2, Performance Level d, Cat. 3



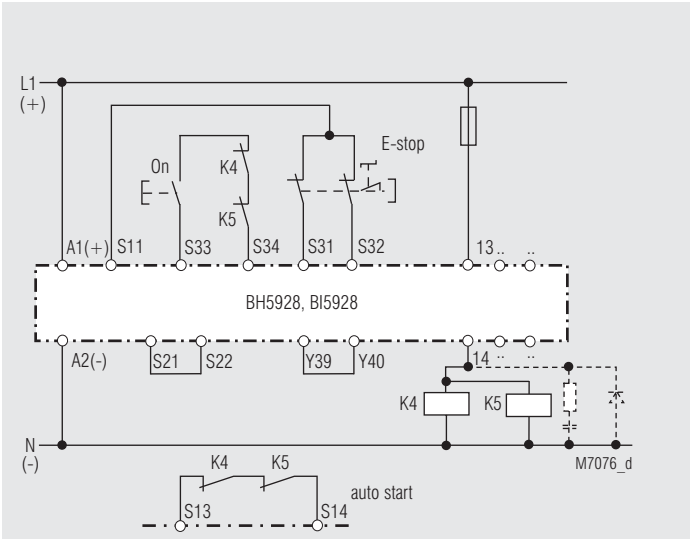
Contact reinforcement by external contactors, 2-channel controlled. The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 5 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S13-S14 or S33-S34)
Suited up to SIL3, Performance Level e, Cat. 4



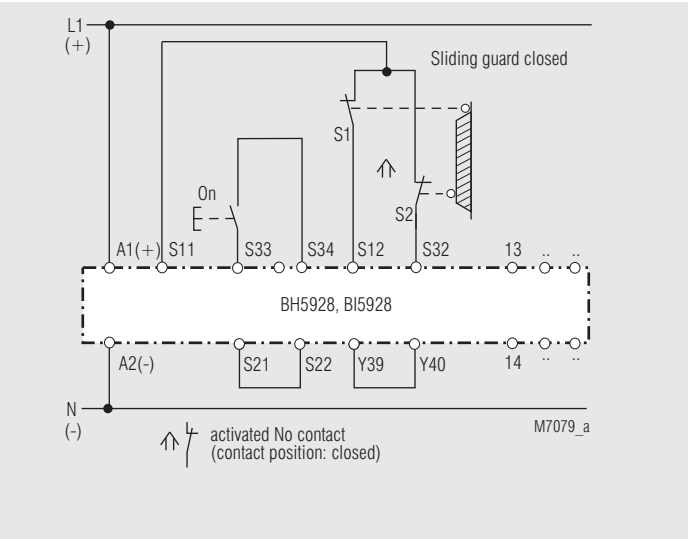
2-channel emergency stop circuit without cross fault monitoring autostart and interruption of time by S1
Suited up to SIL3, Performance Level e, Cat. 4



2-channel emergency stop circuit with cross fault detection
Suited up to SIL3, Performance Level e, Cat. 4

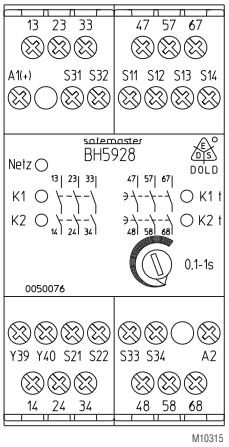
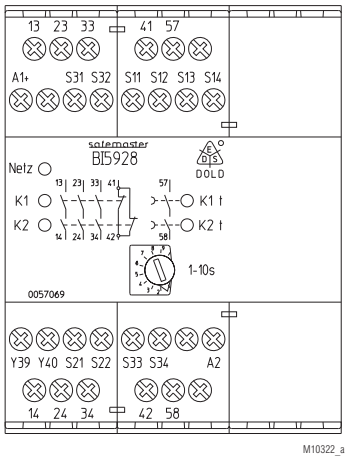
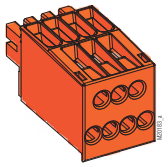
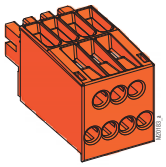
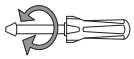
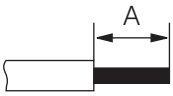
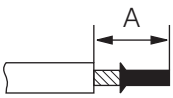
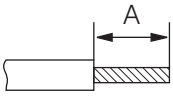


Contact reinforcement by external contactors controlled by one contact path. S33 - S34 must be opened
Suited up to SIL3, Performance Level e, Cat 4, if the external contactors are in the same cabinet and the wiring is short circuit and crossfault prove.

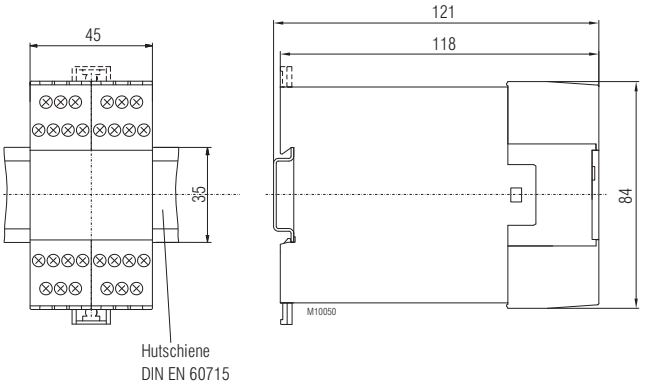


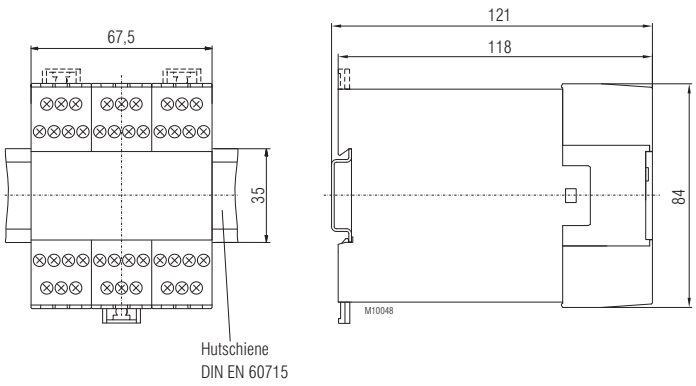
2-channel safety gate monitoring
Suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

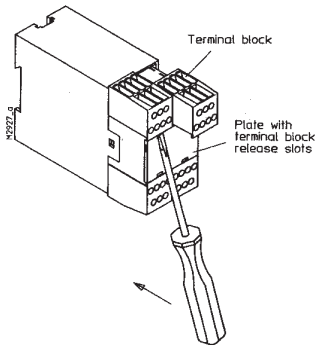
		
		
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

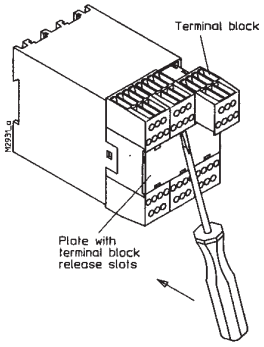
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**





DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**





DE	**Sicherheitstechnische Kenndaten (nur Sofortkontakte)**
EN	**Safety related data (only instantaneous contacts)**
FR	**Données techniques sécuritaires (contact instantané)**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	240,5	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)

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:	99,0	%
PFH_D:	2,05E-10	h^{-1}
PFD_{AVG}:	1,75E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

DE	**Sicherheitstechnische Kenndaten (nur verzögerte Kontakte)**
EN	**Safety related data (only delayed contacts)**
FR	**Données techniques sécuritaires (contact retardée)**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	217,7	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)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	1	
DC:	99,0	%
PFH_D:	2,28E-10	h^{-1}
PFD_{AVG}:	1,95E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

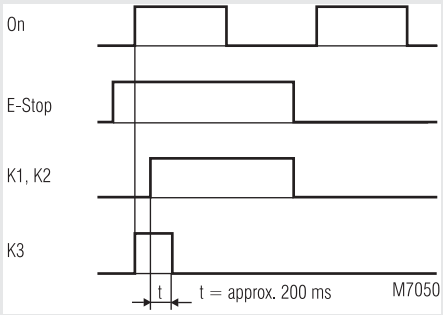
Anforderung seitens der Sicherheitsfunktion an das Gerät im High Demand Mode Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode Consigne résultant de la fonction sécuritaire de l'appareil au High Demande Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Anforderung seitens der Sicherheitsfunktion an das Gerät im Low Demand Mode Demand to our device based on the evaluated neccessary safety level of the application at Low Demand Mode Consigne résultant de la fonction sécuritaire de l'appareil au Low Demande Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN 61511	SIL 3	einmal pro Jahr once per year annuel

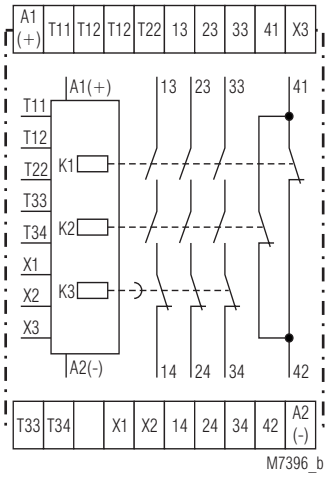
SAFEMASTER
Emergency Stop Module
BN 5930.48/203, BN 5930.48/204

0221559

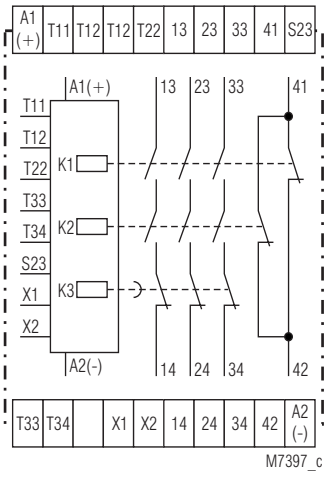
Function Diagram



Circuit Diagrams



BN 5930.48/203



BN 5930.48/204

Your Advantages

- Can be used for long leads in the e-stop loop.
  This allows a long distance between e-stop module and the e-stop button.
- Crossfault detection in the e-stop circuit

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**
- BN 5930.48/203 with cross fault detection by connecting 2 different phases, max. 400 V,
  BN 5930.48/204 with cross fault detection by connecting phase and neutral, max. 230 V
- Dual voltage version
- Emergency-stop circuit T12, T22:
  optionally for AC 110 V / DC 60 V or AC 230 V / DC 110 V
- Output: 3 NO, 1 NC contacts for AC 400 V
- 1-channel or 2-channel circuit
- LED displays for channel 1, 2 and mains
- Feedback circuit X1 - X2 for monitoring external contactors
- Removable terminal strips
- Width 100 mm

Approvals and Markings

CE TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000

Applications

Protection of persons and machines

- Emergency stop circuits on machines
- Monitoring safety gates

Indicators

LED power supply:	on when operating voltage present
LED K1:	on when supply on relay K1
LED K2:	on when supply on relay K2

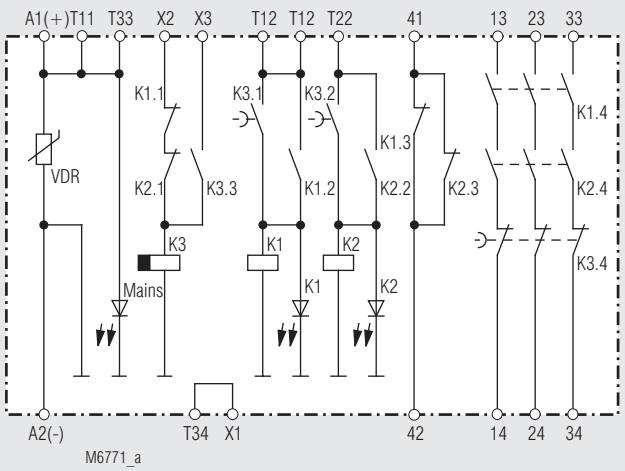
Notes

One or more BN3081 extension modules or external contators with positively driven contacts can be used for contact multiplication of the emergency stop module BN 5930.

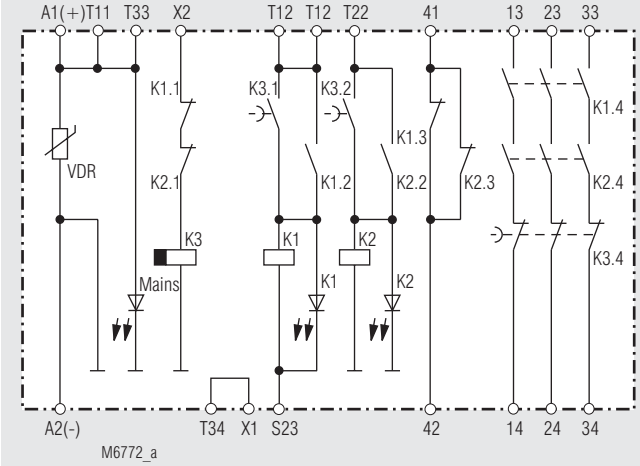
Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
T12, T22, X1, X2, X3, S23	Control inputs
T11, PE(-), T33, T34	Control outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Block Diagrams



BN 5930.48/203



BN 5930.48/204 (with cross fault detection)

Technical Data

Input

Nominal voltage U_N:	AC 110 V* / DC 60 V* or AC 230 V* / DC 110 V* over terminal A1 - A2 other voltages on request
Voltage range:	AC 0.85 ... 1.1 U_N
at 10% residual ripple:	DC 0.9 ... 1.1 U_N
at 48% residual ripple:	DC 0.85 ... 1.1 U_N
Nominal consumption:	approx. 3.9 VA at AC 230 V
Nominal frequency:	50 / 60 Hz
Control voltage T12, T22:	same as nominal voltage
Control current:	approx. 12 mA for K1 and K2 at AC 230 V
Fusing of the device:	internal with PTC

Output

Contacts
BN 5930.48: 3 NO, 1 NC contacts

The contacts 13...33 / 14...34 are safety contacts.
The contact 41-42 can only be used for monitoring.

Response / release time of K1 and K2:	35 ms / 35 ms	
Release delay of K3:	approx. 250 ms	
Contact type:	relay, forcibly guided	
Output nominal voltage:	AC 400 V / DC 230 V	
Thermal current I_{th}:	see continuous current limit curve (max. 10 A in one contact path)	
Switching capacity		
to AC 15:		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life:		
to AC 15 at 2 A, AC 230 V	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible switching frequency:	6000 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
max. line circuit breaker:	C 10 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 15 ... + 55°C at max. 90 % air humidity
Storage :	- 25 ... + 85 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1

Technical Data

EMC	IEC/EN 62 061	
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:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Flat terminals with self-lifting clamping piece Removable terminal strip	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	590 g	

Dimensions

Width x heigth x depth: 100 x 74 x 121 mm

Standard Type

BN 5930.48/204 AC 230 V 50/60 Hz
Article number: 0045350

- With cross fault detection by connecting to phase and neutral, max. 230 V
- Output:3 NO, 1 NC contacts
- Nominal voltage U_N: AC 230 V / DC 110 V
- Width: 100 mm

Ordering Example

BN 5930 .48 /_ _ _ AC 230 V 50/60 Hz

- 50/60 Hz — Nominal frequency
- AC 230 V — Nominal voltage
- /_ _ _ — Variant, if required
- .48 — Contacts
- BN 5930 — Type

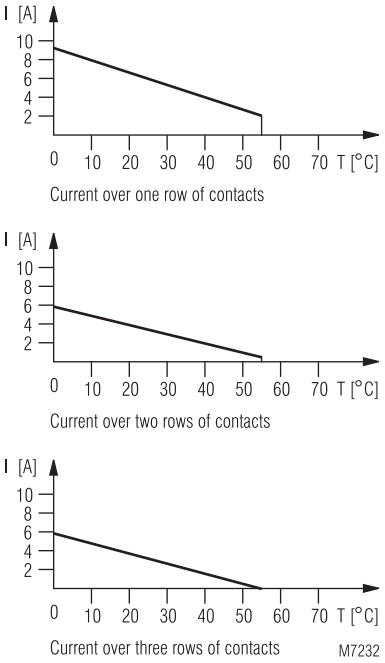
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on T22 (switch channel off on T12)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on T12 (switch channel off on T22)
Device cannot be activated	- Safety relay is welded (replace device)

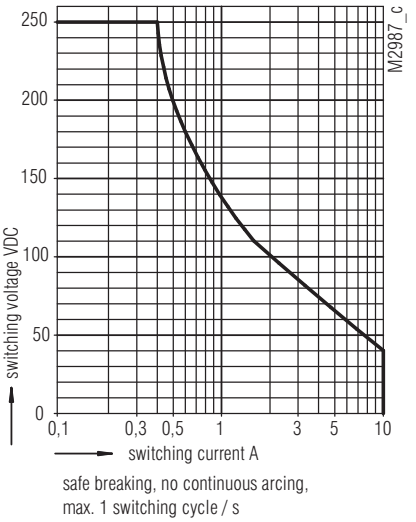
Maintenance and repairs

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

Characteristic

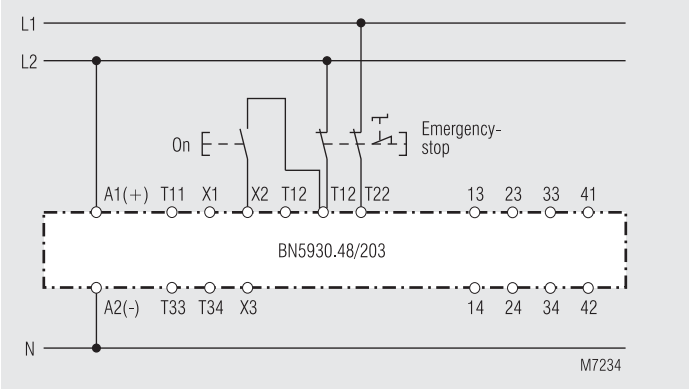


Continuous current limit curves depend on the ambient temperature

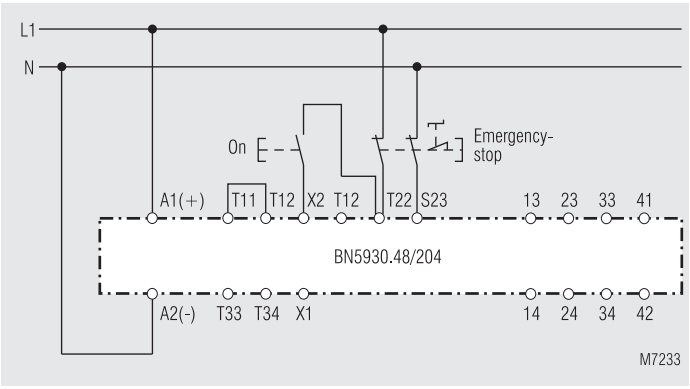


Limit curve for arc-free operation

Application Examples

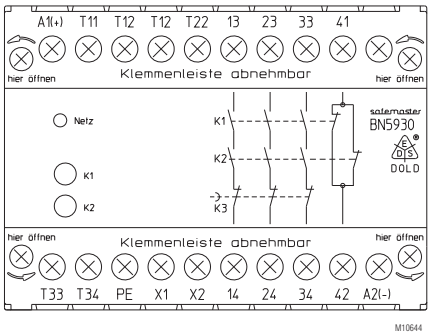


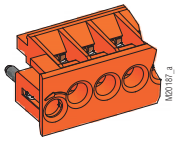
Two-channel emergency stop circuit. "Emergency stop" connected at two different phases, thereby giving "Cross fault detection".
Suited up to SIL3, Performance Level e, Cat. 4

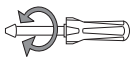
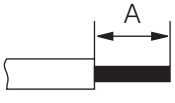
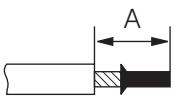
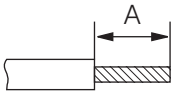


Two-channel emergency stop circuit with "Cross fault detection" in the alternating current network.
Suited up to SIL3, Performance Level e, Cat. 4

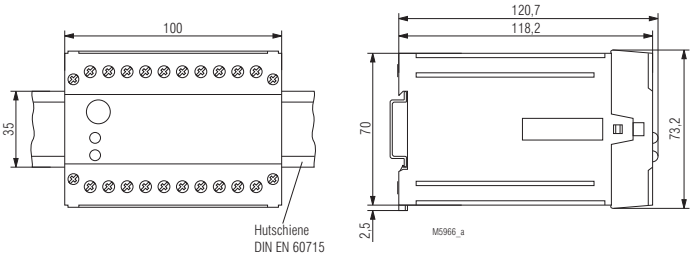
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



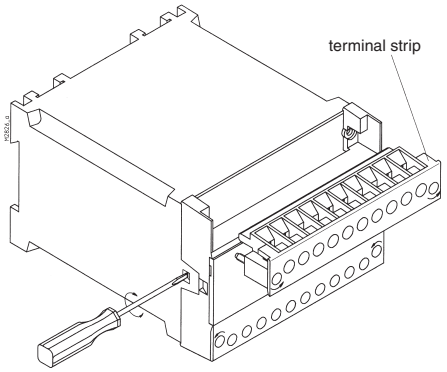


	ø 6 mm / PZ 2 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14
	A = 10 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	240,5	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)

IEC/EN 62061 IEC/EN 61508		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	2,05E-10	h^{-1}

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

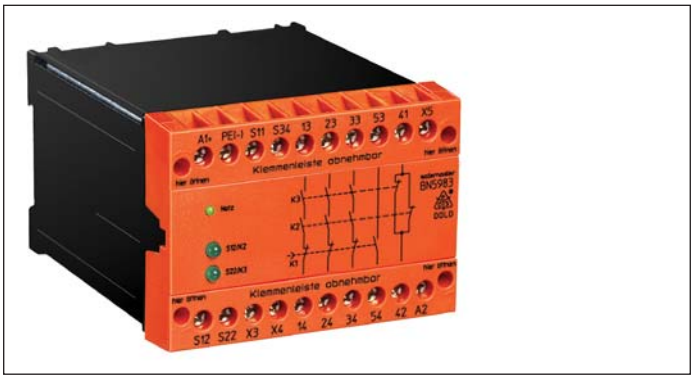
Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

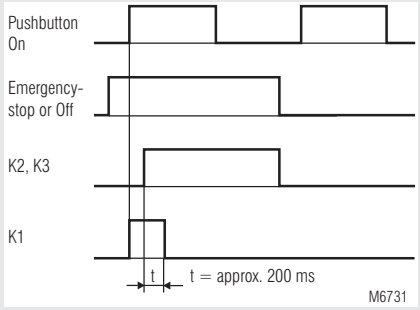
SAFEMASTER
Emergency Stop Module
BN 5983

0221560



- **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**
- Output: 3 NO, 1 NC contacts for AC 400 V
- Optionally gold-plated contacts to switch small loads (input for PLC)
- 1-channel or 2-channel connection
- LED displays for channels 1 and 2
- Feedback circuit X3 - X4 for monitoring external contactors
- Removable terminal strips
- Overvoltage and short circuit protection
- Width 100 mm

Function Diagram



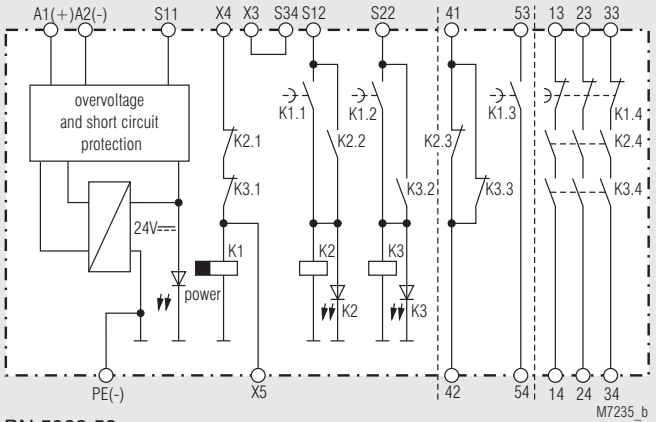
Approvals and Markings

CE · TÜVRheinland CERTIFIED Product Safety Functional Safety www.tuv.com ID 0600000000 · cULus Canada / USA · A025518

Applications

Protection of people and machines
- Emergency-stop circuits on machines
- Monitoring of safety gates

Block Diagrams



BN 5983.53

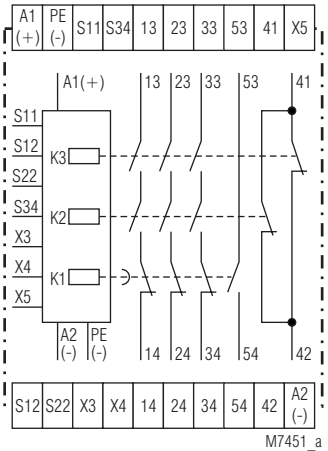
Indicators

LED power supply:	on when operating voltage present
LED S12 / K2:	on when supply on relay K2
LED S22 / K3:	on when supply on relay K3

Notes

The PE terminal permits operation of the device in IT systems with insulation monitoring and also serves as a reference point for testing the control voltage. The internal short-circuit protection will be bridged on DC devices, if the protective ground is connected to terminal PE.
One or more extension modules BN 3081 or external contactors with forcibly guided contacts may be used to multiply the number of contacts of the emergency-stop module BN 5983.

Circuit Diagrams



BN 5983.53, _/104, _/110, _/200

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S34, X3, X4, X5	Inputs
S11, PE(-)	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
41, 42, 53, 54	Forcibly guided indicator output

Technical Data

Input

Nominal voltage U_N:	AC 24, 42, 48, 110, 127, 230, 240 V DC 24, 48, 110 V
Voltage range:	AC 0.8 ... 1.1 U_N
at 10 % residual ripple:	DC 0.9 ... 1.2 U_N
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	5 VA ± 30 %
Nominal frequency:	50 / 60 Hz
Control voltage S11:	DC 24 V
Control current:	max. DC 100 mA
Minimum voltage at terminals S12, S22:	DC 21 V with activated device

Output

Contacts

BN 5983.53: 3 NO, 1 NC contacts
1 delay-release NO contact (K1.3)

The NO contacts 13...33 / 14...34 are safety contacts.
The NC contact 41-42 and the NO contact 53-54 can only be used for monitoring.

Operate time:	35 ms
Release time	
opening in secondary circuit (S12-S22):	30 ms ± 25 %
opening in supply circuit:	100 ms ± 50 %
Release delay of K1:	approx. 200 ms
Contact type:	Relay, forcibly guided
Nominal output voltage:	AC 400 V / DC 230 V
Thermal current I_{th}:	see continuous current limit curve (max. 10 A in one contact path)

Switching capacity

to AC 15:		
NO contacts :	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts :	4 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	4 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 2 A, DC 24 V:	> 240 x 10^3 switching cycles	
Permissible operating frequency:	6 000 switching cycles / h	
Short circuit strength		
max. fuse rating		
NO contact:	10 A gL	IEC/EN 60 947-5-1
NC contact:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55°C at max. 90 % humidity	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency: 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Flat terminals with self-lifting clamping piece Removable terminal strip	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	840 g	

Dimensions

Width x height x depth: 100 x 74 x 121 mm

UL-Data

Nominal voltage U_N:	AC 110, 127, 230 V DC 24 V
Ambient temperature:	- 15 … + 55 °C
Switching capacity:	3 A, 250 Vac G.P.
Wire connection:	60°C / 75°C copper conductors only AWG 16 - 14 Torque 7 lb in

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

CCC-Data

Nominal voltage U_N:	AC 24, 42, 48, 110, 127, 230 V DC 24, 48, 110 V
Thermal current I_{th}:	see continuous current limit curve (max. 5 A in one contact path)

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

Standard Type

BN 5983.53 DC 24 V

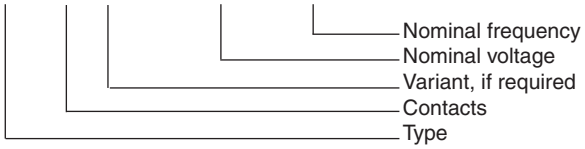
Article number:	0032155
• Output:	3 NO, 1 NC contacts
• Nominal voltage U_N:	DC 24 V
• Width:	100 mm

Variants

BN 5983.53/104:
For switching small loads of 1 mVA ... 7 VA or 1 mW ... 7 W in the ranges 0.1 ... 60 V and 1 ... 300 mA.
The device is also suitable for switching the maximum switching current. However, this will burn off the gold plating of the contacts, so that switching of small loads is no longer possible afterwards.
BN 5983.53/110:
To avoid latching problems in the case of short voltage drops K2 and K3 are switched definitely off before reset.
BN 5983.53/200:
Redundant switching off with device diversity. Device diversity means that safety relays from different production batches or from different manufacturers are used.

Ordering example for Variants

BN 5983 .53 /_ _ _ AC 230 V 50/60 Hz



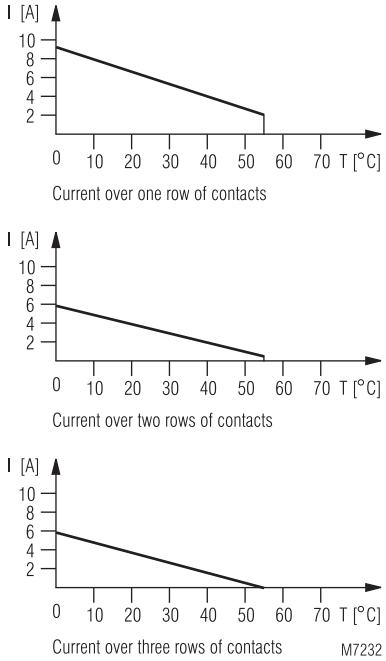
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "S22/K3" lights up, but "S12/K2" remains off	- Safety relay K3 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "S12/K2" lights up, but "S22/K3" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	- Safety relay is welded (replace device) - Safety relay K1 via X5 energized

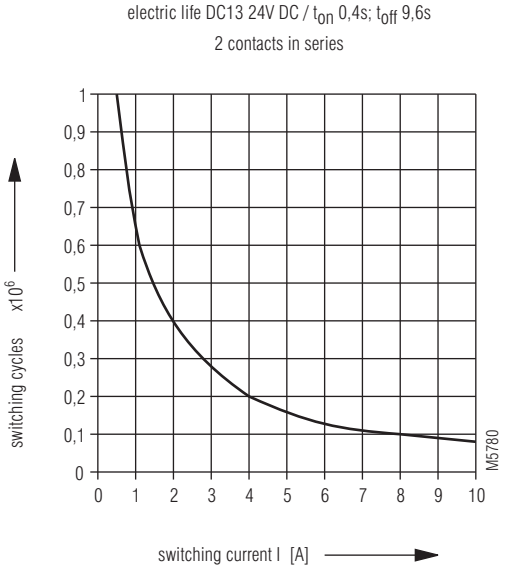
Maintenance and repairs

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

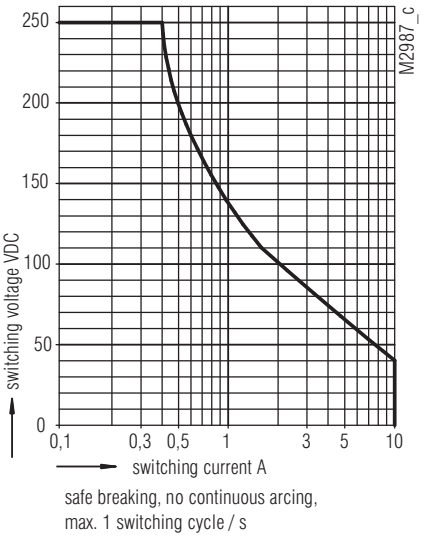
Characteristics



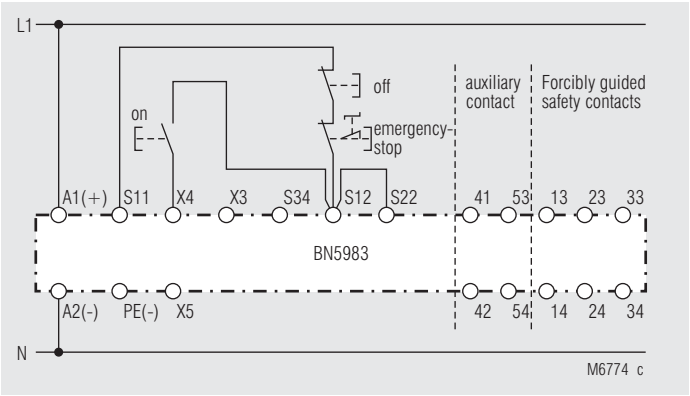
Continuous current limit curves
as a function of ambient temperature



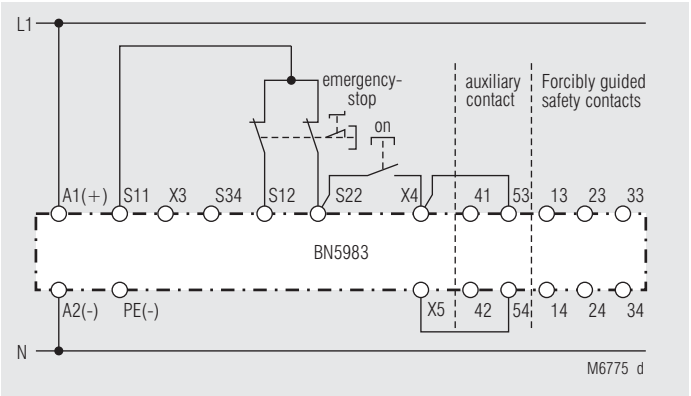
Contact service life



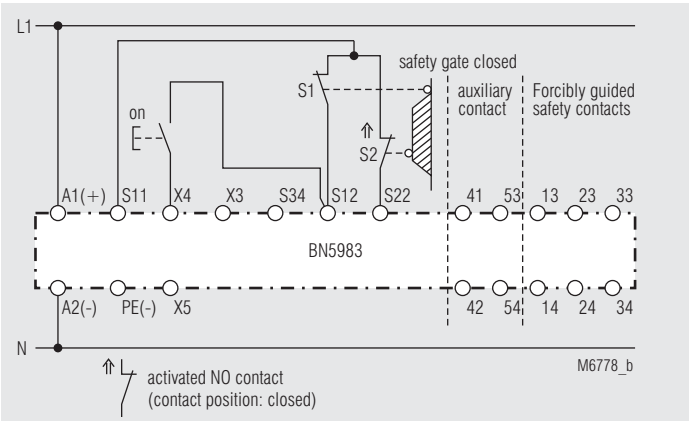
Limit curve for arc-free operation with resistive load



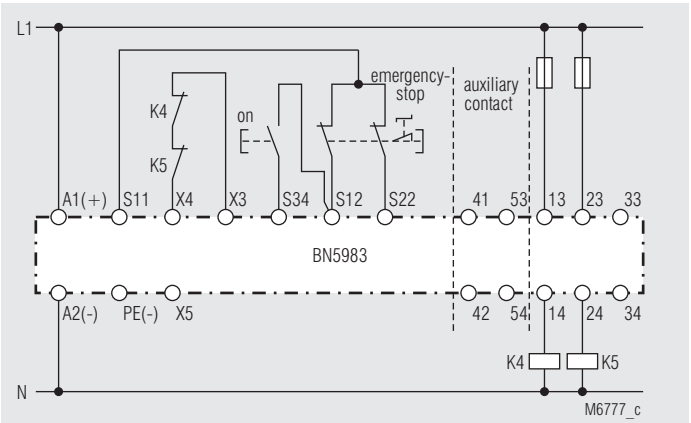
One-channel emergency-stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit.
Suited up to SIL2, Performance Level d, Cat. 3



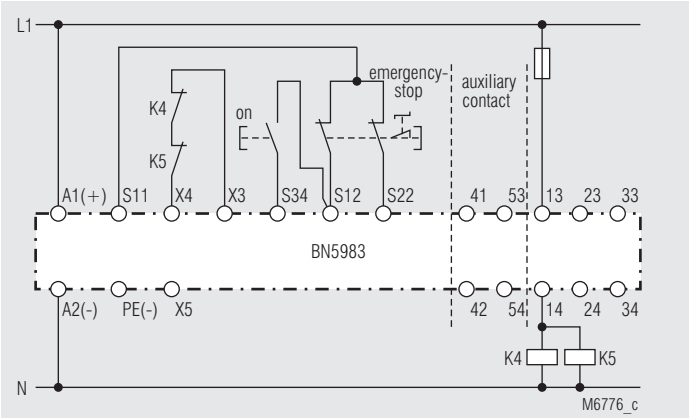
Two-channel emergency stop circuit with line fault detection on start button. The unit starts with the negative edge of the start signal (contrary to the function diagram).
If line fault detection is not necessary the links X4-53 and X5-54 can be removed.
Suited up to SIL3, Performance Level e, Cat. 4



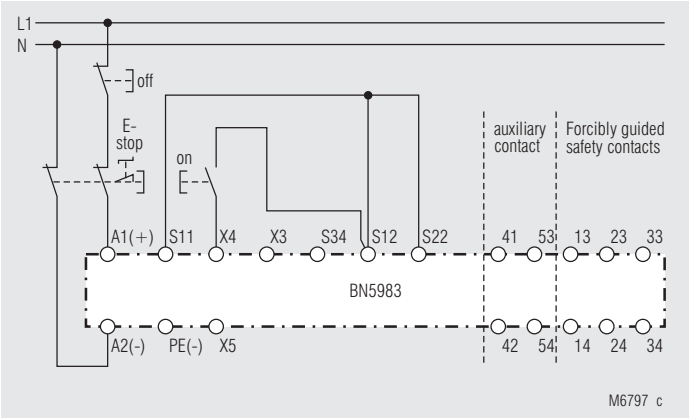
Two-channel monitoring of a safety gate.
Suited up to SIL3, Performance Level e, Cat. 4



Contact reinforcement by external contactors, 2-channel.
The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 10 A. Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals X3 - X4).
Suited up to SIL3, Performance Level e, Cat. 4

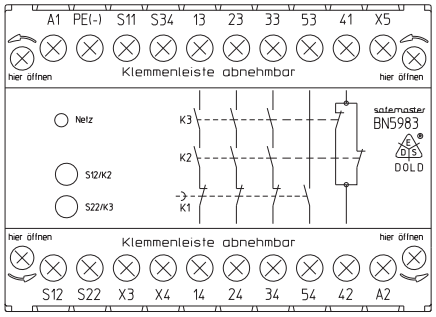


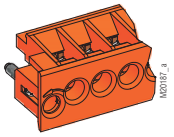
Contact reinforcement by external contactors with reduced safety level.
Suited up to SIL3, Performance Level e, Cat. 4

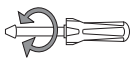
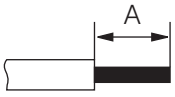
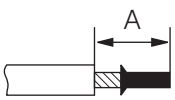
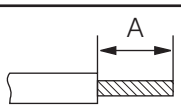


Two-pole emergency-stop circuit with emergency stop control device in supply circuit.
Application for long emergency stop loops where the control voltage drops below the minimum voltage of 21 V.
Attention:
Single faults (e.g. line faults at the emergency stop control device) are not detected with this external circuit configuration.
Suited up to SIL3, Performance Level e, Cat. 4

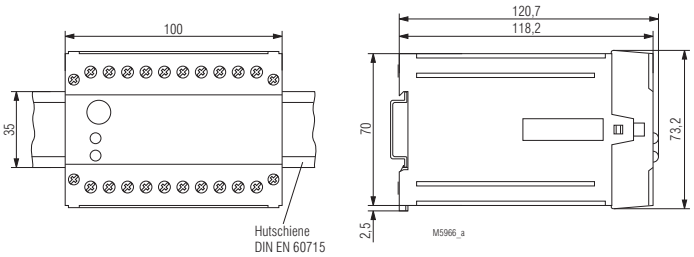
DE	Beschriftung und Anschlüsse
EN	Labeling and connections
FR	Marquage et raccordements
IT	Marcatura e collegamenti



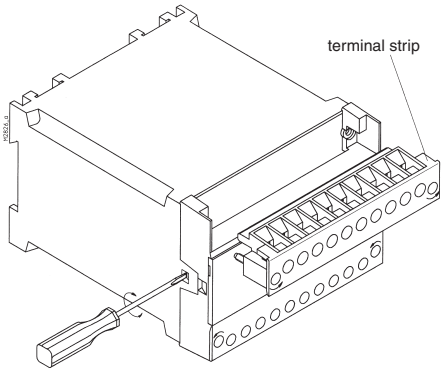


	ø 6 mm / PZ 2 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14
 M10249	A = 10 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14

DE	Maßbild (Maße in mm)
EN	Dimensions (dimensions in mm)
FR	Dimensions (dimensions en mm)
IT	Dimensioni (dimensione in mm)



DE	Montage / Demontage Klemmenleiste
EN	Mounting / disassembly of the terminal strip
FR	Montage / Démontage des borniers
IT	Montaggio / Smontaggio di morsettiera



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	240,5	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)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	2,05E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

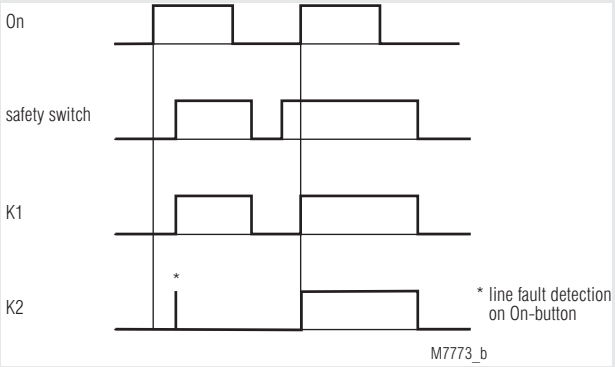
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Switch Gear For Safety Switch
BG 5925/920

0233483

- **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**
- to connect:
  - magnetic switch NE 5020
  - magnetic switch NE 5021
- Output: max. 3 NO contacts, see contacts
- 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- Cross fault monitoring
- LED indicator for state of operation
- LED indicator for channel 1 and 2
- Optionally with fast Auto start
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 22.5 mm

Function Diagram



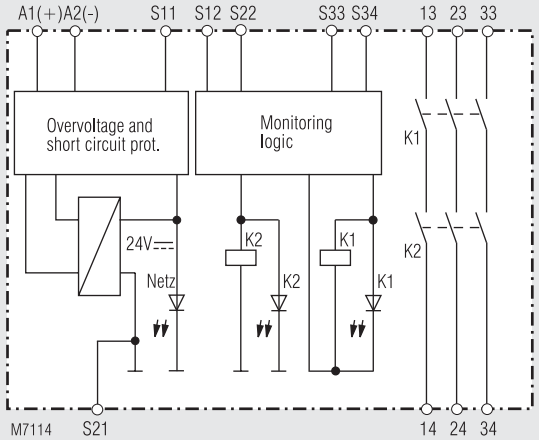
Additional information about this topic

- Data sheet magnetic switch NE 5020
- Data sheet magnetic switch NE 5021

Approvals and Markings

CE · TÜVRheinland CERTIFIED · Functional Safety Type Approved · www.tuv.com ID 0600000000 · C US Canada / USA · A025518

Block Diagram



Application

Protection of people and machines
- Monitoring of safety gates

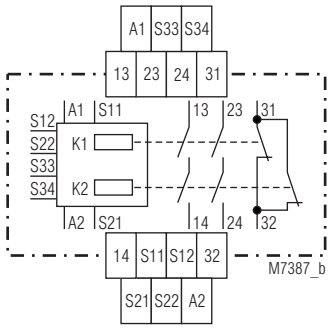
Indicators

upper LED:	on, when supply connected
lower LEDs:	on, when relay K1 and K2 energized

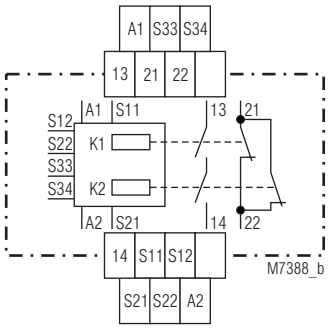
Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S34	Inputs
S11, S21, S33	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
21, 22, 31, 32	Forcibly guided indicator output

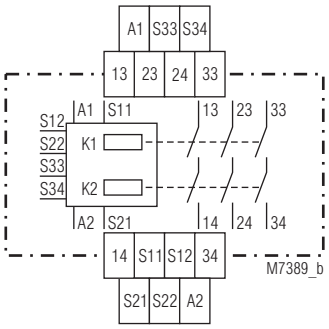
Circuit Diagrams



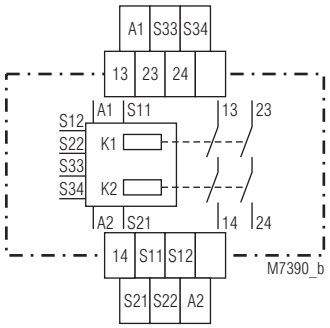
BG 5925.22/920



BG 5925.16/920

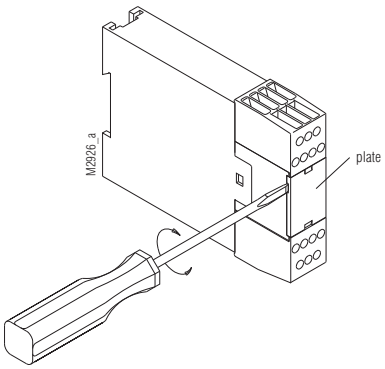


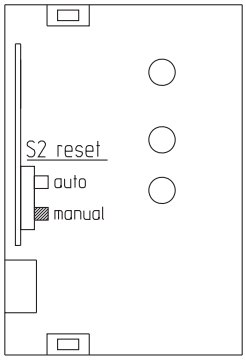
BG 5925.03/920



BG 5925.02/920

Unit Programming





M6374

Disconnect unit over switch S2.
Drawing shows setting at the state of delivery

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S22, the unit will be activated because this line fault is similar to the normal On-function. (Cross fault detection between terminals S12-S22)

The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage and is used to connect the E-stop loop when cross fault monitoring is selected.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2 (-). The short-circuit protection of line A1 (+) remains active.

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range:	
at 10% residual ripple:	0.9 ... 1.1 U_N
Nominal consumption:	DC approx. 2 W
Min. Off-time:	250 ms
Control voltage on S11:	DC 23 V at U_N
Control current over S12, S22:	40 mA at U_N
Min. voltage between terminals S12, S22 and S21:	DC 19.5 V when relay activated and U_N on A1 - A2
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR

Output

Contacts

BG 5925.02/920:	2 NO contacts
BG 5925.03/920:	3 NO contacts
BG 5925.16/920:	1 NO contact, 1 NC contact
BG 5925.22/920:	2 NO contacts, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 21-22 or 31-32 can only be used for monitoring.

Operate delay typ. at U_N:	
Manual start:	40 ms
Automtic start:	250 ms
Release delay typ. at U_N:	
Disconnecting the supply:	50 ms
Disconnecting S12, S22:	15 ms
Contact type:	forcibly guided
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation

Technical Data

Switching of low loads:	24 V, 10 mA	
Thermal current I_{th}:	max. 5 A see current limit curve	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	max. 1 200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Box terminals with M3.5 screws	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

Dimensions

Width x height x depth:	22.5 x 84 x 121 mm

CSA-Data

Nominal voltage U_N:	
BG 5925/920/60:	DC 24 V
Ambient temperature:	-15 … +55°C
Switching capacity:	5A 230Vac
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BG 5925.22/920/60 DC 24 V

Article number:	0052272
• Output:	2 NO contacts, 1 NC contact
• Nominal voltage U_N:	DC 24 V
• Width:	22.5 mm

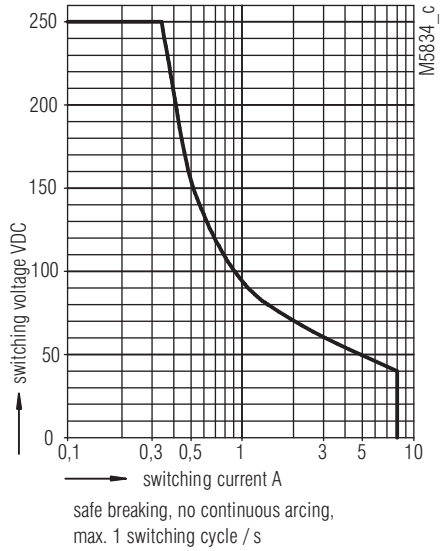
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	- Safety relay K2 is welded (replace device) - Incorrect setting of switch S2 - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S33-S34 not bridged

Maintenance and repairs

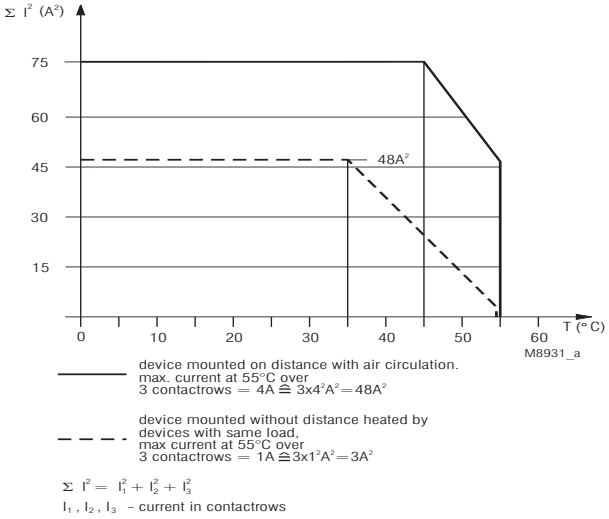
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristic

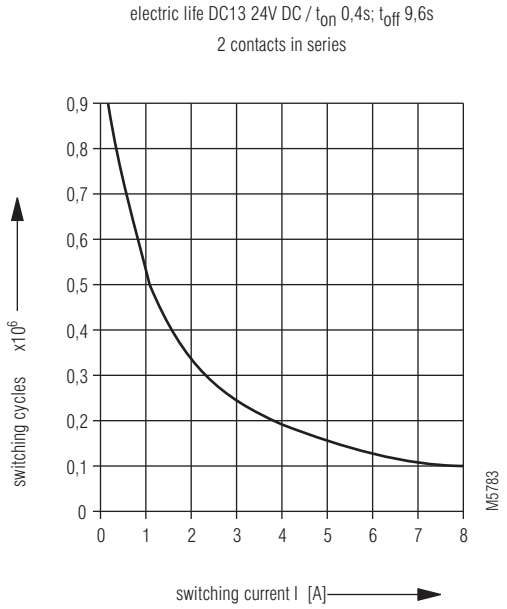


Arc limit curve under resistive load

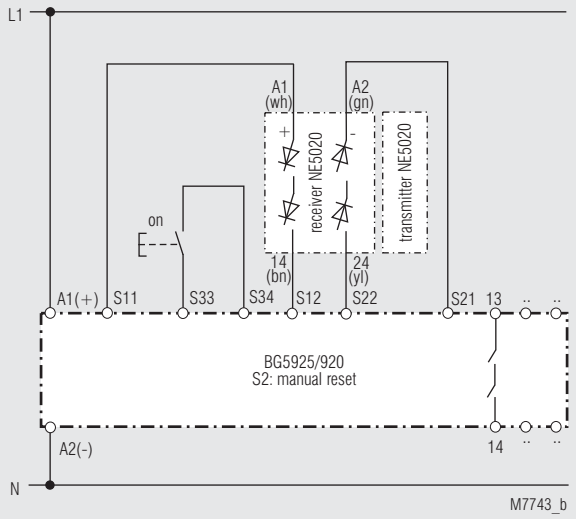
Characteristics



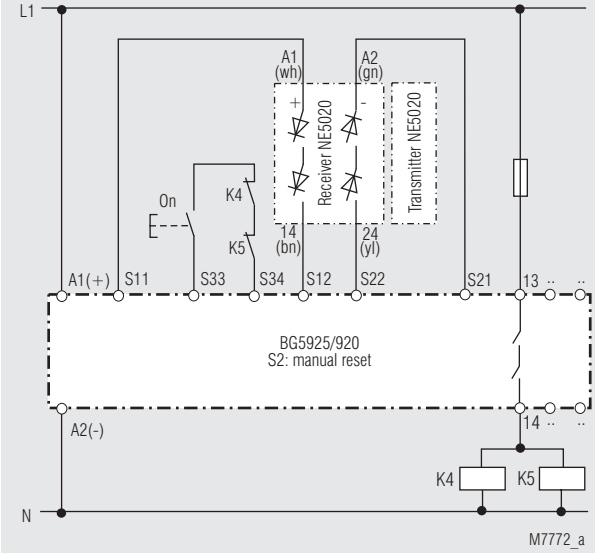
Quadratic total current limit curve



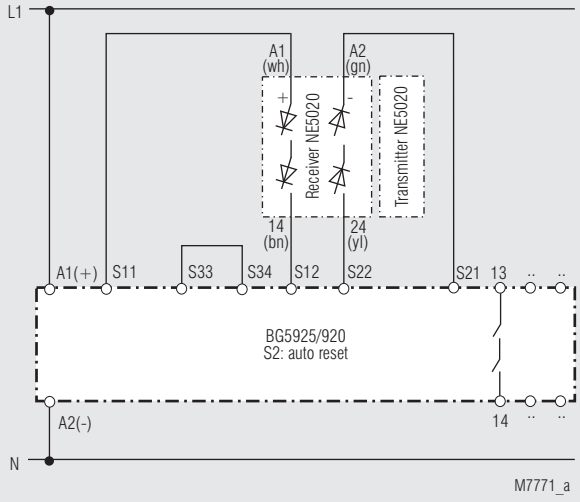
Contact service life



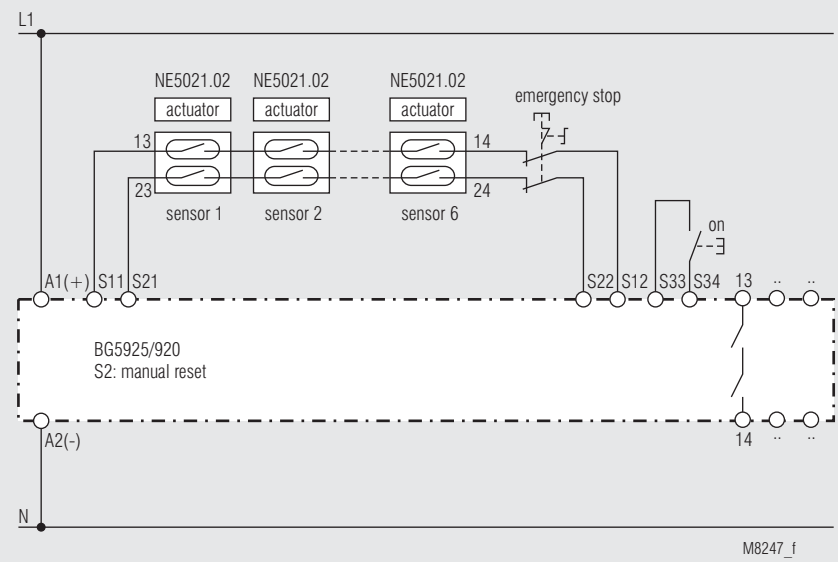
With magnetic switch NE 5020; Start with On-button
Please note: Refer to "Unit programming"!
Switches in position: S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4



With magnetic switch NE 5020; Contact reinforcement by external contactors controlled by one contact path
Please note: Refer to "Unit programming"!
Switches in position: S2 manual start
Suited up to SIL3, Performance Level e, Cat. 4

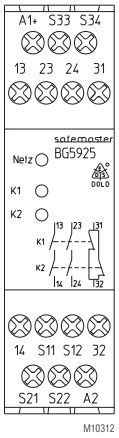


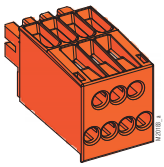
With magnetic switch NE 5020; Automatic start
Please note: Refer to "Unit programming"!
Switches in position: S2 auto start
Suited up to SIL3, Performance Level e, Cat. 4

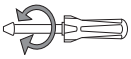
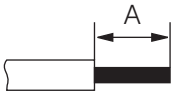
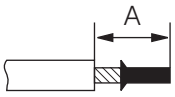
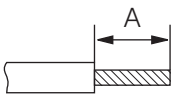


6 magnetic switches NE 5021 + 1 E-stop button in series, manual start. Suited up to SIL3, Performance Level e, Cat. 3

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**





	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Zubehör**
EN	**Accessories**
FR	**Accessoires**
IT	**Accessori**

NE 5020.92

Artikelnummer:
Article number:
Référence:
No. Articolo:
0051641

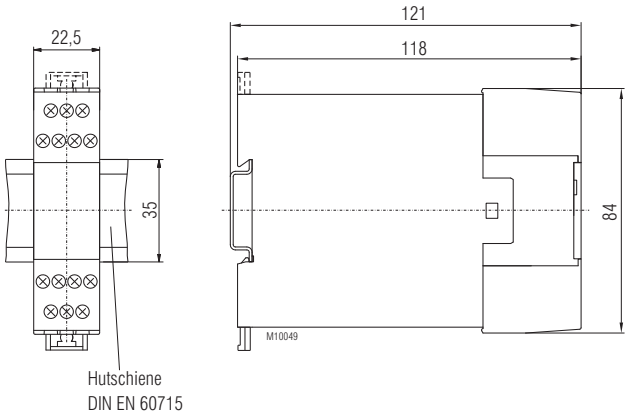
DE	Magnetschalter codiert, für DC 24 V, mit 2 Halbleiterausgängen
EN	Safety switch, magnetic coded, for DC 24 V, with 2 semiconductor outputs
FR	Interrupteur magnétique codé, pour DC 24 V, avec 2 sorties à semi-conducteurs
IT	Interruttore magnetico codificato 24 Vdc con uscita a 2 semiconduttori.

NE 5021.02

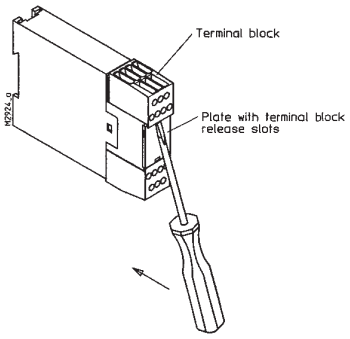
Artikelnummer:
Article number:
Référence:
No. Articolo:
0054695

DE	Magnetschalter codiert, mit 2 Schließern (Reedkontakten)
EN	Safety switch, magnetic coded, with 2 NO contacts (reed contacts)
FR	Interrupteur magnétique codé, avec 2 contacts NO (contacts Reed)
IT	Interruttore magnetico codificato 2 contatti NO in uscita (contatti reed).

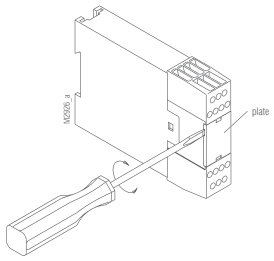
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**

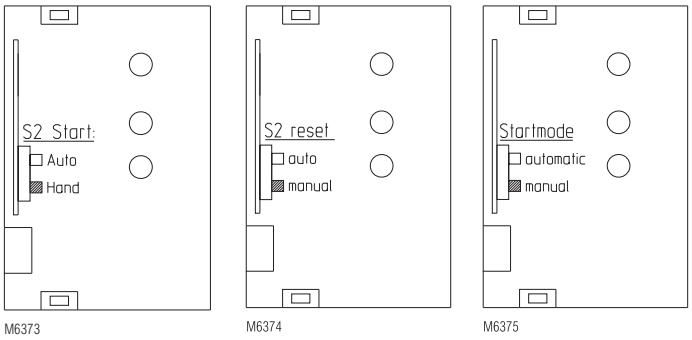


DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**
IT	**Impostazione del modulo**





DE	Geräteprogrammierung über Schalter S2. Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit over switch S2. Drawing shows setting at the state of delivery
FR	Programmation du module par l'interrupteur S2. Position de l'interrupteur à la livraison
IT	Scollegare il modulo su switch S2. Il disegno mostra l'impostazione di fabbrica

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	236,3	a (year)
DC_{avg}:	99,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3,60E+03	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,97E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzione di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

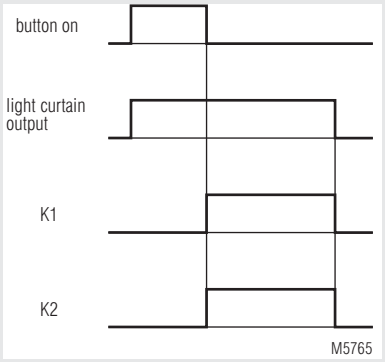
SAFEMASTER
Safety Module For Safety Switches
LG 5925/920

0264281

LG 5925/900

- **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**
- According to EN 50156-2 for furnaces
- to connect:
  - safety switch NE 5020
  - safety switch NE 5021
- Output: max. 4 NO contacts, see contacts
- 1- or 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- with or without cross fault monitoring switch S1
- LED indicator for state of operation
- LED indicator for channel 1 and 2
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with plugable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

Function Diagram



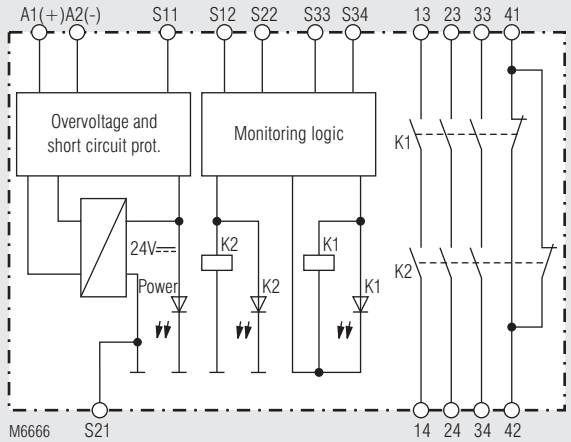
Approvals and Markings

CE · TÜVRheinland CERTIFIED · Functional Safety Type Approved · www.tuv.com ID 0600000000 · A025518

Applications

Protection of people and machines
- Monitoring of safety gates
- Usage in furnace application in continuous operation acc. to EN 50156-1

Block Diagram



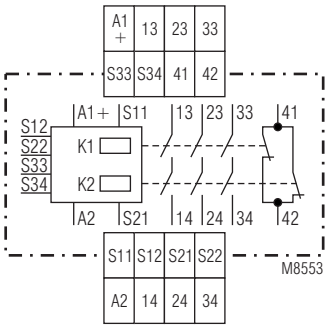
Indicators

upper LED:	on, when supply connected
lower LEDs:	on, when relay K1 and K2 energized

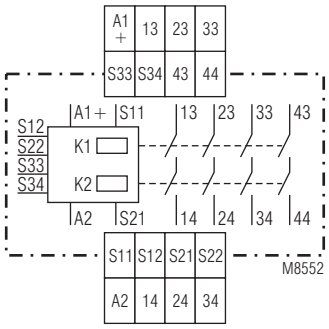
Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close. A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

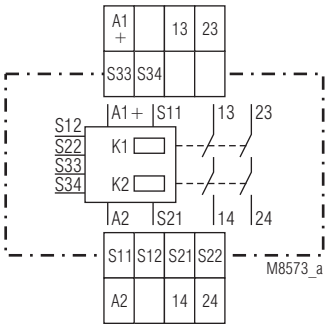
Circuit Diagrams



LG 5925.48/920



LG 5925.04/920



LG 5925.02/920

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S34	Inputs
S11, S21, S33	Outputs
13, 14, 23, 24, 33, 34, 43, 44	Forcibly guided NO contacts for release circuit
41,42	Forcibly guided indicator output

Technical Data

Input

Nominal voltage U_N: DC 24 V
Voltage range: 0.9 ... 1.1 U_N
Nominal consumption: DC approx. 1.7 W
Min. Off-time: 250 ms
Control voltage on S11 at U_N: DC 22.5 V
Control current /typ.) over S12 or S22: 35 mA at U_N
Min. voltage between terminals S12, S22 when relay activated: DC 19 V
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR

Output

Contacts
LG 5925.02/920: 2 NO contacts
LG 5925.04/920: 4 NO contacts
LG 5925.48/920: 3 NO contacts, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 41-42 can only be used for monitoring

Operate delay typ. at U_N:
Manual start: 20 ms
Automtic start: 350 ms
Release delay typ. at U_N:
Disconnecting the supply: 20 ms
Disconnecting S12, S22: 15 ms
Contact type: forcibly guided
Nominal output voltage: AC 250 V
DC: see limit curve for arc-free operation

Technical Data

Thermal current I_{th}: max. 8 A per contact
see current limit curve

Switching capacity
to AC 15:
NO contacts: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts: 2 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
NC 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
Permissible operating frequency: max. 1 200 switching cycles / h
Short circuit strength
max. fuse rating: 10 A gL IEC/EN 60 947-5-1
line circuit breaker: B 6 A
Mechanical life: > 20 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
operation: - 25 ... + 55 °C
storage : - 40 ... + 85 °C
altitude: < 2.000 m
Clearance and creepage distances
rated impuls voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC IEC/EN 62 061
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 V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance: 25 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire fixing: Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting: DIN rail IEC/EN 60 715
Weight: 220 g

Dimensions

Width x height x depth
LG 5925/920: 22.5 x 90 x 121 mm
LG 5925/920 PC: 22.5 x 111 x 121 mm
LG 5925/920 PS: 22,5 x 104 x 121 mm

Standard Type

LG 5925.48/920 DC 24 V

Article number:	0063683
• Output:	3 Schließer, 1 Öffner
• Nominal voltage U_N:	DC 24 V
• Width:	22.5 mm

Ordering Example

LG 5925 . _ _ _ _ /920 DC 24 V

- Nominal voltage
- Type of terminals
  without indication: terminal blocks fixed, with screw terminals
  PC (plugin cage clamp): plugable terminal blocks with cage clamp terminals
  PS (plugin screw): plugable terminal blocks with screw terminals
- Contacts
- Type

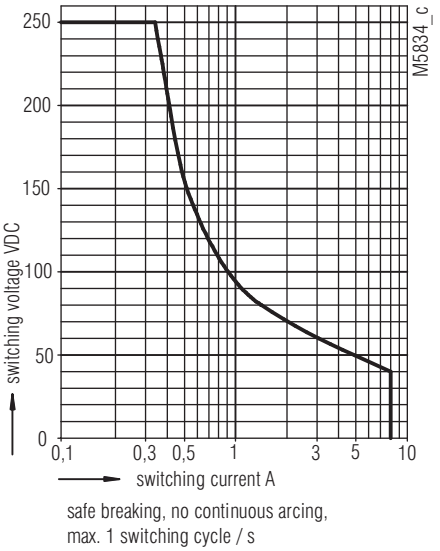
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	- Safety relay K2 is welded (replace device) - Incorrect setting of switch S2 - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S33-S34 not bridged

Maintenance and repairs

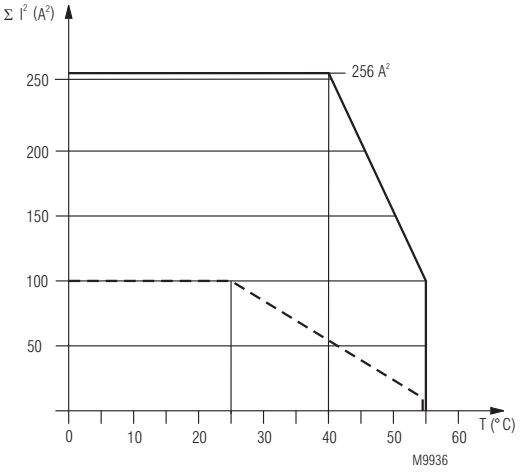
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

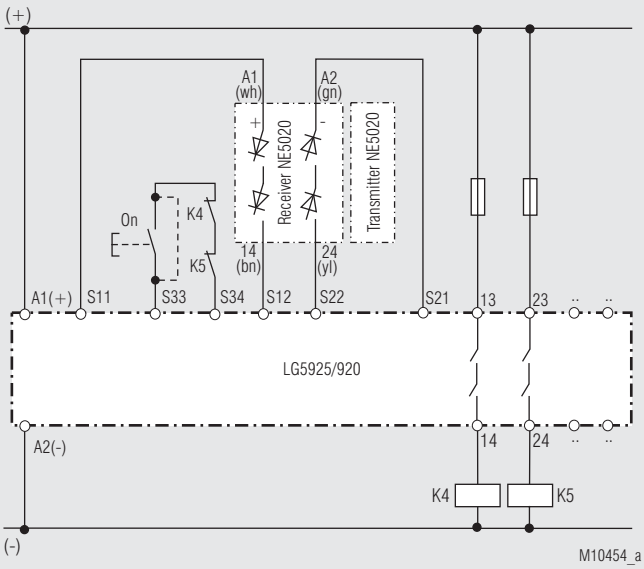
Arc limit curve under resistive load



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

I_1, I_2, I_3, I_4 - current in contactrows

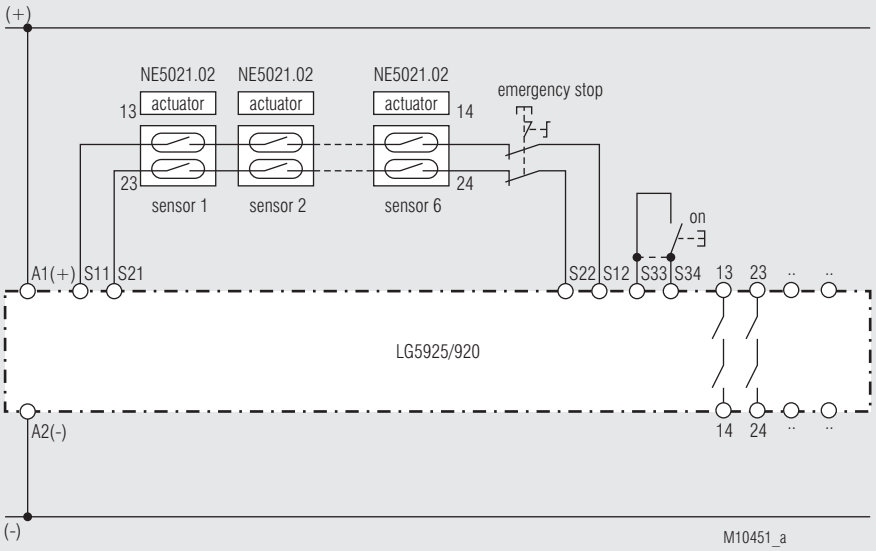
Total current limit curve



With safety switch NE 5020. Contact reinforcement by external contactors. 2-channel operation, cross fault detection

Please note: Refer to „Unit programming“!
Switches in position: S1 cross fault detection
S2 manual start

With autostart link On-button and set S2 to „automatic“.
Suited up to SIL3, Performance Level e, Cat. 4

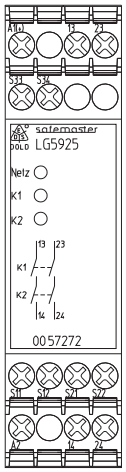
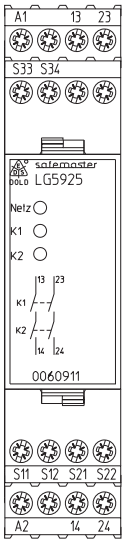
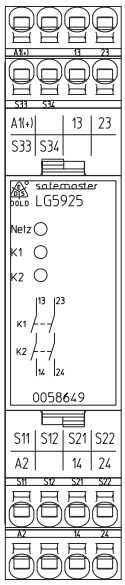
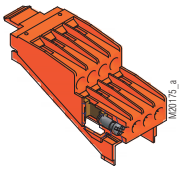
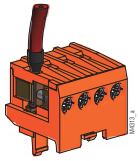
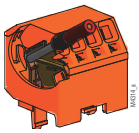
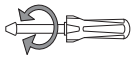
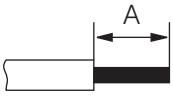
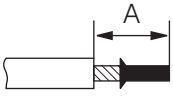
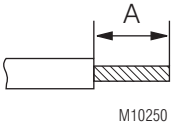


6 safety switches NE 5021 + 1 E-stop button in series. 2-channel operation, cross fault detection

Please note: Refer to „Unit programming“!
Switches in position: S1 cross fault detection
S2 manual start

With autostart link On-button and set S2 to „automatic“.
Suited up to SIL3, Performance Level e, Cat. 3

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M10254	 M10256	 M10255	
		 PS	 PC	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Zubehör**
EN	**Accessories**
FR	**Accessoires**

NE 5020.92

Artikelnummer:
Article number:
Référence:
0051641

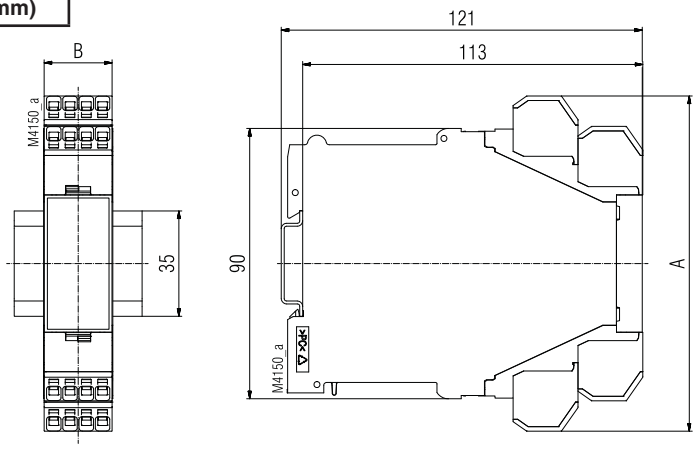
DE	Magnetschalter codiert, für DC 24 V, mit 2 Halbleiterausgängen
EN	Safety switch, magnetic coded, for DC 24 V, with 2 semiconductor outputs
FR	Interrupteur magnétique codé, pour DC 24 V, avec 2 sorties à semi-conducteurs

NE 5021.02

Artikelnummer:
Article number:
Référence:
0054695

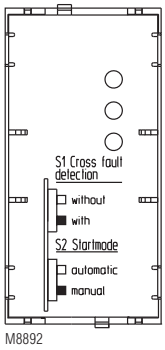
DE	Magnetschalter codiert, mit 2 Schließern (Reedkontakten)
EN	Safety switch, magnetic coded, with 2 NO contacts (reed contacts)
FR	Interrupteur magnétique codé, avec 2 contacts NO (contacts Reed)

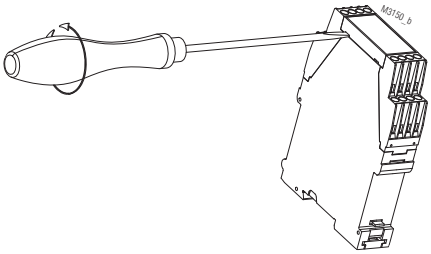
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5925/900	90	22,5
LG 5925/900 PS	104	22,5
LG 5925/900 PC	111	22,5

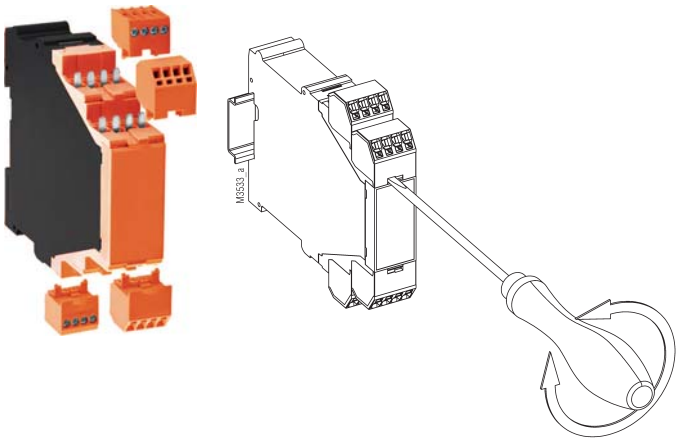
DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**





DE	S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma.

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	216,7	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)

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:	99,0	%
PFH_D:	1,1E-10	h^{-1}
PFD_{AVG}:	8,2E-05	(Low Demand Mode)
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

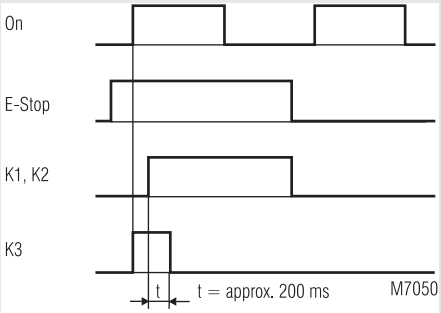
Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode Consigne résultant de la fonction sécuritaire de l'appareil au High Demande Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Emergency Stop Module
BN 5930.48

- same as BN 5983, but with other terminal designation (see circuit diagram)
- **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**
- Output: 3 NO, 1 NC contacts for AC 400 V
- 1-channel or 2-channel circuit
- LED displays for channel 1, 2 and mains
- Feedback circuit X1 - X2 for monitoring external contactors
- Removable terminal strips
- Width 100 mm

Function Diagram

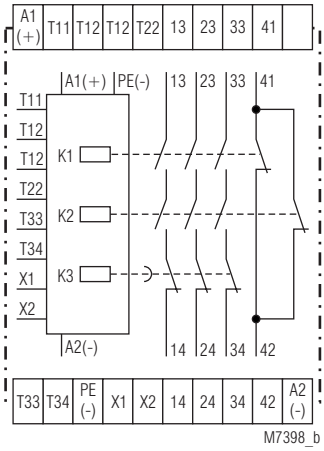


Approvals and Markings

Applications

Protection of persons and machines
- Emergency stop circuits on machines
- Monitoring safety gates

Circuit Diagram



Notes

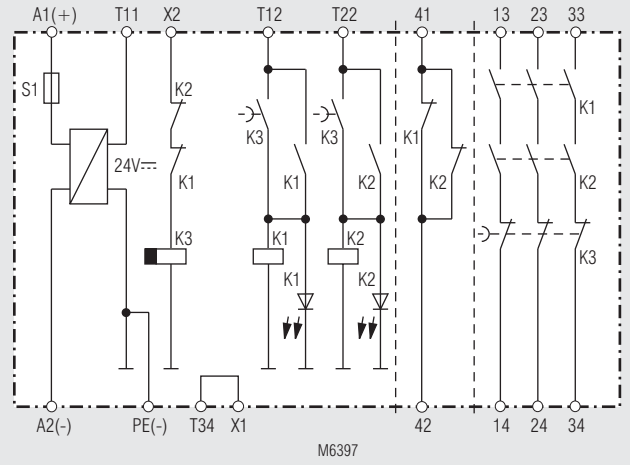
The PE terminal permits operation of the device in IT systems with insulation monitoring and also serves as a reference point for testing the control voltage.

One or more extension modules BN 3081 or external contactors with positively-driven contacts may be used to multiply the number of contacts of the emergency-stop module BN 5930.

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
T12, T22, X1, X2	Inputs
T11, PE(-), T34	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Block Diagrams



Technical Data

Input

Nominal voltage U_N:	AC 24, 48, 110, 127, 230, 240 V *) DC 24 V *) *) see device label
Voltage range:	AC 0.8 ... 1.1 U_N
at 10 % residual ripple:	DC 0.9 ... 1.2 U_N
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	5 VA ± 30 %
Nominal frequency:	50 / 60 Hz
Control voltage S11:	DC 24 V
Control current:	max. DC 100 mA
Minimum voltage at terminals T33, T34:	DC 21 V with activated device

Output

Contacts

BN 5930.48: 3 NO, 1 NC contacts
1 delay-release NO contact (K1.3)

The NO contacts 13...33 / 14...34 are safety contacts.
The NC contact 41-42 can only be used for monitoring.

Operate time:	35 ms	
Release time		
opening in secondary circuit (T33 - T34):	30 ms ± 25 %	
opening in supply circuit:	100 ms ± 50 %	
Release delay of K3:	approx. 200 ms	
Contact type:	Relay, positively-driven	
Nominal output voltage:	AC 400 V / DC 220 V	
Switching capacity:	AC 10 A cos φ 1 .. 0,7, DC 10 A (see arc limit curve under resistive load)	
Thermal current I_{th}:	see continuous current limit curve	
Switching capacity		
to AC 15:		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
Switching capacity max.:	2 000 VA (cos φ = 1) / 120 W	
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	6 000 switching cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
max. line circuit breaker:	C 10 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 15 ... + 55°C at max. 90 % humidity
Storage :	- 25 ... + 85 °C
Altitude:	< 2.000 m

Technical Data

Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency: 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Flat terminals with self-lifting clamping piece Removable terminal strip	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	840 g	

Dimensions

Width x height x depth: 100 x 74 x 121 mm

Standard Type

BN 5930.48 DC 24 V

Article number:	0041438
• Output:	3 NO contacts, 1 NC contact for AC 400 V
• Nominal voltage U_N:	DC 24 V
• Width:	100 mm

Ordering Example

BN 5930 .48 AC 230 V 50/60 Hz

- 50/60 Hz — Nennfrequenz
- AC 230 V — Nennspannung
- .48 — Kontaktbestückung
- BN 5930 — Gerätetyp

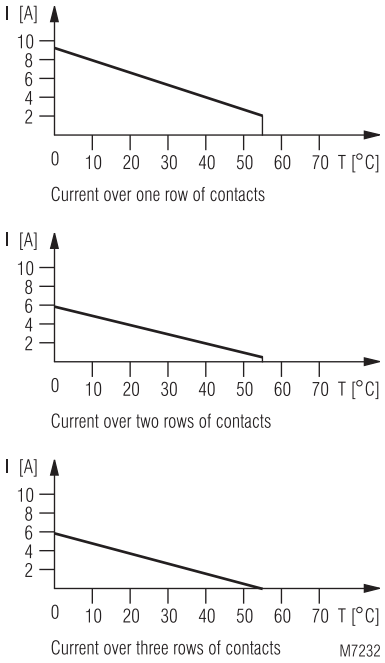
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on T22 (switch channel off on T12)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on T12 (switch channel off on T22)
Device cannot be activated	- Safety relay is welded (replace device)

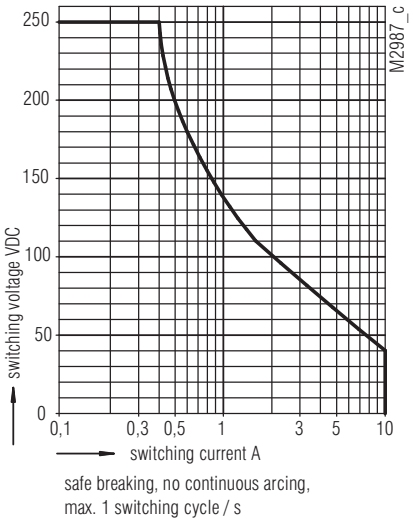
Maintenance and repairs

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

Characteristic

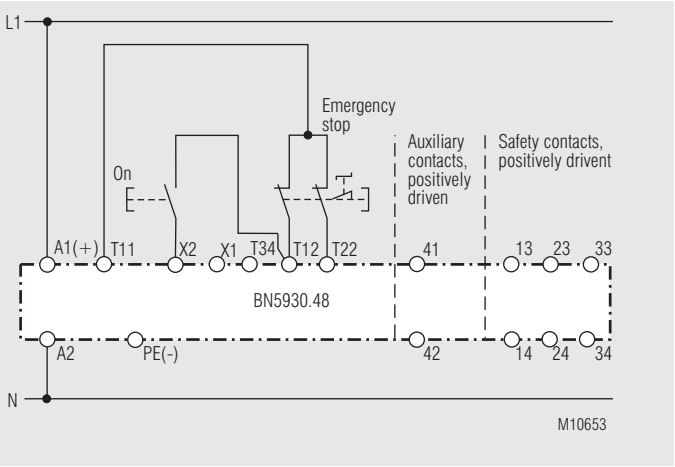


Continuous current limit curves depend on the ambient temperature

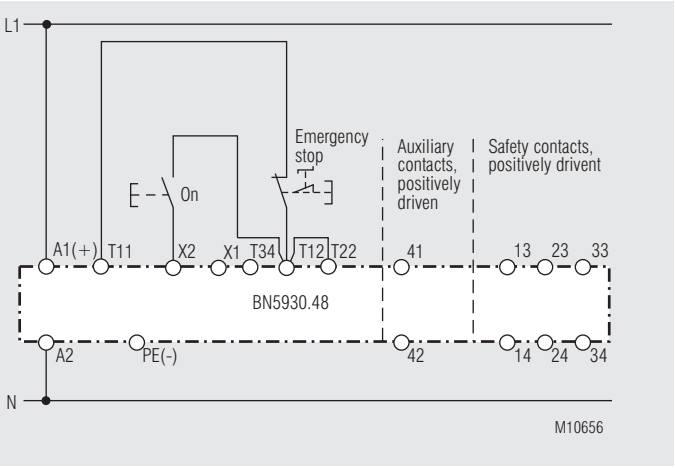


Limit curve for arc-free operation

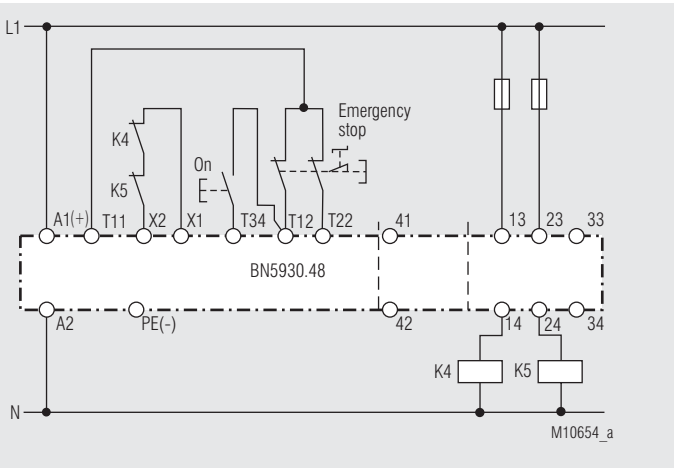
Application Examples



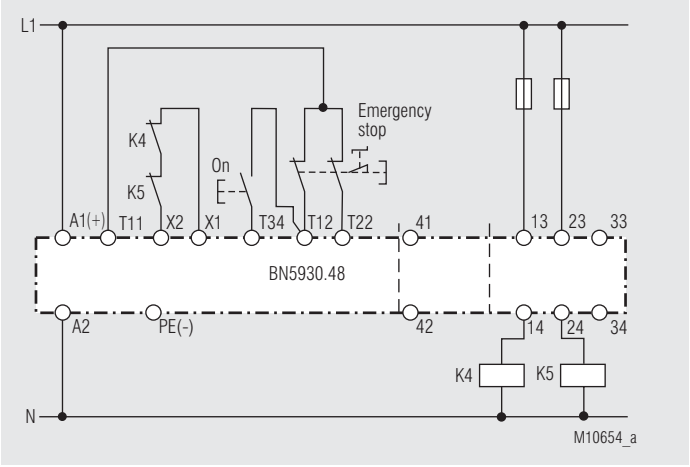
Two-channel emergency stop circuit
Suited up to SIL3, Performance Level e, Cat. 4



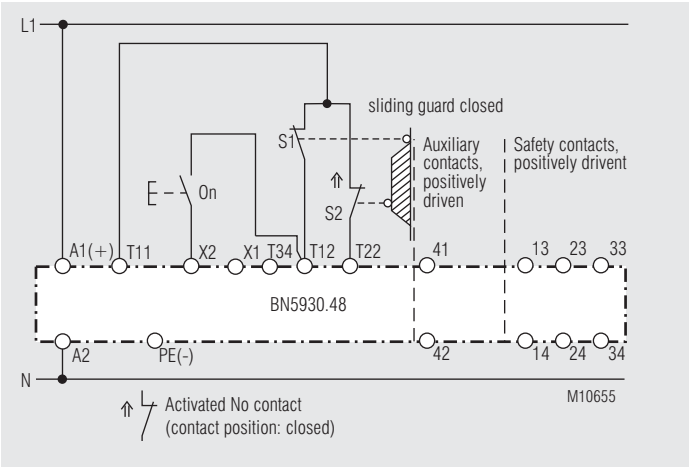
One-channel emergency-stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit.
Suited up to SIL2, Performance Level d, Cat. 3



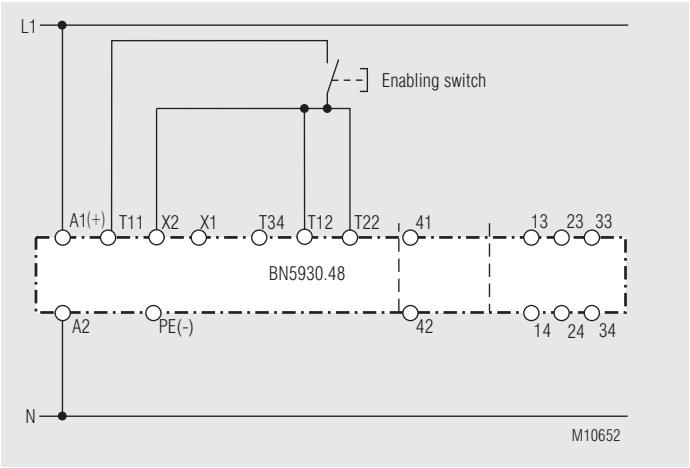
Contact reinforcement by external contactors, 2-channel.
The output contacts can be reinforced by external contactors with positively driven contacts for switching currents > 10 A. Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals X1 - X2).
Suited up to SIL3, Performance Level e, Cat. 4



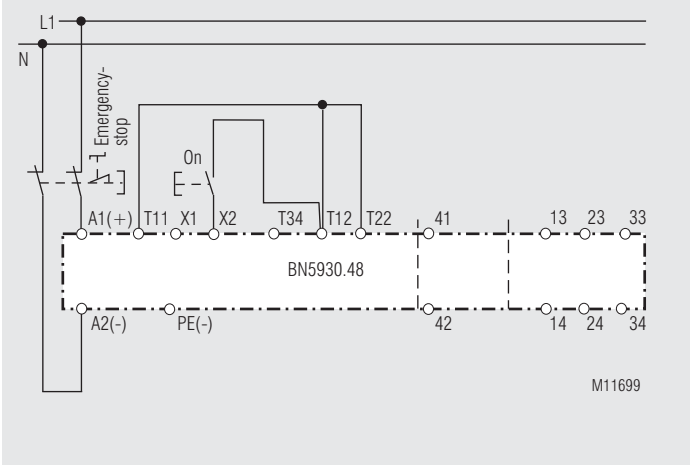
Contact reinforcement by external contactors with reduced safety level.
Suited up to SIL3, Performance Level e, Cat. 4



Two-channel monitoring of a safety gate.
Suited up to SIL3, Performance Level e, Cat. 4



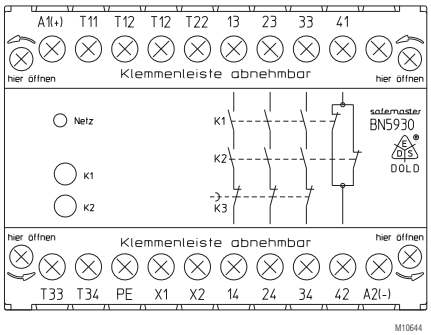
Emergency stop circuit with control of enabling swtich.
Suited up to SIL1, Performance Level c, Cat. 1

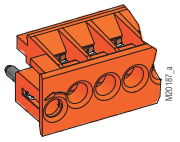


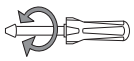
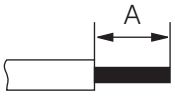
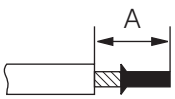
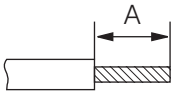
Two-pole emergency-stop with emergency-stop control device in the supply circuit..
Application for long emergency-stop loops in which the control voltage dropped below the minimum voltage of 21 V.

Important:
Single faults (line shorts over the emergency-stop control device) are not identified with this external circuit.
Suited up to SIL3, Performance Level e, Cat. 3

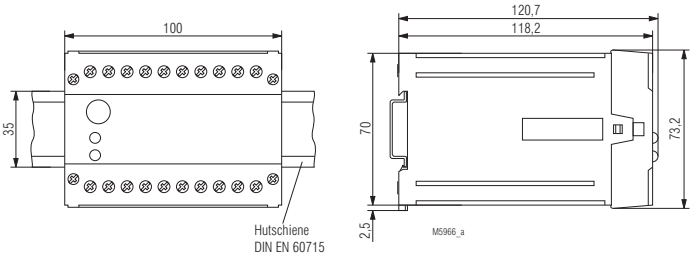
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



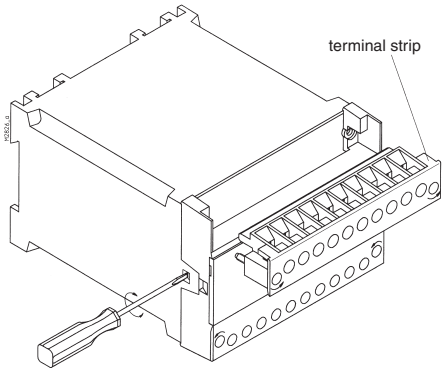


	ø 6 mm / PZ 2 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14
	A = 10 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	240,5	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)

IEC/EN 62061 **IEC/EN 61508**		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	2,05E-10	h^{-1}

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

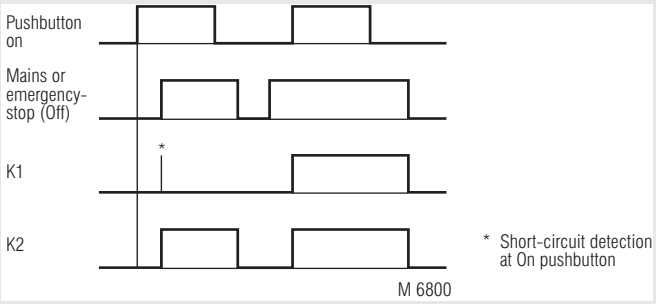
Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

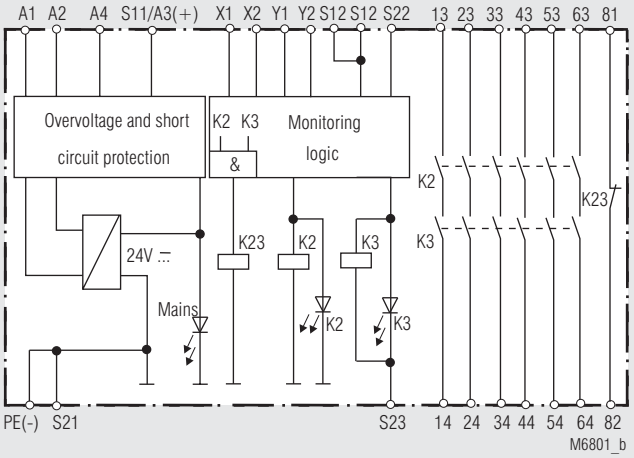
SAFEMASTER
Emergency Stop Module
BO 5988

0221562

Function Diagram



Block Diagram



- **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**
- Output: max. 6 NO, 1 NC contacts or 1 NO contact for AC 250 V
- 1-channel or 2-channel connection
- Line fault detection at On pushbutton
- Feedback circuit X1-X2 for monitoring external contactors
- Integrated short-circuit and overvoltage protection
- LED displays for channels 1 and 2 and supply
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated),
- DIN 46 228-1/-2/-3-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Optionally with release delayed NO contact to 10 min
- Optionally automatic On function after connection of operating voltage or activation via On pushbutton
- Optionally cross fault detection in emergency stop control circuit
- Optionally dual voltage version
- Width 100 mm

Approvals and Markings

CE · TÜVRheinland CERTIFIED Product Safety Functional Safety www.tuv.com ID 0600000000 · c UL us Canada / USA *

* see variants

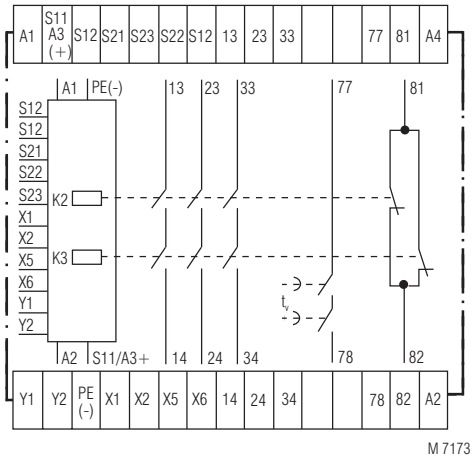
Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of safety gates

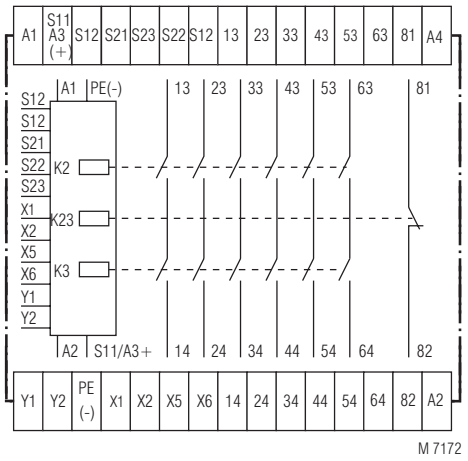
Indicators

LED power supply:	on, when operating voltage present
LED K2:	on, when supply on relay K2
LED K3:	on, when supply on relay K3
only at BO 5988/4_ _, BO 5988/5_ _:	
LED KT2, KT3:	on, when delayed contacts are energized

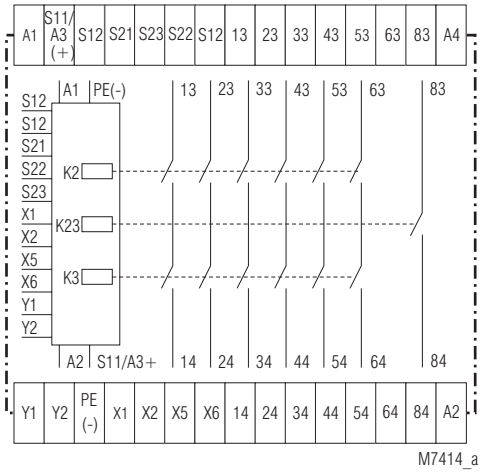
Circuit Diagrams



BO 5988.47



BO 5988.61



BO 5988.62

Connection Terminals

Terminal designation	Signal description
A1, S11/A3 (+)	+ / L
A2, A4	- / N
S12, S22, S23, X2, X5, Y2	Inputs
PE (-), S11/A3 (+), S21, X1, X6, Y1	Outputs
13, 14, 23, 24, 33, 34, 43, 44, 53, 54, 63, 64	Forcibly guided NO contacts for release circuit
81, 82	**only .47:** Forcibly guided indicator output
81, 82	**only .61:** indicator output (NC)
83, 84	**only .62:** indicator output (NO)
77, 78	NO contact release delay Forcibly guided for release circuit

Notes

Jumper assignment for functions:
Activation via On pushbutton / or automatic On function

On push-button Y1 - Y2	Jumper X5 - X6	Function
		The output contacts are switches only after operation of the On pushbutton. Line fault monitoring at the On pushbutton
 M8687		Automatic On function for operating voltage Off/On or after emergency stop release

Line fault detection at the On pushbutton:
The output contacts cannot be closed if the On pushbutton is already closed before the voltage is applied to S12, S22 (also in the event of a line fault at the On pushbutton).
A line fault at the On pushbutton which occures after activation of the device is recognized when swichting-on takes place again and closing of the output contacts is then prevented.
If a line fault occurs at the On pushbutton after the voltage is already present at S12, S22, undesired activation will take place, because this line fault does not differ from the normal closing function.
The gold-plated contacts of the BO 5988 also mean that this module is suitable for switching small loads of 1 mVA ... 7 VA, 1 mW ... 7 W in the range 0.1 ... 60 V, 1 ... 300 mA. The contacts also permit the maximum switching current. However, since the gold plating is burnt off at this current level, the device is no longer suitable for switching small loads after this.
The PE terminal permits operation of the device in IT systems with insulation monitoring and also serves as a reference point for testing the control voltage. The internal short-circuit protection will be bridged on DC devices, if the protective ground is connected to terminal PE.
One or more extension modules BN 3081 or external contactors with forcibly guided contacts may be used to multiply the number of contacts of the emergency stop module BO 5988.

Technical Data

Input

Nominal voltage U_N
BO 5988.--/-00: DC 24 V
BO 5988.--/-24: DC 24 V + AC 24 V
DC 24 V + AC 48 V
DC 24 V + AC 110 V
DC 24 V + AC 230 V
DC 24 V + AC 240 V
either DC 24 is connected to A3-A4 or the AC voltage to A1-A2
Voltage range: AC 0.8 ... 1.1 U_N
at 10 % residual ripple: DC 0.9 ... 1.2 U_N
at 48 % residual ripple: DC 0.8 ... 1.1 U_N
Nominal consumption: AC: approx. 6 VA, DC: approx. 3 W
Nominal frequency: 50 / 60 Hz
Control voltage
at S11: typ. DC + 24 V
at S21: 0 V
Control current: typ. DC 110 mA
Minimum voltage
at terminals S12, S22: DC 21 V with activated device
Recovery time: 2 s
A minimum switch-off time of 10 s must be observed if the line fault monitoring function at the On push-button is active

Output

Technical Data

Contact

BO 5988.61:	6 NO, 1 NC indicator contact
BO 5988.62:	6 NO, 1 NO indictor contact
BO 5988.47:	3 NO, 1 NC indicator contact 1 NO release delayed

The NO contacts 13...63 / 14...64 are safety contacts.
The NC contact 81-82 and the NO contact 83-84 can only be used for monitoring.

Operate time

manual restart:	typ. 30 ms
automatic restart:	1 s

Release time

2-channel disconnecting in secondary circuit (S12, S22 und S23):	30 ms ± 50 %
opening in supply circuit	
BO 5988.47:	100 ms + 50 %
BO 5988.61, BO 5988.62:	50 ms + 50 %
Fault detection time at U_N:	
at 1-channel interruption	
at S12:	typ. 310 ms
at S22 and S23:	30 ms ± 50 %
Time delay t_v:	Auxiliary supply is not necessary during elapse of time:
BO 5988.47/1 _ _ :	0.1 ... 1 s 0.3 ... 3 s 0.5 ... 5 s 1 ... 10 s
BO 5988.47/2 _ _ :	1 s, 3 s, 5 s, 10 s Auxiliary supply must be connected during elapse of time:
BO 5988.47/4 _ _:	0.1 ... 1 s 0.1 ... 1 min 0.3 ... 3 s 0.3 ... 3 min 1 ... 10 s 0.5 ... 5 min 3 ... 30 s 1 ... 10 min
BO 5988.47/5 _ _ :	1 s, 3 s, 10, 30 s 1 min, 3 min, 5 min, 10 min

Repeat accuracy

BO 5988.47/1 _ _ and BO 5988.47/2 _ _ :	± 15 % of setting value
BO 5988.47/4 _ _ and BO 5988.47/5 _ _ :	± 1 % of setting value
Contact type:	Relay, forcibly guided
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation
Signalling contact of BO 5988.61 and BO 5988.62:	AC 10 ... 250 V, DC 10 ... 120 V for AC/DC 0.1 ... 1 A
Thermal current I_{th}:	see total current limit curve (max. 10 A in one contact path)
release delayed NO contact 77-78 at BO 5988.47:	max. 8 A

Switching capacity

to AC 15		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
BO 5988.47		
release delayed NO contact:	3 A / AC 230V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	4 A / DC 24 V	IEC/EN 60 947-5-1
BO 5988.47		
release delayed NO contact:	4 A / DC 24 V	IEC/EN 60 947-5-1

Electrical life

to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 2 A, AC 230 V:	> 240 x 10^3 switching cycles	IEC/EN 60 947-5-1

Permissible operating frequency:	600 switching cycles / h
Short circuit strength	
max. fuse rating:	6 A gL IEC/EN 60 947-5-1
max. line circuit breaker:	C 10 A
Mechanical life:	30 x 10^6 switching cycles

General Data

Operating mode:	Continuous operation
Temperature range	
operation:	- 15 ... + 50°C
storage :	- 25 ... + 85 °C
altitude:	< 2.000 m
Clearance and creepage distances	
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1

Technical Data

EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	850 g	

Dimensions

Width x height x depth:	100 x 74 x 121 mm

UL-Data

Nominal voltage U_N:	
BO 5988.--/-00:	DC 24 V
BO 5988.--/-24:	DC 24 V + AC 24 V DC 24 V + AC 48 V DC 24 V + AC 110 V DC 24 V + AC 230 V DC 24 V + AC 240 V either DC 24 is connected to A3-A4 or the AC voltage to A1-A2
Ambient temperature:	- 15 … + 50 °C
Wire connection:	60°C / 75°C copper conductors only AWG 18 - 16 Torque 7 lb in

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

Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
LED "K2" lights up, but "K3" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22 e.g.S23)
LED "K3" lights up, but "K2" remains off	- Safety relay K3 is welded (replace device) - A 1-channel switch-off occurred on S22 e.g. S23 (switch channel off on S12)
Device cannot be activated	- The delay contacts are not yet switched off - Safety relay is welded (replace device) - Feedback circuit X1 - X2 not closed - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S13-S14 are not bridged

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.

Standard Types

BO 5988.61/024 DC 24 V + AC 230 V 50 / 60 Hz
Article number: 0040375
- Dual voltage version
- Output: 6 NO contacts, 1 NC contact as monitoring contact
- Width: 100 mm

BO 5988.47/124 DC 24 V + AC 230 V 50 / 60 Hz 1 ...10 s
Article number: 0040430
- Dual voltage version
- Output: 3 NO contacts, 1 NC contact as monitoring contact, 1 release delayed NO contact
- With adjustable time delay t_v to 10 s
- Width: 100 mm

Variants

BO 5988._ _ /61: with UL approval (Canada/USA)

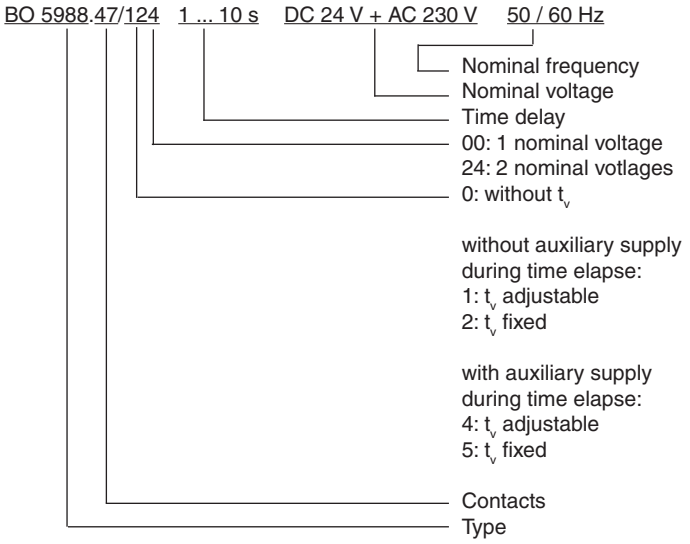
Auxiliary supply is not nesseary during elapse of time:
BO 5988.47 / 1 _ _: 3 NO / 1 NC contacts + t_v adjustable
BO 5988.47 / 2 _ _: 3 NO / 1 NC contacts + t_v fixed

Auxiliary supply must be connected during elapse of time:
BO 5988.47 / 4 _ _: 3 NO / 1 NC contacts + t_v adjustable
BO 5988.47 / 5 _ _: 3 NO / 1 NC contacts + t_v fixed

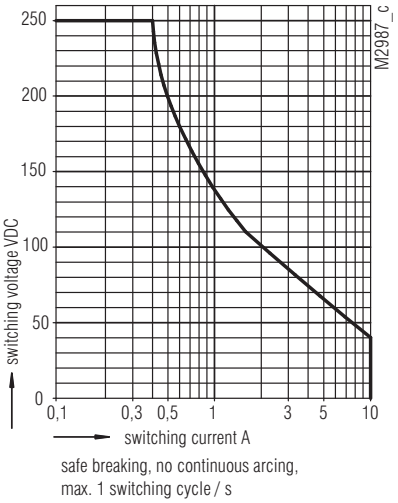
Without time delay t_v:
BO 5988.61 / 0_ _ : 6 NO / 1 NC contacts as monitoring contact
BO 5988.62 / 0_ _ : 6 NO / 1 NC contacts as monitoring contact
BO 5988. _ _ / _00: single voltage model
BO 5988. _ _ / _24: dual voltage model

BO 5988.61 / 324: Dual voltage model 0.5 s operate delay with automatic restart

Ordering example for variants

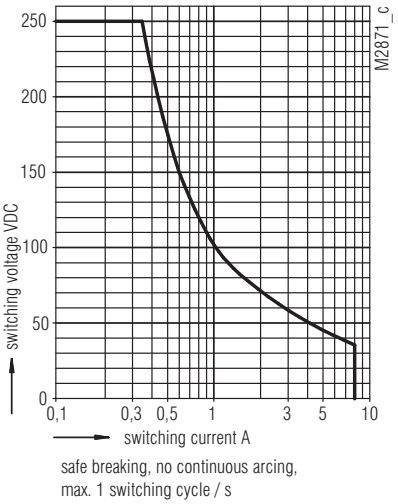


Characteristics



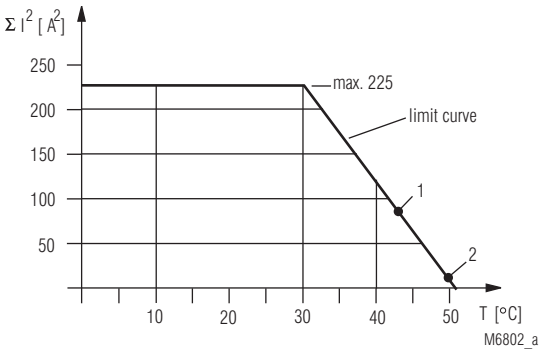
safe breaking, no continuous arcing,
max. 1 switching cycle / s

Limit curve for arc-free operation with resistive load (instantaneous contact)



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Limit curve for arc-free operation with resistive load (delayed contacts)



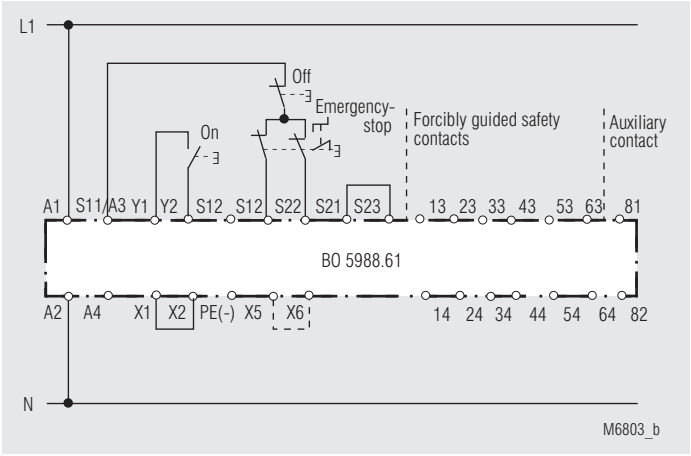
Total current limit curve
It is necessary to use the square of the currents in order to obtain a linear limit curve.

General formula for determination of the maximum ambient temperature
A) Sum of currents² per safety contact = value on scale Σ I² (A²)
B) Max. ambient temperature T = Cross point of scale Σ I² (A²) with limit curve

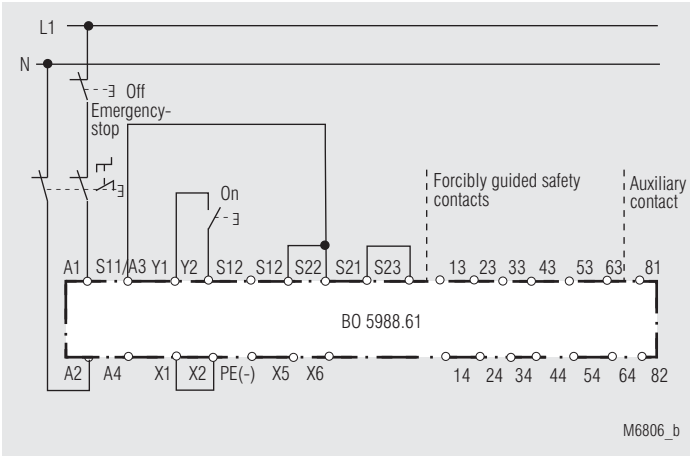
Example 1
A) $(4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 = 96\ A^2$ (Scale Σ I²)
B) Max. ambient temperature T = 43°C (point 1)

Example 2
A) $(0.5\ A)^2 + (1\ A)^2 + (2\ A)^2 + (1\ A)^2 = 6.25\ A^2$ (Scale Σ I²)
B) Max. ambient temperature T = 49°C (point 2)

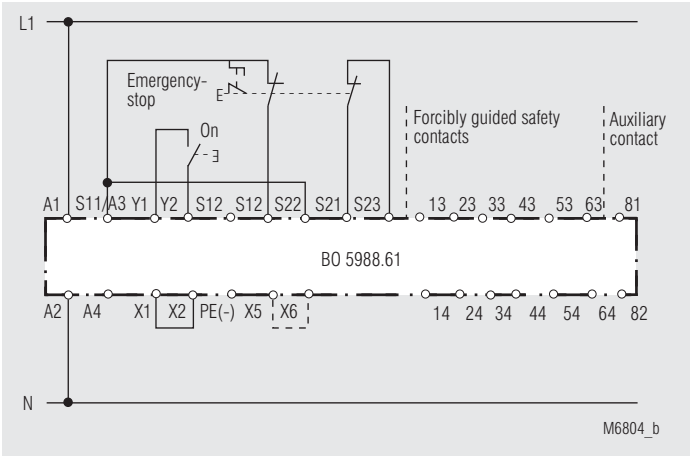
Please note:
The total current² can still be 1.5 A² at 50°C , i.e. 0.5 A per safety contact
A) $(0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 + (0.5\ A)^2 = 1.5\ A^2$
B) Max. ambient temperature = 50°C



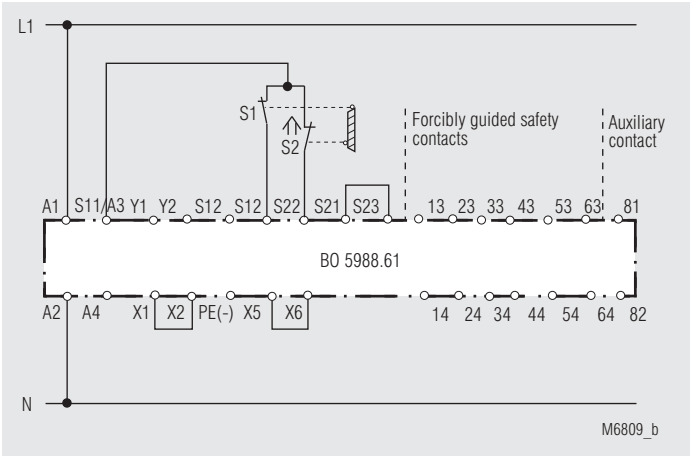
Two-channel emergency stop circuit without cross fault detection.
Activation via On pushbutton. - - - Jumper X5 - X6:
A jumper must be fitted X5 - X6 for the automatic On function.
The On pushbutton is not required.
Suited up to SIL3, Performance Level e, Cat. 4



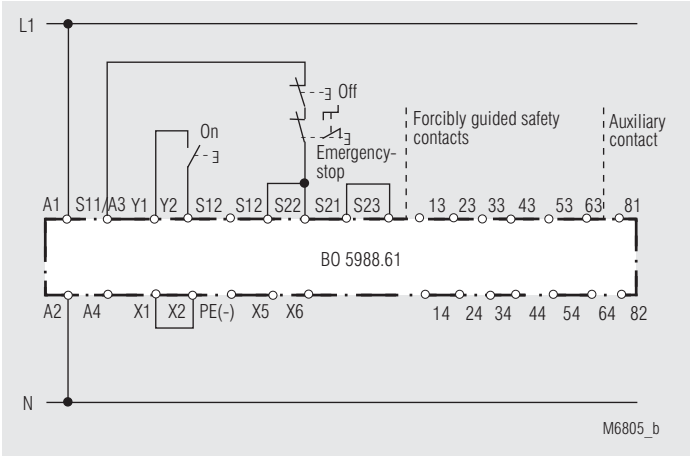
Two-pole emergency stop circuit with emergency stop control device in the supply circuit.
Application for long emergency stop loops where the control voltage drops below the minimum voltage of 21 V.
Attention:
Single faults (e.g. line faults at the emergency stop control device) are not detected with this external circuit configuration.
Suited up to SIL3, Performance Level e, Cat. 4



Two-channel emergency-stop circuit with cross fault detection.
Activation via On pushbutton. - - - Jumper X5 - X6:
A jumper must be fitted X5 - X6 for the automatic On function.
The On pushbutton is not required.
Suited up to SIL3, Performance Level e, Cat. 4

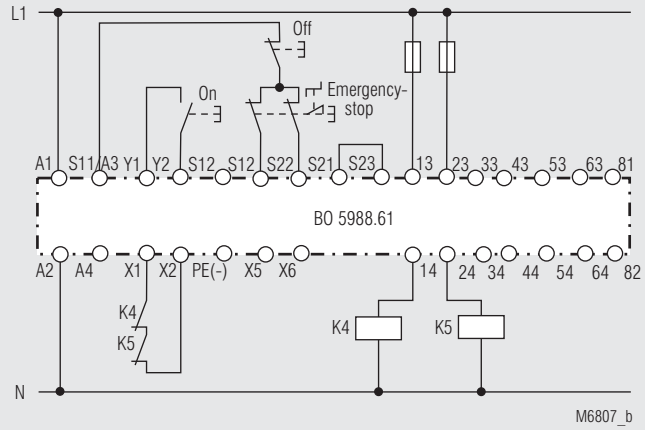


Two-channel monitoring of a safety gate. S1 must not close before S2.
Suited up to SIL3, Performance Level e, Cat. 4

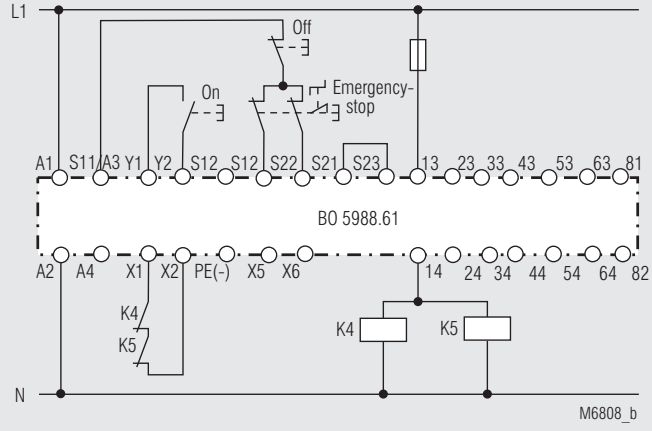


One-channel emergency stop circuit. This circuit does not have any redundancy in the emergency stop control device circuit.
Suited up to SIL2, Performance Level d, Cat. 3

Application Examples

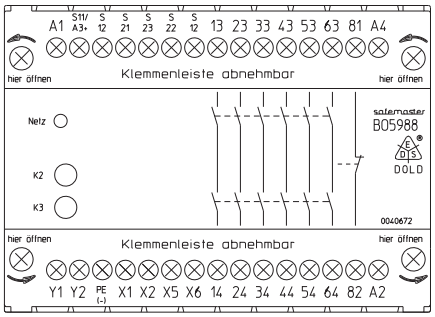


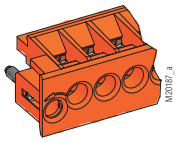
Contact reinforcement by external contactors, two-channel.
The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 8 A. Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals X1 - X2).
Suited up to SIL3, Performance Level e, Cat. 4

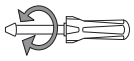
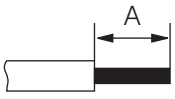
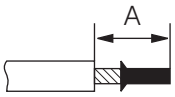
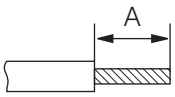


Contact reinformcement by external contactors with reduced safety level.
Suited up to SIL3, Performance Level e, Cat. 4

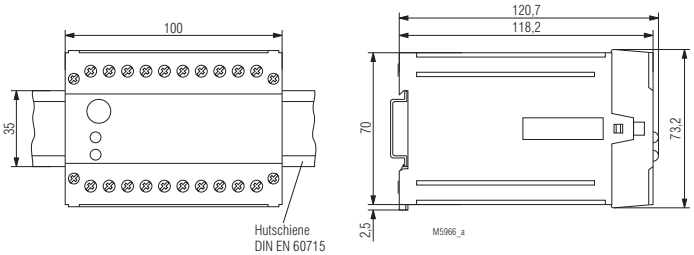
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**



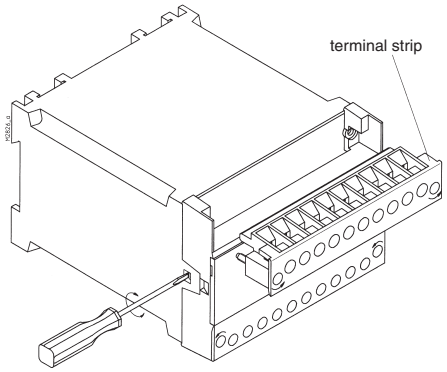


	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**



DE	**Montage / Demontage der Klemmenleiste**
EN	**Mounting / disassembly of the terminal strip**
FR	**Montage / Démontage des borniers**
IT	**Montaggio / Smontaggio di morsettiera**



DE	**Sicherheitstechnische Kenndaten (nur Sofortkontakte)**
EN	**Safety related data (only instantaneous contacts)**
FR	**Données techniques sécuritaires (contact instantané)**
IT	**I dati di sicurezza (solo i contatti istantanei)**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	290,6	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)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	8,1E-11	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

DE	**Sicherheitstechnische Kenndaten (nur verzögerte Kontakte)**
EN	**Safety related data (only delayed contacts)**
FR	**Données techniques sécuritaires (contact retardée)**
IT	**I dati di sicurezza (solo i contatti ritardati)**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	671,0	a (year)
DC_{avg}:	80,2	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508
HFT*):	1	
DC:	80,2	%
PFH_D:	2,2E-8	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Info

DE	Bei verzögerten Kontakten: Performance Level (PL) d und Kategorie 3 nach EN ISO 13849 für Verzögerungen bis max. 30 s. Bei längeren Verzögerungen Performance Level (PL) c und Kategorie 1. Die angeführten Kenndaten gelten für die Standardtype BO 5988.47/124 Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	At delayed contacts: Performance Level (PL) d and category 3 according to EN ISO 13849 for delays up to 30 s max. For longer delays Performance Level (PL) c and category 1. The values stated above are valid for the standard type BO 5988.47/124. 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.
FR	Pour les contacts temporisés: Performance Level (PL) d et catégorie 3 selon EN ISO 13849 pour les temporisations jusqu'à max. 30 s. Pour toute temporisaton plus longue Performance Level (PL) c et catégorie 1. Les valeurs données sont valables pour les produits standards BO 5988.47/124. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	Con contatti ritardati: Performance Level (PL) d e categoria 4 alla EN ISO 13849, per ritardi fino a max. 30 s. Per il ritardo più lungo: Performance Level (PL) c e categoria 1. I rating sopra si applicano al tipo standard BO 5988.47/124. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

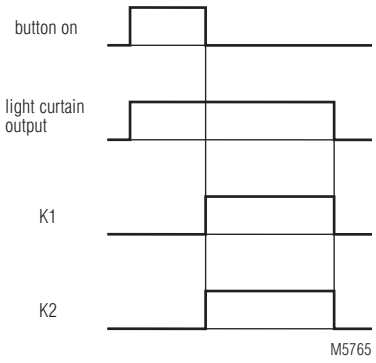
SAFEMASTER
Light Curtain Controller
LG 5925/900

0255047

LG 5925/900

- **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**
- According to EN 50156-2 for furnaces
- For light curtains with symmetric or asymmetric outputs adjustment with switch S1
- Output: max. 4 NO contacts, see contacts
- Single and 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- LED indicator for state of operation
- LED indicator for channel 1 and 2 and power
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

Function Diagram



Approvals and Markings

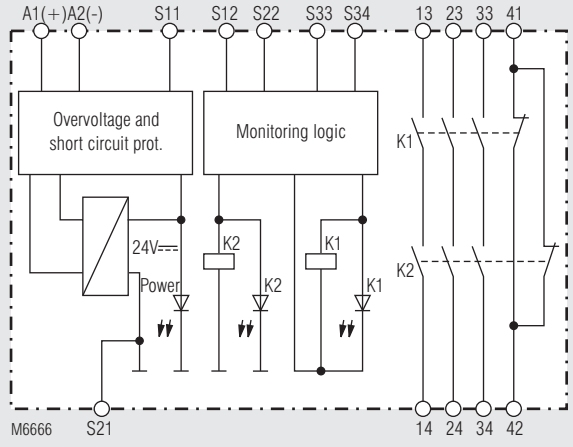
CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | c UL us LISTED Canada / USA | A025518

Applications

Protection of people and machines

- Light curtain controller for light curtains with selftesting (Type 4) according to IEC/EN 61 496-1
- Usage in furnace application in continuous operation acc. to EN 50156-1

Block Diagram



Indicators

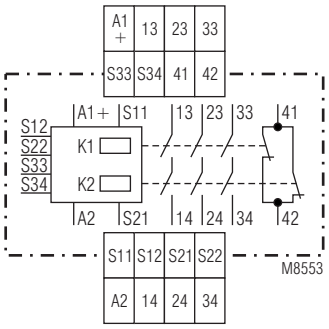
upper LED:	on when supply connected
lower LEDs:	on when relay K1 and K2 energized

Notes

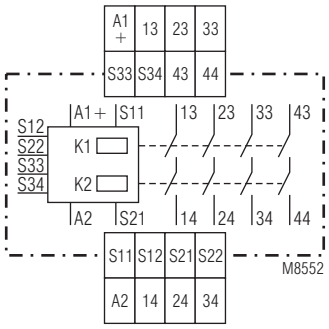
Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close. A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

When using light curtains with asymmetric outputs (one output + switching, one output - switching) the MINUS switching output has to be connected to S22 and the Plus switching to S12.

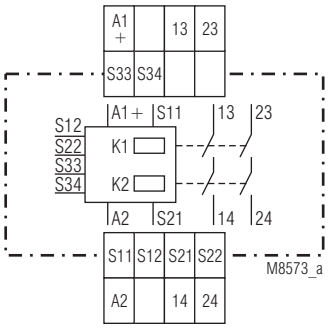
Circuit Diagrams



LG 5925/900.48



LG 5925/900.04



LG 5925/900.02

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S22, S33, S34	Inputs
S11, S21	Reference points to measure the control voltage
13, 14, 23, 24, 33, 34, 43, 44	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Technical Data

Input Circuit

Nominal Voltage U_N: DC 24 V
Voltage range: 0.9 ... 1.1 U_N
Nominal consumption: DC approx. 1.7 W
Min. Off-time: 250 ms
Control voltage on S11 at U_N: DC 22.5 V
Control current typ. over S12, S22: 35 mA at U_N
Min. voltage on S12, S22 when relay activated: DC 21
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR

Output

Contacts
LG 5925.02: 2 NO contacts
LG 5925.04: 4 NO contact
LG 5925.48: 3 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 41-42 can only be used for monitoring.

Operate delay typ. at U_N:
Manual start: 20 ms
automatic start: 350 ms
Release delay typ. at U_N:
Disconnecting S12, S22: 15 ms
Contact type: forcibly guided
Nominal output voltage: AC 250 V
DC: see limit curve for arc-free operation
Thermal current I_{th}: max. 8 A per contact
see current limit curve

Technical Data

Switching capacity
to AC 15:
NO contacts: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts: 2 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
NC contacts: 2 A / DC 24 V IEC/EN 60 947-5-1
Electrical contact life
to 5 A, AC 230 V cos φ = 1: > 2.2 x 10^5 switching cycles
Permissible operating frequency: max. 1 200 operating cycles / h
Short circuit strength
max. fuse rating: 10 A gL IEC/EN 60 947-5-1
line circuit breaker: B 6 A
Mechanical life: > 20 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
operation: - 25 ... + 55 °C
storage : - 40 ... + 85 °C
altitude: < 2.000 m
Clearance and creepage distances
Rated impuls voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC IEC/EN 62 061
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 V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance: 25 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire fixing: Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting: DIN rail IEC/EN 60 715
Weight: 220 g (DC unit)

Dimensions

Width x height x depth
LG 5925: 22.5 x 90 x 121 mm
LG 5925 PC: 22.5 x 111 x 121 mm
LG 5925 PS: 22.5 x 104 x 121 mm

UL-Data

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

Nominal voltage U_N: DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity
LG 5925.04/900
Ambient temperature 35°C: Pilot duty B300
8A 250Vac Resistive
8A 24Vdc Resistive or G.P.
Ambient temperature 55°C: Pilot duty B300
4A 250Vac Resistive
4A 24Vdc Resistive or G.P.

LG 5925.02/900, LG 5925.48/900
Ambient temperature 45°C: Pilot duty B300
8A 250Vac Resistive
8A 24Vdc Resistive or G.P.
Ambient temperature 55°C: Pilot duty B300
6A 250Vac Resistive
6A 24Vdc Resistive or G.P.

Wire connection: 60°C / 75°C copper conductors only
Screw terminals fixed: AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw: AWG 20 - 14 Sol Torque 0.8 Nm
AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp: AWG 20 - 12 Sol/Str

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

Standard Type

LG 5925.48/900/61 DC 24 V

Article number:	0063278
• Output:	3 NO contacts, 1 NC contact
• Nominal voltage U_N:	DC 24 V
• Width:	22.5 mm

Ordering Example

LG 5925 ._ _ _ _ /900 /61 DC 24 V

- Nominal voltage
- UL-approval
- Type of terminals
  without indication:
  terminal blocks fixed with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks with screw terminals
- Contacts
- Type

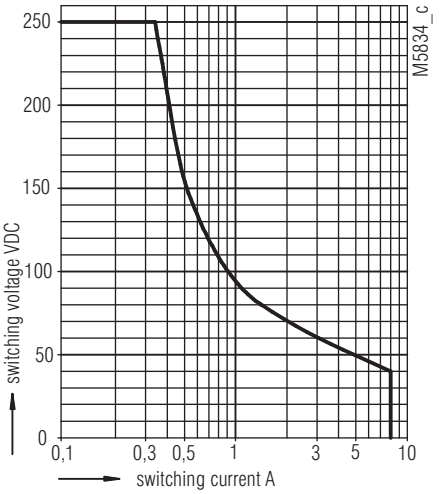
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

Maintenance and repairs

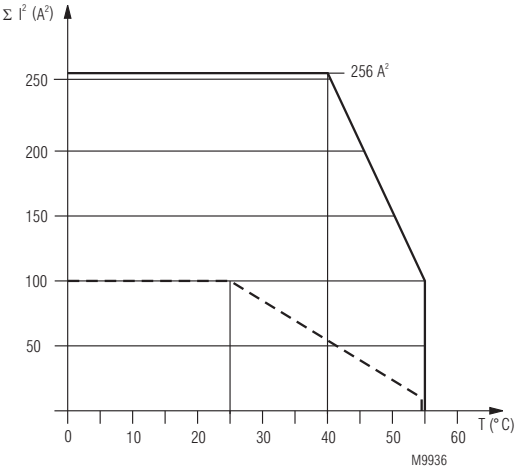
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load



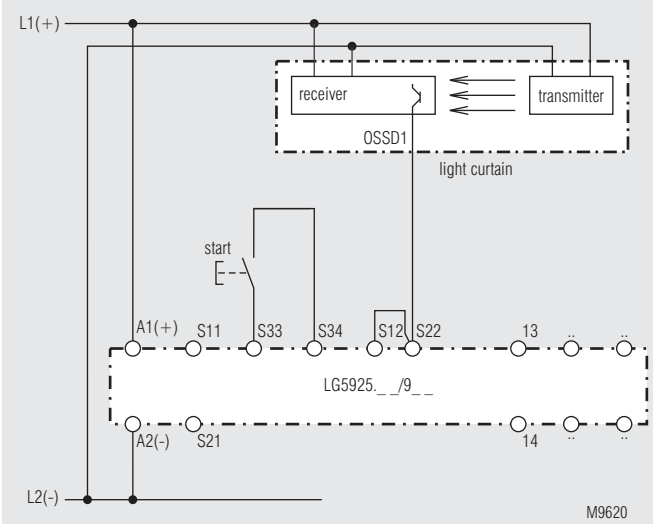
device mounted on distance with air circulation.
max. current at 55°C over
4 contactrows = 5A ≙ 4x5²A²=100A²

device mounted without distance heated by devices with same load,
max current at 55°C over
4 contactrows = 1A ≙ 4x1²A²=4A²

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

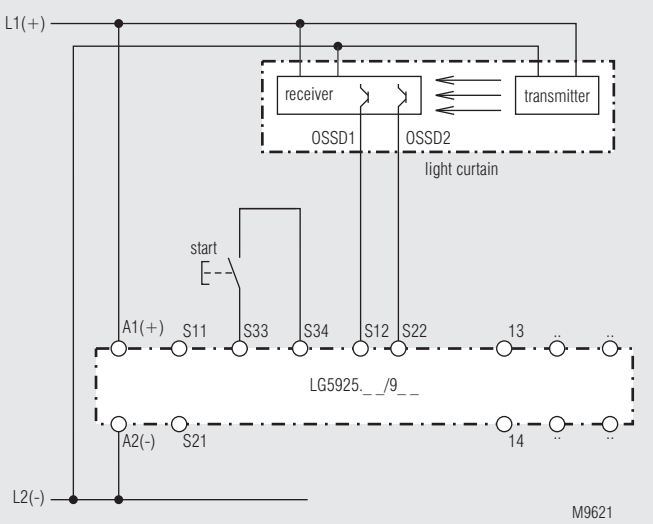
I_1, I_2, I_3, I_4 - current in contactrows

Total current limit curve

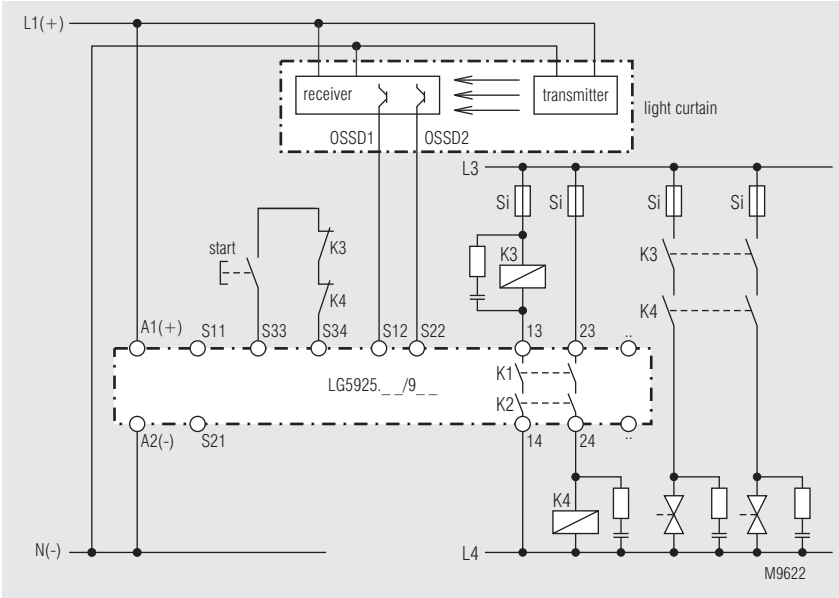


Single channel connection of light curtains with selfttest according to EN 61 496-1.
Note: Refer to "Unit programming"!
Switches in pos.: S1 "symmetrical"
S2 "manual"

When autostart link S33 - S34, S2 set to "automatic".
Suited up to SIL2, Performance Level d, Cat. 2

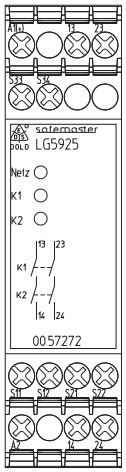
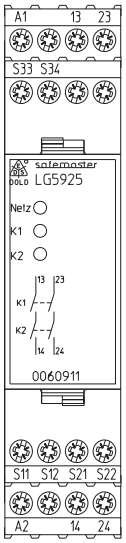
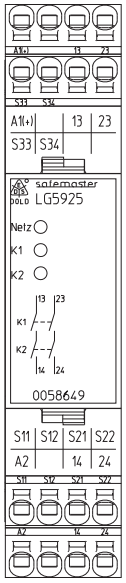
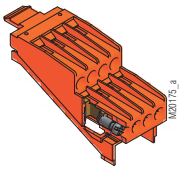
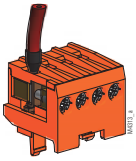
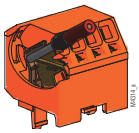
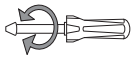
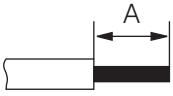
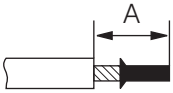
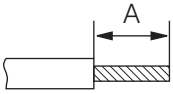


2channel connection of light curtains with selfttest according to EN 61 496-1.
Cross fault detection in the light curtain.
Note: Refer to "Unit programming"!
Switches in pos.:
S1: With symmetric outputs on light curtain switch S1 in position "symmetrical" with asymmetric outputs on light curtains switch S1 in position "asymmetric".
S2: "manual"
Suited up to SIL3, Performance Level e, Cat. 4

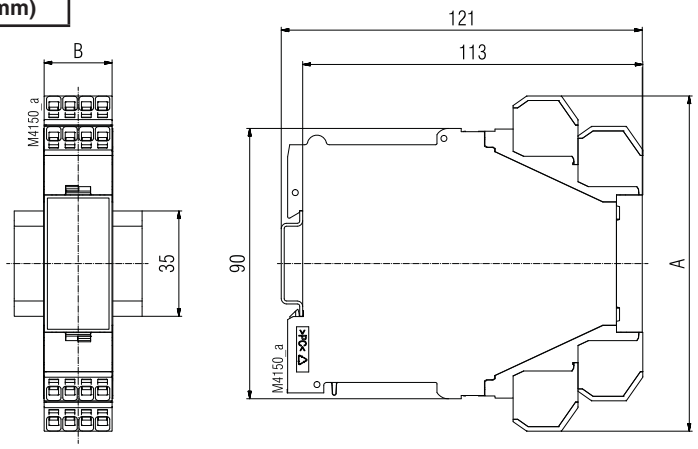


Contact reinforcement and contact extension by external contactors
Note: Refer to "Unit programming"!
Switches in pos.:
Switches in pos.:
S1: With symmetric outputs on light curtain switch S1 in position "symmetrical" with asymmetric outputs on light curtains switch S1 in position "asymmetric".
S2: "manual"
Suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

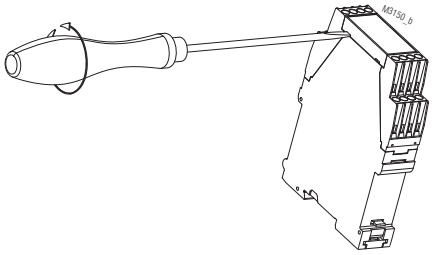
	 M10254	 M10256	 M10255	
		 PS	 PC	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

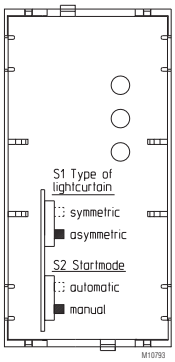
DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5925/900	90	22,5
LG 5925/900 PS	104	22,5
LG 5925/900 PC	111	22,5

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**



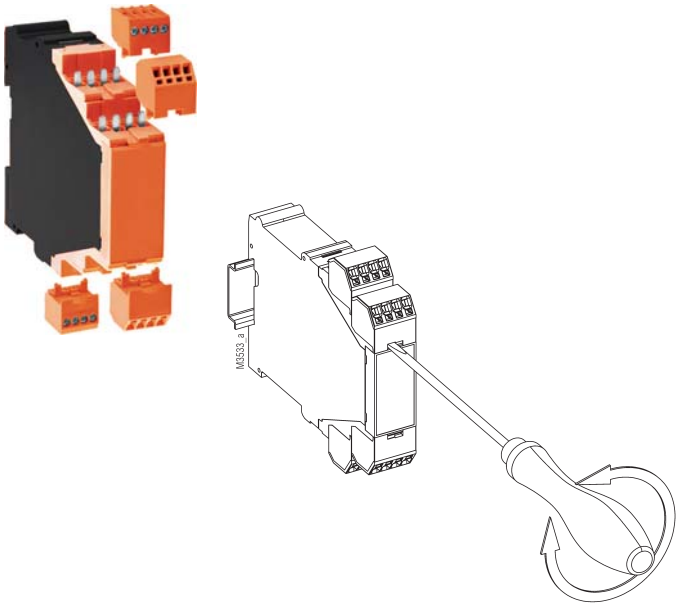


DE	S1 Lichtschrankenausgang ☐ symmetrisch ■ unsymmetrisch
FR	S1 Sortie B.I. ☐ symétrique ■ asymétrique

DE	S2 Start ☐ Auto ■ Hand
FR	S2 Reset ☐ Auto ■ Manu

DE	S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma.

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / Disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers ammovibles PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	216,7	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)

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:	99,0	%
PFH_D:	1,1E-10	h^{-1}
PFD_{AVG}:	8,2E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät im High Demand Mode Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode Consigne résultant de la fonction sécuritaire de l'appareil au High Demande Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

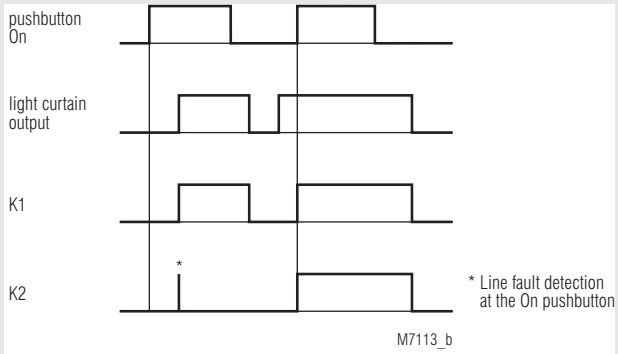
SAFEMASTER
Light Curtain Controller
BG 5925._ _/900

DOLD

0233217

- **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**
- Output: max. 3 NO contacts, see contacts
- Single and 2-channel operation
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- For light curtains with symmetric or asymmetric outputs, selection via S1
- Option: fast auto start
- LED indicator for channel 1 and 2 an power
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 22.5 mm

Function Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 · c UL us LISTED Canada / USA · A025518

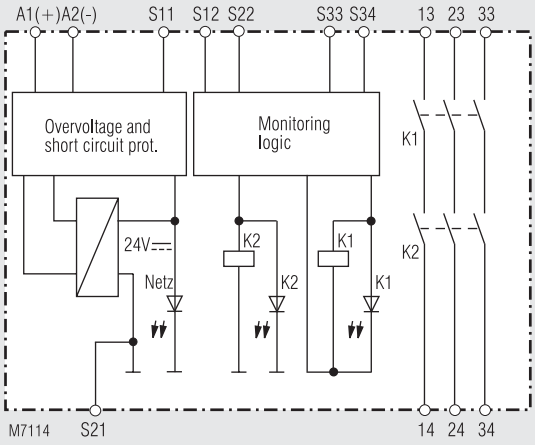
Applications

Protection of people and machines
- switch gear (FSD) for light bars with selftest (type 4) according to IEC/EN 61 496-1

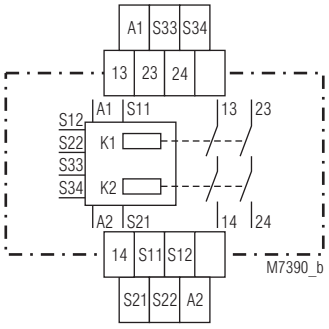
Indicators

upper LED:	on when supply connected
lower LEDs:	on when relay K1 and K2 energized

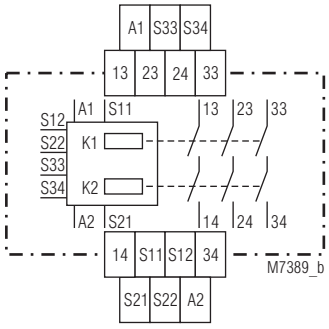
Block Diagram



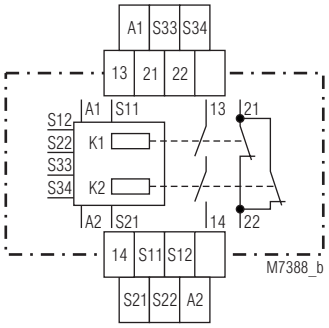
Circuit Diagrams



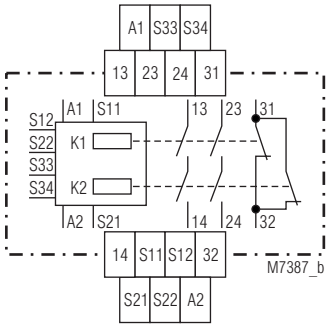
BG 5925.02/900



BG 5925.03/900



BG 5925.16/900

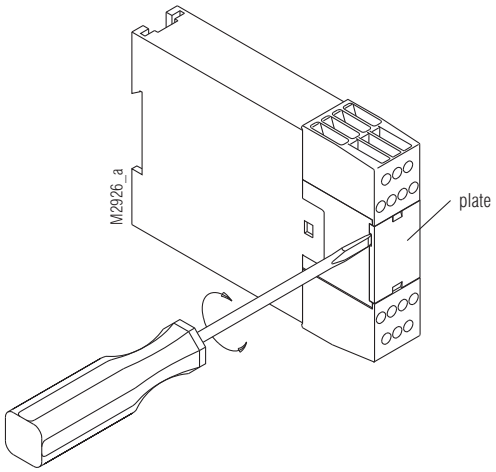


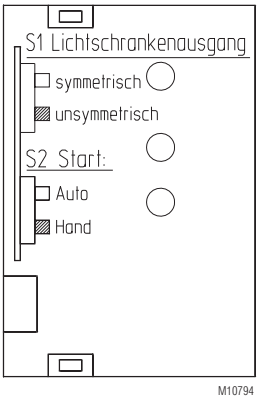
BG 5925.22/900

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S34	Inputs
S11, S21, S33	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
21, 22, 31, 32	Forcibly guided indicator output

Unit Programming





symmetric:
Ligth bars with symmetric outputs

asymmetric:
Light bars with asymmetric outputs

Drawing shows setting at the state of delivery

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S22, the unit will be activated because this line fault is similar to the normal On-function.

When using light curtains with asymmetric outputs (one output + switching, one output - switching) the MINUS switching output has to be connected to S22 and the Plus switching to S12.

The gold plated contacts of the BG 5925 mean that this module is also suitable for switching small loads of 1 mVA - 7 VA, 1 mW - 7 W in the range 0.1 - 60 V, 1 - 300 mA. The contacts also permit the maximum switching current. However since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.

Technical Data

Input circuit

Nominal Voltage U_N:	DC 24 V
Voltage range	DC
at 10% residual ripple:	0.9 ... 1.1 U_N
Nominal consumption:	approx. 2,5 W
Min. Off-time:	250 ms
Control voltage on S11:	DC 23 V at U_N
Control current over S12, S22:	approx. 55 mA at U_N
Min. voltage between terminals S12, S22 and S21:	DC 21 V when relay activated and U_N on A1 - A2
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR

Output

Contacts

BG 5925.02:	2 NO contacts
BG 5925.03:	3 NO contact
BG 5925.16:	1 NO, 1 NC contact
BG 5925.22:	2 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 21-22 or 31-32 can only be used for monitoring.

Operate delay typ. at U_N:	
Manual start:	40 ms
automatic start:	250 ms
BG 5925._ _/901:	100 ms
Release delay typ. at U_N:	
Disconnecting S12, S22:	15 ms
In the case that S22 is not disconnected because of fault:	≤ 200 ms
Contact type:	forcibly guided

Technical Data

Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation	
Switching of low loads:	≥ 100 mV	
(contact 5 µ Au)	≥ 1 mA	
Thermal current I_{th}:	max. 5 A see current limit curve	
Switching capacity		
to AC 15:		IEC/EN 60 947-5-1
NO contact:	AC 3 A / 230 V	
NC contact:	AC 2 A / 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 1 A, DC 24 V:	> 150 x 10^3 switching cycles	
Permissible operating frequency:	max. 1 200 operating cycles / h	
Short circuit strength		
max. fuse rating:	6 A general-purpose	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

Dimensions

Width x height x depth:	22.5 x 84 x 121 mm

UL-Data

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

Nominal voltage U_N:
BG 5925/900, /901: DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity:
Ambient temperature 45°C: Pilot duty B300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.

Ambient temperature 55°C: Pilot duty B300
4A 250Vac Resistive
4A 24Vdc Resistive or G.P.

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BG 5925.02/900/61 DC 24 V
Article number: 0050918
- Output: 2 NO contacts
- Nominal voltage U_N: DC 24 V
- Width: 22.5 mm

Variant

BG 5925._ _ /901/61: unit with fast autostart, switch 2 on "Autostart".
Without line fault detection on ON-button when S2 on "Handstart"

Ordering example for variant

BG 5925 .02 /_ _ _ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: UL-approval
- /_ _ _: Variant, if required
- .02: Contact
- BG 5925: Type

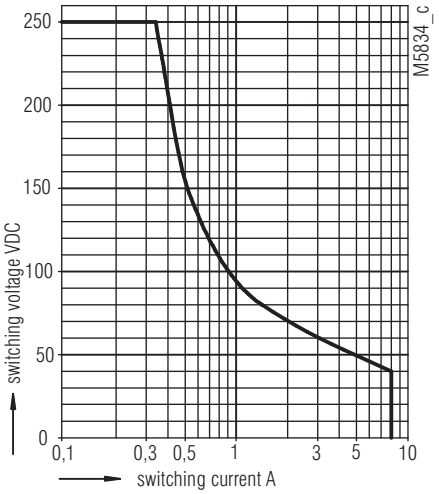
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

Maintenance and repairs

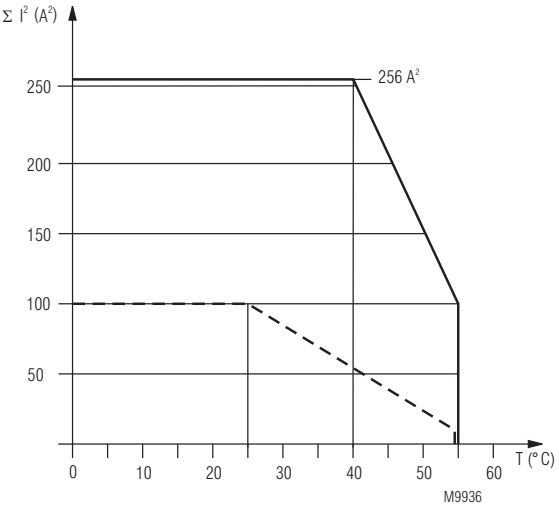
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristic



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load



device mounted on distance with air circulation.
max. current at 55°C over
4 contactrows = 5A ≙ $4x5^2A^2=100A^2$

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

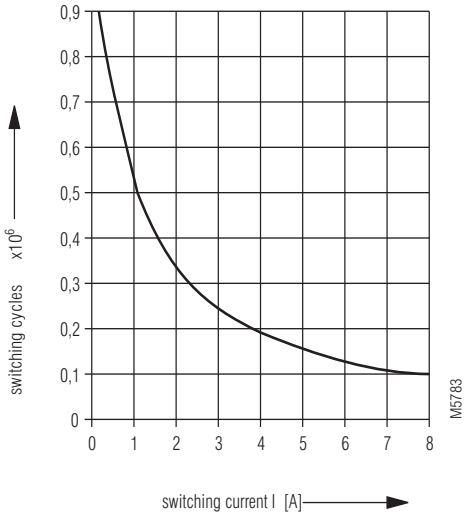
$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$$

I_1, I_2, I_3, I_4 - current in contactrows

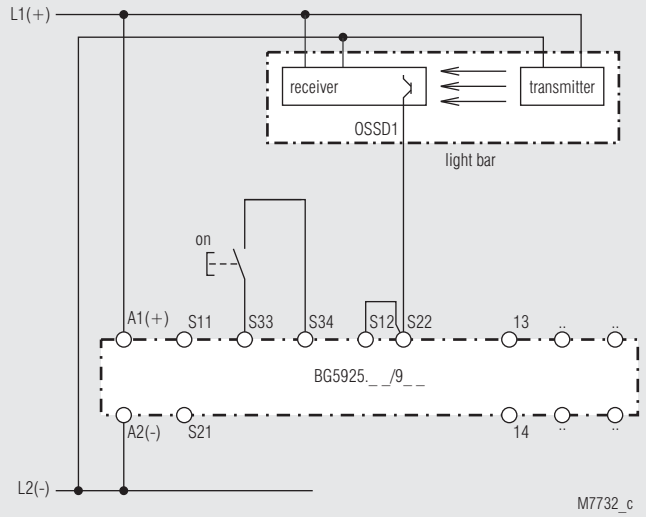
Quadratic total current limit curve

electric life DC13 24V DC / t_{on} 0,4s; t_{off} 9,6s

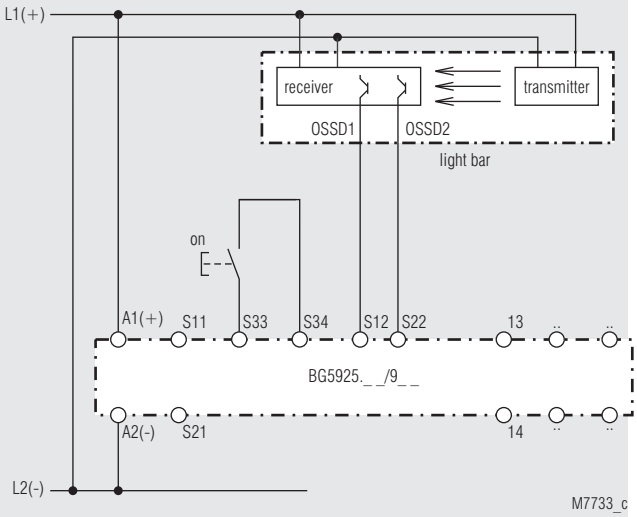
2 contacts in series



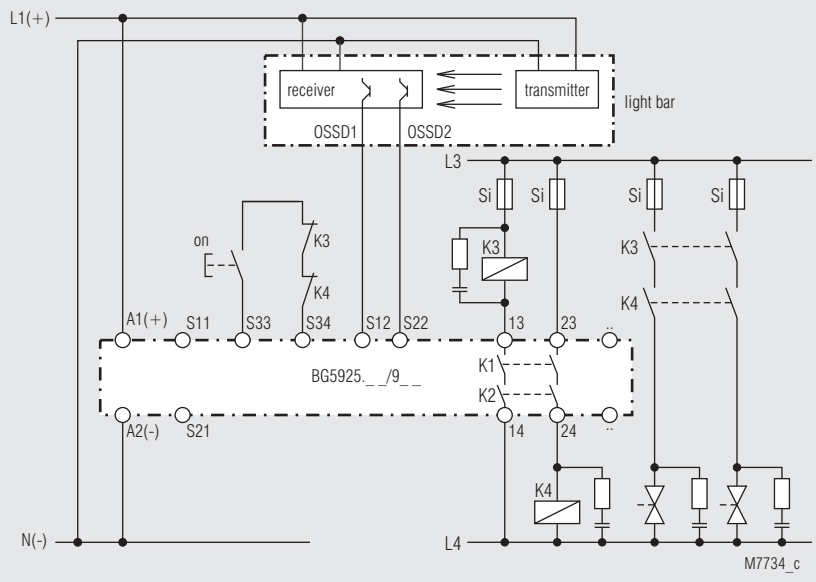
Contact service life



1-channel control by light bar with selftest according to EN 61 496-1
Note: Refer to "Unit programming"!
Switches in pos.: S1: "symmetric"
S2: manual start
Suited up to SIL2, Performance Level d, Cat. 2



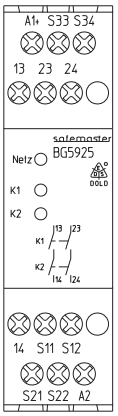
2-channel control by light bar with selftest according to EN 61 496-1.
Crossfault monitoring by light bar.
Note: Refer to "Unit programming"!
Switches in pos.:
S1: On light curtains with symmetric outputs S1 in upper position "symmetric".
On light curtains with asymmetric outputs S1 in lower position "asymmetric".
S2: manual start
Suited up to SIL3, Performance Level e, Cat. 4

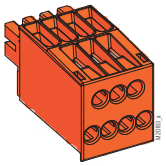


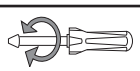
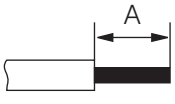
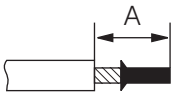
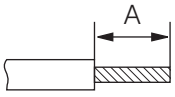
Reinforcement and multiplication of contacts by external contactors
Note: Refer to "Unit programming"!
Switches in pos.:
S1: On line curtains with symmetric outputs S1 in upper position "symmetric".
On line curtains with asymmetric outputs S1 in lower position "asymmetric".
S2: manual start
Suited up to SIL3, Performance Level e, Cat. 4

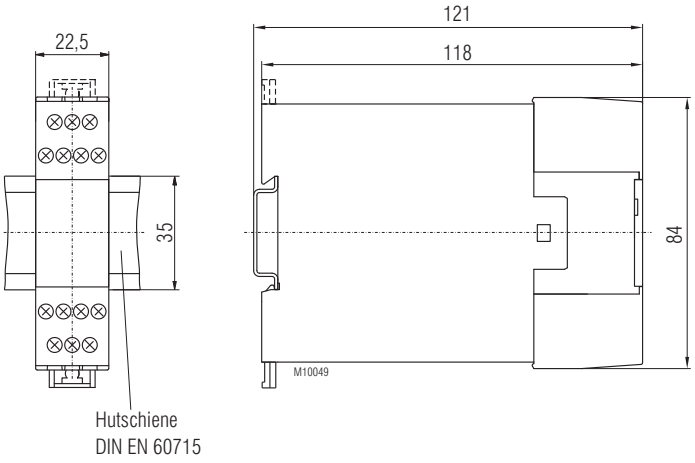
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**

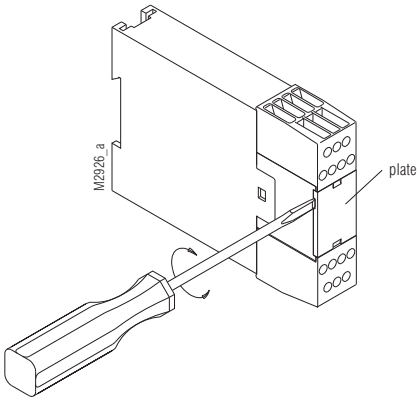


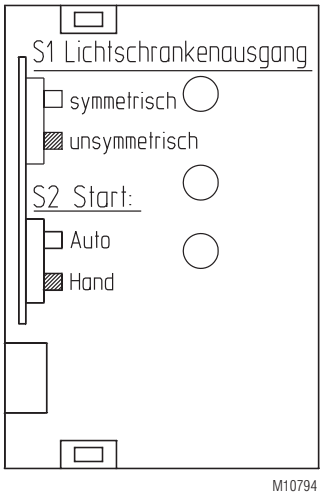


	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16



DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**
IT	**Configurazione del modulo**



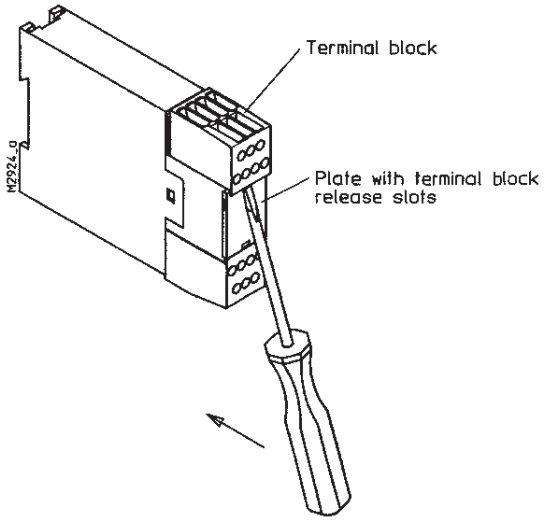


EN	S1 Type of light curtain ☐ symmetric ■ asymmetric
FR	S1 Sortie B.I. ☐ symétrique ■ asymétrique
IT	S1 Barriere ottiche ☐ simmetriche ■ asimmetriche

EN	S2 Start ☐ Automatic ■ Manual
FR	S2 Reset ☐ Auto ■ Manu
IT	S2 Start ☐ Automatico ■ Manuale

DE	**symmetrisch:** Lichtschranken mit symmetrischen Ausgängen **unsymmetrisch:** Lichtschranken mit unsymmetrischen Ausgängen Die Schalterstelllung zeigt den Lieferzustand.
EN	**symmetric:** Ligth bars with symmetric outputs **asymmetric:** Light bars with asymmetric outputs Drawing shows setting at the state of delivery
FR	**symétrique:** barrières lumineuses à sorties symétriques **asymétrique:** barrières lummineuses à sorties asymétriques Appareil livré tel que sur le schéma.
IT	**Senza rilevamento di corto-circuito incrociato:** barriere ottiche con uscite simmetriche **Con rilevamento di corto-circuito incrociato:** barriere ottiche con uscite asimmetriche.

DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	236,3	a (year)
DC_{avg}:	99,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3,60E+03	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	1,97E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzione di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

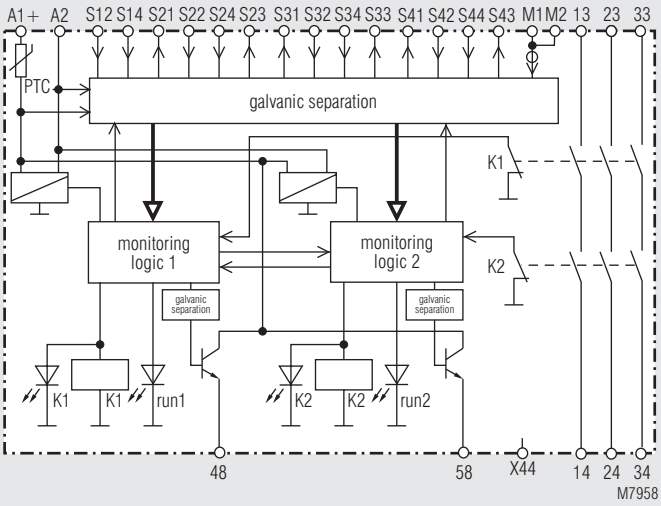
Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Light Curtain Controller With Selectable Operating Modes
BH 5902/01MF2

0237093

Block Diagram



- **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**
  - **Category 4 to EN 954-1**
- To connect max.:
  - 3 light curtains 2-channel or
  - 2 light curtains 2-channel and 2 muting sensors 1-channel or
  - 1 light curtain 2-channel and 4 muting sensors 1-channel or
  - 2 light curtains 2-channel and key switch for stepping operation
  - additionally: Start button and machine contact with line fault detection
- Broken wire detection on light curtain input
- Outputs:
  - 3 NO or 2 NO and 1 NC
  - 2 Semiconductor outputs, protected against short circuit and overload
- Multifunction device, different functions selectable by rotational switches:
  - protective operation e.g. light curtains
  - protective operation with muting, e.g. conveyors
    - * signal sequence of muting sensors can be selected
    - * override function via start button
  - Stepping operation e.g. on presses
    - * optionally with key switch
    - * 1, 2 or 3 steps possible
    - * setting of number of step possible via selector switch
- Suitable to connect light curtains of type 4 or selftesting light curtains type 2 according to IEC/EN 61 496-1, crossfault monitoring in the light curtain
- With under- and overvoltage detection and indication
- Reaction time: max. 30 ms
- LED indication for RUN and Channel 1,2
- Width 45 mm

Approvals and Markings

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

Applications

- Protection of men and machines e.g. presses and conveyors

Indicators

lower green LEDs
K1, K2: - on, when K1 and K2 are energized

upper yellow LED
run 1:
- permanent on, when relay K1 and K2 are energized
- flashes with 1 Hz when the unit waits for the start signal after fault free operation (power up of the unit)
- flashes fast with approx. 3 Hz when the start button is pressed and all conditions for an override are fulfilled during muting
- flashes fast with approx. 3 Hz when at stepping operation the unit waits for interruption of the light curtain
- flashes with failure code to indicate normal indication states that disable the energisation of the output relays (e.g. after not allowed interruption of the light curtain) until the start button is pressed
- flashes with failure code to indicate special failures (e.g. undervoltage)

semiconductor output 48:
- off, when unit is on special failure mode
- normally off when relays K1 and K2 are energized
- continuously on, when unit in muting mode
- shows the same failure codes as LED run 1 (except on special failures)

Indicators

upper yellow LED run 2:
- permanent on, when unit operates correctly
- flashes with failure code to indicate special operation failures (e.g. undervoltage)

semiconductor output 58:
- off, when unit is on special failure mode
- off, when relays K1 and K2 are energized
- symmetric flashing, when a normal functional state is active that disables the energisation of the output relays (e.g. not allowed interruption of a light curtain)
- permanent on, when waiting for start

Notes

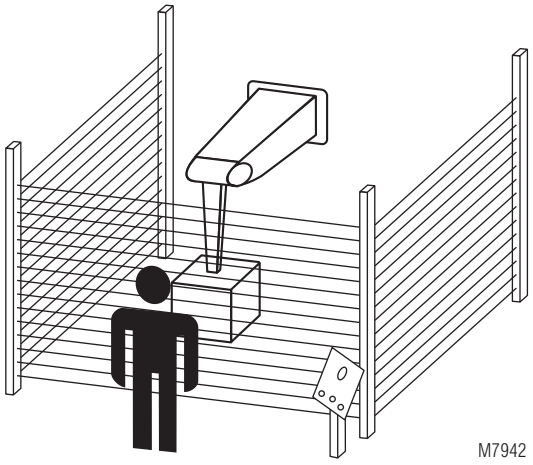
- On BH 5902.22 the NC contact 31-32 must only be used as monitoring contact
- Not suitable for machines where the area behind the light curtain is accessable
- Settings have to be carried out by educated personnel with disconnected power supply

Operation Modes

Protective operation (see Picture 1)
e.g. light curtains to secure dangerous areas
- Connection up to 3 light curtains
- Manual or automatic start possible for each light curtain
- With or without feedback input for external contactors

Possible settings:

			Switch 10: Start mode and feedback input									
			0	1	2	3	4	5	6	7	8	9
			without feedback input					with feedback input				
Switch 1	0	LC 1 LC 2 LC 3	Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)		Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)	
	1	LC 1 LC 2 LC 3	Manu Manu Manu	Manu Auto Manu	Manu Auto Auto			Manu Manu Manu	Manu Auto Manu	Manu Auto Auto		

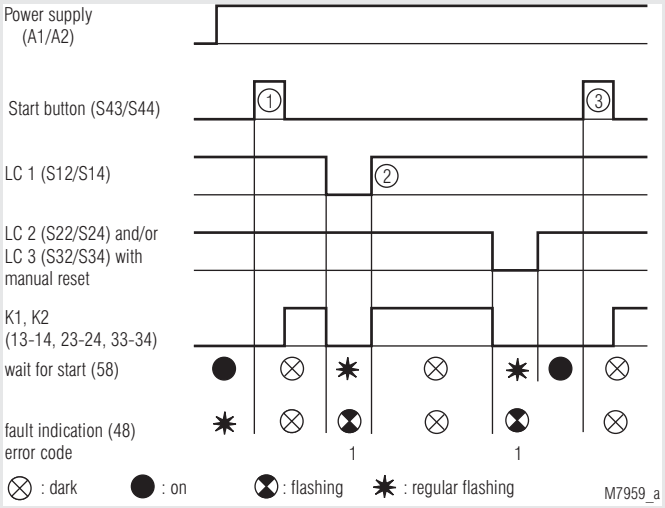


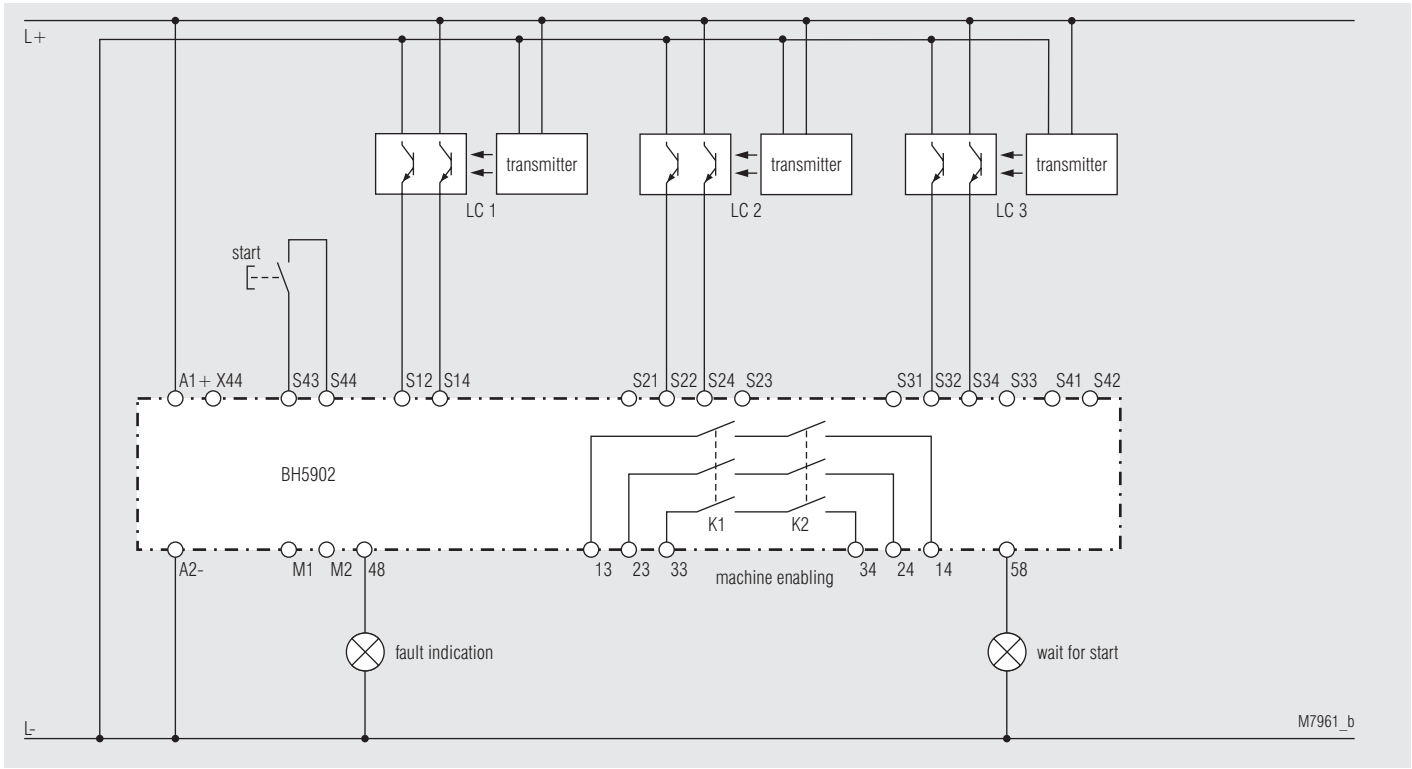
Operation Modes

- **Automatic start**
  On automatic start the contacts K1 and K2 are energized when the light curtain that is set for auto start is free after interruption. It is necessary that the other light curtains with manual start are not interruped.
- **Manual start**
  On manual start the contacts K1 and K2 are energized when the light barrier that is set for manual start is free after interruption and the start button is pressed ③

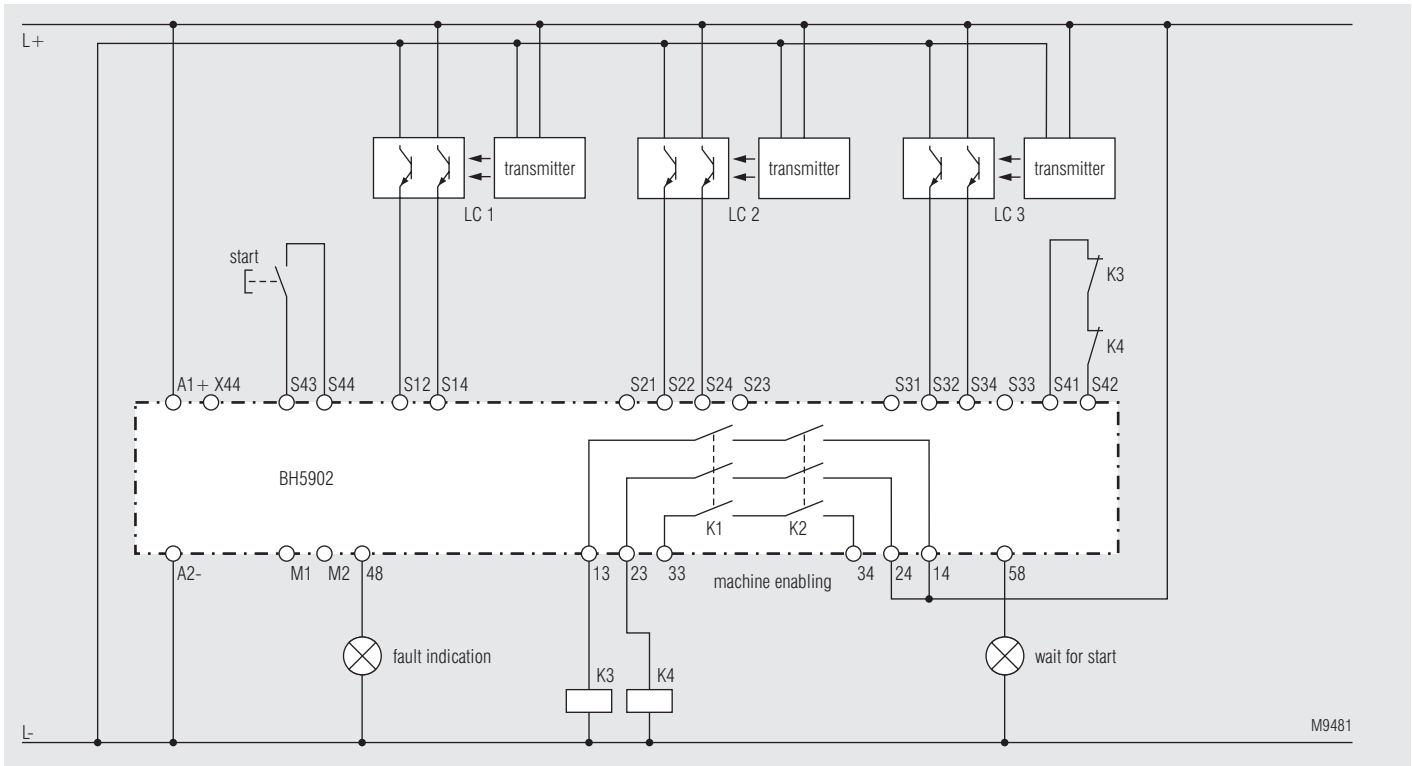
The start button must be activated in 2 conditions:
- after return of the supply voltage ① (when minimum 1 light curtain is programmed for manual start)
- when 1 light curtain with manual start was interrupted ③

Function Diagram





Picture 1: Protective operation with 3 LCs, manual or auto start, setting without feedback input



Picture 2: Protective operation with 3 LCs, manual or autostart, setting with feedback input

Protective operation with muting
e.g. conveyors
- 1 or 2 light curtains
- Muting of light curtain 1
- 2 or 4 muting sensors with different input sequences
- LC1 with auto or manual start
- LC2 always with manual start
- Override via start button
- Manual start is always necessary after supply voltage ist connected

Muting
Muting means to disable temporarily the protective function of a light curtain. This function is used to transport material through a light curtain without stopping the machine. The differentiation between material and persons is done by additional muting sensors which have to create a certain switching sequence together with the light curtain when material passes the light curtain. The muting control starts then the muting cycle for the time the material is passing the light curtain. It must not be possible that a person activates the muting sensors in the same switching sequence as the material. To realise this function 2 different switching sequences can be chosen on BH 5902 either with 2 or 4 muting sensors. This makes sure that if a person passes the light curtain the dangerous movement of the machine is stopped immediately. The muting cycle is indicated by a muting lamp that is controlled and monitored by the BH 5902. The maximum muting time can be set in 10 steps between 10 s and infinite.
If the light curtain is still interrupted after the max. permitted muting time e.g. by blocked material the contacts K1, K2 open and the muting lamp as well as the LED run 1 show failure code 4.

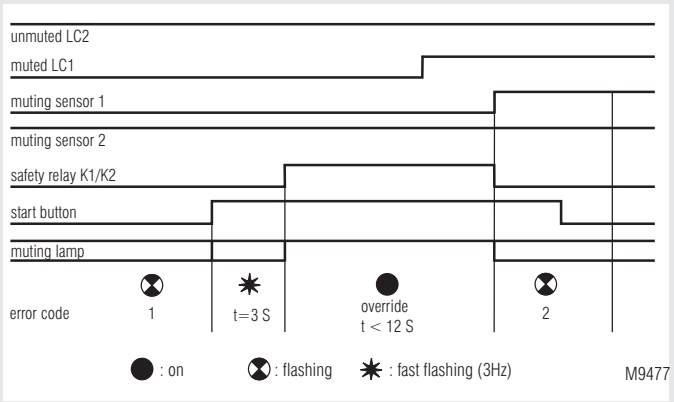
Starting by pressing the start button is only possible if the muting lamp is working and the light curtain to be muted is free of interruption. During the muting cycle a wrong switching sequence or exceeding the maximum muting time leads to failure code 4. This failure can only be reset by pressing the start button. The muting sensors have to be installed in a way, that the correct sequence cannot be achieved manually or by passing the light curtain (see IEC/EN 61 491-1)

Possible settings:

			Switch 10: a = maximum muting time b = maximum synchronising time									
			0	1	2	3	4	5	6	7	8	9
Switch 1	2	LC S1 Auto, muting 2 sensors	a: 10 s / b: 3 s	a: 20 s / b: 3 s	a: 30 s / b: 3 s	a: 1 min / b: 6 s	a: 5 min / b: 30 s	a: 15 min / b: 90 s	a: 30 min / b: 3 min	a: 1 h / b: 3 min	a: 8 h / b: 3 min	no muting time monitoring
	3	LC S1 Manu, muting 2 sensors										
	4	LC S1 Auto, muting 4 sensors										
	5	LC S1 Manu, Muting 4 sensors										

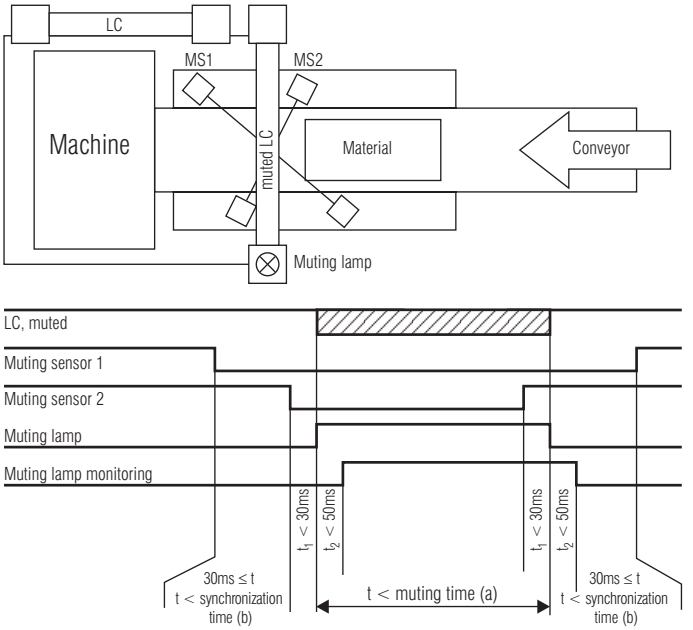
Override
If the monitored area is blocked by transported material and the outputs K1, K2 are switched off, this is indicated by fast flashing (approx. 3 Hz) of the muting lamp. The operator can activate the outputs K1, K2 by pressing the start button for more than 3 s for a maximum time of 12 s until the muting sensor are again inactive or the start button is released again.

Example for an override cycle when muting with 2 sensors

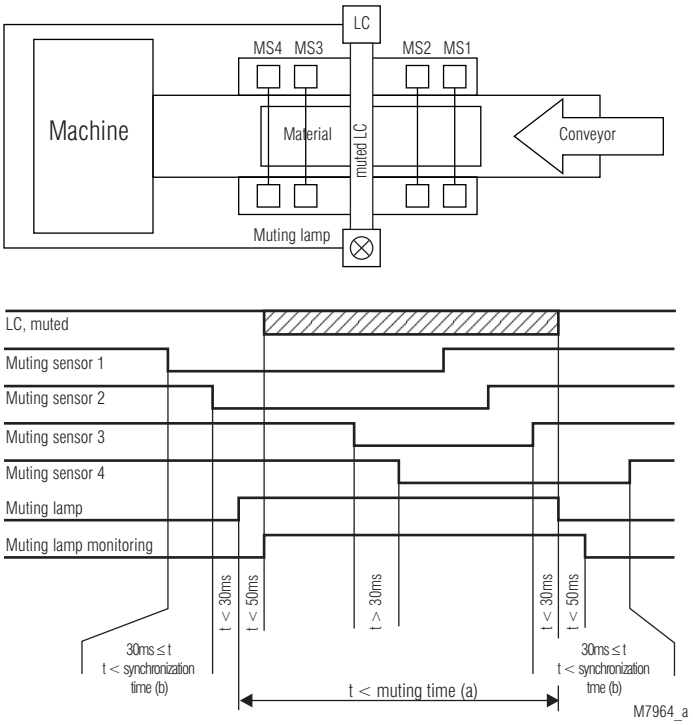


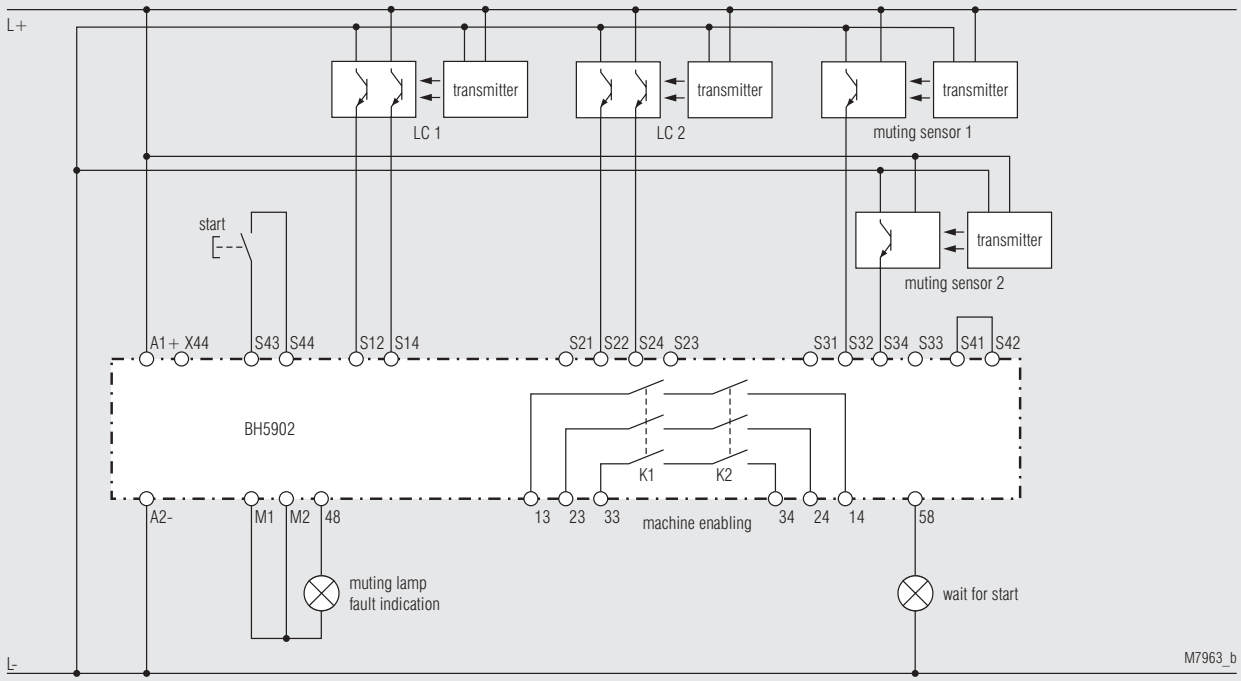
In all function diagrams the part "monitored operation" is the phase where the unit differentiates between men and material.

Using 2 muting sensors

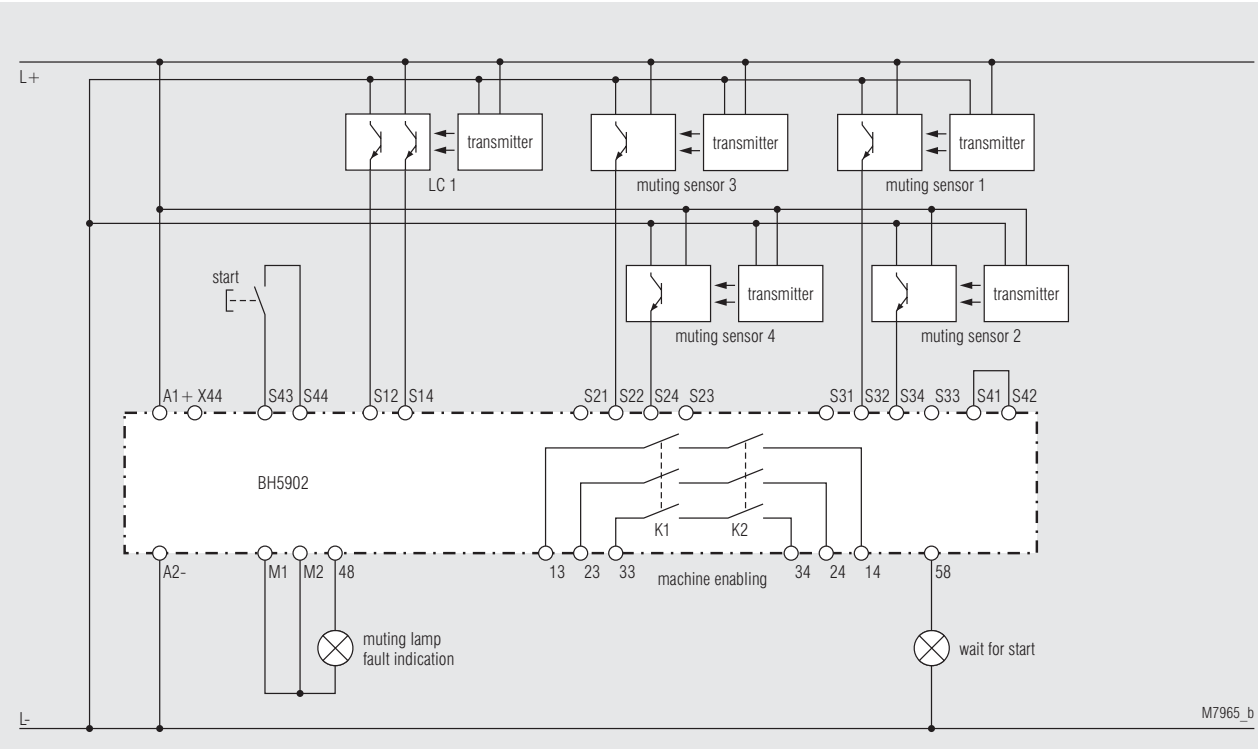


Using 4 muting sensors

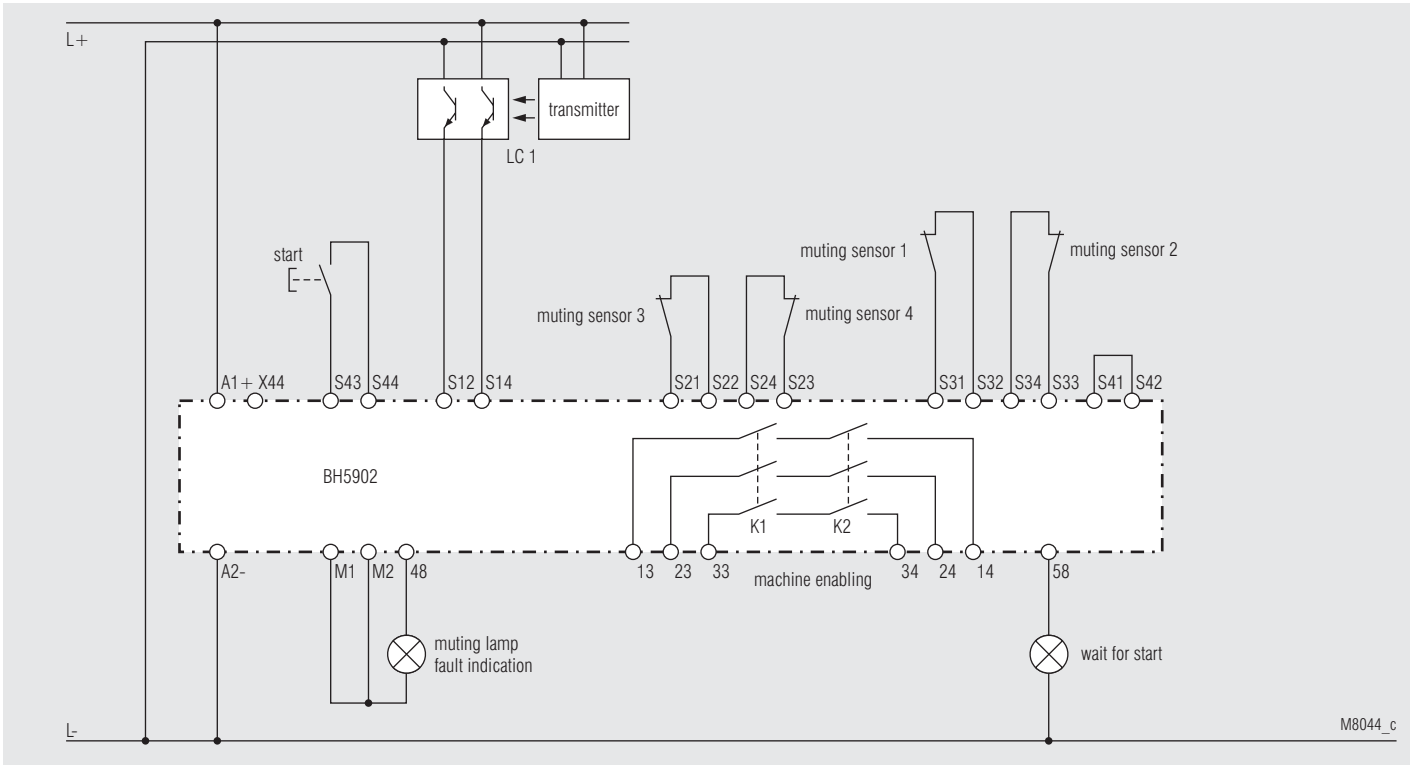




Picture 3: Protective operation with muting a light curtain via 2 muting sensors, 2 light curtains



Picture 4: Protective operation with muting, 1 light curtain, 4 muting sensors



Picture 5: Protective operation with muting via 4 muting sensor contacts

Contact reinforcement
If external relays or contactors are used to reinforce or mulitply the contacts of the safety relays these must be monitored by feeding back one NC contact of each relay/contactor into the start circuit (see application example picture 8).

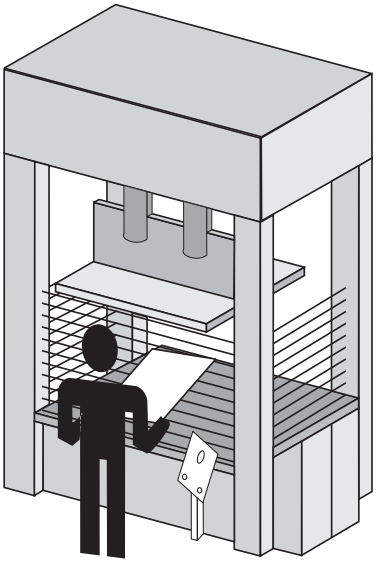
Stepping operation

e.g. Presses with manual operation and automatic start

- Max. 3 light curtains
- LC2 and LC3 always with manual start

Setting functions:

- 1, 2 or 3 steps
- 2 different start sequences
- 2 ways of monitoring the machine contact
- Number of steps fixed or settable with key switch



M7955

Stepping operation enables automatic restart of a machine (Press) after a certain number of accesses into the protected area of the first LC. This Operation consists of start sequence and normal sequence.

Possible settings

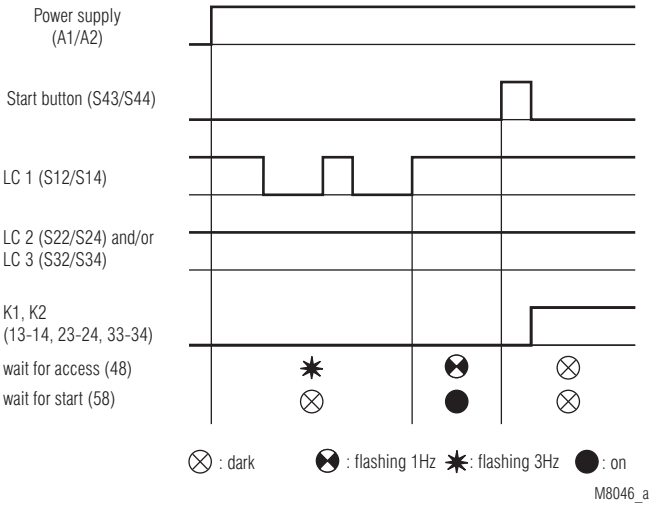
Stepping operation			Switch 10: Number of steps				
			0	1	2	3	4 - 9
Switch 1	6	Stepping operation, contact type 1, Start-sequence: stepping and start	selectable by key switch	1 step	2 step	3 step	not allowed (fault 5)
	7	Stepping operation, contact type 2, Start-sequence: stepping and start					
	8	Stepping operation, contact type 1, Start-sequence: start and stepping					
	9	Stepping operation, contact type 2, Start-sequence: start and stepping					

Start sequence

To enable the machine at start-up on stepping operation 2 different start sequences can be chosen:

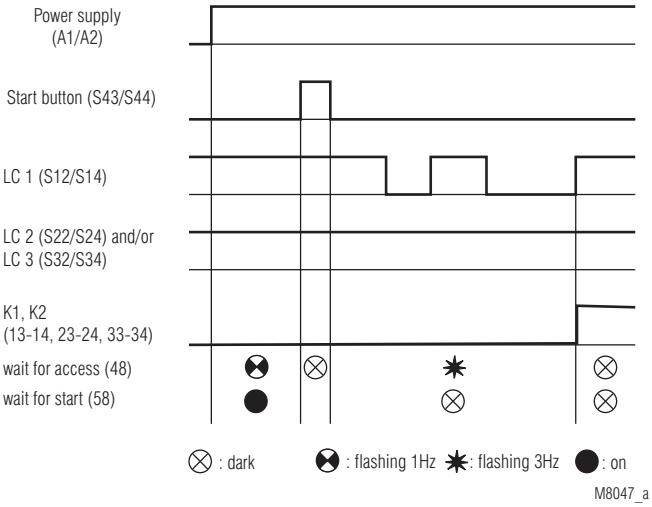
1.) The required number of interruptions of the LC must be completed and then the start button must be pressed.
2.) The start button is pressed first, and after that the required number of interruptions must be completed.

The request to start the operation (e.g. 2 steps according to the diagrams below) is signalled by a flashing lamp (terminal 48). The request to press the start button is signalled by continuous light on a lamp (terminal 58). After finishing the starting sequence correctly the lamps go off and the contact K1 and K2 close.



M8046_a

Start sequence: 2 steps and start button



M8047_a

Start sequence: start button and 2 steps

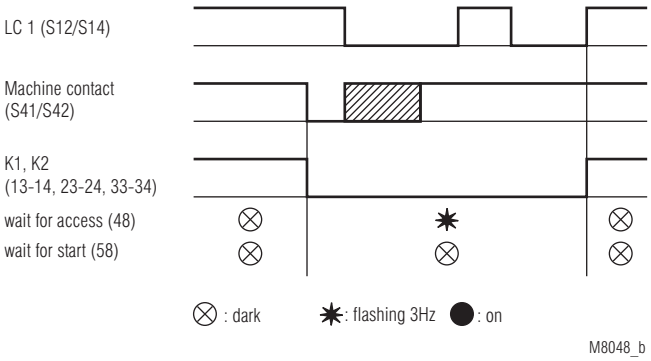
Normal sequence
A correct starting sequence is necessary to run the normal operating sequence. In the normal operating sequence the machine movement is signalled to the light curtain by opening and closing of the machine contact. The output contacts of the BH 5902 are opened when the machine contact opens. After that the operator must interrupt the LC for the required number of times to start again the machine operation. All necessary steps must be completed within 30 s. The demand to access is indicated on fast flashing (3 Hz) output 48. When the required number of interruptions on the LC is completed the lamp goes off and the contacts K1 and K2 close.

Machine contact
To the terminals S41 and S42 of the BH 5902 a machine contact must be connected. It opens and closes depending on the machine movement.

Monitoring of the machine contact
2 ways of monitoring are selectable:

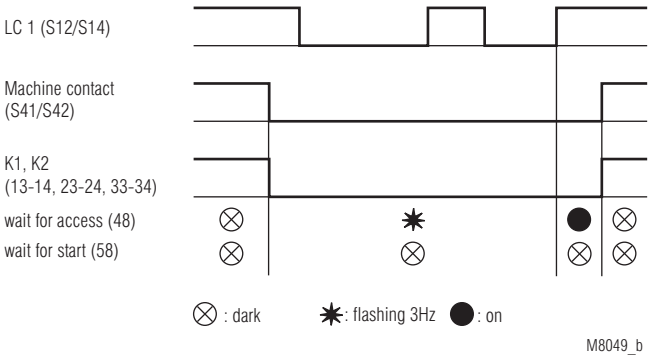
Mode 1
In this mode the access to the LC must only be done when the machine contact has been openend and closed again. An exception is when the access is done while the contact is open and still is going on while the contact closes.

Mode 2
In this mode the accesses are accepted already when the machine contact is open. The machine is only enabled when all the accesses are completed and the machine contact is closed again.



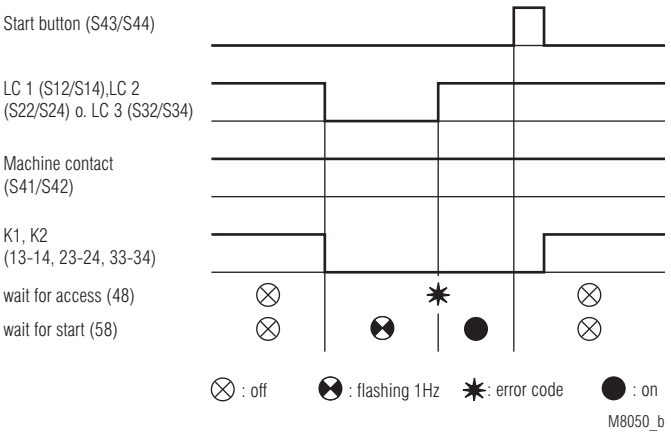
Applictaion: Presses with normal to fast movement

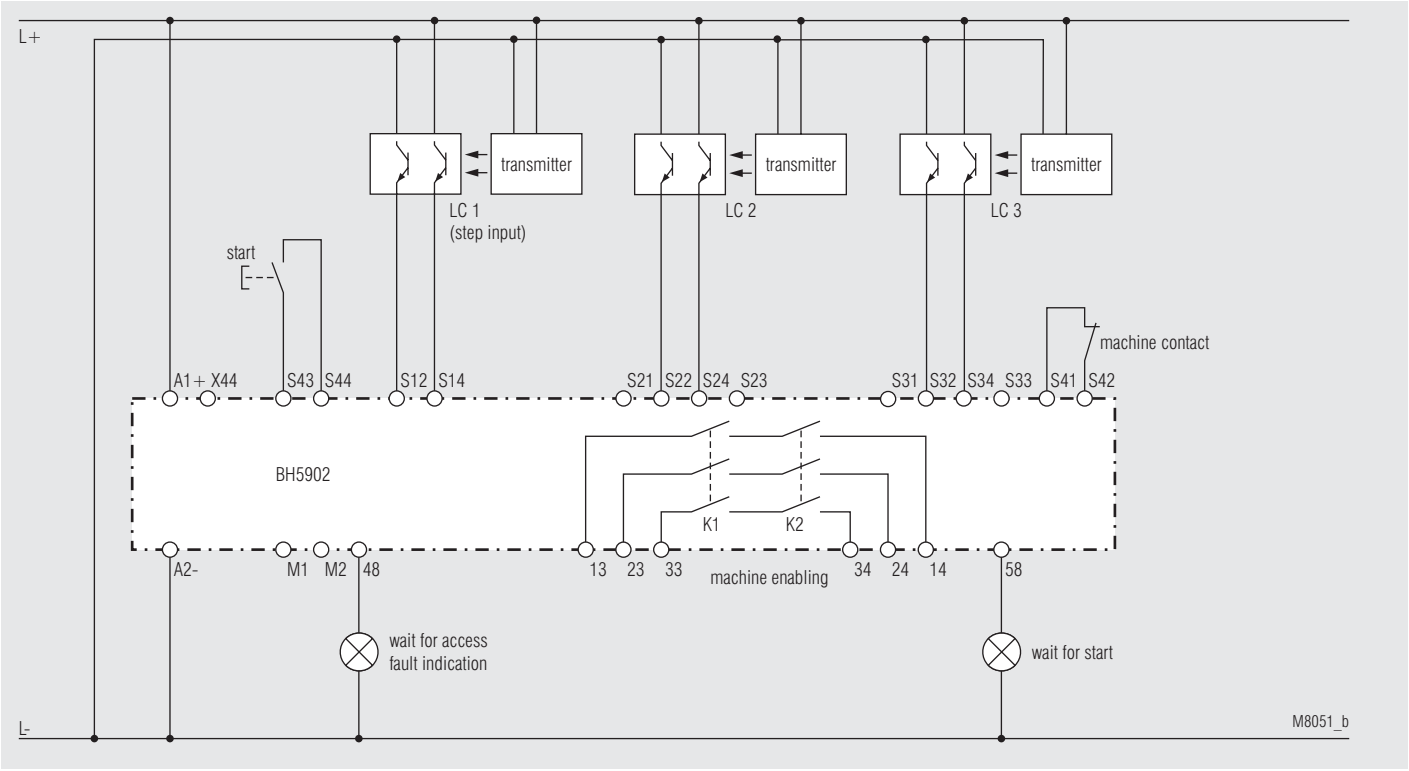
Forbidden access into the light curtain
On forbidden access the lamp (on terminal 58) shows symmetric flashing.



Application: Presses with slow movement

The lamp on terminal 48 flashes with code 1. After finishing the access the lamp on terminal 58 returns to permanent light and signalises, that the machine can be started with the start button.

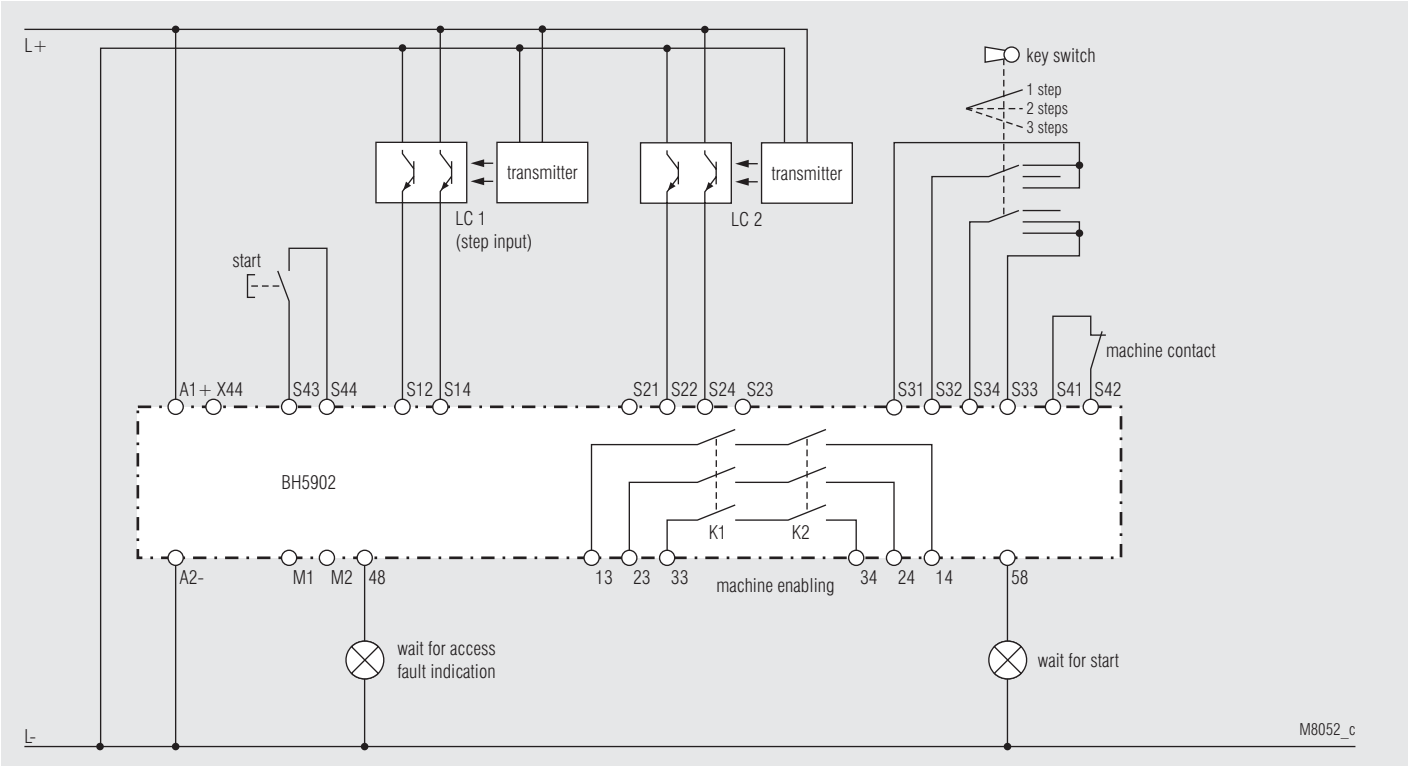




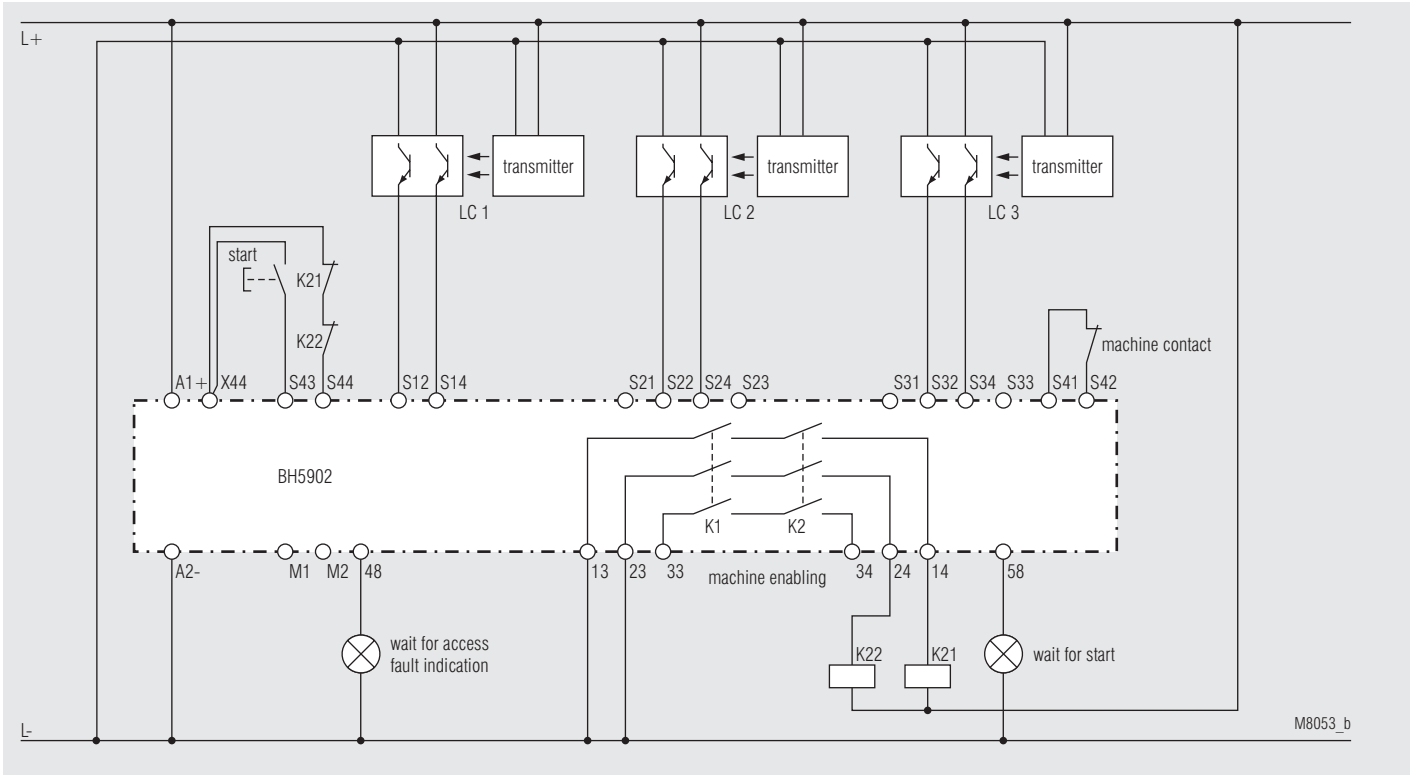
Picture 6: Stepping operation with 3 light curtains

Stepping operation with key switch
e.g. Presses witch changing number of accesses
- selection iwth key switch: 1, 2 or 3 steps

Enable new setting
A changed number of steps is only recognised at standstill (K1 and K2 open).
A new number of steps is signalised by failure indication 3 on the lamp (terminal 48). Pressing the start button will restart the unit. After that the normal start sequence complete swith start button and number of accesses must be completed to enable the machine with the new number of steps.

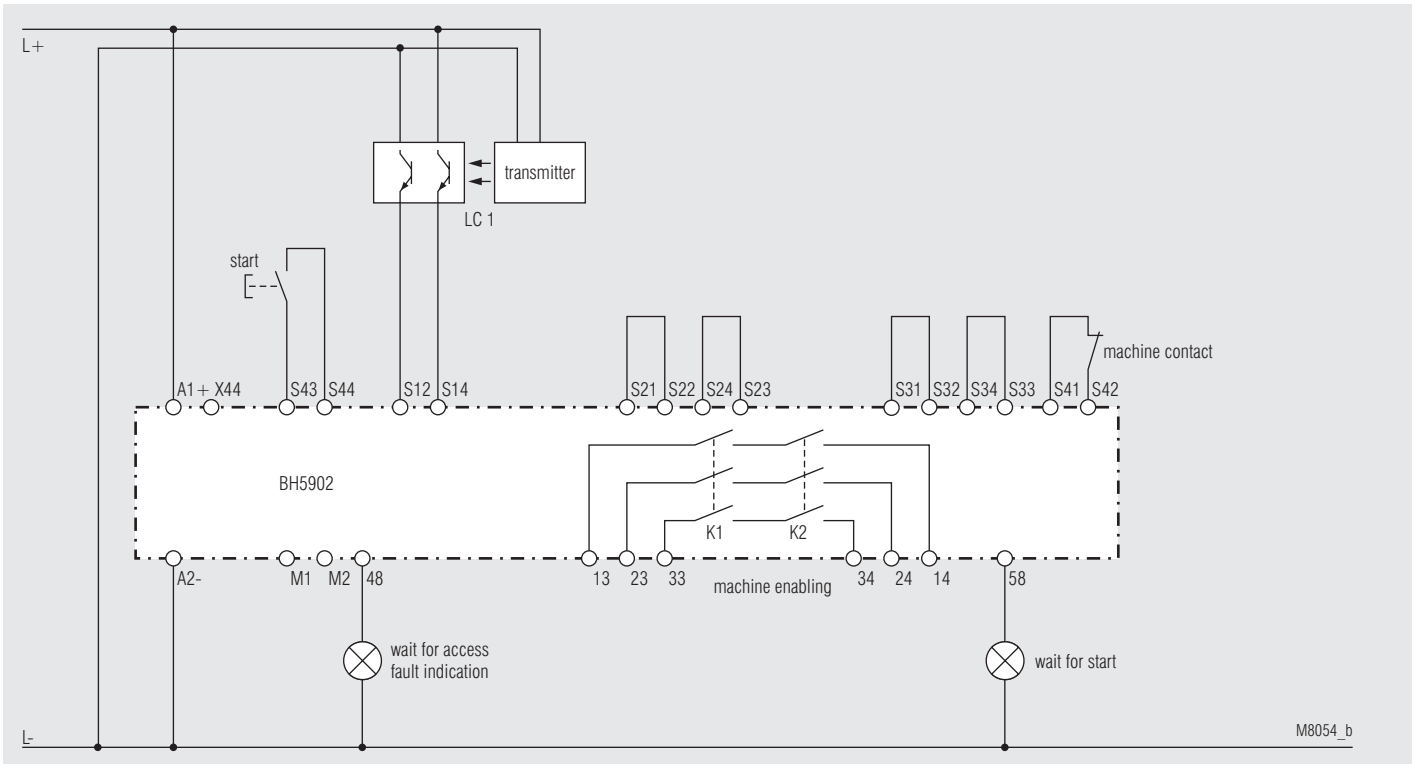


Picture 7: Stepping operation with key switch

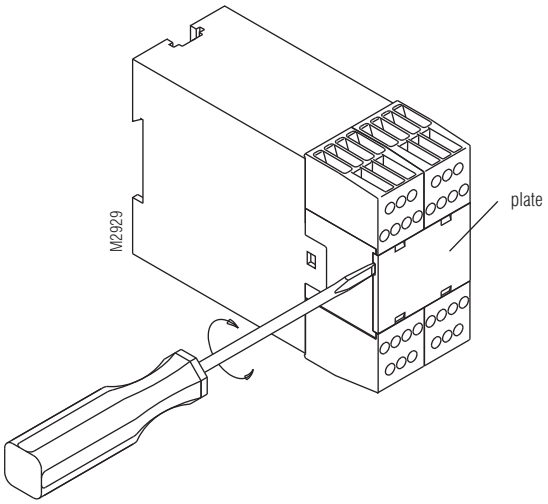


Picture 8: Stepping operation with 3 light curtains and contact reinforcement by external contactors, 2-channel operation (switching of feedback input can also be used at protective operation with muting)

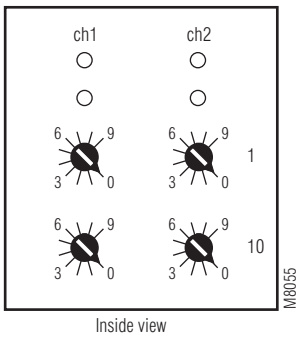
The feed back circuit of the external relays is only tested when the module is started by pressing the push button. When using this circuit the safe function has to be tested in regular intervalls. This can be done by interrupting a light curtain so that a reset requires activation of the start button. activating the module is only possible when all external relays are de-energized.



Picture 9: Stepping operation with one light curtain (with all different operating modes unused inputs must be linked).



Example:
Required function: Protective operation with manual start, with muting, 4 muting sensors, max. 30 s muting time.
Setting:
Upper switches set to "5" for both µprocessors
Lower switches set to "2" for both µprocessors



Inside view

The function setting of BH 5902 is made by 4 rotational switches behind the frontplate (see picture). The switches on the left make the setting for µprocessor 1 (LED run 1) and the switches on the right for µprocessor (LED run 2). For both processors the same functions must be set. On the upper switches (1) the main function is adjusted. On the lower switches (10) the setting of the muting time (Protective operation) or the number of steps (stepping operation) is adjustable.
On muting or stepping function the light curtains LC 2 and LC 3 are always in protective operation with manual start.

Protective operation without muting

			Switch 10: Start mode and feedback input									
			0	1	2	3	4	5	6	7	8	9
			without feedback input					with feedback input				
Switch 1	0	LC 1 LC 2 LC 3	Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)		Auto Manu Manu	Auto Auto Manu	Auto Auto Auto	not allowed (fault 5)	
	1	LC 1 LC 2 LC 3	Manu Manu Manu	Manu Auto Manu	Manu Auto Auto			Manu Manu Manu	Manu Auto Manu	Manu Auto Auto		

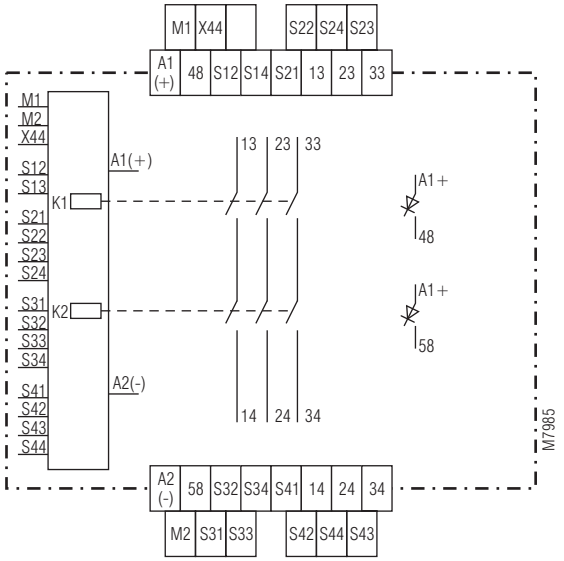
Protective operation with muting

			Switch 10: a = maximum muting time b = maximum synchronising time									
			0	1	2	3	4	5	6	7	8	9
Switch 1	2	LC S1 Auto, muting 2 sensors	a: 10 s / b: 3 s	a: 20 s / b: 3 s	a: 30 s / b: 3 s	a: 1 min / b: 6 s	a: 5 min / b: 30 s	a: 15 min / b: 90 s	a: 30 min / b: 3 min	a: 1 h / b: 3 min	a: 8 h / b: 3 min	no muting time monitoring
	3	LC S1 Manu, muting 2 sensors										
	4	LC S1 Auto, muting 4 sensors										
	5	LC S1 Manu, muting 4 sensors										

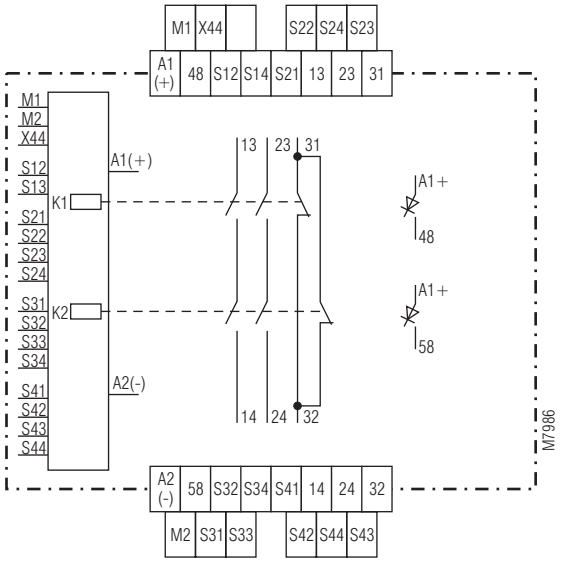
Stepping operation

			Switch 10: Number of steps				
			0	1	2	3	4 - 9
Switch 1	6	Stepping operation, contact type 1, Start-sequence: stepping and start	selectable by key switch	1 step	2 step	3 step	not allowed (fault 5)
	7	Stepping operation, contact type 2, Start-sequence: stepping and start					
	8	Stepping operation, contact type 1, Start-sequence: start and stepping					
	9	Stepping operation, contact type 2, Start-sequence: start and stepping					

Circuit Diagrams



BH 5902.03



BH 5902.22

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S14, S22, S24, S32, S34, S42, S44, M1, M2	Inputs
S21, S23, S31, S33, S33, S41, S43	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
31,32	Forcibly guided NC contacts for release circuit
48, 58	Semiconductor monitoring output
X44	Free junction terminal, volt free

Technical Data

Input

Nominal voltage U_N: DC 24 V
Voltage range:
at max. 5 % residual ripple: 0,85 ... 1,15 U_N
Nominal consumption: max. 170 mA
(no load on semiconductor outputs)
Control voltage on S21, S23, S31, S33, S41, S43, S48, S58: DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, S44: each 4,5 mA at U_N
Min. voltage on terminals S12, S14, S22, S24, S32, S34 S42, S44: DC 16 V
Short circuit protection: internal with PTC
Min. current on M1, M2: 25 mA with active lamp

Output

Contacts
BH 5902.03: 3 NO contacts
BH 5902.22: 2 NO, 1 NC contacts
The NC contact must only be used as monitoring contact !
Contact type: Relay, forcibly guided
Operate delay typ. at U_N:
Manual start: max. 50 ms
Automatic start: max. 1,5 s
Automatic restart: max. 55 ms
Release delay (reaction time): max. 30 ms
(max. 50 ms when failure on LC and only one input channel de-energises)
Output voltage: AC 250 V
DC: see Limit curve for arc-free operation
Switching of low loads: ≥ 100 mV
Thermal current I_{th}: 5 A
Switching capacity
to AC 15:
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 at 0,1 Hz: 8 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 2 A, AC 230 V: 10^5 switching cycles IEC/EN 60 947-5-1
Permissible switching frequency: max. 1 200 switching cycles / h
Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
line circuit breaker: C 8 A
Mechanical life: 10 x 10^6 switching cycles

Semiconductor Outputs

Output (terminal 48 and 58): Transistors, plus-switching
Output voltage: DC 24 V,
max. 100 mA continuous current,
max. 400 mA for 0,5 s internal short circuit, overtemperature and overload protection

General Data

Operating mode: Continuous operation
Temperature range
operation: ± 0 ... + 50 °C
storage : - 25 ... + 85 °C
altitude: < 2.000 m
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
(according to test degree 3)
HF irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients:
on wires for power supply A1-A2: 2 kV IEC/EN 61 000-4-4
on wires for signals and control: 2 kV IEC/EN 61 000-4-4

Technical Data

Surge voltages 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	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	according to IEC/EN 61 496-1 (1997) the unit has to be installed in a housing with protection degree 54.	
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	according to IEC/EN 61 496-1 (1997) Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Shock resistance:		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per axis on 3 axis	
Climate resistance:	0 / 050 / 04 IEC/EN 60 068-1	
Terminal designation:	EN 50 005	
Wire connection:	1 x 2,5 mm² stranded ferruled or 1 x 4 mm² solid or 2 x 1,5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Terminal screws M 3,5 Box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	320 g	

Dimensions

Width x height x depth:	45 x 84 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
$MTTF_d$:	31.5	a
DC / DC_{avg}:	98.9	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	144	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	98.9	%
SFF	99.6	%
PFH_D:	7.80E-09	h^{-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"

Nominal voltage U_N:	DC 24 V
Ambient temperature:	0 … +50°C
Switching capacity:	
Ambient temperature 50°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Semiconductor outputs:	24Vdc, 100 mA
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BH 5902.03/01MF2/61 DC 24 V

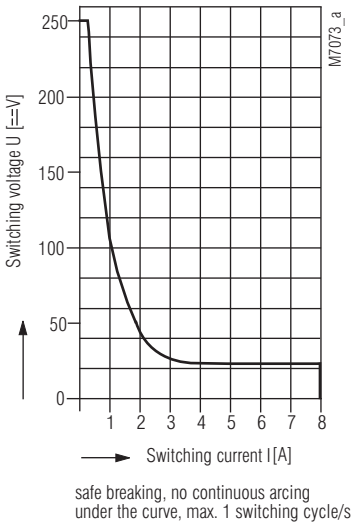
Article number:	0053847
• Output:	3 NO contacts
• all functions settable via rotational switches	
• Nominal voltage U_N:	DC 24 V
• Width:	45 mm

Ordering Example

BH 5902 . _ _ /01MF2/61 DC 24 V

- DC 24 V: Nominal voltage
- . _ _: Contacts
  - .03: 3 NO contacts
  - .22: 2 NO, 1 NC contacts
- BH 5902 . _ _ /01MF2/61: Type

Characteristic



safe breaking, no continuous arcing under the curve, max. 1 switching cycle/s

Arc limit curve

Flashing Codes For Status And Failure Indication

When a failure is detected the relays K1, K2 are de-energized.
The different failures are indicated by different flashing codes on the LEDs run 1 and run 2. The failures are split into 2 groups.

Failure group 1:
System failure
On occurrence of such a failure the unit locks out and shows the failure code, the module can only be reset by switching the unit off and on again. These failures are only indicated on LEDs run 1 and/or run 2. At the same time 2 different codes can be indicated on the 2 LEDs. The outputs (48 and 58) are always off in this state.

Failure group 2:
Function failure
These failure codes are only displayed on LED run 1 and output 48 while LED run 2 remains on permanently.
The relays K1, K2 are de-energized in this state, the module is still active and the relays can be activated by pressing the start button after the failure has been removed.

System failure: (indicated only on LEDs run 1 and/or run 2)

No.*)	Description	Measures and notes
0	internal failure (LEDs off)	If both LEDs are off the relay is defective and has to be sent back for examination.
5	Faulty setting	1) The switches on both channels are not identically 2) The selected setting is not allowed.
6	Undervoltage detection	Left LED is flashing when the voltage drops under the allowed level (< approx. 0.85 UN). After returned to normal a reset is made (similar to power up of the unit).
6	Overvoltage detection	The right LED is flashing when the voltage rises over the allowed level of > approx. 1,15 UN + 5 % residual ripple.
7	Input failure	1) A short circuit occurred on the start button or machine contact input.2) 2) Both signals of one LC are not identically (short circuit, broken wire of defective LC)
8	Failure on output contacts K1, K2	Please check the output K1, K2 circuit and contact current, relay has to be repaired.
9 10 11	Internal failure	Please try to evaluate the circumstances that led to this fault and check with the supplier or manufacturer.
12 13	Internal failure	The relay has to be repaired.

*) No.: number of flash pulses in a series

Flashing Codes For Status And Failure Indication

Function failure: indication on LED run 1 and output 48

No.*)	Description	Measures and notes
1	LC failure	1) One LC has been interrupted. 2) All LC inputs that are not used must be bridged: LC 2: S21-S22, S23-S24 LC 3: S31-S32, S33-S34
2	Failure on start button	1) During start up of the unit and initialising the start button must not be pressed 2) The start button must not be pressed longer than 3 s.
3	Protective operation failure in feed back circuit	1) An operating mode with feed back circuit ist selected and and the circuit connected to S41-S42 is not closed before activation of K1, K2.
3	Stepping operation contact failure	1) The machine contact is not closed in initial position (waiting for start) 2) With contact type 1 the machine contact was not closed at the end of the required first interruption of the light curtain.
4	Muting failure (blocked LC)	1) The selected max. muting time had been exceeded (muting lamp on).
4	Muting failure (lamp)	2) The muting lamp is not connected between terminals 48 and M1 and M2. 3) The necessary bridge is not connected between terminal S41-S42.. 4) The muting lamp is defective. 5) The measuring circuit for the muting lamp is defective, the unit has to be repaired.
5	Stepping operation (key failure)	1) Both contacts of the key switch to select the number of steps are open

*) No.: number of flash pulses in a series

Status indication

run 1 and output 48 are flashing fast with 3 Hz	
Muting operation: Override possible	Minimum one muting sensor is active, LC 1 is interrupted and the start button is pressed. After 3 s with activated start button the override is started for max. 12 s.
Stepping operation: Wait for access	The unit is waiting for the required number of interruptions of the LC so that the safety relays can be activated.

SAFEMASTER
Two-Hand Safety Relay
BG 5933, BH 5933

0230733


BG 5933


BH 5933

Your Advantage

- Compact, ready to connect 2-hand safety circuit
- Cost reduction by replacing conventional contactor circuits
- Feedback circuit Y1 - Y2 to monitor external contactors used for reinforcement of contacts
- EC-type examinated circuit according to the requirements of the health and safety authorities

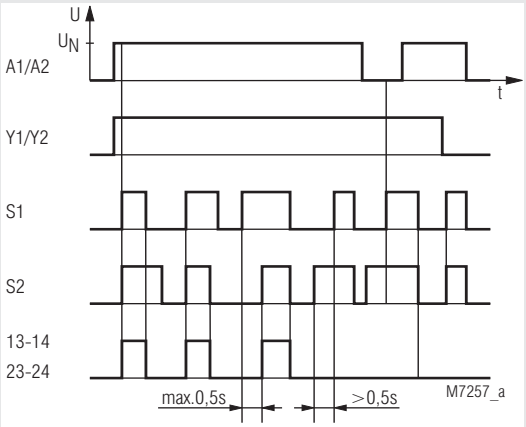
Features

- **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**
  - **Safety Level Type III-C according to EN 574**
  - **the safety regulations for two-hand controls on power-operated presses in metalworking ZH 1-456**
- Inputs for 2 push buttons with 1 NC and 1 NO contact
- Output: 2 NO contacts, 1 NC contact or
  3 NO contacts, 1 NC contact
- Overvoltage and short circuit protection
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- BG 5933: width 22.5 mm
  BH 5933: width 45 mm

Product Description

The BG 5933 or BH 5933 enables and disables a safety circuit in a safe way. It is used to protect people and machines in applications with 2-hand buttons on presses for metal products as well as for other production machinery with dangerous closing movements.

Function Diagram



1.) "S1, S2 activated" means, NC open and NO closed
2.) activated S1, switches "+"-potential
3.) activated S2, switches "-"-potential

Approvals and Markings

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

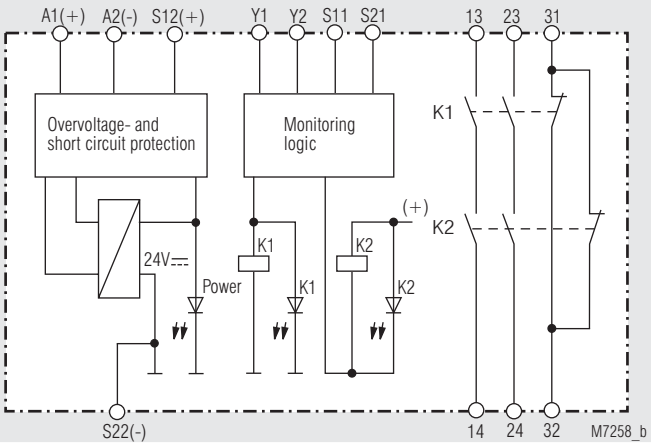
Applications

Designed for press controls in metalworking as well as in other working machines with dangerous closing movements.

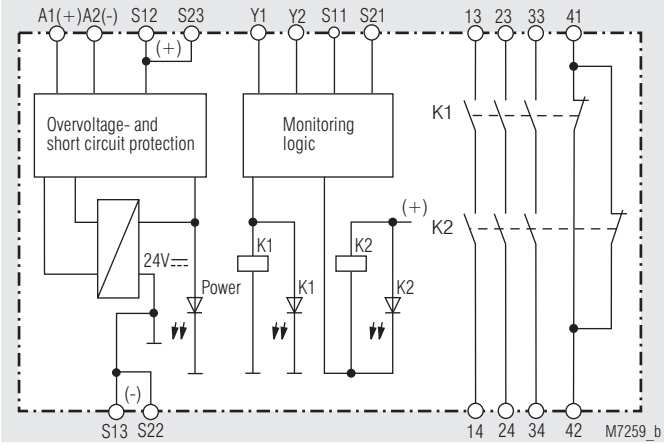
Indication

LED power-supply:	on, when operating voltage applied
LED K1:	on, when relay K1 active
LED K2:	on, when relay K2 active

Block Diagram

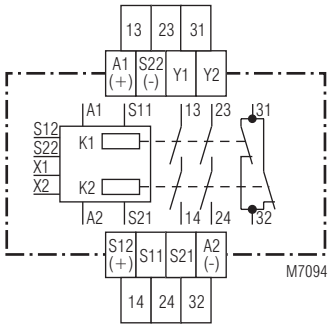


BG 5933

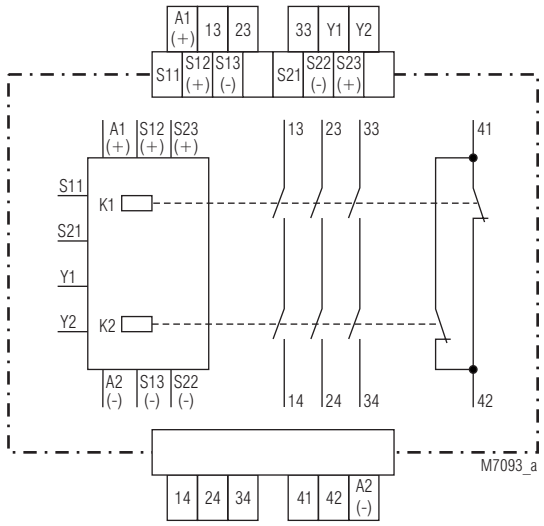


BH 5933

Circuit Diagrams



BG 5933.22



BH 5933.48

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S11, S21, Y1, Y2	Inputs
S12(+), S13(-), S22(-), S23(+)	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
31, 32, 41, 42	Forcibly guided indicator output

Notes

If both buttons are pressed while switching on the operating voltage (e.g. after voltage failure) the output contacts do not energize.
The terminal S22 also serves as reference point for checking the control voltage.
On BG 5933 there is only one terminal S12 and S22.

Set-Up Instructions

The device has to be connected as shown in the application examples. When connecting the push-buttons in parallel or in series the safe function of the relay is disabled. Connected contactors (relays) must have forcibly guided contacts and have to be monitored in the feedback circuit.
To start a dangerous movement, 2 push buttons are used, each equipped with 1 NO and 1 NC contact. The output contacts will be switched if both push buttons are operated within ≤ 0.5 s. The buttons must be designed and installed in a way, that it is not possible to manipulate or to operate them without intention.
The distance between push buttons and dangerous area must be chosen in a way that it is not possible to reach the dangerous area after release of one button before the dangerous movement comes to standstill.

The safety distance "s" is calculated with the following formula:
s = v x t + C

a) moving speed of person v = 1 600 mm/s
b) stopping time of the machine t (s)
c) Additional safety distance C = 250 mm

If the risc of accessing the dangerous area is prohibited while the push buttons are pressed e.g. by covering the buttons, C can be 0. The minimum distance has to be in this case 100 mm. See also EN 574.

Technical Data

Input

Nominal voltage U_N:	
BG 5933:	AC 24 V; DC 24 V
BH 5933:	AC 24, 42, 48, 110, 120, 127, 230, 240 V DC 24 V
Voltage range:	AC 0.85 ... 1.1 U_N
at 10 % residual ripple:	DC 0.9 ... 1.1 U_N
Nominal consumption:	AC approx. 4 VA DC approx. 2.3 W
Nominal frequency:	50 / 60 Hz
Delay time for simultaneity demand:	max. 0.5 s
Recovery time:	1 s
Control contacts:	2 x (1 NO, 1 NC contacts)
Current via control contacts with DC 24 V:	
NO contact:	typ. 50 mA
NC contact:	typ. 20 mA
Fuse protection:	internal with PTC
Overvoltage protection:	by MOV

Output

Contacts:	
BG 5933.22:	2 NO, 1 NC contacts
BH 5933.48:	3 NO, 1 NC contacts

The NO contacts are safety contacts.
The NC contacts 31-32 and 41-42 can only be used for monitoring.

Operate time:	typ. 40 ms	
Release time:	typ. 15 ms	
Contact type:	relay, forcibly guided	
Nominal output voltage:	AC 250 V DC: see continuous current limit curve	
Switching of low loads:	≥ 100 mV	
(contacts with 5 µ Au)	≥ 1 mA	
Thermal current I_{th}:	max. 5 A (see continuous current limit curve)	
Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 2 A, DC 24 V:	> 1.5 x 10^5 switching cycles	
Permissible switching capacity:	max. 1 800 switching cycles / h	
Short circuit strength max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range		
operation:	- 25 ... + 55°C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 62 061	
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:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Terminal screws M3.5 Box terminals with self-lifting wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
BG 5933:	200 g	
BH 5933:	400 g	

Dimensions

Width x height x depth	
BG 5933:	22.5 x 84 x 121 mm
BH 5933:	45.0 x 84 x 121 mm

UL-Data

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

Nominal voltage U_N:	
BG 5933:	AC 24V , DC 24 V
BH 5933:	AC 24, 42, 48, 110, 120, 230 V DC 24V
Ambient temperature:	-15 … +55°C
Switching capacity:	
Ambient temperature 45°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Ambient temperature 55°C:	Pilot duty B300 4A 250Vac G.P. 4A 24Vdc
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Types

BG 5933.22/61 DC 24 V

Artikelnummer:	0063397
• Ausgang:	2 Schließer, 1 Öffner
• Nennspannung U_N:	DC 24 V
• Baubreite:	22,5 mm

BH 5933.48/61 AC 230 V

Artikelnummer:	0061926
• Ausgang:	3 Schließer, 1 Öffner
• Nennspannung U_N:	AC 230 V
• Baubreite:	45 mm

Ordering example

B_ 5933 .22 /61 DC 24 V

- DC 24 V — Nominal voltage
- /61 — with UL approval
- .22 — Contacts
- 5933 — G: 22.5 mm width, H: 45 mm width

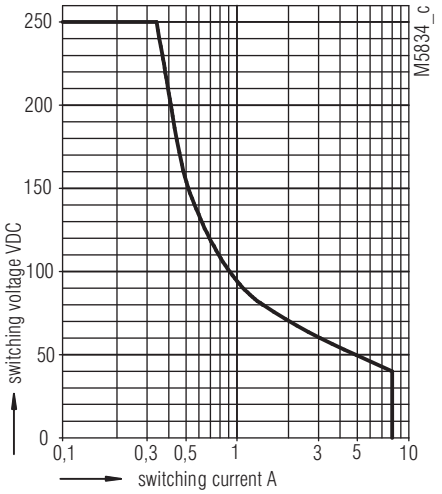
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off or LED "K2" lights up, but "K1" remains off	- Safety relay K1 e.g. K2 is welded (replace device) - The 2-Hand-buttons have not been operated simultaneously within ≤ 0,5s
Device cannot be activated	- Safety relay is welded (replace device) - Feddback circuit Y1-Y2 not closed - The 2-Hand-buttons have not been operated simultaneously within ≤ 0,5s

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.

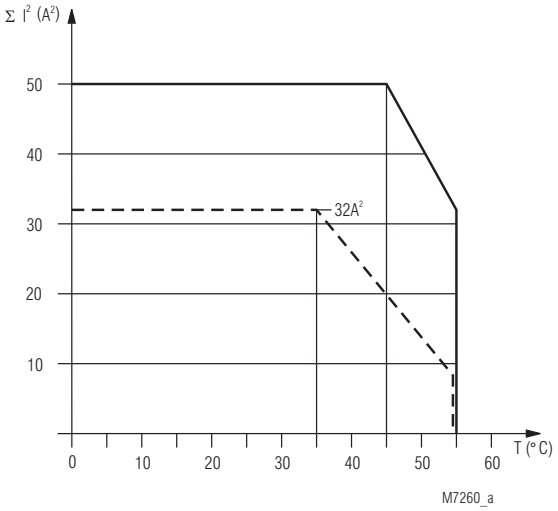
Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Limit curve for arc-free operation with resistive load

Characteristics



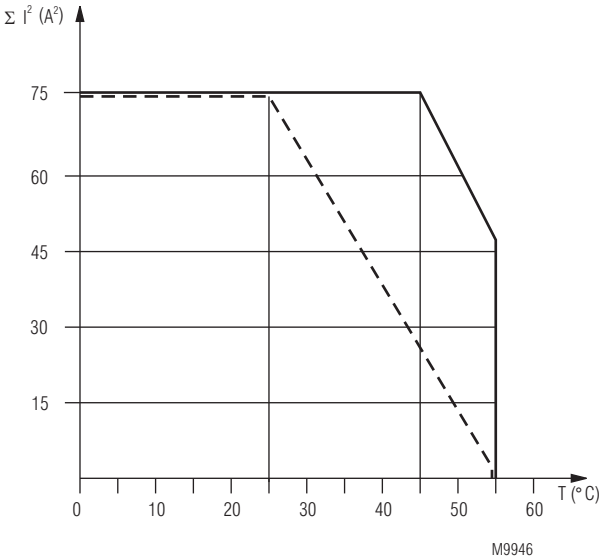
device mounted on distance with air circulation.
max. current at 55°C over
2 contactrows = 4A ≙ 2x4²A²=32A²

device mounted without distance heated by
devices with same load,
max current at 55°C over
2 contactrows = 2A ≙ 2x2²A²=8A²

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

I_1, I_2 - current in contactrows

Continuous current limit curve BG 5933



device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = 4A ≙ 3x4²A²=48A²

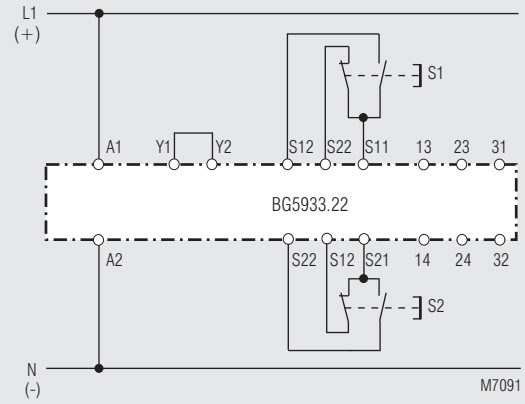
device mounted without distance heated by
devices with same load,
max current at 55°C over
3 contactrows = 1A ≙ 3x1²A²=3A²

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

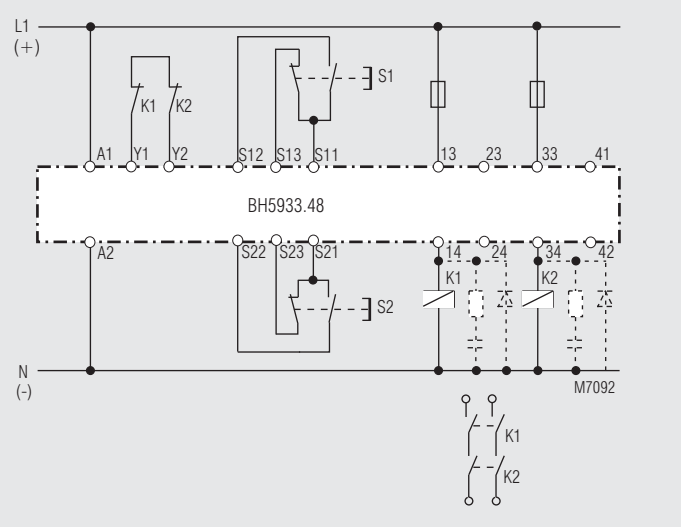
I_1, I_2, I_3 - current in contactrows

Continuous current limit curve BH 5933

Application Examples

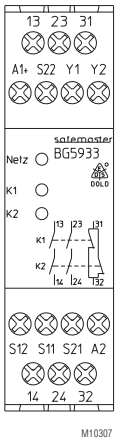
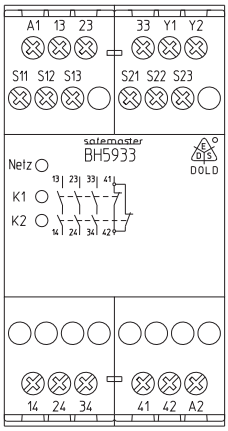
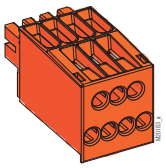
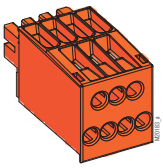
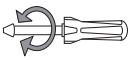
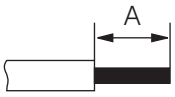
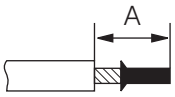
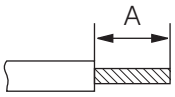


Two-hand control
Suited up to SIL3, Performance Level e, Cat. 4

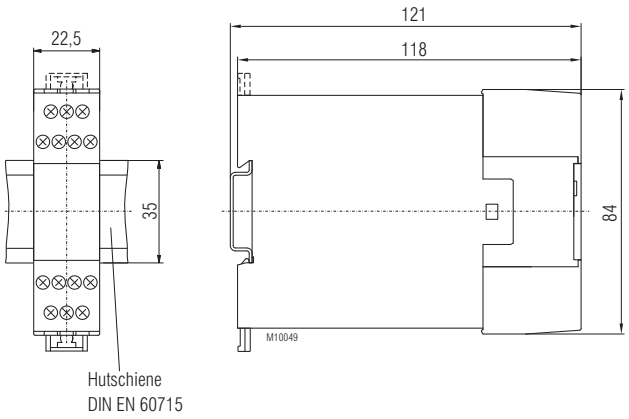


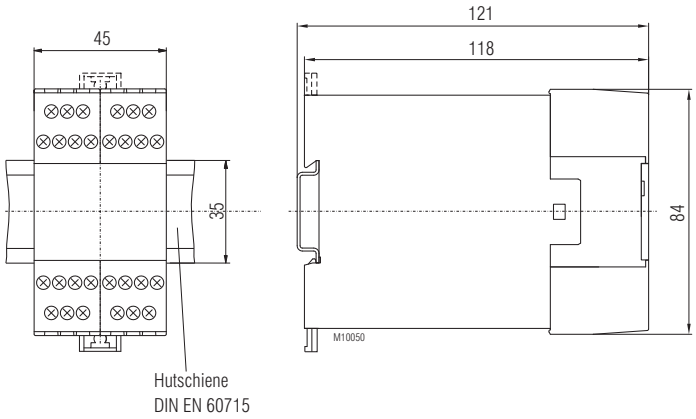
Two-hand control with contact reinforcement via external forcibly guided contactors. When switching inductive loads spark absorbers are recommended.
Suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

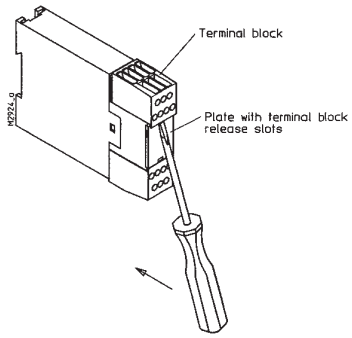
	 M10307	 M10308
		
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**





DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	30,7	a (year)
DC_{avg}:	99,0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
BG 5933 t_{cycle}:	9,50E+01	s/cycle
BH5933 t_{cycle}:	1,40E+02	s/cycle

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	7,51E-09	h^{-1}
T_1:	20	a (year)

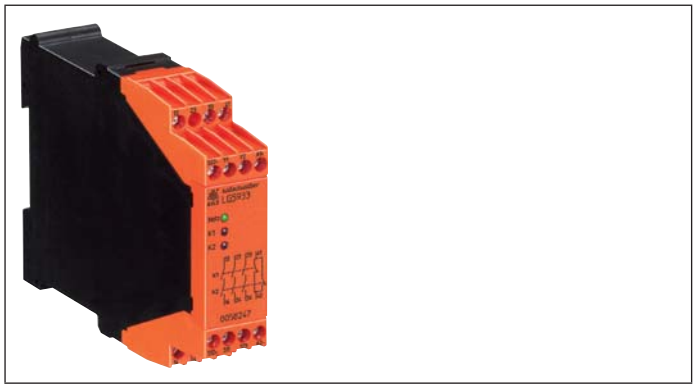
*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Two-Hand Safety Relay
LG 5933



Your Advantage

- Compact, ready to connect 2-hand safety circuit
- Cost reduction by replacing conventional contactor circuits
- Feedback circuit Y1 - Y2 to monitor external contactors used for reinforcement of contacts
- EC-type examinated circuit according to the requirements of the health and safety authorities
- As option with pluggable terminal blocks for easy exchange of devices

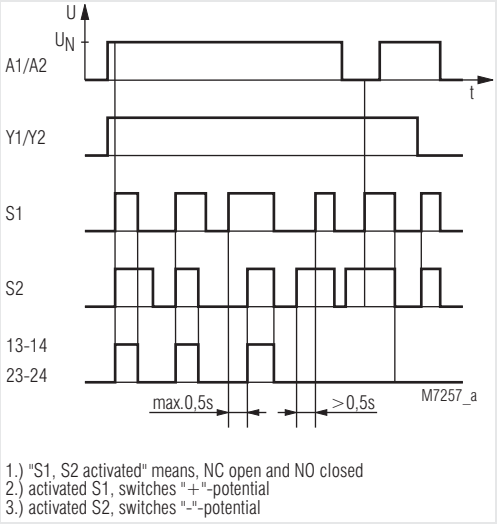
Features

- **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**
  - **Safety level Type III-C to EN 574**
- Inputs for 2 push buttons with 1 NC and 1 NO contact
- Output: 3 NO contacts, 1 NC contact
- Overvoltage and short circuit protection
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- Removable terminal strips
  - LG 5933: fixed screw terminals
  - LG 5933 PS: plug in screw terminals
  - LG 5933 PC: plug in cage clamp terminals
- Width 22.5 mm

Product Description

The LG 5933 enables and disables a safety circuit in a safe way. It is used to protect people and machines in applications with 2-hand buttons on presses for metal products as well as for other production machinery with dangerous closing movements.

Function Diagram



1.) "S1, S2 activated" means, NC open and NO closed
2.) activated S1, switches "+"-potential
3.) activated S2, switches "-"-potential

Approvals and Markings

CE, TÜVRheinland CERTIFIED, Product Safety Functional Safety, www.tuv.com ID 0600000000, A025518

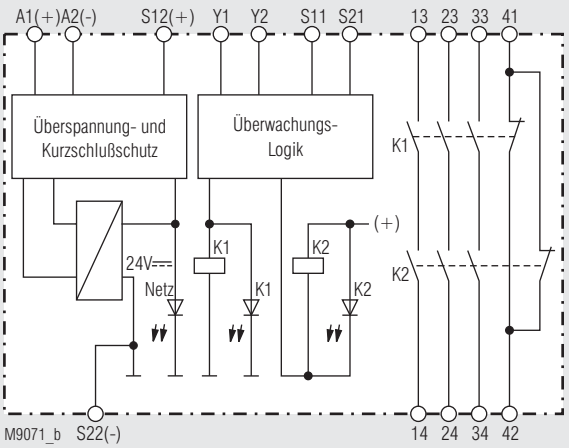
Applications

Designed for press controls in metalworking as well as in other working machines with dangerous closing movements.

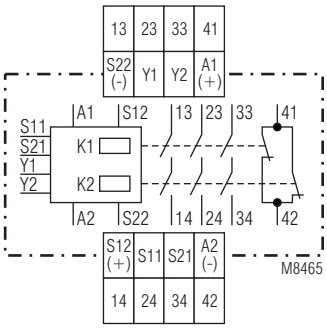
Indication

LED power-supply:	on, when operating voltage applied
LED K1:	on, when relay K1 active
LED K2:	on, when relay K2 active

Block Diagram



Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S11, S21, Y1, Y2	Inputs
S12(+), S22(-)	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
41, 42	Forcibly guided indicator output

Notes

If both buttons are pressed while switching on the operating voltage (e.g. after voltage failure) the output contacts do not energize.
The terminal S22 also serves as reference point for checking the control voltage.
On LG 5933 there is only one terminal S12 and S22.

Set-Up Instructions

The device has to be connected as shown in the application examples. When connecting the push-buttons in parallel or in series the safe function of the relay is disabled. Connected contactors (relays) must have forcibly guided contacts and have to be monitored in the feedback circuit.
To start a dangerous movement, 2 push buttons are used, each equipped with 1 NO and 1 NC contact. The output contacts will be switched if both push buttons are operated within ≤ 0.5 s. The buttons must be designed and installed in a way, that it is not possible to manipulate or to operate them without intention.
The distance between push buttons and dangerous area must be chosen in a way that it is not possible to reach the dangerous area after release of one button before the dangerous movement comes to standstill.

The safety distance "s" is calculated with the following formula:
s = v x t + C

a) moving speed of person v = 1 600 mm/s
b) stopping time of the machine t (s)
c) Additional safety distance C = 250 mm

If the risc of accessing the dangerous area is prohibited while the push buttons are pressed e.g. by covering the buttons, C can be 0. The minimum distance has to be in this case 100 mm. See also EN 574.

Technical Data

Input

Nominal voltage U_N:	AC 24 V, DC 24 V
Voltage range	
at 10 % residual ripple:	AC / DC 0.9 ... 1,1 U_N
Nominal consumption:	AC approx. 4 VA DC approx. 2.3 W
Nominal frequency:	50 / 60 Hz
Delay time for simultaneity demand:	max. 0.5 s
Recovery time:	1 s
Control contacts:	2 x (1 NO, 1 NC contacts)
Current via control contacts with DC 24 V:	
NO contact:	typ. 50 mA
NC contact:	typ. 20 mA
Fuse protection:	internal with PTC
Overvoltage protection:	by MOV

Output

Contacts: 3 NO, 1 NC contacts

The NO contacts are safety contacts.
The NC contact 41-42 can only be used for monitoring.

Operate time:	typ. 30 ms	
Release time:	typ. 25 ms	
Contact type:	forcibly guided	
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation	
Switching of low loads:	≥ 100 mV	
(contacts with 5 µ Au)	≥ 1 mA	
Thermal current I_{th}:	see quadratic total current limit curves	
Switching capacity	(max. 5 A in a contact)	
to AC 15:		
NO contacts:	AC 3 A / 230 V	IEC/EN 60 947-5-1
NC contacts:	AC 2 A / 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
at 5 A, AC 230 V cos φ = 1:	> 2. 2 x 10^5 switch.cycles	
Permissible switching capacity:	max. 1 800 switching cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
Line circuit breaker:	B 6 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperature range		
ioperation:	- 25 ... + 55°C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 62 061	
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:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1

Technical Data

Terminal designation:	EN 50 005
Wire connection	DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid
Insulation of wires or sleeve length:	8 mm
Plug in with screw terminals	
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)
Insulation of wires or sleeve length:	8 mm
Plug in with cage clamp terminals	
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)
min. cross section for connection:	0.5 mm²
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting:	DIN rail IEC/EN 60 715
Weight:	220 g

Dimensions

Width x height x depth	
LG 5933:	22.5 x 90 x 121 mm
LG 5933 PC:	22.5 x 111 x 121 mm
LG 5933 PS:	22.5 x 104 x 121 mm

Standard Type

LG 5933.48 DC 24 V

Article number:	0058247
• Output:	3 NO contacts, 1 NC contact
• Nominal voltage U_N:	DC 24 V
• Width:	22.5 mm

Ordering Example

LG 5933 .48 PS DC 24 V

- DC 24 V: Nominal voltage
- PS: Type of terminals
  - without indication: terminal blocks fixed with screw terminals
  - PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw): pluggable terminal blocks with screw terminals
- .48: Contacts
- LG 5933: Type

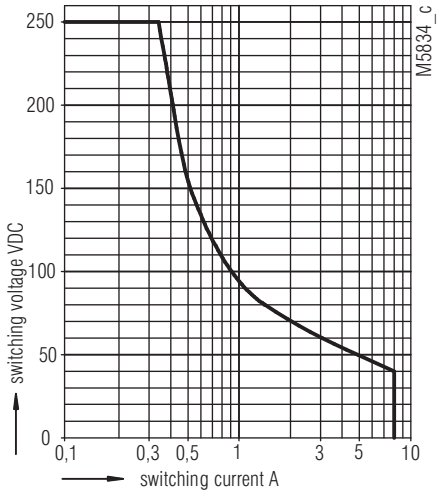
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off or LED "K2" lights up, but "K1" remains off	- Safety relay K1 e.g. K2 is welded (replace device) - The 2-Hand-buttons have not been operated simultaneously within ≤ 0,5s
Device cannot be activated	- Safety relay is welded (replace device) - Feddback circuit Y1-Y2 not closed - The 2-Hand-buttons have not been operated simultaneously within ≤ 0,5s

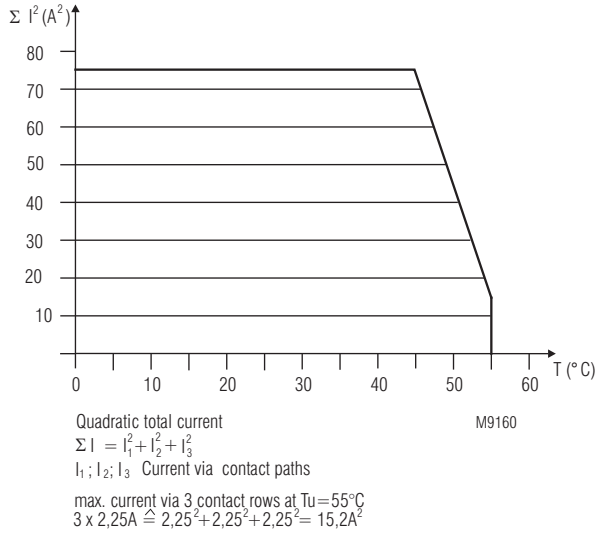
Maintenance and repairs

- 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

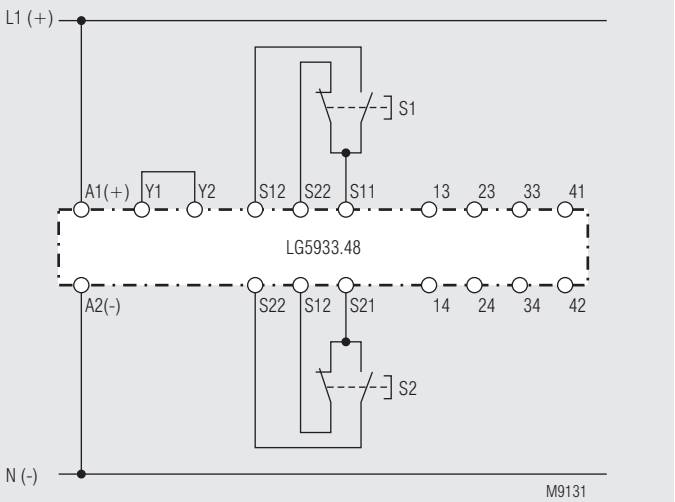


Arc limit curve under resistive load

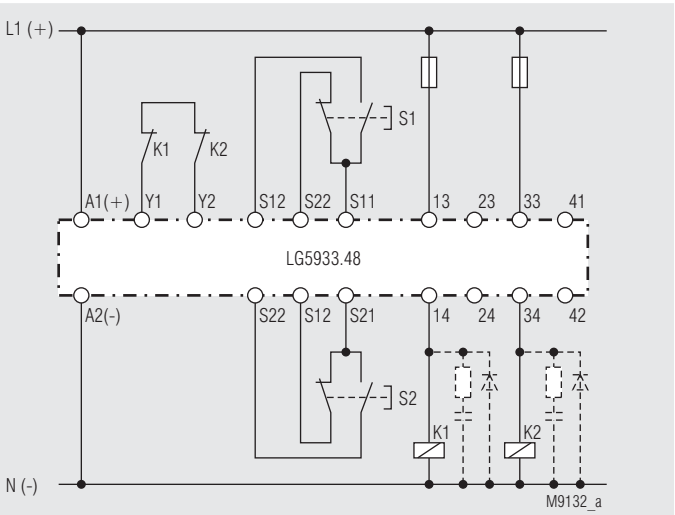


Total current limit curve

Application Examples

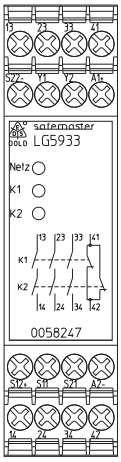
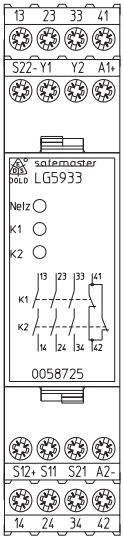
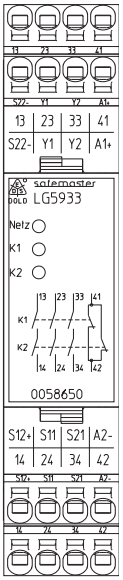
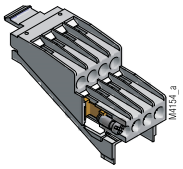
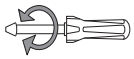
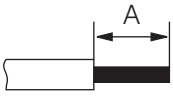
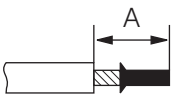
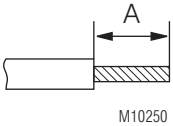


Two-hand control
Suited up to SIL3, Performance Level e, Cat. 4

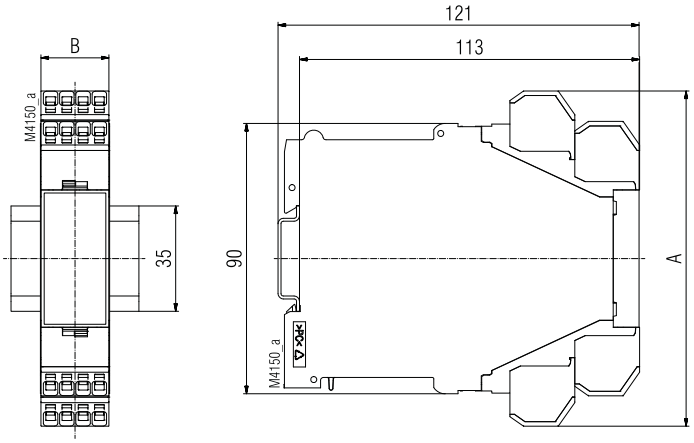


Two-hand control with contact reinforcement via external forcibly guided contactors. When switching inductive loads spark absorbers are recommended.
Suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

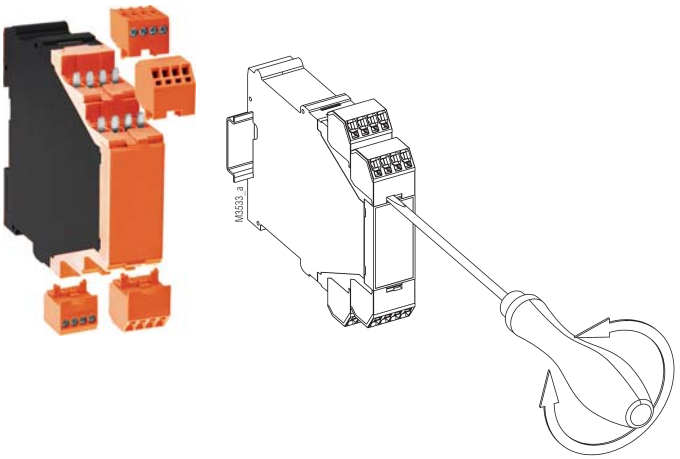
	 M10311	 M10320	 M10321	
		 PS	 PC	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5933	90	22,5
LG 5933 PS	103,6	22,5
LG 5933 PC	111,4	22,5

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	30,7	a (year)
DC_{avg}:	99,0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{cycle}:	1,40E+02	s/cycle

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	7,51E-09	h^{-1}
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Two-Hand Safety Relay
BD 5980N

DOLD

0221551

Features

- **According to**
  - **Performance Level (PL) c and category 1 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 1 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 1 to IEC/EN 61508**
  - **Safety niveau Typ III-A according to EN 574**
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228/-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Optionally dual-voltage version
- Width 45 mm

Product Description

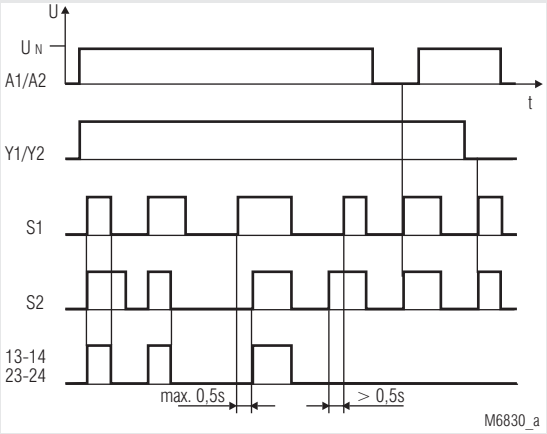
The BD 5980N enables and disables a safety circuit in a safe way. It is used to protect people and machines in applications with 2-hand buttons on presses for metal products as well as for other production machinery with dangerous closing movements according to EN 574 Kategorie III A.

Approvals and Markings

CE TÜV SÜD c UL us Canada / USA *

*) see variants

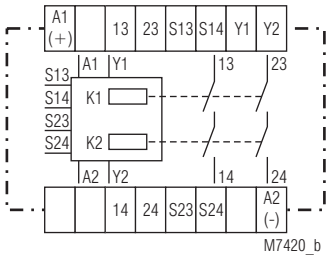
Function Diagram



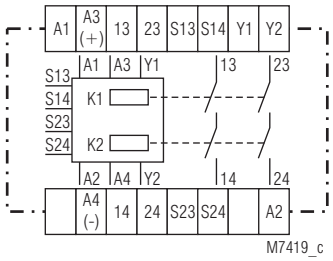
Application

Designed for use in press controls in metalworking as well as in other working machines with dangerous closing movements.

Circuit Diagrams

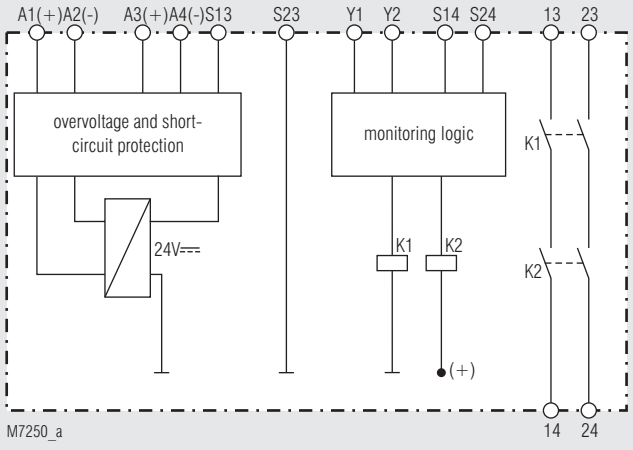


BD 5980N.02



BD 5980N.02/024

Block Diagram



Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S14, S24, Y2	Inputs
S13, S23, Y1	Outputs
13, 14, 23, 24	Forcibly guided NO contacts for release circuit

Technical Data

Input

Nominal voltage U_N		
BD 5980N.02:	DC 24 V, AC 24, 42, 48, 110, 115, 120, 230, 240 V	
BD 5980N.02/024:	DC 24 V[1] + AC 24 V[2] DC 24 V[1] + AC 42 V[2] DC 24 V[1] + AC 110 V[2] DC 24 V[1] + AC 127 V[2] DC 24 V[1] + AC 230 V[2] DC 24 V[1] + AC 240 V[2]	
	[1] DC 24 V at terminals A3-A4 [2] AC at terminals A1-A2	
Voltage range:	AC 0.8 ... 1.1 U_N	
at 10 % residual ripple:	DC 0.9 ... 1.2 U_N	
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N	
Nominal consumption:	AC 24 V ... 230 V	4.0 VA
	DC 24 V	2.5 W
Nominal frequency:	50 / 60 Hz	
Delay time for simultaneity demand:	0.5 s	
Control contacts:	2 x 1 NO contacts	
Current via control contacts:	35 mA at 24 V The control lines must not exceed a length of 30 m and must be routed separately from line cables	
Device fuse protection:	internal with PTC	

Output

Contacts		
BD 5980N.02:	2 NO contacts	
Operate / release time:	typ. 30 ms / typ. 30 ms	
Contact type:	Relay, forcibly guided	
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation	
Thermal current I_{th}:	see continuous current limit curve	
Switching capacity		
to AC 15:	5 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	max. 1200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
max.line circuit breaker:	C 10 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperatur range		
operation:	- 15 ... + 55 °C	
storage:	- 25 ... + 85 °C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC:	IEC/EN 62 061	
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminal plate:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm, frequency10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M3.5, box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	410 g	

Dimensions

Width x height x depth:	45 x 74 x 121 mm

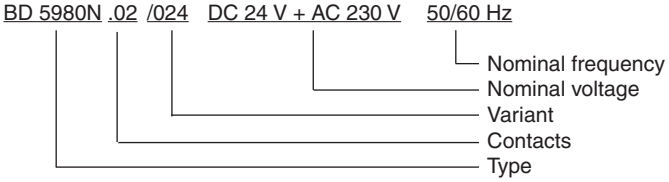
Standard Type

BD 5980N.02 DC 24 V	
Article number:	0035300
• Nominal voltage U_N:	DC 24 V
• Simultaneity:	0,5 s
• Output:	2 NO contacts
• Width:	45 mm

Varianten

BD 5980N.02/61:	with UL approval (Canada/USA)
BD 5980N.02/024:	dual voltage version

Ordering example for variants



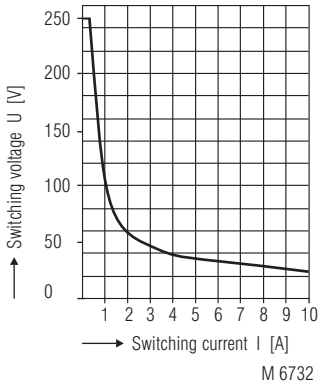
Troubleshooting

Failure	Potential cause
Device cannot be activated	- Power supply not connected - A safety relay is welded (replace device) - Feedback circuit Y1-Y2 not closed - The 2-Hand-buttons have not been operated simultaneously within ≤ 0,5s

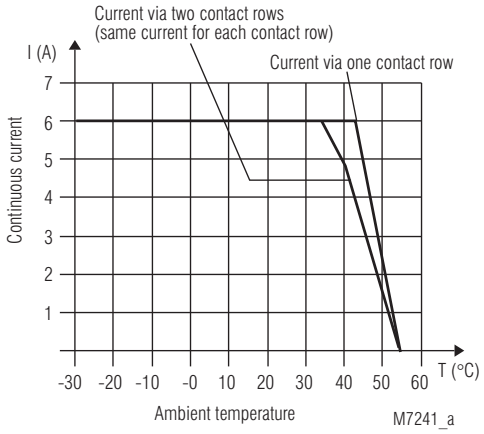
Maintenance and repairs

- 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

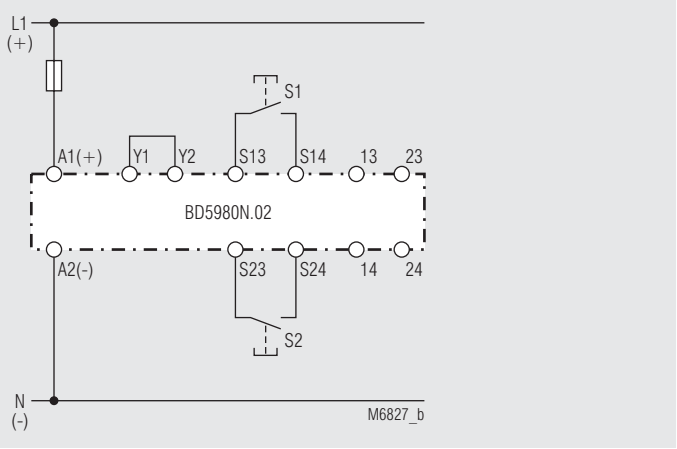


Limit curve for arc-free operation with resistive load

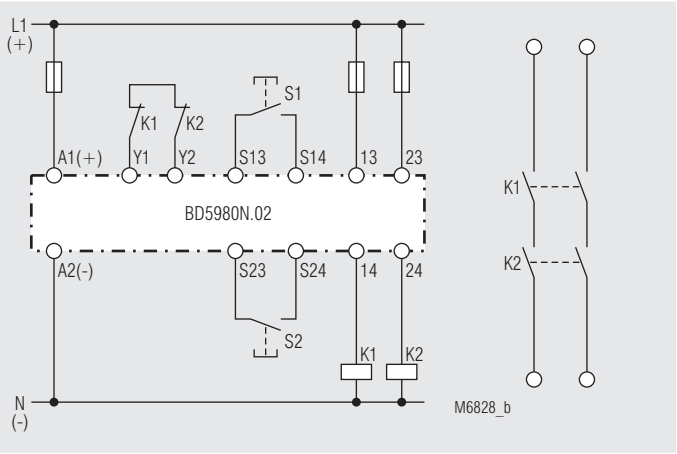


Continuous current limit curve as a function of ambient temperature

Application Examples

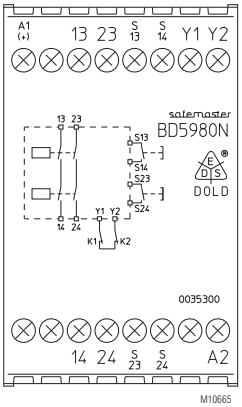


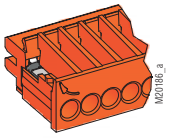
Two-hand control
Suited up to SIL1, Performance Level c, Cat. 1

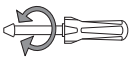
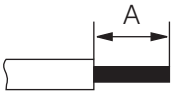
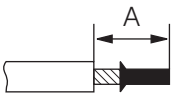
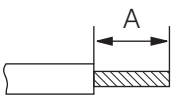


Two-hand control with contact reinforcement via external forcibly guided contactors.
Suited up to SIL1, Performance Level c, Cat. 1

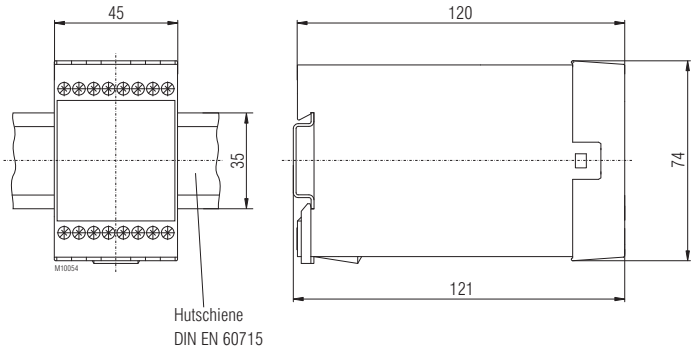
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**





	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	1	
PL:	c	
$MTTF_d$:	342,9	a (year)
DC_{avg}:	4,9	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 **IEC/EN 61508**		
SIL CL:	1	IEC/EN 62061
SIL:	1	IEC/EN 61508
HFT*):	0	
DC:	4,9	%
PFH_D:	8,02E-08	h^{-1}

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzione di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

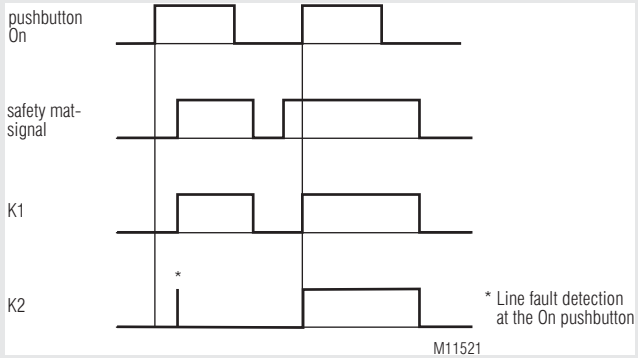
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Safety Mat Switch Gear
BG 5925._ _/910

0224210

- **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**
- Safety-mat switch gear with manual or automatic restart
- Can also be used for safety edges
- Output: max. 3 NO contacts
- Line fault detection on On-button
- Manual restart or automatic restart when connecting the supply voltage, switch S2
- LED indicator for state of operation
- Indicator for status of switching element
- LED indicator for channel 1 and 2
- Removable terminal strips
- Wire connection: also 2 x 1,5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2,5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4
- Width 22,5 mm

Function Diagram



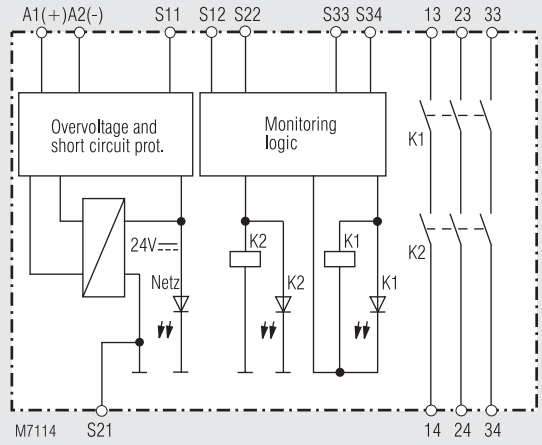
Approvals and Markings

CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | c UL us LISTED Canada / USA | A025518

Applications

Protection of people and machines
- Emergency stop circuits on machines
- Monitoring of safety gates
- Switch gear for lightbars
- Switch gear for safety mats and safety edges

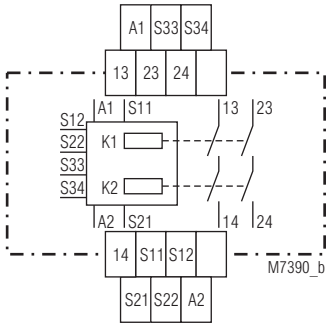
Block Diagram



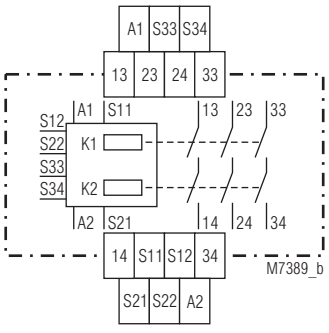
Indicators

upper LED:	ON when supply connected
lower LEDs:	ON when relay K1 and K2 energized

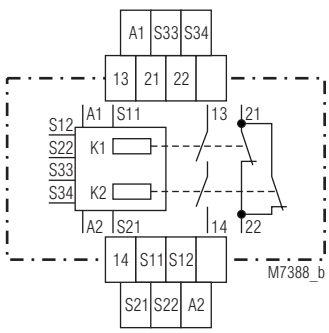
Circuit Diagrams



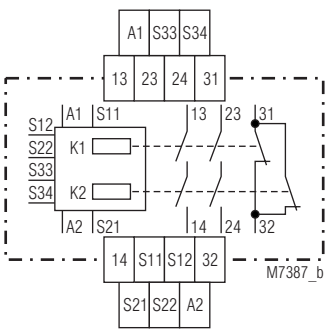
BG 5925.02/910



BG 5925.03/910



BG 5925.16/910

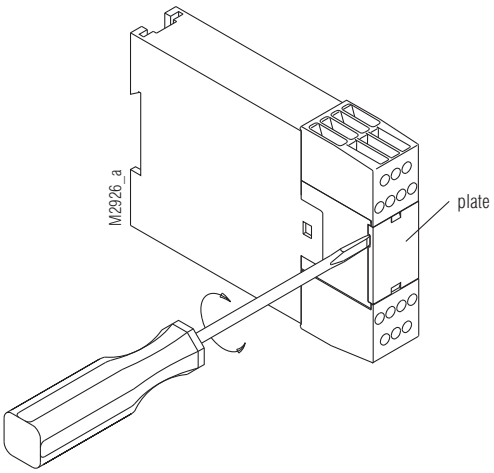


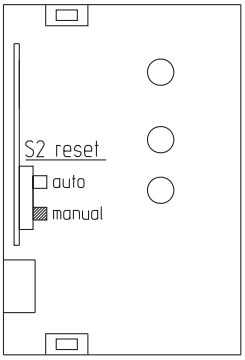
BG 5925.22/910

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S12, S22, S34	Inputs
S11, S21, S33	Outputs
13, 14, 23, 24, 33, 34	Positive driven NO contacts for release circuit
21, 22, 31, 32	Positive guided indicator output

Unit Programming





M6374

Drawing shows setting at the state of delivery

Notes

Line fault detection on On-button:
The line fault detection is only active when S12 and S22 are switched simultaneously. If The On-button is closed before S12, S22 is connected to voltage (also when line fault across On-Button), the output contacts will not close.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close. If a line fault occurs after the voltage has been connected to S12, S22, the unit will be activated because this line fault is similar to the normal On-function. The gold plated contacts of the BG 5925 mean that this module is also suitable for switching small loads of 1 mVA - 7 VA, 1 mW - 7 W in the range 0,1 - 60 V, 1 - 300 mA. The contacts also permit the maximum switching current. However since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.
The terminal S21 permits the operation of the device in IT-systems with insulation monitoring, serves as a reference point for testing the control voltage.
Connecting the terminal S21 to the protective ground bridges the internal short-circuit protection of Line A2 (-). The short-circuit protection of line A1 (+) remains active.
With the model BG 5925/910 control unit for safety mats, the switch S1 must always be set to cross fault monitoring. Depending on the operation of the machine, the switch S2 is set to automatic or manual restart.

Technical Data

Input circuit

Nominal Voltage U_N:	DC 24 V
Voltage range	
at 10% residual ripple:	0,9 ... 1,1 U_N
Nominal consumption:	DC approx. 2 W
Min. Off-time:	1 s
Control voltage on S11:	approx. DC 23 V at U_N
Max. permissible contact resistance of safety mat:	30 Ω
Cross fault current	
between line S11-S12 and line S21-S22 with active safety mat or safety edge	
start-up:	max. 0,4 A for approx. 2 ms
continuously:	approx. 29 mA at U_N
Control current over S12, S22:	40 mA at U_N
Min. voltage between terminals S12, S22 and S21:	DC 21 V when relay activated and U_N on A1 - A2
Short-circuit protection:	Internal fuse rating
Overvoltage protection:	Internal VDR

Output

Contacts

BG 5925.02/910:	2 NO contacts
BG 5925.03/910:	3 NO contact
BG 5925.16/910:	1 NO, 1 NC contact
BG 5925.22/910:	2 NO, 1 NC contact

The NO contacts are safety contacts.
The NC contacts 21-22 or 31-32 can only be used for monitoring.

Operate delay typ. at U_N:		
Manual start:	40 ms	
automatic start:	200 ms	
Release delay typ. at U_N:		
Disconnecting the supply:	50 ms	
Disconnecting S12, S22:	15 ms	
Contact type:	forcibly guided	
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation	
Switching of low loads:	≥ 100 mV	
(contact 5 µ Au)	≥ 1 mA	
Thermal current I_{th}:	5 A (see current limit curve)	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
to DC 13 at 1 A, DC 24 V:	> 150 x 10^3 switching cycles	
Permissible operating frequency:	max. 1 200 operating cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

Dimensions

Width x height x depth: 22,5 x 84 x 121 mm

UL-Data

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

Nominal voltage U_N: DC 24 V

Ambient temperature: -15 … +55°C

Switching capacity:

Ambient temperature 25°C: Pilot duty B300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.

Ambient temperature 55°C: Pilot duty B300
3A 250Vac Resistive
3A 24Vdc Resistive or G.P.

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BG 5925.02/910/61 DC 24 V

Article number:	0049869
• Output:	2 NO contacts
• Nominal voltage U_N:	DC 24 V
• Width:	22,5 mm

Ordering Example

BG 5925 . _ _ /910 /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: with UL-approval
- /910: Contact
- BG 5925: Type

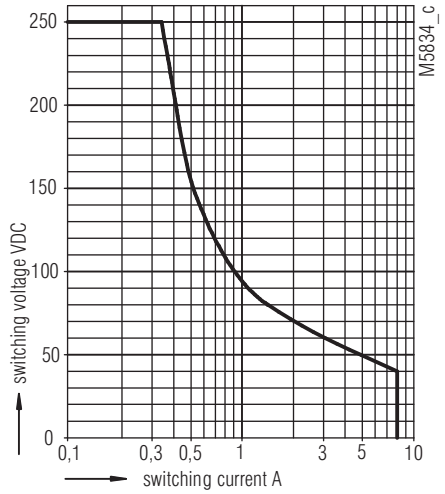
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply not connected
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	- Safety relay K2 is welded (replace device) - Incorrect setting of switch S2 - Manual start mode: Line fault on start-button (disconnect power supply and remove fault) - Automatic start mode: S33-S34 not bridged

Maintenance and repairs

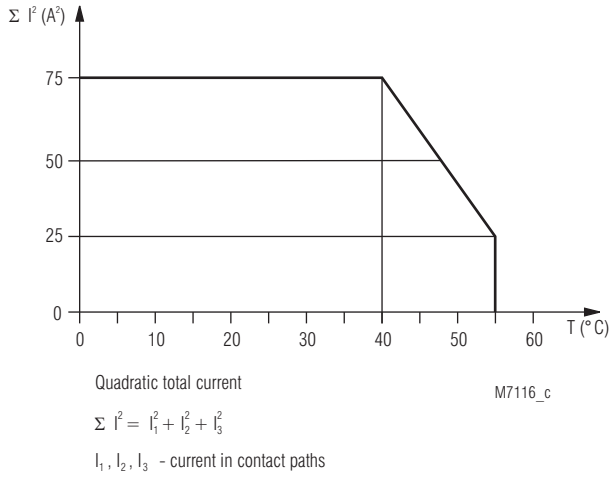
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load



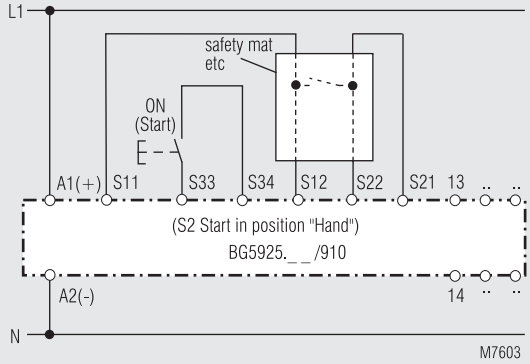
Quadratic total current

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

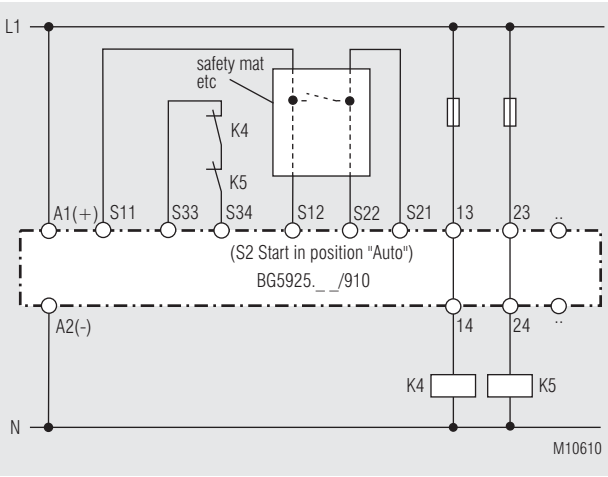
I_1, I_2, I_3 - current in contact paths

Quadratic total current limit curve

Application Examples

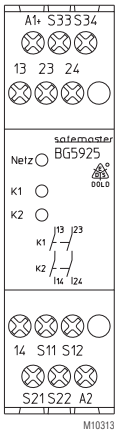


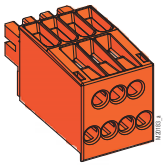
Switch gear for safety mats and edges
switch S2 position: Manual start
(For automatic restart S2 in position Autostart and link on S33-S34)
Suited up to SIL3, Performance Level e, Cat. 4

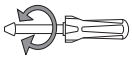
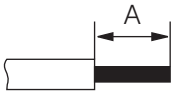
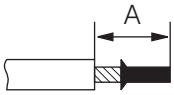
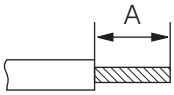


Switch gear for safety mats and edges
Contact reinforcement by external contactors, 2-channel.
switch S2 position: Auto start
Suited up to SIL3, Performance Level e, Cat. 4

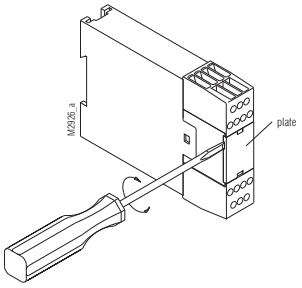
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**
IT	**Marcatura e collegamenti**

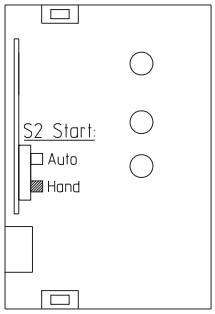




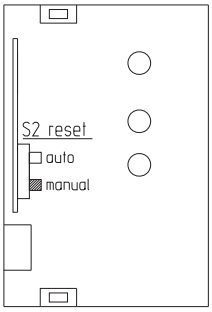
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**
IT	**Impostazione del modulo**

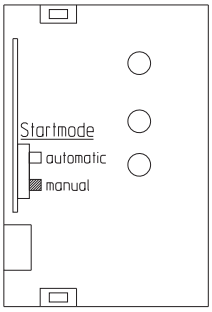




M6373



M6374

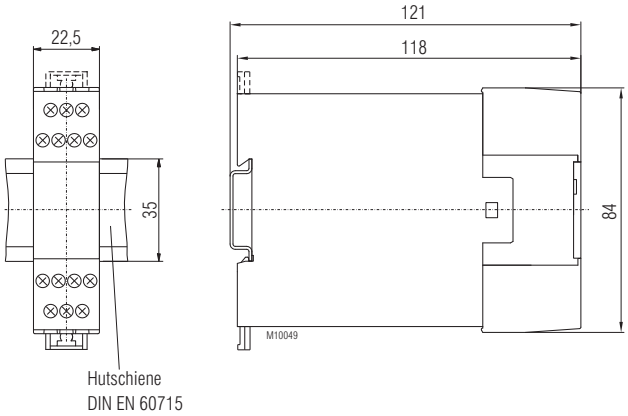


M6375

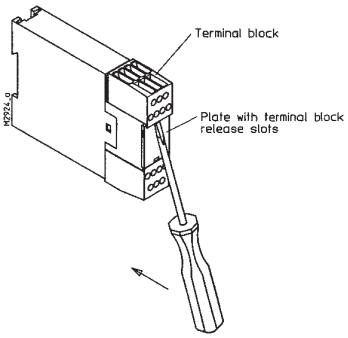
DE	S2 Start ☐ Auto ■ Hand
FR	S2 Reset ☐ Auto ■ Manu
IT	S2 Start ☐ automatico ■ manuale

DE	Die Schalterstellung zeigt den Lieferzustand.
EN	Drawing shows setting at the state of delivery
FR	Appareil livré tel que sur le schéma.
IT	La figura mostra l'impostazione al momento della consegna.

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**
IT	**Dimensioni (dimensione in mm)**



DE	**Montage / Demontage der Klemmenblöcke**
EN	**Mounting / disassembly of the terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**
IT	**Montaggio / Smontaggio di morsetti estraibili**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**
IT	**I dati di sicurezza**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	236,3	a (year)
DC_{avg}:	99,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3,60E+03	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	2,09E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware
Tolleranza ai guasti hardware

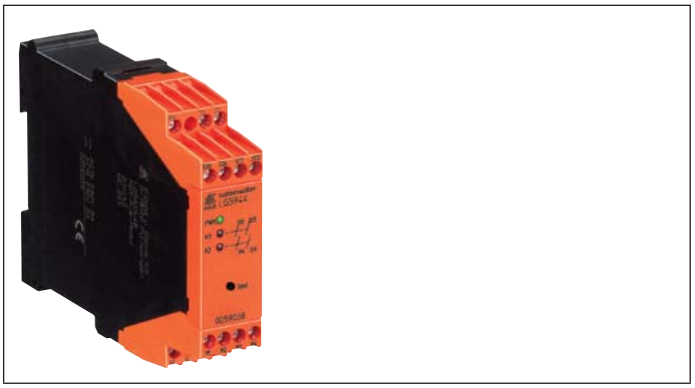
Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
Richiesta al nostro dispositivo basato sul livello di sicurezza neccessary valutata dell'applicazione		Intervall per test ciclico della funzio-ne di securezzia
nach; acc. to; selon; conformi a EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel una volta al mese
	PL d with Cat. 3	einmal pro Jahr once per year annuel una volta al mese
nach; acc. to; selon; conformi a IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel una volta al mese
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel una volta al mese

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.
IT	I rating sopra si applicano al tipo standard. Dati di sicurezza per gli altri modelli sono disponibili su richiesta. I dati caratteristici relativi alla sicurezza per l'intero sistema deve essere determinato dall'utente.

SAFEMASTER
Safety Edge Module
LG 5944

0270982



Product Description

The safety edge module LG 5944 monitors safety edges with a permitted switching current of ≥ 10mA. It enables or disables a safety circuit and can be used to protect men and machine. To avoid a damage of the safety edges by excessive currents, the current provided by the LG 5944 is limited to 10 mA even in the case of a short circuit.

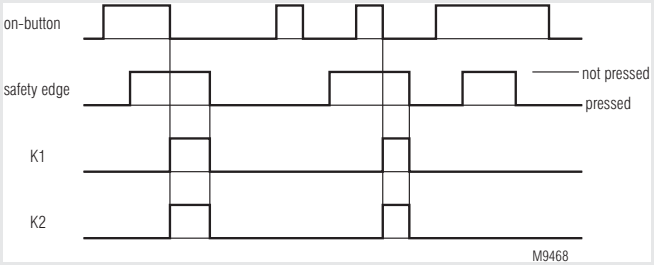
Your Advantages

- Current limitation protects the connected safety edge against electrical destruction by overcurrent and short circuit
- Universal usage with safety edges with different allowed switching currents (also for lower switching currents)
- Pluggable terminal blocks for easy exchange

Features

- **According to**
  - **Performance Level (PL) e and category 3 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61508**
- According to IEC/EN 60 204-1
- Output: 2 redundant safety outputs
- Line fault detection on On-button
- Manual restart or automatic restart, switch S2
- Indication for operating condition
- LED indicator for channel 1 and 2
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width: 22.5 mm

Function Diagram



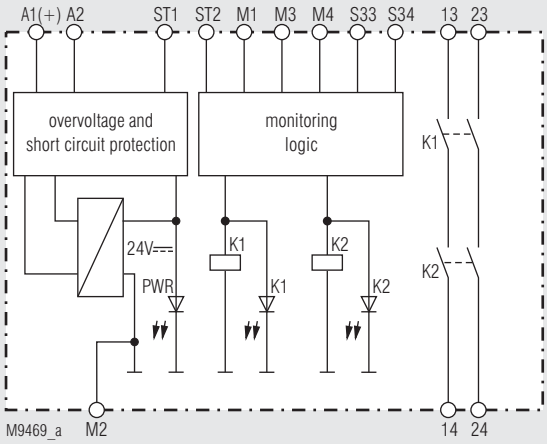
Approvals and Markings

Canada / USA

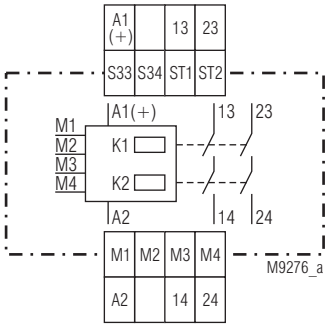
Indicators

green LED PWR:	on when supply connected
green LED K1:	on when relay K1 energized
green LED K2:	on when relay K2 energized

Block Diagram



Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2	- / N
M1, M2, M3, M4	Measuring input
ST1, ST2	Connections for On-button
S33, S34	Connections for Test-button
13, 14, 23, 24	Forcibly guided NO contacts for release circuit

Notes

Line fault detection on start button:
If a linefault is present on the start button before the power is applied to A1,A2, the output contacts will not switch on.
A line fault across the On-button which occurred after activation of the relay, will be detected with the next activation and the output contacts will not close.

To guarantee the oprating safety of the LG5944, the safety fuction has to be tested regularly (time period depending on the application). This has to be done in 2 steps. As first step the sensor must be operated to proof the function of the sensor. As second step the test button on the monitoring device has to be operated (the sensor must not be activated) to simulate a broken sensor wire. in both cases the safety function must operate, which results in de-energisation of the safety output relays K1, K2, switching off the LEDs (K1, K2), opening of the contacts (13/14, 23/24).

Technical Data

Input

Nominal Voltage U_N:	AC / DC 24 V
Voltage range:	DC 0.9 ... 1.2 U_N / AC 0.8 ... 1.1 U_N
Nominal consumption:	DC approx. 1.6 W / AC approx. 3 VA
Short-circuit protection:	Internal with PTC / electr. current limit
Overvoltage protection:	Internal VDR
Max. permissible safety edge contact resistance	
LG 5944/_0_:	200 Ω
LG 5944/_1_:	800 Ω
Termination resistor of the safety edge when connected in 2 wire circuit:	
LG 5944/_0_:	1,2 kΩ
LG 5944/_1_:	8,2 kΩ
Switching current when operated by the safety edge	
LG 5944/00_:	
DC:	approx. 5,5 mA at U_N
AC:	approx. 7,5 mA at U_N
LG 5944/01_:	
DC:	approx. 1,2 mA at U_N
AC:	approx. 1,6 mA at U_N
LG 5944/10_:	
DC:	approx. 3,0 mA at U_N
AC:	approx. 4,1 mA at U_N
LG 5944/11_:	
DC:	approx. 0,6 mA at U_N
AC:	approx. 0,8 mA at U_N

Output

Contacts:	2 Schließer
Operate delay typ. bei U_N:	
Manual start:	20 ms
Automatic start when connecting the power supply:	300 ms
when enabled by the safety edge:	20 ms
Release delay typ. bei U_N:	
Disconnecting the supply:	80 ms
when activating the safety edge:	40 ms
Contact type:	forcibly guided
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation
Thermal current I_{th}:	max. 5 A

Technical Data

Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13:	4 A / 24 V at 0.1 Hz	
Electrical contact life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	max. 1200 switching cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
line circuit breaker:	B 6 A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage:	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
Rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 200 g	

Dimensions

Width x height x depth	
LG 5944:	22.5 x 90 x 121 mm
LG 5944 PC:	22.5 x 111 x 121 mm
LG 5944 PS:	22.5 x 104 x 121 mm

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL60947, "general use applications"

Standards:
- ANSI/UL 60947-1, 5th Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-5-1, 3th Edition (Low-Voltage Switchgear and Controlgear Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)
- CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition (Low-Voltage Switchgear and Controlgear - Part1: General rules)
- CAN/CSA-C22.2 No. 60947-1-14, 1st Edition (Low-Voltage Switchgear and Controlgear - Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)

Switching capacity:	Pilot duty B300, Q300 8A 250Vac Resistive or G.P. 8A 24Vdc
Wire connection:	min. 60°C copper conductors

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

Standard Type

LG 5944.02PC/61	AC/DC 24 V
Article number:	0059038
• Output:	2 NO contacts
• Nominal voltage U_N:	AC/DC 24 V
• Width:	22.5 mm

Ordering Example

LG 5944 .02 _ _ /_ _ _ /61 AC/DC 24 V

- Nominal voltage
- UL-approval
- Termination resistor of the safety edge in 2 wire connection
  - 0 ... 1.2 kΩ
  - 1 ... 8.2 kΩ
- Number of safety edges wire connection
  - 0 device for 1 safety edge (2- and 4- wire connection possible)
  - 1 device for 2 safety edges (only 2-wire connection possible)
- Type of terminals without indication: terminal blocks fixed with screw terminals
  - PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw): pluggable terminal blocks with screw terminals
- Contacts
- Type

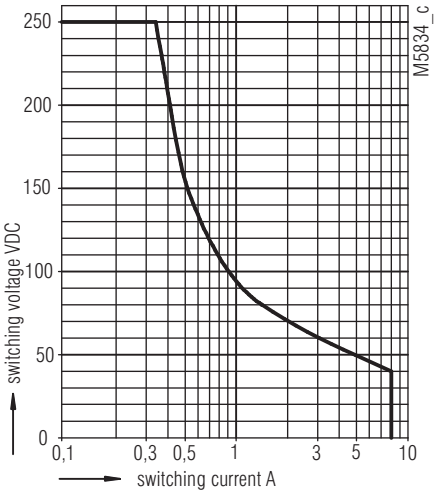
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	- Power supply not connected - Cross fault between S11 and S21
LED "K1" lights up, but "K2" remains off	- Safety relay K1 is welded (replace device) - A 1-channel switch-off occurred on S12 (switch channel off on S22)
LED "K2" lights up, but "K1" remains off	- Safety relay K2 is welded (replace device) - A 1-channel switch-off occurred on S22 (switch channel off on S12)
Device cannot be activated	Manual start mode: - Line fault on start-button (disconnect power supply and remove fault) Automatic start mode: - S33-S34 not bridged - A safety relay is welded (replace device) - Incorrect setting of switch S1

Maintenance and repairs

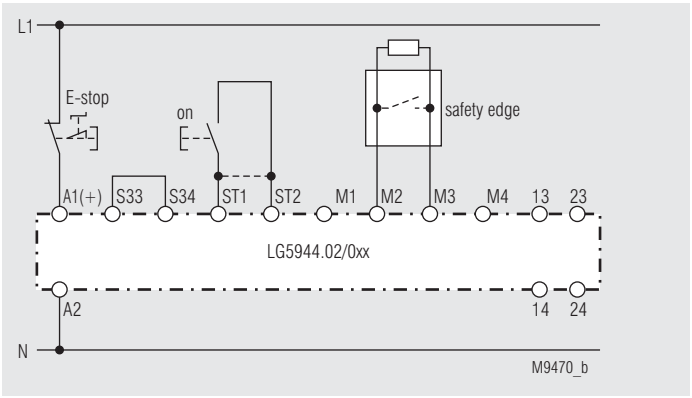
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics

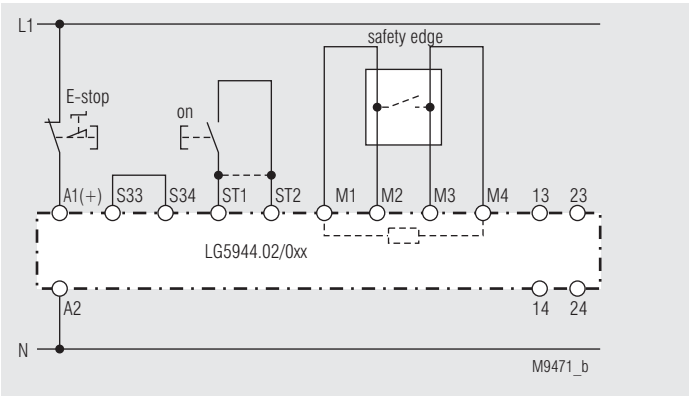


safe breaking, no continuous arcing,
max. 1 switching cycle / s

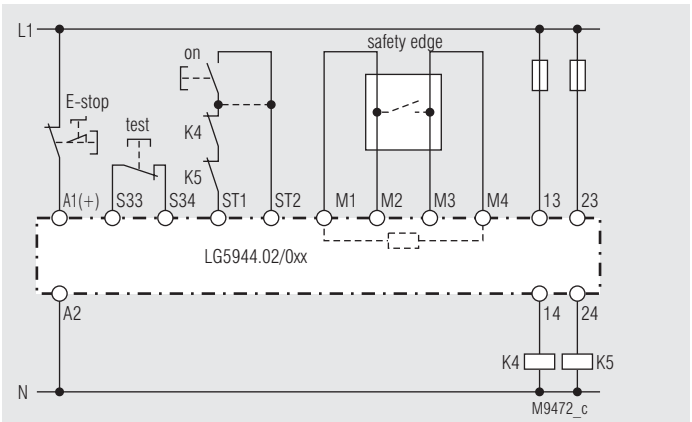
Arc limit curve under resistive load



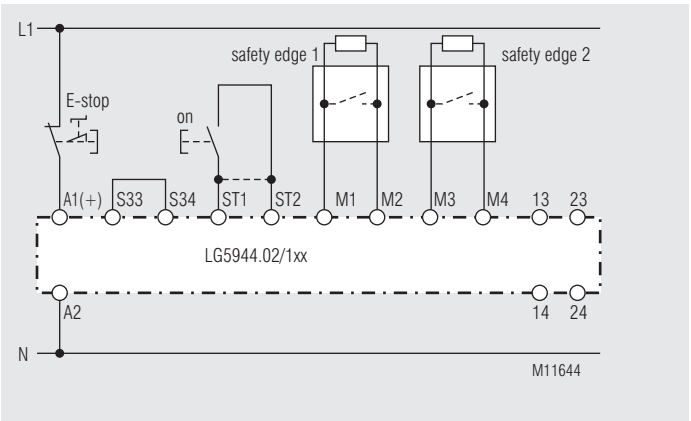
Application example for /0xx
Safety device fore safety edges
Switches in pos.: S2: manual start
(for automatic restart S2 on autostart and ST1-ST2 bridged)
Connection: 2-wire circuit
Suited up to SIL3, Performance Level e, Cat. 3



Application example for /0xx
Safety device fore safety edges
Switches in pos.: S2: manual start
(for automatic restart S2 on autostart and ST1-ST2 bridged)
Connection: 4-wire circuit
Suited up to SIL3, Performance Level e, Cat. 3

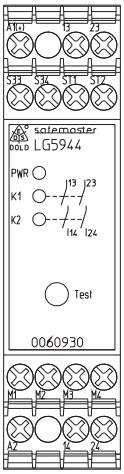


Application example for /0xx
Contact multiplication by external contactors.
The function of the external contactors is monitored by connecting the NC contacts into the feedback circuit ST1-ST2 (for automatic restart S2 on autostart and instead of the ON button ST1-ST2 has to be bridged).

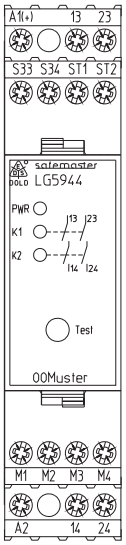


Application example for /1xx
Safety device fore safety edges
Switches in pos.: S2: manual start
(for automatic restart S2 on autostart and ST1-ST2 bridged)
If only 1 sensor is connected to one of the sensor inputs M1/M2, the other sensor input M3/M4 has has to be bridged with a resistor (/10x: 1,2 kOHM ±1%; /11x: 8,2 kOhm ±1%).
Suited up to SIL3, Performance Level e, Cat. 3

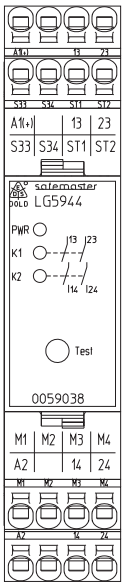
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



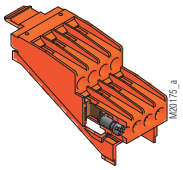
M11562

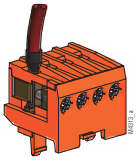


M11563

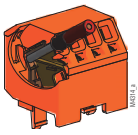


M11564

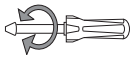
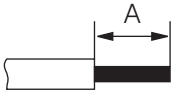
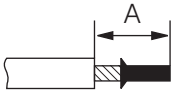
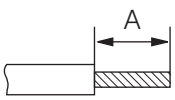

M20175_a


M4814_a

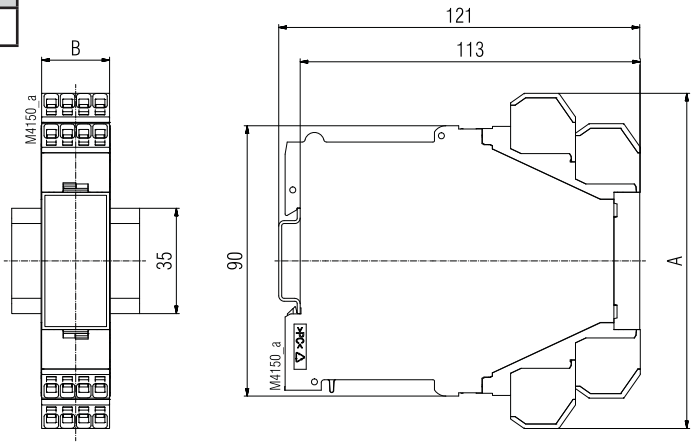
PS


M4814_a

PC

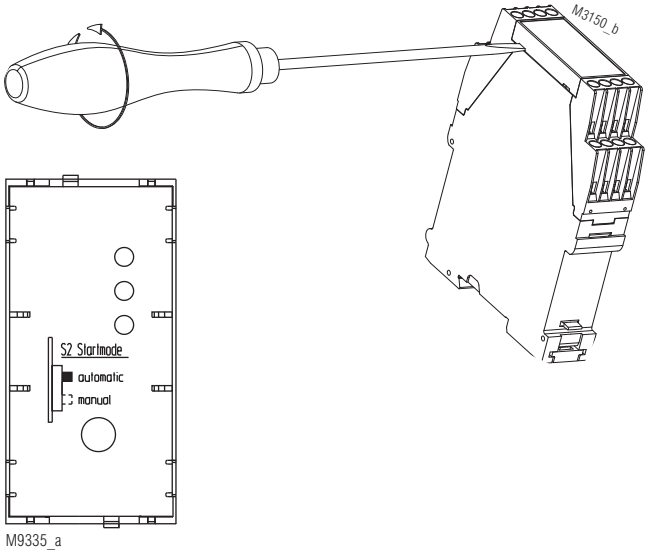
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



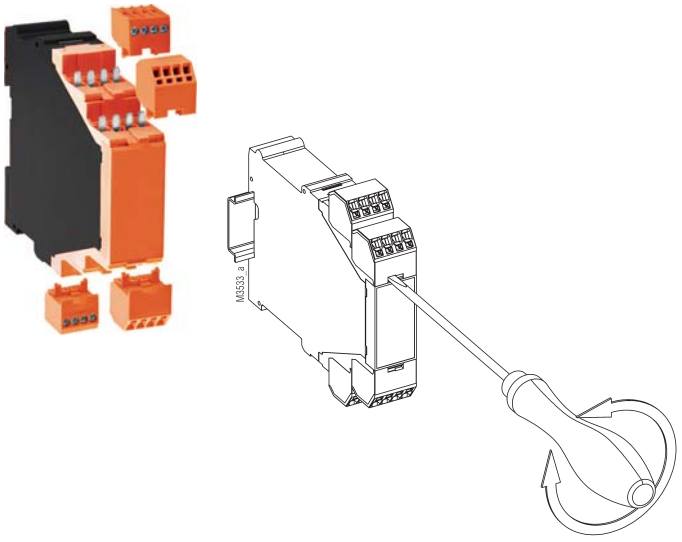
	A	B
LG 5944	90	22,5
LG 5944 PS	104	22,5
LG 5944 PC	111	22,5

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**



DE	S2 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	Disconnect unit before setting of S2 Drawing shows setting at the state of delivery
FR	Commutation de S2 uniquement hors tension. Appareil livré tel que sur le schéma.

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers ammovibles**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	e	
$MTTF_d$:	703,0	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)

IEC EN 62061 IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC:	99,0	%
PFH_D:	6,7E-11	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
nach; acc. to; selon; EN ISO 13849-1	PL e with Cat. 3	einmal pro Monat once per month mensuel
	PL d mit Cat. 3	einmal pro Jahr once per year annuel
nach; acc. to; selon; IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

SAFEMASTER
Extension Module
BG 5929

DOLD

0230763

- **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**

  when connected to a suitable safety module
- Redundant and forcibly guided contacts
- Output: max. 5 NO contacts or 4 NO contacts / 1 NC contact
- 1- or 2-channel connection
- LED indication for operation
- Removeable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 22.5 mm

Indication

BG 5929	LED K1/K2:	on, when operating voltage applied
BG 5929/100	LED K1:	on, when relay K1 energized
	LED K2:	on, when relay K2 energized

Notes

The extension module must only be used together with a safety unit e.g. LG 5925) that monitors the feedback circuit Y1/Y2 to achieve (SIL CL) 3 acc. to IEC/EN 62061, SIL 3 to IEC/EN 61508, Performance Level (PL) e and Category 4 to EN ISO 13849-1: 2008.

Approvals and Markings

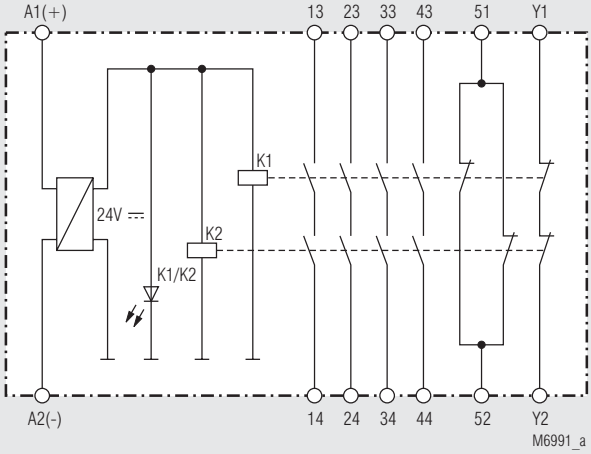
CE | TÜVRheinland Type Approved | cULus Canada / USA *

* see variants

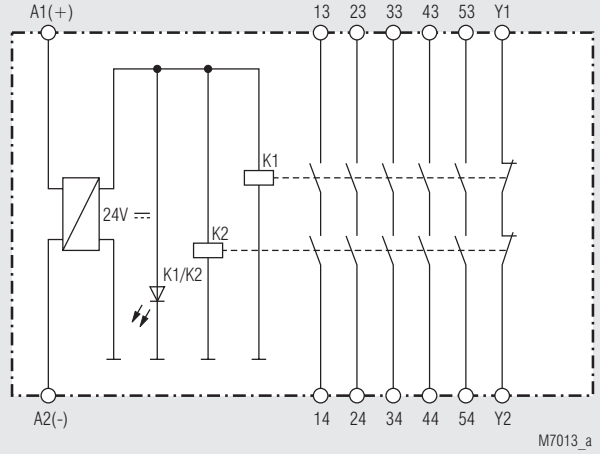
Applications

Contact multiplication of emergency-stop modules and safety door monitors.

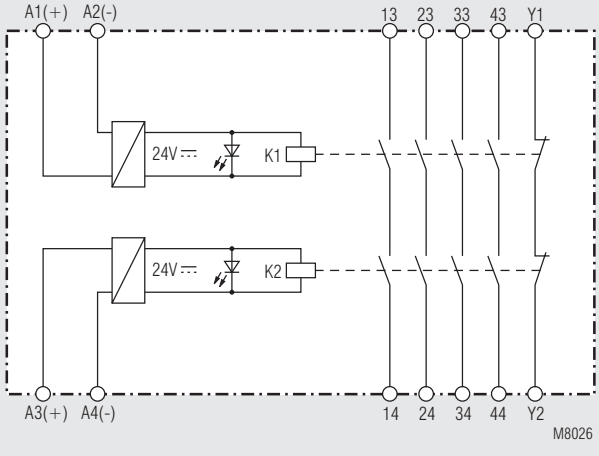
Block Diagrams



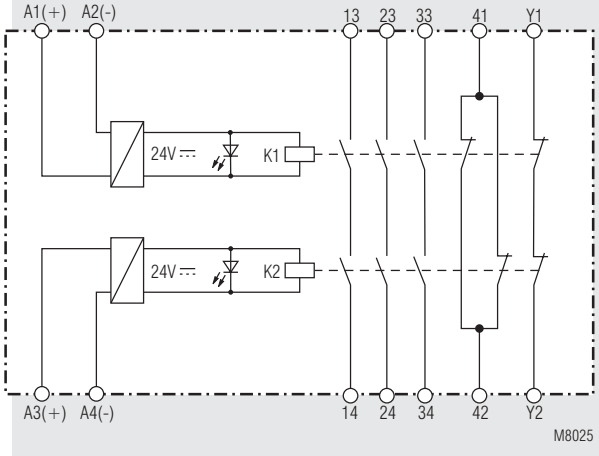
BG 5929.54



BG 5929.60

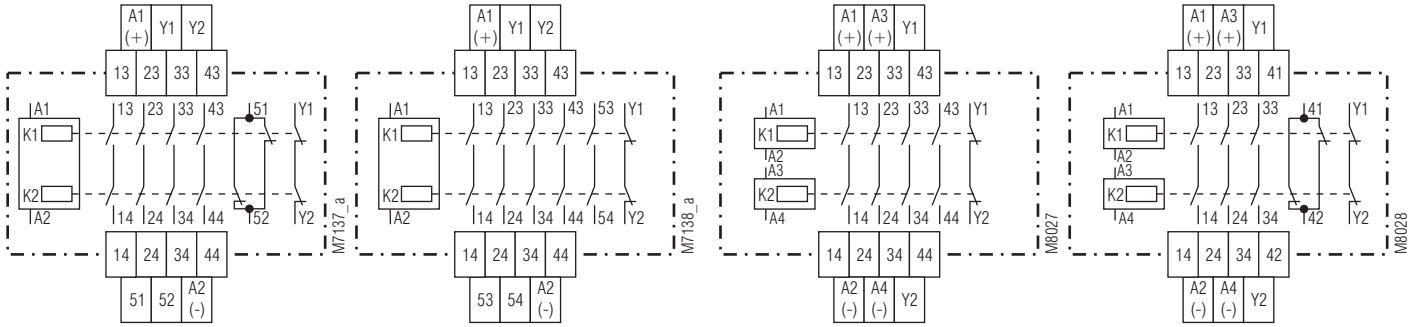


BG 5929.04/100



BG 5929.48/100

Circuit Diagrams



BG 5929.54 BG 5929.60 BG 5929.04/100 BG 5929.48/100

Technical Data

Input

Nominal voltage U_N:	AC/DC 24 V
Voltage range:	AC 0.8 ... 1.1 U_N
at 10% residual ripple:	DC 0.9 ... 1.1 U_N
at 48% residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption	
BG 5929	
AC 24 V:	2.1 VA
DC 24 V:	1.5 W
BG 5929/100	
AC 24 V:	2 x 1.1 VA
DC 24 V:	2 x 0.75 W
Nominal frequency:	50 / 60 Hz
Control current:	
BG 5929	
AC 24 V:	60 mA
DC 24 V:	65 mA
BG 5929/100	
AC 24 V:	2 x 40 mA
DC 24 V:	2 x 40 mA

Output

Contacts	
BG 5929.60:	5 NO contacts, 1 NC contact for feed back circuit
BG 5929.54:	4 NO contacts, 1 NC contact 1 NC contact for feed back circuit
BG 5929.04/100:	4 NO contacts, 1 NC contact for feed back circuit
BG 5929.48/100:	3 NO contacts, 1 NC contact, 1 NC contact for feed back circuit
Operate time:	max. 20 ms
Release time:	max. 35 ms
Contact type:	relay, forcibly guided
Nominal output voltage:	AC 250 V
Thermal current I_{th}:	see total current limit curve max. 5 A
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	1 A / DC 24 V IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	4 A / 24 V at 0.1 Hz
NC contact:	4 A / 24 V at 0.1 Hz
Electrical life	
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles IEC/EN 60 947-5-1
Permissible switching capacity:	1200 switching cycles / h
Short circuit strength	IEC/EN 60 947-5-1
max. fuse rating:	6 A gL
max. line circuit breaker:	C 8 A
Mechanical life:	10 x 10^6 switching cycles

General Data

Operating mode:	Continuous operation
Temperature range	
operation:	- 15 ... + 55 °C
storage :	- 25 ... + 85 °C
altitude:	< 2.000 m

Technical Data

Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/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:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	terminal screws M 3.5 box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	180 g	

Dimensions

Width x heigth x depth:	22.5 x 84 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:		
Category::	4	
PL:	e	
$MTTF_d$:	144,3	a
DC / DC_{avg}:	99.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3.60E+03	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC/EN 62061 / IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	99.0	%
SFF	99.7	%
PFH_D:	3,27E-10	h^{-1}
T_1:	20	a

*) HFT = Hardware-Failure Tolerance

Info 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.

Standard Type

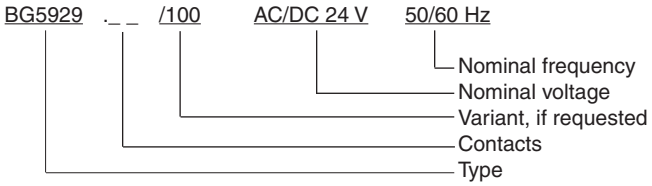
BG 5929.60 AC/DC 24 V 50/60 Hz

Article number:	0050807
• Output:	5 NO contacts, 1 NC contact for feed back circuit
• Nominal voltage U_N:	AC/DC 24 V
• Width:	22.5 mm

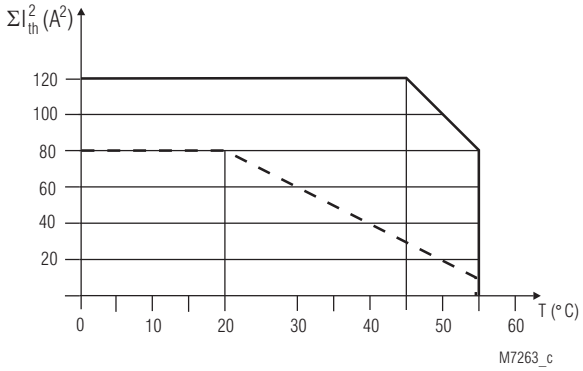
Variants

BG 5929._ _ /61:	with UL-approval
BG 5929._ _ /100:	for 2-channel connection, with 2 LEDs

Ordering example for variants



Characteristics



AC / DC 24 V device mounted on distance with aircondition

AC / DC 24 V device mounted without distances heated by devices with same load

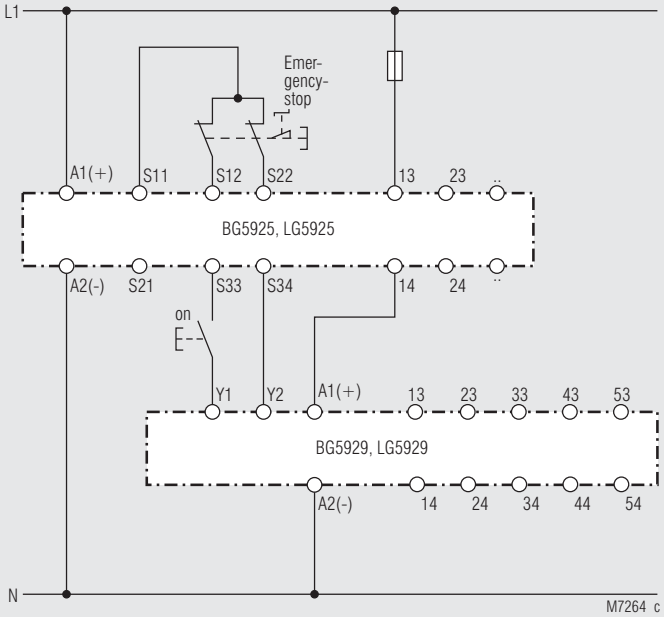
quadratic total current

$$\Sigma I^2_{th} = I^2_{th1} + I^2_{th2} + I^2_{th3} + I^2_{th4} + I^2_{th5}$$

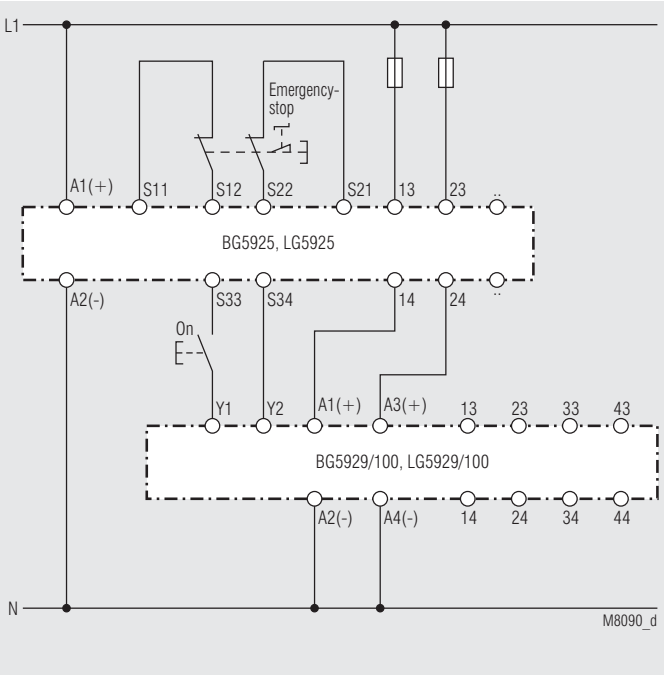
I_{th1} , I_{th2} , I_{th3} , I_{th4} , I_{th5} : thermal current I_{th} on contact rows

Total current limit curve

Application Examples



Contact multiplication with 2-channel e-stop and feedback circuit suited up to SIL3, Performance Level e, Cat. 4



Contact multiplication with BG 5929/100, suited up to SIL3, Performance Level e, Cat. 4

0262945

SAFEMASTER
Extension module
LG 5929

ORIGINAL

DOLD

Before installing, operating or maintaining this device, these instructions must be carefully read and understood.

DANGER

Dangerous voltage.

Electric shock will result in death or serious injury.

Disconnect all power supplies before servicing equipment.

CAUTION

Safe operation of the device is only guaranteed when using certified components!

Important Notes

The product hereby described was developed to perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors, evaluation units, signals and logical modules for safe disconnections. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. DOLD cannot guarantee all the specifications of an installation or machine that was not designed by DOLD. The total concept of the control system into which the device is integrated must be validated by the user. DOLD also takes over no liability for recommendations which are given or implied in the following description. The following description implies no modification of the general DOLD terms of delivery, warranty or liability claims.

Safety Regulations

- This device must be installed and operated by trained staff who are familiar with these instructions and with the current regulations for safety at work and accident prevention.
- Pay attention to applicable local regulations, especially regarding safety measures.
- The shock protection on the connected elements and the cable insulation must be designed for the highest voltage applied to the device.
- Opening the device or implementing unauthorized changes voids any warranty
- The unit should be panel mounted in an enclosure rated at IP 54 or superior. Dust and dampness may lead to malfunction.
- Adequate fuse protection must be provided on all output contacts with capacitive and inductive loads.
- The safety function must be triggered during commissioning.

Designated use

The LG 5929 is designed to multiply the number of safety output contacts of safety modules and gate monitors.
When used in accordance with its intended purpose and following these operating instructions, this device presents no known residual risks. Non-observance may lead to personal injuries and damages to property.

Main 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**

  when connected to a suitable safety module
- Control from semiconductor safety outputs (light curtains, e-stop, etc.) is also possible
- Redundant and forcibly guided contacts
- Output: max. 5 NO contacts or 4 NO contacts / 1 NC contact, 1 NC for feedback circuit
- 1- or 2-channel connection
- LED indication for operation
- Removable terminal strips
  - LG 5929: fixed screw terminals
  - LG 5929 PS: plug in screw terminals
  - LG 5929 PC: plug in cage clamp terminals

Practical note

The extension module LG 5929 must only be used together with a safety unit e.g. LG 5925) that monitors the feedback circuit Y1/Y2 to achieve (SIL CL) 3 acc. to IEC/EN 62061, SIL 3 to IEC/EN 61508, Performance Level (PL) e and Category 4 to EN ISO 13849-1: 2008.

Connection Terminals

Terminal designation	Signal designation
A1 (+), A3 (+)	+ / L
A2 (-), A4 (-)	- / N
13, 14, 23, 24, 33, 34, 43, 44, 53, 54	Forcibly guided NO contacts for release circuit
51,52	Forcibly guided indicator output
Y1,Y2	Forcibly guided feedback circuit

Indication

LG 5929
LED K1/K2: on, when operating voltage applied

LG 5929/100
LED K1: on, when relay K1 energized
LED K2: on, when relay K2 energized

Technical Data

Input

Nominal voltage U_N:	AC / DC 24 V, AC / DC 110 / 115 V, AC 110 / 115 V, AC 230 / 240 V*)	
	*) see device label	
Voltage range:	AC 0.85 ... 1.1 U_N	
at 10% residual ripple:	DC 0.9 ... 1.1 U_N	
at 48% residual ripple:	DC 0.85 ... 1.1 U_N	
Nominal consumption at U_N		
AC / DC 24 V:	1.8 VA	
AC / DC 110/115 V:	2.0 VA	
AC 110/115 V, 230/240 V:	3.0 VA	
Nominal frequency:	50 / 60 Hz	
Control current:		
at 24 V over 2 relays:	75 mA	

Output

Contacts		
LG 5929.60,LG 5929.60/100:	5 NO contacts, 1 NC contact for feed back circuit	
LG 5929.54,LG 5929.54/100:	4 NO contacts, 1 NC contact 1 NC contact for feed back circuit	
Operate time:	max. 20 ms	
Release time:	max. 35 ms	
Contact type:	relay, forcibly guided	
Nominal output voltage:	AC 250 V	
Thermal current I_{th}:	see total current limit curve*) max. 5 A	

*) see datasheet LG 5929 on **www.dold.com**

Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
NC contact:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible switching capacity:	1200 switching cycles / h	
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
max. line circuit breaker:	B 6 A	
Mechanical life:	20 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 15 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
	0.5 kV at AC/DC 24 V	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
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:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6

Technical Data

Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	205 g	

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 45°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Ambient temperature 55°C:	Pilot duty B300 4A 250Vac G.P. 4A 24Vdc
Wire connection:	60°C / 75°C copper conductors only
Fixed screw terminal:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw terminal:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp terminal:	AWG 20 - 12 Sol/Str

Technical data that is not stated here, can be found in the general technical data.

Troubleshooting

Failure	Potential cause
LED "K1/K2" does not light up	Power supply not connected

Maintenance and repairs

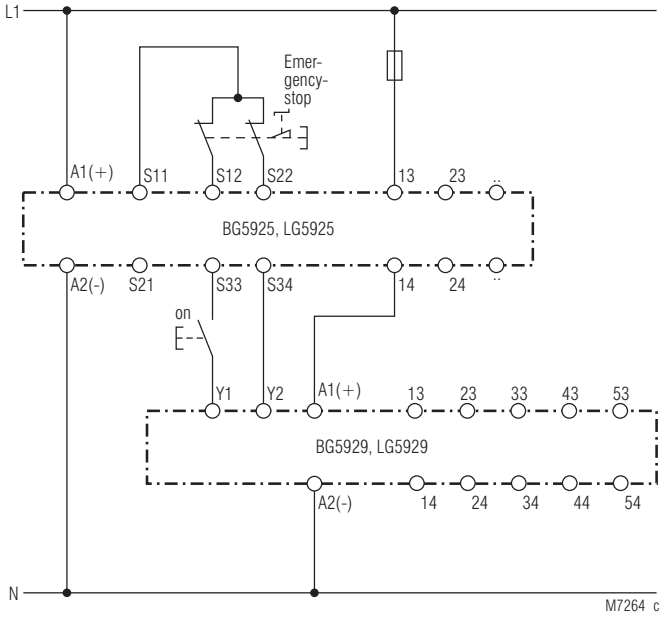
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Variants

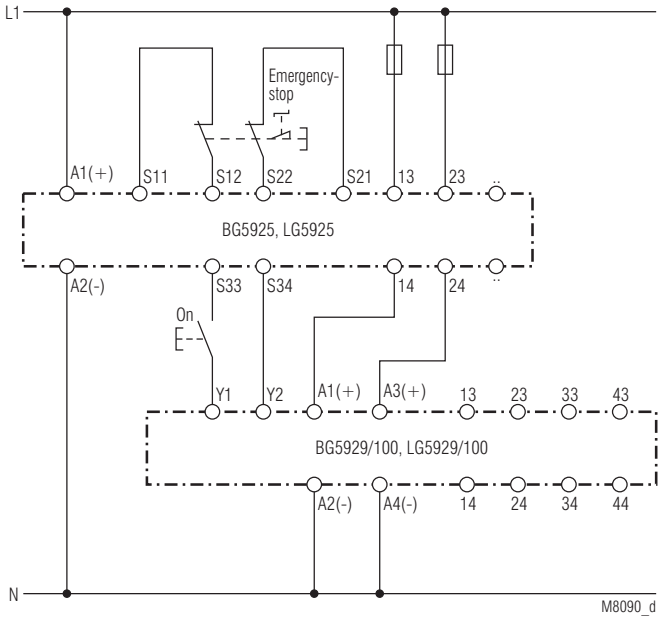
LG 5929._ _ /100: for 2-channel connection, with 2 LEDs

DE	**Anwendungsbeispiele**
EN	**Application examples**
FR	**Exemples d'utilisation**

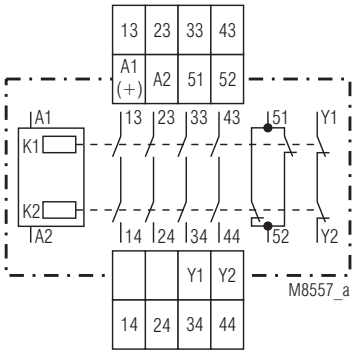
DE	LG 5929, geeignet bis SIL3, Performance Level e, Kat. 4
EN	LG 5929, suited up to SIL3, Performance Level e, Cat. 4
FR	LG 5929, convient jusqu'à SIL3, Performance Level e, Cat. 4



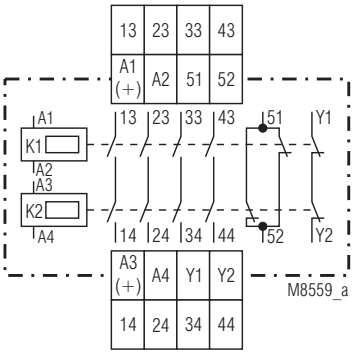
DE	Kontaktvervielfachung mit LG 5929/100, geeignet bis SIL3, Performance Level e, Kat. 4
EN	Contact multiplication with LG 5929/100, suited up to SIL3, Performance Level e, Cat. 4
FR	Multiplication des contacts avec LG 5929/100, convient jusqu'à SIL3, Performance Level e, Cat. 4



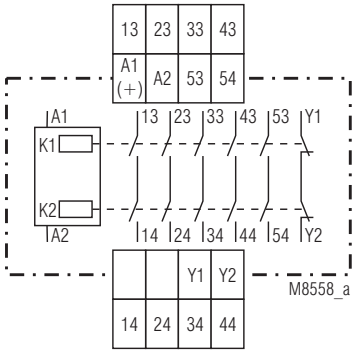
DE	**Schaltbilder**
EN	**Circuit diagrams**
FR	**Schémas**



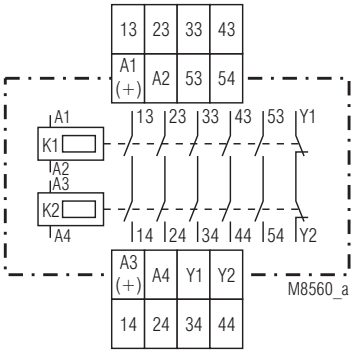
LG 5929.54



LG 5929.54/100

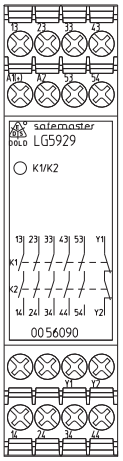


LG 5929.60

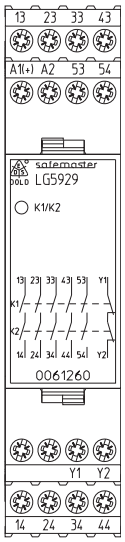


LG 5929.60/100

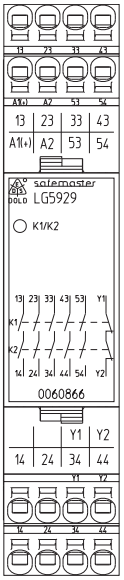
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



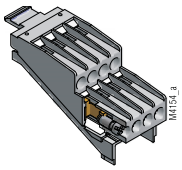
M10310



M10318

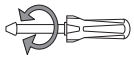
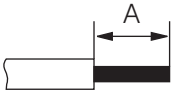
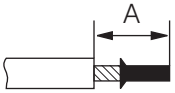
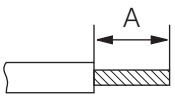


M10319

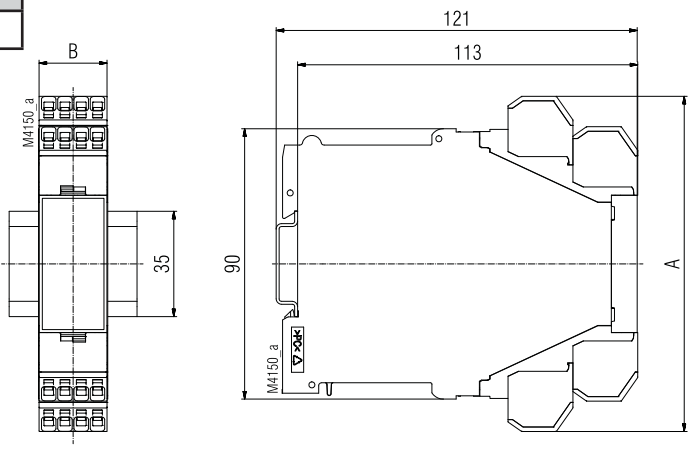

M4154_a


PS


PC

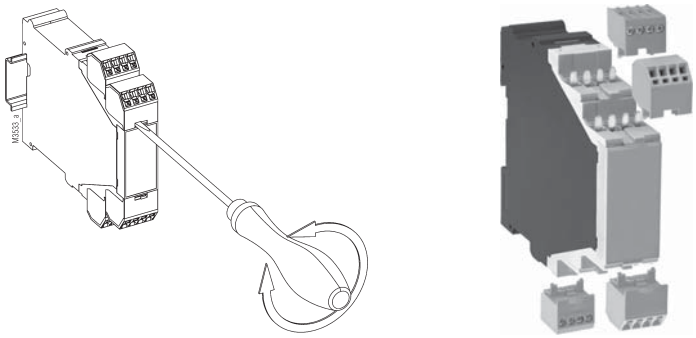
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LG 5929	90	22,5
LG 5929 PS	104	22,5
LG 5929 PC	111	22,5

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Démontage des borniers ammovibles**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	144,3	a (year)
DC_{avg}:	99,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3,60E+03	s/cycle
	≙ 1	h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	99,0	%
SFF	99,7	%
PFH_D:	3,27E-10	h^{-1}
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

DE	**Zulassungen und Kennzeichen**
EN	**Approvals and Markings**
FR	**Homologations et sigles**

CE | TÜVRheinland Type Approved | c UL us LISTED Canada / USA | PCT AE68 | CCC A025518

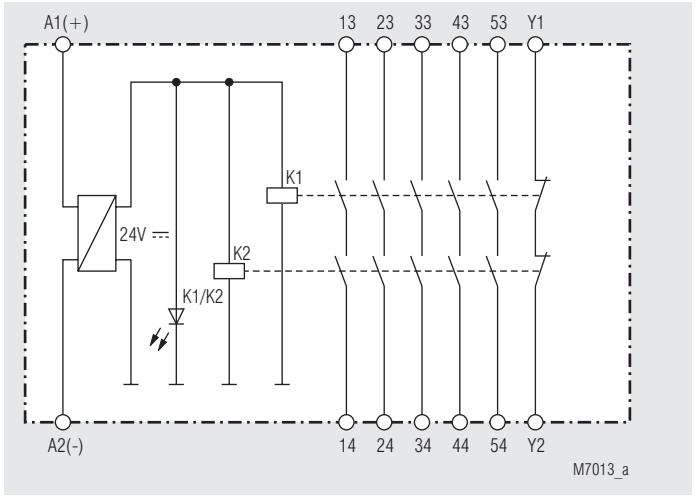
SAFEMASTER
Extension Module
UG 6929

0269007

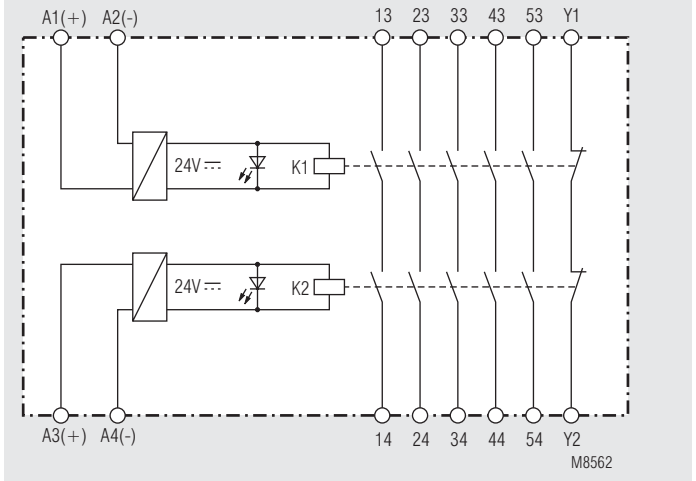
Product Description

If more safety cicuits have to be switched, than a safety module provides, the extension module UG 6929 is used. It offers safe and reliable contact multiplication and re-enforcment for safety modules with monitoring of the feedback circuit. Safe semiconductor outputs can be extended by relay output contacts. The extension module has forcibly guided contacts and can be delivered with different contact arrangements.

Block Diagrams



UG 6929.60



UG 6929.60/100

Your Advantage
- Safety contact multiplication

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 when connected to a suitable safety module**
- According to EN 50156-1 for furnaces
- Control with safety semiconductor outputs (light curtain, e-stop) possible
- Redundant and forcibly guided contacts
- Output: max.7 NO or 6 NO contacts / 1 NC contact, 1 NC contact for feedback circuit
- 1- or 2-channel
- Indication
- 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

Type Approved
TÜVRheinland CERTIFIED
www.tuv.com ID 0004000000
c UL us LISTED
Canada / USA
* see variants

Application

For multiply the number of safety output contacts of safety modules and gate monitors.

Indicators

UG 6929

green LED K1/K2:	on, when relay K1 and K2 energized

UG 6929/100

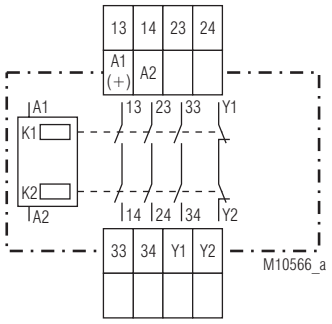
green LED K1:	on, when relay K1 energized
green LED K2:	on, when relay K2 energized

Notes

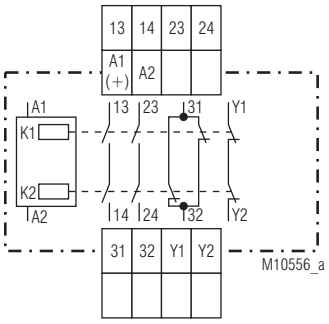
The extension module UG 6929 must only be used together with a safety unit e.g. (UG 6970) that monitors the feedback circuit Y1/Y2 to achieve (SIL CL) 3 acc. to IEC/EN 62061, SIL 3 to IEC/EN 61508, Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008.

Connection Terminals

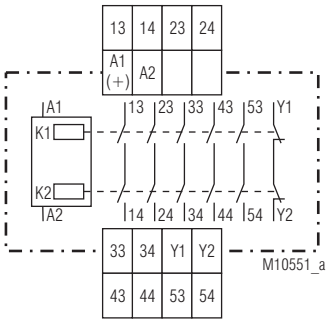
Terminal designation	Signal description
A1 (+), A3 (+)	+ / L
A2, A4	- / N
13, 14, 23, 24, 33, 34, 43, 44, 53, 54, 63, 64, 73, 74	Forcibly guided NO contacts for release circuit
31, 32, 51,52, 71, 72	Forcibly guided indicator output
Y1,Y2	Forcibly guided feedback circuit



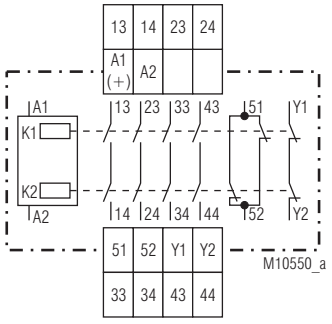
UG6929.03



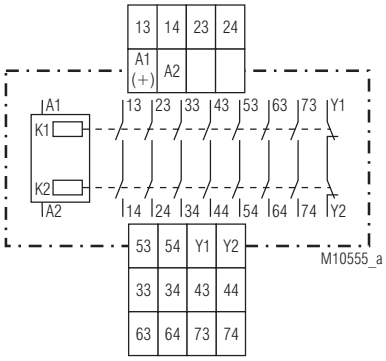
UG6929.22



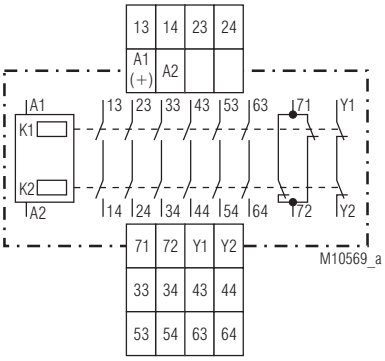
UG6929.60



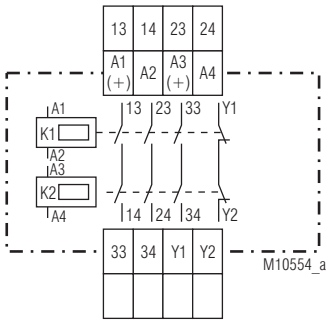
UG6929.54



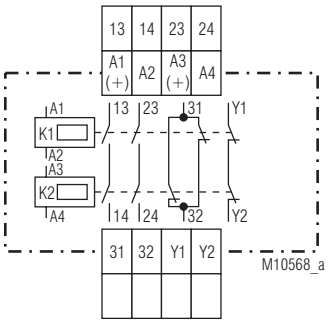
UG6929.62



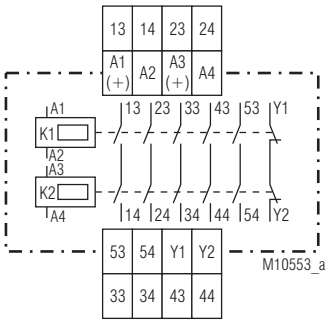
UG6929.61



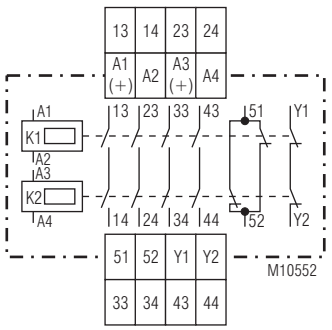
UG6929.03/100



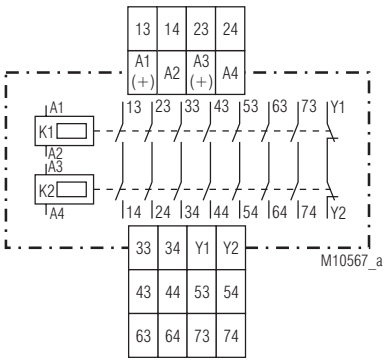
UG6929.22/100



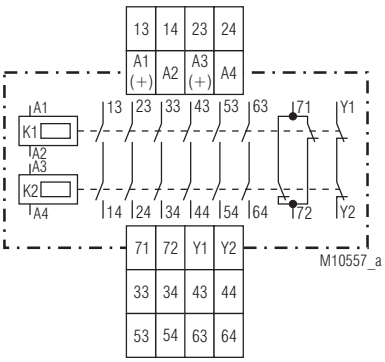
UG6929.60/100



UG6929.54/100



UG6929.62/100



UG6929.61/100

Technical Data

Input

Nominal voltage U_N:	AC/DC 24 V AC 120 V, AC 230 V
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption	
AC/DC 24 V:	typ. 1.8 VA
AC120 V, AC 230 V:	typ. 3,4 VA
Nominal frequency:	50/60 Hz

Output

Contacts	
UG 6929.03, UG 6929.03/100:	3 NO contacts,1 NC contact for feedback circuit
UG 6929.22, UG 6929.22/100:	2 NO contacts, 2 NC contacts for feedback and indicator circuit
UG 6929.60, UG 6929.60/100:	5 NO contacts,1 NC contact for feedback circuit
UG 6929.54, UG 6929.54/100:	4 NO contacts, 2 NC contacts for feedback and indicator circuit
UG 6929.62, UG 6929.62/100:	7 NO contacts, 1 NC contact for feedback circuit
UG 6929.61, UG 6929.61/100:	6 NO contacts, 2 NC contacts for feedback and indicator circuit
Operate time:	max. 20 ms
Release time:	max. 35 ms
Nominal output voltage:	AC 250 V DC: see arc limit curve under resistive load) Y1/Y2: max. DC 30 V
Thermal current I_{th}:	max. 8 A (see quadratic total current limit curve)

Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 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
NC contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
NC contacts:	4 A / 24 V at 0.1 Hz	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. switching frequency:	1200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperature range		
Operation:	- 25 ... + 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	IEC/EN 62 061	
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	
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
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 6929 PS:	22.5 x 110 x 120.3 mm
UG 6929 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"

Contact version:	.03, .22, .54, .60
Ambient temperature:	- 15 … + 55 °C
Switching capacity:	Pilot duty B300, Q300 5A 250Vac Resistive or G.P. 5A 24Vdc Resistive
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 6929.60PS/61 AC/DC24V

Article number:	0065304
• Output:	5 NO contacts, 1 NC contact for feedback circuit
• Nominal voltage:	AC/DC 24 V
• Width:	22.5 mm

Variant

UG 6929._ _ /100:	for 2-channel with 2 LEDs
UG 6929._ _/61:	with UL approval

Ordering example for variant

UG 6929 ._ _ _ _ / 100 /61 AD/DC 24 V

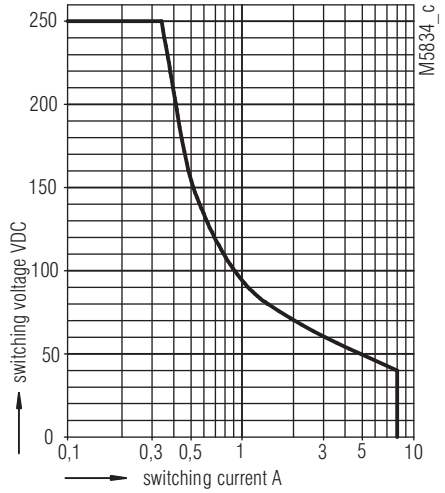
- Nominal voltage
- UL-approval
- Variant, if required
- Type of terminals
  - PC (plugin cageclamp): removable terminal blocks, with cageclamp
  - PS (plugin screw): removable terminal blocks, with screw terminals
  - PT (plugin TWIN cageclamp): removable terminal blocks, with TWIN cage clamp
- Contacts
- Type

Troubleshooting

Failure	Potential cause
LED "K1/K2" does not light up	Power supply not connected

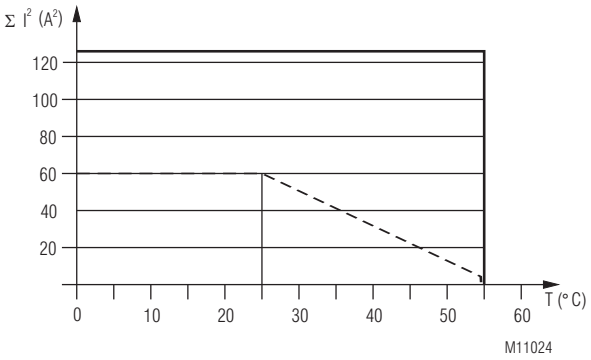
Maintenance and Repairs

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



safe breaking, no continuous arcing,
max. 1 switching cycle / s

Arc limit curve under resistive load



AC 230V — device mounted on distance with air circulation.
max. current at 55°C over
5 contact path = 5A ≙ $5x5^2A^2 = 125A^2$

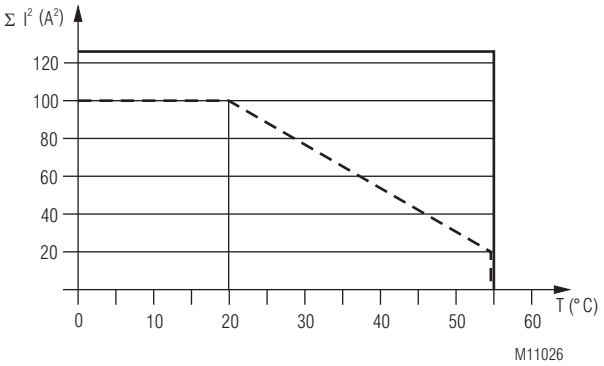
AC 230V — device mounted without distance heated by
devices with same load,
max current at 55°C over
5 contact path = 1A ≙ $5x1^2A^2 = 5A^2$

Quadratic total current

$$\Sigma I^2_{th} = I^2_{th1} + I^2_{th2} + I^2_{th3} + I^2_{th4} + I^2_{th5}$$

I_{th1} , I_{th2} , I_{th3} , I_{th4} , I_{th5} : current in contact paths

Quadratic total current limit curve AC 230 V



AC / DC 24V — device mounted on distance with air circulation.
max. current at 55°C over
5 contact path = 5A ≙ $5x5^2A^2 = 125A^2$

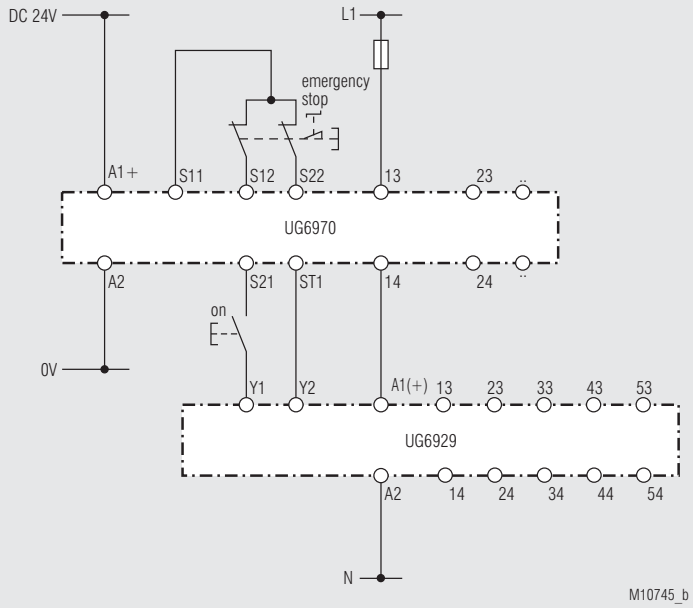
AC / DC 24V — device mounted without distance heated by
devices with same load,
max current at 55°C over
5 contact path = 2A ≙ $5x2^2A^2 = 20A^2$

Quadratic total current

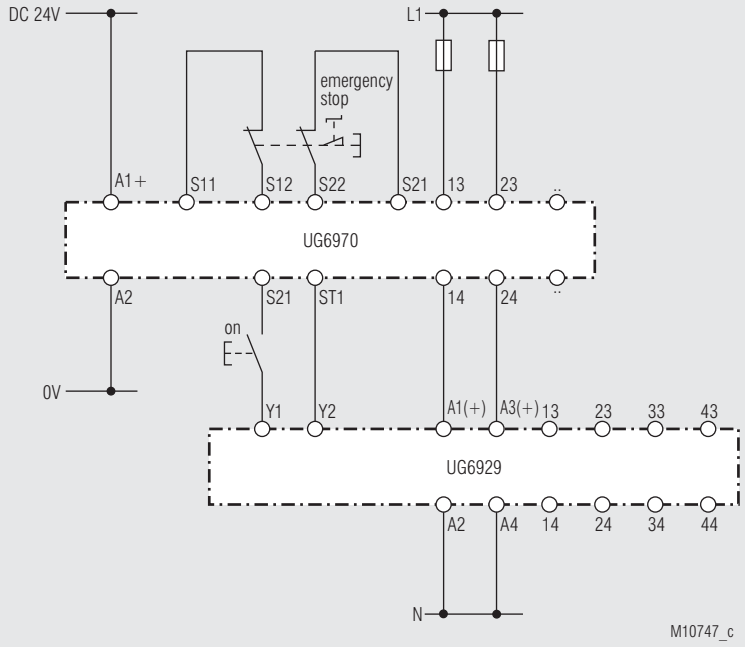
$$\Sigma I^2_{th} = I^2_{th1} + I^2_{th2} + I^2_{th3} + I^2_{th4} + I^2_{th5}$$

I_{th1} , I_{th2} , I_{th3} , I_{th4} , I_{th5} : current in contact paths

Quadratic total current limit curve AC/DC 24 V

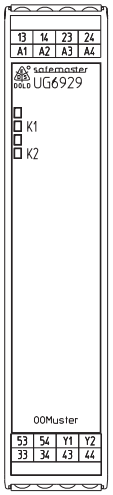
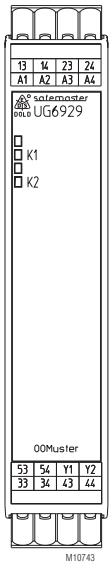
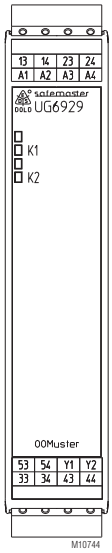
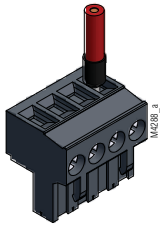
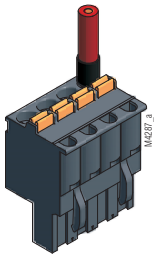
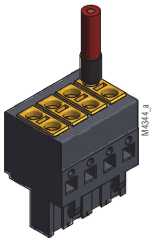
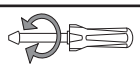
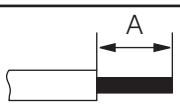
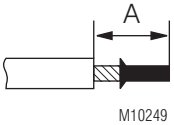
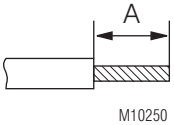


UG 6929; suited up to SIL3, Performance Level e, Cat. 4, if the extention module UG 6929 and the controlling safety module (e.g. UG 6970) are in the same cabinet.

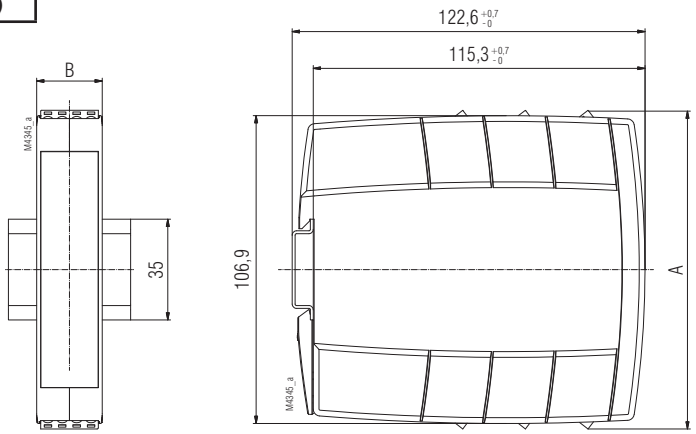


Contact extensions with UG6929/100; suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

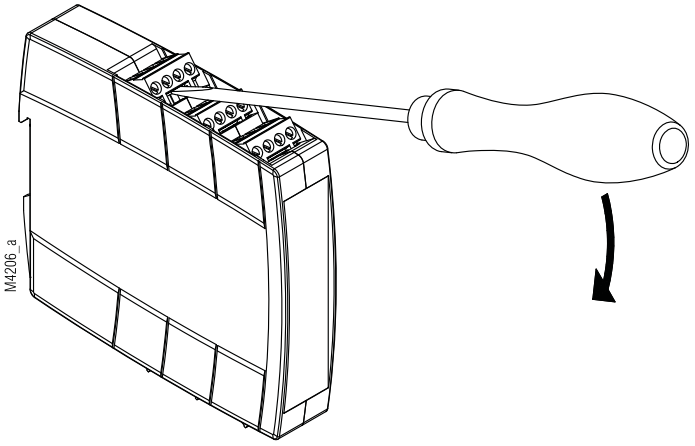
	 M10749	 M10743	 M10744
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
UG 6929 PS	110 ± 1	22,5
UG 6929 PC	120 ± 1	
UG 6929 PT		

DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT -terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	144,3	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)

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:	99,0	%
PFH_D:	3,59E-10	h^{-1}
T_1	20	a (year)

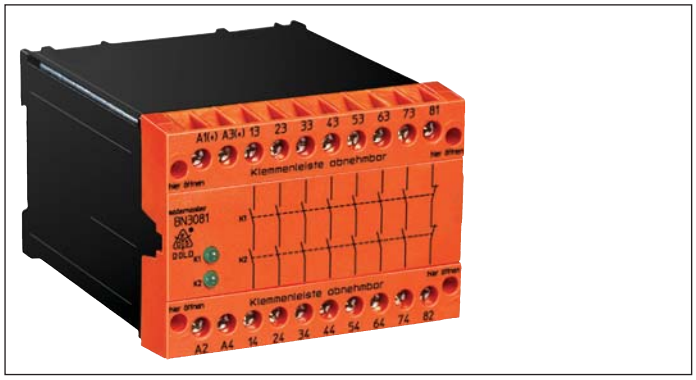
*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511, EN 50156-1	SIL 3	einmal pro Jahr once per year annuel

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Expansion Module
BN 3081

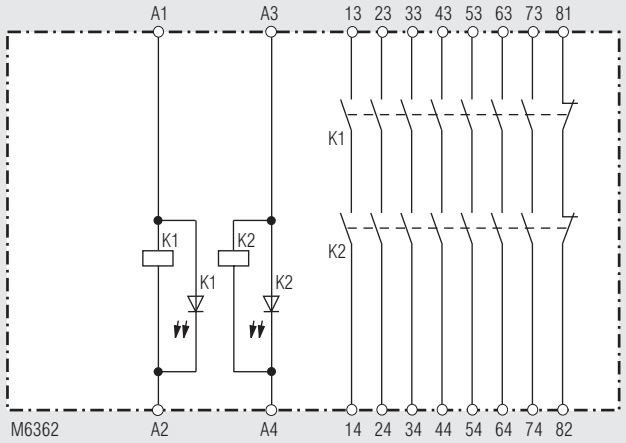
0221558



- **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**

  when connected to a suitable safety module
- Redundant and forcibly guided contacts
- Output: 7 NO contacts, 1 NC contact for feed back circuit
- 1- or 2-channel connection
- LED displays for channels 1.2
- Removable terminal strips
- Width 100 mm

Block Diagram



Approvals and Marking

CE | TÜVRheinland Type Approved | c UL us * Canada / USA | A025518

* see variants

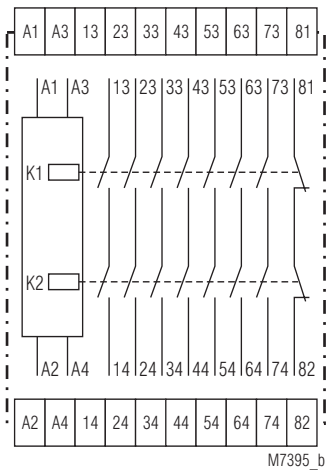
Applications

Contact multiplication of e-stop modules and safety door monitors.

Indication

LED K1:	on when supply on relay K1
LED K2:	on when supply on relay K2

Circuit Diagram



Notes

The extension module must only be used together with a safety unit (e.g. LG 5925) that monitors the feedback circuit 81/82 to achieve (SIL CL) 3 acc. to IEC/EN 62061, SIL 3 to IEC/EN 61508, Performance Level (PL) e, Category 4 to EN ISO 13849-1: 2008.

Connection Terminals

Terminal designation	Signal designation
A1 (+), A3 (+)	+ / L
A2, A4	- / N
13, 14, 23, 24, 33, 34, 43, 44, 53, 54, 63, 64, 73, 74	Positive guided NO contacts for release circuit
81, 82	Forcibly guided feedback circuit

Technical Data

Input

Nominal voltage U_N:	AC 110, 115, 120, 230 V; DC 110 V AC/DC 24, 48 V For extension modules where the nominal voltage is the mains voltage EN 60204 part 9.1.1 must be fulfilled
Voltage range:	AC 0.8 ... 1.1 U_N
at 10% residual ripple:	DC 0.9 ... 1.2 U_N
at 48% residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	5.5 VA; 2.8 W
Nominal frequency:	50 / 60 Hz
Control current:	approx. 12 mA for K1 and K2 at AC 230 V approx. 55 mA for K1 and K2 at DC 24 V

Output

Contacts	
BN 3081.63:	7 NO contacts, 1 NC contact for feed back circuit The NO contacts are safety contacts. **ATTENTION! The NC contacts 81-82 can only be used for monitoring.**
Response / release time of K1 and K2:	35 ms / 35 ms
Contact type:	Relay, forcibly guided
Nominal output voltage:	AC 400 V / DC 230 V
Thermal current I_{th}:	See Limit curve for arc-free operation (max. 10 A in one contact path)
Switching capacity	
to AC 15	
NO contact:	5 A / AC 230 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	4 A / DC 24 V IEC/EN 60 947-5-1
according to DC 13	
NO contact:	6 A / DC 24 V at 0,1 Hz
Electrical life	
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles IEC/EN 60 947-5-1
Permissible operating frequency:	6000 switching cycles / h
Short circuit strength max. fuse rating:	10 A gL IEC/EN 60 947-5-1
max. line circuit breaker:	C10A
Mechanical life:	10 x 10^6 switching cycles

General Data

Operating mode:	Continuous operation
Temperature range	
Operation:	- 15 ... + 55 °C at max. 90 % humidity
Storage :	- 25 ... + 85 °C
Altitude:	< 2.000 m
Clearance and creepage distances	
Rated impuls voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1
EMC	
Electrostatic discharge:	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 voltages between	
wires for power supply:	2 kV IEC/EN 61 000-4-5
between wire and ground:	4 kV IEC/EN 61 000-4-5
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 V0 behavior according to UL subject 94
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz, IEC/EN 60 068-2-6

Technical Data

Climate resistance:	15 / 055 / 04 IEC/EN 60 068-1
Terminal designation:	EN 50 005
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1 Terminal strip removable
Mounting:	DIN rail DIN/EN 60 715
Weight:	510 g

Dimensions

Width x height x depth:	100 x 74 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	103,1	a (year)
DC / DC_{avg}:	99.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	2.60E+06	s/Zyklus
	≙ 1	/mth (month)

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	99.0	%
SFF	99.7	%
PFH_D:	6.65E-10	h^{-1}
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:

NO contact:	Pilot duty B300 10A 250Vac G.P. 10A 24Vdc
NC contact:	10A 250Vac G.P. 10A 24Vdc
Wire connection:	Only for 60°C / 75°C copper conductors AWG 16 - 14 Torque 0.8 Nm

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

CCC-Daten

Thermal current I_{th}:	See quadratic total current limit curve (max. 5 A in one contact path)

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

Standard Type

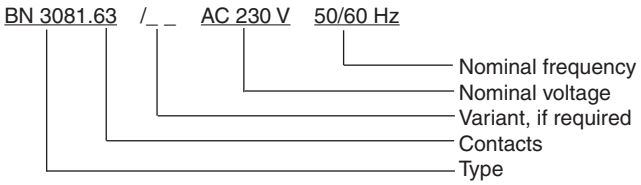
BN 3081.63 AC/DC 24 V

Article number:	0044207
• Output:	7 NO contacts, 1 NC contact for feed back circuit
• Nominal voltage U_N:	AC/DC 24 V
• Width:	100 mm

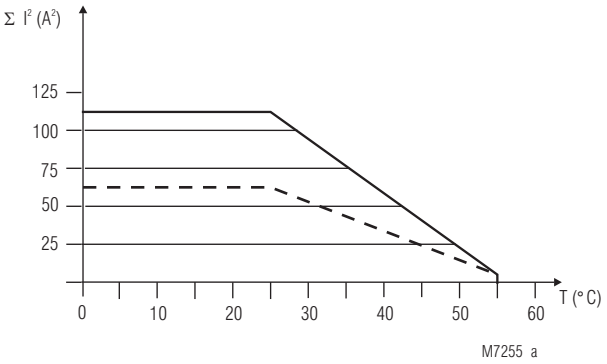
Variant

BN 3081.63/61: with UL-approval

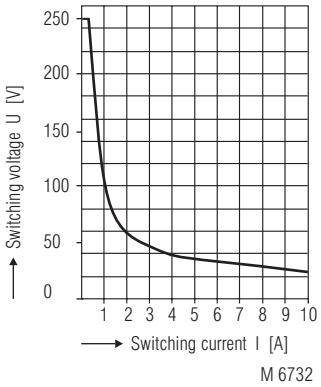
Ordering example for variant



Characteristics

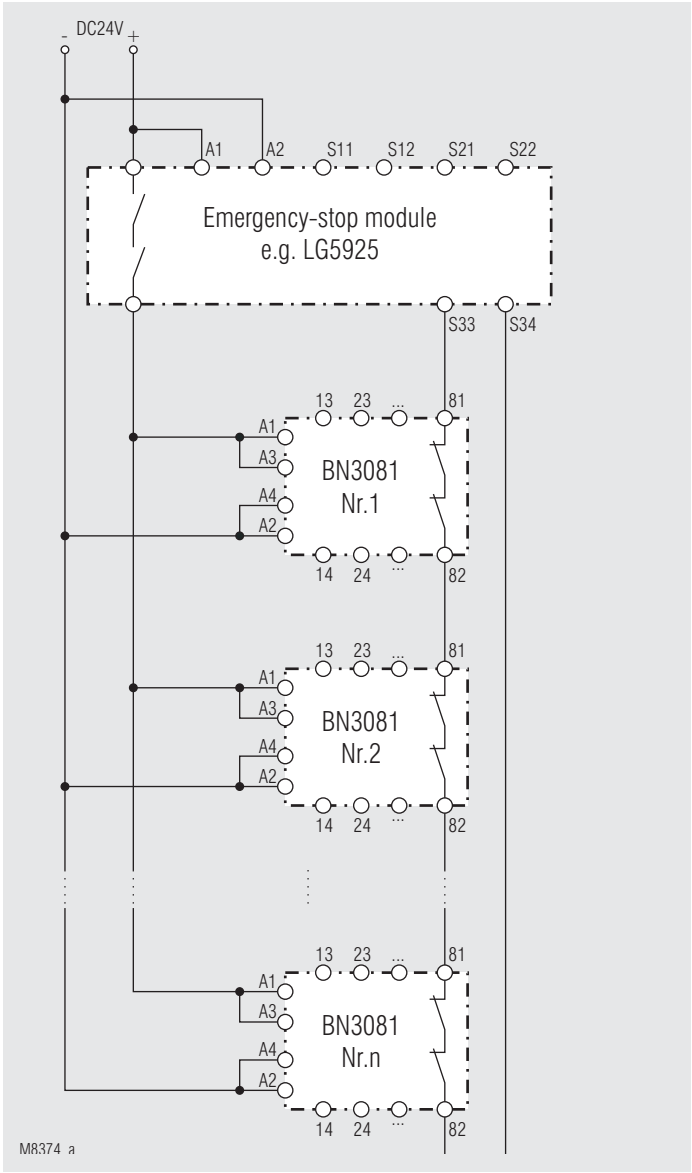


Quadratic total current limit curve

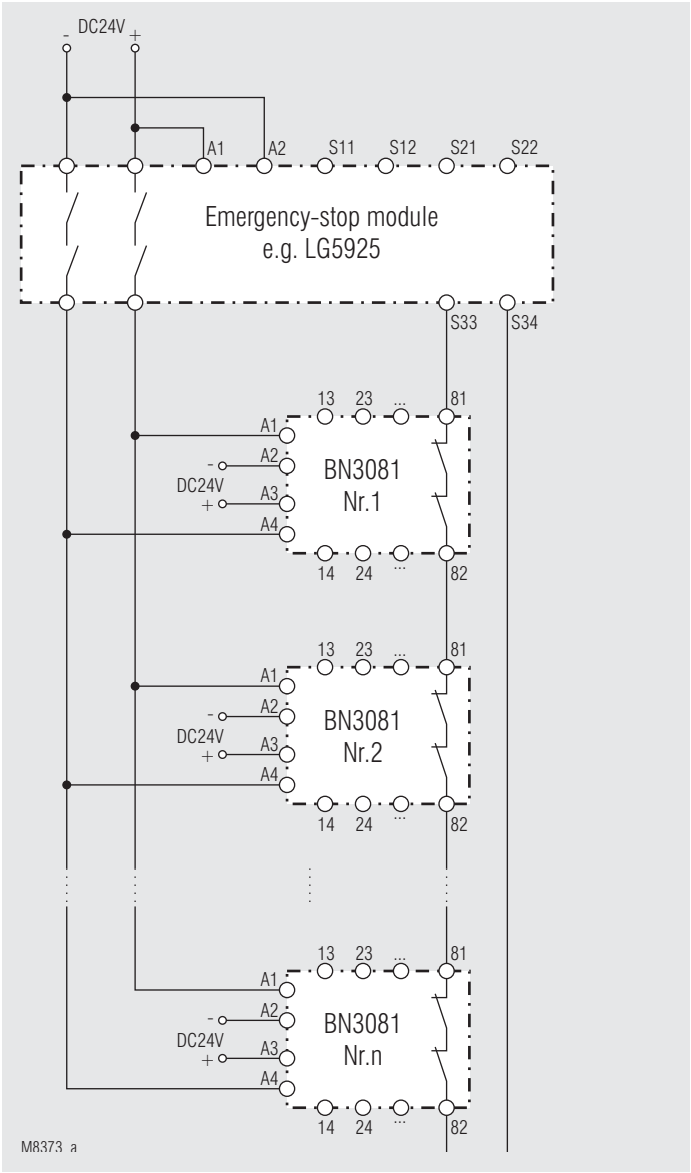


Limit curve for arc-free operation for resistive load

Application Examples



Contact multiplication with several extension moduls 1-channel;
suitable up to SIL3, Performance Level e, Cat. 4

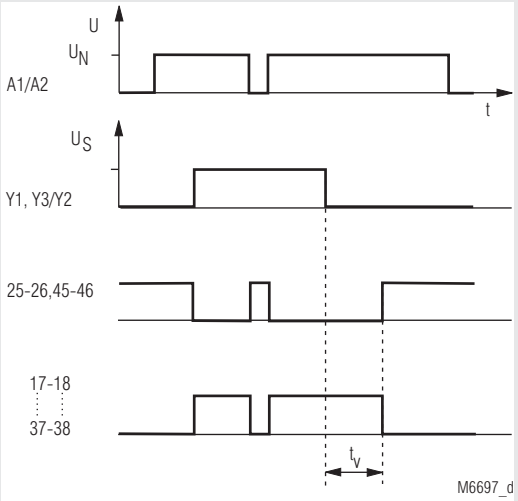


Contact multiplication with several extension moduls 2-channel
with cross fault monitoring;
suitable up to SIL3, Performance Level e, Cat. 4

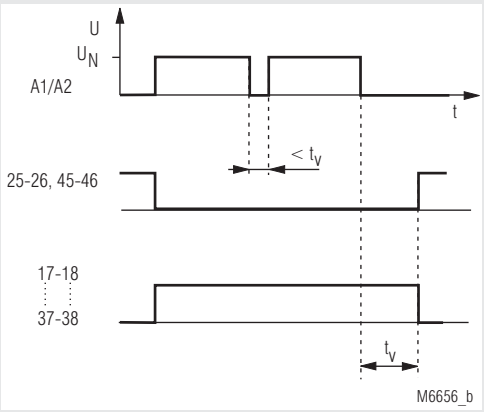
SAFEMASTER
Delay module, release delay
BG 7925, BH 7925

0226827

Function Diagram for devices with auxiliary voltage



Function Diagram for devices without auxiliary voltage



- **According to**
  - **Performance Level (PL) d and category 2 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 2) to IEC/EN 61508**
  - **Category 2 nach EN 954-1**
- **Variants /_ _2 to /_ _3**
  - **Performance Level (PL) d and category 3 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 2) to IEC/EN 61508**
  - **Category 3 to EN 954-1**
- Adjustable time delay
- Long time stability by digital timing circuit
- With auxiliary voltage
- 1 timing circuit
- BH 7925 in dual voltage version
- BH 7925 optionally for AC 230 V
- Output: 1 NC contact, 1 NO contact, forcibly guided or
  1 NC contact, 3 NO contacts, forcibly guided
- Indication of state of operation
- Removable terminal strips
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated),
- DIN 46 228-1/-2/-3/-4 or
  2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Optionally with 2 timing circuits
- Optionally fixed time delay
- Optionally without auxiliary voltage on BH 7925
- Optionally for switching small loads
- BG 7925: width 22.5 mm
  BH 7925: width 45 mm

Approvals and Markings

Canada / USA A025518

* see variants [1] only for BH 7925

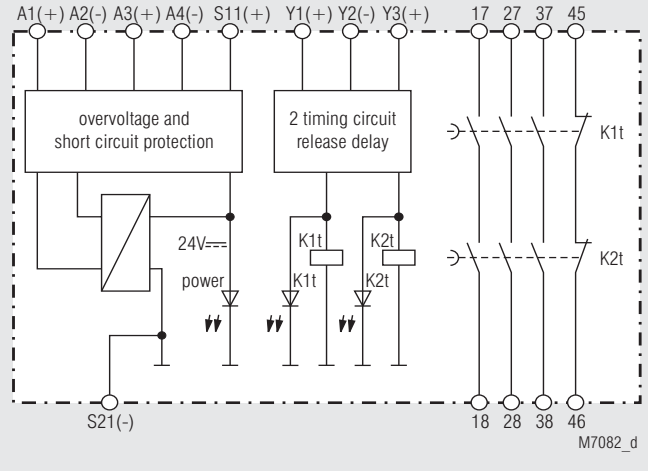
Application

Delayed switch-off in safety-control circuits, stop-category 1 according to IEC/EN 60 204-1

Indication

LED "Power":	on, when operating voltage applied
LED K1t:	on, when output relay K1t activated
LED K2t:	on, when output relay K2t activated

Block Diagram



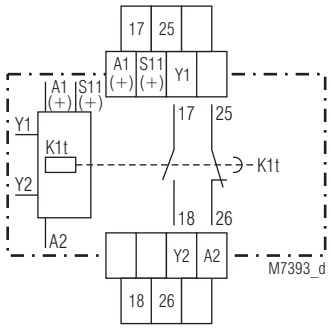
Block diagram for units with 2 timing circuits.
In units with only 1 circuit K2t is missing.

Notes

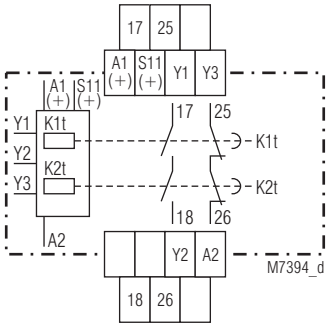
The output contacts of the two timing circuits are connected in series. This results in so-called switch off redundancy, i.e. the contact path is opened reliably after expiry of the predefined delay time, even if a contact in this path is welded.
AC-models can be connected to DC 24 V via terminals A3-A4.
For units with auxiliary supply the control of the time circuits is made via terminals Y1, Y3/Y2 (see application examples). Plus is connected to Y1, Y3 and minus to Y2. Units without auxiliary supply are controlled with the nominal voltage U_N.

Attention!
Before activating the unit it has to be checked by monitoring the NC contacts 45, 46, if both relays have been de-energized.
The gold plated contacts of the BG 7925.21/40_ mean that this module is also suitable for switching small loads of 1 mVA - 7 VA, 1 mW - 7 W in the range 0.1 - 60 V, 1 - 300 mA. The contacts also permit the maximum switching current. However since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.

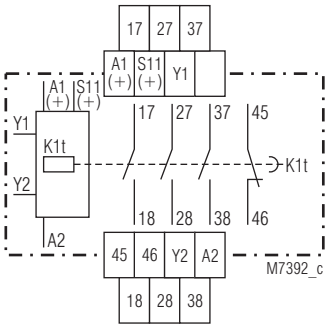
Circuit Diagrams



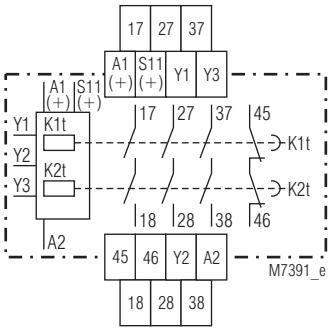
BG 7925.21, BG 7925.21/001
1 timing circuit



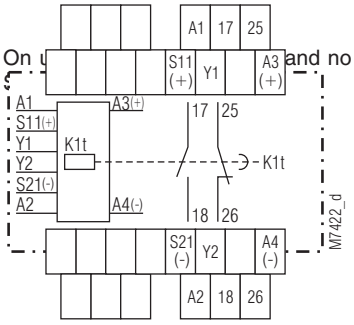
BG 7925.21/002, BG 7925.21/003
2 timing circuits



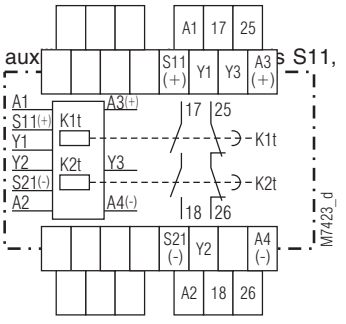
BG 7925.96, BG 7925.96/001
1 timing circuit



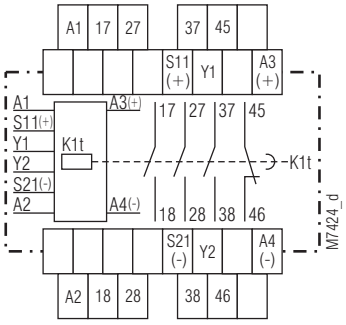
BG 7925.96/002, BG 7925.96/003
2 timing circuits



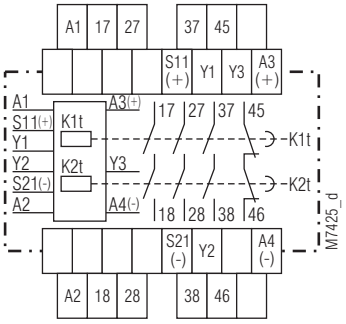
BH 7925.21/_00, BH 7925.21/_01
1 timing circuit



BH 7925.21/_02, BH 7925.21/_03
2 timing circuits



BH 7925.96/_00, BH 7925.96/_01
1 timing circuit



BH 7925.96/_02, BH 7925.96/_03
2 timing circuits

On units with 1 timing circuit and no auxiliary supply the terminals S11, S21, Y1 and Y2 do not exist.

Connection Terminals

Terminal designation	Signal description
A1 (+), A3 (+)	+ / L
A2 (-), A4 (-)	- / N
Y1(+), Y2(-), Y3 (+)	Inputs
S11(+), S21 (-)	Outputs
17,18, 27, 28, 37, 38	Positive guided NO contacts for release circuit
25, 26, 45, 46	NC contact positive guided for release circuit

Technical Data

Time circuit

Time delay t_v:	adjustable	fixed
	0.1 ... 1 s	1 s
	0.3 ... 3 s	3 s
	0.5 ... 5 s	5 s
	1 ... 10 s	10 s
	3 ... 30 s	30 s
	10 ... 100 s	
	30 ... 300 s	
	3 ... 30 min	

Longer time on request. Units without auxiliary supply are available only up to 10 s with 1 timing circuit or 5 s with 2 timing circuits.

Repeat accuracy:	±1 % of the setting value
Min. turn-on time:	10 % of full scale value 50 % of full scale value for units without auxiliary supply

Input

Nominal voltage U_N	
(Auxiliary voltage U_H)	
BG 7925:	AC/DC 24 V
BH 7925:	AC/DC 24 V[1] and AC 230 V[2] [1] on terminals A3 - A4 [2] on terminals A1 - A2
Voltage range:	AC 0.8 ... 1.1 U_N
with 10 % residual ripple:	DC 0.9 ... 1.1 U_N
with 48 % residual ripple:	DC 0.8 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Nominal consumption:	typically DC 2.0 W typically AC 4.2 VA
Control voltage U_S	
at Y1, Y2, Y3:	typically DC 24 V
current in Y1, Y3:	typically 6.5 mA

Output

Contacts	
BG 7925.21, BH 7925.21:	1 NO contact, 1 NC contact
BG 7925.96, BH 7925.96:	3 NO contacts, 1 NC contact
Contact type:	Relay, forcibly guided
Release delay typ. at U_N	
BG7925, BH7925/0xx	
Disconnecting the supply:	35 ms
Disconnecting Y1, Y2, Y3:	35 ms + t_v
BH5925/1xx	
Disconnecting the supply:	35 ms + t_v
Disconnecting Y1, Y2, Y3:	35 ms + t_v
Nominal output voltage:	AC 10 ... 250 V DC 10 ... 110 V
Thermal current I_{th}:	max. 5 A
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
BG/BH 7925.21	
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
BG/BH 7925.96	
NC contact:	2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13	
BG/BH 7925.21	
NO contact:	2 A / DC 24 V IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V IEC/EN 60 947-5-1
BG/BH 7925.96	
NO contact:	1 A / DC 24 V IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V IEC/EN 60 947-5-1
to DC 13	
BG/BH 7925.96	
NO contact:	4 A / DC 24 V at 0.1 Hz
NC contact:	4 A / DC 24 V at 0.1 Hz

Technical Data

Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	≥ 2.5 x 10^5 switching cycles	
Permissible operating frequency:	max. 2000 switching cycles / h please note minimum closing time	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 15 ... + 55°C	
Strorage:	- 25 ... + 85°C	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for voltage supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF irradiation:	10 V	IEC/EN 61 000-4-6
Interference suppression:	limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminal plate:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Wire connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Terminal screws M 3.5 Box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	210 g	

Dimensions

Width x height x depth	
BG 7925:	22,5 x 84 x 121 mm
BH 7925:	45 x 84 x 121 mm

Safety Related Data BG7925/_ _0 and /_ _1

Values according to EN ISO 13849-1:		
Category:	2	
PL:	d	
$MTTF_d$:	210.1	a (year)
DC / DC_{avg}:	98.5	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)
Values according to IEC/EN 62061 / IEC/EN 61508:		
SIL CL:	2	IEC/EN 62061
SIL	2	IEC/EN 61508
HFT:	0	
DC / DC_{avg}:	98.5	%
SFF	99.5	%
PFH_D:	8.26E-09	h^{-1}
T_1:	20	a (year)

Technical Data

Safety Related Data BG7925/_ _2 and /_ _3

Values according to EN ISO 13849-1:

Category:	3	
PL:	d	
$MTTF_d$:	210.1	a
DC / DC_{avg}:	98.5	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

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

SIL CL:	2	IEC/EN 62061
SIL	2	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	98.5	%
SFF	99.5	%
PFH_D:	3.76E-10	h^{-1}
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"

Nominal voltage U_N:
BG7925, /001, /002, /003: AC/DC 24V

Ambient temperature: - 15 ... + 55°C

Switching capacity
NO contact: Pilot duty B300
5A 250Vac Resistive
5A 24Vdc Resistive or G.P.

NC contact: 5A 250Vac Resistive
5A 24Vdc Resistive or G.P..

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Sol Torque 0.8 Nm

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

CCC-Data

Nominal voltage U_N:
BH 7925: AC/DC 24 V und AC 230 V

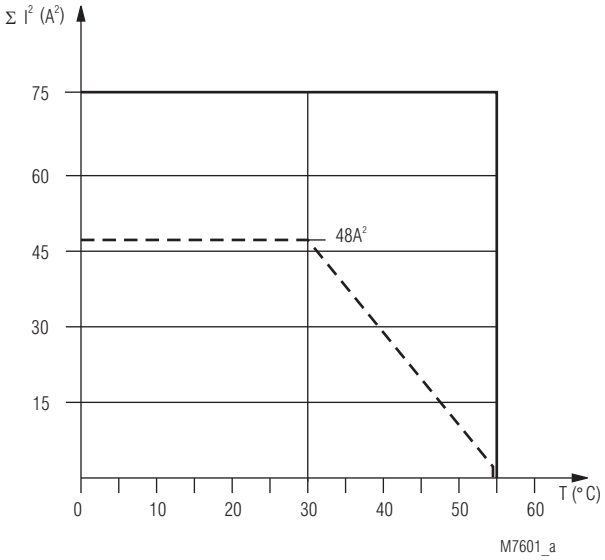
Thermal current I_{th}: max. 4 A
(see quadratic total current limit curve)

Switching capacity
to DC 13

NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1

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

Characteristics



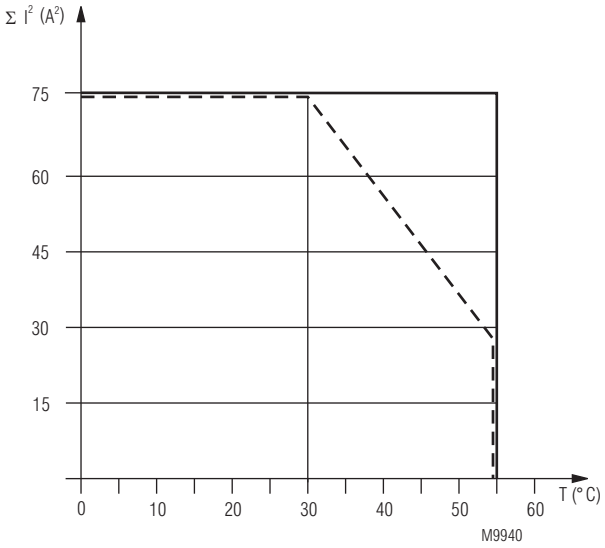
device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = 5A ≙ $3x5^2A^2=75A^2$

device mounted without distance heated by devices with same load,
max current at 55°C over
3 contactrows = 1A ≙ $3x1^2A^2=3A^2$

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

I_1, I_2, I_3 - current in contactrows

Total current limit curve BG 7925



device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = 5A ≙ $3x5^2A^2=75A^2$

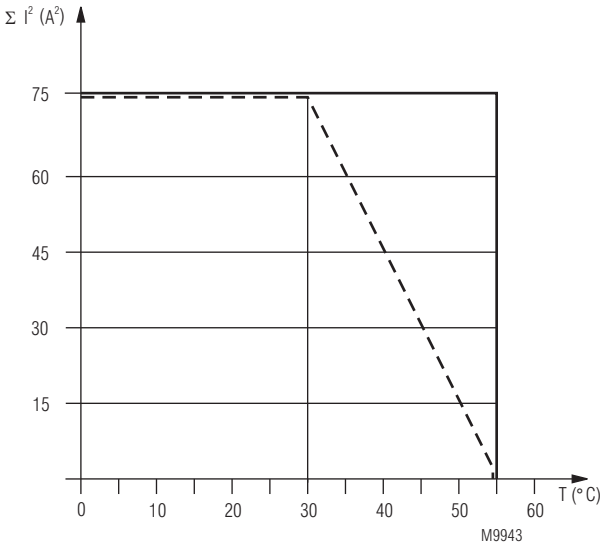
device mounted without distance heated by devices with same load,
max current at 55°C over
3 contactrows = 3A ≙ $3x3^2A^2=27A^2$

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

I_1 , I_2 , I_3 - current in contactrows

Total current limit curve BH 7925 AC/DC 24 V

Characteristic



device mounted on distance with air circulation.
max. current at 55°C over
3 contactrows = 5A ≙ $3x5^2A^2=75A^2$

device mounted without distance heated by devices with same load,
max current at 55°C over
3 contactrows = 1A ≙ $3x1^2A^2=3A^2$

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

I_1, I_2, I_3 - current in contactrows

Total current limit curve BH 7925 AC 230 V

Standard Types

BG 7925.21 AC/DC 24 V 50/60 Hz 1 ... 10 s
Article number: 0049628
- With auxiliary voltage
- 1 timing circuit
- Adjustable time delay 1 ... 10 s
- Output: 1 NO contact, 1 NC contact
- Nominal voltage U_N: AC/DC 24 V
- Width: 22,5 mm

BH 7925.21/100 AC/DC 24 V + AC 230 V 50/60Hz 1 ... 10 s
Article number: 0050034
- Without auxiliary voltage
- 1 timing circuit
- Adjustable time delay 1 ... 10 s
- Output: 1 NO contact, 1 NC contact
- Nominal voltage U_N: AC/DC 24 V + AC 230 V
- Width: 45 mm

Variants

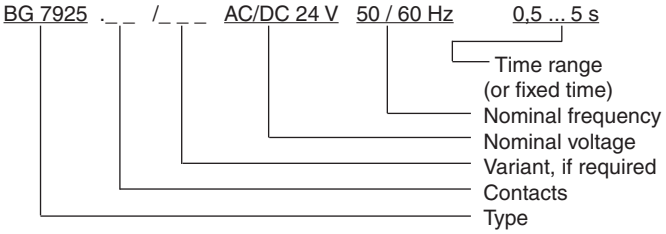
BG 7925/61: with UL approval

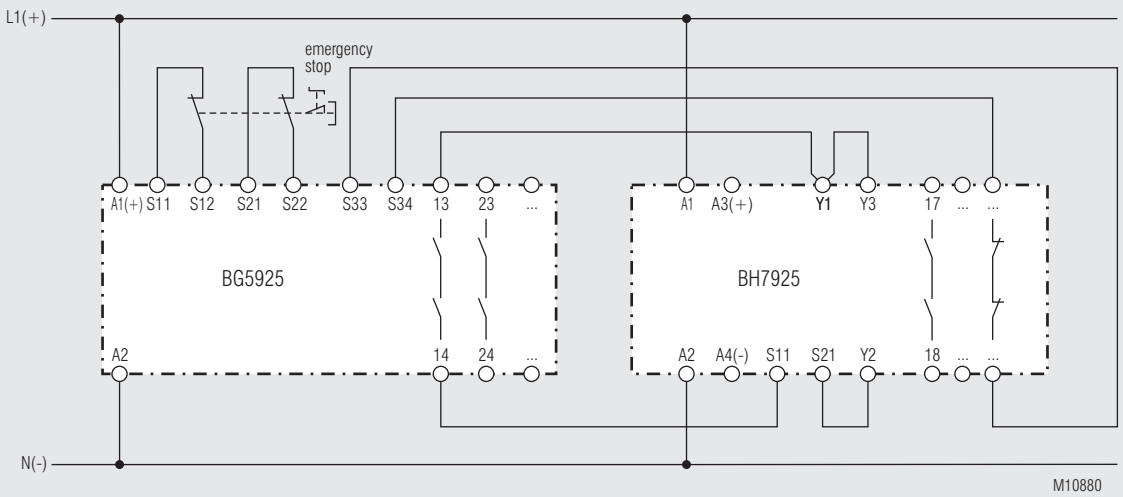
						1 timing circuit		2 timing circuits	
	Gold plated contacts 5 µm Au	Without auxiliary supply	With auxiliary supply	AC/DC 24 V	AC/DC 24 V + AC 230 V	adjustable	fixed	adjustable	fixed
BG 7925.21			X	X		X			
BG 7925.21/001			X	X			X		
BG 7925.21/002			X	X				X	
BG 7925.21/003			X	X					X
BG 7925.21/400	X		X	X		X			
BG 7925.21/401	X		X	X			X		
BG 7925.21/402	X		X	X				X	
BG 7925.21/403	X		X	X					X
BG 7925.96			X	X		X			
BG 7925.96/001			X	X			X		
BG 7925.96/002			X	X				X	
BG 7925.96/003			X	X					X
BH 7925.21			X		X	X			
BH 7925.21/001			X		X		X		
BH 7925.21/002			X		X			X	
BH 7925.21/003			X		X				X
BH 7925.96			X		X	X			
BH 7925.96/001			X		X		X		
BH 7925.96/002			X		X			X	
BH 7925.96/003			X		X				X
BH 7925.21/100		X			X	X			
BH 7925.21/101		X			X		X		
BH 7925.21/102		X			X			X	
BH 7925.21/103		X			X				X
BH 7925.96/100		X			X	X			
BH 7925.96/101		X			X		X		
BH 7925.96/102		X			X			X	
BH 7925.96/103		X			X				X

BG 7925 modules require auxiliary voltage. BH 7925 modules are available with or without auxiliary voltage.

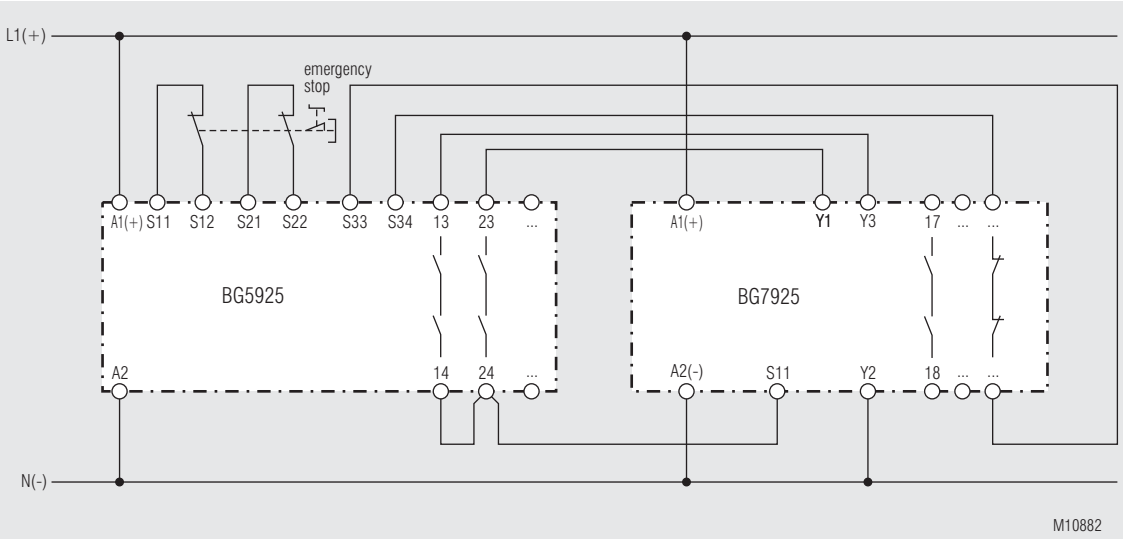
The devices with gold plated contacts are suitable for switching small loads.

Ordering example for Variants

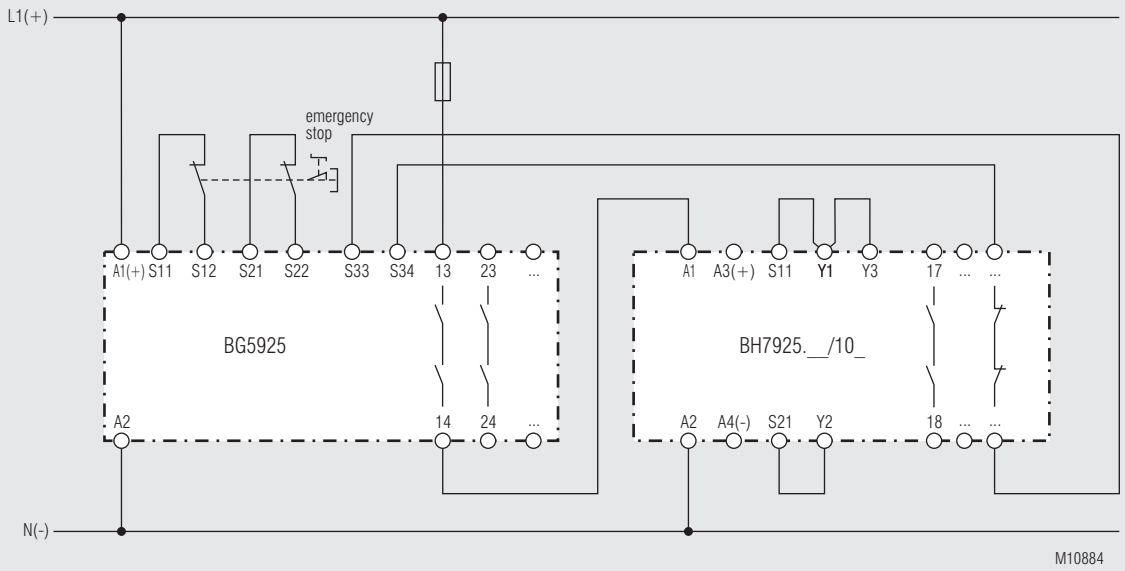




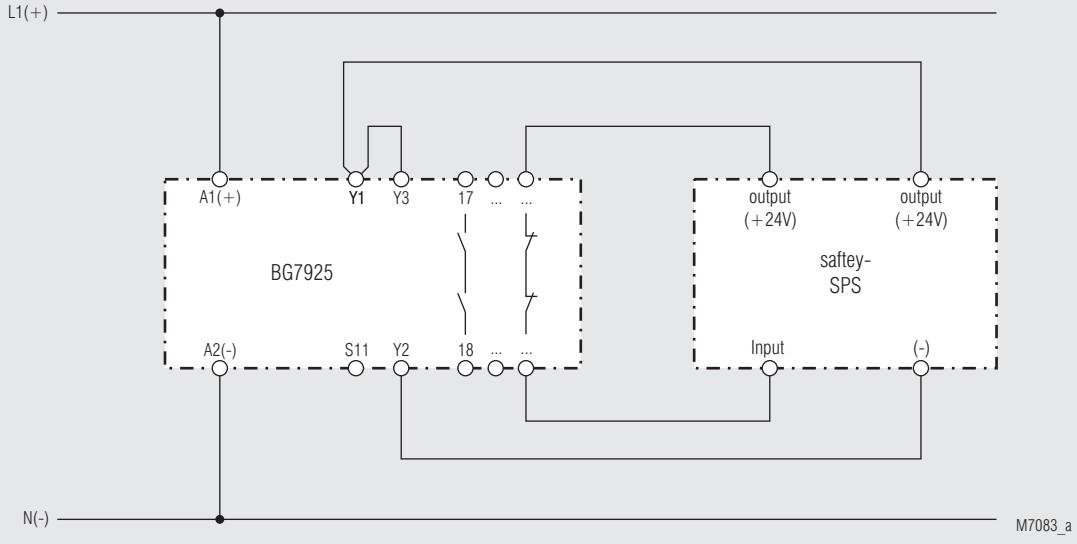
Versions with auxiliary voltage. Time control with internal voltage S11(+), S21(-). Suited up to SIL2 Performance Level d, Cat. 3



Versions with auxiliary voltage. Seperate control of 2 timing circuits with internal voltage S11 (+). Suited up to SIL2 Performance Level d, Cat. 3



Versions without auxiliary voltage. Control of timing circuits over K1. Suited up to SIL2 Performance Level d, Cat. 3

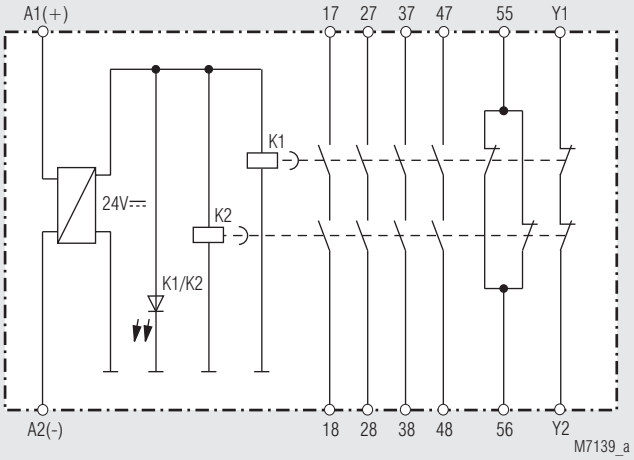


Time control with external voltage (e.g. PLC). If voltage peaks ≥ 500 V are expected, they have to be limited by suitable means. Suited up to SIL2 Performance Level d, Cat. 3

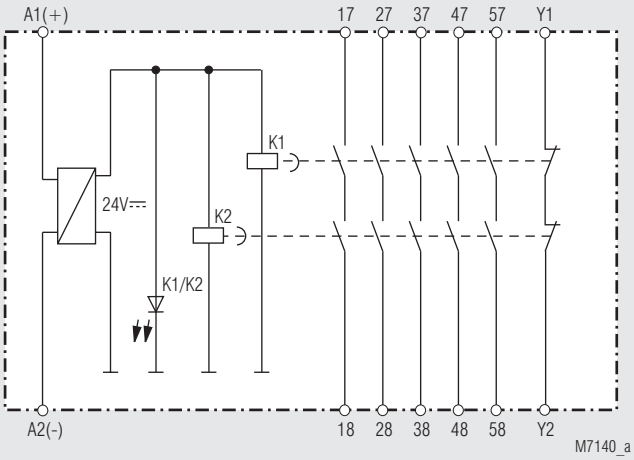
SAFEMASTER
Delay Module, Release Delay
BG 7926

- **According to**
  - **Performance Level (PL) d and category 2 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 2 to IEC/EN 61508 and IEC/EN 61511 when connected to a suitable safety module**
- Redundant and forcibly guided contacts
- 1 timing circuit
- Fixed time delay 1, 2 or 3 sec
- Without auxiliary supply
- Output: 5 NO contacts or 4 NO contacts / 1 NC contact, 1 NC contact for feed back circuit
- Indicator LED for operation
- Removable terminal strips
- Wiring diameter: also 2 x 1.5 mm² stranded ferruled with sleeve DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 22.5 mm

Block Diagrams



BG 7926.54



BG 7926.60

Approvals and Markings

CE TÜV SUD c UL us Canada / USA *

* see variants

Application

Delayed disconnection of safety relevant circuits, stop category 1 according to IEC/EN 60 204-1.

Indicator

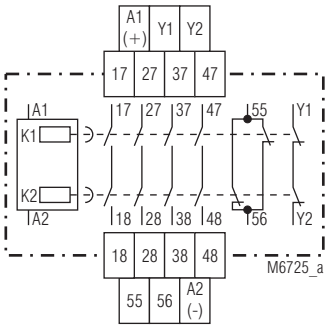
LED K1/K2: On, when control voltage applied

Notes

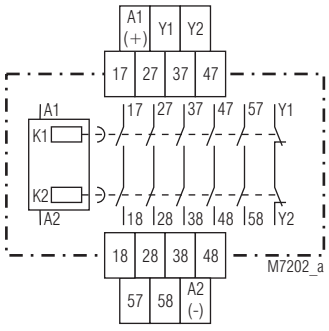
Attention!

To achieve the safety levels stated under features, the supervising control (e. g. BG 5924) must check the NC contact Y1/Y2 before starting to make sure that both relays (K1 and K2) are switched off.

Circuit Diagrams



BG 7926.54



BG 7926.60

Technical Data

Time circuit

Release time:	1 s; 2 s; 3 s fixed other times on request
Time accuracy:	30 %
Repeat accuracy:	± 5 % of nominal value
Min. closing time:	200 % of nominal value

Input

Nominal voltage U_N:	AC/DC 24 V
Voltage range:	AC 0.8 ... 1.1 U_N
at 10 % residual ripple:	DC 0.9 ... 1.1 U_N
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption	
AC 24 V:	2.1 VA
DC 24 V:	3 W
Nominal frequency:	50 / 60 Hz
Control current	
AC 24 V:	100 mA
DC 24 V:	120 mA

Output

Contacts	
BG 7926.60:	5 NO contacts, 1 NC contact for feed back circuit
BG 7926.54:	4 NO contacts, 1 NC contact, 1 NC contact for feed back circuit
Response time:	max. 20 ms
Release time:	1 s, 2 s, 3 s
Type of contact:	relay, forcibly guided
Nominal output voltage:	AC 250 V
Thermal current I_{th}:	max. 5 A (see total current limit curve)

Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
NC contact:	4 A / 24 V at 0.1 Hz	
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	
Permissible switching frequency:	600 switching cycles / h	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
line circuit breaker:	C8A	
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 15 ... + 55°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wires and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminal plate:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequenz 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1

Technical Data

Wire connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled with sleeve or 2 x 1.5 mm² stranded ferruled with sleeve DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire connection:	Plus-Minus terminal screws M3.5 Box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	180 g	

Dimensions

Width x height x depth:	22.5 x 84 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:		
Category:	2	
PL:	d	
$MTTF_d$:	142.1	a (years)
DC_{avg}:	98.2	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC/EN 62061 / IEC/EN 61508 / IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	0	
DC_{avg}:	98.2	%
SFF:	99.4	%
PFH_D:	1.26E-08	h^{-1}
PFD:	5.41E-05	
T_1:	20	a (years)

*) 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"

Nominal voltage U_N:	AC/DC 24 V
Ambient temperature:	-15 … +50°C,
Switching capacity	
NO contact :	Pilot duty B300 5A 250Vac Resistive 5A 24Vdc Resistive or G.P.
NC contact:	5A 250Vac Resistive 5A 24Vdc Resistive or G.P.
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BG 7926.60 3 s AC/DC 24 V 50/60 Hz

Article number:	0050808
• Output:	5 NO contacts, 1 NC contact for feed back circuit
• Release time:	3 s
• Nominal voltage U_N:	AC/DC 24 V
• Width:	22.5 mm

Ordering Example

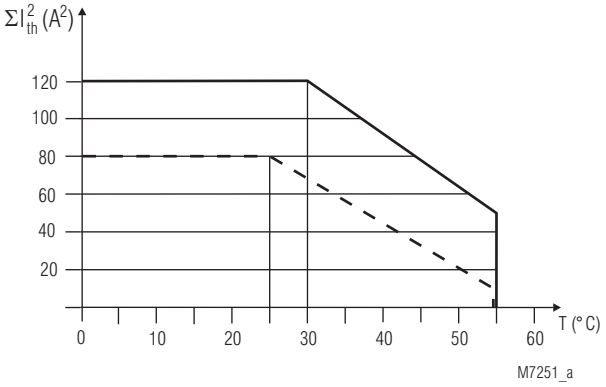
BG 7926 .60 3 s AC/DC 24 V 50 / 60 Hz

- 50 / 60 Hz — Nominal frequency
- AC/DC 24 V — Nominal voltage
- 3 s — Release time
- .60 — Contacts
- BG 7926 — Type

Variant

BG 7926/61: with UL-approval

Characteristic



AC / DC 24 V device mounted on distance with aircondition

AC / DC 24 V device mounted without distances heated by devices with same load

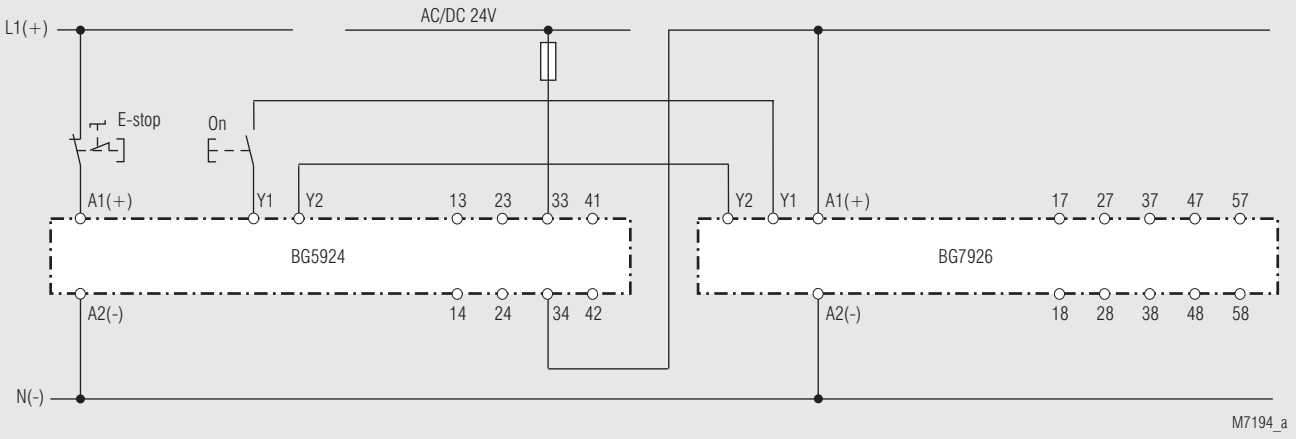
quadratic total current

$$\Sigma I^2_{th} = I^2_{th1} + I^2_{th2} + I^2_{th3} + I^2_{th4} + I^2_{th5}$$

I_{th1} , I_{th2} , I_{th3} , I_{th4} , I_{th5} : thermal current I_{th} on contact rows

Total current limit curve

Application Example

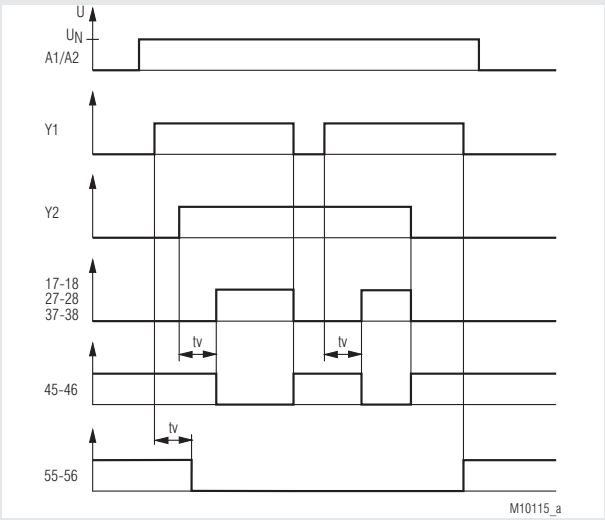


Multiplication of contacts at single channel E-stop circuit with feedback loop.
Suited up to SIL2, Performance Level d, Cat. 2

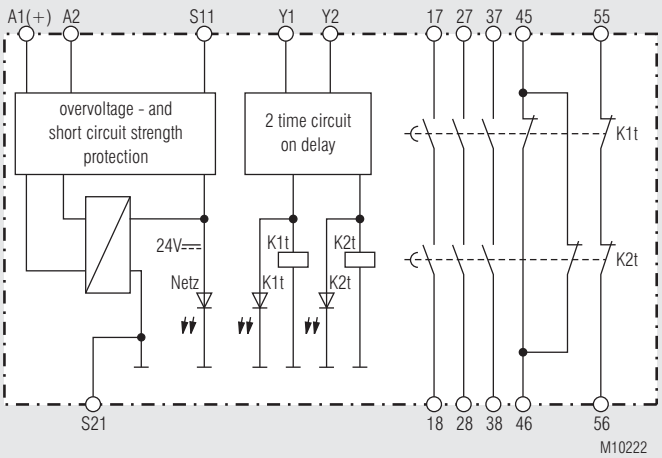
SAFEMASTER
Delay Module, On Delayed
LG 7927

0261959

Function Diagram



Block Diagram



Your advantage
- Easy to realise safe timing circuits
- 4 forcibly guided output contacts at only 22.5 mm width

Features
- **According to**
  - Performance Level (PL) d and category 3 to EN ISO 13849-1
  - SIL Claimed Level (SIL CL) 2 to IEC/EN 62061
  - Safety Integrity Level (SIL) 2 to IEC/EN 61508 and IEC/EN 61511 when connected to a suitable safety module
- Adjustable time delay
- As option fixed time delay
- High long life stability due to digital time base
- Adjustable with or without cross fault detection
- Output: 3 NO contacts + 1 NC contact + 1 forcibly guided
- feedback contact
  or 4 NO contacts + 1 forcibly guided feedback contact
- LED indicator for channel 1, 2 and operation voltage
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or
  2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- 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

Canada / USA

A025518

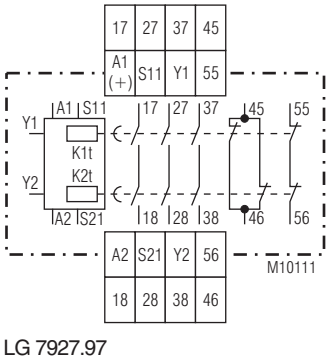
Applications

- Delayed start or enabling of a movement.
- Delayed enabling of a solenoid lock, e.g. SAFEMASTER STS

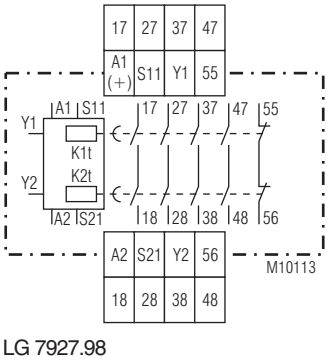
Indicators

upper LED:	on, when supply connected
lower LED:	on, when relay K1t and K2t energized

Circuit Diagrams



LG 7927.97



LG 7927.98

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S11, S21	Inputs
Y1, Y2	Outputs
17, 18, 27, 28, 37, 38, 47, 48	Positive driven NO contacts for release circuit
45, 46	Positive guided indicator output
55, 56	Positive guided feedback circuit

Technical Data

Input

Nominal voltage U_N:	DC 24 V AC/DC 24 V
Voltage range:	0.9 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Nominal consumption:	typ. DC 2.0 W typ. AC 3.5 VA
Control voltage on S11:	min. DC 20 V at U_N
Control current in Y1, Y2:	typ. DC 2,2 mA at U_N typ. AC 3,1 mA at U_N
Short-circuit protection:	Internal with PTC
Überspannungsschutz:	Internal with VDR

Output

Contacts

LG 7927.97:	3 NO contacts, 2 NC contacts
LG 7927.98:	4 NO contacts, 1 NC contacts

ATTENTION! The NC contacts 45-46 can only be used for monitoring.

Contact type:	forcibly guided	
Release delay typ. at U_N:		
Disconnecting the supply:	35 ms	
Disconnecting Y1, Y2:	40 ms	
Time delay t_v:	**adjustable**	**fixed**
	0.1 ... 1 s	1 s
	0.3 ... 3 s	3 s
	0.5 ... 5 s	5 s
	1.0 ... 10 s	10 s
	3.0 ... 30 s	30 s
	6.0 ... 60 s	60 s
	30.0 ... 300 s	300 s
	Other time ranges on request	
Repeat accuracy:	± 1% of setting value	
Thermal current I_{th}:	max. 5 A (see quadratic total current limit curve)	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
NC contact:	4 A / 24 V at 0.1 Hz	
Electrcal life:		
at 5 A, AC 230 V cos. φ = 1:	> 2.2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Permissible switching frequency:	max. 2000 switching cycles / h with manual restart and short release delay time	
Short circuit strength		
Max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperaturr range		
Operation:	- 15 ... + 55°C	
Strorage:	- 25 ... + 85°C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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 subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1

Technical Data

Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 190 g	

UL-Data

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

Nominal voltage U_N:	AC/DC 24 V
Ambient temperature:	-15 … +55°C
Switching capacity:	
Ambient temperature 45°C:	Pilot duty B300 5A 250Vac Resistive 5A 24Vdc Resistive or G.P.
Ambient temperature 55°C:	Pilot duty B300 4A 250Vac Resistive 4A 24Vdc Resistive or G.P.
Wire connection:	60°C / 75°C copper conductors only
Screw terminals fixed:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp:	AWG 20 - 12 Sol/Str

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

Standard Type

LG 7927.97/61 DC 24 V 1 ... 10 s

Article number:	0062790
• Output:	3 NO contacts, 2 NC contacts
• Nominal voltage U_N:	DC 24 V
• Time delay t_v:	1 ... 10 s
• Width:	22.5 mm

Ordering Example

LG 7927 ._ _ _ _ /61 AC/DC 24 V

- Nominal voltage
- UL approval
- Type of terminals
  without indication:
  terminal blocks fixed,
  with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks
  with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks
  with screw terminals
- Contacts
- Type

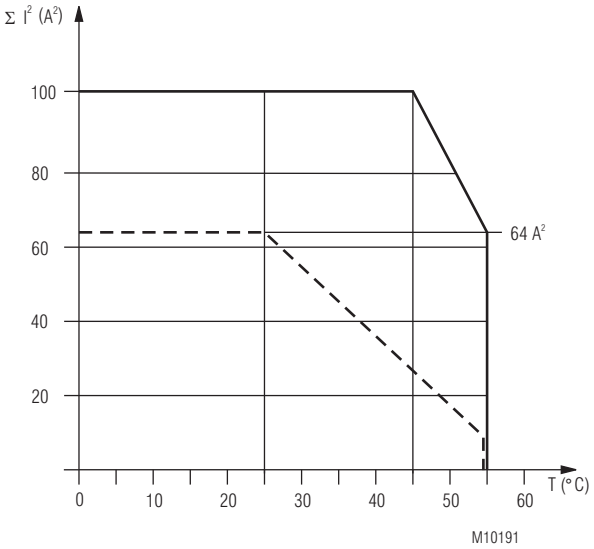
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply A1/A2 not connected
LED "K1t" lights up, but "K2t" remains off	- Signal on Y2 is not present - Wrong setting of operation mode (cross fault detection)
LED "K2t" lights up but "K1t" remains off	- Signal on Y1 is not present
Device cannot be activated	Safety relay is welded (replace device)

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.

Characteristic



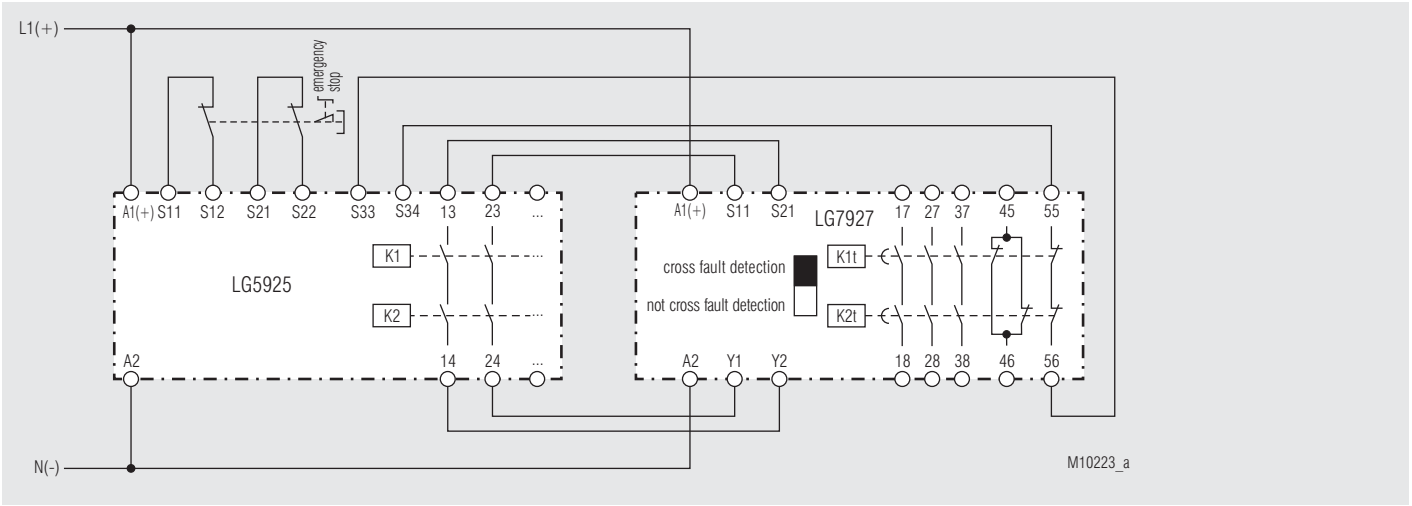
AC/DC 24V device mounted on distance with air circulation.
max. current at 55°C over
4 contactrows = 4A ≙ $4x4^2A^2=64A^2$

AC/DC 24V device mounted without distance heated by devices with same load,
max current at 55°C over
4 contactrows = 1,5A ≙ $4x1,5^2A^2=9A^2$

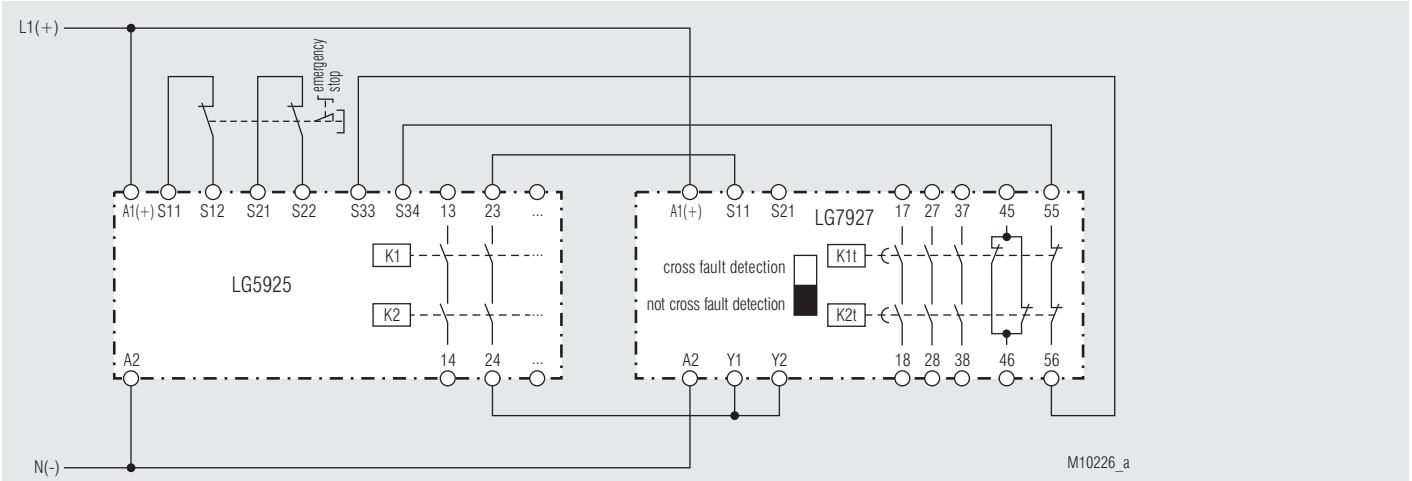
$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$$

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

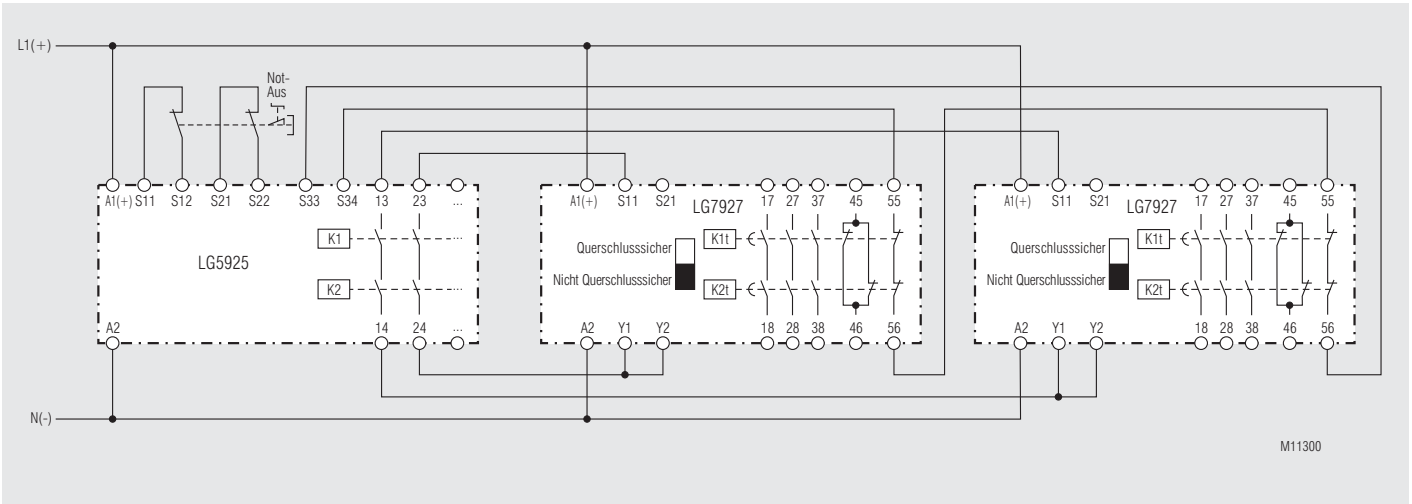
quadratic total current limit curve



LG 5925 with LG 7927, cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3



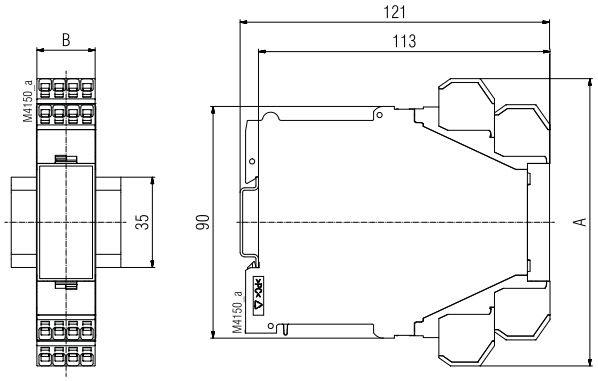
LG 5925 with LG 7927, non cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3



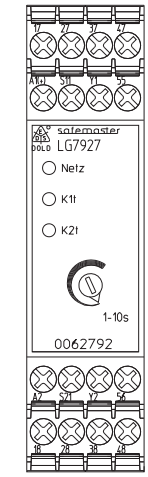
LG 5925 with two LG 7927, non cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3

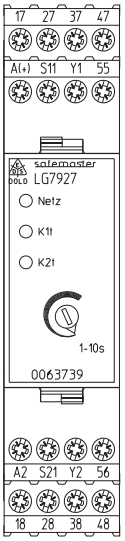
DE	**Maßbilder (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**

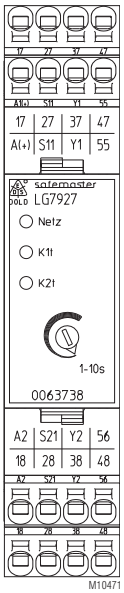
	A	B
LG 7927	90	22,5
LG 7927 PS	104	22,5
LG 7927 PC	111	22,5

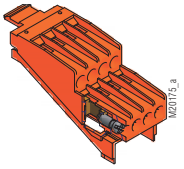


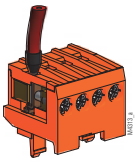
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



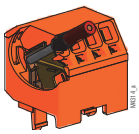




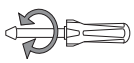
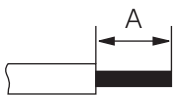
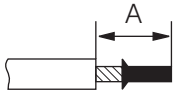
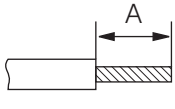




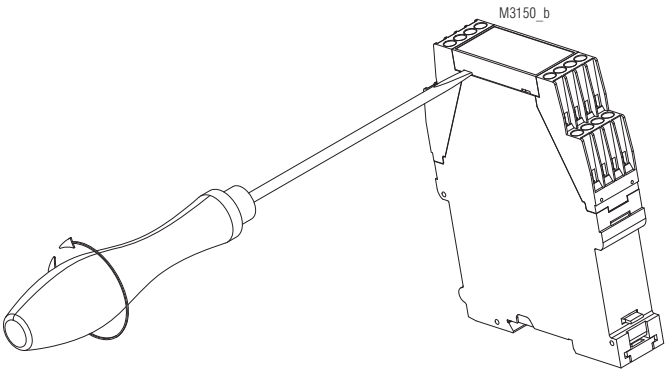
PS

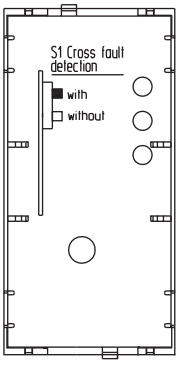


PC

	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**



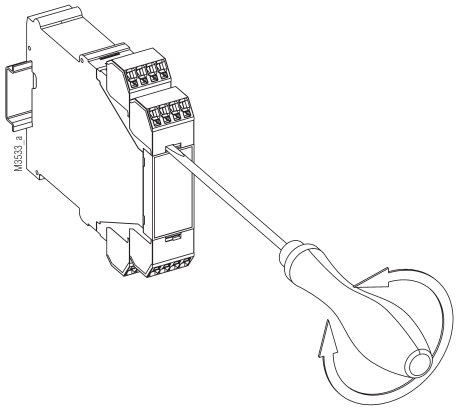


M10121

DE	S1 Querschlußerkennung ■ sicher ☐ nicht sicher
FR	S1 Transversal ■ avec ☐ sans

DE	Zur Einstellung der Betriebsart mit oder ohne Querschlußerkennung, ist der Schalter S1 vorgesehen. Dieser Schalter befindet sich hinter der Front-Abdeckplatte. Dabei ist zu beachten, daß die Betriebsarteinstellung immer vor der Einstellung der Zeit erfolgen muß, und vor Abnahme der Frontplatte, der Zeitdrehschalter auf Linksanschlag zu stellen ist. Nach der Einstellung der Betriebsart wird die Front-Abdeckplatte wieder montiert. Dabei ist darauf zu achten, daß sich der Zeitdrehschalter während der Montage auf Linksanschlag befindet. Zur Sicherheit ist nach der Montage nochmals zu prüfen, ob noch eine Zeitverstellung über den gesamten Zeitbereich möglich ist. (!) S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	To alter the operation mode with or without crossfault monitoring the switch S1 is used. It is located behind the front cover. The adjustment of the operating mode must be selected before the adjustment of the time as the time potentiometer has to be set fully anti-clock-wise before removing the front plate. After selecting the operating mode the front plate is remounted. Please make sure that the setting knob is also in left position while mounting the front plate. For safety please check after finishing if a setting of the complete range is still possible. (!) Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Le commutateur S1 est prévu pour le réglage du type de fonctionnement, avec ou sans reconnaissance de cc transversaux. Ce commutateur est situé sous la face avant. **IMPORTANT : Le commutateur doit être ajusté avant le réglage du temps, parce-que il faut tourner la tige du potentiomètre de réglage de temps tout à gauche avant de pouvoir retirer la face avant.** Après paramétrage du cc transversal, il faut remettre la face avant en prenant garde de tourner la tige du potentiomètre à gauche afin de l'introduire correctement dans son potentiomètre. Il est également conseillé de vérifier si le potentiomètre tourne bien sur l'ensemle de la plage de réglage. (!) Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	172,3	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)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	1	
DC:	99,0	%
PFH_D:	2,95E-10	h^{-1}
PFD_{AVG}:	2,50E-05	
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

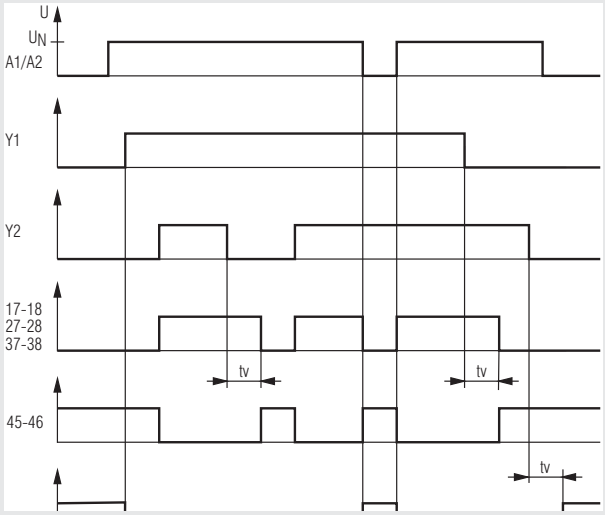
Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

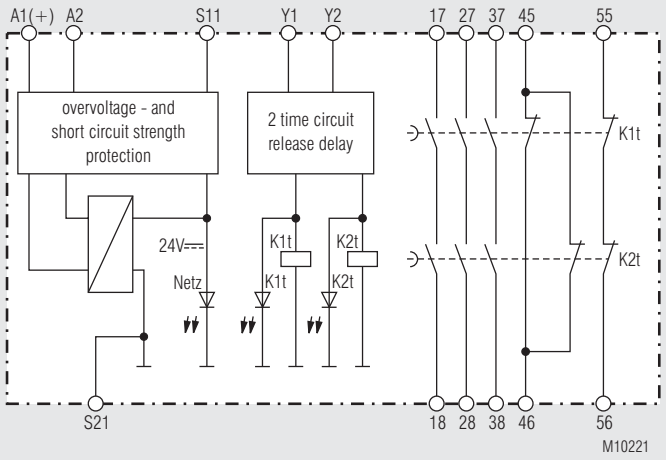
SAFEMASTER
Delay Module, Release Delayed
LG 7928

0261960

Function Diagram



Block Diagram



Your advantage
- Easy to realise safe timing circuits
- 4 forcibly guided output contacts at only 22.5 mm width

Features
- **According to**
  - Performance Level (PL) d and category 3 to EN ISO 13849-1
  - SIL Claimed Level (SIL CL) 2 to IEC/EN 62061
  - Safety Integrity Level (SIL) 2 to IEC/EN 61508 and IEC/EN 61511 when connected to a suitable safety module
- Adjustable time delay
- As option fixed time delay
- High long life stability due to digital time base
- Adjustable with or without cross fault detection
- Output: 3 NO contacts + 1 NC contact + 1 forcibly guided feedback contact or 4 NO contacts + 1 1 forcibly guided feedback contact
- LED indicator for channel 1, 2 and operation voltage
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- 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

Canada / USA

A025518

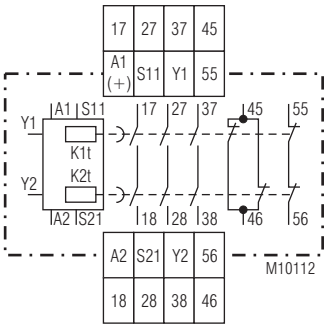
Applications

- Delayed disconnection with the possibility for status check of the safety relays, stop category 1 according to DIN EN 60204-1
- Controlled stop of system parts

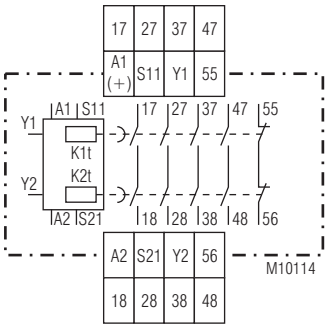
Indicators

upper LED: on, when supply connected
lower LED: on, when relay K1t and K2t energized

Circuit Diagrams



LG 7928.97



LG 7928.98

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2 (-)	- / N
S11, S21	Inputs
Y1, Y2	Outputs
17, 18, 27, 28, 37, 38, 47, 48	Positive driven NO contacts for release circuit
45, 46	Positive guided indicator output
55, 56	Positive guided feedback circuit

Technical Data

Input

Nominal voltage U_N:	DC 24 V AC/DC 24 V
Voltage range:	0.9 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Nominal consumption:	typ. DC 2.0 W typ. AC 3.5 VA
Control voltage on S11:	min. DC 20 V at U_N
Control current in Y1, Y2:	typ. DC 2,2 mA at U_N typ. AC 3,1 mA at U_N
Short-circuit protection:	Internal with PTC
Überspannungsschutz:	Internal with VDR

Output

Contacts

LG 7928.97:	3 NO contacts, 2 NC contacts
LG 7928.98:	4 NO contacts, 1 NC contacts

ATTENTION! The NC contacts 45-46 can only be used for monitoring.

Contact type:	forcibly guided
Release delay typ. at U_N:	
Disconnecting the supply:	35 ms
Disconnecting Y1, Y2:	40 ms

Time delay t_v:

adjustable	fixed
0.1 ... 1 s	1 s
0.3 ... 3 s	3 s
0.5 ... 5 s	5 s
1.0 ... 10 s	10 s
3.0 ... 30 s	30 s
6.0 ... 60 s	60 s
30.0 ... 300 s	300 s

Other time ranges on request

Repeat accuracy:	± 1% of setting value
Thermal current I_{th}:	max. 5 A (see quadratic total current limit curve)
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	2 A / DC 24 V IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V IEC/EN 60 947-5-1
to DC 13	
NO contact:	4 A / 24 V at 0.1 Hz
NC contact:	4 A / 24 V at 0.1 Hz
Electrcal life:	
at 5 A, AC 230 V cos. φ = 1:	> 2.2 x 10^5 switch. cycl. IEC/EN 60 947-5-1
Permissible switching frequency:	max. 2000 switching cycles / h with manual restart and short release delay time
Short circuit strength	
Max. fuse rating:	6 A gL IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles

General Data

Nominal operating mode:	continuous operation
Temperaturr range	
Operation:	- 15 ... + 55°C
Strorage:	- 25 ... + 85°C
Altitude:	< 2.000 m
Clearance and creepage distance	
rated impulse voltage / pollution degree:	4 kV / 2 IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061
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 subject 94
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance:	15 / 055 / 04 IEC/EN 60 068-1

Technical Data

Terminal designation:	EN 50 005
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting:	DIN rail IEC/EN 60 715
Weight:	approx. 190 g

UL-Data

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

Nominal voltage U_N:	AC/DC 24 V
Ambient temperature:	-15 … +55°C
Switching capacity:	
Ambient temperature 45°C:	Pilot duty B300 5A 250Vac Resistive 5A 24Vdc Resistive or G.P.
Ambient temperature 55°C:	Pilot duty B300 4A 250Vac Resistive 4A 24Vdc Resistive or G.P.
Wire connection:	60°C / 75°C copper conductors only
Screw terminals fixed:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp:	AWG 20 - 12 Sol/Str

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

Standard Type

LG 7928.97/61 DC 24 V 1 ... 10 s

Article number:	0062795
• Output:	3 NO contacts, 2 NC contacts
• Nominal voltage U_N:	DC 24 V
• Time delay t_v:	1 ... 10 s
• Width:	22.5 mm

Ordering Example

LG 7928 . _ _ _ _ /61 AC/DC 24 V

- Nominal voltage
- UL approval
- Type of terminals
  without indication:
  terminal blocks fixed,
  with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks
  with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks
  with screw terminals
- Contacts
- Type

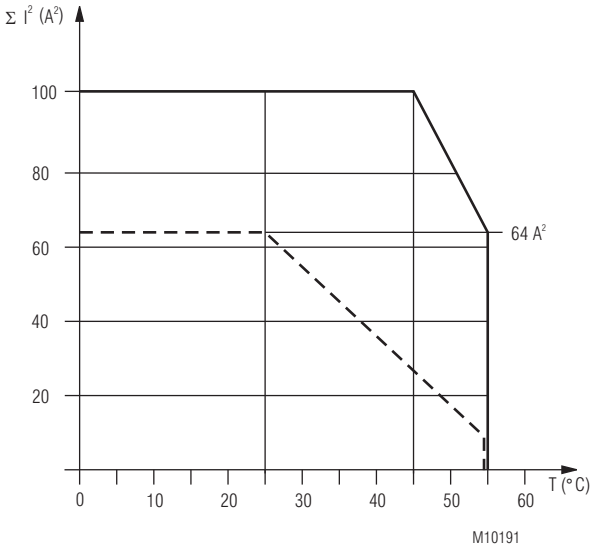
Troubleshooting

Failure	Potential cause
LED "Power" does not light up	Power supply A1/A2 not connected
LED "K1t" lights up, but "K2t" remains off	- Signal on Y2 is not present - Wrong setting of operation mode (cross fault detection)
LED "K2t" lights up but "K1t" remains off	- Signal on Y1 is not present
Device cannot be activated	Safety relay is welded (replace device)

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.

Characteristic



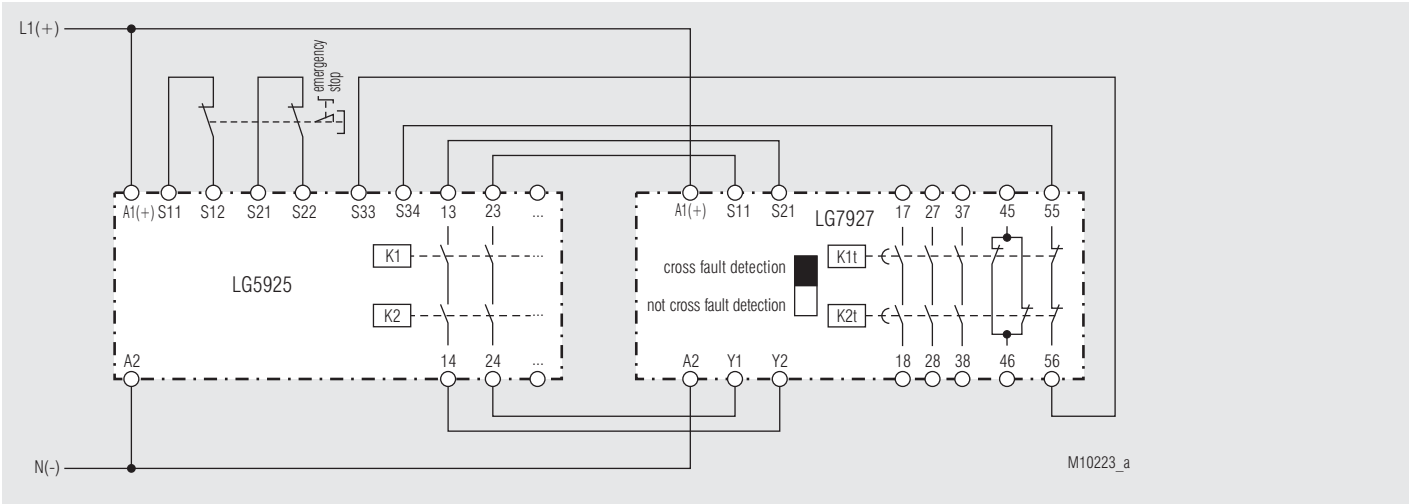
AC/DC 24V device mounted on distance with air circulation.
max. current at 55°C over
4 contactrows = 4A ≙ $4x4^2A^2=64A^2$

AC/DC 24V device mounted without distance heated by devices with same load,
max current at 55°C over
4 contactrows = 1,5A ≙ $4x1,5^2A^2=9A^2$

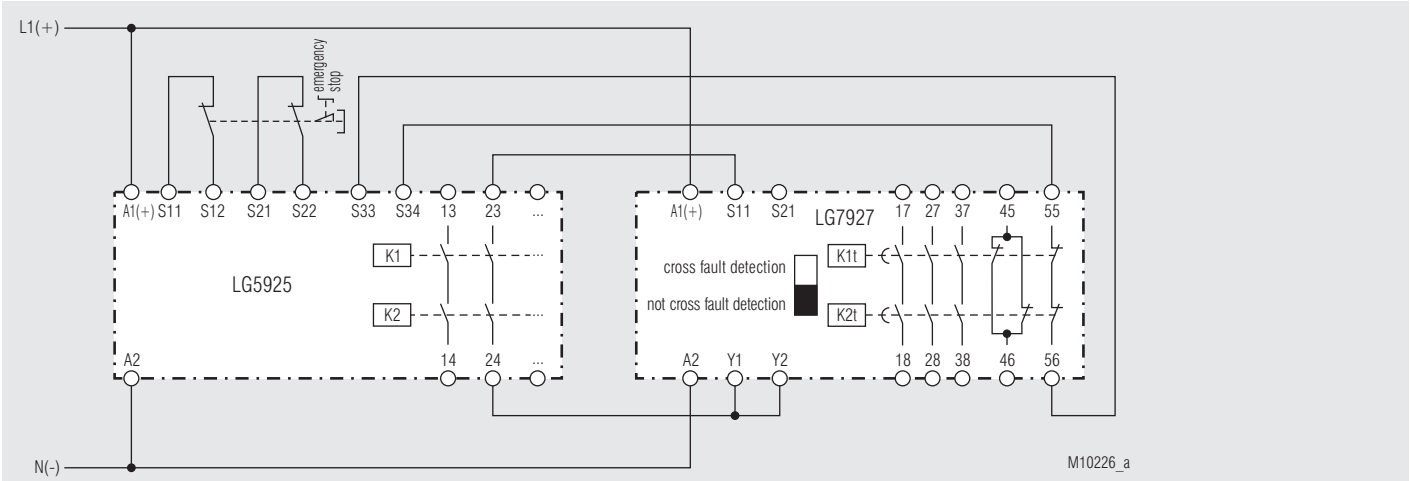
$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$$

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

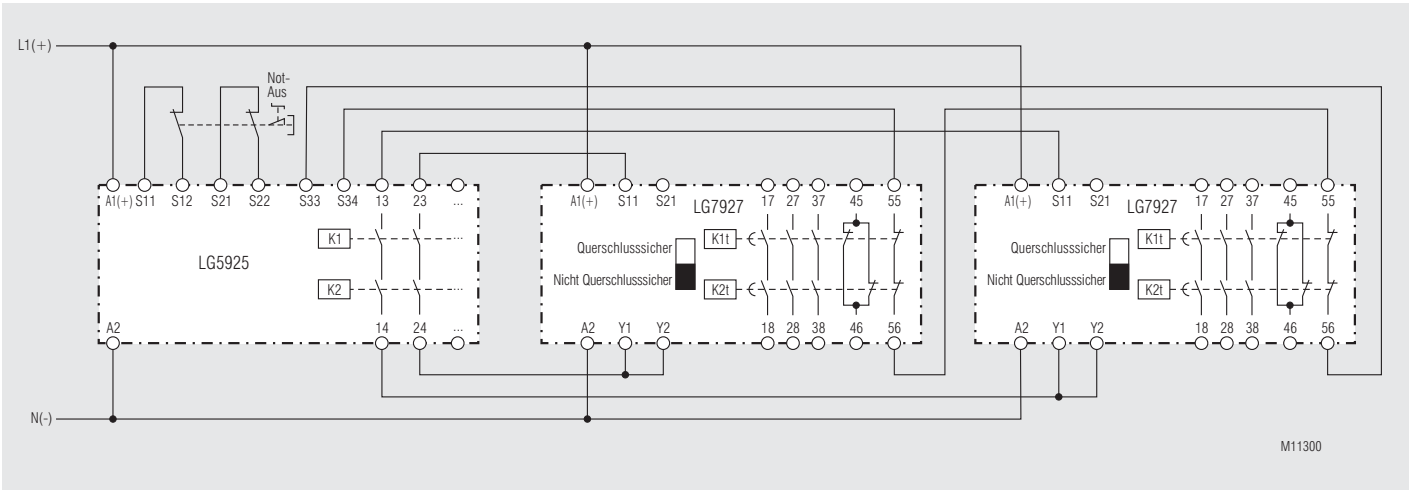
quadratic total current limit curve



LG 5925 with LG 7928, cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3



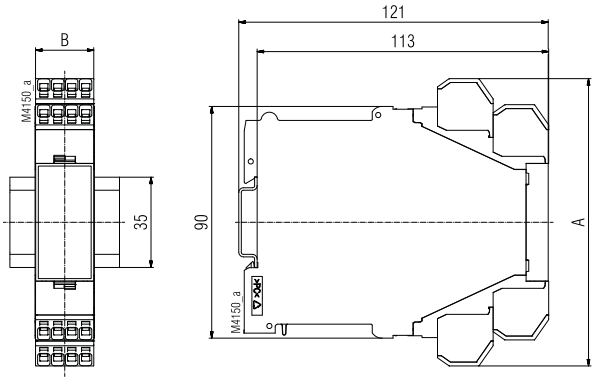
LG 5925 with LG 7928, non cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3



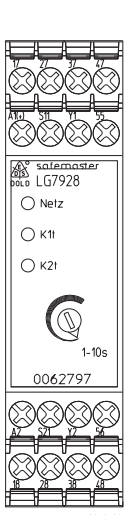
LG 5925 with two LG 7928, non cross fault detection, suitable up to SIL2, Performance Level d, Cat. 3

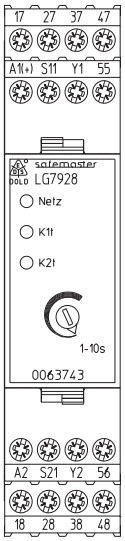
DE	**Maßbilder (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**

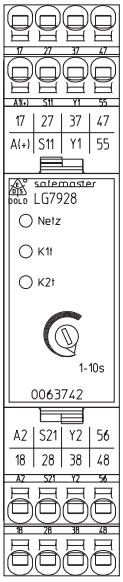
	A	B
LG 7928	90	22,5
LG 7928 PS	104	22,5
LG 7928 PC	111	22,5

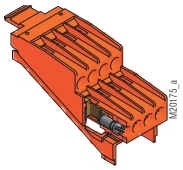


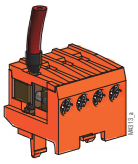
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



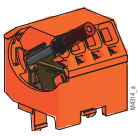




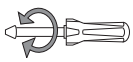
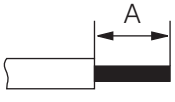
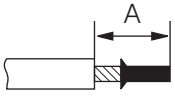
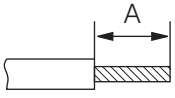




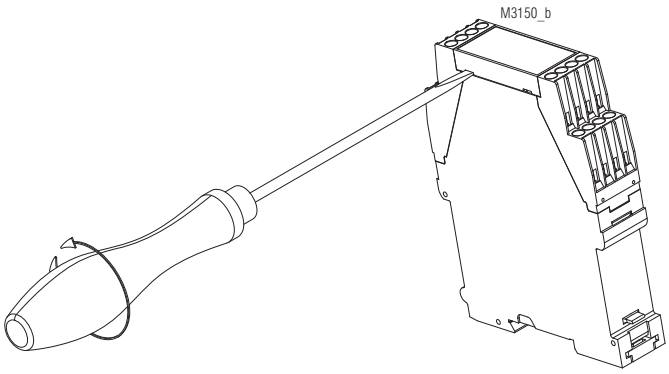
PS

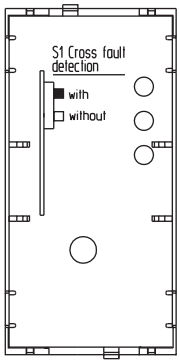


PC

	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Geräteprogrammierung**
EN	**Setting**
FR	**Programmation de l'appareil**



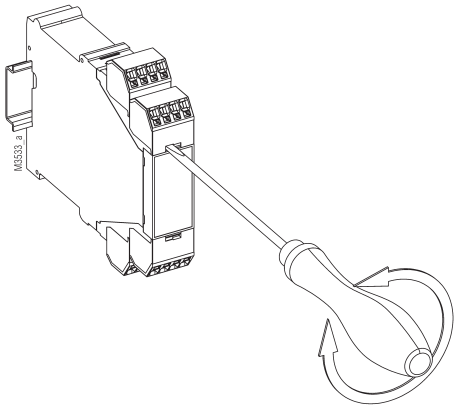


M10121

DE	S1 Querschlußerkennung ■ sicher ☐ nicht sicher
FR	S1 Transversal ■ avec ☐ sans

DE	Zur Einstellung der Betriebsart mit oder ohne Querschlußerkennung, ist der Schalter S1 vorgesehen. Dieser Schalter befindet sich hinter der Front-Abdeckplatte. Dabei ist zu beachten, daß die Betriebsarteinstellung immer vor der Einstellung der Zeit erfolgen muß, und vor Abnahme der Frontplatte, der Zeitdrehschalter auf Linksanschlag zu stellen ist. Nach der Einstellung der Betriebsart wird die Front-Abdeckplatte wieder montiert. Dabei ist darauf zu achten, daß sich der Zeitdrehschalter während der Montage auf Linksanschlag befindet. Zur Sicherheit ist nach der Montage nochmals zu prüfen, ob noch eine Zeitverstellung über den gesamten Zeitbereich möglich ist. (!) S1 darf nur bei unbestromtem Gerät betätigt werden! Die Schalterstellung zeigt den Lieferzustand.
EN	To alter the operation mode with or without crossfault monitoring the switch S1 is used. It is located behind the front cover. The adjustment of the operating mode must be selected before the adjustment of the time as the time potentiometer has to be set fully anti-clock-wise before removing the front plate. After selecting the operating mode the front plate is remounted. Please make sure that the setting knob is also in left position while mounting the front plate. For safety please check after finishing if a setting of the complete range is still possible. (!) Disconnect unit before setting of S1 Drawing shows setting at the state of delivery
FR	Le commutateur S1 est prévu pour le réglage du type de fonctionnement, avec ou sans reconnaissance de cc transversaux. Ce commutateur est situé sous la face avant. **IMPORTANT : Le commutateur doit être ajusté avant le réglage du temps, parce-que il faut tourner la tige du potentiomètre de réglage de temps tout à gauche avant de pouvoir retirer la face avant.** Après paramétrage du cc transversal, il faut remettre la face avant en prenant garde de tourner la tige du potentiomètre à gauche afin de l'introduire correctement dans son potentiomètre. Il est également conseillé de vérifier si le potentiomètre tourne bien sur l'ensemle de la plage de réglage. (!) Commutation de S1 uniquement hors tension. Appareil livré tel que sur le schéma

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	172,3	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)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 IEC/EN 61511
HFT*):	1	
DC:	99,0	%
PFH_D:	2,95E-10	h^{-1}
PFD_{AVG}:	2,50E-05	
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER
Delay module, Release Delay
BA 7924, IL 7824, IN 7824

0221537

BA 7924.21

BA 7924.21/002

IL 7824.21

IN 7824.21

- **According to**
  - **Performance Level (PL) c and category 2 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 2 to IEC/EN 61508**
  - **Category 2 to EN 954-1**
- **BA 7924.21/002 und BA 7924.21/003**
  - **Performance Level (PL) d and category 3 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 2 nach IEC/EN 62061**
  - **Safety Integrity Level (SIL) 2 to IEC/EN 61508**
  - **Category 3 to EN 954-1**
- Release delay
- Without auxiliary voltage
- Output: 1 NC, 1 NO contacts, forcibly guided
- Operating state display
- Optionally with adjustable or fixed time delay up to 30 s
- Optionally with redundant timing circuit
- Optionally with 1 or 2 separate timing circuits
- Optionally also in housing for distribution board
- Width 45 mm, 35 mm or 52.5 mm

Approvals and Markings

Canada / USA

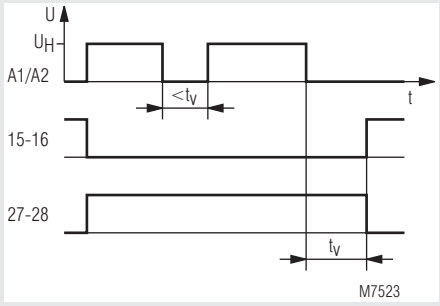
A025518

* see variants

Application

- Delayed disconnection with testable switching status of output relays.

Function Diagram



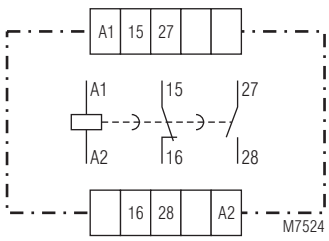
Indicators

LED's comes on when A1 / A2 connected to supply

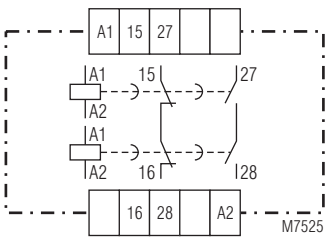
Notes

The output contacts of the two timing circuits are connected in series in the BA 7924.21/002 and /003 modules. This results in so-called switch-off redundancy, i.e. the contact path 27-28 is opened reliably after expiry of the predefined delay time, even if a contact in this path is welded.

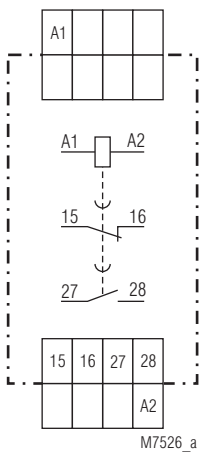
Circuit Diagrams



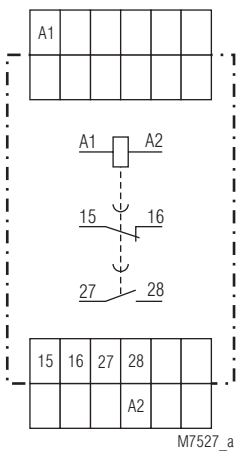
BA 7924.21
BA7924.21/100



BA 7924.21/002
BA 7924.21/003



IL 7824.21



IN 7824.21

Technical Data

Time delay t_v

BA 7924.21:	0.1 ... 1 s; 0.3 ... 3 s; 0.5 ... 5 s; 1 ... 10 s; 3 ... 30 s
BA 7924.21/001:	1 s; 3 s; 5 s; 10 s; 30 s fixed
BA 7924.21/002:	5 s; 10 s fixed
BA 7924.21/003:	0.5 ... 5 s; 1 ... 10 s
IL 7824.21:	0.1 ... 1 s; 0.3 ... 3 s
IL 7824.21/100:	0.5 s; 1 s; 3 s fixed
IN 7824.21:	0.5 ... 5 s; 1 ... 10 s
IN 7824.21/100:	5 s; 10 s fixed
Repeat accuracy:	±15 % of set value
Minimum closing time:	50 % of full scale value

Input

Nominal voltage U_N:	DC 24 V AC 230 V (only BA 7924.21 and BA 7924.21/001)
Voltage range:	AC 0.8 ... 1.1 U_N
at 10 % residual ripple:	DC 0.9 ... 1.2 U_N
at 48 % residual ripple:	DC 0.8 ... 1.1 U_N
Nominal consumption:	0.85 W / 4.5 VA
at BA 7924.21/002 and BA 7924.21/003:	1.7 W
Nominal frequency:	50 / 60 Hz

Output

Contacts

BA 7924.21:	1 NC, 1 NO contacts	
IL/IN 7824.21:	1 NC, 1 NO contacts	
Contact type:	Relay, forcibly guided	
Release delay typ. bei U_N:	10 ms + t_v	
Nominal output voltage:	AC 10 ... 250 V, DC 10 ... 110 V	
Thermal current I_{th}:	max. 8 A	
Switching capacity		
to AC 15		
for NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
for NC contact	1 A / AC 230 V	IEC/EN 60 947-5-1
to AC 13		
for NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
for NC contact	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 2.5 x 10^5 switching cycles	
Permissible operating frequency:	max. 2000 switching cycles / h but please note minimum closing time	
Short circuit strength		
max. fuse rating:	6 A gL	LIEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 40 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 62 061	
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminal plate:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal arrangement		
at BA 7924:	DIN 46199-5	
Terminal designation:	EN 50 005	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BA 7924 DC / AC:	200 g / 350 g	
IL 7824 / IN 7824:	120 g / 150 g	

Dimensions

Width x heigth x depth	
BA 7924:	45 x 74 x 133 mm
IL 7824:	35 x 89 x 58 mm
IN 7824:	52.5 x 89 x 58 mm

CCC-Data

Nominal voltage U_N:		
BA 7924:	DC 24 V, AC 230V	
Thermal current I_{th}:	max. 5 A	
Switching capacity		
to AC 15		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1

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

Standard Type

BA 7924.21 DC 24 V 0.3 ... 3 s

Article number:	0039707
• Output:	1 NO contact 1 NC contact
• Nominal voltage U_N:	DC 24 V
• Time range:	0.3 ... 3 s
• Width:	45 mm

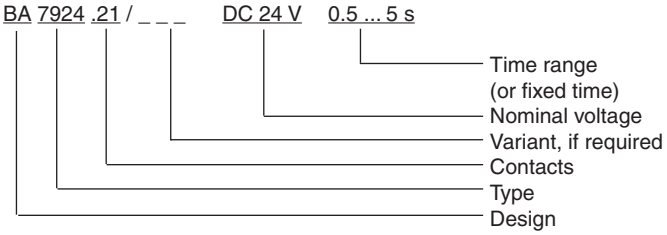
Variants

BA 7924.21/61:	with UL approval (Canada/USA)
BA 7924.21:	1 timing circuit, adjustable time
BA 7924.21/001:	1 timing circuit, fixed time
BA 7924.21/002:	2 timing circuit, fixed time
BA 7924.21/003:	2 timing circuit, adjustable time

Delay modules in housing for distribution board:

IL 7824.21:	1 timing circuit, adjustable time delay, 35 mm wide
IN 7824.21:	1 timing circuit, adjustable time delay, 55 mm wide
IL 7824.21/100:	1 timing circuit, fixed time delay, 35 mm wide
IN 7824.21/100:	1 timing circuit, fixed time delay, 55 mm wide

Ordering example for variants



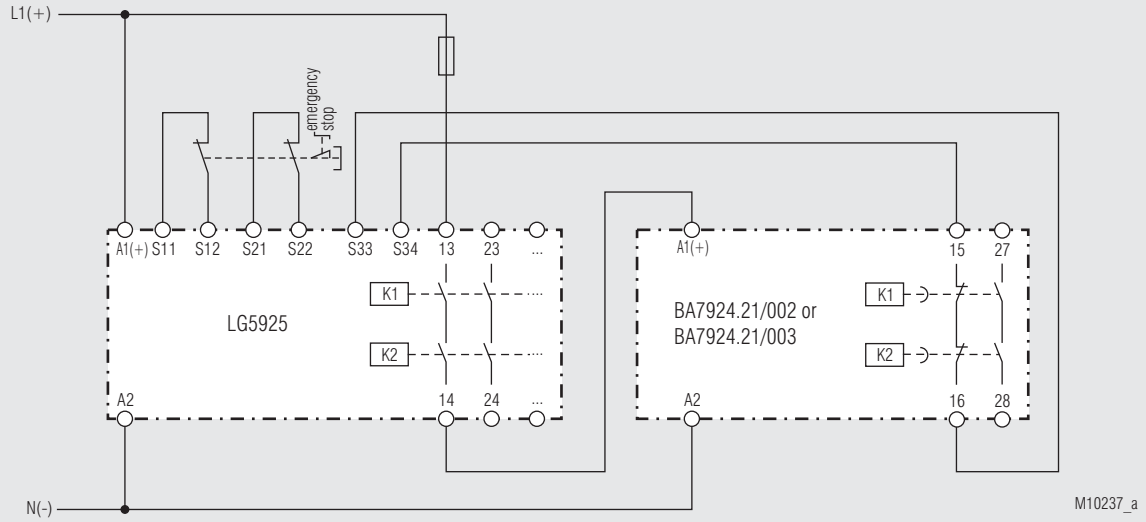
Troubleshooting

Failure	Potential cause
Device cannot be activated	- Power supply not connected - Unit defective

Maintenance and repairs

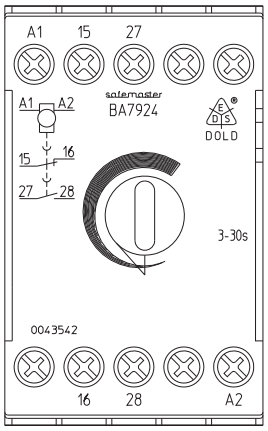
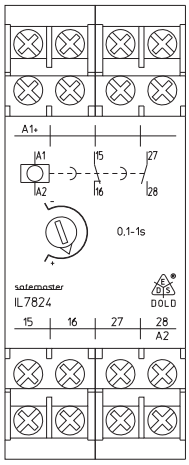
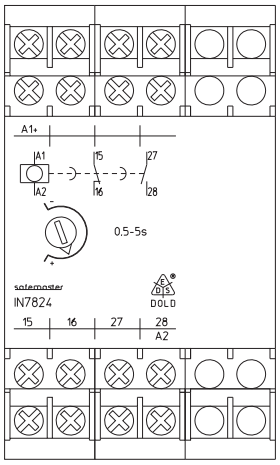
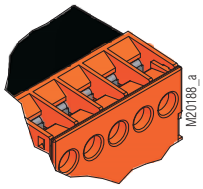
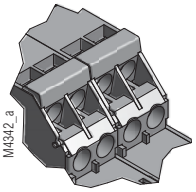
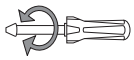
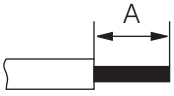
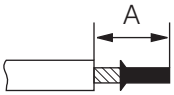
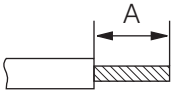
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Application Example

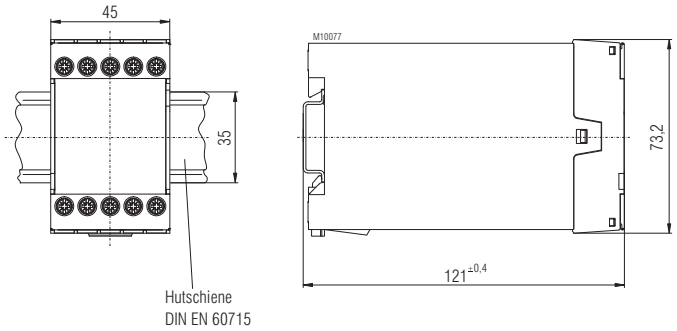


LG 5925 with BA 7924.21/002 e.g. BA 7924.21/003, suitable up to SIL 3, Performance Level e; Cat. 3

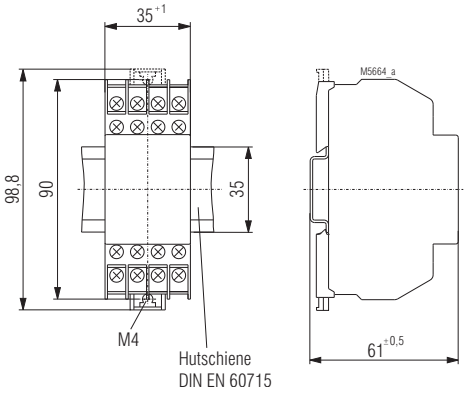
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M10683	 M10684	 M10685
	 M20188_a	 M4342_a	
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	
 M10248	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	
 M10249	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	
 M10250	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	

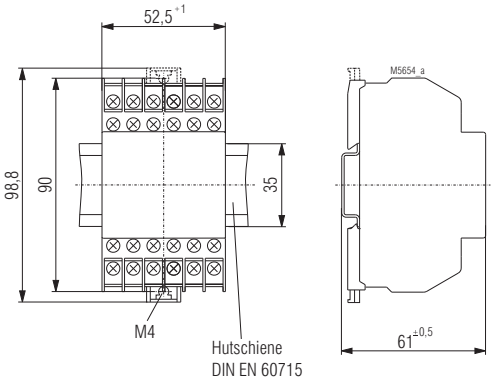
DE	**Maßbilder (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



BA 7924



IL 7924



IN 7924

DE	**Sicherheitstechnische Kenndaten BA7924.21 und /001**
EN	**Safety related data BA7924.21 and /001**
FR	**Données techniques sécuritaires BA7924.21 et /001**

EN ISO 13849-1:		
Kategorie / Category:	2	
PL:	c	
$MTTF_d$:	574,4	a (year)
DC_{avg}:	78,8	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	0	
DC:	78,8	%
PFH_D:	4,21E-08	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

DE	**Sicherheitstechnische Kenndaten BA 7924.21/002 und /003**
EN	**Safety related data BA 7924.21/002 and /003**
FR	**Données techniques sécuritaires BA 7924.21/002 et /003**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	d	
$MTTF_d$:	582,1	a (year)
DC_{avg}:	79,9	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511:		
SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT*):	1	
DC:	79,9	%
PFH_D:	2,63E-09	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

SAFEMASTER
Connecting Module
HC 3098

0257865

ET1415.047 + OA 5669 | ET1415.044 | ET1415.041

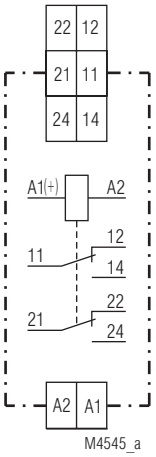
- According to DIN EN 61810
- With forcibly guided contacts according to IEC 61810-3
- Pluggable safety relay
- Low rated power consumption: 0.8 W
- Max. 2 output contacts
- Contact material: AgNi with fine gold
- High thermal current up to I_{th} = 5 A
- Large temperature range: - 40 ... + 85 °C
- As option with free-wheel diode or varistor between A1/A2
- As option with $AgSnO_2$ or AgNi with hard gold
- Width: 15.8 mm

Notes

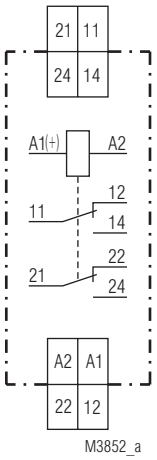
Safety relay with forcibly guided contacts OA 5669 and socket for supporting DIN-rail mounting.

Approval and Markings

Circuit Diagrams



ET1415.047, ET1415.044



ET1415.041

Technical Data

Input

Nominal voltage U_N:	DC 6, 12, 24, 48, 60, 110 V other on request
Voltage range:	0.8 ... 1.4 U_N
Nominal consumption:	0.8 W

Output

Contacts		
HC 3098 with OA 5669.16:	1 NO contact and 1 NC contact	
HC 3098 with OA 5669.12:	2 changeover contacts	
Contact material:	AgNi10 + 0.2 µm Au	
Operate time:	typical 15 ms	
Release time:	typical 12 ms	
Nominal output voltage:	AC 250 V	
Thermal current I_{th}:	3 x 5 A	
Switching capacity		
according to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60947-5-1
according to DC 13		
NO contact:	2 A / DC 24 V	IEC/EN 60947-5-1
NC contact:	2 A / DC 24 V	IEC/EN 60947-5-1
Electrical life		
at 1 s ON, 1 s OFF		
at AgSnO		
AC 230 V, 6 A cos φ = 1:	2 x 10^5 switch. cycl.	IEC/EN 60947-5-1
at AgNi:	> 1 x 10^5 switching cycles	IEC/EN 60947-5-1
permissible switching frequency:	10 switching cycles / s	
Switching voltage min. / max:	AC/DC 10 V / DC 250 V, AC 380 V	
	AgNi + 5 µm Au: 100 mV / AC/DC 60 V	
Switching current min. / max:	0.3 A / 5 A	
	AgNi + 5 µm Au: 1 mA / 0.3 A	
Switching capacity min./max:	3 VA / 2000 VA	
	AgNi + 5 µm Au: 1 mVA / 7 VA	
	3 W / 240 W	
	AgNi + 5 µm Au: 1 mW / 7 W	
Mechanical life:	> 50 x 10^6 switching cycles	

Technical Data

General Data

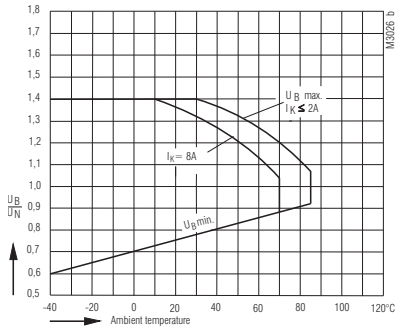
Nominal operating mode:	continuous operation	
Temperature range:	- 40 ... + 85 °C	
Clearance and creepage distance		
rated impulse voltage /		
degree of protection:	2.5 kV / 2	IEC 60664-1
Overvoltage category:	III	
EMC		
Electrostatic discharge(ESD):	8 kV (air)	IEC/EN 61000-4-2
HF irradiation:	10 V/m	IEC/EN 61000-4-3
Fast transients:	4 kV	IEC/EN 61000-4-4
Surge voltages		
between		
wires for power supply:	2 kV	IEC/EN 61000-4-5
between wire and ground:	4 kV	IEC/EN 61000-4-5
HF-wire guided:	10 V	IEC/EN 61000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection:		
Terminals:	IP 20	IEC/EN 60 529
Enclosure:	thermoplastic with VO behaviour according to UL Subj. 94	

Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60068-2-6
Climate resistance:	humid heat	IEC/EN 60068-2-30
Terminal designation:	EN 50005	
Wire connection		
ET 1415.041, ET 1415.044:	0.14 ... 2.5 mm² solid (14 - 20 AWG) 0.14 ... 2.5 mm² stranded (14 - 20 AWG) 0.14 ... 1.5 mm² sleeved end (14 - 25 AWG)	
ET 1415.047:	2 x (0.2 ... 1.5) mm² solid (16 - 25 AWG) 2 x (0.2 ... 1.5) mm² stranded (16 - 25 AWG) 2 x (0.2 ... 1.5) mm² sleeved end (16 - 25 AWG)	
Wire fixing:		
ET 1415.041, ET 1415.044:	Screw terminals	
ET 1415.047:	Cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60715
Weight:		
ET1415._ _ _:	see accessories	
OA 5669:	15 g	

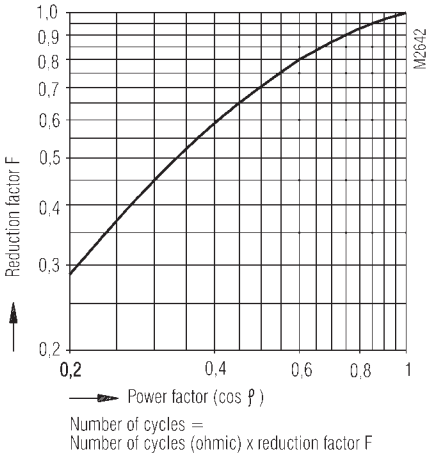
Dimensions

Width x height x depth:	13 x 25.5 x 29 mm

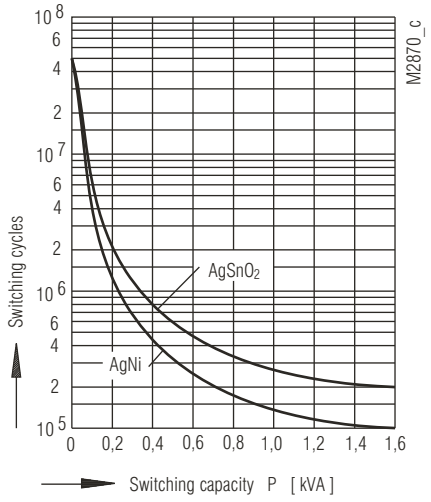
Characteristics



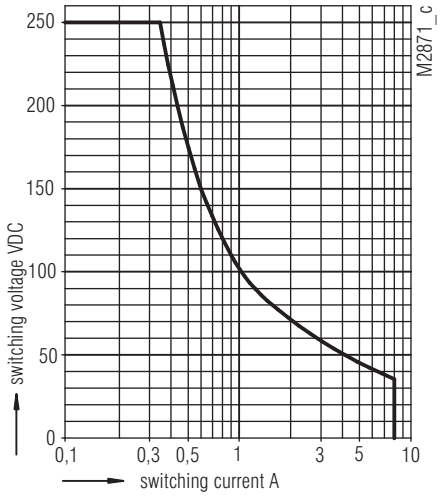
Operating voltage limit curve



Reduction factor for inductive loads



Contact service life



Limit curve for arc-free operation

Technical Data

Coil data with design version for Standard Type:

Nominal voltage DC V	Voltage range V	Resistance Ω (±10%)	AgNi		
			OA 5669.12	OA 5669.16	
6	4.5 ... 8.4	44	3001	3011	3501
12	9.0... 16.8	175	3002	3012	3502
24	18.0 ... 33.6	720	3003	3013	3503
48	36.0 ... 67.0	2 880	3004	3014	3504
60	45.0 ... 84.0	4 500	3005	3015	3505
110	82.0 ... 154.0	15 000	3006	3015	3506
				1)	2)

Design version

Nominal voltage DC V	AgNi (hard gold)			$AgSnO_2$		
	OA 5669.12	OA 5669.16		OA 5669.12	OA 5669.16	
6	3031	3041	3511	3061	3071	3521
12	3032	3042	3512	3062	3072	3522
24	3033	3043	3513	3063	3073	3523
48	3034	3044	3514	3064	3074	3524
60	3035	3045	3515	3065	3075	3525
110	3036	3046	3516	3065	3075	3526
		1)	2)		1)	2)

1) = Pin configuration standard

2) = Pin configuration reverse

Ordering Example

OA 5669. _ _ / 3 _ _ _ _ 1

- L = Solder line proof (IP 40)
  W = Wash proof (IP 67)
- Design version
- Ambient-temperature up to + 85°C
- Contacts
  .02 = 2 NO contacts
  .16 = 1 NO contact, 1 NC contact
  .12 = 2 changeover contacts
- Type

Accessories

Function module
ET1415.913: DC 24 V, with free-wheel diode and green LED
Article number 0056828

ET1415.911: DC 24 V, with free-wheel diode and red LED
Article number 0055909

ET1415.912: AC/DC 24 V, with varistor and green LED
Article number 0055910

ET1415.924: DC 60 V, with free-wheel diode and red LED
Article number 0062552

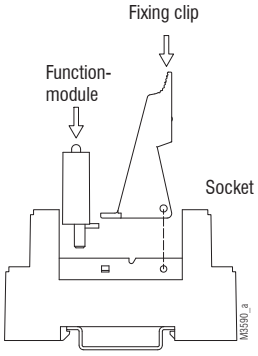
Socket incl. fixing clip
ET 1415.041: with screw terminals
Article number 0055571

ET 1415.044: with screw terminals and safe separation
Article number 0059274

ET 1415.047: with cage clamp terminals
Article number 0059270

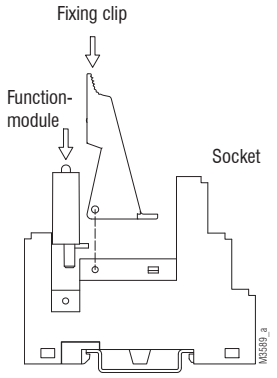
Accessories

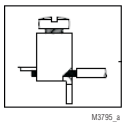
Socket ET 1415.041



- Socket for DIN-rail
- incl. fixing clip

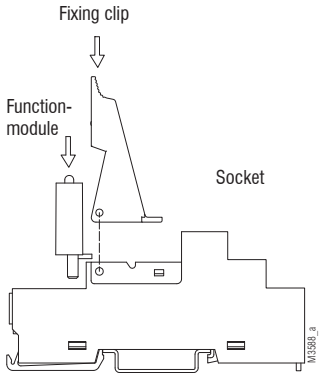
Socket ET 1415.044

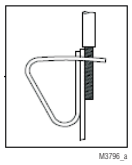




Screw terminals

Socket ET 1415.047





Cage clamp
terminals

- Socket for DIN-rail
- incl. fixing clip
- incl. safe separation between ciol and contacts according to DIN EN 60947-1, DIN EN 61140, DIN EN 60204

Degree of protection

Terminals:	IP 20	IEC/EN 60529
Terminal designation:	EN 50005	
Wire connection		
ET 1415.041, ET 1415.044:	0.14 ... 2.5 mm² solid (14 - 20 AWG)	
	0.14 ... 2.5 mm² stranded (14 - 20 AWG)	
	0.14 ... 1.5 mm² sleeved end (14 - 25 AWG)	
ET 1415.047:	2 x (0.2 ... 1.5) mm² solid (16 - 25 AWG)	
	2 x (0.2 ... 1.5) mm² stranded (16 - 25 AWG)	
	2 x (0.2 ... 1.5) mm² sleeved end (16 - 25 AWG)	
Wire fixing:		
ET 1415.041, ET 1415.044:	Screw terminals	
ET 1415.047:	Cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60715
Weight:		
ET 1415.041:	approx. 38.5 g	
ET 1415.044:	approx. 43.5 g	
ET 1415.047:	approx. 42.0 g	

Dimensions

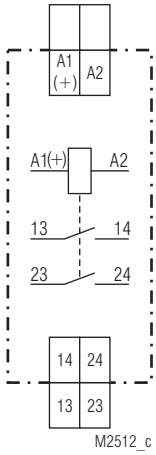
Width x height x depth:	
ET 1415.041:	15.8 x 75 x 69.0 mm
ET 1415.044:	15.8 x 75 x 75.0 mm
ET 1415.047:	15.8 x 97 x 75.5 mm

SAFEMASTER
Interface Module
IK 3079

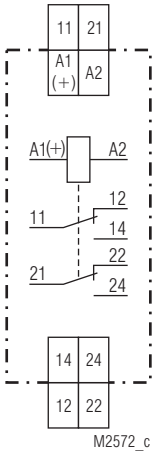
0221564

- According to IEC/EN 61 810-1
- With input protection circuit against voltage peaks
- Forcibly guided contacts according to IEC 61810-3
- I_{th} max. 8 A or 2 x 5 A
- Functional display by LED
- Optionally 2 NO or 2 changeover contacts or 1 NO and 1 NC
- IK 3079/103: with forcibly guided contacts according to ZH/457
- DIN rail or screw mounting
- 17.5 mm width

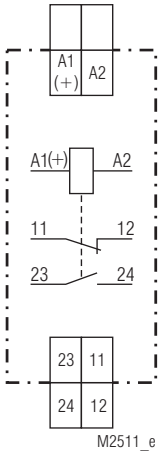
Circuit Diagrams



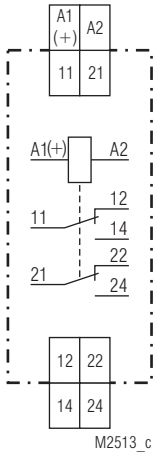
IK 3079.02



IK 3079.12
IK 3079.12/103



IK 3079.16
IK 3079.16/103



IK 3079.12 (special version)

Connection Terminals

Terminal designation	Signal description
A1+	L / +
A2	N / -
11, 12	NC contact
13, 14; 23, 24	NO contacts
11, 12, 14 21, 22, 24	C/O contacts

Approvals and Markings

CE

Indicator

green LED:	on, when control voltage connected

Technical Data

Input

Nominal voltage U_N:	
IK 3079.02, IK 3079.16:	AC/DC 24 V
IK 3079.12:	AC/DC 24 V, AC 230 V
IK 3079.12/103, IK 3079.16/103:	DC 24 V
Voltage range:	AC 0.8 ... 1.1 U_N, DC 0.9 ... 1.2 U_N
Nominal consumption:	approx. 0.9 W
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 % of nominal frequency

Output

Contacts		
IK 3079.02:	2 NO contacts	
IK 3079.12, IK 3079.12/103:	2 changeover contacts	
IK 3079.16, IK 3079.16/103:	1 NC and 1 NO contact	
Response time:	≤ 8 ms	
Release time:	≤ 15 ms	
Contact type:	Spring contact	
Nominal output voltage:	AC 10 V ... AC 400 V	
Thermal current I_{th}:	max. 8 A or 2 x 5 A simultaneous	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 2.5 x 10^5 switching cycles	
Permissible switching frequency:	max. 10 switching cycles / s	
Switching capacity min. / max.:	0.1 VA / 2 000 VA or 2 x 1250 VA simultaneous 0.1 W / 200 W	
Mechanical life:	≥ 50 x 10^6	

General Data

Operating mode:	Continuous operation
Temperature range	
IK 3079	
Operation:	- 25 ... + 60 °C
Storage:	- 25 ... + 70 °C
IK 3079/103	
Operation:	- 20 ... + 85 °C
Storage:	- 25 ... + 90 °C
Relative air humidity:	93 % bei 40 °C
Altitude:	< 2,000 m

Technical Data

Clearance and creepage distances
rated impulse voltage / pollution degree

Input / Output:	4 kV / 2	IEC 60 664-1
Output / Output:	2.5 kV / 2 only for 1-phase systems (same phase)	IEC 60 664-1

EMC

Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529

Housing: Thermoplastic with V0-behaviour according to UL subject 94

Vibration resistance: Amplitude 0.35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6

Climate resistance: Humid heat IEC/EN 60 068-1

Terminal designation: EN 50 005

Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded ferruled
DIN 46 228-1/-2/-3/-4

Wire fixing: Flat terminals with self-lifting clamping piece IEC/EN 60 999-1

Fixing torque: 0.8 Nm

Mounting: DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory

Weight: 60 g

Dimensions

Width x height x depth: 17.5 x 89 x 58 mm

Standard Type

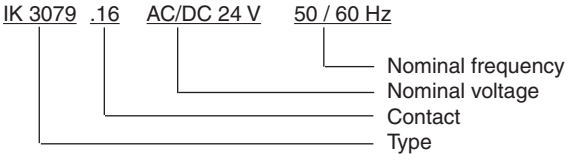
IK 3079.16 AC/DC 24 V

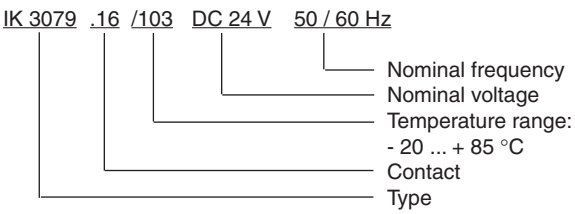
Article number:	0041187
• Temperature range:	- 20 ... + 55 °C
• Output:	1 NC, 1 NO contact
• Nominal voltage U_N:	AC/DC 24 V
• Width:	17.5 mm

IK 3079.16/103 DC 24 V

Article number:	0053851
• Temperature range:	- 20 ... + 85 °C
• Output:	1 NC, 1 NO contact
• Nominal voltage U_N:	AC/DC 24 V
• Width:	17.5 mm

Ordering Example

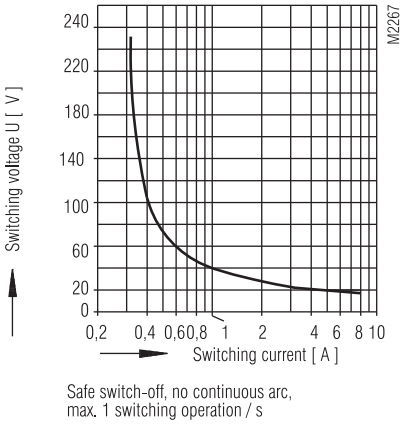




Accessories

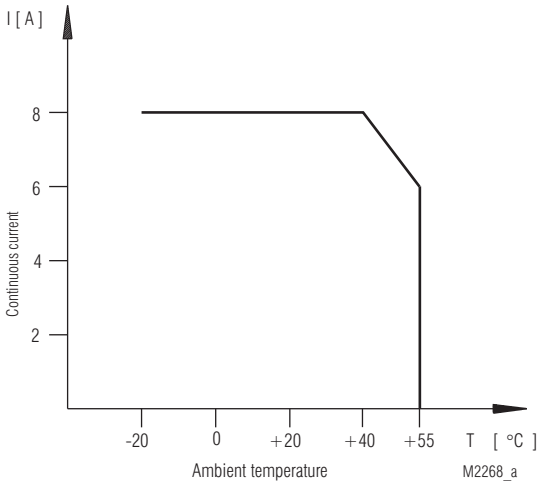
ET 4086-0-2: Additional clip for screw mounting
Article number: 0046578

Characteristics

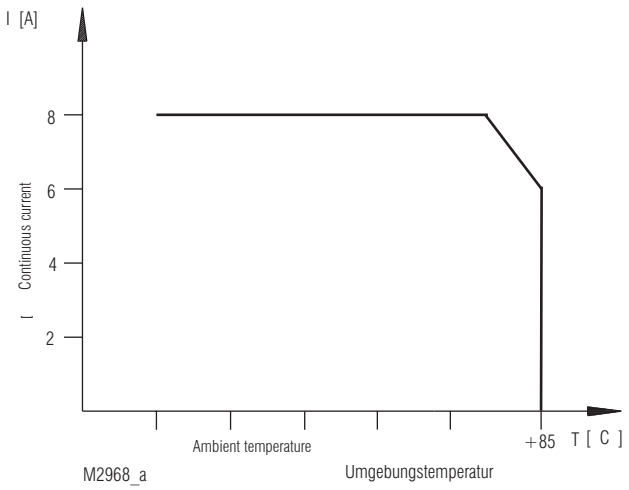


Safe switch-off, no continuous arc,
max. 1 switching operation / s

Limit curve for arc-free operation under ohmic load



IK 3079: Continuous current limit curve as a function of the ambient temperature (only for not mounted devices)



IK 3079/103: Continuous current limit curve as a function of the ambient temperature (only for not mounted devices)

SAFEMASTER
Interface Module
HC 3096N, HL 3096N

0270331

HC 3096N [1)]

HL 3096N [1)]

OA 5611

HC plug in socket [2)]

OA 5612

HL plug in socket [2)]

Your Advantages

- Simple contact extension and re-inforcement also of safety modules
- Cost and space saving alternative compared to contactors
- Simple contact monitoring via forcibly guided NC contact
- large wire cross section 0.5 - 2.5 mm² (12-24 AWG) reduces thermal load on wires

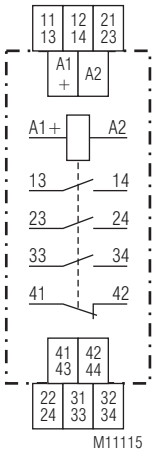
Features

- According to DIN EN 61810-1, IEC 60664-1, IEC/EN 60 947-5-1
- With forcibly guided contacts according to IEC 61810-3
- Models with soldered in or plug-in PCB safety relay consisting of:
  - plug in socket HC 3096N and safety relay OA 5611
  - plug in socket HL 3096N and safety relay OA 5612
- With polarity protected diode
- Optionally with free-wheeling diode across A1+ and A2
- Optionally AgNi + 0,2 µm Au or AgNi + 5 µm Au
- For DIN rail mounting according IEC/EN 60715
- HC 3096N:width 18 mm
  HL 3096N: width 36 mm

Approvals and Markings

CE | c UL us LISTED [1)] Canada / USA | c UL us [2)] Canada / USA

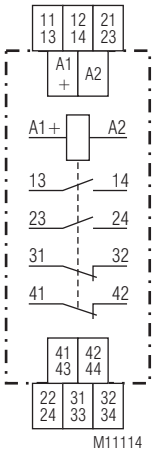
Circuit Diagrams



M11115

HC 3096N.48

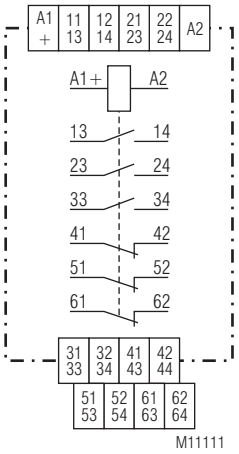
HC 3096N/10_
+ OA 5611.48



M11114

HC 3096N.52

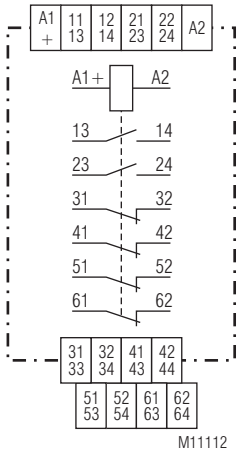
HC 3096N/10_
+ OA 5611.52



M11111

HL 3096N.18

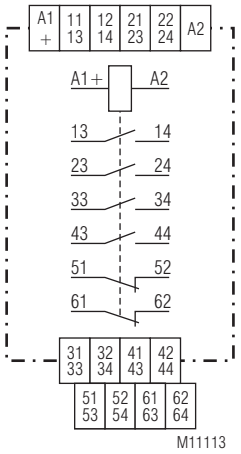
HL 3096N/10_
+ OA 5612.18



M11112

HL 3096N.50

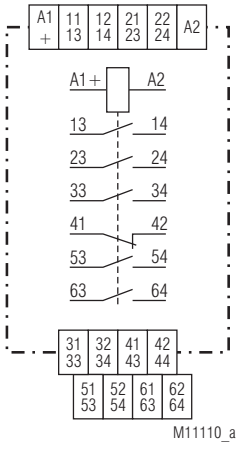
HL 3096N/10_
+ OA 5612.50



M11113

HL 3096N.54

HL 3096N/10_
+ OA 5612.54



M11110_a

HL 3096N.60

HL 3096N/10_
+ OA 5612.60

Connection Terminals

Terminal designation	Signal description
A1+	L / +
A2	N / -
41, 42 / 61, 62	NC contact
All other contacts see relevant circuit diagram	NC contacts / or NO contacts

Technical Data

Input

Nominal voltage U_N:	DC 24, 60, 110 V other voltages on request	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption		
HC 3096N:	0.6 W	
HL 3096N:	0.8 W	
HL 3096N.50:	1.0 W	

Output

Contacts:		
HC 3096N.52, OA 5611.52:	2 NO and 2 NC contacts	
HC 3096N.48, OA 5611.48:	3 NO and 1 NC contacts	
HL 3096N.18, OA 5612.18:	3 NO and 3 NC contacts	
HL 3096N.50, OA 5612.50:	2 NO and 4 NC contacts	
HL 3096N.54, OA 5612.54:	4 NO and 2 NC contacts	
HL 3096N.60, OA 5612.60:	5 NO and 1 NC contacts	
Contact material:	AgNi + 0,2µm Au, AgNi + 5µm Au other on request	
Contact type:	spring contact	
Operate time:	typical 20 ms	
Release time:	typical 6 ms	
Measured nominal voltage:	AC 250 V	
Thermal current I_{th}		
HC 3096N:	3 x 5 A	
HL 3096N:	4 x 5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
according to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
NC contact:	4 A / 24 V at 0.1 Hz	
Electrical life		
HC 3096N		
to AC 230 V / 5 A cosφ = 1:	≥ 2 x 10^5 switching cycles	
HL 3096N		
at DC 24 V / 5 A ohmic:	≥ 2 x 10^5 switching cycles	
Permissible switching frequency:	10 switching cycles / s	
Short circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 40 ... + 55 °C	
Storage:	- 25 ... + 70 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
Input / output		
HC devices:	6 kV / 2	IEC 60 664-1
HL devices:	4 kV / 2	IEC 60 664-1
output / output:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
Insulation test voltage, type test:	2,5 kV; 1 min	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transient:	4 kV	IEC/EN 61 000-4-4
Surge voltages 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	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection

Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	Humid heat	IEC/EN 60 068-2-30
Terminal designation:	EN 50 005	
Wire connection:	0.5 ... 2,5 mm² solid 0.5 ... 2,5 mm² flexible	
Wire fixing:	Captive slotted screw	
Fixing torque:	0,5 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
HC 3096N:	approx. 71 g	
HL 3096N:	approx. 90 g	

Dimensions

Width x height x depth	
HC 3096N:	18 x 106 x 65 mm
HL 3096N:	36 x 106 x 65 mm

UL Data

Nominal voltage U_N:	DC 6 ... 110 V
Switching capacity:	
Ambient temperature 60 °C:	Pilot duty B300 5 A 250Vac G. P. 5 A 24Vdc 0.4 A 250Vac resistive
Wire connection:	60°C / 75°C copper conductors only AWG 24 - 12 torque value 4.4 lb-in

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

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2, T3 and TX compliant	
Voltage range:	0.7 ... 1.25 U_N with operational limitations	
Protective coating of the PCB:	No	

Standard Types

HC 3096N.48/400 DC 24 V

Article number:	0066000
• 3 NO, 1 NC contact	
• AgNi + 0.2 µm Au	
• Width:	18 mm

HL 3096N.54/400 DC 24 V

Artikelnummer:	0066040
• 4 NO, 2 NC contact	
• AgNi + 0.2 µm Au	
• Width:	36 mm

Ordering Example

H_ 3096N. _ _ / _ _ _ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: with UL approval
- 1st _: 0: Ag Ni; 1: AgNi + 5 µm Au
- 2nd _: 0: Standard
- 3rd _: 4: with LED; 9: with free-wheeling diode and LED
- _ _: Contacts
- H_: C: 4 Contacts; width: 18 mm; L: 6 Contacts; width: 36 mm

Variants

Plug in socket
H_ 3096N /102: Plug in socket with free-wheeling diode and LED
H_ 3096N /103: Plug in socket with LED

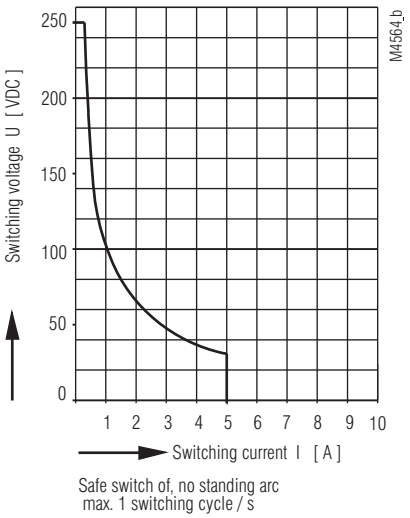
further variants on request

Ordering example for variants

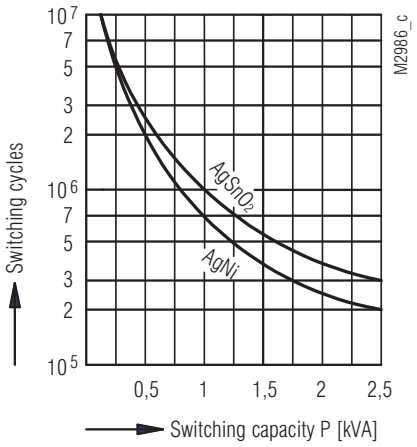
H_ 3096N / 10 _ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: with UL-approval
- 2: Plug in socket with free-wheeling diode and LED
- 3: Plug in socket with LED
- 0: Standard
- 1: Plug in socket
- C: 4 Contacts; width: 18 mm
- L: 6 Contacts; width: 36 mm

Characteristic



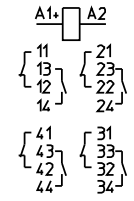
Arc limit curve under resistive load



Contact service life

Connection example for HC 3096N/10_/61

Relay: OA 5611.52 ≙ 2 NO contacts and 2 NC contacts (Standard)

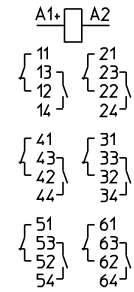


Contact	Contact-type	Connection
1	NO contact	13, 14
2	NO contact	23, 24
3	NC contact	31, 32
4	NC contact	41, 42

The terminal assignment is according to the diagram on the installed relay

Connection example for HC 3096N/10_/61

Relay: OA 5612.18 ≙ 3 NO contacts and 3 NC contacts (Standard)



Contact	Contact-type	Connection
1	NO contact	13, 14
2	NO contact	23, 24
3	NO contact	33, 34
4	NC contact	41, 42
5	NC contact	51, 52
6	NC contact	61, 62

The terminal assignment is according to the diagram on the installed relay

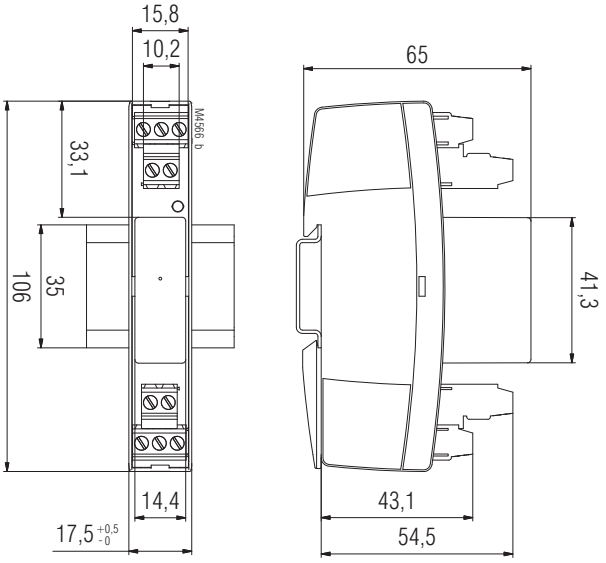
Safety Notes

Dangerous voltage.
Electric shock will result in death or serious injury.

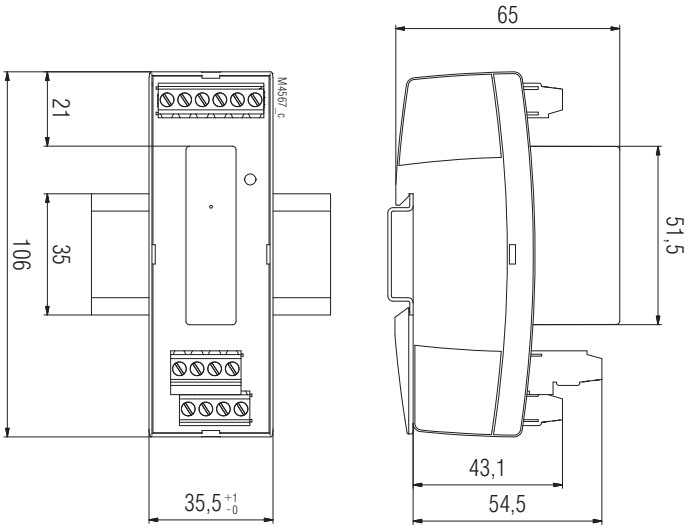
Disconnect all power supplies before servicing equipment.

- Faults must only be removed when the relay is disconnected
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Installation work must only be done when power is disconnected.

Dimensions with safety relay

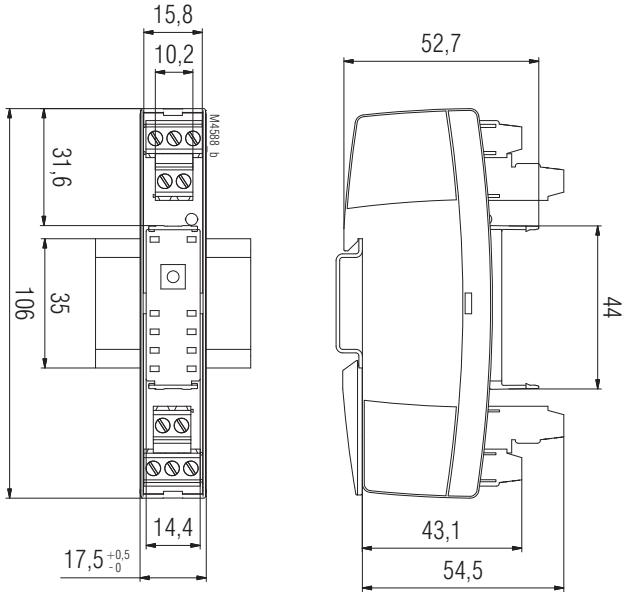


HC 3096N

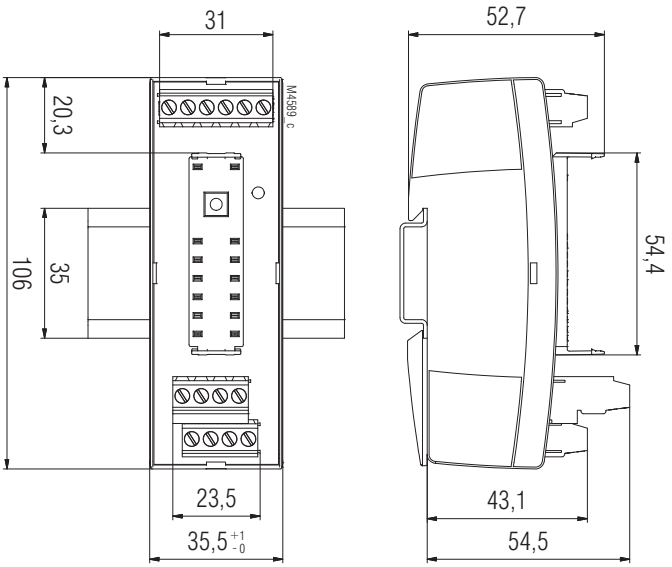


HL 3096N

Dimensions with plug in socket



HC 3096N



HL 3096N

SAFEMASTER
Interface Modules
LG 3096, MK 3096N

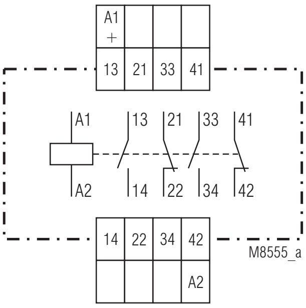
DOLD

0246370

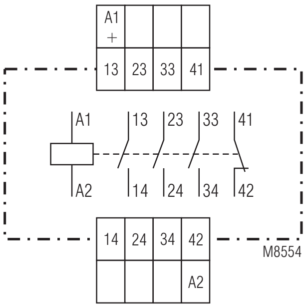
LG 3096 MK 3096N

- With **forcibly guided** contacts according to IEC 61810-3
- Max. 6 contacts
- As option goldplated contacts to switch low loads
- Wire connection: also 2 x 1.5 mm^2 stranded ferruled, or
- 2 x 2.5 mm^2 solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

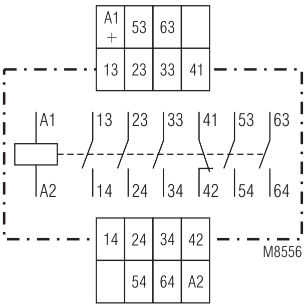
Circuit Diagrams



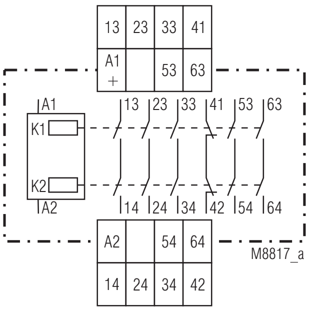
LG 3096.52
MK 3096N.52



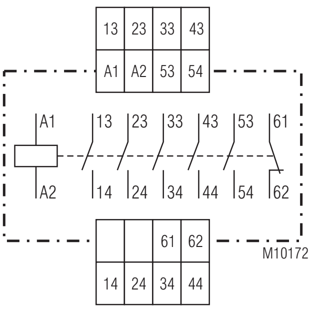
LG 3096.48
MK 3096N.48



LG 3096.60
MK 3096N.60



MK 3096N.60/100



LG 3096.60/300

Approvals and Markings

CE | C US Canada / USA * | A025518 *

* see variants

Application

- Switching device with the possibility to monitor the contact status via forcibly guided NC contacts.

Connection Terminals

Terminal designation	Signal description
A1 / A2	Supply voltage
13, 14, 23, 24, 33, 34, 43, 44, 53, 54, 63, 64	Forcibly guided NO contacts
21, 22, 41, 42, 61, 62	Forcibly guided NC contacts

Technical Data

Input

Nominal voltage U_N:		
LG 3096:	DC 24, 48 V; AC 100, 230 V	
MK 3096:	DC 24, 48 V	
Voltage range:	0.8... 1.1 U_N	
Nominal consumption	0.6 W	

Output

Contacts:		
MK 3096.52, LG 3096.52:	2 NO and 2 NC contacts	
MK 3096.48, LG 3096.48:	3 NO and 1 NC contacts	
MK 3096.60, LG 3096.60:	5 NO and 1 NC contacts	
Contact type:	forcibly guided	
Operate time:	typical 20 ms	
Release time:	typical 15 ms	
Nominal output voltage:	AC 250 V	
Thermal current I_{th}	5 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
(switching frequency: 0.1 Hz):	0,5 A / DC 110 V	
	4 A / DC 24 V	
2 contacts in series:	1 A / DC 110 V	
MK 3096N/100:	1 A / DC 110 V	
2 contacts in series:	4 A / DC 110 V	
Electrical life		IEC/EN 60 947-5-1
NO contacts:		
to AC 15 at 3 A, AC 230 V:	1.5 x 10^5 switching cycles	
NO contacts:		
to AC 15 at 2 A, AC 230 V:	3 x 10^5 switching cycles	
NC contacts:		
to AC 15 at 2 A, AC 230 V:	1 x 10^5 switching cycles	
Permissible switching frequency:	10 switching cycles / s	
Switching voltage min./max.:	AC/DC 10 V / DC 250 V, AC 400 V	
Switching current min./max.:	10 mA / 5 A	
Switching capacity min./max.:	3 VA / 1250 VA	
	3 W / 200 W	
Short circuit strength max. fuse rating:		
LG 3096:	10 A gL	IEC/EN 60 947-5-1
MK 3096N:	10 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 20 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60°C	
Strorage:	- 40 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
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	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6

Technical Data

Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight	160 g	

Dimensions

Width x height x depth	
LG 3096:	22.5 x 90 x 121 mm
LG 3096 PC:	22.5 x 111 x 121 mm
LG 3096 PS:	22.5 x 104 x 121 mm
MK 3096N:	22.5 x 90 x 102 mm
MK 3096N PC:	22.5 x 111 x 102 mm
MK 3096N PS:	22.5 x 104 x 102 mm

Classification to DIN EN 50155 for MK 3096N

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

CSA-Data for LG 3096

Switching capacity:	3A 250Vac
Wire connection:	60°C / 75°C copper conductors only
Fixed screw terminal:	AWG 20 - 12 Sol/Str Torque 0.8 Nm
Plug in screw terminal:	AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm
Plug in cage clamp terminal:	AWG 20 - 12 Sol/Str Torque 0.8 Nm

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

CCC-Data for MK 3096N

Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:	1,5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

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

Standard Types

LG 3096.60 DC 24 V

Article number:	0056147
• Output:	5 NO and 1 NC contacts
• Width:	22.5 mm

MK 3096N.60 DC 24 V

Article number:	0055931
• Output:	5 NO and 1 NC contacts
• Width:	22.5 mm

Variants

LG 3096._ _/004

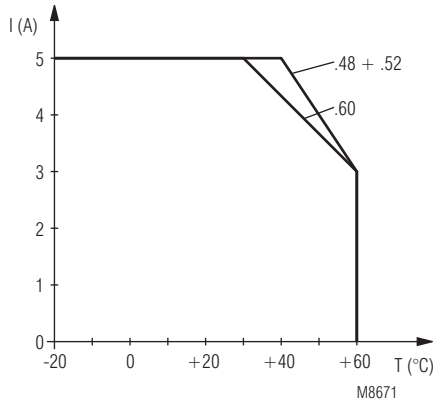
MK 3096N._ _/004:	With gold plated contacts to switch low loads. Because of the gold plated contacts the MK 3096N_ _/004, LG 3096_ _/004 can be used to switch small loads 1 mVA ... 7 VA, 1 mW ... 7 W in the range of 0.1 ... 60 V, 1 ... 300 mA. The gold plated contacts allow also to switch the maximum current but the gold plating will be burnt off. After that the contacts cannot be used any more to switch the small loads.
LG 3096._ _ /300:	AC-units
LG 3096._ _ /304:	AC-units with gold plated contacs
LG 3096._ _/_ _ _ /60:	with CSA-approval (Canada/USA), on request
MK 3096N/100:	2 contacts switched internally in series.
MK 3096N:	with CCC-approval on request

Ordering example for variants

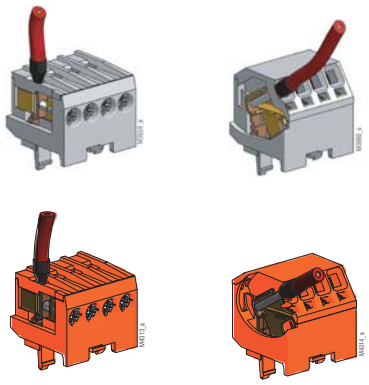
MK 3096N._ _ PS/_ _ _ DC 24 V

- DC 24 V — Nominal voltage
- PS/_ _ _ — Variant, if required
- PS — Type of terminals
  - without indication: terminal blocks fixed, with screw terminals
  - PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw): pluggable terminal blocks with screw terminals
- MK 3096N._ _ — Contacts
- MK 3096N — Type

Characteristic



Options with Pluggable Terminal Blocks



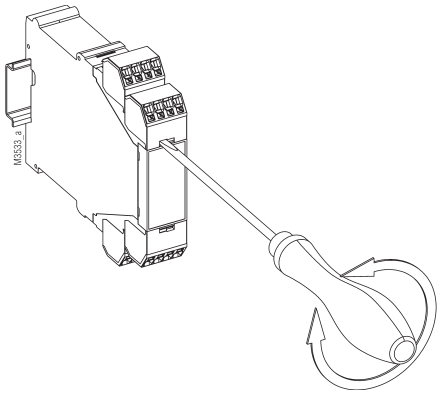
Screw terminal (PS/plugin screw)

Cage clamp terminal (PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Interface Module
UG 3096, UH 3096

0266488

UG 3096

UH 3096

Your Advantages
- According to IEC/EN 60 947-5-1
- Simple contact multiplication and reinforcement also for safety modules
- Cost and space saving alternative compared to contactors
- Easy monitoring of contact state via forcibly guided NC contacts

Features
- With **forcibly guided** contacts according to IEC 61810-3
- UG 3096: 8 output contacts
  UH 3096: 16 output contacts
- As option with gold plated contacts to switch low loads
- As option with contacts connected in series to switch high DC-loads
- As option with pluggable terminal block for easy exchange of devices
  - with screw terminals
- UG 3096: Width 22.5 mm
  UH 3096: Width 45 mm

Approvals and Markings

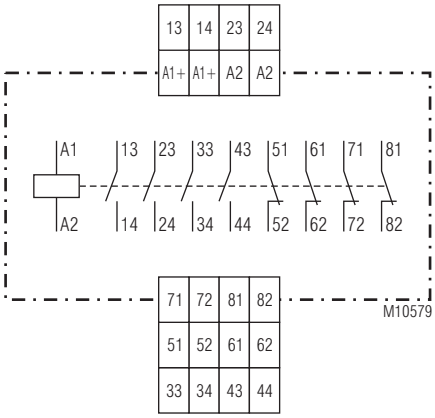
CE

Applications

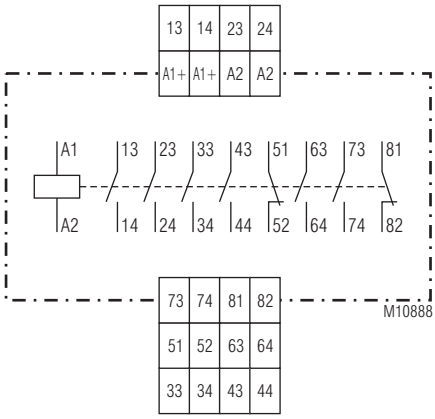
- Interfacing between control and load circuits
- Contact multiplication and reinforcement
- separate switching of several current circuits, e. g. with
  - Machines and plants,
  - Energy production and transport

Indicator

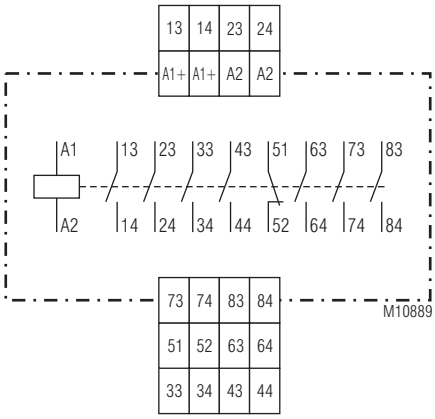
green LED: on, when supply connected



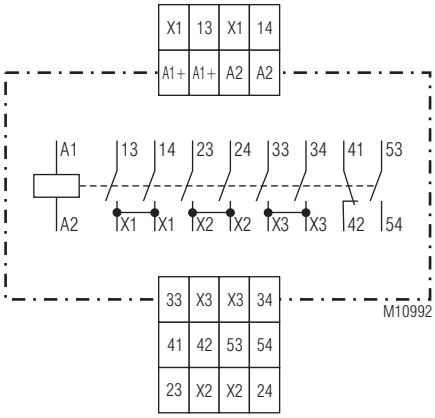
UG 3096.57



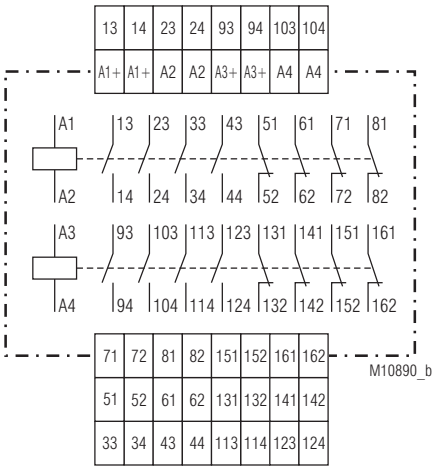
UG 3096.59



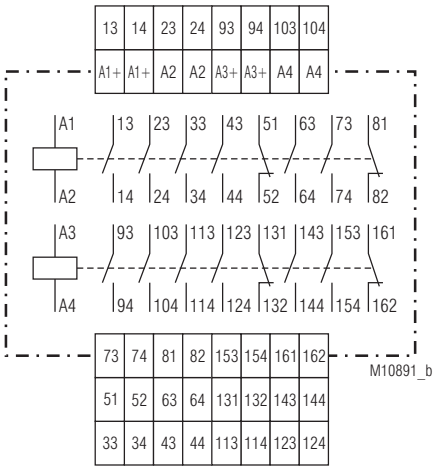
UG 3096.63



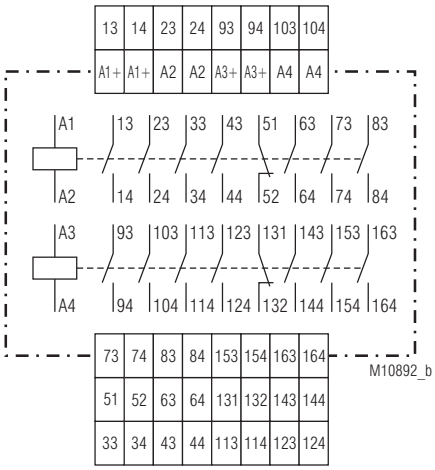
UG 3096.63/800



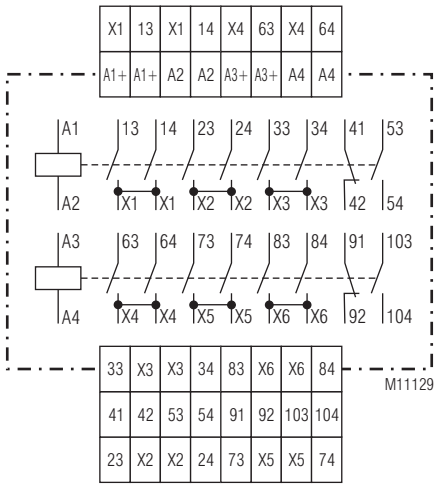
UH 3096.78



UH 3096.79



UH 3096.80



UH 3096.80/800

Connection Terminals

Terminal designation	Signal description
A1 / A2	Supply voltage relay 1
A3 / A4	Supply voltage relay 2
13 ... 162	Output contacts after contacts
X1 ... X6	Internal bridges for variant /800

Technical Data

Input

Nominal voltage U_N: DC 24 V, 110 V (others on request)
Voltage range: 0.8 ... 1.1 U_N
Nominal consumption:
UG 3096: 1.4 W
UH 3096: 2.8 W

Output

Contacts:
UG 3096.57: 4 NO and 4 NC contacts
UG 3096.59: 6 NO and 2 NC contacts
UG 3096.63: 7 NO and 1 NC contacts
UH 3096.78: 8 NO and 8 NC contacts
UH 3096.79: 12 NO and 4 NC contacts
UH 3096.80: 14 NO and 2 NC contacts
Contact type: forcibly guided
Operate time: typical 30 ms
Release time: typical 12 ms
Nominal output voltage: AC 250 V, DC 24 V
Thermal current I_{th}: max. 6 A
(see quadratic total current limit curve)

Switching capacity

to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz		
NO contacts:	4 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	4 A / DC 24 V	IEC/EN 60 947-5-1
NO contacts:	1 A / DC 110 V	IEC/EN 60 947-5-1
2 contacts in series		
NO contacts:	3 A / DC 110 V	IEC/EN 60 947-5-1
3 contacts in series		
NO contacts:	5 A / DC 110 V	IEC/EN 60 947-5-1

Electrical life

NO contacts:		
to AC 15 at 1 A, AC 230 V:	1.5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
NO contacts:		
to AC 15 at 0.5 A, AC 230 V:	2.5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
NC contacts:		
to AC 15 at 1 A, AC 230 V:	1 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
NO contacts:		
to DC 13 at 1 A, DC 24 V:	0.5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1

Permissible switching frequency: 10 switching cycles / s
Switching voltage min./max.: AC/DC 10 V / AC/DC 250 V
Switching current min./max.: 10 mA (typical values) / 6 A
Short circuit strength
max. fuse rating: 6 A gG / gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode: Continuous operation
Temperature range:
Operation: - 20 ... + 60° C
Storage: - 40 ... + 60° C
Clearance and creepage distances
rated impulse voltage / pollution degree
Auxiliary voltage / contacts: 6 kV / 2 IEC 60 664-1
Contacts / contacts: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 MHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltages between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/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 subject 94
Vibration resistance: Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: DIN 46 228-1/-2/-3/-4
Plugin with screw terminals (PS)
max. cross section for connection: 1 x 0.25 ... 2.5 mm^2 solid or 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
Wire fixing: captive slotted screw
Fixing torque: 0.5 Nm
Mounting: DIN rail IEC/EN 60 715
Weight
UG 3096: approx. 215 g
UH 3096: approx. 420 g

Dimensions

Width x height x depth
UG 3096 PS: 22.5 x 110 x 120.3 mm
UH 3096 PS: 45 x 110 x 120.3 mm

Standard Types

UG 3096.57 DC 24 V
Article number: 0065332
- 4 NO contacts, 4 NC contacs
- Width: 22.5 mm

UH 3096.78 DC 110 V
Article number: 0065062
- 8 NO contacts, 8 NC contacts
- Width: 45 mm

Variants

UG 3096.57/004: For switching small loads of 10 mVA ... 12 VA resp. 10 mW ... 12 W in the ranges 2 ... 60 V und 2 ... 300 mA. The device is also suitable for switching the maximum switching current. However, this will burn off the gold plating of the contacts, so that switching of small loads is no longer possible afterwards.

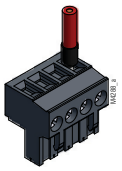
UG 3096.63/800: With contacts connected in series to switch high DC-loads

Ordering example for variant

UG 3096 .57 _ _ / _ _ _ DC 24 V

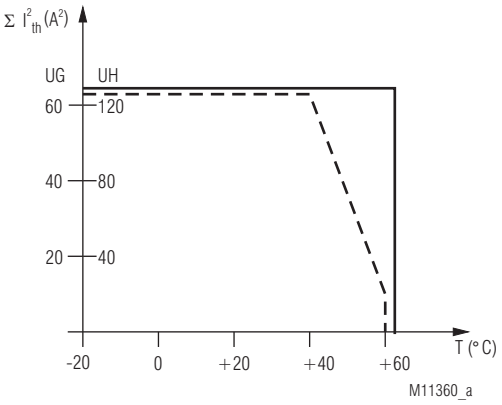
- DC 24 V: Nominal voltage
- _ _ _: Variant, if required
- _ _: Type of terminals
- .57: Contacts
- UG 3096: Type

Option with Pluggable Terminal Block



Screw terminal
(PS/plugin screw)

Characteristic



Mounted with distance, with air circulation

Mounted without distance, heated by units with similar load

Quadratic total current

$$\Sigma I^2_{th} = I^2_{th1} + \ldots + I^2_{th8} + \ldots + I^2_{th16}$$

$I_{th1} \ldots _{th16}$: thermal current in contactrows

Quadratic total current limit curve

SAFEMASTER
Interface Module
UG 3088

0270828

Your Advantages
- According to IEC/EN 60 947-5-1
- Economic and space safing because of 2 separate interface modules in one enclosure
- Simple contact multiplication and reinforcement - also of safety modules
- Cost and space saving alternative compared to contactors
- Simple contact monitoring by forcibly guided contacts
- With pluggable terminal blocks for easy exchange of devices

Features
- With forcibly guided contacts according to IEC 61810-3
- Version with up to 2 x 4 contacts
- Variant to switch high DC-load
- Width: 22,5 mm

Product Description

The interface module UG3088 includes 2 separate devices in one enclosure. Because of its forcibly guided contacts a safe interfacing between control circuit and load circuit is provided. It can also be used to multiply and reinforce the contacts of safety modules. Different internal configuration possibilities allow to offer interface modules for various applications. To switch e.g. high DC loads the the output contacts can be connected in series. On the module with 2NO and 2 NC contacts these can be connected internally as changeover contacts. Also a common control of both relays with only one input can be done.

Approvals and Markings

CE

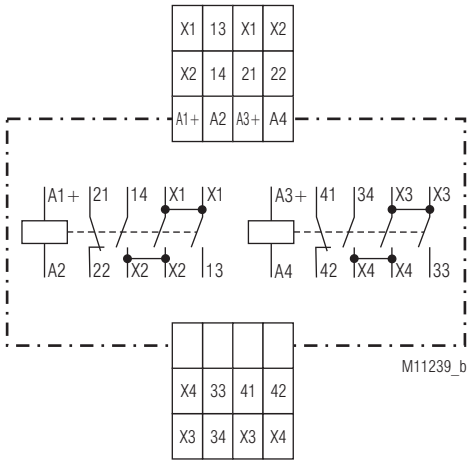
Applications

- Interfacing between control and load circuits
- Contact multiplication and reinforcement
- Separate switching of several current circuits, e. g. at
  - Machines and plants
  - Energy production and transport

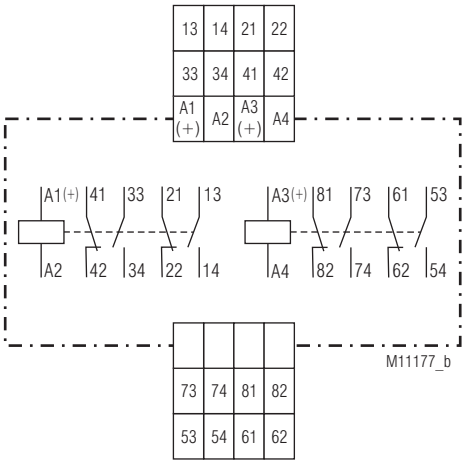
Indicators

green LED 1:	on, when supply connected at Relay 1
green LED 2:	on, when supply connected at Relay 2

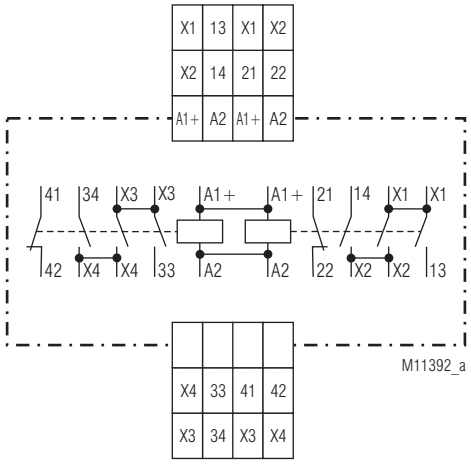
Circuit Diagrams



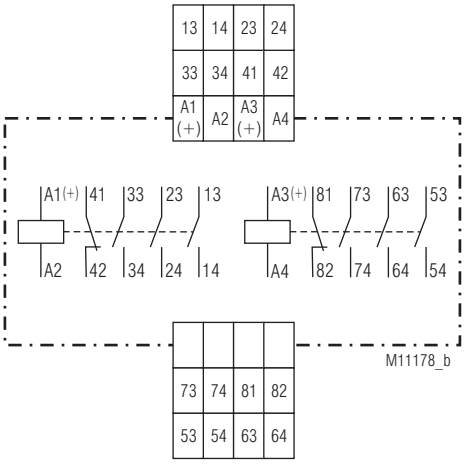
UG 3088.52PS/100



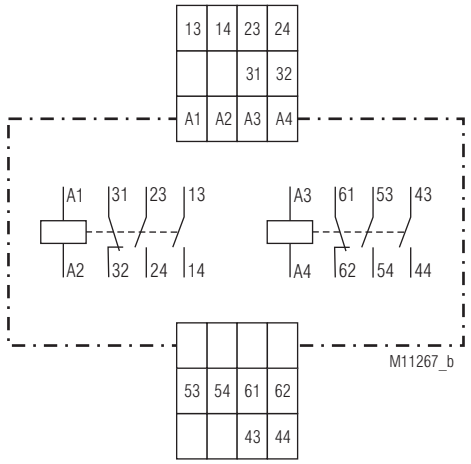
UG 3088.57



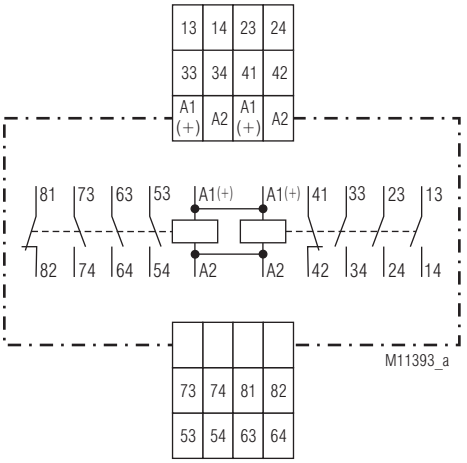
UG 3088.52/101



UG 3088.59



UG 3088.54 (AC 230 V, DC 220 V)



UG3088.59/001

Connection Terminals

Terminal designation	Signal description
A1, A2	Operation voltage Relay 1
A3, A4	Operation voltage Relay 2
13, 14, 23, 24, 33, 34 53, 54, 63, 64, 73, 74	Positive guided NO contacts for release circuit
21, 22, 41, 42, 61, 62, 81, 82	Positive guided NO contacts

Technical Data

Input

Nominal voltage U_N:	AC 24, 48, 110, 230 V DC 24, 48, 110, 220 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption		
DC 24 V:	1.1 W	
DC 110 V:	1.3 W	
AC 230 V:	2.1 W	
Nominal frequency:	50 / 60 Hz	
Min. Off-time:	250 ms	

Output

Contacts:		
UG 3088.52/100, /101:	2 NO contacts, 2 NC contacts	
UG 3088.54		
(AC 230 V, DC 220 V):	4 NO contacts, 2 NC contacts	
UG 3088.57:	4 NO contacts, 4 NC contacts	
UG 3088.59, /001:	6 NO contacts, 2 NC contacts	
Contact material:	AgNi + 0.2 µm Au	
Operate time U_N:	typical 10 ms (only for DC devices)	
Release time:	typical 15 ms (only for DC devices)	
Nominal output voltage:	AC 250 V, DC 24 V	
Thermal current I_{th}:	2,5 A	
Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 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
NC contacts:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13:		
NO contacts:	0.5 A / DC 110 V	IEC/EN 60 947-5-1
NC contacts:	0.5 A / DC 110 V	IEC/EN 60 947-5-1
Switching capacity variant /100 (internal 3 NO connected in series)		
to DC 13:		
NO contacts:	3 A / DC 110 V at 0.1 Hz	
NC contacts:	3 A / DC 110 V at 0.1 Hz	
Electrical life		
NO contacts		
to AC 15 at 1 A, AC 230 V:	1,5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
NC contacts		
to AC 15 at 1 A, AC 230 V:	1 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
NO contacts		
to DC 13 at 1 A, DC 24 V:	0,5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
Permissible switching frequency:	2 switching cycles / s	
Switching voltage min./max.:	AC/DC 10 V / AC/DC 250 V	
Switching current min./max.:	10 mA / 2,5 A	
Short circuit strength max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 40 x 10^6 switching cycles	

General Data

Mounting-position:	any	
Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 40 ... + 60°C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (base insulation)	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 20	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast mit V0-Verhalten nach UL Subjekt 94	

Technical Data

Vibration resistance:	Amplitude 0,35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		
Plugin with screw terminals		
max. cross section for connection:	1 x 0.25 ... 2.5 mm^2 solid or stranded ferruled (isolated) or 2 x 0.25 ... 1.0 mm^2 massiv oder stranded ferruled (isolated)	
Insulation of wires or sleeve length:	7 mm	
Wire fixing:	captive slotted screw	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 180 g	

Dimensions

Width x height x depth:	22.5 x 105 x 120.3 mm

Standard Types

UG 3088.59PS DC 24 V
Article number: 0066280
- 6 NO contacts, 2 NC contacts
- Width: 22.5 mm

UG 3088.57PS DC 110 V
Article number: 0066380
- 4 NO contacts, 4 NC contacts
- Width: 22.5 mm

Variants

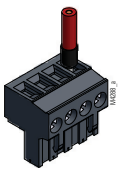
UG 3088._ _PS/100:	With contacts connected in series to switch high DC-loads. Separate control of the 2 relays
UG 3088._ _PS/101:	With contacts connected in series to switch high DC-loads. Common control of the 2 relays

Ordering example for variants

UG 3088 .57 PS / _ _ _ DC 24 V

- DC 24 V: Nominal voltage
- _ _ _: Variant, if required
- PS: Type of terminals
  PS (plugin screw): pluggable terminal blocks, with screw terminals
- .57: Contacts
- UG 3088: Type

Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

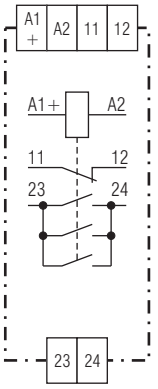
SAFEMASTER
Interface Module
HK 3087N

0273025

Product Description

The interface module HK 3087N has forcibly guided contacts. Therefore it can be used to safely separate control and load circuits as well as to reinforce contacts of safety devices.
The interface module has a strong isolation between monitoring and load contact and is designed for high thermal current.

Circuit Diagram



M11283_a

HK 3087N.16

Connection Terminals

Terminal designation	Signal description
A1+	+ 24 V DC Coil
A2	GND Coil
11, 12	Forcibly guided indicator contact
23, 24	Forcibly guided load contact

Your Advantages
- Simple contact extension and re-inforcement also of safety modules
- Cost and space saving alternative compared to contactors
- Simple contact monitoring via forcibly guided NC contact
- large wire cross section 0.5 - 6 mm² (10 - 24 AWG) reduces thermal load on wires

Features
- According to IEC/EN 61810-1, IEC 60664-1,
- With forcibly guided contacts according to IEC 61810-3
- Models with soldered in PCB safety relay
- With polarity protected diode
- Optionally with free-wheeling diode across relay coil
- With LED indicator
- Optionally AgNi + 0,2 µm Au or AgNi + 5 µm Au
- For DIN rail mounting according IEC/EN 60715
- Clearance and creepage distance between NC and NO contact > 10 mm
- Width 22,5 mm

Approvals and Markings

CE

Applications

- Interfacing between control and load circuits
- Contact extension and re-inforcement
- Separate switching of several current circuits, e. g. at
  - Machines and plants,
  - Energy production and transport

Indicator

green LED: on, when supply connected

Technical Data

Input

Nominal voltage U_N: DC 24 V (andere auf Anfrage)
Voltage range: 0,8 ... 1,2 U_N
Nominal consumption: 1,0 W

Output

Contacts
HK 3087.16, OA 5602.48: 1 NO and 1 NC contact
Contact material: $AgSnO_2$ + 0,2 µmAu
other on request
Contact type: spring contact
Operate time: max. 20 ms
Release time: max. 39 ms
Nominal output voltage: AC 250 V
Thermal current I_{th}
NO contact: 25 A
NC contact: 5 A
Switching capacity
to AC 15
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13
NO contact: 4 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 2 A / DC 24 V IEC/EN 60 947-5-1

Technical Data

Electrical life
NO contact
to AC 15 at 1 A, AC 230 V: 1.5 x 10^6 switch. cycl. IEC/EN 60 947-5-1
to AC 15 at 0.5 A, AC 230 V: 2.5 x 10^6 switch. cycl. IEC/EN 60 947-5-1
NC contact
to AC 15 at 1 A, AC 230 V: 1 x 10^6 switch. cycl. IEC/EN 60 947-5-1
to DC 13 at 1 A, DC 24 V: 0.5 x 10^6 switch. cycl. IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating
NO contact: 32 A gL IEC/EN 60 947-5-1
NC contact 6 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 50 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range: - 40 ... + 55°C
Clearance and creepage distances
between NC contact, auxiliary voltage and NO contact: > 10 mm
rated impulse voltage / pollution degree: 6 kV / 2 IEC 60 664-1
Clearance and creepage distances
between auxiliary voltage and NC contact: > 3 mm
rated impulse voltage / pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transient: 4 kV IEC/EN 61 000-4-4
Surge voltages 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 IEC/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
Vibration resistance: Amplitude 0.35 mm
Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: Humid heat IEC/EN 60 068-2-30
Terminal designation: EN 50 005
Leiteranschluß:

NC contact auxiliary voltage	NO contact
0.5 ... 2.5 mm² solid	0,5 ... 6 mm² solid
0.5 ... 2.5 mm² flexible	0,5 ... 4 mm² flexible

Wire connection: Cable wedging according to the elevator principle with captive plus-minus-terminal screws
Mounting: DIN rail IEC/EN 60 715
Weight: approx. 130 g

Dimensions

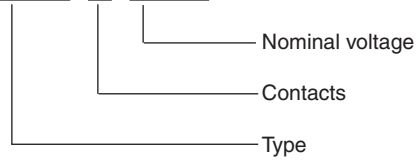
Width x height x depth: 22.5 x 106 x 75 mm

Standard Type

HK 3087N.16 DC 24 V
Article number: 0066764
- 1 NO contact , 1 NC contact
- Contact material $AgSnO_2$ + 0.2 µm Au
- Width: 22.5 mm

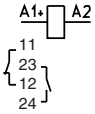
Ordering Example

HK 3087N. 16 DC 24 V



Connection Example for HK 3087N.16

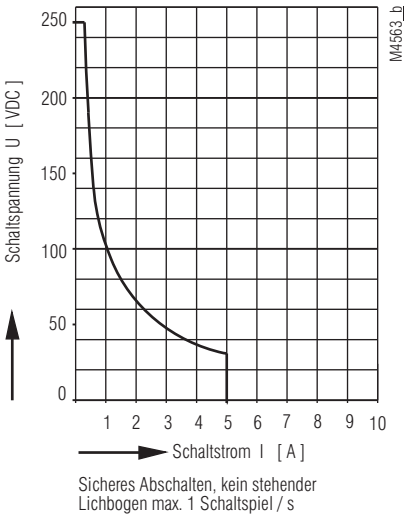
Relay: OA 5602.48 ≙ 1 NO contact and 1 NO contact (standard)



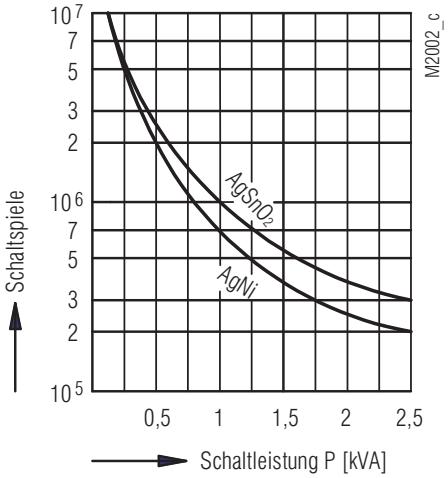
Contact	Contact-type	Connection
1	NC contact	11, 12
2	NO contact	23, 24

The terminal assignment is according to the diagram on the installed relay

Characteristic (NC contact)

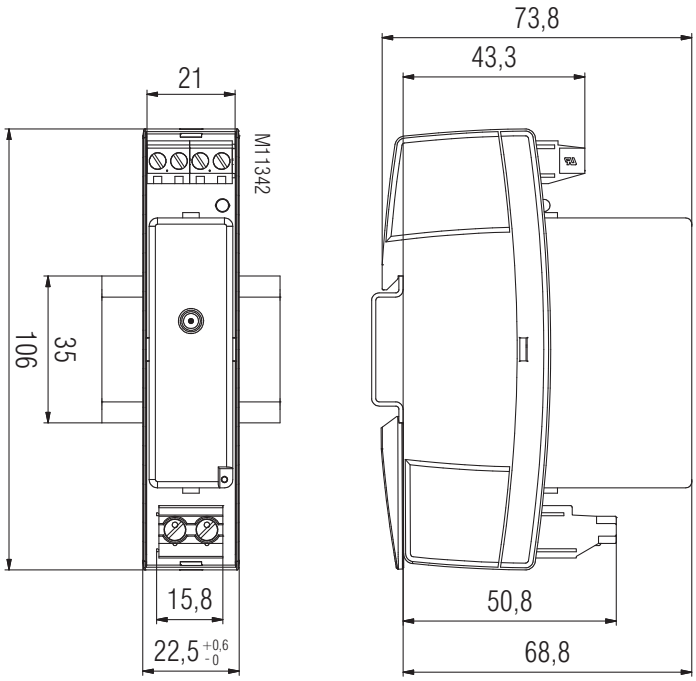


Arc limit curve under resistive load



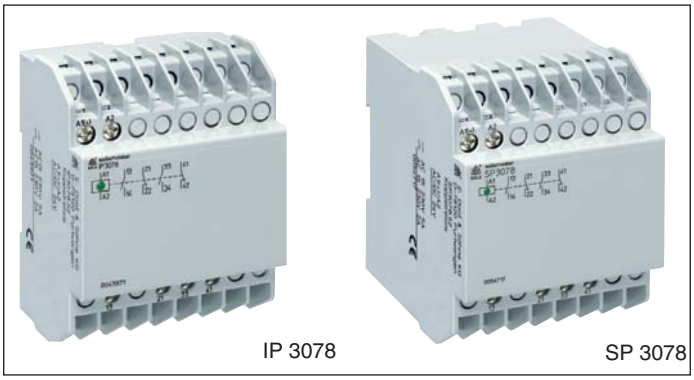
Contact service life

Dimension



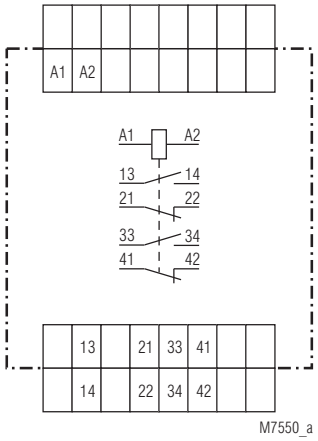
SAFEMASTER
Interface Module
IP 3078, SP 3078

0221572

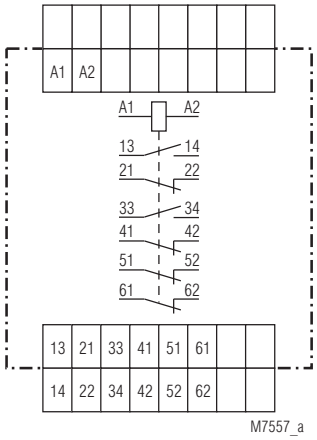


- According to IEC/EN 60 947-5-1, IEC/EN 61 810-1
- Forcibly guided contacts according to IEC 61810-3
- Max. 6 output contacts
- High thermal current I_{th} = 8 A
- LED for operating state
- Devices available in 2 enclosure versions:
- IP 3078: depth 61 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SP 3078: depth 100 mm, with terminals at the top
- Width 70 mm

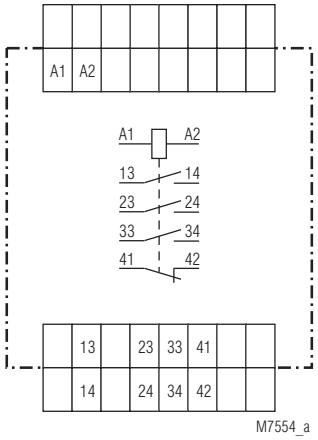
Circuit Diagrams



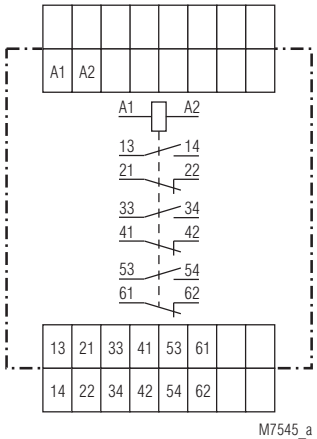
IP 3078.52, SP 3078.52



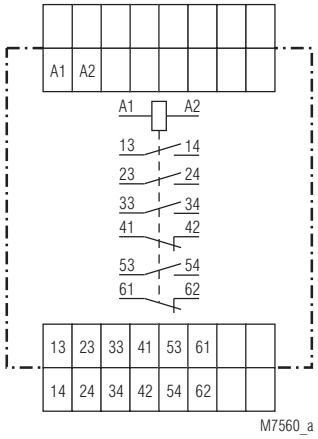
IP 3078.50, SP 3078.50



IP 3078.48, SP 3078.48



IP 3078.18, SP 3078.18



IP 3078.54, SP 3078.54

Approvals and Markings

CE

Indicators

green LED: on, when supply connected

Connection Terminals

Terminal designation	Signal description
A1	+ / L
A2	- / N
13, 14; 23, 24; 33, 34; 53, 54	Forcibly guided NO contacts for release circuit
21, 22; 41, 42; 51, 52; 61,62	Forcibly guided NC contacts for release circuit

Technical Data

Input

Nominal voltage U_N: AC/DC 24 V
AC 220 ... 240 V
Voltage range: 0.8 ... 1.1 U_N
Nominal consumption:
IP 3078.52, SP 3078.52: 1 W / 2 VA
IP 3078.18, SP 3078.18: 1.5 W / 4 VA
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 % of nominal frequency

Output

Contacts
IP 3078.52, SP 3078.52: 2 NO and 2 NC contacts
IP 3078.50, SP 3078.50: 2 NO and 4 NC contacts
IP 3078.48, SP 3078.48: 3 NO and 1 NC contacts
IP 3078.18, SP 3078.18: 3 NO and 3 NC contacts
IP 3078.54, SP 3078.54: 4 NO and 2 NC contacts
Response time: typ. 25 ms
Release time: typ. 20 ms
Contact type: Spring contact
Nominal output voltage: min. AC/DC 10 V
max. DC 250 V, AC 230 / 400 V
Thermal current I_{th}: 8 A
(see continuous current limit curve)

Switching capacity
to AC 15:
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V: 2.5 x 10^5 switching cycles
Permissible switching frequency: max. 36 000 switching cycles / h
Mechanical life: ≥ 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 20 ... + 60 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 6,0 GHz:	20 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	20 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Captive terminal screw M3.5 clamping piece as per IEC 60 664-1 / IEC/EN 60 999-1	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IP 3078:	225 g	
SP 3078:	274 g	

Dimensions

Width x height x depth	
IP 3078:	70 x 90 x 61 mm
SP 3078:	70 x 90 x 100 mm

Standard Type

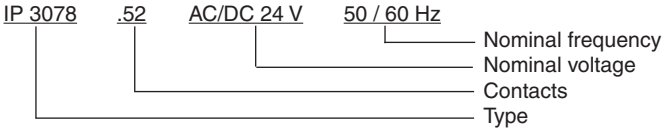
IP 3078.52 AC/DC 24 V

Article number:	0043971
• Output:	2 NO, 2 NC contacts
• Nominal voltage U_N:	AC/DC 24 V
• Width:	70 mm

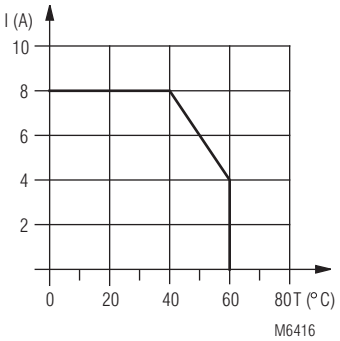
IP 3078.52 AC/DC 24 V

Article number:	0054717
• Output:	2 NO, 2 NC contacts
• Nominal voltage U_N:	AC/DC 24 V
• Width:	70 mm

Ordering Example



Characteristic



Continuous current limit curve

SAFEMASTER
Interface Module
HL 3094, HO 3094, HO 3095

0258396

HL 3094

HL 3094/100 HA 5601

HO 3094/100,
HO 3095/100

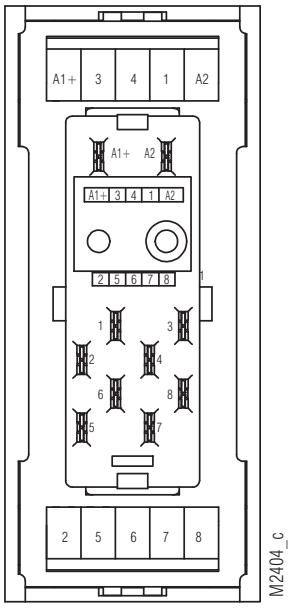
HA 5602
HA 5603

- According to IEC/EN 60255-1, IEC/EN 61810-1
- With forcibly guided contacts according to IEC 61810-3
- Low nominal consumption: 0.75 W / 1 W / 1.25 W
- Max. 8 output contacts
- Contact material AgNi + 0.2 µm Au
- High thermal current I_{th} = 8 A
- Large temperature range: -25 ... +55°C
- Safety relay soldered on PCB
- Optional AgNi + 5 µm Au or AgSnO + 0.2 µm Au
- Optional with free-wheeling diode across A1/A2
- Plug in relay option
  HA 5601 on socket HL 3094/10_
  HA 5602 on socket HO 3094/10_
  HA 5603 on socket HO 3095/10_
- DIN rail or srew mounting
- HL: 38 mm width
  HO: 73.3 mm width

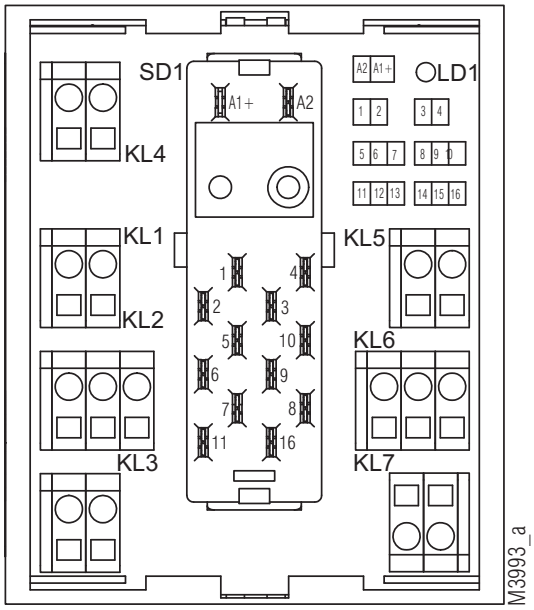
Approvals and Markings

CE

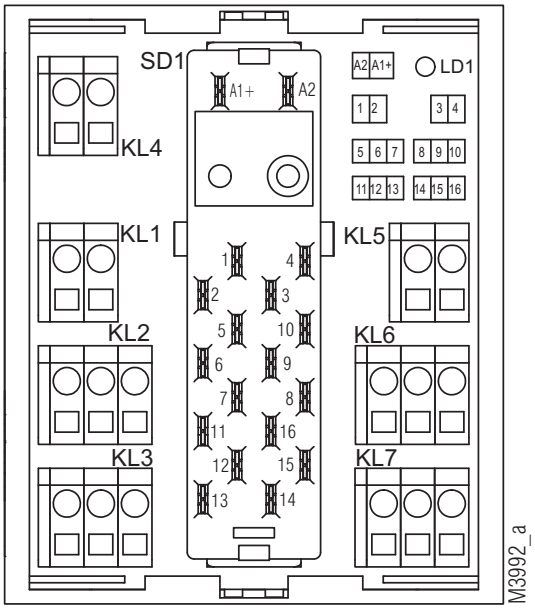
Socket Labeling



HL 3094/100, HL 3094/101

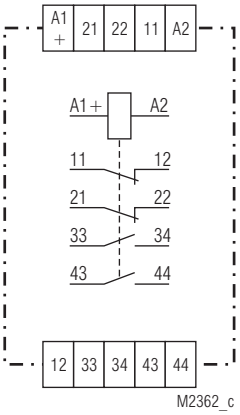


HO 3094/100, HO 3094/101
HO 3094/102, HO 3094/103

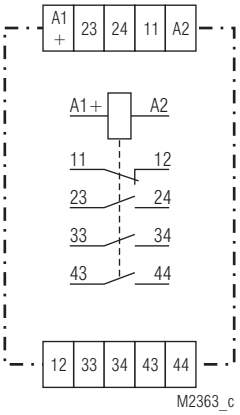


HO 3095/100, HO 3095/101
HO 3095/102, HO 3095/103

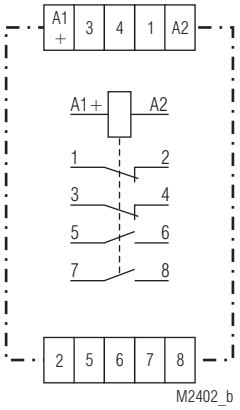
Circuit Diagrams



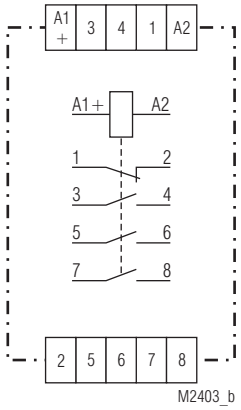
HL 3094.52



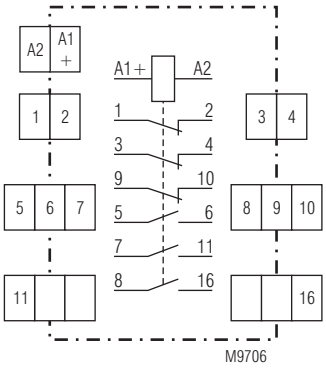
HL 3094.48



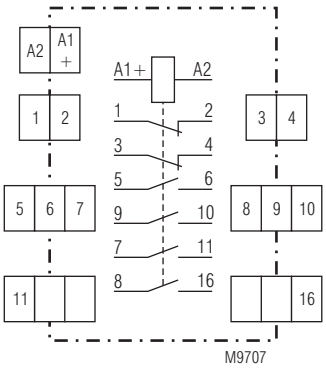
HA 5601.52



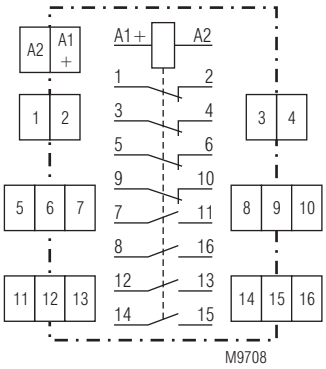
HA 5601.48



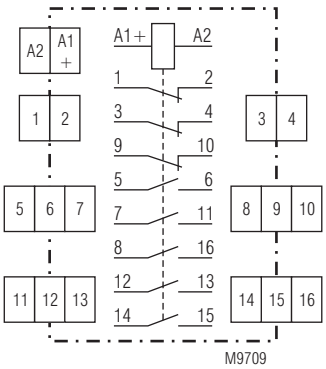
HA 5602.18



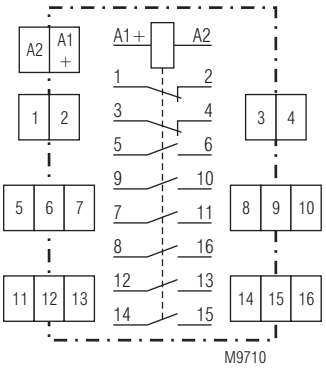
HA 5602.54



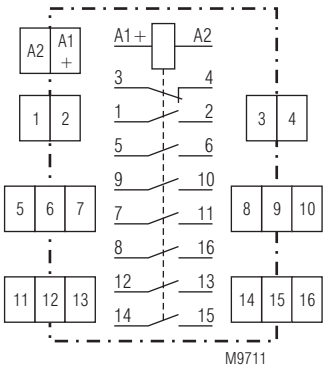
HA 5603.57



HA 5603.58



HA 5603.59



HA 5603.63

Connection Terminals

Terminal designation	Signal description
A1+	L / +
A2	N / -
11, 12 / 1, 2	NC contact
All other contacts see relevant circuit diagram	NC contacts / or NO contacts

Technical Data

Input

Nominal voltage U_N:	DC 6, 12, 24, 48, 60, 110 V other voltages on request	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption:		
HL 3094:	0.75 W	
HO 3094:	1 W	
HO 3095:	1.25 W	

Output

Contacts		
HL 3094.52, HA 5601.52:	2 NO, 2 NC contacts	
HL 3094.48, HA 5601.48:	3 NO, 1 NC contacts	
HO 3094.18, HA 5602.18:	3 NO, 3 NC contacts	
HO 3094.54, HA 5602.54:	4 NO, 2 NC contacts	
HO 3095.57, HA 5603.57:	4 NO, 4 NC contacts	
HO 3095.58, HA 5603.58:	5 NO, 3 NC contacts	
HO 3095.59, HA 5603.59:	6 NO, 2 NC contacts	
HO 3095.63, HA 5603.63:	7 NO, 1 NC contacts	
Contact material:	AgNi + 0.2 µm Au	
Measured nominal voltage:	AC 250 V	
Contact type:	spring contact	
Operate time:	≤ 40; typical 27 ms	
Release time:	≤ 10; typical 5 ms	
Thermal current I_{th}:	3 x 8 A	
Switching capacity		
to AC 15		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
at 1 s x On, 1 s Off		
at AC 230 V 5 A cos φ = 1:	> 7 x 10^5 switching cycles / AgSnO > 5 x 10^5 switching cycles / AgNi	
at AC 230 V 8 A cos φ = 1:	> 3 x 10^5 switching cycles / AgSnO > 2 x 10^5 switching cycles / AgNi	
to AC 15 at 1 A, AC 230 V:	1.5 x 10^6 switching cycles	
Permissible switching frequency:	10 switching cycles / s	
Switching voltage min./max.:	AC/DC 10 V / DC 250 V, AC 400 V (100 mV / AC/DC 60 V for AgNi-contacts + 5 µm Au)	
Switching current min./max.:	10 mA / 8 A (2 mA / 0.3 A for AgNi-contacts + 5 µm Au)	
Switching power min./max.:	0.1 VA / 2000 VA (10 mVA / 7 VA for AgNi-contacts + 5 µm Au) 0,1 W / 240 W (10 mW / 7 W for AgNi-contacts + 5 µm Au)	
Short circuit strength max. fuse rating:	6 A gL / gG	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 25 ... + 55 °C	
Storage:	- 25 ... + 70 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:		
Input / Output:	4 kV / 2 (basis insulation)	IEC 60 664-1
Output / Output:	4 kV / 2 (basis insulation)	IEC 60 664-1
Overvoltage category:	III	
Insulation test voltage, type test:	2.5 kV; 1 min	

Technical Data

EMC

Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/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	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	Humid heat	IEC/EN 60 068-2-30
Terminal designation:	EN 50 005	
Wire connection:	0.14 ... 4 mm^2 solide 0.14 ... 2.5 mm^2 flexible	
Wire fixing		
HL 3094:	box terminals	
HO 3094, HO 3095:	cage clamp terminals	
Fixing torque:	0.4 Nm	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight:		
HL 3094 (incl. relay):	approx. 120 g	
HL 3094/100:	approx. 58 g	
HO 3094 (incl. relay):	approx. 173 g	
HO 3095 (incl. relay):	approx. 183 g	
HO 3094/100, HO 3095/100:	approx. 93 g	
HA 5601:	approx. 78 g	
HA 5602:	approx. 85 g	
HA 5603:	approx. 95 g	

Dimensions

Width x height x depth	
Interface module HL 3094:	37.8 x 88 x 55.2 mm
Interface module HO 3094:	73.8 x 88 x 51.9 mm
Interface module HO 3095:	73.8 x 88 x 51.9 mm
Socket HL 3094 with safety relay HA 5601:	37.8 x 88 x 65.5 mm
Socket HO 3094 with safety relay HA 5602:	73.8 x 88 x 59.9 mm
Socket HO 3095 with safety relay HA 5603:	73.8 x 88 x 59.9 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Voltage range:	0.7 ... 1.25 U_N with operational limitations	
Protective coating of the PCB:	No	

Standard Type

HL 3094.52 DC 24 V

Article number:	0047426
• 2 NO, 2 NC contacts	
• Contact material:	AgNi + 0.2 µm Au
• Nominal voltage U_N:	DC 24 V
• Width:	38 mm

Variants

Interface module:

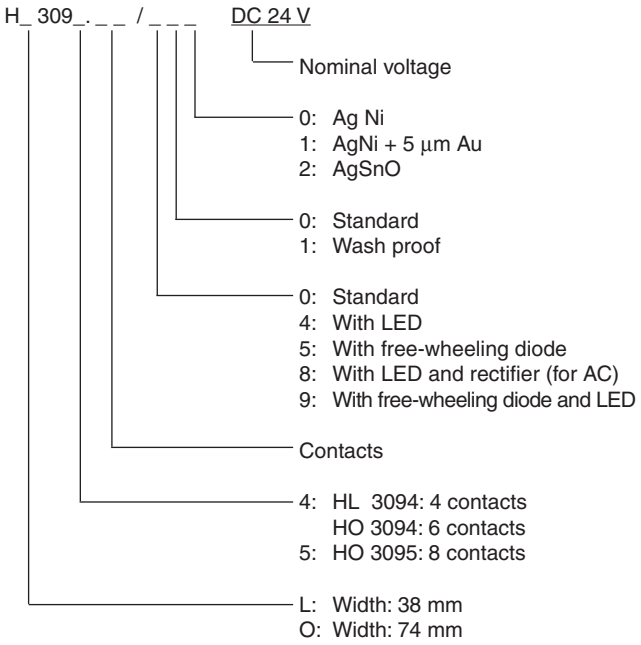
H_ 309_ /100:	Socket
H_ 309_ /101:	Socket with free-wheeling diode
H_ 309_ /102:	Socket with free-wheeling diode + LED
H_ 309_ /103:	Socket with LED

Safety relay

HA 5601._ _, HA 5602._ _, HA 5603._ _:	Contact material AgNi + 0.2 µm Au
HA 5601._ _/001, HA 5602._ _/001 HA 5603._ _/001:	Contact material AgNi + 5 µm Au
HA 5601._ _/002, HA 5602._ _/002, HA 5603._ _/002:	Contact material AgSnO + 0.2 µm Au

other variants on request

Ordering example for variants



Accessories

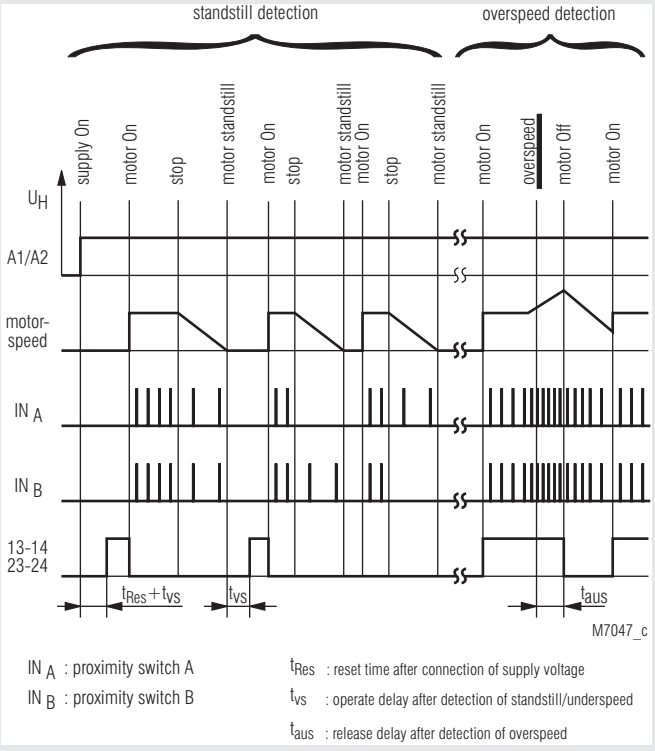
ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578

SAFEMASTER S
Speed or Standstill Monitor
BH 5932

0223010

- **According to**
  - **Performance Level (PL) e and category 3 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**
- **For stop category 0 according to EN 418**
- 2-channel input
- To monitor rotation and linear movement
- PNP proximity sensor inputs
- Optionally inputs for NPN proximity sensors
- Monitoring of connected sensor
- Fixed setting, adjustable as option
- Energized when speed is under setting value
- LED indication
- Feedback circuit X1 - X2 to monitor external contacts
- Forcibly guided contacts
- 2 NO, 1 NC contact
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3
- Width 45 mm

Function Diagram



IN A : proximity switch A
IN B : proximity switch B

tRes : reset time after connection of supply voltage
tvs : operate delay after detection of standstill/underspeed
taus : release delay after detection of overspeed

Approvals and Markings

CE, TÜV SÜD, c UL us LISTED Canada / USA, A025518

Application

Monitoring of speed or standstill also during setup operation

Indication

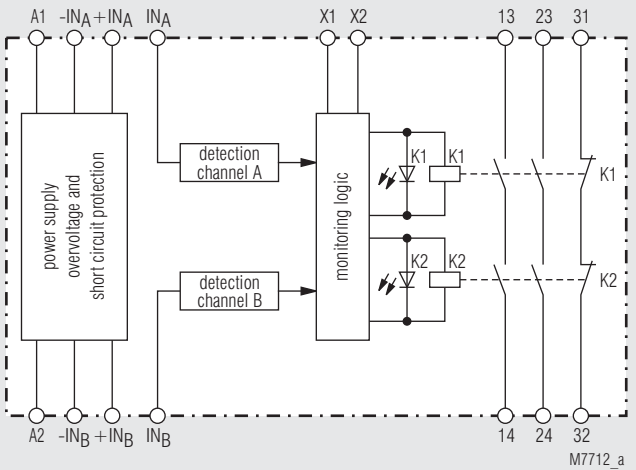
Standstill monitoring:

1. green LED:	on, when supply voltage connected
2. green LED:	on, when standstill detected on channel 1
3. green LED:	on, when standstill detected on channel 2

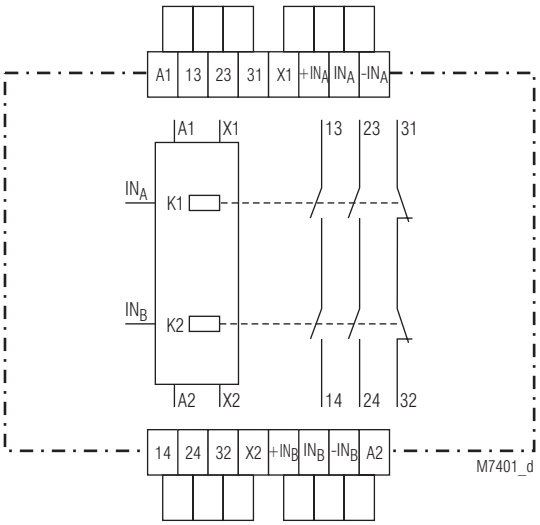
Overspeed monitoring:

1. green LED:	on, when supply voltage connected
2. green LED:	on, when no overspeed detected on channel 1
3. green LED:	on, when no overspeed detected on channel 2

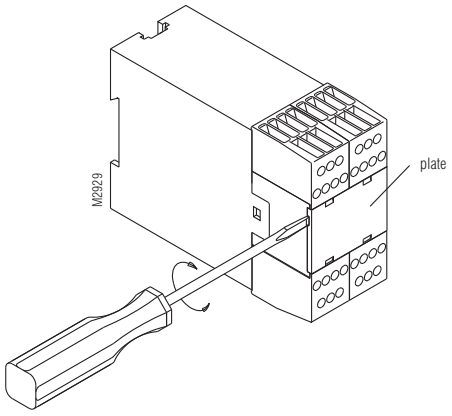
Block Diagram



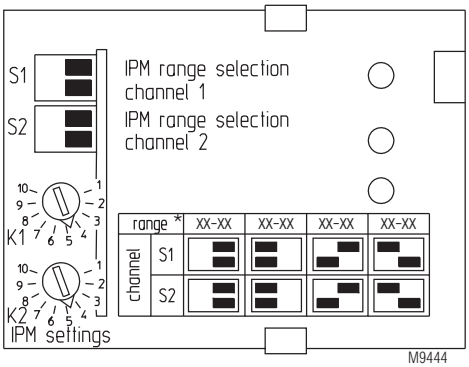
Circuit Diagram



Unit Programming



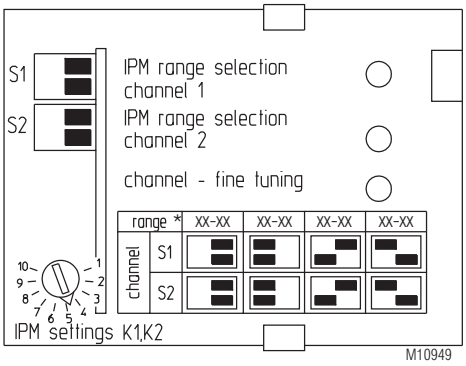
Model with separate adjustable channels



range* : 8-60 / 60-450 / 450-3600 / 1800-14000 lpm
or 20-110 / 120-900 / 950-7000 / 3700-26000 lpm

Only operate switches while unit is disconnected

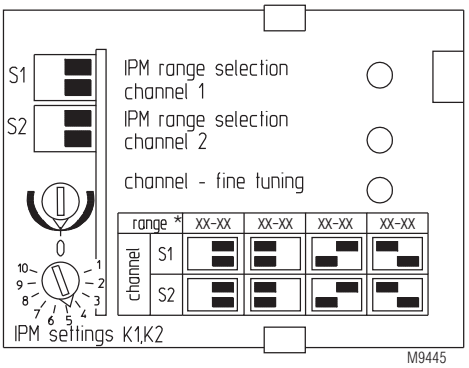
Model with common setting for both input channels



range* : 8-60 / 60-450 / 450-3600 / 1800-14000 lpm
or 7-90 / 60-700 / 470-5500 / 1800-21000 lpm

Only operate switches while unit is disconnected

Model with common setting for both input channels and fine tuning to synchronise both channels



range* : 5-40 / 35-340 / 300-2700 / 1200-10500 lpm
or 10-80 / 80-650 / 600-5300 / 2400-20000 lpm

Only operate switches while unit is disconnected

Notes

The device can be used for standstill and speed monitoring. All units have 2 sensing channels.

Variants
Three main variants are available:
BH 5932.22/_ _0: Devices with fixed tripping value
BH 5932.22/_ _2: Devices with separate adjustment for both channels
BH 5932.22/_ _1: Devices with common adjustment for both channels
BH 5932.22/_ _3: Devices with common adjustment for both channels and fine tuning to synchronise both channels

Setting ranges
On adjustable units the total range is split up in 4 sub ranges that can be selected with 2 DIP-switches per channel. To adjust the setting value in the selected range the potentiometers are used.

Adjustment of setting range
The number of pulses [lpm] to be adjusted can be calculated using the following formula:

Rpm x number of sensing spots = lpm

e.g. 7.5 Rpm x 2 sensing spots = 15 lpm

Operation as standstill monitor
Both channels must be adjusted so that they switch simultaneously. The maximum time after standstill detection until switching of the output relays is depending on the adjusted lpm value. This delay can be calculated as follows:

$$\frac{60\ s}{\text{adjusted lpm-value}} + 2.5\ s = t_{vs}$$

t_{vs} ≙ operate delay after standstill detection

e.g. at a setting of 15 lpm

$$\frac{60\ s}{15} + 2.5\ s = 6.5\ s$$

Operation as overspeed monitor
Especially on overspeed monitoring it is necessary to adjust both channels precisely on simultaneous switching. If the two channels switch not at the same time the disconnection of the drive is only made with the faster channel. The speed can drop immediately so that the slower channel does not detect overspeed and remains switched on. A new start is then disabled and the relay does not switch on again. A restart is only possible by desconnecting the power supply. To achieve an accurate setting the lpm setting value should be in the middle part of the setting range. The adjustment of simultaneous switching is easier on units with separate setting for each channel as on units with fine tuning potentiometer.

Proximity sensors
For safe operation the proximity sensors should be mounted vibration free. The position of the sensors should be chosen in a way that both sensors are operated simultaneously. Care must be taken that the sensors do not influence each other. The connection of the sensors to the supply is monitored. If there is an interruption in the sensor supply the corresponding output relay cannot be switched on, or if it is already on, it will switch off immediately. To achieve a fault free operation, the sensor must have draw at least 3 mA in off state. If sensors with lower consumption are used only devices without sensor detection can be operated. According to EN ISO 13849-1, the sensors must be checked for correct function in reasonalble time intervals.

Feedback circuit, reset, LEDs and timing
The reset circuit X1 - X2 must be closed before connecting the power supply. The unit is ready for operation after typically 1.5 sec after the supply is connected.

The LEDs channel 1 and channel 2 are on when the corresponding relay is energized. The output contacts of the relays will only be activated if both input channels reach the enabling condition within a time span of approx. 2 sec. If the response value is not reached on both channels within this time, e.g. because of a defective sensor or because the sensors do not simultaneously switch the output contacts are not enabled.

Technical Data

Input

Nominal voltage U_N:	AC/DC 24 V AC 110, 230 V
Voltage range	
AC:	0.85 ... 1.1 U_N
DC:	0.9 ... 1.1 U_N
Nominal consumption:	approx. 4 VA, 2.5 W
Nominal frequency	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Start up reset time t_{Res}:	1.5 s
Hysteresis:	typ. 6 %

Inputs for NPN- or optional PNP Proximity Sensors

Input voltage:	DC 24 V
Input current:	max. 25 mA (per channel)
Min. current of sensor	3 mA
Min. pulse time:	1 ms On, 1 ms Off
Max. lpm at inputs	
IN_A und IN_B:	30000 lpm

Speed Ranges [lpm]

Devices with fixed tripping value

BH 5932.22/_ _0:	15 / 30 / 60 / 120 lpm, fixed others on request (the output contacts close, when the speed is under the fixed lpm values)
Operate delay at standstill:	see formula
Release delay on overspeed:	t_{aus} = typ. 700 ms

Devices with separate adjustment for both channels

BH 5932.22/_ _2	
Range 8 ... 14000 lpm:	adjustable in 4 subranges 8 ... 60, 60 ... 450, 450 ... 3600, 1800 ... 14000 lpm
or	
range 20 ... 26000 lpm:	adjustable in 4 subranges 20 ... 110, 120 ... 900, 950 ... 7000, 3700 ... 26000 lpm
Operate delay at standstill:	see formula
Release delay on overspeed	
Range 8 ... 14000:	t_{off} = typ. 700 ms
Range 20 ... 26000:	t_{off} = typ. 350 ms

Devices with common adjustment for both channels

BH 5932.22/_ _1	
Range 8 ... 14000 lpm:	adjustable in 4 subranges 8 ... 60, 60 ... 450, 450 ... 3600, 1800 ... 14000 lpm oder
Range 7 ... 21000 lpm:	adjustable in 4 subranges 7 ... 90, 60 ... 700, 470 ... 5500, 1800 ... 21000 lpm
Operate delay at standstill:	see formula
Release delay on overspeed	
Range 8 ... 14000:	t_{aus} = typ. 700 ms
Range 7 ... 21000:	t_{aus} = typ. 350 ms

Devices with common adjustment for both channels and fine tuning to synchronise both channels

BH 5932.22/_ _3	
Range 5 ... 10500 lpm:	adjustable in 4 subranges 5 ... 40, 35 ... 340, 300 ... 2700, 1200 ... 10500 lpm
or	
range 10 ... 20000 lpm:	adjustable in 4 subranges 10 ... 80, 80 ... 650, 600 ... 5300, 2400 ... 20000 lpm
Operate delay at standstill:	see formula
Release delay on overspeed	
Range 5 ... 10500:	t_{off} = typ. 700 ms
Range 10 ... 20000:	t_{off} = typ. 350 ms

Technical Data

Output

Contacts:	2 NO, 1 NC	
Contact type:	forcibly guided	
Thermal current I_{th}:	4 A	
Switching curren:	AC: 8 A cos φ 1 ... 0.7	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
nach DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
according to DC 13		
NO contact:	4 A / DC 24 V at 0.1 Hz	
NC contact:	4 A / DC 24 V at 0.1 Hz	
Elektrical life		IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V:	≥ 3 x 10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 25 ... + 60 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		IEC 60 664-1
Input / output	4 kV / 2	
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
Interference suppression		
Auxiliary voltage		
AC 110 V, AC 230 V:	Limit value class B	EN 55 011
AC/DC24V:	Limit value class A*)	EN 55 011

*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated.
To avoid this, appropriate measures have to be taken.

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	Plus-minus terminal screws M3.5 box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	410 g	

Dimensions

Width x height x depth:	45 x 85 x 121 mm

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 60°C:	Pilot duty B300 4A 250Vac G.P. 4A 24Vdc
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

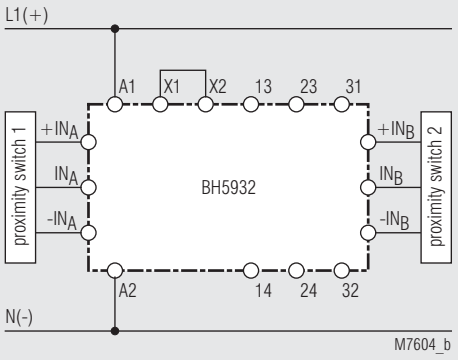
BH 5932.22/112/61	AC/DC 24 V	20 ... 26000 lpm
Article number:		0059482
BH 5932.22/112/61	AC/DC 24 V	8 ... 14000 lpm
Article number:		0065009
• Output:		2 NO, 1 NC contacts
• Nominal voltage U_N:		DC 24 V
• Input:		for pnp-sensors and with sensor detection
• Width:		45 mm

Ordering example for variants

BH 5932 .22 /_ _ _ /61 AC 230 V 50/60 Hz 60 lpm

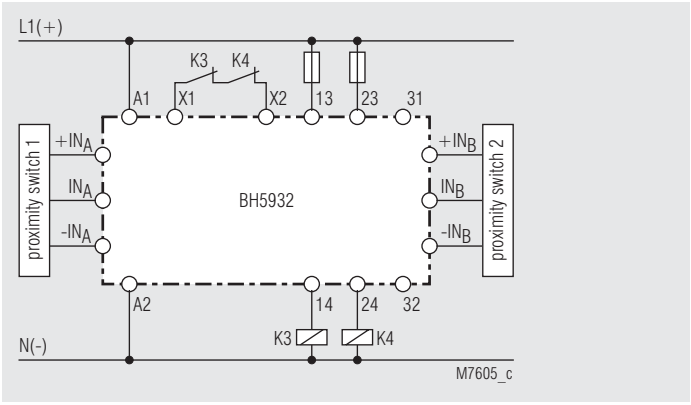
- Setting value
- Nominal frequency
- Nominal voltage
- UL approval
- Variants, if required
  - 0 = fester Ansprechwert
  - 1 = adjustable setting value channel 1 and 2 ogether adjustable
  - 2 = adjustable setting value channel 1 and 2 separated adjustable
  - 3 = adjustable setting value channel 1 and 2 together adjustable with fine tuning to synchronise both channels
- 0 = npn-input
- 1 = pnp-input
- 0 = without sensor detection
- 1 = with sensor detection
- Contacts
- Type

Connection Example

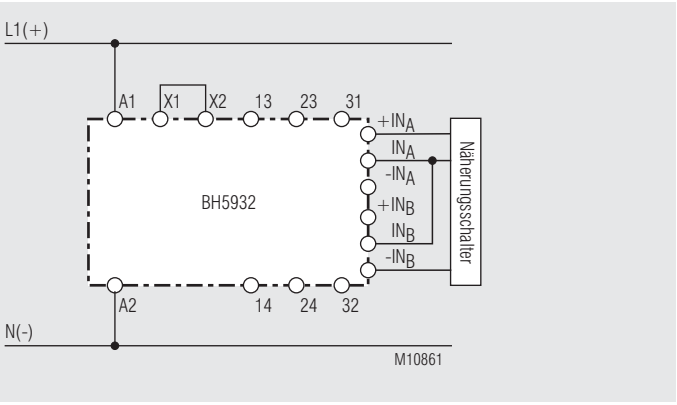


Standard connection
suited up to SIL3, Performance Level e, Cat. 3

Connection Examples

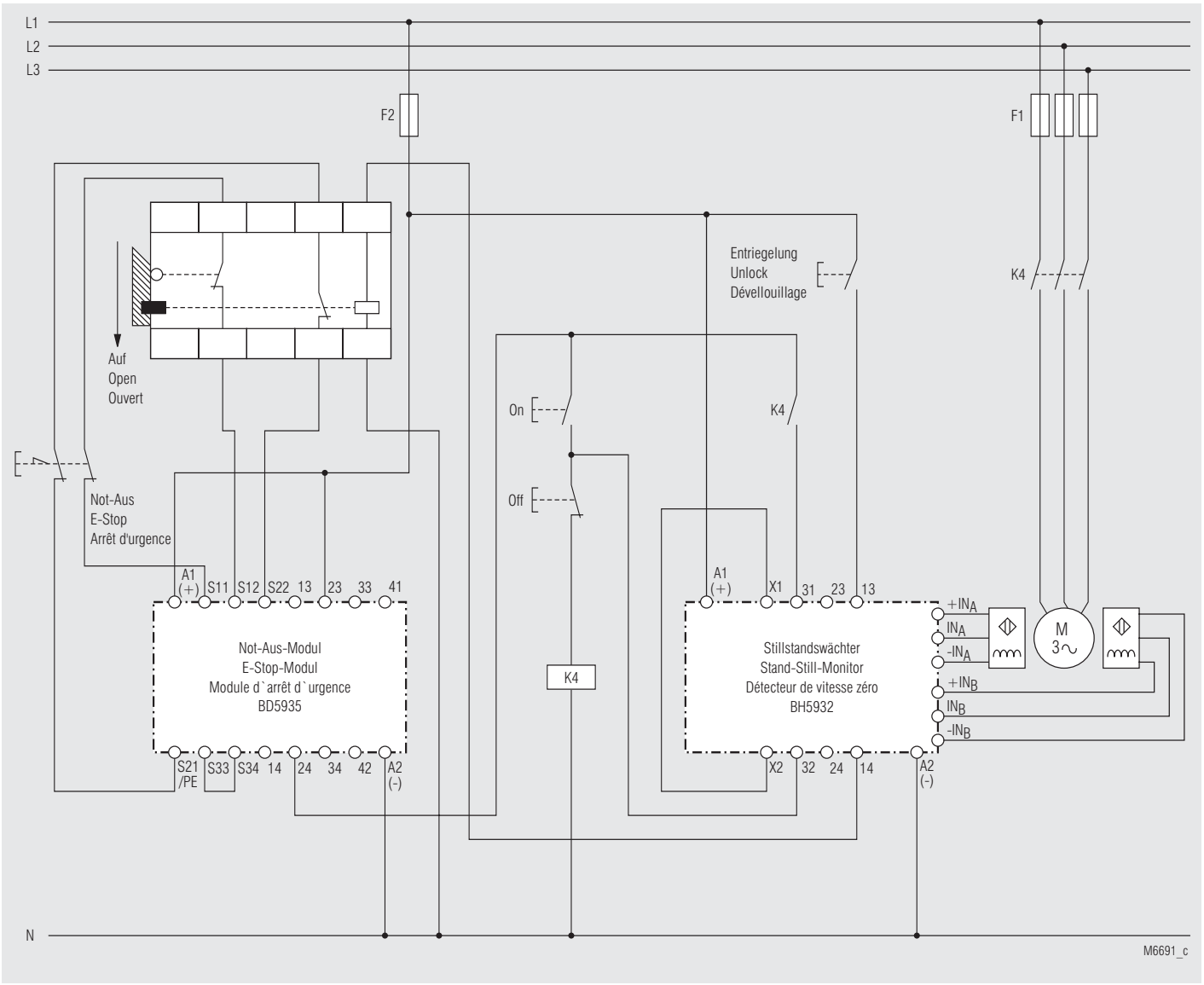


Connection with external contactors,
suited up to SIL3, Performance Level e, Cat. 3



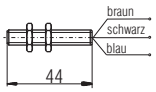
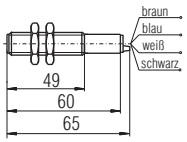
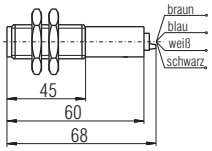
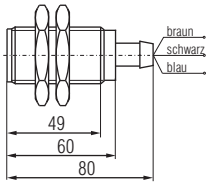
Connection with proximity sensors
suited up to SIL2, Performance Level c, Cat. 2
(to achieve Cat. 2 the safety function has to be tested on a regulare base.)

Application Example



suited up to SIL3, Performance Level e, Cat. 3

Initiators (proximity sensors), induktive

Type	NA 5001.01.10 pnp NA 5001.01.20 npn	NA 5002.01.34 pnp/npn	NA 5005.01.34 pnp/npn	NA 5010.01.10 pnp NA 5010.01.20 npn
Dimensions	 M8x1 SW13 M6935_a	 M12 x 1 SW 17 M6936_a	 M 18 x 1 SW 24 M7032_a	 M30 x 1,5 SW 36 M7033_b
Enclosure	Metal	Metal	Metal	Metal
Switching distance S_n	1 mm	2 mm	5 mm	10 mm
Switching frequency	5 000 Hz	1 000 Hz	300 Hz	200 Hz
Hysteresis	2 ... 10 %			
Repeat accuracy	5 %			
Voltage range	10 ... 30 V			
Residual ripple	< 10 %			
Continuous current	≤ 200 mA	≤ 100 mA	≤ 100 mA	≤ 400 mA
Output	.10 pnp NO .20 npn NO	.34 pnp NO + npn NO	.34 pnp NO + npn NO	.10 pnp NO .20 npn NO
Indication of output state	LED			
Ambient temperature	- 25 ... 70°C			
Temperature influence	10 %			
Degree of protection	IP 67			
Connection wire	2 m			
Fixing torque	4 Nm	15 Nm	40 Nm	100 Nm
Weight	45 g	70 g	120 g	270 g

Connection Table BH 5932, BH 5932 / 00_

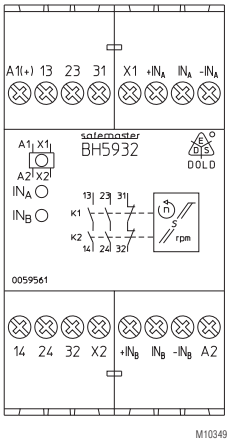
Type	Wire	Terminal on BH 5932
NA 5001.01.20	brown +	+ In_A / + In_B
	blue -	- In_A / - In_B
	black NO	In_A / In_B
NA 5002.01.34 NA 5005.01.34	brown +	+ In_A / + In_B
	blanc NO	In_A / In_B
	blue -	- In_A / - In_B
	black -	- In_A / - In_B
NA 5010.01.20	brown +	+ In_A / + In_B
	blue -	- In_A / - In_B
	black NO	In_A / In_B

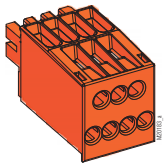
Connection Table BH 5932, BH 5932 / 01_

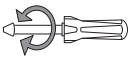
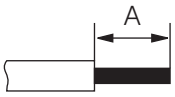
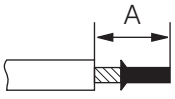
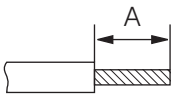
Type	Wire	Terminal on BH 5932
NA 5001.01.10	brown +	+ In_A / + In_B
	blue -	- In_A / - In_B
	black NO	In_A / In_B
NA 5002.01.34 NA 5005.01.34	brown +	+ In_A / + In_B
	blanc +	+ In_A / + In_B
	blue -	- In_A / - In_B
	black NO	In_A / In_B
NA 5010.01.10	brown +	+ In_A / + In_B
	blue -	- In_A / - In_B
	black NO	In_A / In_B

ATTENTION!
Only the initiators NA5001.01.10, NA5001.01.20, NA5010.01.10 and NA5010.01.20 are usable for units with initiator-detection (BH 5932.22/1xx) !

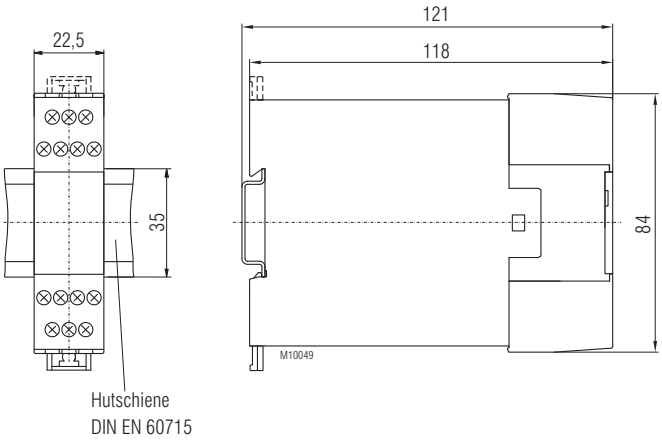
DE	Beschriftung und Anschlüsse
EN	Labeling and connections
FR	Marquage et raccordements



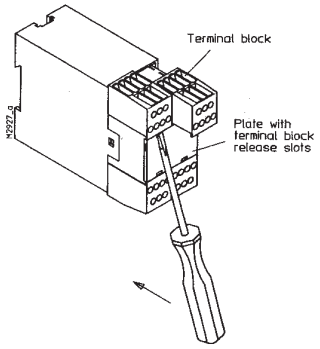


	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16
	A = 10 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16

DE	Maßbild (Maße in mm)
EN	Dimensions (dimensions in mm)
FR	Dimensions (dimensions en mm)



DE	Montage / Demontage der Klemmenblöcke
EN	Mounting / disassembly of the terminal blocks
FR	Montage / Démontage des borniers ammovibles



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	3	
PL:	e	
$MTTF_d$:	280,3	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)

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:	99,0	%
PFH_D:	1,74E-10	h^{-1}
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

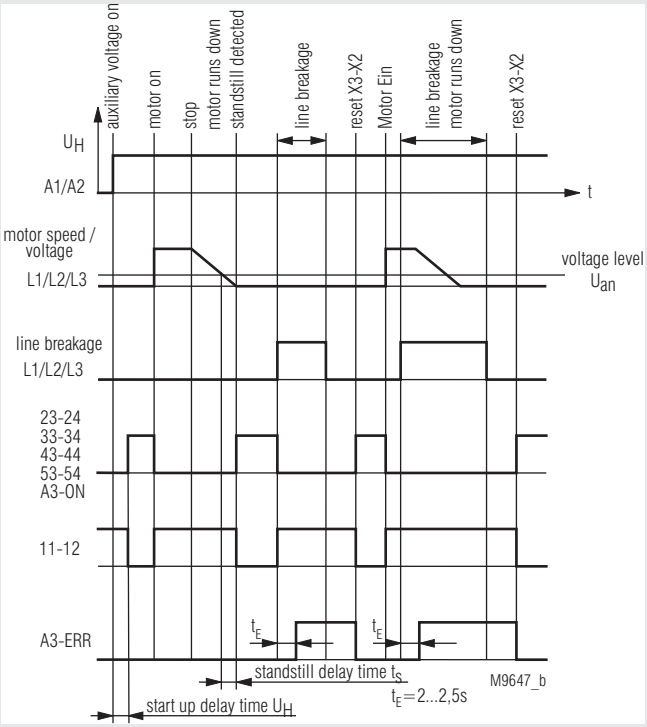
Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511	SIL 3	einmal pro Jahr once per year annuel

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

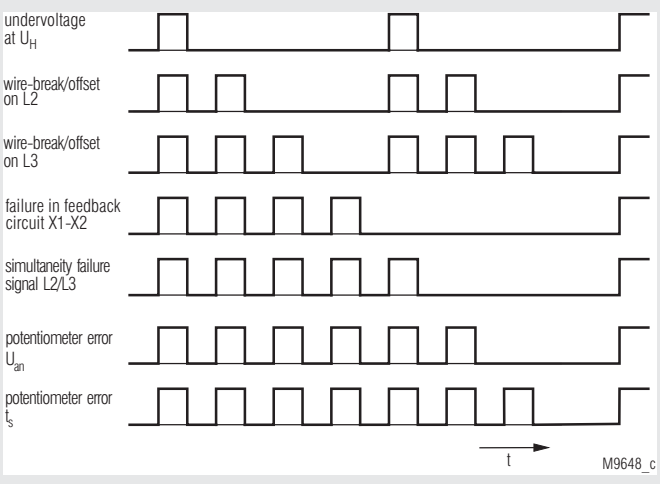
SAFEMASTER S
Standstill Monitor
LH 5946

0255161

Function Diagramm



Flashing Codes



Flashing codes of the LED „ERR“ in sequence of priority

Your Advantages

- Without sensor and safe
- Fast reaction time
- Easy to retrofit
- Combined with Interlock SAFEMASTER STS

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, IEC/EN 61511 and EN 61800-5-2**
- Safe standstill detection on 3- and single-phase motors
- No external sensors necessary
- Independent of direction
- Broken wire detection
- Forcibly guided safety contacts:
  3 NO contacts, 1 NC contact for AC 250 V
- 2 semiconductor monitoring outputs
- 1 monitoring output (NO contact)
- Adjustable voltage setting
- Adjustable standstill time delay
- LED indicators for standstill, event of line breakage and operation voltage
- Suitable for operation with inverters
- Width 45 mm

Approvals and Markings

CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | c UL us LISTED Canada / USA | A025518 | EAC

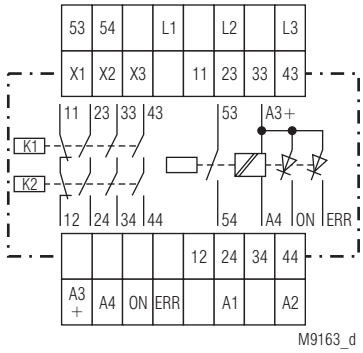
Applications

Safe standstill detection on 3- and single-phase motors, e.g. to enable gate interlocks on machine tools or to activate hold in brakes.

Function

The Standstill monitor LH5946 is suitable to monitor the standstill of all electric motors that generate a remanence voltage while coasting to stop. The LH 5946 is connected to the motor terminals and measures the induced back emf voltage. 2 redundant measuring channels are used (L2-L1 and L3 L1). If the back emf voltage drops to 0 simultaneously in both channels this indicates standstill and the output relay is energized.
To adopt the unit to all different types of motors and applications the voltage threshold indicating standstill on LH 5946 is adjustable. Also the time delay between detection and energisation of the relay is adjustable (standstill time ts).
In addition the unit detects broken wire on the measuring inputs L1 / L2 / L3. If broken wire is detected the output relays goes into safe state (as with running motor). This state is stored and can be reset by bridging terminals X3-X2.
The input signals of both channels are permanently compared. If the signals are different for more then 2.5 sec a simultaneity failure is detected. This failure resets when both input channels receive simultaneous signals with a level, above the voltage threshold and hysteresis.
To the terminals X1-X2 the feedback circuit of external contactors (used for contact reinforcement) is connected (NC contact). If no feedback circuit is required, these terminals must be linked. Open terminals will cause a failure message.

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
L1 - L2 - L3	Connection to monitored motor
11 - 12	Safety contacts (NC)
23 - 24, 33 - 34, 43 - 44	Safety contacts (NO)
53 - 54	Monitoring contact (NO)
X1 - X2	Connection of feedback circuit (for external contactors)
X2 - X3	Manual reset for external faults
A1 - A2	Auxiliary supply (U_H)
A3(+) - A4	Supply for semiconductor outputs
ON:	Semiconductor output indicates state of safety contacts
ERR:	Semiconductor output indicates failures
Attention: The outputs 53-54, ON and ERR are only monitoring outputs and must not be used in safety circuits!	

Indicators

green-red LED „UH“:	green on, when operation red on, with internal error
yellow-green LED „OUT“:	yellow on, at EMK > U_{an} flashes green at time progression of t_s permanent on, when output contacts are enable
red LED „ERR“:	flashes at error in measuring and feedback circuit and low auxiliary voltage U_H (see flashing codes)

Function

The LH 5946 can be used for standstill detection on all 3-phase, single phase and DC motors, that generate a voltage caused by remanence when freewheeling. As the voltage level Uan for standstill monitoring and the time delay ts, after detection of standstill until the safety relays are switched on, are adjustable, the function can be adopted to different motors and applications.

Basic function of LH 5946

The auxiliary voltage is connected to the terminals A1-A2; the LED „UH“ lights up green. On undervoltage or missing auxiliary supply the safety outputs are disabled.
If semiconductor monitoring outputs are used, their supply voltage must be connected to A3(+)-A4.

A motor connected to the terminals L1-L2-L3 of the LH 5946 generates a voltage when running down (motor is switched off). The voltage is proportional to the speed and caused by residual magnetism (remanence). This voltage is measured redundant on 2 input channels via the terminals L2 and L3 with L1 as common reference.

If the voltage drops on both channels below the adjusted value U_{an}, the unit detects standstill. When the terminals X1-X2 of the feedback circuit are bridged and the time delay ts is finished, the safety contacts 23-24, 33-34 and 43-44 close while contact 11-12 opens. All 4 contact paths have 2 forcibly guided contacts of 2 safety relays wired in series.

At the same time the monitoring relay energises (53-54 closes), the semiconductor output „ON“ is switched on and the LED „OUT“ lights green. During time delay ts this LED flashes.

If the voltage measured on terminals L1-L2-L3 of LH 5946 rises over the adjusted value plus hysteresis in at least one channel (the motor is switched on or the shaft turns mechanically), the forcibly guided output contacts are switched off immediately (contacts 23-24, 33-34 and 43-44 open while contact 11-12 closes). The monitoring relay de-energises (53-54 opened), the semiconductor output „ON“ goes off and the LED „OUT“ lights yellow (= U_{an} over adjusted value).

Feedback circuit X1 - X2

If the safety contacts control external contactors/components (e.g. to reenforce or multiply the contacts) the safety function of them must be monitored.
This is done with the feed back circuit (terminals X1-X2) to which the NC contacts of the contactors/components must be connected. (see also wiring diagrams).

The LH 5946 will only enable its safety output if the feedback loop X1-X2 is closed while standstill is detected, i.e. the external contactors/components are in initial state (NC contacts are closed).

The feedback circuit X1-X2 must be closed as long as the safety outputs (because of running motor or external failure) are not enabled. If not the failure „feedback circuit“ is indicated.

If the feedback circuit is not used, the terminals X1-X2 must be bridged.

Failure monitoring

The LH 5946 includes a number of facilities to to detect failures that could influence the safety function of the module. The failure check is carried out on power up of the unit and in cycles during normal operation. If a failure occurs the output relays switch off. The failure state is indicated with the LEDs „ERR“ and „UH“ and the semiconductor output „ERR“ switches on. With safety relevant failures the unit differentiates between external failures (broken wire / offset, simultaneity failure, feedback circuit failure) and internal failures.
Broken wire / offset failures and feedback circuit failures can be stored or automatic reset after removing the fault. (see chapter failure storing).

Broken wire / offset

The connection wires between LH 5946 and motor are continuously monitored for broken wire and on a DC-voltage offset higher then U_{an}. In the case of a broken wire or offset failure the output relays are switched off immediately and the LED „OUT“ lights yellow. In addition a failure signal comes up with delay (on broken wire after 2 s on offset failure after 8 s): the semiconductor output „ERR“ switches on and the LED „ERR“ flashes with failure code 2 or 3 depending on the failure located either between L1-L2 or L1-L3.

Simultaneity of the measuring signals

As additional safety feature the 2 input signals (L2 and L3) are compared continuously. This allows to detect also internal failures in one measuring channel.

If the signals are different for at least 2.5 s (one channel $>U_{an}$ the other $<U_{an}$) simultaneity failure is detected. The semiconductor output „ERR“ is switched on and the LED „ERR“ flashes with failure code 5.

If the measured signals return to the same level $<U_{an}$ the error remains stored and the outputs are disabled.

The simultaneity failure is only reset when both channels return to $> U_{an}$. If after that both channels drop below the setting value, get $< U_{an}$ the out relays will switch on.

Failure in feedback circuit X1-X2

As already mentioned the failure code „feedback circuit“ occurs when the outputs are disabled and there is no connection between terminal X1-X2. The semiconductor output „ERR“ is switched on and the LED „ERR“ flashes with failure code 4.
Also when both input signals drop now to $<U_{an}$ and besides the open feedback loop no other failures are present the feedback circuit failure remains active and the outputs remain disabled.
If the feedback circuit is now closed and the unit is on auto reset for external failures (see failure storing) the output relays are enable and switch on.

Potentiometer error

To achieve the required safety when adjusting the voltage threshold for standstill detection, ech setting function is realised with 2 potentiometers having one common setting knob. If on 2 corresponding potentiometers a different setting is detected the potentiometer error U_{an} or t_s is displayed.

To remove the failure please try to readjust the potentipometer. Please make sure that you feel the detent

Internal device failure

Internal failures are always stored, independent of the reset input X3 and cause the output relays immediately to switch off, the semiconductor output „ERR“ to switch on and the LED „UH“ to change it’s colour from green to red.
Examples for internal failures:

- Failure on safety relays e.g. welded output contacts
- Internal failures on measuring channels and measuring circuits
- Internal failures on control circuits for the safety relays
- failures on setting potentiometers for U_{an} and t_s
- Undervoltage failure (LED „ERR“ flashes with failure code 1)

Failure indication with flash code of LED „ERR“

The flash codes indicate failures caused externally (see diagram flashing codes for failure indication on page 9).
A series of flash pulses 1-7 followed by a slightly longer space is displayed. The flash code indicates the type of failure. If several failures are present at the same time only the failure with the highest priority (lowest flash code) is shown. When this failure is removed the other existing failures are displayed in the same way according to their priority.

Failure storing / reset (terminals X2-X3)

With the external failures broken wire/offset and feedback circuit the operator can choose between manual and automatic reset after the failure is removed.

X2-X3 open:	manual reset
X2-X3 closed:	automatic reset

(!) Attention

The a.m. storing function of the external failures broken wire /offset, and feedback circuit is not a safety function. I.e. in respect to safety aspects it can not be regarded as guaranteed. The reset for these failures must be therefore regarded as auto reset after removing the faults.

Internal device failures that could occur in seldom cases (e.g. caused by temporary interference) can be reset by switching the supply voltage off and on. If a reset is not possible also if the voltage is applied correctly, the device could be defective and should be sent back to the manufacturer for examination or repair.

Connection of LH 5946

The LH 5946 has to be connected according to connection examples or in a similar way. The connection of DC- motors is made as with single phase AC-motors.

L1 - L2 - L3

The measuring wires L1-L2-L3 have to be connected directly to the windings of the monitored motor (not via transformers) in order to provide a correct broken wire detection for the connection wires and motor windings. The motor windings must not be disconnected from the measuring wires by motor contactors, because broken wire detection is activated and standstill monitoring is disabled.

Interference to the measuring wires should be avoided as no standstill may be detected by the LH 5946. If possible the measuring wires should be run separately from the motor wires or screened wires should be used. In this case the screen can be connected at the motor side.

A1 - A2

Connection of the auxiliary supply, recommended fuse : 2A.

A3+ / A4

DC 24 V supply (12 … 30 V) for the semiconductor monitoring outputs „ON“ and „ERR“, if these are used.

11-12, 23-24, 33-34, 43-44

Safety output contacts, connection according to the connection examples or similar.
Recommended fuse: 5 A fast acting, to avoid welding of the contacts in the case of external wiring or component failures. See also technical data.

53 - 54

Monitoring contact to indicate the state of the safety output (non safety contact)

X1 - X2 (feedback circuit)

Connection of NC contacts of external components or contactors for contact re-enforcement, must be linked if not used.

X2 - X3

Connection for manual or auto reset, connection is made according to the required application. When monitoring DC motors or in the case of DC-braking the broken wire / offset failure will be shown during operation. In this case the terminals must be linked because if storing the failure would not allow activation of the safety contacts at standstill.

Attention

The terminals X1-X2-X3 have electrical connections to the measuring inputs L1-L2-L3. Volt free contacts must be used for bridging. If terminal X3 should be controlled by a PLC via an interface relay this must have the necessary insulation between the motor voltage (measuring input) and PLC potential.

Operation Notes

Motors with switched windings

(e.g. star delta starters, reversing circuits, multi speed motors)

With these applications please make sure, that the measuring inputs must be linked via the motor windings. An open connection will result in broken wire indication and disable the safety contacts.
When connecting the LH 5946 to a 3-phase motor with star delta starter the star contactor must be energized while the motor is switched off, in order to achieve closed circuits between L1-L2-L3 via the motor windings.

If it is not possible to switch in the star contactor after the motor is switched off, the measuring inputs of the LH 5946 have to be connected like a single phase connection. L2-L3 are bridged and connected to one end of a motor winding and L1 to the other end of the same winding.

For reversing circuits and multi speed motors please follow the same procedure.

If in a 3-phase connection of LH 5946 windings are switched over, and the interruptions of the measuring circuits are longer then 2 s, the standstill monitor detects broken wire. In order not to store this failure, the unit should work with auto reset.

Operation with DC motors

The LH 5946 can be used on DC motors if these generate a remanence voltage during run down.

The connection is made similar as with a single phase motor.

As the remanence voltage in this case is normally a DC voltage the unit will detect a broken wire / offset failure and indicate it on LED „ERR“ and semiconductor output „ERR“. Taking this in mind and operating the unit with auto reset for these failures the unit can be used for safety standstill monitoring.

Operation with electronic motor controller

(inverters, DC-brakes)

The operation of LH 5946 to detect standstill on motors with electronic motor control is possible, if the output voltage of the motor controller drops under the adjusted response value on standstill. (No position control on inverters, no DC voltage on brakes after standstill).

If the inverter produces a DC offset or a DC brake is active, an offset or broken wire failure is indicated on LED „ERR“ and semiconductor output „ERR“. This error resets automatically if on terminals X2-X3 automatic reset is selected.

When there are inverters in the installation it is recommended to use screened measuring wires to the motor. The screen can be connected to the motor.

Attention

If the motor current is run down by inverters or softstop modules in a slow way the motor may be de-magnetised. It is necessary to check if the remaining remanence voltage is sufficient to guarantee a correct and safe standstill monitoring. At high frequencies an increasing damping of the measuring inputs has to be taken into account (see technical data Measuring input „response value dependant on frequency“).

Setup and Setting

Preparation

- Motor on standstill
- Terminals L1-L2-L3 connected to the motor windings
- Provide link on terminals X1-X2
- Provide also link on X2-X3 on DC motors or DC braking
- Adjust U_{an} to minimum
- Adjust t_s to minimum (0.2 s)

Connect correct auxiliary voltage to terminals A1-A2

⇒ After 1 sec the LEDs „UH“ and „OUT“ light up green and the safety contacts are switched on. Also the monitoring relay and the semiconductor output „ON“ must be activated.

If standstill is not detected (LED „OUT“ lights yellow), possibly interference is coupled on the measuring circuit. Adjust U_{an} higher or screen the measuring wires.

Start of motor

⇒ LED „OUT“ changes colour to yellow. The output relays and the semiconductor output „ON“ switch off. On DC motors the LED „ERR“ starts to flash after 2 s with flash code 2 and the output „ERR“ comes on.

Stop of motor – run down DC braking off

The speed at which standstill is detected (yellow LED „OUT“ changes to green/green flashing) can be adjusted on Potentiometer „U_{an}“. When the run down is slow or irregular the time delay must possibly be increased to avoid switching on and off of the output relays. Possibly this effect can also be avoided by slightly increasing Uan. During time delay ts the LED „OUT“ flashes green.

If standstill detection shall only take place at very low speed of the motor, U_{an} is set normally to minimum. By increasing the delay time ts a possible pulsing of the output relays can be avoided. A longer time delay will also guarantee standstill detection only when the motor has already stopped turning. (especially on motors that generate only a small remanence voltage).

On slow decrease of motor speed it is possible that a simultaneity failure occurs (see failure monitoring) when the measuring channels reach the tripping values slowly and not within 2.5 sec. To avoid this failure a single phase connection could be the solution (to make sure that both inputs get the same signal) or the increase of the setting value U_{an}.

If the run down time of the motor is short ts can be set to a minimum (0.2 s). This is suitable in production systems to shorten machine cycles.

! Attention

It is the responsibility of the user to adjust Uan and ts in a way that standstill detection and enabling of the safety contacts in the application is only possible when danger to men and material by the rotating can be excluded.

Technical Data

Input (L1 - L2 - L3)

Measuring-/Motor voltage:	max. AC 690 V
Input resistance:	500 kΩ
Response value U_{an}:	20 mV ... 400 mV, adjustable or 0.2 ... 4 V, adjustable

Response value dependent on frequency

Input frequency (Hz):	50	100	200	400	600	1k	1,5 k	2k
Multiplication factor for U_{an}:	1,0	1,1	1,2	1,5	2,0	2,8	5	8

Hysteresis (for detection of running motor):	100 %
Release delay for detection of running motor:	< 100 ms
Standstill time delay t_s:	0.2 ... 6 s adjustable
Auxiliary voltage U_H (A1 - A2):	AC 115 V, AC 230 V, AC 400 V, DC 24 V
Recommended fusing:	2 A
Voltage range	
AC:	0.8 ... 1.1 U_N
DC:	0.9 ... 1.2 U_N
Nominal consumption:	5 VA, 3 W
Nominal frequency (AC):	50 / 60 Hz
Frequency range (AC):	45 ... 65 Hz
max. residual ripple (DC):	10 %
Start up delay when connecting U_H at standstill:	0,4 ... 0,8 s + adjustable t_s

Output

Contacts (saftey contacts)		
LH 5946.48:	3 NO contacts, 1 NC contact	
Contact type:	relay, positive guide	
Nominal output voltage:	AC 250 V	
Thermal current I_{th}:	5 A (bis 40°C)	
Quadratic total current:	see derating curve	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact	1 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
NC contact	4 A / 24 V at 0.1 Hz	IEC/EN 60 947-5-1
Fusing of the safety contacts:	max. fuse rating 4AgL line circuit breaker C6A	
Max. operating frequency:	1200 / h	
Contact service life		
at AC 230 V / 5 A cosφ = 0.5:	≥ 2 x 10^5 switching cycles	
Mechanical life:	≥ 50 x 10^6 switching cycles	
Semiconductor monitoring output:	100 mA DC 24 V, plus switching, galvanic separation; supply via A3+ / A4 for output; „ON“ and „ERR“	
NO monitoring contact:	3 A AC 250 V (closed when enabled)	

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range		
operation:	- 25 ... + 60°C (+ 40°C with max. contact current, see Derating)	
storage:	- 40 ... + 75°C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impulse voltage / pollution degree:		IEC 60 664-1
Contacts 11/12, 23/24, 33/34, 43/44 against all others:	6 kV / 2	
Contacts 11/12, 23/24, 33/34, 43/44 against each others:	4 kV / 2	
Indicator contact 53/54 against all others:	4 kV / 2	
Semiconductor outputs A3+/ ON / ERR / A4 against all others:	6 kV / 2	
Auxiliary voltage A1 / A2 against all others		
at auxiliary voltage AC:	6 kV / 2	
at auxiliary voltage DC:	4 kV / 2	
Control terminal X1 / X2 / X3:	no galvanic separation to L1 / L2 / L3	
EMC	IEC/EN 62 061	
Interference suppression		
Auxiliary voltage AC:	limit value class B	EN 55 011
Auxiliary voltage DC:	limit value class A*)	EN 55 011

*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Enclosure:	thermoplastic with VO behaviour according to UL subject 94	
Vibration resistance:	amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	25 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		DIN 46 228-1/-2/-3/-4
UL detail:	60°C Copper conductors only	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 400 g	

Dimensions

Width x height x depth:	45 x 90 x 121 mm

UL-Data

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

Auxiliary voltage U_H	
for DC 24 V:	Device must be supplied with a Class 2 or a voltage / current limited power supply (max. 4 A).
Measuring-/Motor voltage:	max. AC 600 V
Ambient temperature:	- 25 ... + 60°C, (+ 40°C with max. contact current, see Derating)
Switching capacity	
safety contacts (11/12, 23/24, 33/34, 43/44)	
Ambient temperature 40°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc G.P.
Ambient temperature 60°C:	Pilot duty B300 2A 250Vac G.P. 2A 24Vdc G.P.
Switching capacity	
indicator contact (53/54)	3A 250Vac G.P.
Wire connection:	60°C / 75°C copper conductors only
Fixed screw terminal:	1 x AWG 20 - 12 Sol/Str Torque 0.8 Nm or 2 x AWG 20 - 14 Sol/Str Torque 0.8 Nm
Plug in screw terminal:	AWG 20 - 14 Sol Torque 0.8 Nm or AWG 20 - 18 Str Torque 0.8 Nm
Plug in cage clamp terminal:	AWG 20 - 12 Sol/Str

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

EAC-Data

Auxiliary voltage U_H: DC 24V

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

Standard Type

LH 5946.48/61 20 ... 400 mV UH DC 24 V 0.2 ... 6 s

Article number:	0059266
• Safety output:	3 NO contacts, 1 NC contact
• Response value U_{an}:	20 ... 400 mV
• Auxiliary voltage U_H:	DC 24 V
• Standstill time t_s:	0.2 ... 6 s

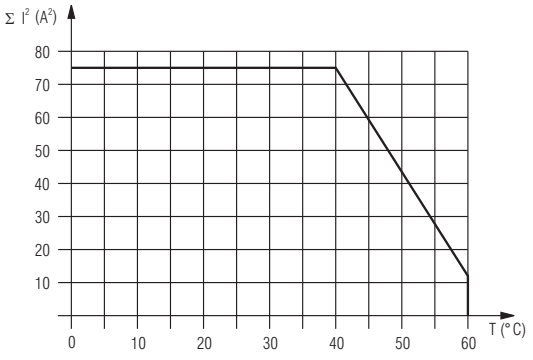
- 1 semiconductor and 1 NO contact for indicator output
- 1 semiconductor for fault indicator output
- Width: 45 mm

Ordering Example

LH 5946.48 _ _ 61 20 ... 400 mV UH DC 24 V 0.2 ... 6 s

- Standstill time t_s
- Auxiliary voltage U_H
- Response value U_{an}
- UL-approval
- Type of terminals
  without indication:
  terminal blocks fixed,
  with screw terminals
  PC (plugin cage clamp)
  pluggable terminal blocks
  with cage clamp terminals
  PS (plugin screw)
  pluggable terminal blocks
  with screw terminals
- Type

Characteristic



Quadratic total current

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

I_1, I_2, I_3 - current in contact paths

max. permitted current up to 40°C on 3 contact paths = 5A

($5^2+5^2+5^2 = 75A^2$)

max. permitted current up to 60°C on 3 contact paths = 2A

($2^2+2^2+2^2 = 12A^2$)

Derating curve for contact currents of safety contacts

Troubleshooting

Failure:
The unit enables the safety outputs while the motor is still turning (LED „OUT“ lights green).
Solution:
Reduce setting of U_{an} if necessary to minimum. If the outputs are still enabled a wiring problem on the measuring wires could be the reason (short circuit on terminals L2/L3 to L1) or the motor generates only a very low remanence voltage. Please check connection of measuring inputs to motor winding according to the connection examples.

Failure:
The output contacts are enabled to early (motor has not finally stopped):
Solution:
Adjust setting value U_{an} to lower level. Additionally the delay time ts could be increased.

Failure:
Output contacts remain disabled while the motor is already on standstill
Solution:
Observe status of indicator LEDs:

1. LED „UH“ lights green?
   If **yes**, go to 2.
   If **no**, U_H has undervoltage or the unit has an internal device failure. (Internal failures can occur in the case of undervoltage, welded safety output contacts or seldom because of interference)
   ⇒ switch supply voltage off and on. If the failure still exists in spite of correct auxiliary supply UH the unit could be defective and has to be sent to manufacturer for test or repair.

2. LED „ERR“ (red) flashes with code 1?
   If **no**, go to 3.
   If **yes**, the unit has detected undervoltage
   ⇒ Apply correct auxiliary voltage

3. LED „OUT“ flashes green?
   If **no**, go to 4.
   If **yes**, standstill is detected, but the time ts till enabling of the outputs is not elapsed.
   ⇒ wait till time ts is finished.
   If after 6 s the outputs are not enabled, the measuring input L1-L2-L3 receives intermittent voltage peaks that are higher then U_{an}.
   This should normally be indicated by intermittent yellow flashes on the LED).
   ⇒ Adjust U_{an} to a higher value, clear interference on measuring wires (use screened cables).

4. LED „OUT“ lights yellow?
   If **yes**, the voltage on the measuring input is higher then the adjusted value U_{an}; go to 5.
   If **no**, LED is off
   Standstill is detected (voltage on measuring input is $<U_{an}$) but the outputs are not enabled because
   a) Feedback circuit X1-X2 is not closed or
   b) a simultaneity failure occurred (see failure monitoring) or
   c) a previous failure (broken wire / offset, feedback circuit) is still stored (terminals x2-x3 are not linked.

   The type of failure is indicated by flash code on the red LED „ERR“:

   a) flash code 4 (feedback circuit not closed)
   b) flash code 5 (simultaneity fault of the measuring signals on L2 L3)
   c) code 2, 3 or 4 depending on priority and failure.

   ⇒ - close feedback circuit
   - Bridge terminals X2-X3 (manual reset)

   If now still the simultaneity failure (flash code 5 on LED „ERR“) is indicated it can be reset by switching the auxiliary supply off and on. The reset also takes place, when both input signals rise above Uan e.g. when starting the motor. If the simultaneity failure remains active after start of the motor (e.g. because of short circuit between L2-L1 or L3-L1) the wiring of the measuring circuit has to be checked according to the connection example.
   If the simultaneity failure occurs often e. g. on slow decease of the motor speed, the problem can be solved by increasing the tripping value U_{an} or/and by making a single phase instead of a 3-phase connection of the measuring circuit to the motor.

Troubleshooting

5. LED „OUT“ lights yellow while the motor is on standstill
   If the yellow LED „OUT“ is on this indicates that the measuring inputs still receive an input signal higher then the adjusted value U_{an}

   Observe in addition the LED „ERR“:

   a) if it stays off after a time of 8 s the problem could be a interference or residual voltage (induced AC voltage) on the measuring inputs
   ⇒ Increase the setting of U_{an}
   If this shows no result, or if an increase is not wished, the interference to the measuring lines must be reduced e.g. by screening, shortening or separating the wires, Test: Disconnect motor and short circuit terminals L1-L2-L3 on the unit, the yellow LED must change to green or green flashing.

   b) if the red LED flashes code 2 the unit has detected broken wire or DC voltage offset between the measuring inputs L1 and L2 (or between L1 and L2 and L1 and L3).

   c) if the red LED flashes code 3 the unit has detected broken wire or DC voltage offset on measuring input L3

   In the 2 last cases the wiring between LH 5946 terminals L1-L2-L3 and the motor terminals has to be checked on interruption. Possibly the interruption comes from disregarding the operating remarks for motors with switchable windings (see remarks).

If failures by interruption of the input circuits can be excluded the failure can result from a DC voltage offset > Uan. This can come from motor controllers like inverters or DC brakes that are not completely switched off and supply a DC-voltage to the measuring circuit (check with Voltmeter). If the DC content is only minor, the failure can be removed by increasing the setting value Uan The yellow LED „OUT“ must change to green or green flashing. If not the motor controllers must be switched off in a way that standstill can be detected correctly.

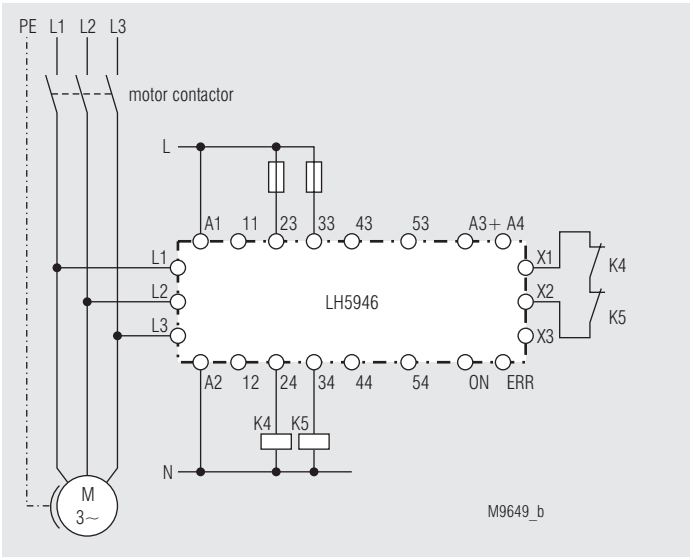
Failure:
While motor is on operation a failure is indicated.
If the LED „UH“ lights red, an internal failure occurred.
Solution:
Switch auxiliary supply off and on again (see 1.)

If the LED „ERR“ indicates a failure the flash code shows the type of fault and how to remove it. Flash code 2 or 3 are normal during operation of DC motors. If the terminals X2-X3 are bridged, The failure is reset automatically at standstill and the output relays are enabled. The same is valid for operation with electronic controllers, if these produce a DC voltage e.g. during braking of a DC-brake.

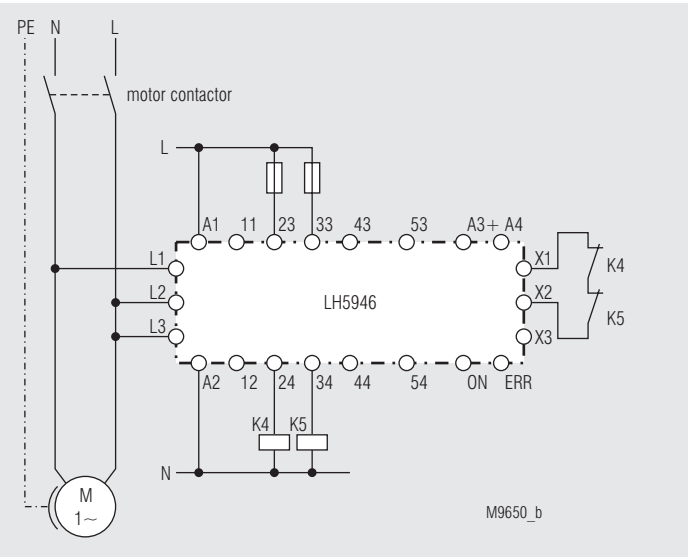
Maintenance and Repairs

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

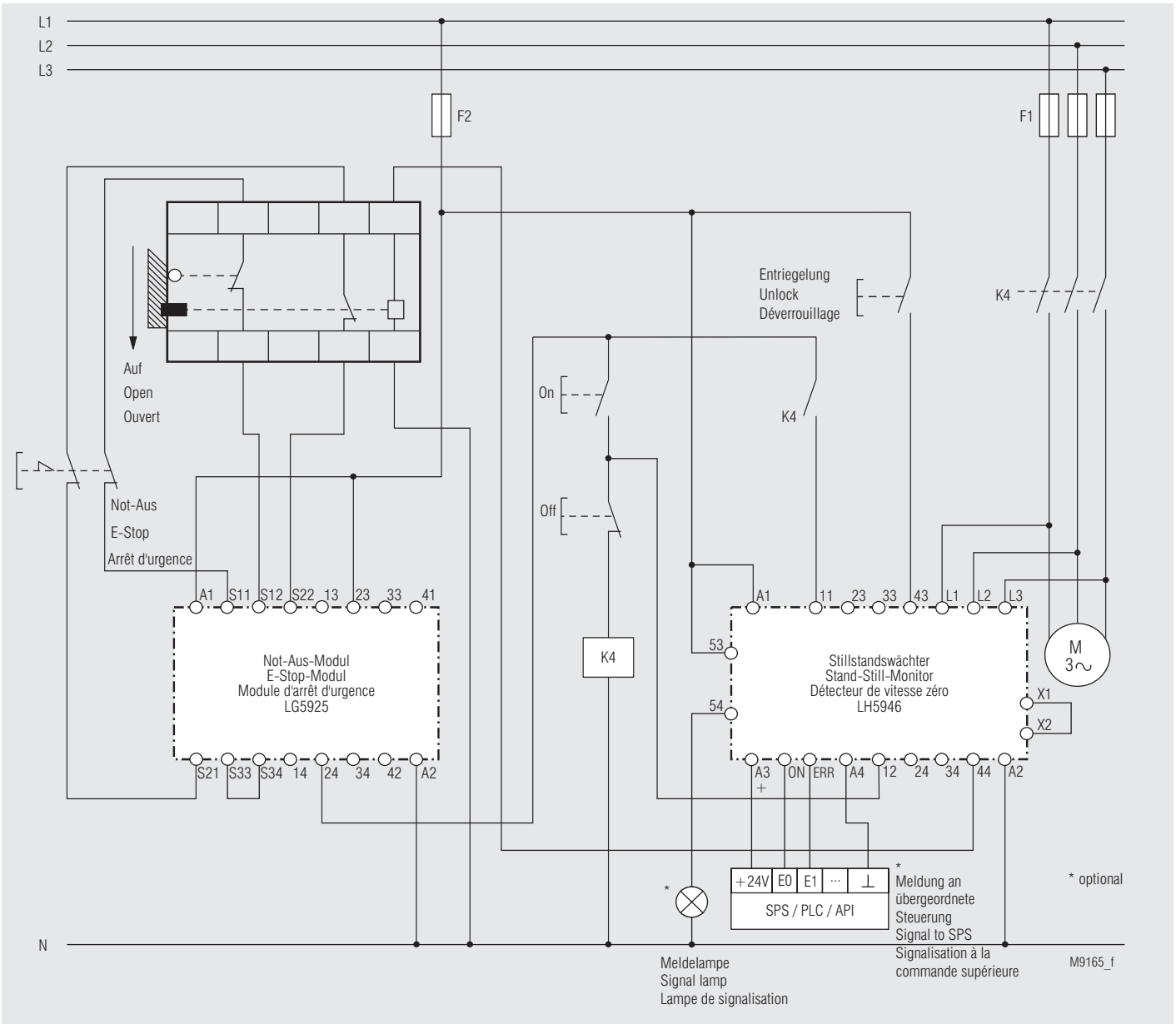
Connection Examples



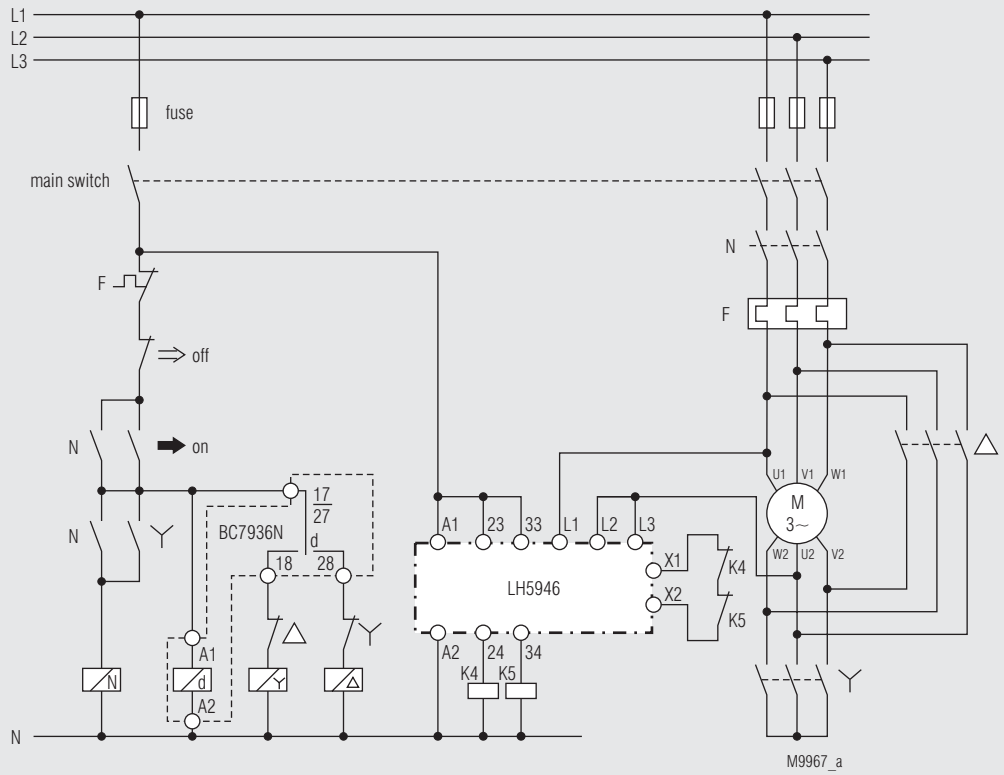
With 3-phase motor; suitable up to SIL3, Performance Level e, Cat. 4



With single-phase motor; suitable up to SIL3, Performance Level e, Cat. 4

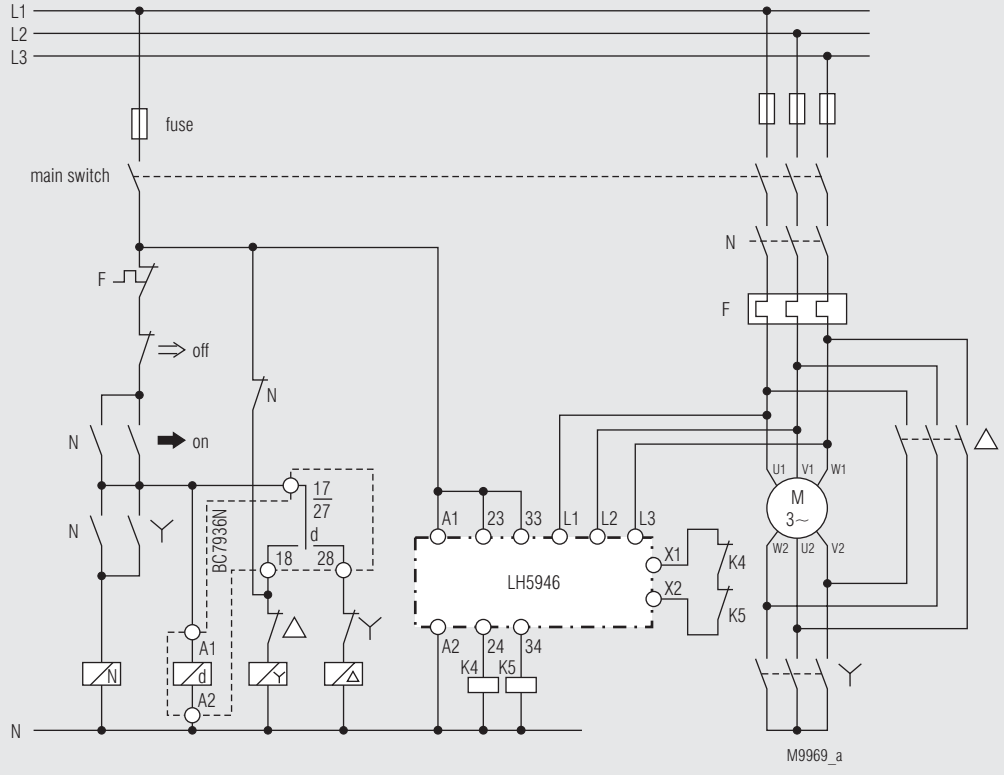


Typical connection combination with E-Stop; suitable up to SIL3, Performance Level e, Cat. 4



d = star delta timer
N = mains contactor
Y = star-contactor
△ = triangle contactor

Typical connection combination with star delta timer, 2-channel connection of the measuring inputs; suitable up to SIL3, Performance Level e, Cat. 4

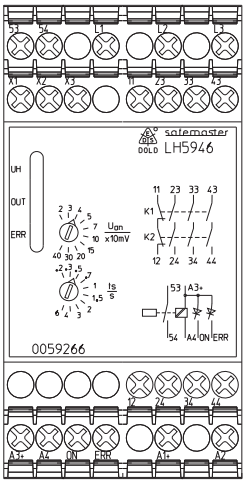


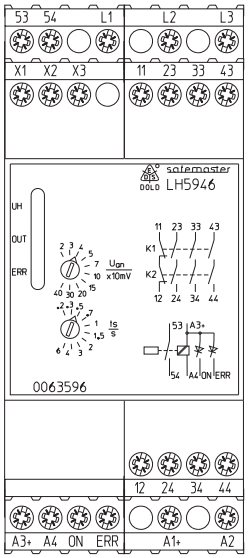
d = star delta timer
N = mains contactor
Y = star-contactor
△ = triangle contactor

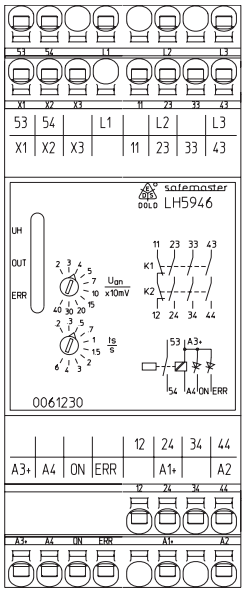
With "3-phase" connection of LH5946 the star contactor (Y) has to be closed after the motor is switched off to detect standstill. If this is not the case the failure signal "broken wire" blocks the output contacts in off posisition.

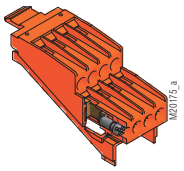
Typical connection combination with star delta timer, 3-channel connection of the measuring inputs; suitable up to SIL3, Performance Level e, Cat. 4

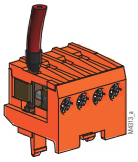
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**



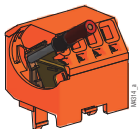




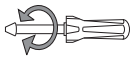
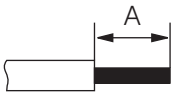
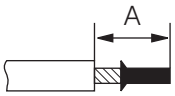
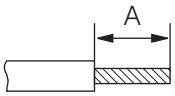




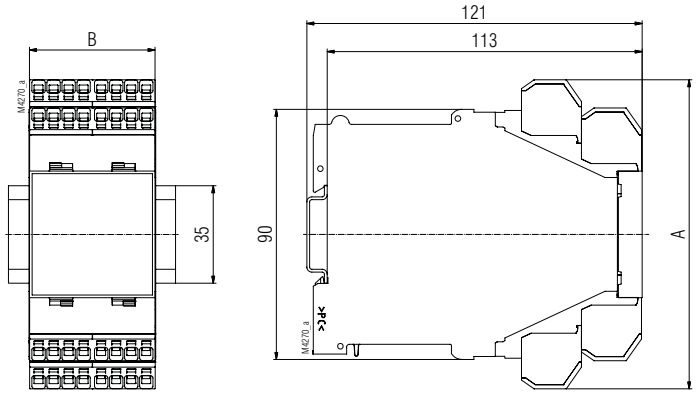
PS



PC

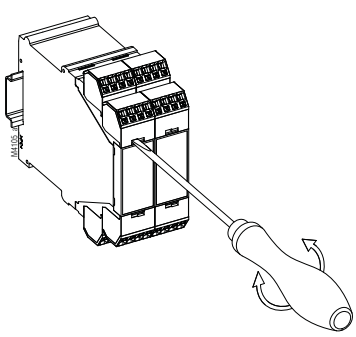
	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	ø 4 mm / PZ 1 0,8 Nm 7 LB. IN	DIN 5264-A; 0,5 x 3	
 M10248	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12
 M10249	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1 mm² 2 x AWG 20 to 18	A = 10 ... 12 mm 1 x 0,5 ... 1,5 mm² 1 x AWG 20 to 16	A = 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14
 M10250	A = 8 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12 2 x 0,5 ... 2,5 mm² 2 x AWG 20 to 14	A = 8 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14 2 x 0,5 ... 1,5 mm² 2 x AWG 20 to 16	A = 10 ... 12 mm 1 x 0,5 ... 2,5 mm² 1 x AWG 20 to 14	A = 12 mm 1 x 0,5 ... 4 mm² 1 x AWG 20 to 12

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
LH 5946	90	45
LH 5946 PS	104	45
LH 5946 PC	111	45

DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	93	a (years)
DC_{avg}:	99,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	28,8E+03	s/cycle
	≙ 1	/8 h (hours)

IEC/EN 62061 IEC/EN 61508 IEC/EN 61511 EN 61800-5-2:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508 / IEC/EN 61511 / EN 61800-5-2
HFT*):	1	
DC:	99,0	%
PFH_D:	4,10E-10	h^{-1}
T_1:	20	a (years)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508, EN 61800-5-2	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

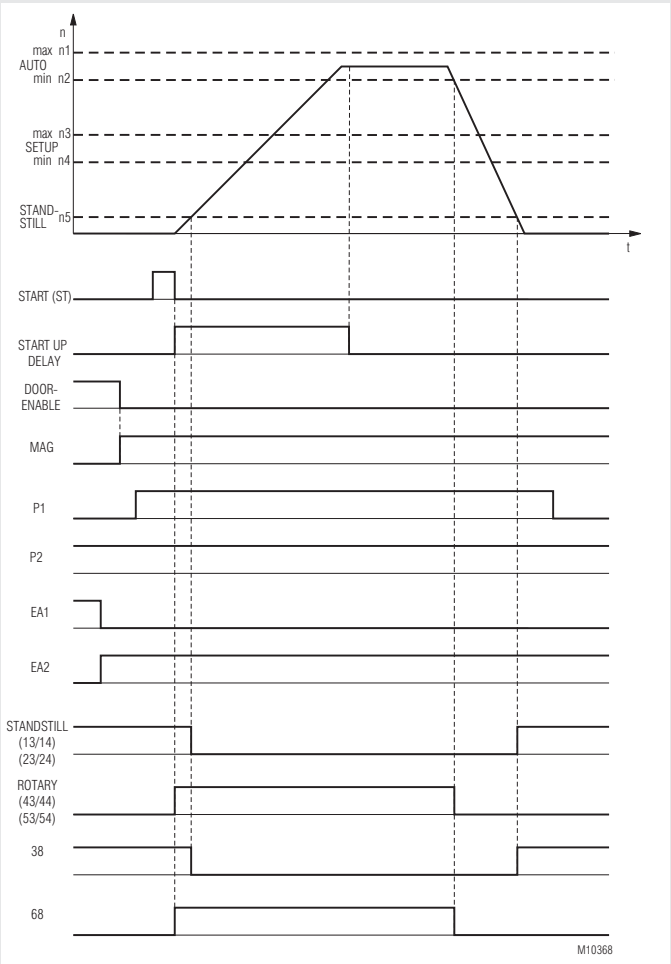
SAFEMASTER S
Speed Monitor
UH 5947

0263384

Product Description

The speed monitor UH 5947 provides safe monitoring of motors and rotating equipment. It is used in machines and plants where machine movements or moving parts can be a danger to men and machine. Using the front side display the parameters can be easily and comfortably adapted to the individual application or changed when necessary.

Function Diagram



Your Advantages

- Three in one
  - safe speed monitoring in automatic and set up operation
  - safe standstill monitoring
  - safe integrated gate monitoring
- For safety applications up to PL e / Cat 4 and SIL 3
- Space and costsaving, no external safe gate monitoring required
- Simple and time saving setup without PC
- Comfortable, menu guided configuration via frontside display
- Reducing interruption time in production by extensive diagnostic functions
- Easy to integrate in existing drive applications
- Suitable for all common motor feedback systems and proximity sensors
- Copy parameter settings in other units by pressing only a push button
- Higer safety by 2-channel mode selector, external connection
- With adjustable ratio between 2 sensors e.g. to detect a broken shaft
- Possible languages: english, german, french, italian, spanish

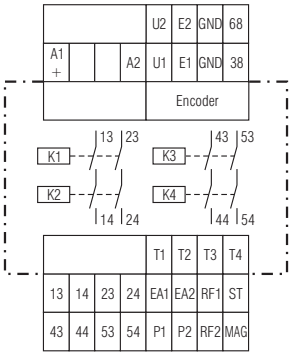
Features

- **According to**
  - **Performance Level (PL) e und 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**
- According to EN 60204
- Device setting on menu-driven display or via RJ45 (FCC Western-Modular 8P8C) with connection cable (copy function)
- Change tracking
- Adjustable operation mode
  - Automatic mode: Monitoring of automatic rotational speed window and standstill speed.
  - Setup mode: Monitoring of setup rotational speed window. Standstill is permanently enabled.
- Single or 2-channel safety gate monitoring
- Integrated user friendly display for parameters and operation status
  - for set point and actual value of U/min or m/min
  - set point display also as frequency value
  - with numerous diagnostic features
- Adjustable start up delay (0 ... 999 s)
- Adjustable time delay for standstill detection (13/14, 23/24) (0 ... 999 s)
- Adjustable monitoring time for feedback circuit RF1 (0,5 ... 999 s)
- Monitoring of an release magnet
- Monitoring of feedback circuits
- Activation of the output path 43/44, 53/54 with on/off pushbutton with short circuit detection or automatic making function
- Adjustable PNP- or NPN-sensors
- Connection of different encodern possible (sin/cos, TTL, HTL)
- 2-channel function
- Forcibly guided contacts
- LED-indicators and 2 semiconductor monitoring output
- With pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 45 mm

Approvals and Markings

CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | c UL us LISTED Canada / USA | CCC A025518 | EAC

Circuit Diagram



M10325_a UH 5947.04

Connection Terminals

Terminal designation	Signal description
A1 (+)	+ / L
A2	- / N
U1, U2	+ supply for proximity sensors or NAMUR-sensors
GND	- supply for proximity sensors
E1, E2	Input for pulse signal from proximity sensors or NAMUR-sensors
13, 14, 23, 24, 43, 44, 53, 54	Forcibly guided NO contacts for release circuit
38, 68	Semiconductor-monitoring output
T1, T2, T3, T4	Control output
ST, MAG, RF1, RF2, P1, P2, EA1, EA2	Control input

Application

This device is designed for machinery and installations where hazards to people and property may be caused by the movement of machines or parts. The device permanently monitors for standstill (output circuit 13/14, 23/24) and rotational speed (output circuit 43/44, 53/54). For the rotational speed monitoring, it is possible to choose between automatic and setup mode. If properly connected, the UH5947 can be used to implement the safety functions STO (safe torque off), SOS (safe operation stop), SLS (safely limited speed), SSM (safe speed monitoring), SSR (safe speed range), as well as SDL (safe door locking) as per standard EN 61800-5-2.

Functions

The device can be configured from the display and keys on the front plate or via RJ45 using a suited connection cable (see accessories) by means of the copy function.
Following measuring sensors can be used to sense the rotational speed:

- Two NPN or PNP proximity sensors (special version with NAMUR sensors) connected to the inputs E1 and E2. The proximity sensors (NAMUR sensors) are supplied with 24VDC from the speed relay to the terminal U1 and U2 (special version NAMUR 8.2V DC).
- Encoders (sin/cos, TTL, HTL) connected to the RJ45 interface via cable adapter (optionally available). The powersupply for the encoder is not provided by the speed monitor. Feedback influences should not occur.
- Combination from encoder and one proximity or NAMUR sensor for special version.

Indicator

DEVICE:	green	→ Run
	green-flashing	→ Parameterization mode
	red-flashing	→ Parameterization error
	red	→ Device fault
K1/K2:	green	→ Output contact 13/14, 23/24 closed
	green-flashing	→ Stop monitoring feedback loop 2 failed
K3/K4:	green	→ Output contact 43/44, 53/54 closed
	green-flashing	→ Stop monitoring feedback loop 1 failed
SF:	OFF	→ no failure
	red	→ (external) failure
DISPLAY:		→ Status indication
		→ Alarms / diagnostics
		→ Parameterization

Device and Function Description

Overview on terminals and their function

Supply voltage A1, A2

Terminal for power supply to the device (see technical data).

Measuring inputs U1, U2, GND, E1, E2, and RJ45

The terminals E1 and E2 are provided for NPN or PNP proximity sensors (special version with NAMUR sensors). The switches are supplied with 24VDC (special version NAMUR U1, U2 = 8.2VDC) via the terminals U1, U2 and GND. The type of sensor (NPN or PNP) is to be selected in the menu.
The RJ45 interface is suited for the connection of encoders with sin/cos, TTL and HTL signals.

Output circuits (contacts) 13/14, 23/24, 43/44, 53/54

The device has two output circuits that are equipped with each two safety relays (standstill K1, K2; speed range (window) K3, K4) with forcibly guided contacts connected in series.

- Automatic mode: Monitoring of automatic rotational speed window and standstill speed.
- Setup mode: Monitoring of setup rotational speed window. Standstill is permanently enabled.

Signalling outputs 38 und 68

The non safety semiconductor signalling outputs 38 and 68 are designed for connection to a PLC, for example. They work as follows:
The terminal 38 outputs the internal supply potential (U_{Rel} approx. 24 V) when the rotational speed drops under the set standstill speed ($n < n_{Still}$), i.e. a standstill is detected.
The terminal 68 outputs the internal supply potential (U_{Rel} approx. 24 V) when the rotational speed is within the set speed limits of the setup or automatic mode ($n_{min} < n < n_{max}$).
If the release monitoring time is exceeded for RF1, a flash code signal is shown on monitoring output 68 with an ON/OFF ratio of 50/50.
Variant /101: The semiconductor outputs are not switching synchronous to the relay outputs. The semiconductor outputs give out the incoming signal

of E1 with a ratio 1:2 if sensor selection is E1+E2. If E1+E2 is not chosen in sensor selection, the semiconductor outputs have no function.
Variant /200: the transistor outputs are not connected to the relay status. They are continuously on when the unit is on operation and are switched off as soon as a failure is detected.

Test signals T1, T2, T3, T4

To detect errors in the input circuitry or while the safety-related inputs ST, RF1, RF2, EA1, EA2, P1, P2, and MAG are processed, a dynamic output signal is routed via the switching elements and via the start and feedback circuits. To this end, the output signals on the individual outputs T1, T2, T3 and T4 are different allowing to detect cross faults between the output signals.

Signal input ST (start circuit)

The start signal is applied to this input. ST is supplied from the test signal T4. To start the movement connected to 23/24 and the monitoring the ON/OFF pushbutton has to be pressed for manual starting. This pushbutton is monitored for cross fault and short circuit by requiring a falling edge for starting. Therefore, it may not be pressed for more than 3 sec. When a cross fault or short circuit is detected the device changes to the safe condition and a diagnostic alarm is displayed. Once the fault is eliminated, a reset (see fault handling) or a restart by switching off and back on the supply voltage is required. For automatic starting, the test signal T4 must be present on ST via a jumper to start the device.

Signal input MAG (interlocking of the safety gate)

MAG is supplied from the test signal T4. To start the dangerous movement (output 43/44, 53/54) the safety gate must be locked. The locking magnet has a contact that is read from the device via the MAG terminal. When this contact is not closed the device cannot be started or immediately changes to a safe condition (output contact 43/44, 53/54 drops out). However, when the contact is closed again the device can be started again. It is not needed to acknowledge the alarm.
At automatic mode the contact is permanently monitored. When it is not used the terminals T4 and MAG must be bridged.
In setup mode the signal input MAG is not monitored.

Signal input RF1 (feedback circuit for setup or automatic mode)

RF1 is supplied from the test signal T3. The terminal RF1 is used to read the NC contacts of the external contactors that are connected to the terminal 44, 54. Switching through of the output contact 43/44, 53/54 is only possible when the feedback contacts are closed. When the output contacts 43/44, 53/54 are switched off, the feedback contacts must be closed within the monitoring time tf. If not a failure message is displayed (see section time functions).
If no contact extension or reinforcement is used, the terminals T3 and RF1 must be bridged.

Signal input RF2 (feedback circuit for standstill)

RF2 is supplied from the test signal T3. The terminal RF2 is used to read the NC contacts of the external contactors that are connected to the terminal 14, 24. Switching through of the output contact 13/14, 23/24 is only possible when the feedback contacts are closed. When the output contact 13/14, 23/24 is opened the feedback contacts need to be closed again after 1 second, otherwise a diagnostic alarm appears. Once the fault is eliminated, a reset (see fault handling) or a restart by switching off and back on the supply voltage is required.
If no contact extension or reinforcement is used, the terminals T3 and RF2 must be bridged.

Signal inputs P1 and P2 (position switches for safety gate)

P1 is supplied from the test signal T1 and P2 from the test signal T2. These terminals are used to connect the position switches for the safety gate with tumbler mechanism. To achieve the highest possible categories (Performance Level e as per DIN EN ISO 13849-1 and SIL3 as per IEC EN 61508) the position switches are connected via two channels. The position switches are monitored for silmultaneity. When the position switches are opened the contacts P1 and P2 must be opened within t < 1.0 sec. A diagnostic alarm appears on the display when the simultaneity is not met. Once the fault is eliminated, a reset (see fault handling) or a restart by switching off and back on the supply voltage is required. To start the output contact 43/44, 53/54 both position switches must be closed at automatic mode.

Device and Function Description

When the connection is only single-channel or two separate single-channel position switches are connected for a lower category the detection of simultaneity has to be disabled in the menu. When using a single-channel position switch the terminals T2 and P2 have to be bridged.
If none of the position switches are used, the terminals T1 and P1 and the terminals T2 and P2 have to be bridged.
In setup mode the signal inputs P1 and P2 are not monitored.

Signal inputs EA1 and EA2 (operating mode selection)

This speed monitor is suited for monitoring 2 different operating modes (setup and automatic mode). The speed limits for each operating mode are set in the menu using the keys. A safety-related two-channel antivalent switch connected to the terminals EA1 and EA2 is used to select the operating mode and thus the speed to be monitored.
Monitoring of the setup speed is selected when EA1 is connected to T1 via the antivalent selector switch and EA2 is disconnected from T2 by the antivalent switch. To monitor the automatic speed EA1 must be disconnected from T1 by the antivalent switch and EA2 must be connected to T2 via the antivalent selector switch. Both channels of the switch are monitored for simultaneity (t_{diff} < 1.0 s). When the simultaneity is not fulfilled or a cross fault between EA1 and EA2 is present the device changes to a safe failure condition. Once the fault is eliminated, a reset (see fault handling) or a restart by switching off and back on the supply voltage is required. If no selection switch is connected to EA1 and EA2, wire links have have to be installed according to the required function. (set up mode bridge EA1 to T1; automatic mode bridge EA2 to T2).

Times

Start-up delay time t_a

The start-up delay time is used to override the monitoring during the motor's start-up time until it has reached a certain rotational speed, for example. When the parameterized min. setup or automatic speed is not reached within the parameterized start-up delay time t_a the device immediately switches to a safe condition. The contacts 43/44, 53/54 are opened and the signalling output 68 is de-energized.
The start-up delay time is counted down whenever the device is restarted, a change from setup to automatic mode occurs in automatic start mode, or the ON/OFF pushbutton is pressed in manual start mode. However, the precondition before starting the start-up delay time is always that all safety requirements (position switch, magnet switch, feedback circuit) except of the speed are fulfilled. During this start-up delay time, the output contact 43/44, 53/54 is permanently switched through provided the safety requirements such as position and magnet switches remain fulfilled.

Release delay time t_v

The release delay time is the time that is counted down until the output contacts 13/14, 23/24 and the signalling contact 15 are switched through after a detected standstill.

Release monitoring time t_f

The release monitoring time is used to check the contactors connected to the output contacts 43/44, 53/54. When the feedback to RF1 is not present within the parameterized release monitoring time t_f after release of the output 43/44, 53/54 a 50/50 flashing code is immediately issued from the signalling output 68. Additionally, an alarm is displayed.
Once the fault is eliminated, a reset (see fault handling) or a restart by switching off and back on the supply voltage is required.

Response time up to the cut-out process after expiration of the set start-up delay time

The max. response time up to the detection of an underfrequency condition depends on the threshold to be checked. The max. response time up to the detection of an overfrequency condition depends on the present measuring signal. The lower the set threshold the more time needs the device to detect the failure. To achieve a quicker response time encoders or gearwheels may be used which deliver more pulses per revolution (e.g. encoders with line number 32). This reduces the time $1/f_{Threshold}$ by the factor that equals to the encoder's number of lines or number of teeth.

General rule: $$t_{response\_max} = \frac{1}{f} + t_{Reaktion}$$

Example: Underspeed to be monitored in setup mode 120 rpm = 2 Hz

With prox. sens.: (1 pulse/rev.) $$t_{response\_max} = \frac{1}{2\ Hz} + 150\ ms = 650\ ms$$

With encoder with number of lines = 32: $$t_{response\_max} = \frac{1}{2\ Hz \times 32} + 150\ ms = 166\ ms$$

f = set frequency threshold or frequency of the present measuring signal (e.g. underfrequency in setup mode)

$t_{response}$ = internal response time after detection of cut-out frequency (max. 150 ms)

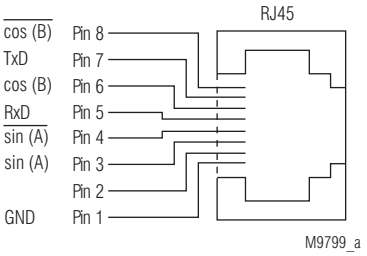
Display

In normal operating mode, all settings can be checked at any time by pressing the UP or DOWN keys.
Additionally, the current speed from proximity sensor 1 or from the encoder is displayed. However, this speed does not correspond to the device's accuracy and is only designed for diagnostic purposes.
In the case of wiring errors and system failures corresponding diagnostic messages are displayed on the display unless they are deliberately disabled in the parameterization.

Parameterization

Parameterization and pin assignment of the RJ45 interface

When the UH 5947 is appropriately configured, the RJ45 interface is used to connect an encoder to the device. All 4 signal paths (A, $\overline{A}$, B, $\overline{B}$) and GND must be connected with the Encoder.
Moreover, this interface can be used to parameterize another device using an appropriate transfer cable OA 5947/100 (see accessories) and the copy function. This is useful when the speed monitor is to be used in a serial application or has to be replaced in case of failure.



Parameterization using the display

See attached form page 57

Change tracking

To detect non permitted changes of the settings, the menue item change tracking is available. This setting allows to activate a counter once, which is then incremented with each confirmed change of the settings. After activation of this function the user cannot reset the counter or disable this function again.

The parameterization menü has follow structure: Illustration shows the factory setting [2)]

1.	Parameterization			
	1.1	Monitored motion [1)]		
			Translational	x
			Rotational	-
		Esc		OK
	1.2	Encoder type [1)]		
			Lin. encoder	-
			Rot. encoder	x
		Esc		OK
	1.3	Encoder selection		
			RJ45:Encoder + E2	x
			RJ45:Encoder	-
			E1 + E2	-
		Esc		OK
	1.4	Lead / transm.		
			Transmission	
			1 : 1	
			Lead	
			10,000	mm
		Esc		OK
	1.5	Encoder settings		
			Signal form	
			sin/cos or TTL	x
			HTL	
			Resolution	
			xxxxxx bzw. xxx,xxx	Imp/U e.g. mm
		Esc		OK
	1.6	Sensor settings		
			Sensor type	
			pnp	x
			npn	-
			Resolution E1	
			10	Imp/U e.g. mm
			Resolution E2	
			10	Imp/U e.g. mm
		Esc		OK
	1.7	Speed limits		
			n1: Automatic max	
			100	m/min
			n2: Automatic min	
			80	m/min
			n3: Set-up max	
			60	m/min
			n4: Set-up min	
			40	m/min
			n5: Standstill	
			10	m/min
		Esc		OK
	1.8	Times		
			Start override	
			5,0	s
			Release delay	
			5,0	s
			Switch-off monit.	
			5,0	s
		Esc		OK
	1.9	Start type		
			Manual start	x
			Automatic start	-
		Esc		OK
	1.10	Prot. door monit.		
			Simultaneity on	x
			Simultaneity off	-
		Esc		OK
	Esc			OK

2.	Display settings			
	2.1	Languages		
			english	x
			deutsch	-
			français	-
			español	-
			italiano	-
		Esc		OK
	2.2	Contrast		
			50	%
		Esc		OK
	2.3	Lighting		
			Off	-
			3 s	-
			10 s	x
			1 min	-
			5 min	-
			On	-
		Esc		OK
	2.4	Diagnosis		
			Do not display	-
			Display	x
		Esc		OK
	2.5	Error message		
			Do not display	-
			Display	x
		Esc		OK
	2.6	Status indicator		
			Manual	x
			3 s	-
			10 s	-
			1 min	-
			5 min	-
		Esc		OK
	Esc			OK
3.	Copy settings			
		Parameters		
		Display settings		
		Param. + disp. sett.		
	Esc			OK
4.	Factory settings			
		Parameters		
		Display settings		
		Param. + disp. sett.		
	Esc			OK
5.	Change tracking			
		activate		
	Esc			OK
6.	About UH 5947			
	Esc			
Esc				OK

[1)] When changing this setting the values of 1.4, 1.5 and 1.7 will be reset to default values

[2)] Customers specific variants have other factory settings. They are available on request.

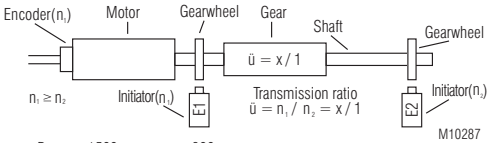
Notes for Configuration

Installing the measuring sensors

Cross faults between measuring sensors must be excluded by an appropriate cable installation.

Gear ratio or shaft break monitoring

For certain applications, it may be necessary to set a gear ratio. To this end, the following arrangement of proximity sensors or encoder is required:
It has to be taken into account that the rotational speed to be monitored on encoder or proximity sensor 1 (E1) must always larger than or equal to the rotational speed to be monitored on proximity sensor 2 (E2). The set speed limits on the display for a set gear ratio always refer to the encoder or proximity sensor 1 (E1).
In the case that the gear arranged between E1 and E2 has no integer gear ratio, a corresponding adjustment is possible by a modification of the resolution settings for E1/E2 (pulses/rev. or mm).



z.B.: $n_1 = 1500$ rpm ; $_2n = 300$ rpm

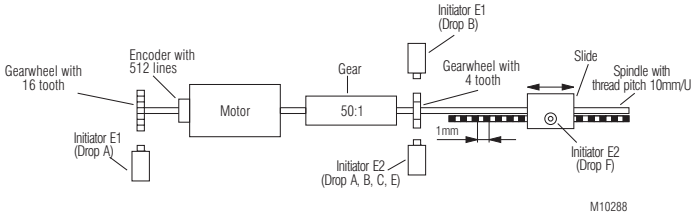
$$ü = \frac{n_1}{n_2} = \frac{1500 \text{ rpm}}{300 \text{ rpm}} = 5$$

➨ Input on the display ü = 5:1

This arrangement is also used to detect a shaft break. Taking the gear ratio into account, when the measured signals between sensor on the motor and sensor on the shaft do not correspond, the device immediately switches to a safe failure condition.

Configuration Examples

Monitored movement: rotational; sensor type: rotationally



Settings on the display based on the above example:

Case A:
Sensor selection: E1+E2
Proximity sensor resolution E1: 16 pulses/rev.
Proximity sensor resolution E2: 4 pulses/rev.
Gear ratio: 50:1
The speed limits (rpm) to be set refer to the rotational speed on proximity sensor E1.

Case B:
Sensor selection: E1+E2
Proximity sensor resolution E1: 4 pulses/rev.
Proximity sensor resolution E2: 4 pulses/rev.
Gear ratio: 1:1 (as measuring is on the same location)
The speed limits (rpm) to be set refer to the rotational speed on proximity sensor E1.

Case C:
Sensor selection: Encoder+E2
Encoder resolution: 512 pulses/rev.
Proximity sensor resolution E2: 4 pulses/rev.
Gear ratio: 50:1
The speed limits (rpm) to be set refer to the rotational speed on the encoder.

Case D:
Sensor selection: Encoder
Encoder resolution: 512 pulses/rev.
Gear ratio: Not relevant as only one sensor is selected.
The speed limits (rpm) to be set refer to the rotational speed on the encoder.

Case E: Monitoring of the cradle for 3m/min, for example
Sensor selection: Encoder+E2
Encoder resolution: 512 pulses/rev.
Proximity sensor resolution E2: 4 pulses/rev.
Gear ratio: 50:1
The rotational speed limits (rpm) to be set refer to the rotational speed on the encoder. Therefore, to monitor the cradle as shown, at first the translational movement has to be converted in a corresponding rotational movement. This is done as follows:

$$\text{Rotational monitoring limit} = \frac{\text{Translational monitoring limit x gear ratio}}{\text{Pitch}}$$

$$= \frac{3 \text{ m/min x } 50}{10 \text{ mm/U}} = 15000 \text{ U/min}$$

Case F: Monitoring of the cradle for 3m/min, for example
Sensor selection: Encoder+E2
Encoder resolution: 512 pulses/rev.
Proximity sensor resolution E2: 10 pulses/rev. (1 mm/pulse)
Gear ratio: 50:1
The rotational speed limits (rpm) to be set refer to the rotational speed on the encoder. Therefore, to monitor the cradle as shown, at first the translational movement has to be converted in a corresponding rotational movement. The resolution of the proximity sensor E2 has to be calculated too. This is done as follows:

$$\text{Rotational prox. sens resolution E2} = \frac{\text{Pitch}}{\text{Translational proximity sensor resolution E2}}$$

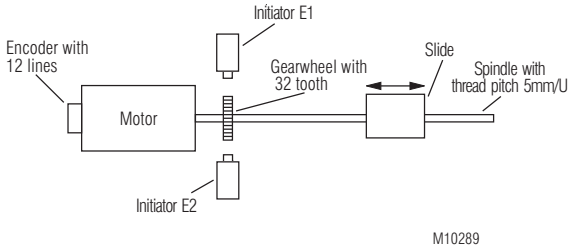
$$= \frac{10 \text{ mm/U}}{1 \text{ mm/Imp.}} = 10 \text{ Imp./U}$$

$$\text{Rotational monitoring limit} = \frac{\text{Translational monitoring limit x gear ratio}}{\text{Pitch}}$$

$$= \frac{3 \text{ m/min x } 50}{10 \text{ mm/U}} = 15000 \text{ U/min}$$

Configuration Examples

Monitored movement: translational; sensor type: rotationally



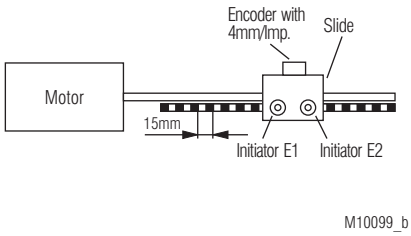
Settings on the display based on the above example:

Case A:
Sensor selection: E1+E2
Proximity sensor resolution E1: 32 pulses/rev.
Proximity sensor resolution E2: 32 pulses/rev.
Pitch: 5 mm/rev.
The speed limits (m/min) to be set refer to the rotational speed on proximity sensor E1.

Case B:
Sensor selection: Encoder+E2
Encoder resolution: 12 pulses/rev.
Proximity sensor resolution E2: 32 pulses/rev.
Pitch: 5 mm/rev.
The speed limits (m/min) to be set refer to the rotational speed on the encoder.

Case C:
Sensor selection: Encoder
Encoder resolution: 12 pulses/rev.
Pitch: 5 mm/rev.
The speed limits (m/min) to be set refer to the rotational speed on the encoder.

Monitored movement: translational; sensor type: linear



Settings on the display based on the above example:

Case A:
Sensor selection: E1+E2
Proximity sensor resolution E1: 15 mm/pulse
Proximity sensor resolution E2: 15 mm/pulse
The speed limits (m/min) to be set refer to the frequency on proximity sensor E1.

Case B:
Sensor selection: Encoder+E2
Encoder resolution: 4 mm/pulse
Proximity sensor resolution E2: 15 mm/pulse
The speed limits (m/min) to be set refer to the frequency on the encoder.

Case C:
Sensor selection: Encoder
Encoder resolution: 4 mm/pulse
The speed limits (m/min) to be set refer to the frequency on the encoder.

Technical Data

Input

Nominal voltage U_N:	AC/DC 110 ... 240 V, DC 24 V
Voltage tolerance	
AC/DC:	0.8 ... 1.2 U_N
DC:	0.9 ... 1.1 U_N
Nominal frequency (AC):	50 / 60 Hz
Frequency range (AC):	45 ... 65 Hz
max. residual ripple (DC):	48 %
Nominal consumption	
AC/DC:	< 6.5 W
DC:	< 5 W
Min. Off-time:	150 ms
Measuring accuracy:	± 2 %
Hysteresis:	6.25 %

Initiators

Input current:	DC 24 V (provided by the device)
Output:	as option PNP or NPN
Voltage on E1 and E2:	min. DC 10 V
Min. pulse duration e. g. on and off time:	75 µs
Setting range:	1 Hz ... 2 kHz

Encoder

Version:	with 2 signal paths (A, B) and their inverted signals ($\overline{A}$, $\overline{B}$))
Output:	as option TTL, HTL or sin/cos (U_A = 1 V_{PP}) When RJ45: Encoder is selected in setup routine under item 1.3 (sensor selection) a defined failure behaviour is necessary (high resistive outputs) in the case of missing powersupply or internal encoder failure. A forced dynamisation (t < 24 h) is necessary during longer standstill periods.
Setting range:	1 Hz ... 400 kHz

Special Version NAMUR

Supply voltage:	DC 8,2 V (provided by the device)
Input current:	max. 10 mA
Response value	
Low:	typ. 1,6 mA
High:	typ. 1,8 mA
Broken wire:	≤ 0,15 mA
Short circuit:	> 6,0 mA
Min. pulse duration e. g. on and off time:	75 µs
Setting range:	1 Hz ... 2 kHz

Output

Contacts	2 safe relay groups with each 2 NO contacts in series	
Contact:	Relay positive guide	
Thermal current I_{th}:	max. 5 A (see quadratic total current limit curve)	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	4 A / 24 V at 0.1 Hz	
Electrical life		
at 5 A, AC 230 V cos φ = 1:	≥ 1 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC EN 60 947-5-1
Mechanical life:	≥ 50 x 10^6 switching cycles	
Semiconductor monitoring output:	2 piece; 20 mA DC 24 V, plus switching	

Technical Data

Gerneral Data

Nominal operating mode:	continuous operation	
Temperature range		
Operation:	0 ... + 60 °C	
Storage:	- 20 ... + 70 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 62 061	
interference suppression:	Limit value classe B	EN 55 011
Degree of protection:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz,IEC/EN 60 068-2-6	
Climate resistance:	0 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Wire fixing:	captive slotted screw or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 420 g	

Dimensions

Width x height x depth:	45 x 107 x 121 mm

UL-Data

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

Nominal voltage U_N:	
DC 24 V:	Device must be supplied with a Class 2 or a voltage / current limited power supply (max. 4 A).
AC/DC 110 ... 240 V, 50 / 60 Hz:	single or double phase
Ambient temperature:	0 … +60°C
Switching capacity	
Semiconductor outputs:	24Vdc, 20mA, pilot duty
Switching capacity	
Release circuit	
U_N = DC 24 V:	Pilot duty B300 5A 250Vac resistive only 5A 24Vdc resistive only
U_N = AC/DC 110 ... 240 V:	
Ambient temperature 60°C:	Pilot duty B300 2A 250Vac resistive only
Ambient temperature 40°C:	Pilot duty B300 5A 250Vac resistive only
Wire connection:	60°C / 75°C copper conductors only
Plugin screw terminal:	AWG 28 - 12 Sol/Str Torque 0.5 Nm
Plugin cage clamp terminal:	AWG 24 - 12 Sol/Str
Plugin twin cage clamp terminal:	AWG 24 - 16 Sol/Str

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

EAC-Data

Nominal voltage U_N: DC 24V

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

Standard Type

UH 5947.04PS/61	DC 24 V
Article number:	0063476
• Safety output:	2 NO contacts for standstill monitoring 2 NO contacts for monitoring of speed range (window)
• Nominal voltage U_N:	DC 24 V
• Width:	45 mm

Variants

UH 5947.04 _ _ / _ _ _0_ / 61 DC 24 V

- DC 24 V: Nominal voltage
  - AC/DC 110 ... 240 V
- 61: UL approval
- _0_: Sensor types
  - 0 = for PNP- NPN sensors
  - 1 = for NAMUR sensor
- _ _ _: Function
  - 0 = Standard
  - 1 = At sensor selection „E1+E2" The semiconductor outputs give out the incoming signal of E1 with a ratio 1:2. Other sensor selection: The semiconductor outputs have no function
  - 2 = The transistor outputs 38 and 68 are continuously on when the unit is on operation and are switched off as soon as a failure is detected
- _ _ /: Customers specific factory setting, on request
- _ _ /: 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
- UH 5947.04: Type

Accessories

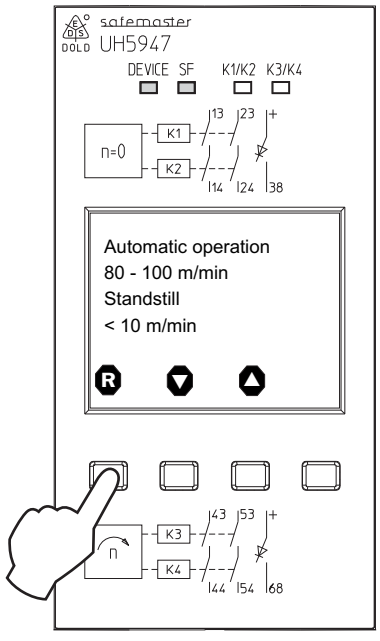
OA5947/100:	Connection cable for copy function and adaptor
KY5947 H1/S1:	15 pole adaptor to connect an encoder or for controllers of Siemens /Heidenhain with corresponding PIN arrangement (see remarks for accessories in operating manual)
KY5947 H2/S4:	25 pole adaptor to connect an encoder or for controllers of Siemens /Heidenhain with corresponding PIN arrangement (see remarks for accessories in operating manual)

Troubleshooting

Failure	Potential cause
LED "SF" ON	- external failure (detailed description on display)
LED "Device" ON red	- Device failure (if the failure still exists after restart, replace device)
LED "Device" flashes red	- Parameter failure (min. one adjusted frequency to be monitored is out of range)

Fault Handling

When faults are detected on or in the device they are indicated on the display by an appropriate message. If a reset of the device is necessary due to the fault, at first the alarm and the associated diagnostic message have to be acknowledged. Then, the left key has to be pressed for approx. 3 sec. to initiate a reset of the device.



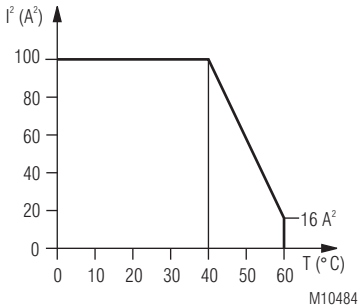
M10374

If a system failure is detected again after restart the device must be replaced and sent back to manufacturer.

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



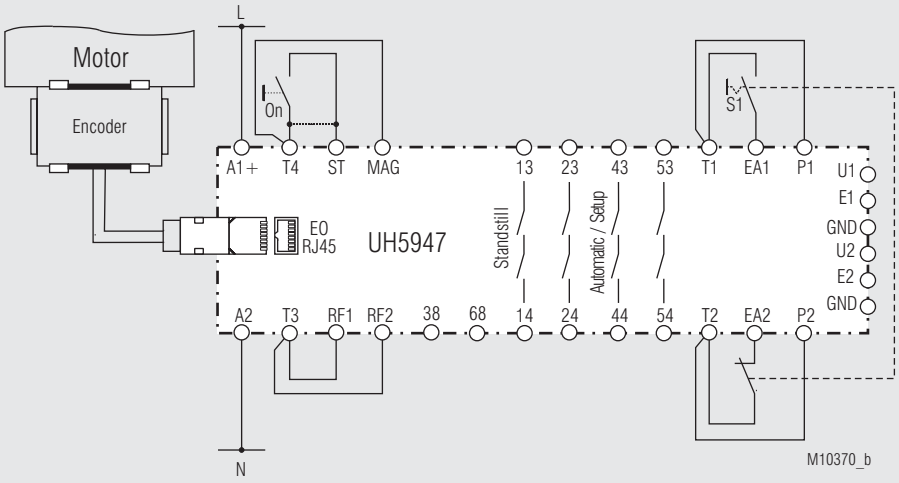
M10484

Max. zulässiger Strom bei 60°C über 4 Kontaktreihen = 2A ≙ $4x2^2A^2 = 16A^2$

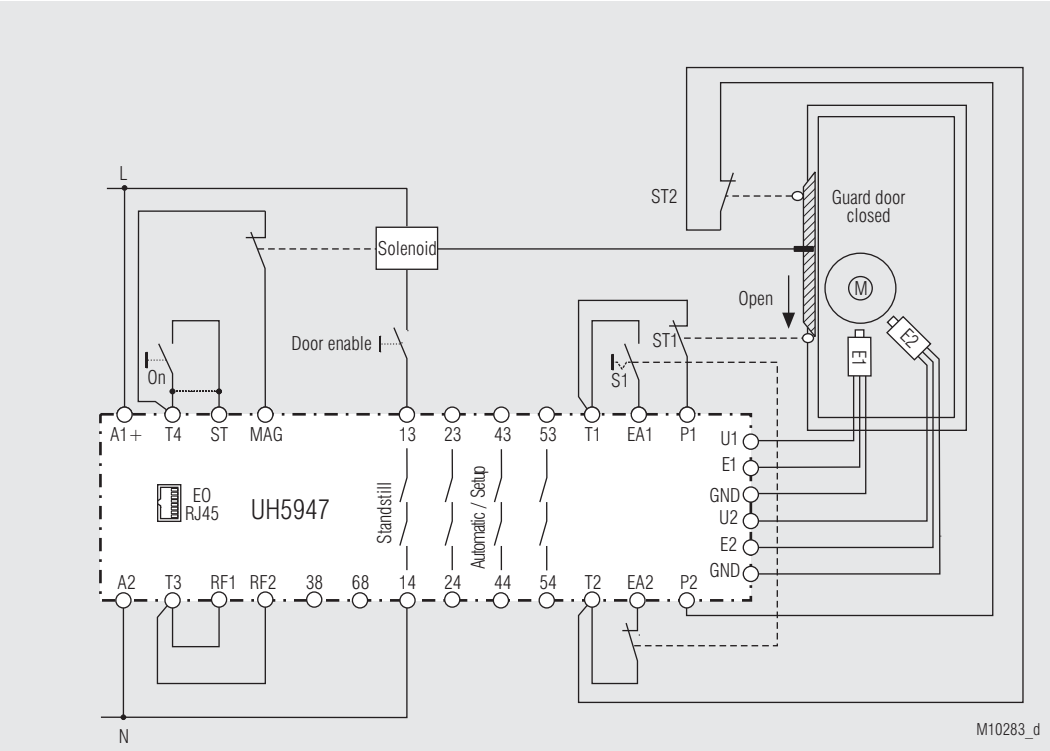
$I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$

I_1 , I_2 , I_3 , I_4- Strom in den Kontaktpfaden

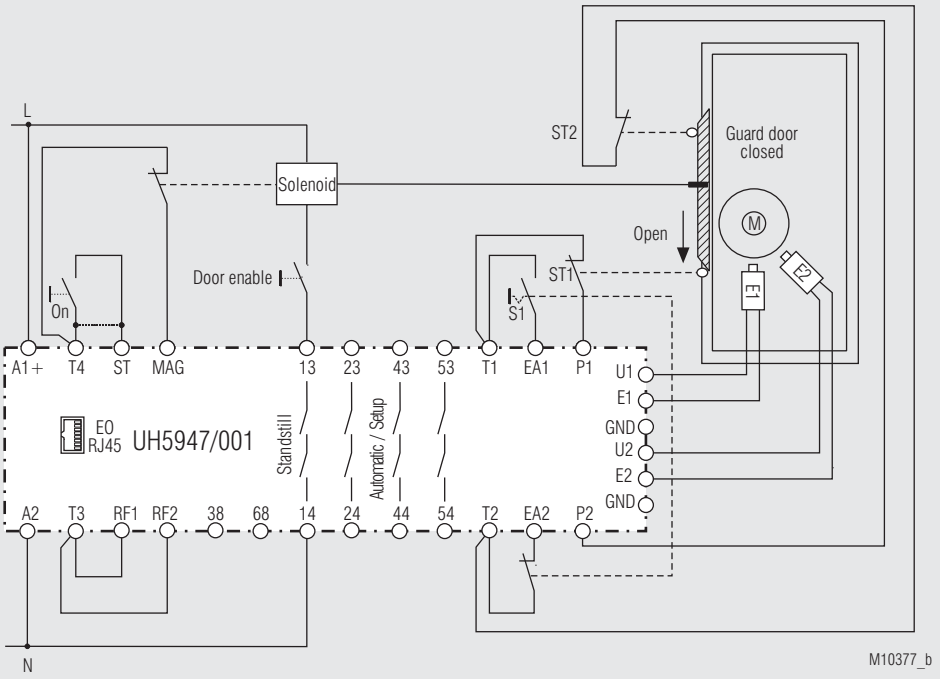
quadratic total current limit curve



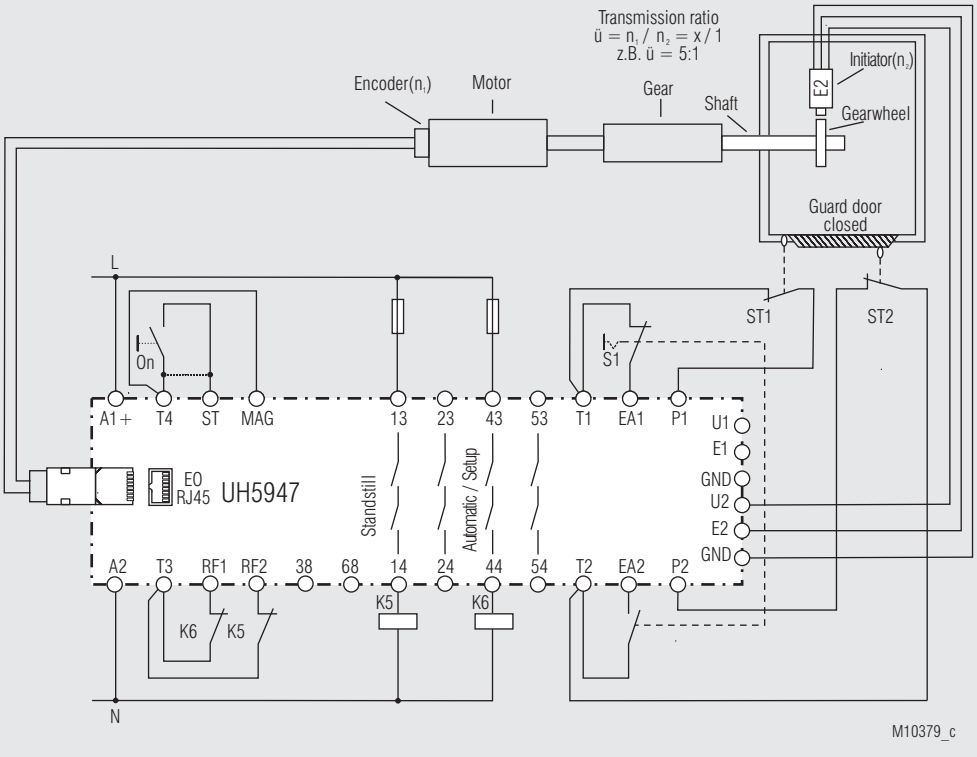
Rotational speed and standstill monitoring with suitable encoder, automatic mode; for manual start: ON/OFF pushbutton to T4/ST; for automatic start: jumper to T4/ST; suited up to SIL3, Performance Level e, Cat. 4 (Requirement for Cat. 4 is, that during longer periods of standstill a forced dynamisation (t < 24 h) has to be carried out).



Two-channel rotational speed and standstill monitoring by means of two NPN or PNP proximity sensors; automatic mode; safety gate monitoring active; for manual start: ON/OFF pushbutton to T4/ST; for automatic start: jumper to T4/ST; suited up to SIL3, Performance Level e Cat. 4 (Requirement for Cat. 4 is, that during longer periods of standstill a forced dynamisation (t < 24 h) has to be carried out).

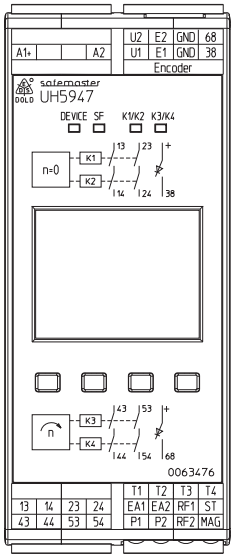
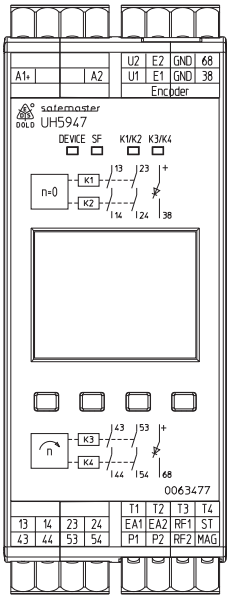
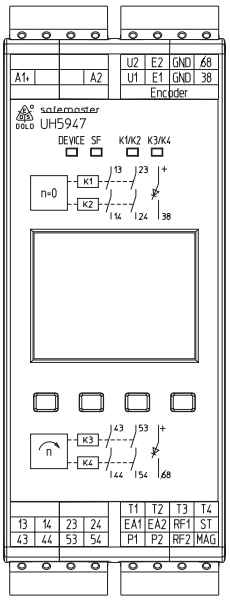
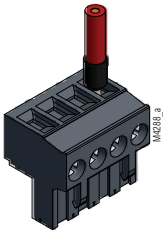
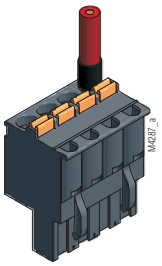
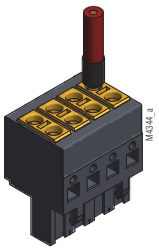
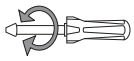
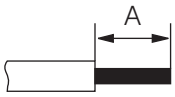
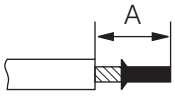
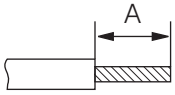


Rotational speed and standstill monitoring by means of encoder and two NAMUR-sensor; automatic mode; safety gate monitoring active; for manual start: ON/OFF pushbutton to T4/ST; for automatic start: jumper to T4/ST; suited up to SIL3, Performance Level e; Cat. 4

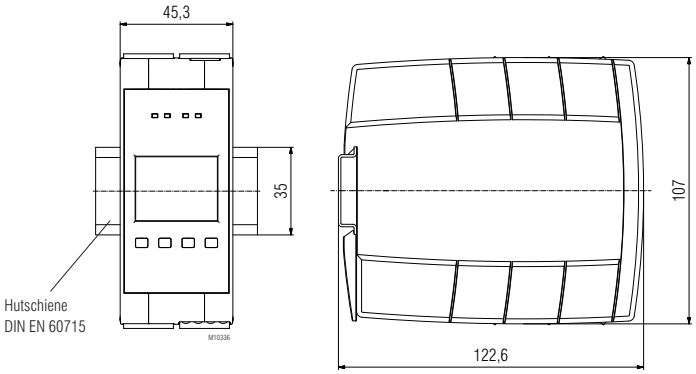


Rotational speed and standstill monitoring by means of encoder and one NPN or PNP proximity sensor; setup mode; gear ratio set; safety gate monitoring active; for manual start: ON/OFF pushbutton to T4/ST; for automatic start: jumper to T4/ST; suited up to SIL3, Performance Level e, Cat. 4 (Requirement for Cat. 4 is, that during longer periods of standstill a forced dynamisation (t < 24 h) has to be carried out).

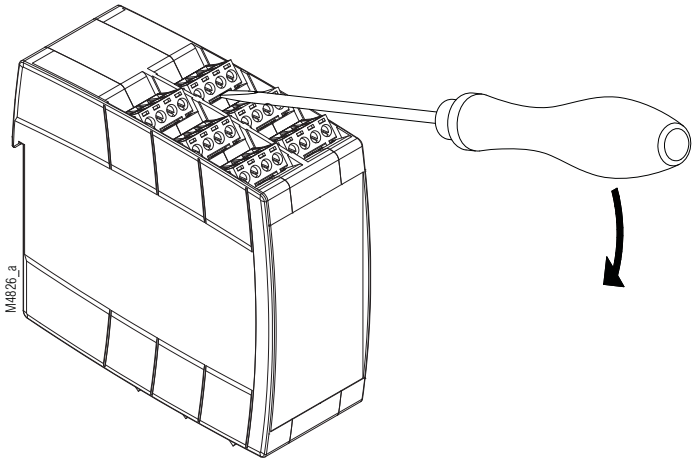
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M10401	 M10618	 M11436
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC terminal blocks**
FR	**Montage / Démontage des borniers PS / PC**

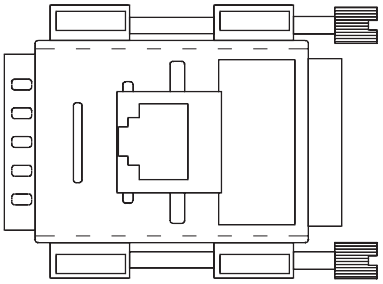


DE	**Zubehör**
EN	**Accessories**
FR	**Accessoires**

KY 5947 H1/S1

DE	Der 15-polige Adapter dient als Verbindung zwischen Encoder, Steuerung und dem Drehzahlwächter. Er ist für Steuerungen von Siemens/Heidenhain mit folgender PIN-Belegung ausgelegt:
EN	15 pole adaptor to connect an encoder or for controllers of Siemens /Heidenhain with corresponding PIN arrangement (see remarks for accessories in operating manual)
FR	Adaptateur de liaison à 15 poles pour le branchement du codeur ou pour le branchement de la commande Siemens/Heidenhein avec l'affectation des points défini. (Voir remarques dans la notice 'utilisation)

Signal	SUB-D15	RJ45
VCC	1	2
GND	2	1
A	3	3
$\overline{A}$	4	4
B	6	6
$\overline{B}$	7	8

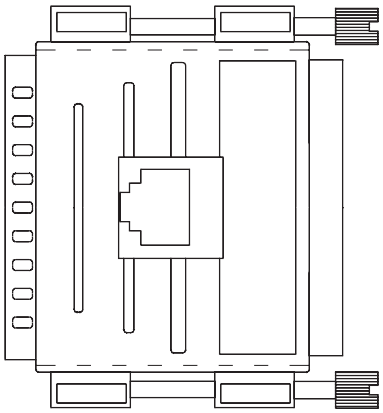


M10620

KY 5947 H2/S4

DE	Der 25-polige Adapter dient als Verbindung zwischen Encoder, Steuerung und dem Drehzahlwächter. Er ist für Steuerungen von Siemens/Heidenhain mit folgender PIN-Belegung ausgelegt:
EN	25 pole adaptor to connect an encoder or for controllers of Siemens /Heidenhain with corresponding PIN arrangement (see remarks for accessories in operating manual)
FR	Adaptateur de liaison à 25 poles pour le branchement du codeur ou pour le branchement de la commande Siemens/Heidenhein avec l'affectation des points défini. (Voir remarques dans la notice 'utilisation)

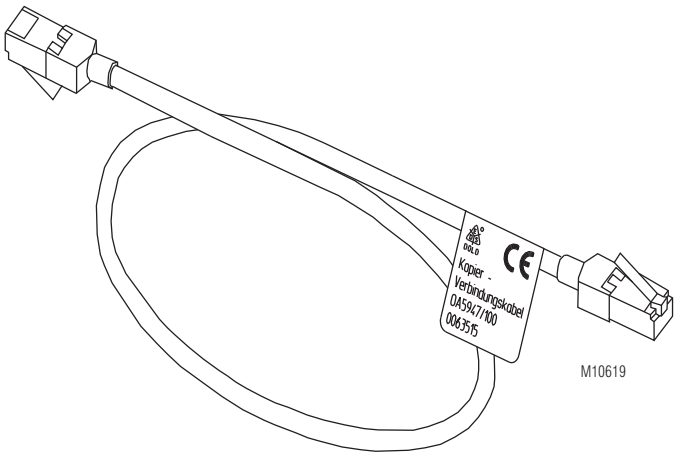
Signal	SUB-D25	RJ45
VCC	1	2
GND	2	1
A	3	3
$\overline{A}$	4	4
B	6	6
$\overline{B}$	7	8



M10621

OA 5947/100

DE	**Verbindungskabel für Kopierfunktion und Adapter.**
EN	**Connection cable for copy function and adaptor**
FR	**Cable de liaison pour la fonction copie avec connecteur RJ45**



M10619

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	122	a (year)
DC_{avg}:	97,5	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

IEC/EN 62061 IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508
HFT*):	1	
DC:	97,5	%
PFH_D:	3,02E-09	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

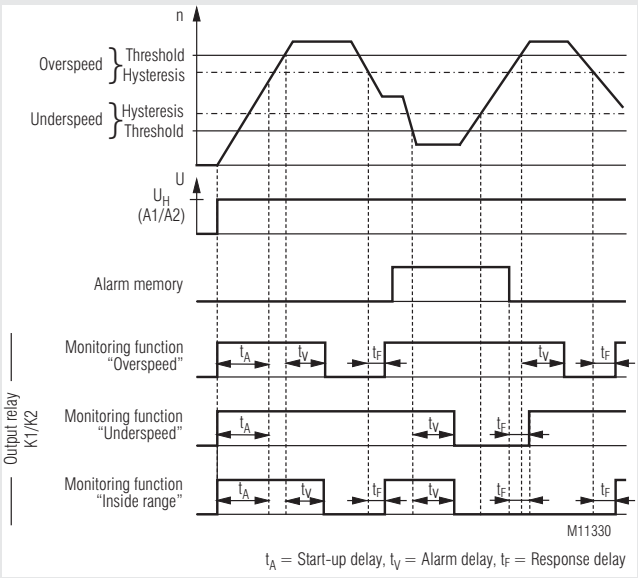
SAFEMASTER S
Speed monitor
UH 6932

0273535

Product Description

The speed monitor UH 6932 provides safe monitoring of motors and rotating equipment. It is used in machines and plants where machine movements or moving parts can be a danger to men and machine. Using the front side display the parameters can be easily and comfortably adapted to the individual application or changed when necessary.

Function Diagram



t_A = Start-up delay, t_V = Alarm delay, t_F = Response delay

Your Advantage

- For safety applications up to PL e / Cat. 4 and SIL 3
- Simple and time saving setup without PC
- Comfortable, menu guided configuration via frontside display
- Reducing interruption time in production by extensive diagnostic functions
- Easy to integrate in existing drive applications
- Possible languages: english, german, french

Features

- **According to**
  - **Performance Level (PL) e und 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**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61511**
- Overspeed, underspeed or window monitoring
- Integrated user friendly frontside display
  - Comfortable, menu guided configuration
  - For set point and actual value of Hz
- Fast reaction time by measuring duration of cycle of input frequency
- For PNP- or NPN-sensors
- Adjustable hysteresis
- Adjustable reset delay function from 0 ... 100 s
- Adjustable start up time delay from 0 ... 100 s
- Adjustable alarm delay from 0.1 ... 100 s
- Manual or auto-reset
- 2-channel function
- Forcibly guided output contacts
- LED-indicators and 2 semiconductor monitoring output
- Width 45 mm
- With pluggable terminal blocks for easy exchange of devices
- Variant /_ _1:
  - it is possible to set a variety of response parameters by means of a 4 bit selection facility from an overriding control unit;
  - analog output (2 V to 10 V) corresponding to the current speed;
  - the possibility of overriding the speed by a supervisory function (muting);
  - adjustable switchover time from 0 ... 100 s

Approvals and Markings

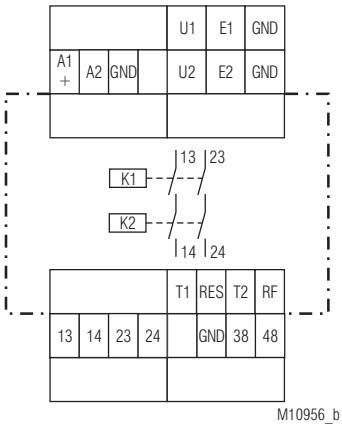
CE · TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 · c UL us LISTED Canada / USA

Application

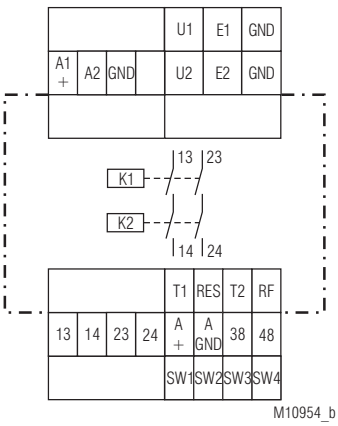
This device is designed for machinery and installations where hazards to people and property may be caused by the movement of machines or parts.

With correct connection it is possible to realise with the UH 6932 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor) and SSR (Safe Speed Range) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Circuit Diagrams



UH 6932



UH 6932/_ _1

Connection Terminals

Terminal designation	Signal designation
A1+	DC24V
A2	0V
U1, U2	(+) supply for proximity sensors
E1, E2	measuring inputs for proximity sensors
GND	Reference potential for Semiconductor monitoring output and control outputs, as well as (-) supply for proximity sensors
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
38, 48	Semiconductor-monitoring output
T1, T2	Control output
RES, RF, SW1, SW2, SW3, SW4	Control input
A +, A GND	Analogue output

Functions

The auxiliary voltage is connected to terminals A1 to A2. The equipment can be configured via the display and the setting keys on the front plate. The detection of the speed is effected via two NPN- or PNP-proximity switches, which are connected up at the Inputs: E1 and E2. The electric power supply for the proximity switch is provided from the speed monitor of 24V DC at the Terminals: U1 and U2. For each initiator a separate wire has to be used and wired separately. The input speed are compared internally to the thresholds already set on the equipment. As the internally measures the time periods, the fastest possible speed detection monitoring is possible. Should the over-speed function be set, then the output relay will switch to the alarm mode, when the set response parameter is over-exceeded longer than the parametered alarm-delay function (t_V). Should the speed fall again below the response parameter, minus the set hysteresis, the output relay will be activated after the expiry of the reset-delay time period (t_F) and return to its pre-set permitted supervisory state. As regards the under-speed function, the output relay will switch to the alarm mode, when the set response parameter is under-exceeded longer than the parametered alarm-delay function (t_V) time period. As soon as the speed return to the range governed by the response parameter, plus the set hysteresis, then the output relay will again return to the pre-set permitted state after the expiry of the reset-delay time period (t_F). In the „internal window function mode“, the output relay will switch to the alarm setting when the speed exceed the pre-set permitted range of the response parameter. Once the speed again return within the range of both the upper- and lower response parameters, minus and/or plus the pre-set hysteresis values (upper response parameter minus- and/or the lower response parameter plus -the relative hysteresis values), then the output relay will again switch back to the pre-set permitted range after the expiry of the reset-delay time period (t_F).

Functions

In the „external window function mode“, the monitoring function acts inversely to the „internal window function“. Should the manual reset function be activated, then the output relay continues to remain in the alarm setting when the speed return to the pre-set permitted range. A resetting of the saved parameter is possible when the reset input is activated or the auxiliary voltage is shutdown.
When a start-up delay time (t_A) is set, then the set start-up delay time will initially expire as soon as the auxiliary voltage of the equipment is switched-on and the 'RF' feedback circuit is closed. The start-up delay time will also expire after a reset of the manual reset mode. During this time period, a speed evaluation is disabled and the output relays remain at the pre-set permitted setting. The start-up delay function can, for example override an alarm message during the start-up stage of a generator or electric motor. Should, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.
With correct connection it is possible to realise with the UH 6932 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor) and SSR (Safe Speed Range) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Indicators

LED ON:	green	On, when supply connected
	green-flashing	Parameterization mode
	red-flashing	Parameterization error
LED K1/K2:	green	Relay K1 and K2 energized
	yellow	Muting (Relay K1 and K2 energized)
LED ERR:	red	Internal failure
	red-flashing	External failure
LED t:	green-flashing	(K1/K2; light up) Expiry of the delay time periods t_A or t_U
	yellow-flashing	(K1/K2 does not light up) Expiry of the delay time periods t_F
	yellow-flashing	(K1/K2 light up) Expiry of the delay time periods t_V
DISPLAY:		Status indication Alarms / diagnostics Parameterization

Reset the manual reset, automatic reset function
In the manual reset function mode, a reset input is provided for acknowledging error messages (over-speed and under-speed). Should a 'T1' status engage the input for longer than 1 second, then a reset will be conducted in the equipment. A renewed reset is however possible if the reset signal at the reset input is briefly interrupted. In the automatic reset mode, the input will be ignored because the above mentioned error message will be automatically reset.

Semiconductor outputs
The Semiconductor Output: 38 will indicate the status of the Relays: K1 / K2. When the relays are energized, then the Semiconductor Output: 38 is switched on. The Semiconductor Output: 48 will report errors within the equipment. Should an error actually exist, then the Semiconductor Output: 48 will be switched on.
The semiconductor outputs are not safety related. They can be used for monitoring purposes.

Setting the speed thresholds
For the monitoring functions: „internal window monitoring function" and in the „external window monitoring function", a minimum difference between the lower- and the upper -threshold of 5% is to be anticipated at the upper speed threshold, in addition to the already set hysteresis parameter. This is internally verified during the setting of the speed threshold and an error message will be displayed in case of any erroneous setting and/or the setting will not be permitted by the display. The maximum settable lower speed threshold can be calculated as follows:

Monitoring function: „Internal window monitoring":
Maximum lower threshold =
upper speed threshold - (5% + 2 x hysteresis) x upper speed threshold
Example:
Upper speed threshold 100 Hz, hysteresis 2%
Maximum lower speed threshold =
100 Hz - (0.05 + 2 x 0.02) x 100 Hz = 91 Hz

Monitoring function: „External window monitoring:
Maximum speed threshold =
upper speed threshold - 5% x upper speed threshold
Example:
Upper speed threshold 100 Hz, any required hysteresis
maximum lower speed threshold =
100 Hz – 0.05 x 100 Hz = 95 Hz

Feedbak circuit
The feedback contacts of external contactors are monitored on terminal RF. The terminal RF gets the test signal from T2 via normally open contacts of the contactors which are connected to terminals 14 and 24. The normally closed contact have to be closed to start the device. If no contact extension or reinforcement is used, the terminals RF and T2 have to br bridged.

Start up time delay t_A
The start-up delay time period expires when switching-on the auxiliary voltage of the equipment, once the 'RF' feedback circuit is closed. In addition, the start-up delay time period will also expire after a reset in the manual reset mode. During this time period, no speed evaluation is conducted. The LED 't' will flash and the output contacts: 13 to 14 and 23 to 24 will remain closed during this time period. As a result of the start-up delay time period, an alarm message can, for example be overridden during the start-up time period of a generator or electric motor. Should however, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.

Alarm delay t_v
The alarm-delay time period will expire when the equipment has recognised, that the speed exceed the permitted range. Only after the expiry of the alarm-delay time period, will the output contacts :13 to 14 and 23 to 24 be switched off. When the speed again enter the permitted range during the alarm-delay time period, then the alarm-delay function is terminated. The LED 't' will flash during the time period.

Device and function description

Reset delay time t_F
The reset-delay time period represents the time during after which the output contacts: 13 to 14 and 23 to 24 are switched on (when the speed is within a permitted range). Should the speed again enter the alarm state during the runoff of the reset-delay time period (when the speed exceed the required range), the reset-delay time period will be terminated. The LED 't' will flash during the same time period.
The start-up delay time period will override the reset-delay time period, i.e. when the output contacts are on by the start-up delay mode, then the reset-delay time period will be overridden (output contacts: 13 to 14 and 23 to 24 are closed). Even after an expiry of the start-up delay time period, the reset-delay time period will not be initiated.

Display
In normal operating mode, all settings can be checked at any time by pressing the UP or DOWN keys.
Additionally, the actula speed is displayed. However, this spped does not correspond to the device's accuracy and is only designed for diagnostic purposes.
In the case of wiring errors and system failures corresponding diagnostic messages are displayed on the display.

Parameterization using the display
See attached form page 43

Change tracking
To detect non permitted changes of the settings, the menue item change tracking is available. This setting allows to activate a counter once, which is then incremented with each confirmed change of the settings. After activation of this function the user cannot reset the counter or disable this function again.

Only at variant /_ _ 1

Digital selection via the software Inputs: SW1 to SW4
Four various speed modes with different response parameters, can be configured via the software Inputs: SW1 to SW4 (see Table). The electric power supply for the inputs should be between 10V DC and 26.4V DC to GND. A switchover configuration can also be undertaken during the operating mode. Should a speed mode be altered whilst operating, then the switchover time period (t_U) will commence, provided the output relays are switched on through the switchover, and the start-up delay time period has expired. During this time period, no speed evaluation will be conducted and the output relays remain energized (closed). Should during the switchover time period the speed modus again be altered, then the switchover time will not again be initiated. After the expiry of the switchover time period, the monitoring function will be continued at the currently set speed mode). The switchover time period, for example can affect the overriding of an alarm message during the start-up stage- or the braking stage -of a generator or electric motor.

SW1	SW2	SW3	SW4	Mode
0	0	1	1	Frequency mode 1
0	1	1	0	Frequency mode 2
1	0	0	1	Frequency mode 3
1	1	0	0	Frequency mode 4

Caution !

Any continuously repeated switching over of the speed modus (always immediately after the expiry of the switchover time period) can lead to the situation, that the equipment starts to function similarly as in the 'Muting Mode' (i.e. the speed monitoring function is overridden and the output relays remain permanently on).

Muting function
The speed monitoring function can be overridden on the display and by an appropriate activation of the software Digital Inputs: SW1 to SW4. For this purpose, the muting function should be activated when parametering on the display. Once this function is activated, then it will continue to be possible to continue to switch over between the speed moduses: 1 to 3, as described above. Should a selection be made of the speed mode 4 (muting) via the 'SW' software inputs, then no further speed monitoringwill be conducted. The output relays remain permanently on and the start-up delay function (t_A), the switchover time period function (t_U), the reset-delay function (t_F) and the alarm-delay function (t_V) will all be reset.

Analogue output A+ and A GND
The analogue output 2-10 V shows the actual measured frequency. The maximum value of the analogue output (10 V) is equal to the adjusted upper frequency threshold. The minimum value of the analogue output (2 V) is equal to the adjusted lower frequency threshold. The scaling is frequency linear.
In the monitoring function „underfrequency" the maximum value of the analogue output is equal to the highest possible setting value of the device (2000 Hz).
In the monitoring function „overfrequency" the minimum value of the analogue output is equal to 0 Hz.
If the muting function is selected, the maximum value of the analogue output is equal to the maximum setting value of the device (2000 Hz) and the minimum value is equal to 0 Hz.
In the case of a failure the analogue output goes to 0V.
The analogue output is not safety related. It can be used for diagnosis.

Switchover time period t_U
The switchover time period expires when the speed mode is altered during operations at the Software Inputs: SW1 to SW4, the output contacts are closed, no start-up delay function is running and the Switchover Time Period: 'tU' has not already been initiated and/or is running. During this time period, no speed monitoring is conducted and the output contacts remain on.

The parameterization menü has follow structure: Illustration shows the factory setting [4]

1.	Parameterization			
1.1	Monitoring function			
		Overspeed	x	
		Underspeed	-	
		Inside range	-	
		Outside range	-	
	Esc			OK
1.2	Limits			
		Frequency mode 1		[1]
		upper limit		[2]
		400.0 Hz		
		lower limit		[3]
		200.0 Hz		
		Frequency mode 2		
		upper limit		
		400.0 Hz		
		lower limit		
		200.0 Hz		
		Frequency mode 3		
		upper limit		
		400.0 Hz		[1]
		lower limit		
		200.0 Hz		
		Frequency mode 4		
		upper limit		
		400.0 Hz		
		lower limit		
		200.0 Hz		
	Esc			OK
1.3	Hysteresis			
		5 %		
	Esc			OK
1.4	Time Delay			
		Start-up delay		
		0.0 s		
		Response delay		
		0.0 s		
		Alarm delay		
		0.1 s		
		Changeover bridging		[1]
		0.0 s		
	Esc			OK
1.5	Alarm memory			
		Alarm memory	x	
		automatic reset	-	
	Esc			OK
1.6	Muting function			
		activate	-	
		deactivate	x	
	Esc			OK
Esc				OK

2.	Display settings			
2.1	Languages			
		english	x	
		deutsch	-	
		français	-	
	Esc			OK
2.2	Contrast			
		50	%	
	Esc			OK
2.3	Backlight			
		OFF	-	
		10 s	x	
		1 min	-	
		5 min	-	
	Esc			OK
2.4	Status ndicator			
		Manual	x	
		10 s	-	
		1 min	-	
		5 min	-	
	Esc			OK
Esc				OK
3.	Factory settings			
		Parameters		
		Display settings		
		Parameter + display settings		
	Esc			OK
4.	Change_tracking			
		activate		
	Esc			OK
Esc				OK

[1] only available at variant /_ _1.
[2] not available at monitoring function „underspeed“.
[3] not available at monitoring function „overspeed“.
[4] Customers specific variants have other factory settings. They are available on request.

Technical Data

Frequency Measuring Input E1 and E2

Supply voltage:	DC 24 V (provided by the device)
Input current:	max. 30 mA
Output:	as option PNP or NPN
HIGH-level:	DC 10 V ... DC 26.4 V
LOW-level:	< DC 2 V
Min. pulse duration e. g. on and off time:	75 µs
Input frequency:	< 3 kHz
Response value:	adjustable from 1 Hz ... 2 kHz
Measuring accuracy:	< ± 2 %
Stability of the setting threshold at variation of auxiliary voltage and temperature:	< ± 1 %
Hysteresis:	adjustable from 2 ... 10 % of the set response value
Reaction time of Frequency monitoring:	Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms + adjusted response delay
Response delay t_v:	adjustable from 0.1 ... 100 s
Start up time delay t_A:	adjustable from 0 ... 100 s
Reset delay t_F:	adjustable from 0 ... 100 s
Switchover time period t_U:	adjustable from 0 ... 100 s
Accuracy of the adjustable times:	< ± 5 %
Time between connection of auxiliary supply and ready to mesure:	approx. 1.5 s (with start up delay is 0)

Auxiliary circuit (A1-A2)

Auxiliary voltage U_H:	DC 24 V The power supply shall meet the requirements of SELV / PELV
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption:	typ. 3.2 W
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR
Duty-cycle Reset button:	> 3 s

Output

Contacts:	2 NO contacts	
Contact type:	Relay forcibly guide	
Thermischer Strom I_{th}:	8 A (see current limit curve)	
Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13:	4 A / DC 24 V at 0.1 Hz	
Electrical life		
at 5 A, AC 230 V cos φ = 1:	> 2.2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles	
Semiconductor monitoring output:	DC 24 V, 50 mA, plus switching	
Analogue output:	2 ... 10 V, max. 10 mA	

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range		
operation:	- 20 ... + 60°C	
storage:	- 20 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impuls voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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 V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Wire fixing:	captive slotted screw	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 320 g	

Dimensions

Width x height x depth:	45 x 107 x 121 mm

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL60947, "general use applications"

Standards:
- ANSI/UL 60947-1, 5th Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-5-1, 3th Edition (Low-Voltage Switchgear and Controlgear Part5-1: Control circuit Devices an Switching Elements - Electro-mechanical Control Circuits Devices)
- CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition (Low-Voltage Switch-gear and Controlgear - Part1: General rules)
- CAN/CSA-C22.2 No. 60947-1-14, 1st Edition (Low-Voltage Switch-gear and Controlgear - Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)

Nominal voltage U_N:

DC 24 V: Device must be supplied with a Class 2 or a voltage / current limited power supply.

Switching capacity:

Semiconductor monitoring outputs: 24Vdc, 50mA, pilot duty

Switching capacity

Relay output device free-standing:

Ambient temperature 60°C: Pilot duty B300, Q300
8A 250Vac G.P.
8A 24 Vdc

Device mounted without distances heated by devices with same load:

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

Ambient temperature 60°C: Pilot duty C300, Q300
4A 250Vac G.P.
4A 24 Vdc

Wire connection

Ambient temperature 60°C, 4A bzw. 55°C, 5A: min. 75°C aluminum or copper conductors

Ambient temperature 60°C, 8A: min. 90°C aluminum or copper conductors

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

Standard Type

UH 6932.02PS/61 DC 24 V

Article number:	0066816
• Output:	2 NO contacts
• Auxiliary voltage U_H:	DC 24 V
• Width:	45 mm

Ordering Example

UH 6932 .02 _ _ / 0 _ _ /61 DC 24 V

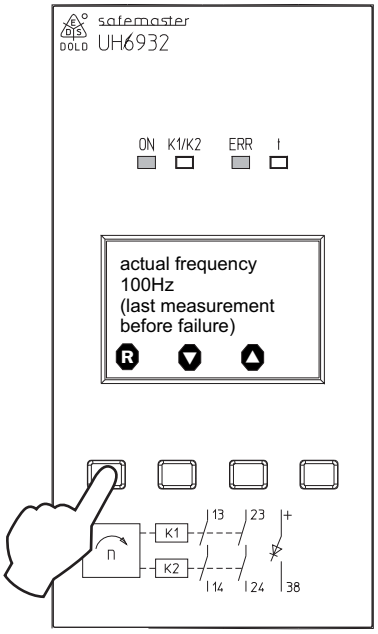
- DC 24 V: Nominal voltage
- /61: UL-approval
- 0 = Standard; 1 = with different frequency mode and analogue output
- 0 = npn-input; 1 = pnp-input
- _ _: Type of terminals; PS (plug in screw): pluggable terminal blocks, with screw terminals
- .02: Contacts
- UH 6932: Type

Troubleshooting

Failure	Potential cause
LED „ON“ does not light up	- Power supply A1+/A2 not connected
LED „ON“ flashes red	- Parameterization error (detailed description on display)
LED „ERR“ flashes red	- External failure (detailed description on display)
LED „ERR“ continuously on	- Device failure (if the failure still exists after restart, replace device)

Fault handling

When faults are detected on or in the device they are indicated on the display by an appropriate message. If a reset of the device is necessary due to the fault, at first the alarm and the associated diagnostic message have to be acknowledged. Then, the left key has to be pressed for approx. 3 sec. to initiate a reset of the device.



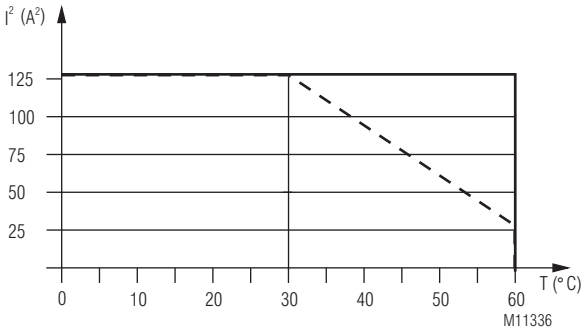
M11256

If a system failure is detected again after restart the device must be replaced and sent back to manufacturer.

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.

Characteristic



M11336

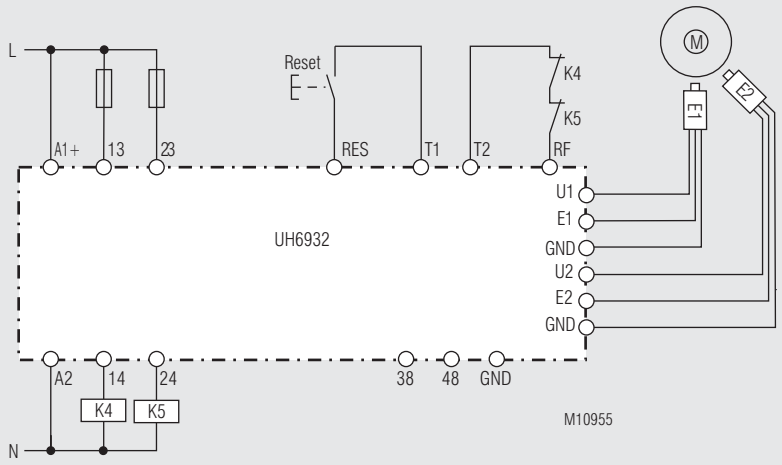
——— device free-standing
max. current at 60°C over
2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

– – – device mounted without distance heated by devices with same load,
max. current at 60°C over
2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

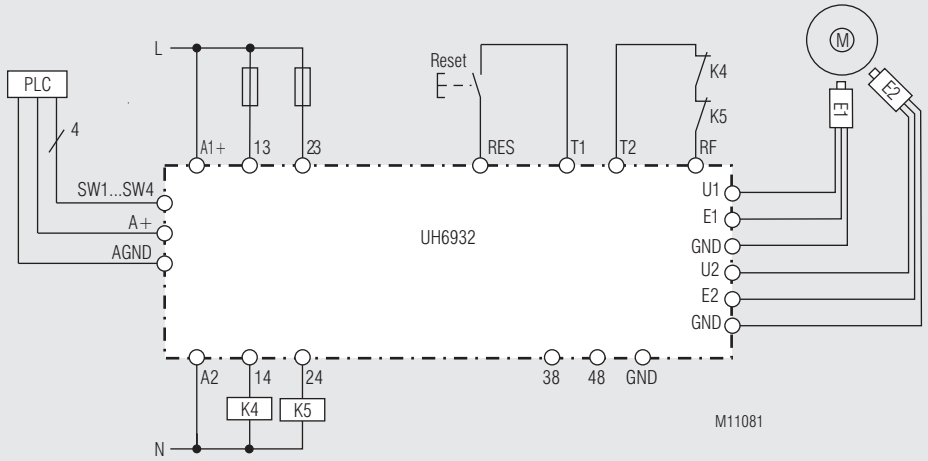
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - current in contact paths

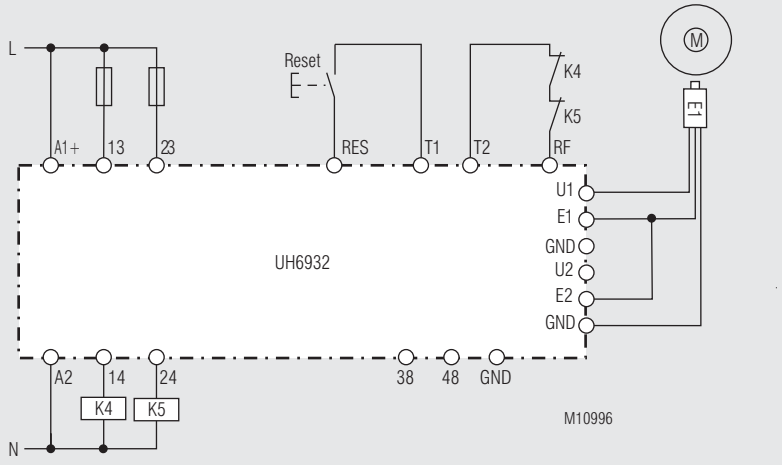
Quadratic total current limit curve



Standard connection,
Suited up to SIL3, Performance Level e, Cat. 4

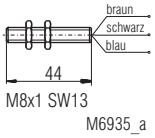
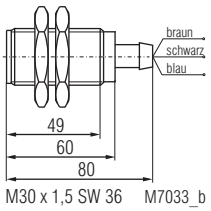


Standard connection with UH6932/_ _1,
Suited up to SIL3, Performance Level e, Cat. 4



Connection with a proximity sensor,
Suited up to SIL 2, Performance Level c, Cat. 2
(to achieve Cat. 2 the safety function has to be tested on a regulare base)

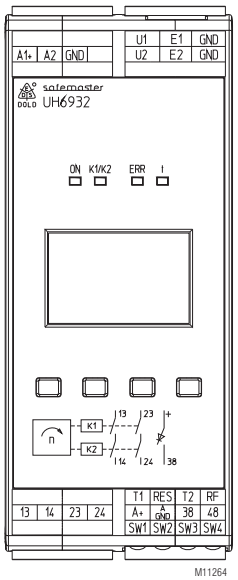
Initiators (proximity sensors), induktive

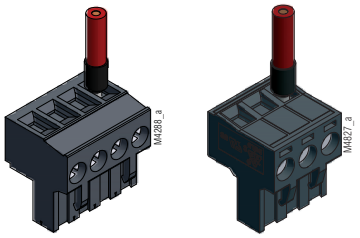
Type	NA 5001.01.10 pnp NA 5001.01.20 npn	NA 5010.01.10 pnp NA 5010.01.20 npn
Dimensions		
Enclosure	Metal	Metal
Switching distance S_n	1 mm	10 mm
Switching frequency	5 000 Hz	200 Hz
Hysteresis	2 ... 10 %	
Repeat accuracy	5 %	
Voltage range	10 ... 30 V	
Residual ripple	< 10 %	
Continuous current	≤ 200 mA	≤ 400 mA
Output	.10 pnp NO .20 npn NO	.10 pnp NO .20 npn NO
Indication of output state	LED	
Ambient temperature	- 25 ... 70°C	
Temperature influence	10 %	
Degree of protection	IP 67	
Connection wire	2 m	
Fixing torque	4 Nm	100 Nm
Weight	45 g	270 g

Connection Table UH 6932

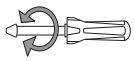
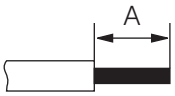
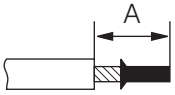
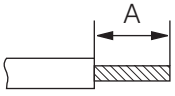
Initiator type	Initiator-connection	Terminal on UH 6932
NA 5001.01.10 NA 5001.01.20 NA 5010.01.10 NA 5010.01.20	brown +	U1 / U2
	blue -	GND
	black NO	E1 / E2

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

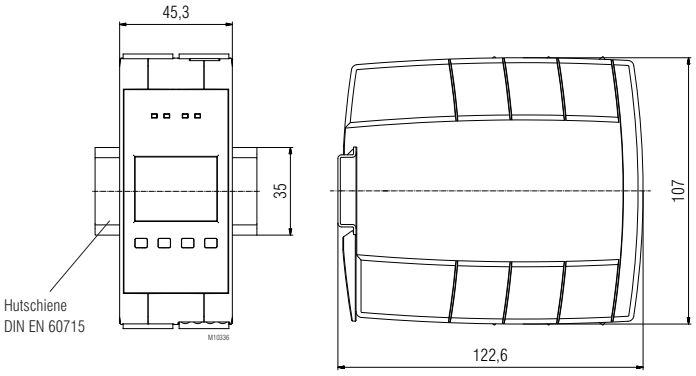




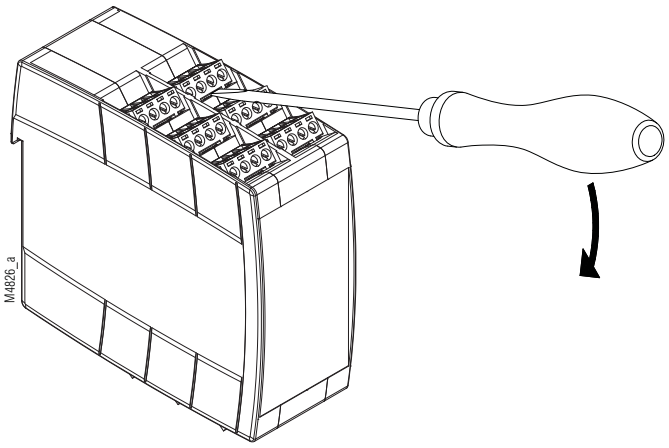
PS

	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN
	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18
	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18
	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS-Klemmenblöcke**
EN	**Mounting / disassembly of the PS terminal blocks**
FR	**Montage / Démontage des borniers PS**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	146,1	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)

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:	99,0	%
PFH_D:	1,8E-10	h^{-1}
PFD_{AVG}:	8,1E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode		Intervall for cyclic test of the safety function
Consigne résultante de la fonction sécuritaire de l'appareil au High Demand Mode		Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

DE	Bei längeren Stillstandszeiten wird eine Überprüfung der Sicherheitsfunktion empfohlen.
EN	During longer periods of inactivity a test of the safety function is recommended.
FR	Un contrôle de la fonction sécuritaire doit être effectué en cas d'arrêts prolongés.

SAFEMASTER S
Frequency Monitor
UH 6937

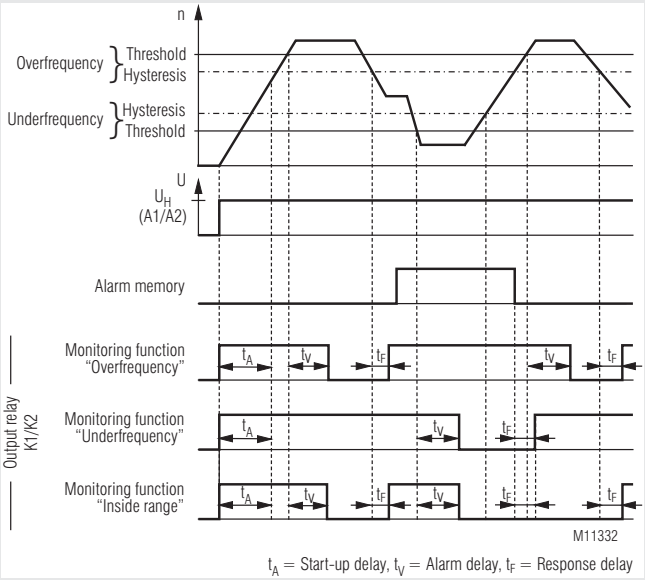
DOLD

0273539

Product Description

The frequency monitor UH 6937 provides safe frequency monitoring of AC voltages. It is used to monitor the output frequency of inverters or the rotor frequency of slipring motors. An other application area is the monitoring of motors in crane plants. Using the front side display the parameters can be easily and comfortably adapted to the individual application or changed when necessary.

Function Diagram



t_A = Start-up delay, t_V = Alarm delay, t_F = Response delay

Your Advantage

- For safety applications up to PL e / Cat. 4 and SIL 3
- Simple and time saving setup without PC
- Comfortable, menu guided configuration via frontside display
- Reducing interruption time in production by extensive diagnostic functions
- Easy to integrate in existing drive applications
- For inverters up to 1200 Hz
- Possible languages: english, german, french

Features

- **According to**
  - **Performance Level (PL) e und 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**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61511**
- Over-, underfrequency or window monitoring of single or 3-phase in AC systems
- Integrated user friendly frontside display
  - Comfortable, menu guided configuration
  - For set point and actual value of Hz
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring inputs for AC-voltages of 8 ... 280 V for single-phase monitoring as well as 16 ... 690 V for single- and 3-phase monitoring
- Suitable for inverters
  - Variant /0_ _ : 1 ... 700 Hz
  - Variant /1_ _ : 1 ... 1200 Hz
- Adjustable hysteresis
- Adjustable reset delay function from 0 ... 100 s
- Adjustable start up time delay from 0 ... 100 s
- Adjustable alarm delay from 0.1 ... 100 s
- Manual or auto-reset
- galvanic separation between measuring input, auxiliary voltage and output contacts
- 2-channel function
- Forcibly guided output contacts
- LED-indicators and 2 semiconductor monitoring output
- Width 45 mm
- With pluggable terminal blocks for easy exchange of devices
- Variant /_ _1:
  - it is possible to set a variety of response parameters by means of a 4 bit selection facility from an overriding control unit;
  - analog output (2V to 10V) corresponding to the current speed;
  - the possibility of overriding the speed by a supervisory function (muting);
  - adjustable switchover time from 0 ... 100 s

Approvals and Markings

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

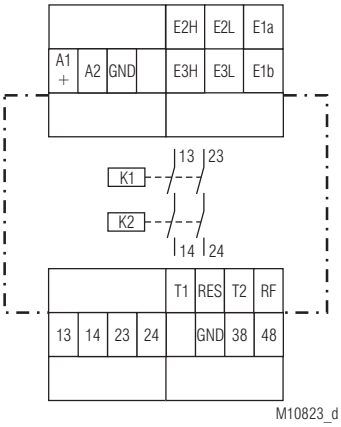
Applications

Safe frequency monitoring of AC voltages

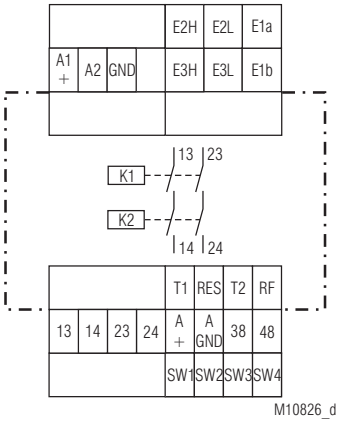
- Safe monitoring of the outputfrequency of inverters
- Safe monitoring of the rotorfrequency of slipring motors
- Safe control / monitoring of motorts in crane applications

With correct connection it is possible to realise with the UH 6937 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor) and SSR (Safe Speed Range) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Circuit Diagrams



UH6937



UH6937/_ _1

Connection Terminals

Terminal designation	Signal designation
A1+	DC24V
A2	0V
E1a, E1b, E2L, E2H, E3L, E3H	Frequency measuring inputs
GND	Reference potential for semiconductor monitoring output and control outputs
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
38, 48	Semiconductor-monitoring output
T1, T2	Control output
RES, RF, SW1, SW2, SW3, SW4	Control input
A +, A GND	Analogue output

Functions

The auxiliary voltage is connected to terminals A1-A2. he equipment can be configured via the display and the setting keys on the front plate. Terminals E1a, E1b, E2L, E2H, E3L and E3H form the measuring input.
For low voltages the measuring voltage is connected to E1a-E2L and E1b-E3L and for higher voltages to E1a-E2H and E1b-E3H (see section technical data).
When monitoring single phase AC voltage, it is recommended to connect the terminals E1a-E2L or E1a-E2H directly to the inverter, the terminals E1b-E3L or E1b-E3H directly to the motor connection terminals. Seperate wires in separate cables with space to each other have to be used for each of the frequency inputs. When monitoring 3-pase AC voltages it is recommended to wire these terminals directly to the motor connection terminals.
The input frequency is compared to the setting value. As the device measures the cycle duration the fastest frequency measurement is possible.
Should the over-frequency function be set, then the output relay will switch to the alarm mode, when the set response parameter is over-exceeded longer than the parametered alarm-delay function (t_V). Should the frequency fall again below the response parameter, minus the set hysteresis, the output relay will be activated after the expiry of the reset-delay time period (t_F) and return to its pre-set permitted supervisory state.
As regards the under-frequency function, the output relay will switch to the alarm mode, when the set response parameter is under-exceeded longer than the parametered alarm-delay function (t_V) time period. As soon as the frequency return to the range governed by the response parameter, plus the set hysteresis, then the output relay will again return to the pre-set permitted state after the expiry of the reset-delay time period (t_F).

Functions

In the „internal window function mode“, the output relay will switch to the alarm setting when the frequency exceed the pre-set permitted range of the response parameter. Once the frequency again return within the range of both the upper- and lower response parameters, minus and/or plus the pre-set hysteresis values (upper response parameter minus- and/or the lower response parameter plus -the relative hysteresis values), then the output relay will again switch back to the pre-set permitted range after the expiry of the reset-delay time period (t_F).
In the „external window function mode“, the monitoring function acts inversely to the „internal window function“. Should the manual reset function be activated, then the output relay continues to remain in the alarm setting when the frequency return to the pre-set permitted range. A resetting of the saved parameter is possible when the reset input is activated or the auxiliary voltage is shutdown. When a start-up delay time period (t_A) is set, then the set start-up delay time period will initially expire as soon as the auxiliary voltage of the equipment is switched-on and the ‘RF’ feedback circuit is closed. The start-up delay time period will also expire after a reset of the manual reset mode. During this time period, a frequency evaluation is disabled and the output relays remain at the pre-set permitted setting. The start-up delay function can, for example override an alarm message during the start-up stage of a generator or electric motor. Should, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.
With correct connection it is possible to realise with the UH 6937 the safety functions STO (Safe Torque Off), SOS (Safe Operating Stop), SLS (Safely Limited Speed), SSM (Safe Speed Monitor) and SSR (Safe Speed Range) according to EN 61800-5-2. The actual realisation of the safety functions has to be validated in each application of the product for safety aspects.

Indicators

LED ON:	green	On, when supply connected
	green-flashing	Parameterization mode
	red-flashing	Parameterization error
LED K1/K2:	green	Relay K1 and K2 energized
	yellow	Muting (Relay K1 and K2 energized)
LED ERR:	red	Internal failure
	red-flashing	External failure
LED t:	green-flashing	(K1/K2; light up) Delay times runoff t_A or t_U
	yellow-flashing	(K1/K2 does not light up) Delay times runoff t_F
	yellow-flashing	(K1/K2 light up) Delay times runoff t_V
DISPLAY:		Status indication Alarms / diagnostics Parameterization

Frequency measuring input
The measuring input is divided up in to voltage ranges (AC 8 ... 280 V on E1a-E2L und E1b-E3L and AC 16...690 V on E1a-E2H and E1b-E3H). If the measuring voltage is always higher then AC 16 V, the higher range should be used. A special dimensioned measuring input with low pass characteristic avoids the measuring of the pulse frequency. In addition the input sensitivity is adapted to the voltage-/frequency-characteristic of inverters.
Plesae make sure that the frequency measuring inputs are connected to the same single or 3-phase voltage system.

Manual reset, automatic reset
In the manual reset mode, a reset-input function is provided for acknowledging error messages (overfrequency and underfrequency. Should a 'T1' status engage the input for longer than 1 second, then a reset will be conducted in the equipment. A renewed reset is however possible if the reset signal at the reset input is briefly interrupted. In the automatic reset mode, the input will be ignored because the above mentioned error message will be automatically reset.

Semiconductor outputs
The Semiconductor Output: 38 will indicate the status of the Relays: K1 / K2. When the relays are energized, then the Semiconductor Output: 38 is switched on. The Semiconductor Output: 48 will report errors within the equipment. Should an error actually exist, then the Semiconductor Output: 48 will be switched on.
The semiconductor outputs are not safety related. They can be used for monitoring purposes.

Setting the frequency thresholds
For the monitoring functions: „internal window monitoring function" and in the „external window monitoring function", a minimum difference between the lower- and the upper -threshold of 5% is to be anticipated at the upper frequency threshold, in addition to the already set hysteresis parameter. This is internally verified during the setting of the speed threshold and an error message will be displayed in case of any erroneous setting and/or the setting will not be permitted by the display. The maximum settable lower frequency threshold can be calculated as follows:

Monitoring function: „Internal window monitoring":
Maximum lower threshold =
upper frequency threshold - (5% + 2 x hysteresis) x upper frequency threshold
Example:
Upper frequency threshold 100 Hz, hysteresis 2 %
Maximum lower frequency threshold =
100 Hz - (0.05 + 2 x 0.02) x 100 Hz = 91 Hz

Monitoring function: „External window monitoring:
Maximum frequency threshold =
upper frequency threshold - 5 % x upper frequency threshold
Example:
Upper frequency threshold 100 Hz, any required hysteresis
maximum lower frequency threshold =
100 Hz – 0.05 x 100 Hz = 95 Hz

Feedbak circuit
The feedback contacts of external contactors are monitored on terminal RF. The terminal RF gets the test signal from T2 via normally open contacts of the contactors which are connected to terminals 14 and 24. The normally closed contact have to be closed to start the device. If no contact extension or reinforcement is used, the terminals RF and T2 have to br bridged.

Start up time delay t_A
The start-up delay time period expires when switching-on the auxiliary voltage of the equipment, once the 'RF' feedback circuit is closed. In addition, the start-up delay time period will also expire after a reset in the manual reset mode. During this time period, no frequency evaluation is conducted. The LED 't' will flash and the output contacts: 13 to 14 and 23 to 24 will remain closed during this time period. As a result of the start-up delay time period, an alarm message can, for example be overridden during the start-up time period of a generator or electric motor. Should however, after a reset (in the manual reset mode), the feedback circuit not be closed, then the equipment will go into a safe error state.

Alarm delay t_v
The alarm-delay time period will expire when the equipment has recognised, that the frequency exceed the permitted range. Only after the expiry of the alarm-delay time period, will the output contacts :13 to 14 and 23 to 24 be switched off. When the frequency again enter the permitted range during the alarm-delay time period, then the alarm-delay function is terminated. The LED 't' will flash during the time period.

Notes

Reset delay time t_F
The reset-delay time period represents the time during after which the output contacts: 13 to 14 and 23 to 24 are switched on (when the frequency is within a permitted range). Should the frequency again enter the alarm state during the runoff of the reset-delay time period (when the speed exceed the required range), the reset-delay time period will be terminated. The LED 't' will flash during the same time period.
The start-up delay time period will override the reset-delay time period, i.e. when the output contacts are on by the start-up delay mode, then the reset-delay time period will be overridden (output contacts: 13 to 14 and 23 to 24 are closed). Even after an expiry of the start-up delay time period, the reset-delay time period will not be initiated.

Display
In normal operating mode, all settings can be checked at any time by pressing the UP or DOWN keys.
Additionally, the frequency is displayed. However, this frequency does not correspond to the device's accuracy and is only designed for diagnostic purposes.
In the case of wiring errors and system failures corresponding diagnostic messages are displayed on the display.

Parameterization using the display
See attached form page 49

Change tracking
To detect non permitted changes of the settings, the menue item change tracking is available. This setting allows to activate a counter once, which is then incremented with each confirmed change of the settings. After activation of this function the user cannot reset the counter or disable this function again.
Only at variant /_ _ 1

Digital selection via the software Inputs: SW1 to SW4
Four various frequency modes with different response parameters, can be configured via the software Inputs: SW1 to SW4 (see Table). The electric power supply for the inputs should be between 10V DC and 26.4V DC to GND. A switchover configuration can also be undertaken during the operating mode. Should a frequency mode be altered whilst operating, then the switchover time period (t_U) will commence, provided the output relays are switched on through the switchover, and the start-up delay time period has expired. During this time period, no speed evaluation will be conducted and the output relays remain energized (closed). Should during the switchover time period the speed modus again be altered, then the switchover time will not again be initiated. After the expiry of the switchover time period, the monitoring function will be continued at the currently set frequency mode). The switchover time period, for example can affect the overriding of an alarm message during the start-up stage- or the braking stage -of a generator or electric motor.

SW1	SW2	SW3	SW4	Mode
0	0	1	1	Frequency mode 1
0	1	1	0	Frequency mode 2
1	0	0	1	Frequency mode 3
1	1	0	0	Frequency mode 4

Caution !

Any continuously repeated switching over of the frequency modus (always immediately after the expiry of the switchover time period) can lead to the situation, that the equipment starts to function similarly as in the 'Muting Mode' (i.e. the frequency monitoring function is overridden and the output relays remain permanently on).

Muting function
The frequency monitoring function can be overridden on the display and by an appropriate activation of the software Digital Inputs: SW1 to SW4. For this purpose, the muting function should be activated when parametering on the display. Once this function is activated, then it will continue to be possible to continue to switch over between the frequency moduses: 1 to 3, as described above. Should a selection be made of the frequency mode 4 (muting) via the 'SW' software inputs, then no further frequency monitoring will be conducted. The output relays remain permanently on and the start-up delay function (t_A), the switchover time period function (t_U), the reset-delay function (t_F) and the alarm-delay function (t_V) will all be reset.

Analogue output A+ and A GND
The analogue output 2-10 V shows the actual measured frequency. The maximum value of the analogue output (10 V) is equal to the adjusted upper frequency threshold. The minimum value of the analogue output (2 V) is equal to the adjusted lower frequency threshold. The scaling is frequency linear.
In the monitoring function „underfrequency" the maximum value of the analogue output is equal to the highest possible setting value of the device (Variant UH 6937/0_ _ = 600 Hz and UH 6937/1_ _ = 1000 Hz).
In the monitoring function „overfrequency" the minimum value of the analogue output is equal to 0 Hz.
If the muting function is selected, the maximum value of the analogue output is equal to the maximum setting value of the device (Variant UH 6937/0_ _ = 600 Hz and UH 6937/1_ _ = 1000 Hz) and the minimum value is equal to 0 Hz.
In the case of a failure the analogue output goes to 0V.
The analogue output is not safety related. It can be used for diagnosis.

Switchover time period t_U
The switchover time period expires when the frequency mode is altered during operations at the Software Inputs: SW1 to SW4, the output contacts are closed, no start-up delay function is running and the Switchover Time Period: 'tU' has not already been initiated and/or is running. During this time period, no frequency monitoring is conducted and the output contacts remain on.

The parameterization menü has follow structure: Illustration shows the factory setting [4]

1.	Parameterization			
	1.1	Monitoring function		
		Overfrequency	x	
		Underfrequency	-	
		Inside range	-	
		Outside range	-	
		Esc		OK
	1.2	Limits		
		Frequency mode 1		[1]
		upper limit		[2]
		400.0 Hz		
		lower limit		[3]
		200.0 Hz		
		Frequency mode 2		
		upper limit		
		400.0 Hz		
		lower limit		
		200.0 Hz		
		Frequency mode 3		
		upper limit		
		400.0 Hz		[1]
		lower limit		
		200.0 Hz		
		Frequency mode 4		
		upper limit		
		400.0 Hz		
		lower limit		
		200.0 Hz		
		Esc		OK
	1.3	Hysteresis		
		5 %		
		Esc		OK
	1.4	Time Delay		
		Start-up delay		
		0.0 s		
		Response delay		
		0.0 s		
		Alarm delay		
		0.1 s		
		Changeover bridging		[1]
		0.0 s		
		Esc		OK
	1.5	Alarm memory		
		Alarm memory	x	
		Automatic reset	-	
		Esc		OK
	1.6	Muting function		
		activate	-	
		deactivate	x	
		Esc		OK
	Esc			OK

2.	Display settings			
	2.1	Languages		
		english	x	
		deutsch	-	
		français	-	
		Esc		OK
	2.2	Contrast		
		50	%	
		Esc		OK
	2.3	Backlight		
		OFF	-	
		10 s	x	
		1 min	-	
		5 min	-	
		Esc		OK
	2.4	Status indicator		
		Manual	x	
		10 s	-	
		1 min	-	
		5 min	-	
		Esc		OK
	Esc			OK
3.	Factory settings			
		Parameters		
		Display settings		
		Parameter + display settings		
	Esc			OK
4.	Change tracking			
		activate		
	Esc			OK
Esc				OK

[1] only available at variant /_ _1.
[2] not available at monitoring function „underfrequency“.
[3] not available at monitoring function „overfrequency“.
[4] Customers specific variants have other factory settings. They are available on request.

Technical Data

Frequency Measuring Input

Voltage range
E1a-E2L, E1b-E3L: AC 8 ... 280 V
E1a-E2H, E1b-E3H: AC 16 ... 690 V
(dependent to frequency see characteristic)
Input frequency:
Variante /0_ _: < 700 Hz
Variante /1_ _: < 1200 Hz
Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts
Response value
Variant /0_ _: adjustable from 1 Hz ... 600 Hz
Variant /1_ _: adjustable from 1 Hz ... 1000 Hz
Pulse frequency inverters
Variant /0_ _: ≥ 1 kHz
Variant /1_ _: ≥ 2 kHz
Measuring accuracy: < ± 2 %
Stability of the setting threshold at variation of auxiliary voltage and temperature: < ± 1 %
Hysteresis: adjustable from 2 ... 10 % of the set response value
Reaction time of frequency monitoring: Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms + adjusted response delay
Alarm delay t_V: adjustable from 0.1 ... 100 s
Start up time delay t_A: adjustable from 0 ... 100 s
Reset delay t_F: adjustable from 0 ... 100 s
Switchover time period t_U: adjustable from 0 ... 100 s
Accuracy of the adjustable times: < ± 5 %
Time between connection of auxiliary supply and ready to mesure: approx. 1.5 s (with start up delay is 0)

Auxiliary circuit (A1-A2)

Auxiliary voltage U_H (galvanic separation to measuring input): DC 24 V
The power supply shall meet the requirements of SELV / PELV.
Voltage range: 0.8 ... 1.1 U_H
Nominal consumption: typ. 3.2 W
Short-circuit protection: Internal PTC
Overvoltage protection: Internal VDR
Duty-cycle Reset button: > 3 s

Output

Contacts: 2 NO contacts
Contact type: Relay forcibly guide
Thermischer Strom I_{th}: 8 A
(see current limit curve)
Switching capacity
to AC 15: 3 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1
to DC 13: 4 A / DC 24 V at 0.1 Hz
Electrical life
at 5 A, AC 230 V cos φ = 1: > 2.2 x 10^5 switch. cycl. IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 10 A gL IEC/EN 60 947-5-1
Mechanical life: 20 x 10^6 switching cycles
Semiconductor monitoring output: DC 24 V, 50 mA, plus switching
Analogue output: 2 ... 10 V, max. 10 mA

Technical Data

General Data

Nominal operating mode: continuous operation
Temperature range
operation: - 20 ... + 60°C
storage: - 20 ... + 70°C
Altitude: < 2.000 m
Clearance and creepage distance
rated impuls voltage /
pollution degree:
measuring input to the remainder: 6 kV / 2 IEC 60 664-1
output to the remainder: 4 kV / 2 IEC 60 664-1
EMC IEC/EN 61 326-3-1, IEC/EN 62 061
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 V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0,35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: DIN 46 228-1/-2/-3/-4
Wire fixing: captive slotted screw
Mounting: DIN-rail IEC/EN 60 715
Weight: approx. 320 g

Dimensions

Width x height x depth: 45 x 107 x 121 mm

Standard Type

UH 6937.02PS/61 DC 24 V
Article number: 0066820
- Output: 2 NO contacts
- Auxiliary voltage U_H: DC 24 V
- Width: 45 mm

Ordering Example

UH 6937 .02 _ _ /_0_ /61 DC 24 V

- DC 24 V: Nominal voltage
- /61: UL-approval
- /_0_: 0 = Standard; 1 = with different frequency mode and analogue output
- _ _: Max. response value; 0 = 600 Hz; 1 = 1000 Hz
- .02: Type of terminals; PS (plug in screw): pluggable terminal blocks, with screw terminals
- UH 6937: Contacts; Type

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL60947, "general use applications"

Standards:
- ANSI/UL 60947-1, 5th Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-5-1, 3th Edition (Low-Voltage Switchgear and Controlgear Part5-1: Control circuit Devices an Switching Elements - Electro-mechanical Control Circuits Devices)
- CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition (Low-Voltage Switch-gear and Controlgear - Part1: General rules)
- CAN/CSA-C22.2 No. 60947-1-14, 1st Edition (Low-Voltage Switch-gear and Controlgear - Part5-1: Control circuit Devices an Switching Elements - Electromechanical Control Circuits Devices)

Nominal voltage U_N:
DC 24 V: Device must be supplied with a Class 2 or a voltage / current limited power supply.

Switching capacity:
Semiconductor monitoring outputs: 24Vdc, 50mA, pilot duty

Switching capacity
Relay output
device free-standing:
Ambient temperature 60°C: Pilot duty B300, Q300
8A 250Vac G.P.
8A 24 Vdc

Device mounted without distances heated by devices with same load:
Ambient temperature 55°C: Pilot duty B300, Q300
5A 250Vac G.P.
5A 24 Vdc

Ambient temperature 60°C: Pilot duty C300, Q300
4A 250Vac G.P.
4A 24 Vdc

Voltage range
E1a-E2L, E1b-E3L: AC 8 ... 280 V
E1a-E2H, E1b-E3H: AC 16 ... 600 V

Wire connection
Ambient temperature
60°C, 4A bzw. 55°C, 5A: min. 75°C aluminum or copper conductors

Ambient temperature
60°C, 8A: min. 90°C aluminum or copper conductors

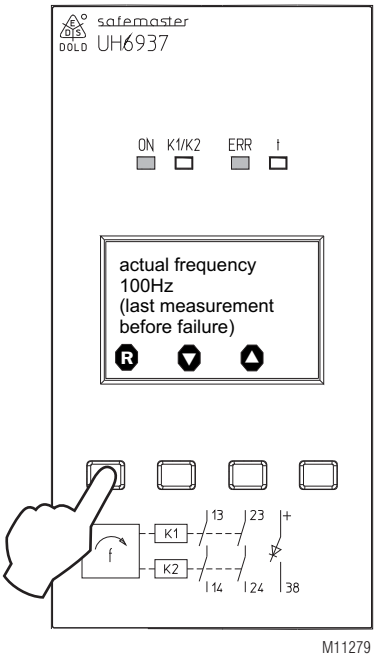
Technical data that is not stated in the UL-Data, can be found in the technical data section.

Troubleshooting

Failure	Potential cause
LED „ON" does not light up	- Power supply A1+/A2 not connected
LED „ON" flashes red	- Parameterization error (detailed description on display)
LED „ERR" flashes red	- External failure (detailed description on display)
LED „ERR" continuously on	- Device failure (if the failure still exists after restart, replace device)

Fault handling

When faults are detected on or in the device they are indicated on the display by an appropriate message. If a reset of the device is necessary due to the fault, at first the alarm and the associated diagnostic message have to be acknowledged. Then, the left key has to be pressed for approx. 3 sec. to initiate a reset of the device.

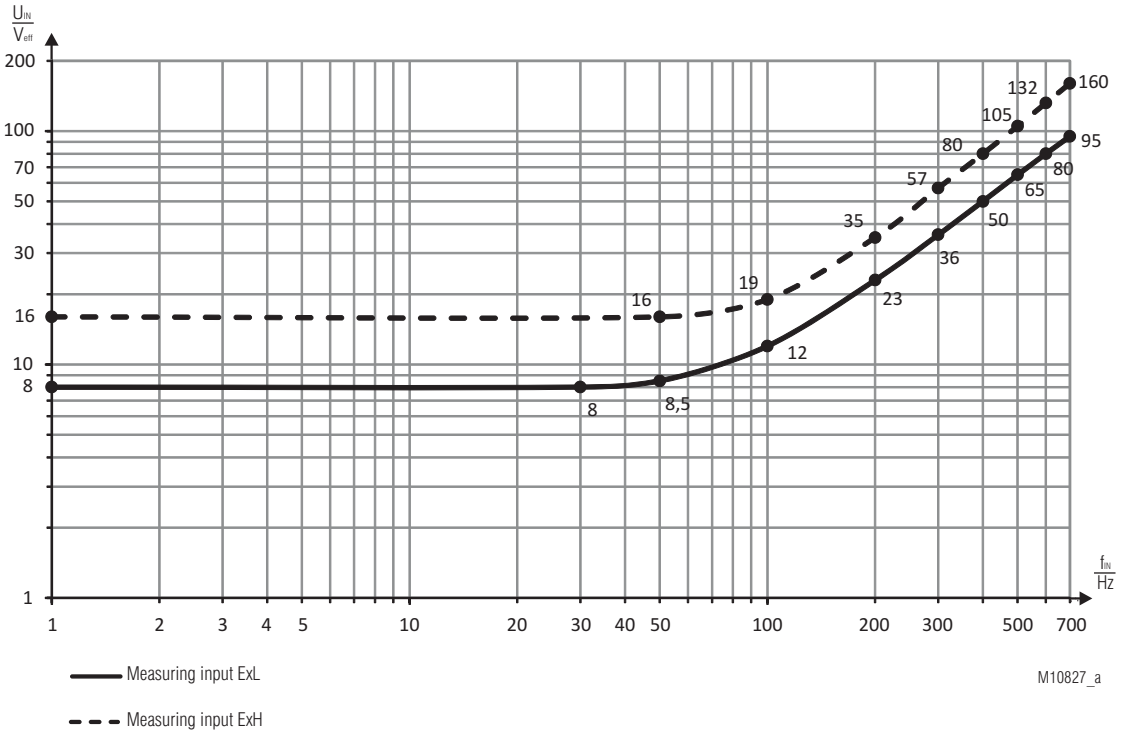


M11279

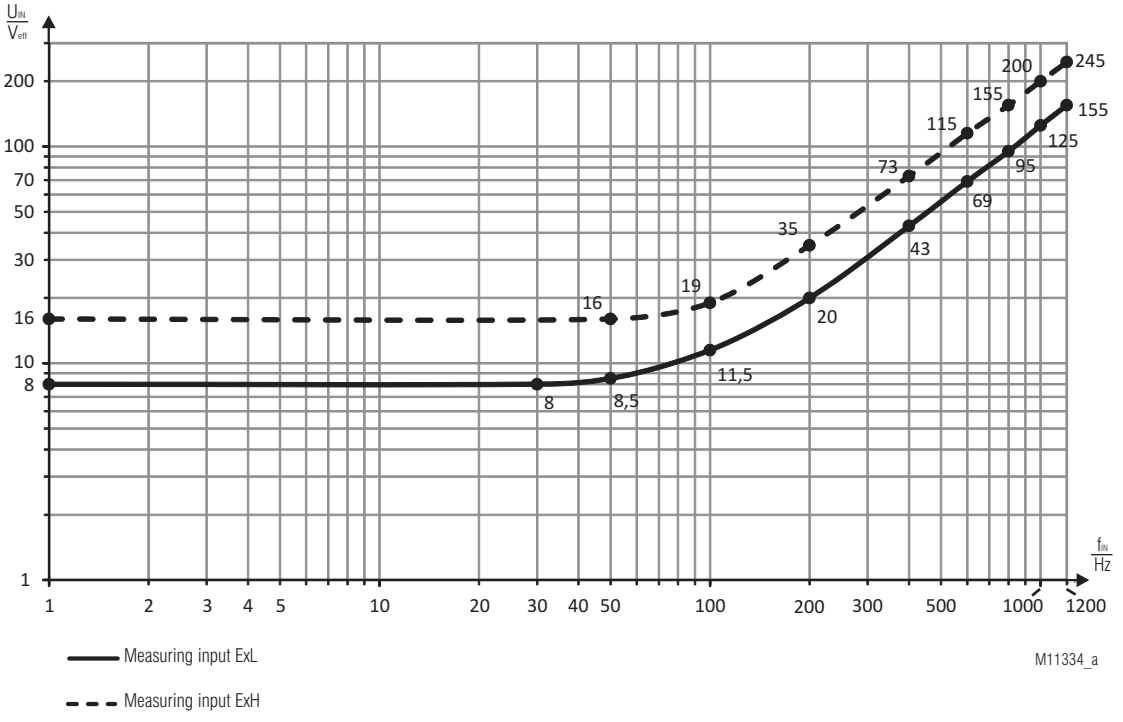
If a system failure is detected again after restart the device must be replaced and sent back to manufacturer.

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.

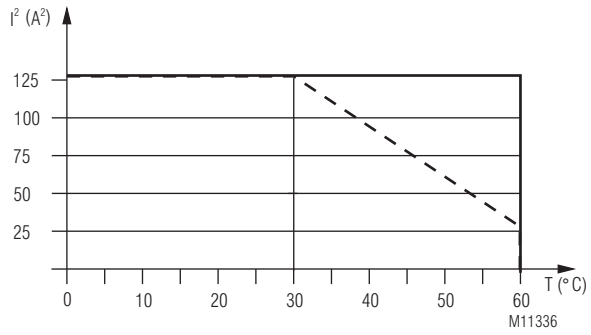


Min. voltage at measuring input for variant /0_ _



Min. voltage at measuring input for variant /1_ _

Characteristic



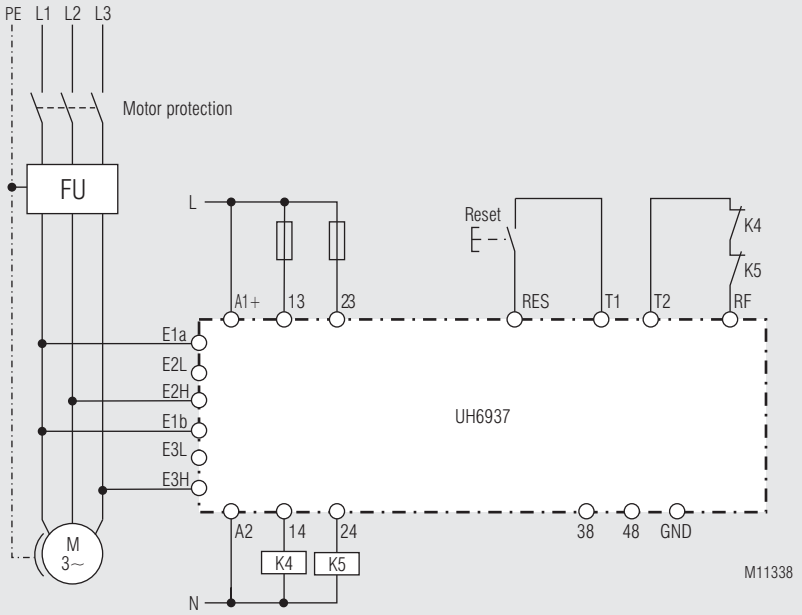
device free-standing
max. current at 60°C over
2 contact path = 8A $\hat{=}$ $2x8^2A^2 = 128A^2$

device mounted without distance heated by
devices with same load,
max. current at 60°C over
2 contact path = 4A $\hat{=}$ $2x4^2A^2 = 32A^2$

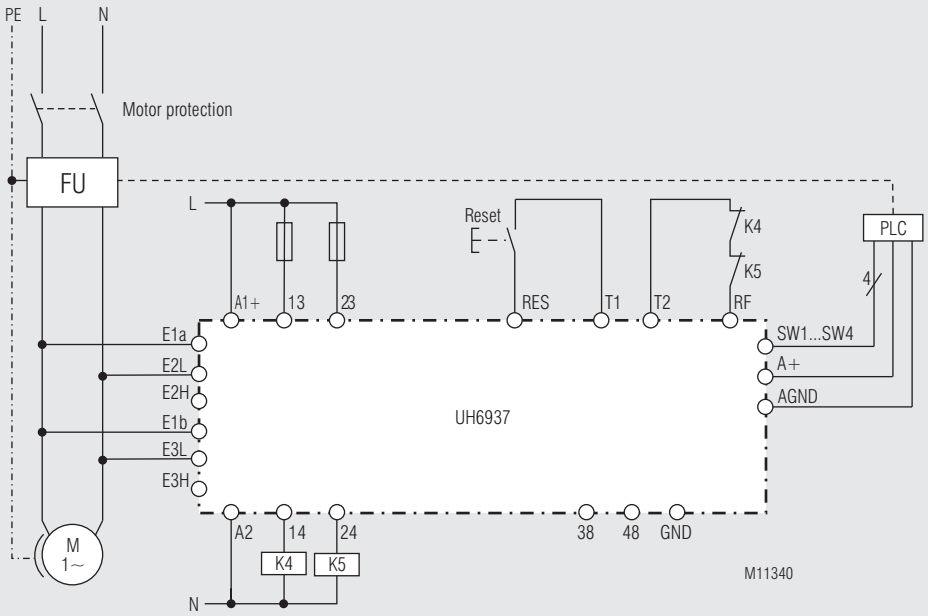
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - current in contact paths

Quadratic total current limit curve

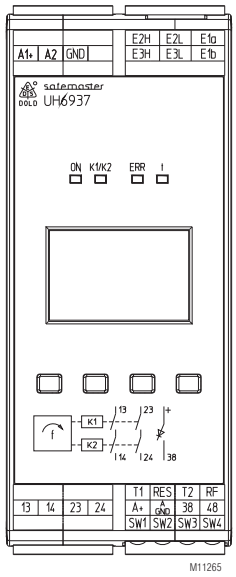


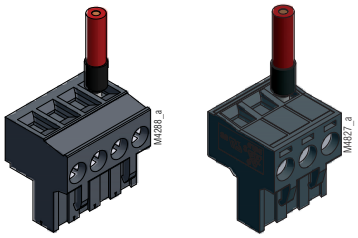
Inverter monitoring function, 3-phase, suited up to SIL3, Performance Level e, Cat. 4



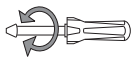
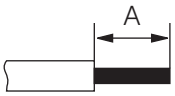
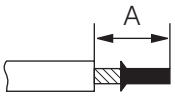
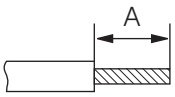
Inverter monitoring function, single-phase with variant UH6937/_ _1, suited up to SIL3, Performance Level e, Cat. 4

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

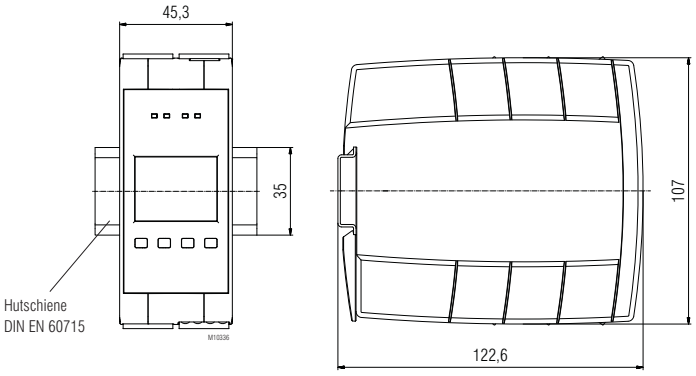




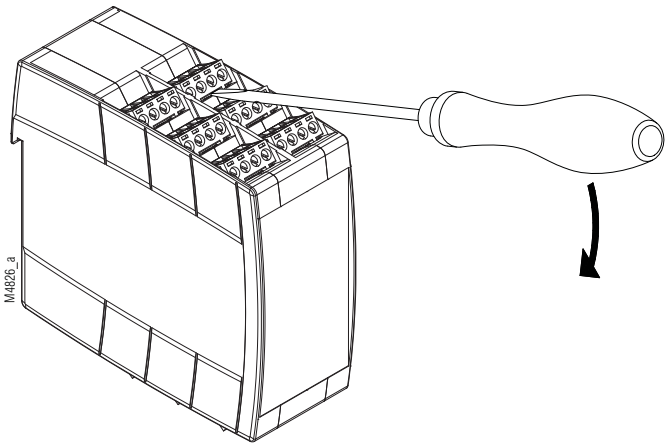
PS

	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN
	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18
	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18
	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS-Klemmenblöcke**
EN	**Mounting / disassembly of the PS terminal blocks**
FR	**Montage / Démontage des borniers PS**



DE	**Demontage der steckbaren Klemmenblöcke (Stecker)** 1. Gerät spannungsfrei schalten. 2. Schraubendreher in die frontseitige Aussparung zwischen Stecker und Frontplatte hineinschieben. 3. Schraubendreher um seine Längsachse drehen. 4. Beachten Sie bitte, dass die Klemmenblöcke nur auf dem zugehörigen Steckplatz montiert werden.
EN	**Removing the terminal blocks with cage clamp terminals** 1. The unit has to be disconnected. 2. Insert a screwdriver in the side recess of the front plate. 3. Turn the screwdriver to the right and left. 4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.
FR	**Démontage des borniers amovibles** 1. Mise hors tension de l'appareil 2. Enfoncer un tourne-vis dans la fente entre la face avant et le bornier 3. Tourner le tourne-vis pour libérer le bornier 4. Tenir compte du fait que les borniers ne doivent être montés qu'à leur place appropriée

DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	139,6	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)

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:	99,0	%
PFH_D:	1,9E-10	h^{-1}
PFD_{AVG}:	8,2E-05	(Low Demand Mode)
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät im High Demand Mode		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application at High Demand Mode		Intervall for cyclic test of the safety function
Consigne résultante de la fonction sécuritaire de l'appareil au High Demand Mode		Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

DE	Bei längeren Stillstandszeiten wird eine Überprüfung der Sicherheitsfunktion empfohlen.
EN	During longer periods of inactivity a test of the safety function is recommended.
FR	Un contrôle de la fonction sécuritaire doit être effectué en cas d'arrêts prolongés.

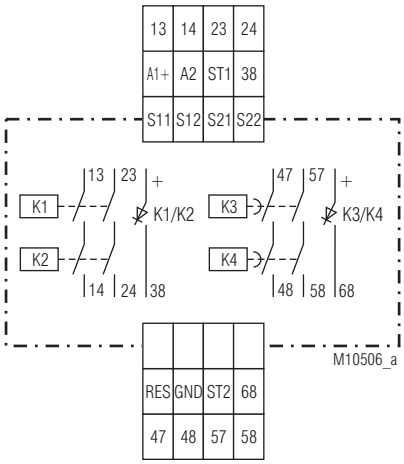
SAFEMASTER C
Multifunctional Safety Timer
UG 6960

0269008

Product Description

The multifunction safety timer UG 6960 provides protection of men and machines by enabling and disabling a safety circuit. This is done by the adjusted time delay function. Simply select 1 out of 5 delay functions with a rotary switch – ready. The adjusted time is safe over the complete setting range. The UG 6960 is available for different safety functions. It has safe delayed and instantaneous contacts.

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1 +	DC 24 V
A2	0 V
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
47, 48, 57, 58	Forcibly guided NO contacts for delayed contacts
38, 68	Semiconductor monitoring output
GND	Reference potential for Semiconductor monitoring output
S11, S21	Control output
S12, S22, ST1, ST2, RES	Control input

Your Advantage

- **Various delay functions adjustable at device:**
  - Release delay
  - Release delay retriggerable
  - On delay
  - Fleeting on make / break
  - Delay function settable via potentiometer
- **Various safety functions defined:**
  - E-Stop
  - Safety gate
  - Two-hand control
  - Safety mat / Safety edge
  - Exclusive or contacts
  - Light curtain
- Manual or auto start
- Instantaneous contact and safety delayed contacts
- 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 instantaneous contact and 2 NO contacts delayed
- 1 semiconductor output for instantaneous contacts
  1 semiconductor output for delayed contacts
- LED indicator for operation, safety function, time delay 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

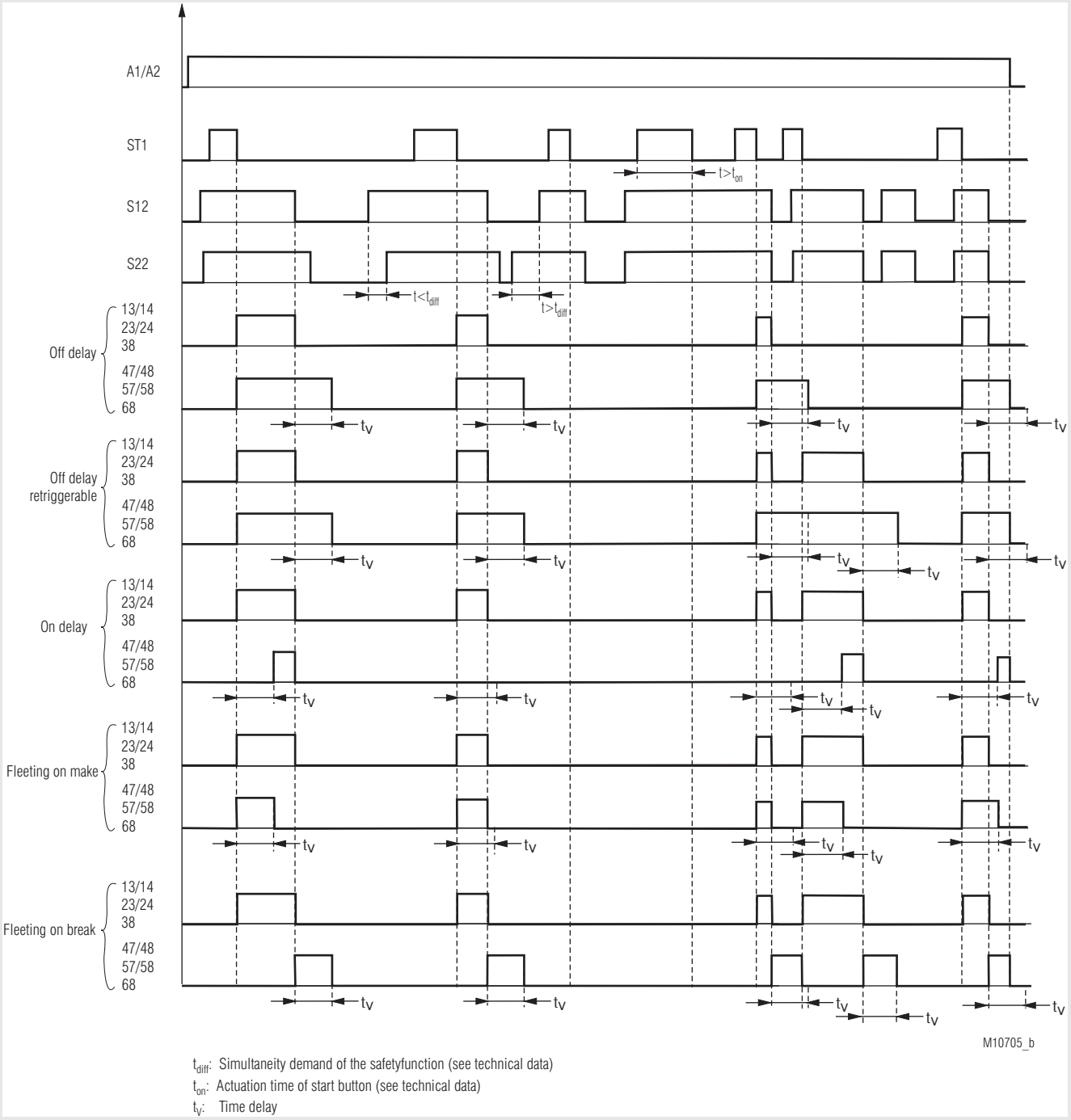
Application

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

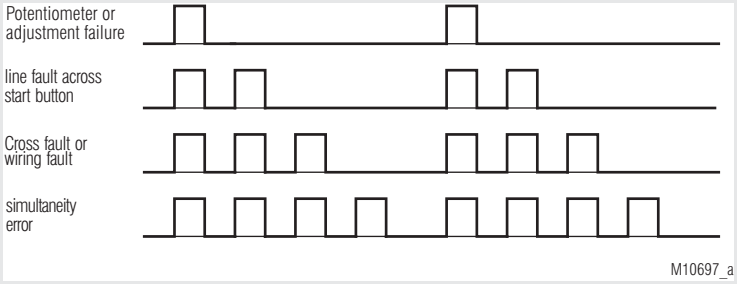
green LED ON:	on, when supply connected
red LED ERR:	on, at internal error flashes at external error
green LED K1/K2:	on, when relay K1 and K2 energized (instantaneous contact) flashes at external errors
green LED K3/K4:	on, when relay K3 and K4 energized (delayed contacts) flashes during time delay

Function Diagram

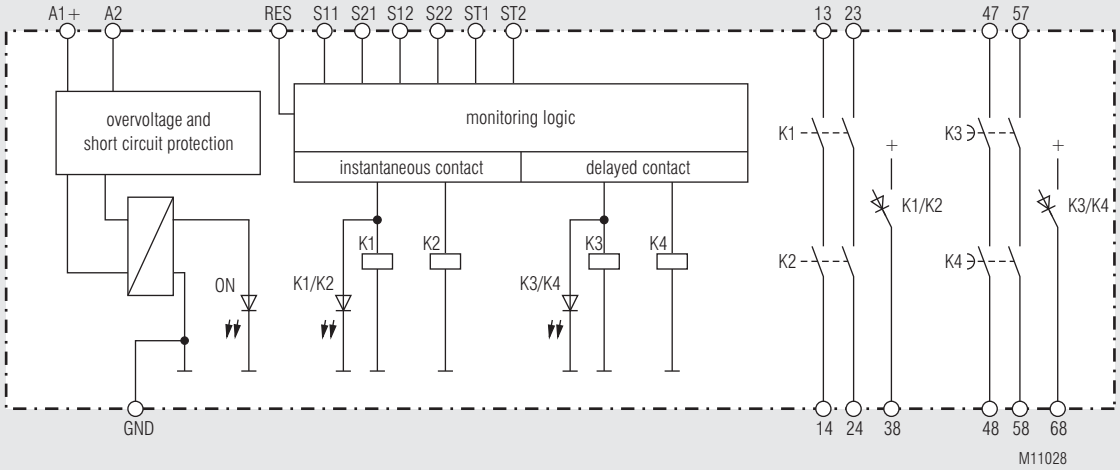


t_{diff}: Simultaneity demand of the safetyfunction (see technical data)
t_{on}: Actuation time of start button (see technical data)
t_V: Time delay

Fault Indication by Flashing Code



Block Diagrams



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.
Only an automatic start at safety function two-hand control /3_ _ 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.

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 delay mode
On the variant /_0_ the delay mode can be set via rotary switch t_{Fkt} .
Possible functions:

t_{Fkt}	Function
1	Release delay
2	Release delay retriggerable
3	On delay
4	Fleeting on make
5	Fleeting on break

Description of the time delay functions

Off delay
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the adjusted time delay is started. After elapse of the delay time the delayed contacts switch off.
Restarting of the output contacts is only possible after the time is fully elapsed.

Off delay retriggerable
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the adjusted time delay is started. After elapse of the delay time the delayed contacts switch off.
On before the time is elapsed, or the the external failure is removed and reset and the starting conditions are fulfilled (manual or auto start) the delayed contacts remain switched on.

On delay
If the sensors/switches of the safety function are switched on the adjusted time delay is started. After elapse of the delay time the delayed contacts switch on. If the sensors/switches of the safety function are switched off before the time is elapsed, the time is stopped and the delayed safety contacts remain switched off. When the sensors/switches of the safety function are switched on again then the time delay is started from the beginning.

Practical Notes

Fleeting on make
If the sensors/switches of the safety function are switched on, the delayed contacts are switched on and the adjusted time delay is started. After elapse of the delay time the delayed contacts switch off.
If the sensors/switches of the safety function are switched off before the time is elapsed the delayed safety contacts are also switched off.

Fleeting on break
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the delayed safety contacts are switched on and the adjusted time delay is started.
After elapse of the delay time the delayed contacts switch off. If the sensors/switches of the safety function are switched off before the time is elapsed the delayed safety contacts are also switched off again.

Adjusting the time delay
With rotary switch t_{max} the time range for the delayed contacts is selected. With rotary switch t the time is adjusted within the selected range in 10 % steps.
Example: required time = 0.8 s

1. Example:
t_{max} = 1 s ; t = 0.8 ≥ t_v = t_{max} x t = 1 s x 0.8 = 0.8 s

2. Example:
t_{max} = 2 s ; t = 0.4 ≥ t_v = t_{max} x t = 2 s x 0.4 = 0.8 s

Repeat accuracy
The repeat accuracy of the delayed contact depends on different factors:

Repeat accuracy t_W = system reaction time[1] ± 1 % of t_v

[1] Pick up or drop off time depending on delay mode

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:	typ. 8 mA at U_N
Min. voltage on terminals	
S12, S22 when relay activated:	DC 10 V

Output

Contacts	2 NO instantaneous contacts 2 NO delayed contacts

The NO contacts can be used for safe braking.

Delay t_v		
ranges at /_ _0:	8 time ranges in one unit (seconds or minutes) settable via rotational switch	
	0.1 ... 1	1.0 ... 10
	0.2 ... 2	3.0 ... 30
	0.3 ... 3	10 ... 100
	0.5 ... 5	30 ... 300
	other times on request	
fixed at /_ _1:	seconds or minutes	
	1, 2, 3, 5, 10, 30, 100, 300	
	other times on request	
Time setting in:		
10% steps of		
max. time range value		
Repeat accuracy:	see formula	
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	
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:	< 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:	< 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	
Simultaneity demand:	< 1 s	

Technical Data

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:	> 1.5 x 10^5 switching cycles	
Permissible operating frequency		
instantaneous contact:	max. 1800 switching cycles / h	
delayed contact:	max. 360 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	
Semiconductor monitoring output		
(not safety):	1 for instantaneous contact 1 for delayed contact max. 50 mA DC 24 V, plus switching	

General Data

Nominal operating mode:	continuous operation	
Temperature range		
Operation:	- 25 ... + 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	IEC/EN 61 326-3-1, IEC/EN 62 061	
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	
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire fixing:	captive slotted screw or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 250 g	

Dimensions

Width x height x depth:	
UG 6960 PS:	22.5 x 110 x 120.3 mm
UG 6960 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

Switching capacity:

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 6960.04PS/100/61 DC24V 300 s

Article number:	0065424
• Safety function:	e-stop
• Delay function:	adjustable
• Time delay:	adjustable
• Output:	2 NO contacts instantaneous contacts 2 NO contacts delayed contacts
• Nominal voltage:	DC 24 V
• Width:	22.5 mm

Variants

UG 6960 .04 _ _ / _ _ _ /61 DC 24 V 300 s

- max. time range or fixed time
- Nominal voltage
- UL-approval
- Time delay
  - 0 = adjustable
  - 1 = fixed
- Delay function
  - 0 = adjustable
- Safety function
  - 1 = e-stop, with cross fault detection
  - 2 = safety gate, with cross fault detection
  - 3 = two-hand control, with cross fault detection
  - 4 = safety mat / Safety edge, with cross fault detection
  - 5 = Exclusive or contacts, with cross fault detection
  - 6 = e-stop, without cross fault detection
  - 7 = safety gate, without cross fault detection
  - 8 = light curtain, without cross fault detection
- 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

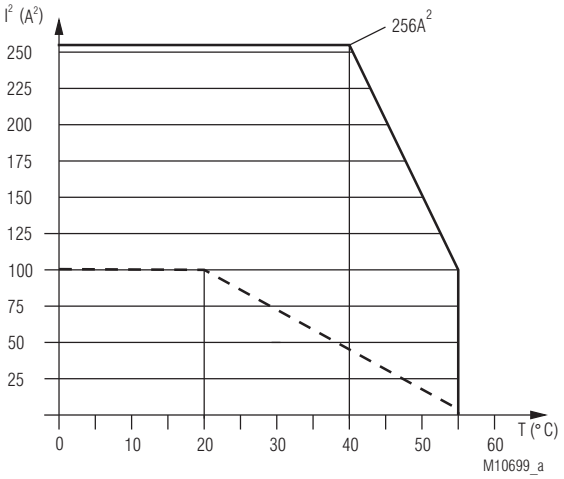
Troubleshooting

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



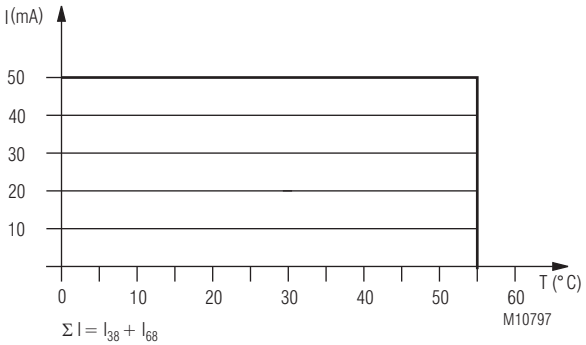
device free-standing
max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

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

Quadratic total current limit curve output contacts



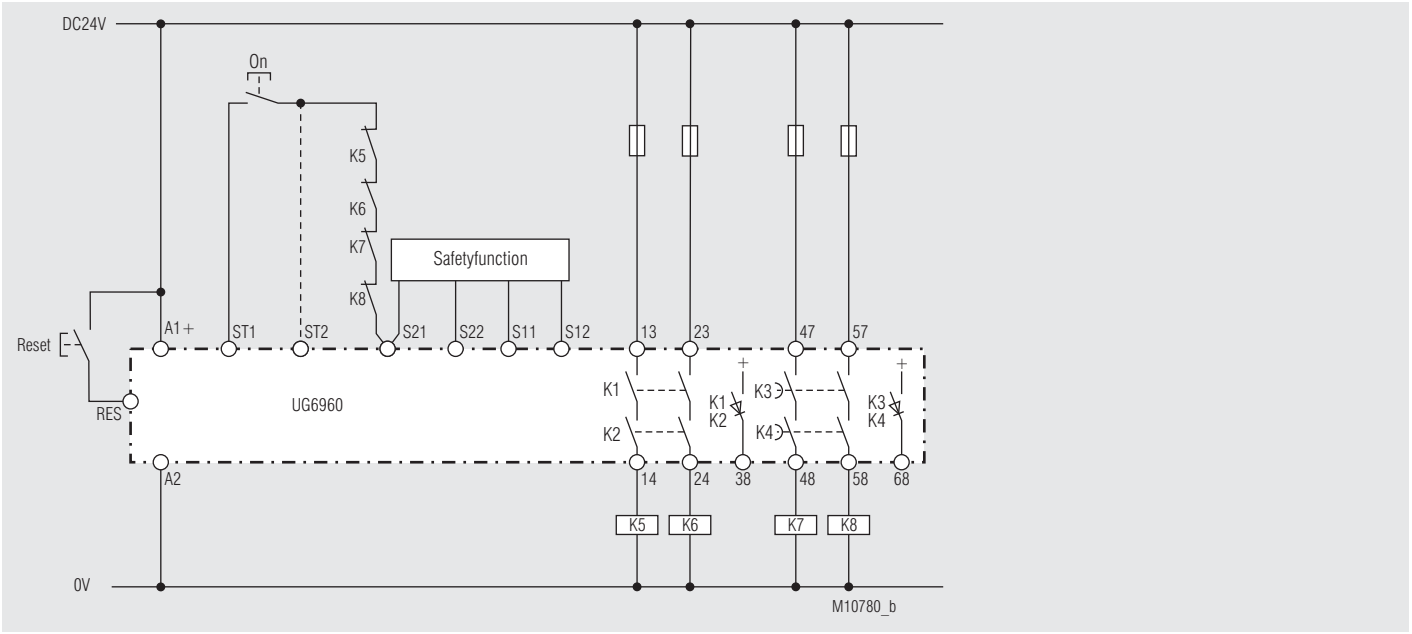
$\Sigma I = I_{38} + I_{68}$

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

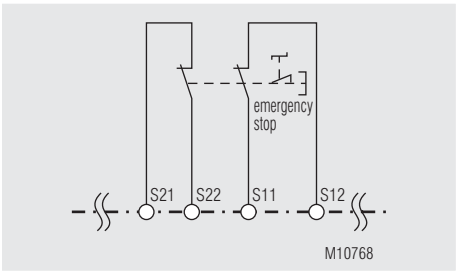
I_{38} - current semiconductor output 38

I_{68} - current semiconductor output 68

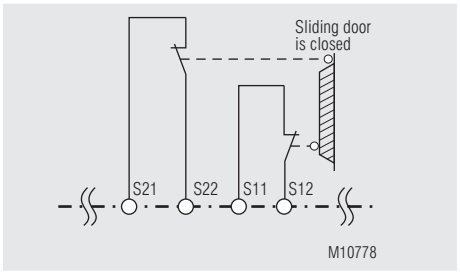
Quadratic total current limit curve semiconductor monitoring outputs



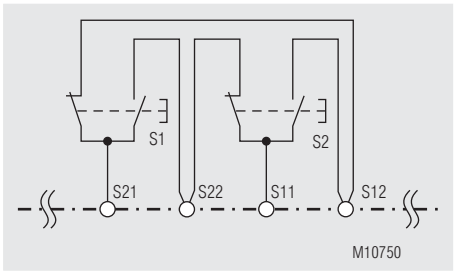
Safetyfunction: see below, Manual-Start (for automatic start make a bridge to ST2 instead of ON button).
Delay function: release delay (1)
K1/K2 instantaneous contact, K3/K4 delayed contact



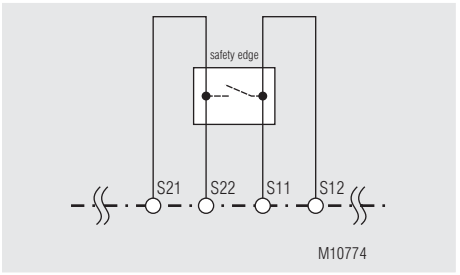
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



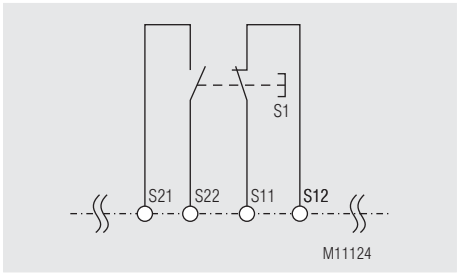
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



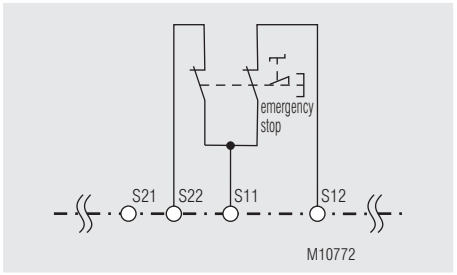
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



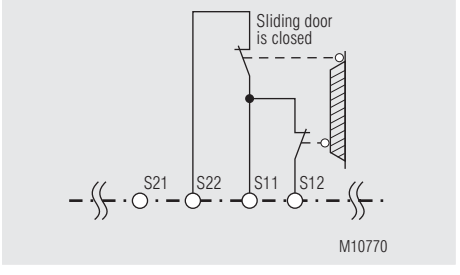
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



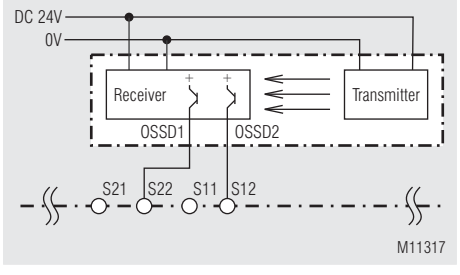
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



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



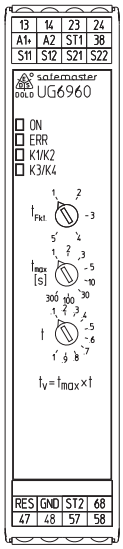
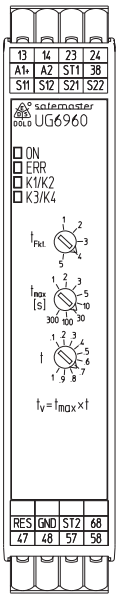
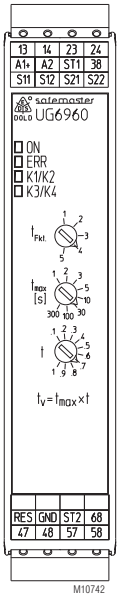
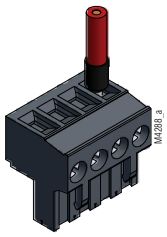
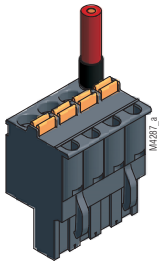
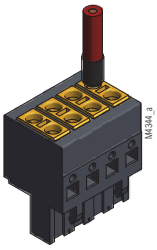
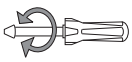
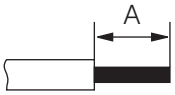
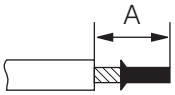
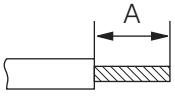
Fct.: Safety gate (7),
without cross fault detection
SIL 3, PL e, Cat. 4 [1]



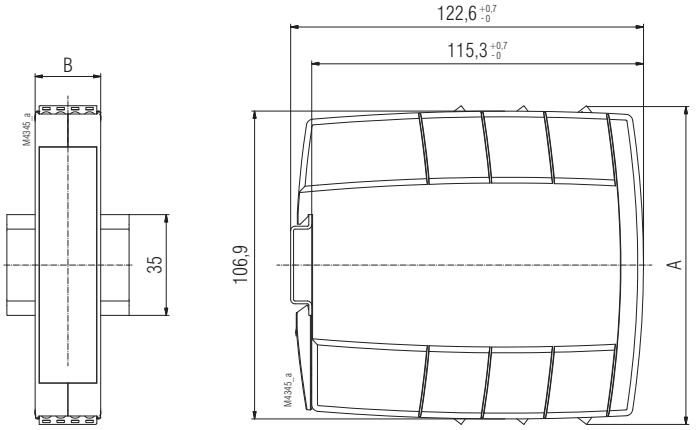
Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4 [2]

[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.

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

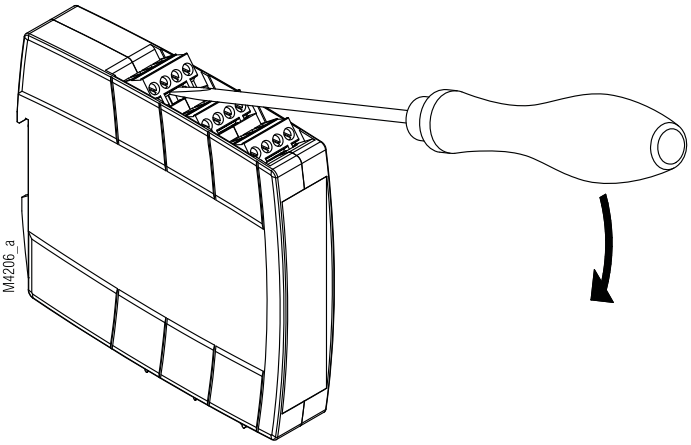
		 M10741	 M10742
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
UG 6960 PS	110 ± 1	22,5
UG 6960 PC	120 ± 1	
UG 6960 PT		

DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	133,3	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)

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:	99,0	%
PFH_D:	3,94E-10	h^{-1}
T_1	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheits-funktion an das Gerät		Intervall für zyklische Überprüfung der Sicherheitsfunktion
Demand to our device based on the evaluated neccessary safety level of the application.		Intervall for cyclic test of the safety function
Consigne résultant de la fonction sécuritaire de l'appareil		Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511, EN 50156-1	SIL 3	einmal pro Jahr once per year annuel

Info

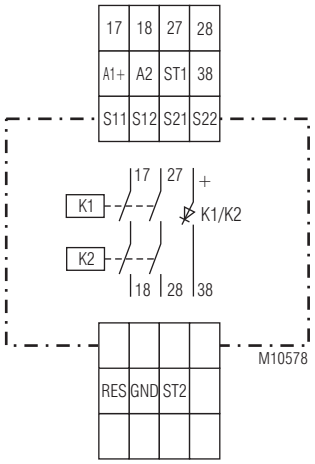
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER C
Multifunctional Safety Timer
UG 6961

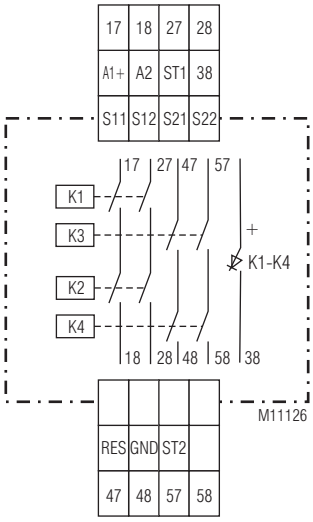
Product Description

The multifunctional safety timer UG 6961 provides protection of men and machines by enabling and disabling a safety circuit. This is done by the adjusted time delay function. Simply select 1 out of 5 delay functions with a rotary switch – ready. The adjusted time is safe over the complete setting range. The UG 6961 is available for different safety functions. It has safe delayed and instantaneous contacts.

Circuit Diagram



UG 6961.02



UG 6961.04

Your Advantage

- **Various delay functions adjustable at device:**
  - Release delay
  - Release delay retriggerable
  - On delay
  - Fleeting on make / break
  - Delay function settable via potentiometer
- **Various safety functions defined:**
  - E-Stop
  - Safety gate
  - Two-hand control
  - Safety mat / Safety edge
  - Exclusive or contacts
  - Light curtain
- 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: 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

Provide an on-delay or off-delay when a activating a safety function. 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.

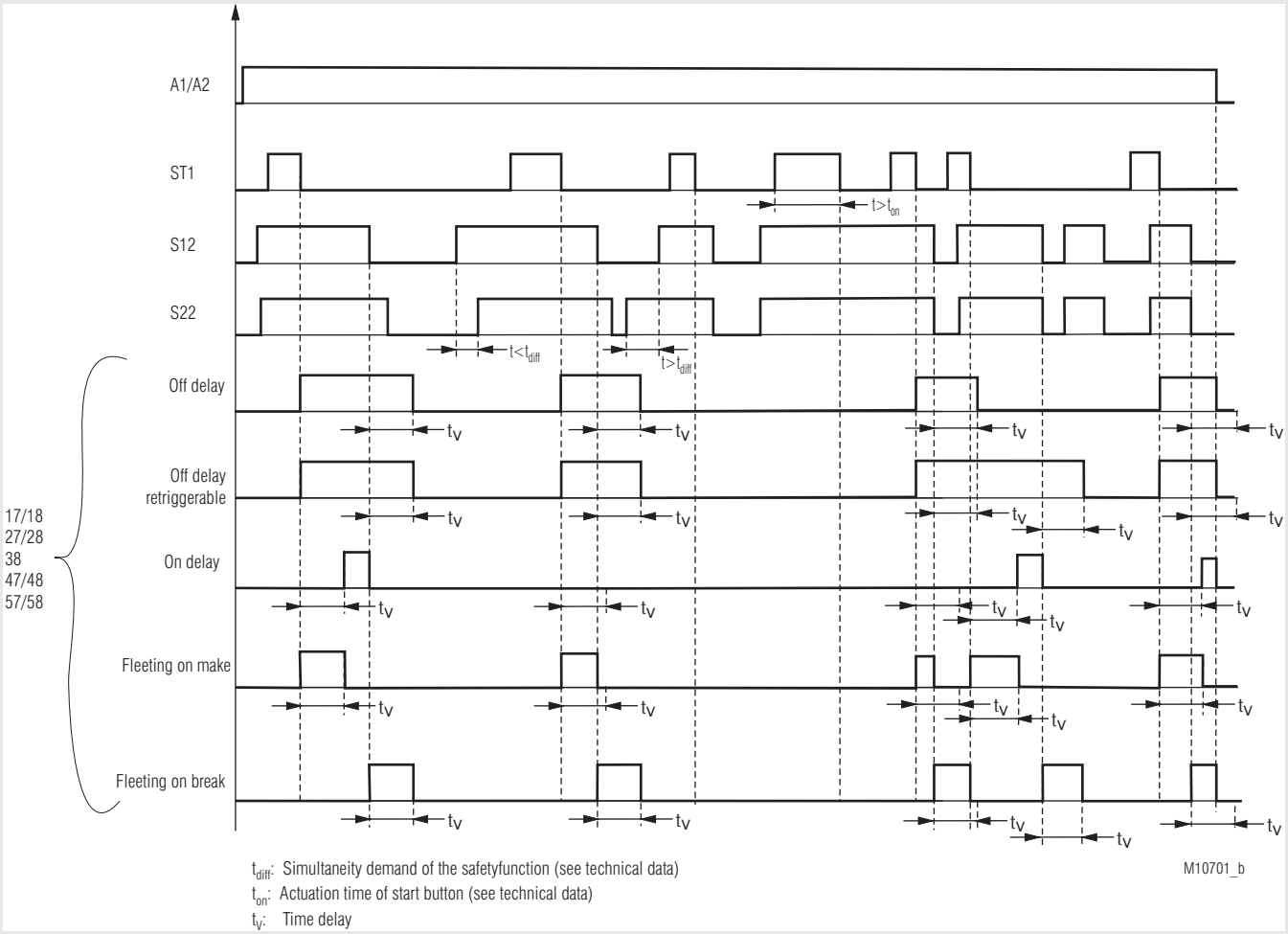
Connection Terminals

Terminal designation	Signal description
A1 +	DC 24 V
A2	0 V
17, 18, 27, 28, 47, 48, 57, 58	Forcibly guided NO contacts for delay contacts
38	Semiconductor monitoring output
GND	Reference potential for Semiconductor monitoring output
S11, S21	control output
S12, S22, ST1, ST2, RES	control input

Indicators

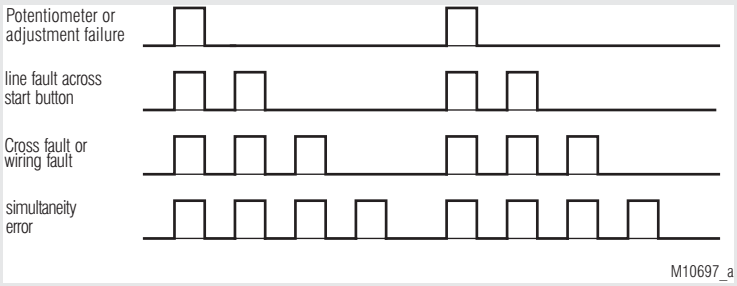
green LED ON:	on, when supply connected
red LED ERR:	on, at internal error flashes at external error
green LED K1/K2 (.02) e.g. K1-K4 (.04):	on, when relay K1 and K2 (.02) energized, e.g. when relay K1, K2, K3 and K4 (.04) energized flashes during time delay

Function Diagram

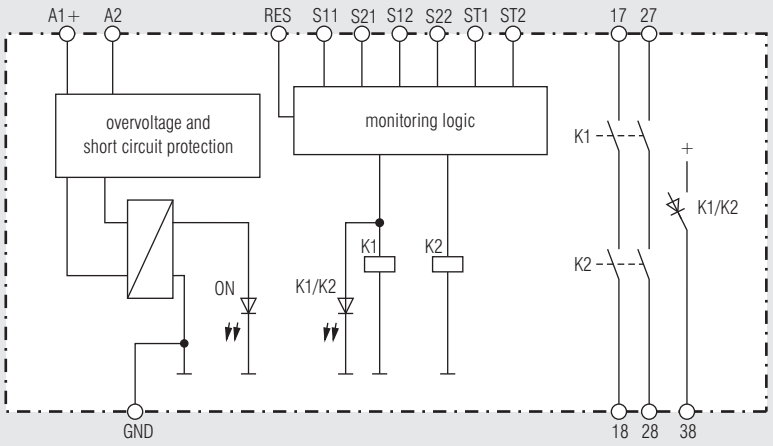


t_{diff}: Simultaneity demand of the safetyfunction (see technical data)
t_{on}: Actuation time of start button (see technical data)
t_V: Time delay

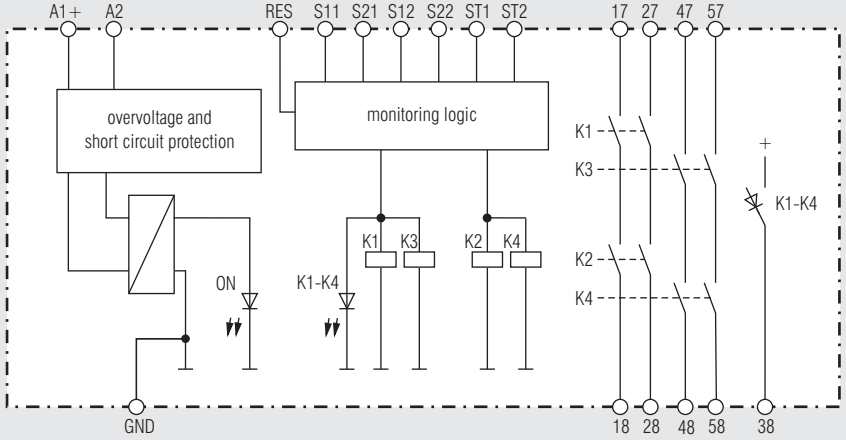
Fault Indication by Flashing Code



Block Diagrams



UG 6961.02



UG 6961.04

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.
Only an automatic start at safety function two-hand control /3_ _ 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.

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 delay mode
On the variant /_0_ the delay mode can be set via rotary switch t_{Fkt} .
Possible functions:

t_{Fkt}	Function
1	Release delay
2	Release delay retriggerable
3	On delay
4	Fleeting on make
5	Fleeting on break

Description of the time delay functions

Off delay
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the adjusted time delay is started. After elapse of the delay time the contacts switch off.
Restarting of the output contacts is only possible after the time is fully elapsed.

Off delay retriggerable
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the adjusted time delay is started. After elapse of the delay time the delayed contacts switch off.
On before the time is elapsed, or the the external failure is removed and reset and the starting conditions are fulfilled (manual or auto start) the contacts remain switched on.

On delay
If the sensors/switches of the safety function are switched on the adjusted time delay is started. After elapse of the delay time the contacts switch on.
If the sensors/switches of the safety function are switched off before the time is elapsed, the time is stopped and the safety contacts remain switched off. When the sensors/switches of the safety function are switched on again then the time delay is started from the beginning.

Practical Notes

Fleeting on make
If the sensors/switches of the safety function are switched on, the contacts are switched on and the adjusted time delay is started. After elapse of the delay time the contacts switch off.
If the sensors/switches of the safety function are switched off before the time is elapsed the safety contacts are also switched off.

Fleeting on break
If the sensors/switches of the safety function are switched off or an external failure in the safety function is detected, the safety contacts are switched on and the adjusted time delay is started.
After elapse of the delay time the contacts switch off. If the sensors/switches of the safety function are switched off before the time is elapsed the safety contacts are also switched off again.

Adjusting the time delay
With rotary switch t_{max} the time range for the delayed contacts is selected. With rotary switch t the time is adjusted within the selected range in 10 % steps.
Example: required time = 0.8 s

1. Example:
t_{max} = 1 s ; t = 0.8 ≥ t_v = t_{max} x t = 1 s x 0.8 = 0.8 s

2. Example:
t_{max} = 2 s ; t = 0.4 ≥ t_v = t_{max} x t = 2 s x 0.4 = 0.8 s

Repeat accuracy
The repeat accuracy of the delayed contact depends on different factors:

Repeat accuracy t_W = system reaction time[1] ± 1 % of t_v

[1] Pick up or drop off time depending on delay mode

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. 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 (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:	typ. 8 mA at U_N
Min. voltage on terminals	
S12, S22 when relay activated:	DC 10 V

Output

Contacts

UG 6961.02	2 NO contacts
UG 6961.04	4 NO contacts

The NO contacts can be used for safe braking.

Delay t_v

ranges at /_ _0:	8 time ranges in one unit (seconds or minutes) settable via rotational switch	
	0.1 ... 1	1.0 ... 10
	0.2 ... 2	3.0 ... 30
	0.3 ... 3	10 ... 100
	0.5 ... 5	30 ... 300
	other times on request	
fixed at /_ _1:	seconds or minutes	
	1, 2, 3, 5, 10, 30, 100, 300	
	other times on request	

Time setting in 10% steps of max. time range value	
Repeat accuracy:	see formula
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
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:	< 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:	< 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
Simultaneity demand:	< 1 s

Technical Data

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 gG / 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	

General Data

Nominal operating mode:	continuous operation	
Temperature range		
Operation:	- 25 ... + 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	IEC/EN 61 326-3-1, IEC/EN 62 061	
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:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
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 6961 PS:	22.5 x 110 x 120.3 mm
UG 6961 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
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 6961.02PS/100/61 DC24V 300 s

Article number:	0065425
• Safety function:	e-stop
• Delay function:	adjustable
• Time delay:	adjustable
• Output:	2 NO contacts
• Nominal voltage:	DC 24 V
• Width:	22.5 mm

Variants

UG 6961 ._ _ _ _ / _ _ _ /61 DC 24 V 300 s

- 300 s: max. time range or fixed time
- DC 24 V: Nominal voltage
- /61: UL-approval
- Time delay
  - 0 = adjustable
  - 1 = fixed
- Delay function
  - 0 = adjustable
- Safety function
  - 1 = e-stop, with cross fault detection
  - 2 = safety gate, with cross fault detection
  - 3 = two-hand control, with cross fault detection
  - 4 = safety mat / Safety edge, with cross fault detection
  - 5 = Exclusive or contacts, with cross fault detection
  - 6 = e-stop, without cross fault detection
  - 7 = safety gate, without cross fault detection
  - 8 = light curtain, without cross fault detection
- 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

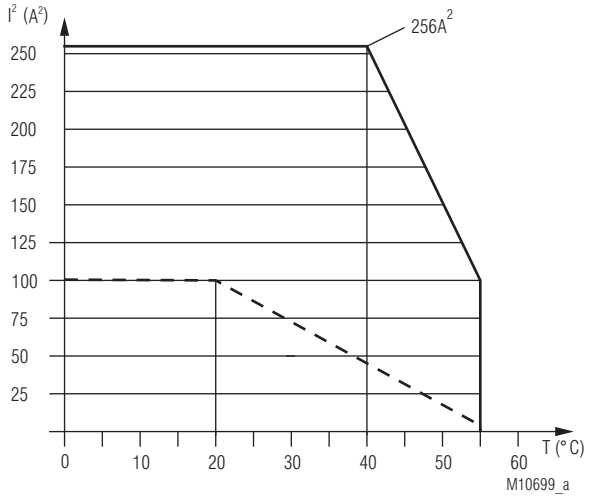
Troubleshooting

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



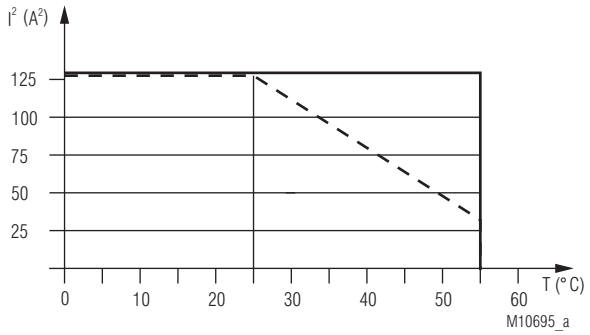
device free-standing
max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

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 6961.04
Quadratic total current limit curve



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

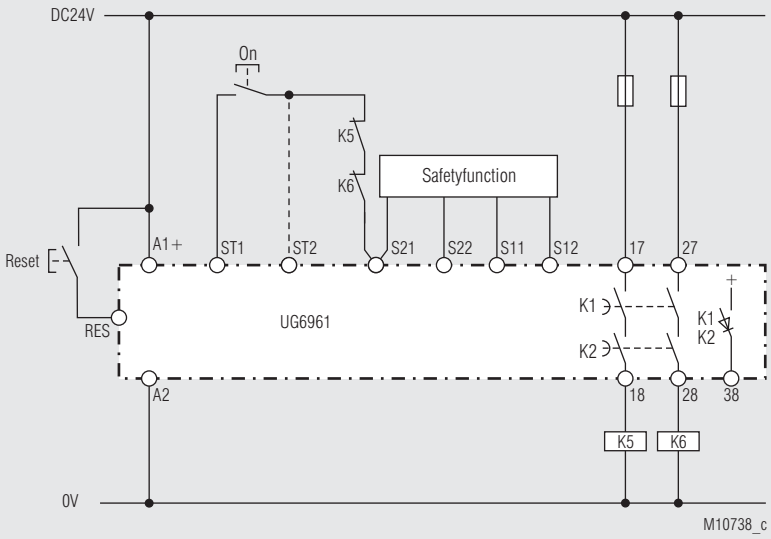
device mounted without distance heated by
devices with same load,
max. current at 55°C over
2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

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

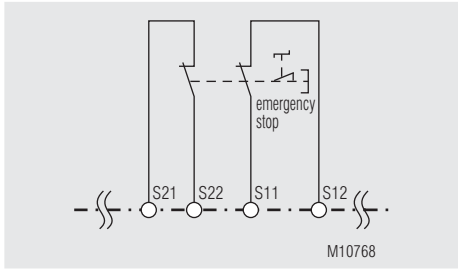
I_1, I_2 - current in contact paths

UG 6961.02
Quadratic total current limit curve

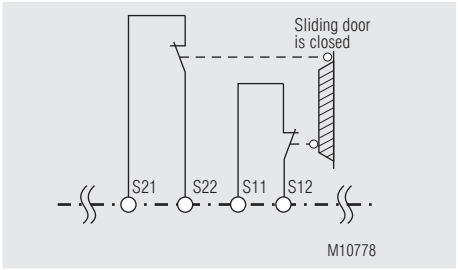
Application Examples with safety function



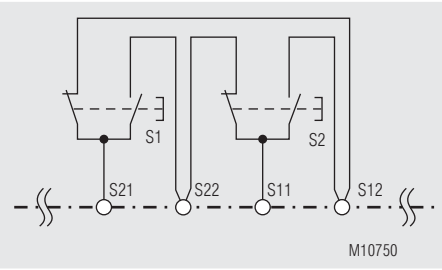
Safetyfunction: see below, Manual-Start (for automatic start make a bridge to ST2 instead of ON button).
Delay function: release delay (1)



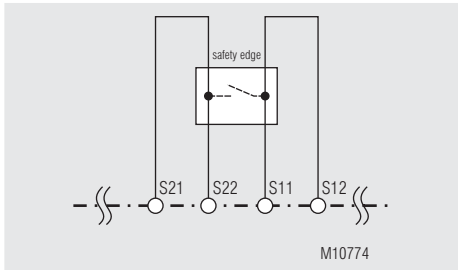
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



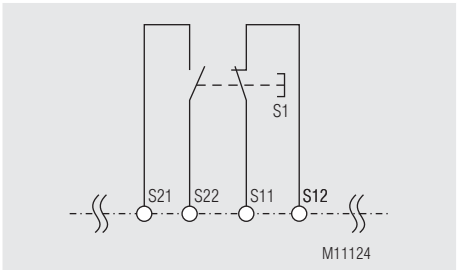
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



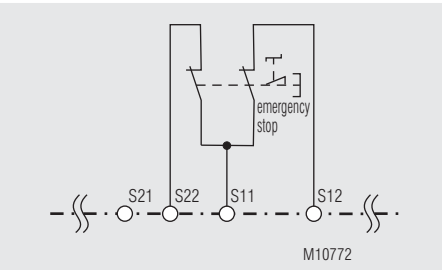
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



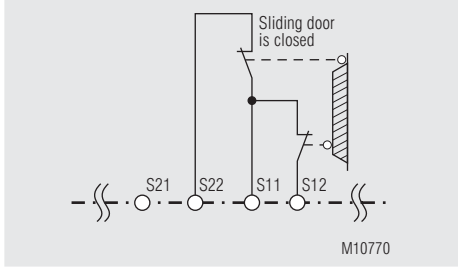
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



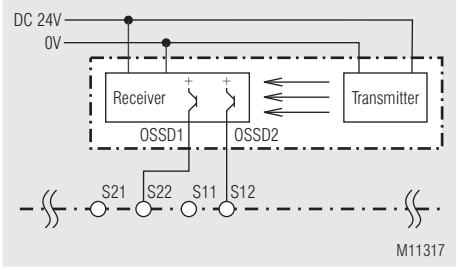
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



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



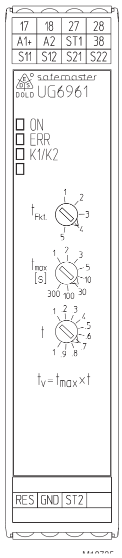
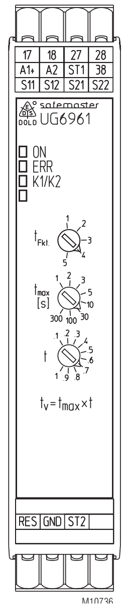
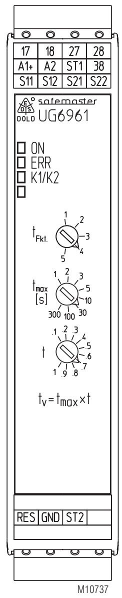
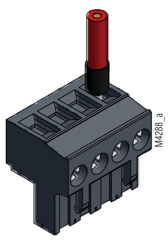
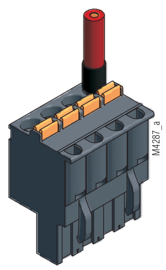
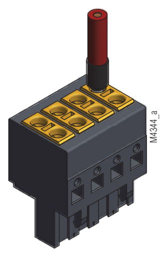
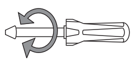
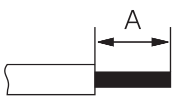
Fct.: Safety gate (7),
without cross fault detection
SIL 3, PL e, Cat. 4 [1]

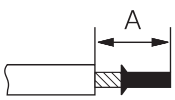


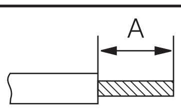
Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4 [2]

[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.

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

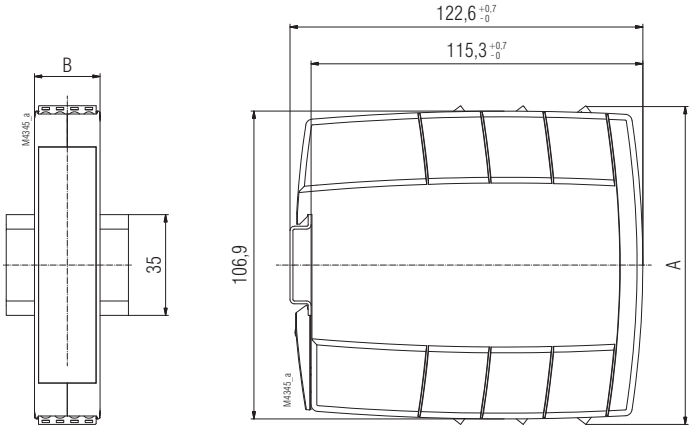
<table>
<tr>
<td></td>
<td> 
</td>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td></td>
<td> 
PS</td>
<td> 
PC</td>
<td> 
PT</td>
</tr>
<tr>
<td>  </td>
<td>DIN 5264-A; 0,6 x 3,5
0,5 Nm
5 LB. IN</td>
<td>DIN 5264-A; 0,6 x 3,5</td>
<td>DIN 5264-A; 0,4 x 2,5</td>
</tr>
<tr>
<td> 

M10248</td>
<td>A = 7 mm
1 x 0,2 ... 2,5 mm²
1 x AWG 24 to 12
2 x 0,2 ... 1,0 mm²
2 x AWG 24 to 18</td>
<td>A = 10 mm
1 x 0,2 ... 2,5 mm²
1 x AWG 24 to 12</td>
<td>A = 8 mm
1 x 0,2 ... 1,5 mm²
1 x AWG 24 to 16</td>
</tr>
<tr>
<td> 

M10249</td>
<td>A = 7 mm
1 x 0,25 ... 2,5 mm²
1 x AWG 24 to 12
2 x 0,25 ... 1,0 mm²
2 x AWG 24 to 18</td>
<td>A = 10 mm
1 x 0,25 ... 2,5 mm²
1 x AWG 24 to 12
2 x 0,25 ... 1,5 mm² mit
TWIN-Aderendhülse</td>
<td>A = 8 mm
1 x 0,25 ... 1,5 mm²
1 x AWG 24 to 16</td>
</tr>
<tr>
<td> 

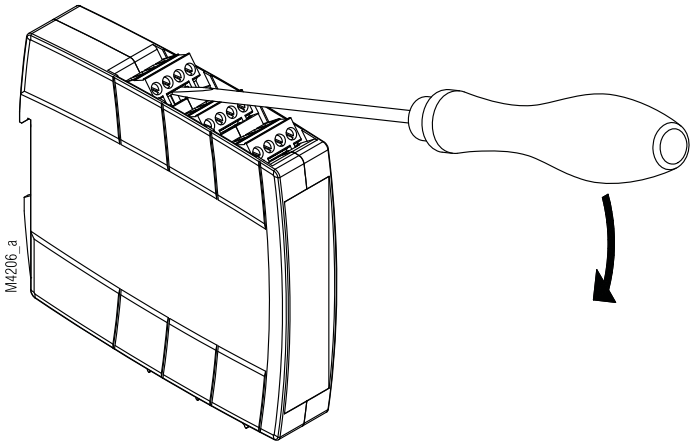
M10250</td>
<td>A = 7 mm
1 x 0,2 ... 2,5 mm²
1 x AWG 24 to 12
2 x 0,2 ... 1,5 mm²
2 x AWG 24 to 16</td>
<td>A = 10 mm
1 x 0,2 ... 2,5 mm²
1 x AWG 24 to 12</td>
<td>A = 8 mm
1 x 0,2 ... 1,5 mm²
1 x AWG 24 to 16</td>
</tr>
</table>

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
UG 6961 PS	110 ± 1	22,5
UG 6961 PC	120 ± 1	
UG 6961 PT		

DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	215,7	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)

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:	99,0	%
PFH_D:	2,33E-10	h^{-1}
T_1	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511, EN 50156-1	SIL 3	einmal pro Jahr once per year annuel

Info

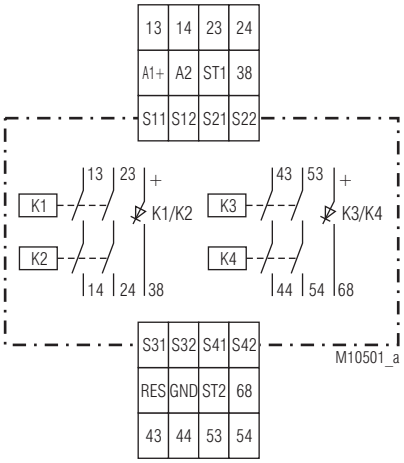
DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	The values stated above are valid for the standard type. 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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER C
Multifunctional Safety Module
UG 6970

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



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

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.

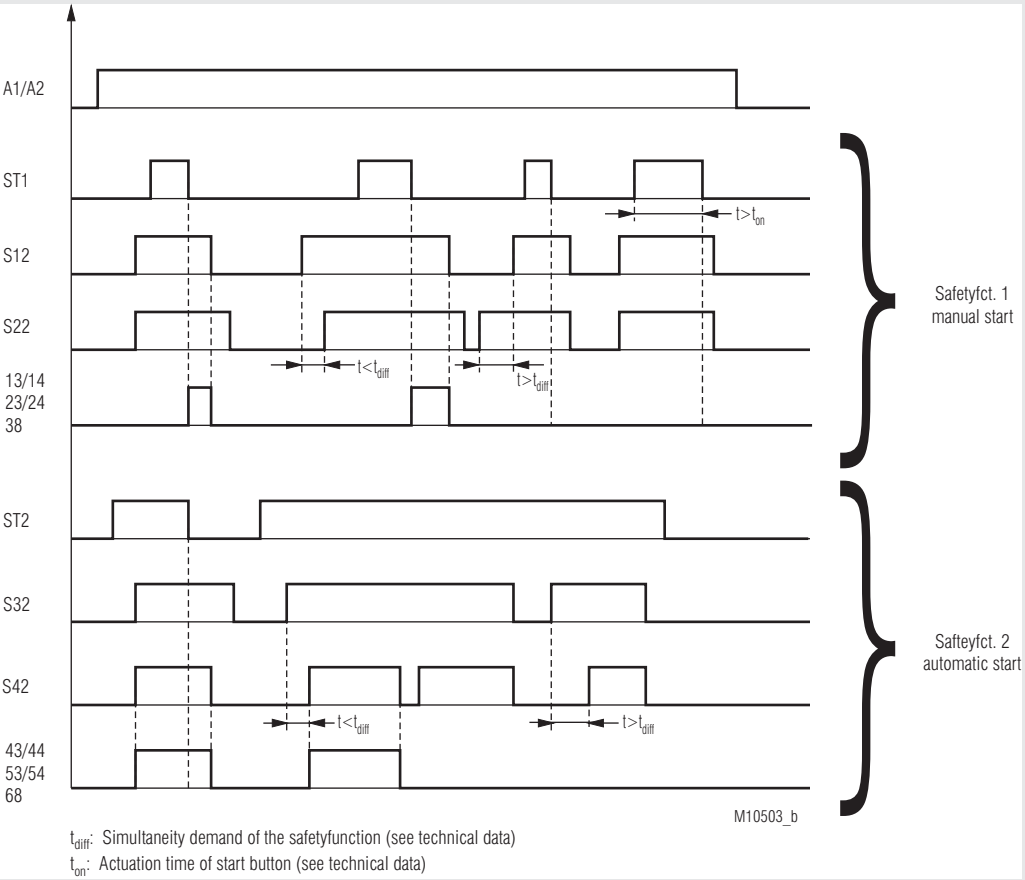
Connection Terminals

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

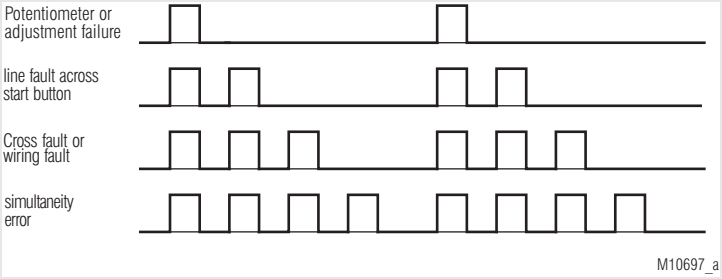
green LED ON:	on, when supply connected
red LED ERR:	on, at internal error flashes at external error
green LED K1/K2:	on, when relay K1 and K2 energized (safety function 1) flashes at external errors of safety function 1
green LED K3/K4:	on, when relay K3 and K4 energized (safety function 2) flashes at external errors of safety function 2

Function Diagram

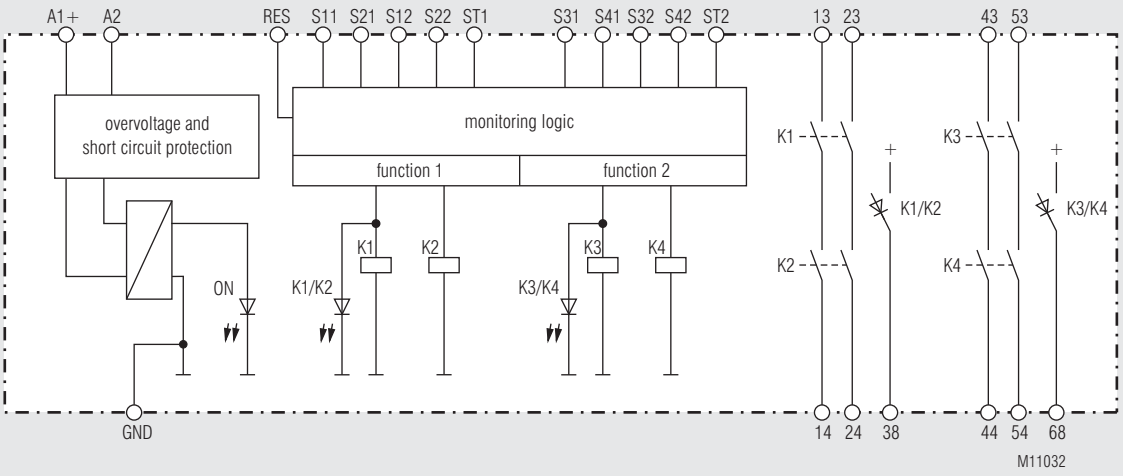


t_{diff}: Simultaneity demand of the safetyfunction (see technical data)
t_{on}: Actuation time of start button (see technical data)

Fault Indication by Flashing Code



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	

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 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:	> 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 60 947-5-1
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 ... + 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	IEC/EN 61 326-3-1, IEC/EN 62 061	
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:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
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

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
Switching capacity:	
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 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

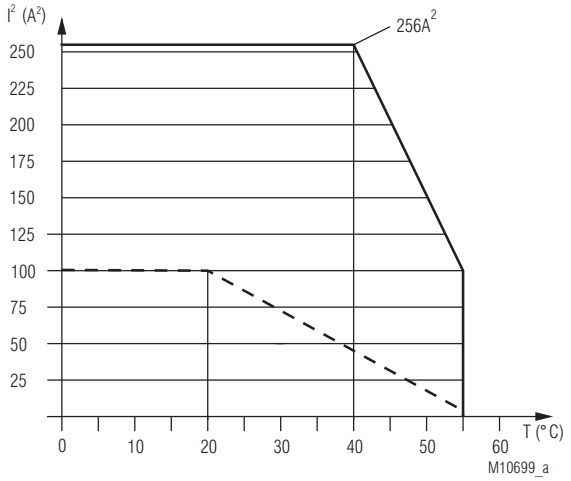
Troubleshooting

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



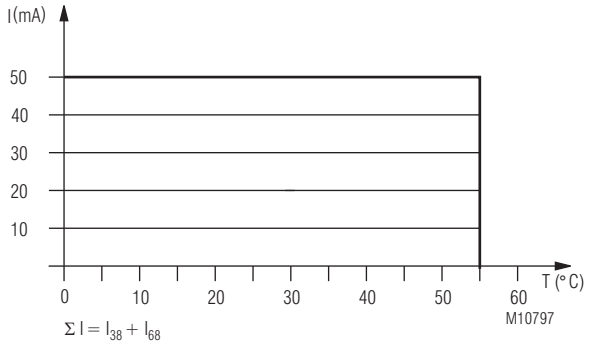
device free-standing
max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

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

Quadratic total current limit curve output contacts



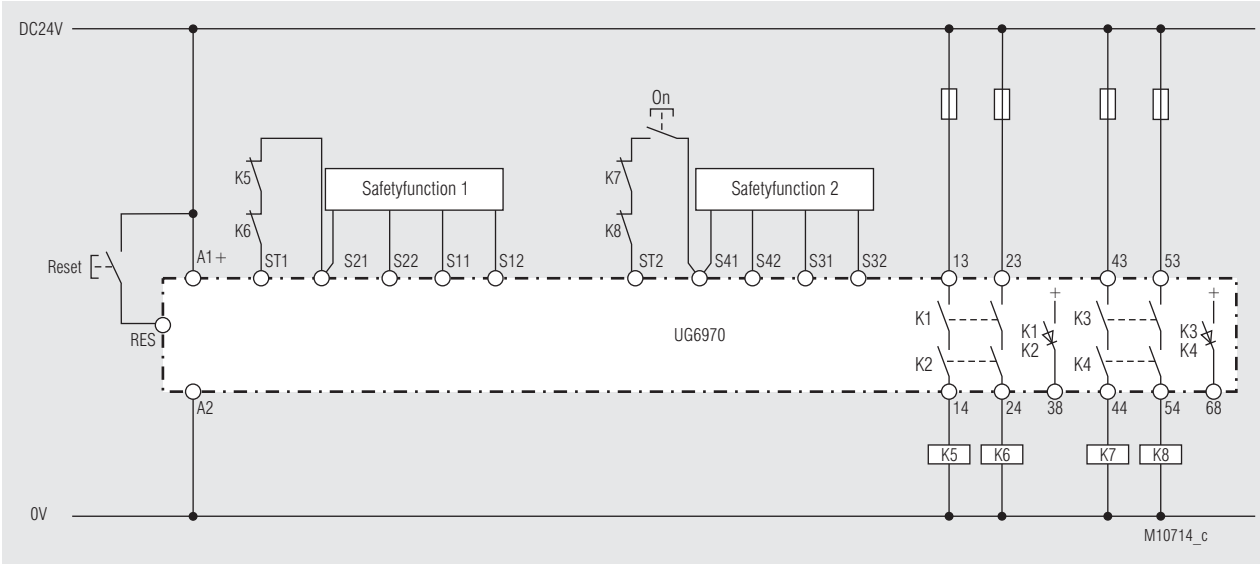
$\Sigma I = I_{38} + I_{68}$

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

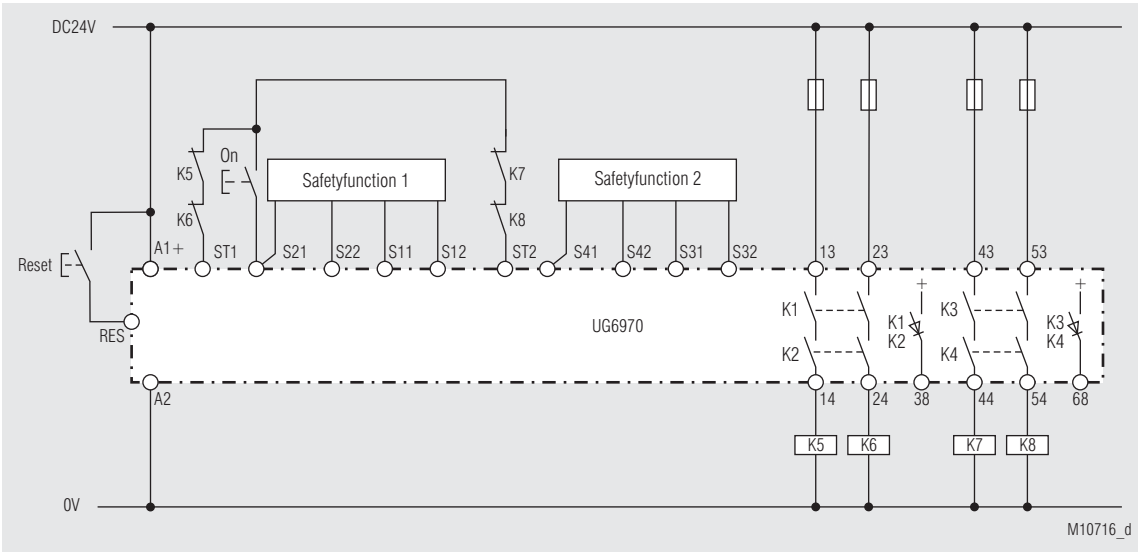
I_{38} - current semiconductor output 38

I_{68} - current semiconductor output 68

Quadratic total current limit curve semiconductor monitoring outputs

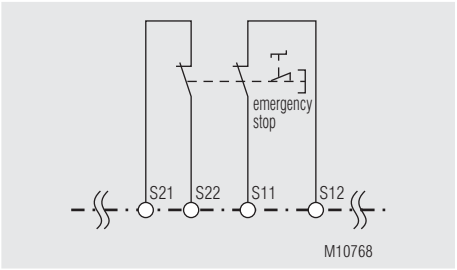


Operating mode: 3 (Fkt1=AUTO ; Fkt2=MANUAL)
Safety function 1: see page 7, Auto-Start
Safety function 2: see page 7, Manual-Start

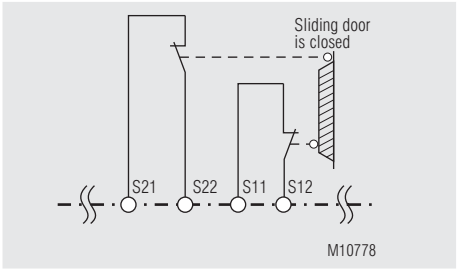


Operating mode: 5 (MANUAL with common button)
Safety function 1: see page 7, Manual-start with common button
Safety function 2: see page 7, Manual-start with common button

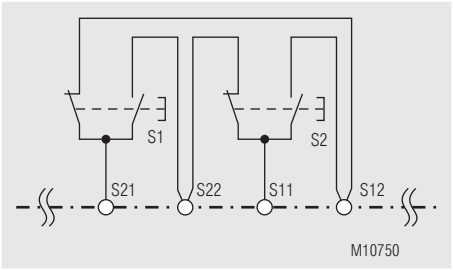
Application Examples with safety function 1



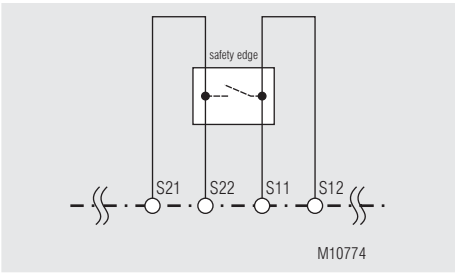
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



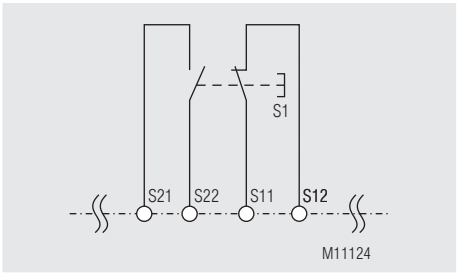
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



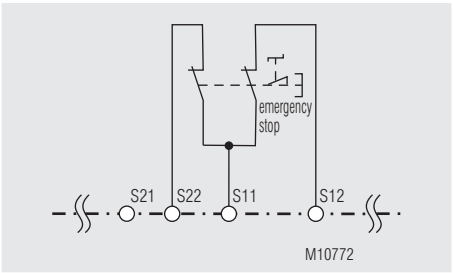
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



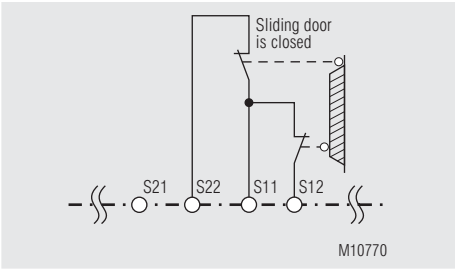
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



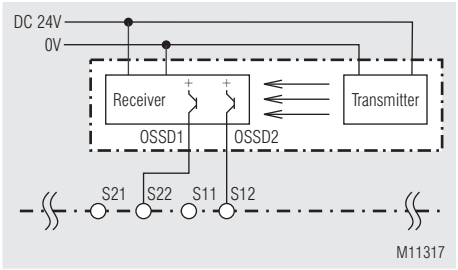
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



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]



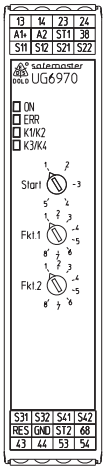
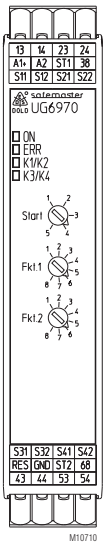
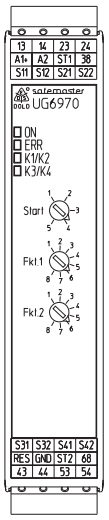
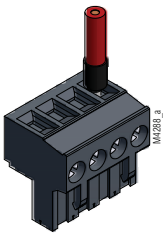
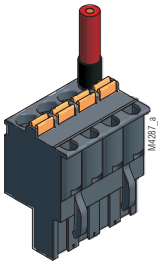
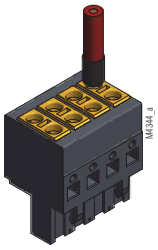
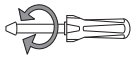
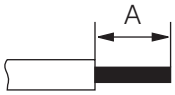
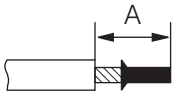
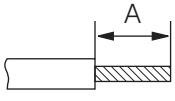
Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4 [2]

[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.

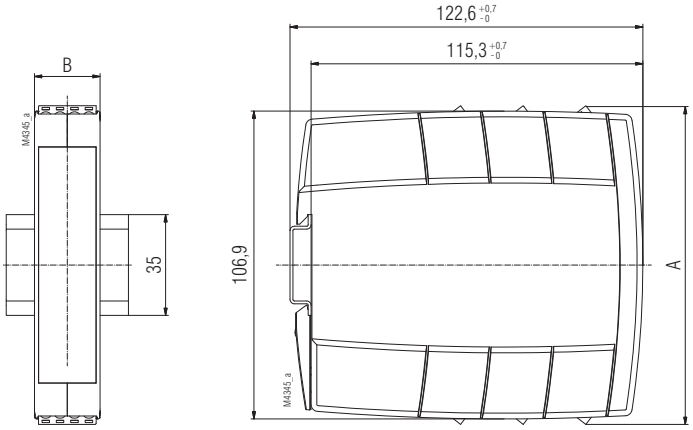
Application Examples with safety function 2

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

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

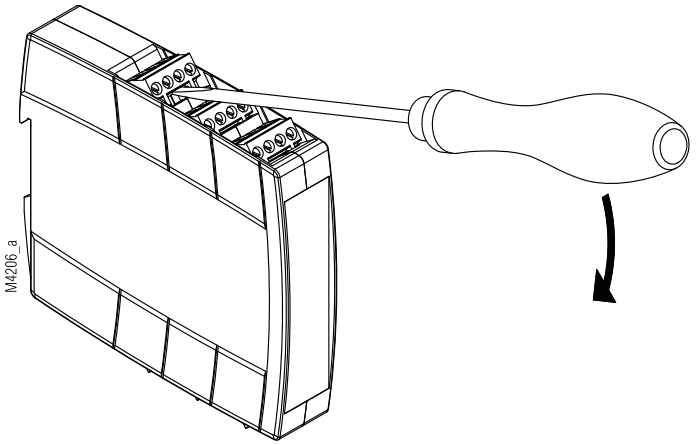
			
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
UG 6970 PS	110 ± 1	22,5
UG 6970 PC	120 ± 1	
UG 6970 PT		

DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	134,5	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)

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:	99,0	%
PFH_D:	3,89E-10	h^{-1}
T_1	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511, EN 50156-1	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

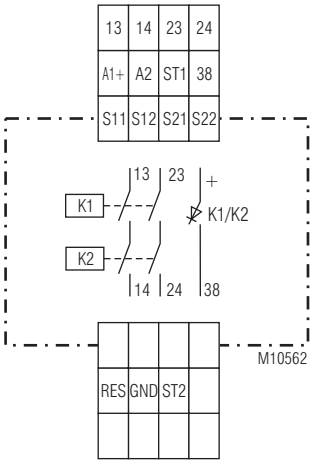
SAFEMASTER C
Multifunctional Safety Module
UG 6980

0269011

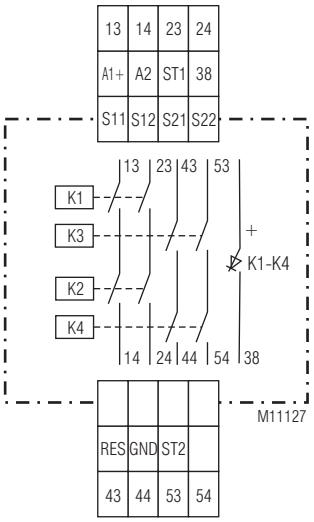
Product Description

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



UG 6980.04

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	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
- 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: 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

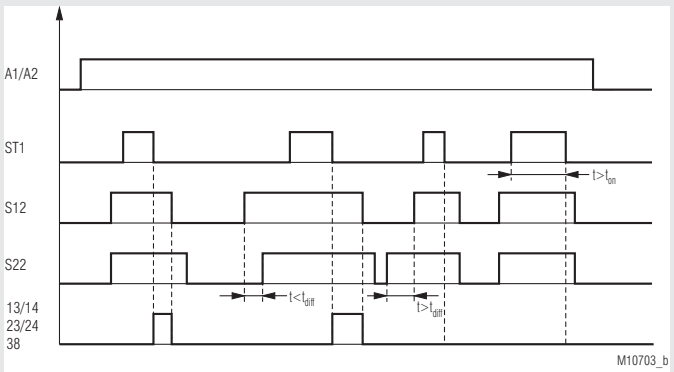
Protection of people and machines

- Emergency stop circuits on machines
- Monitoring of position switches on a safety gate
- Switch gear (FSD) for light bars with selftest (type 4) according 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)
- Switch gear for safety mats, safety edges and tape switches with a max. switching current of 15 mA.

Indicators

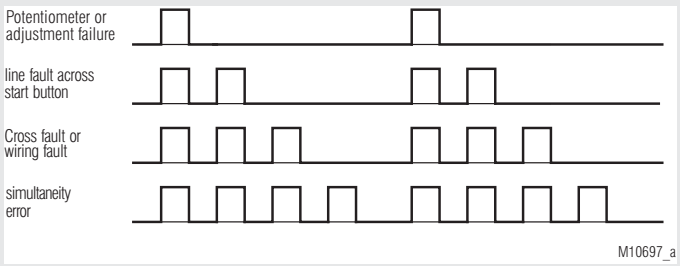
green LED ON:	on, when supply connected
red LED ERR:	on, at internal error flashes at external error
green LED K1/K2 (.02) e.g. K1-K4 (.04):	on, when relay K1 and K2 (.02) energized, e.g. when relay K1, K2, K3 and K4 (.04) energized flashes at external error

Function Diagram

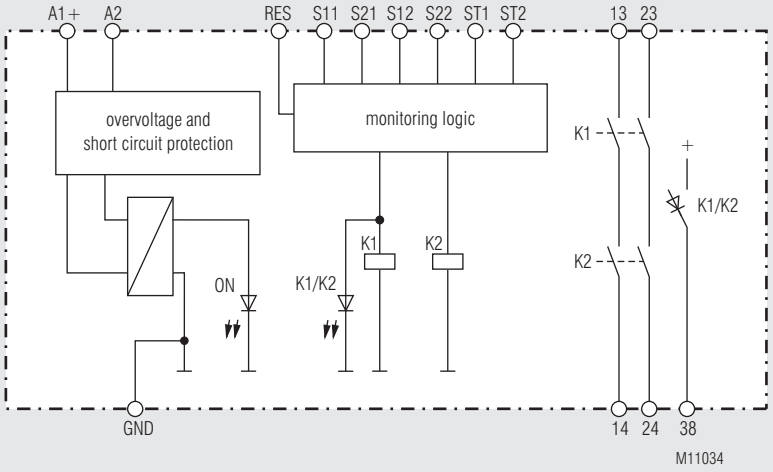


t_{diff}: Simultaneity demand of the safetyfunction (see technical data)
t_{on}: Actuation time of start button (see technical data)

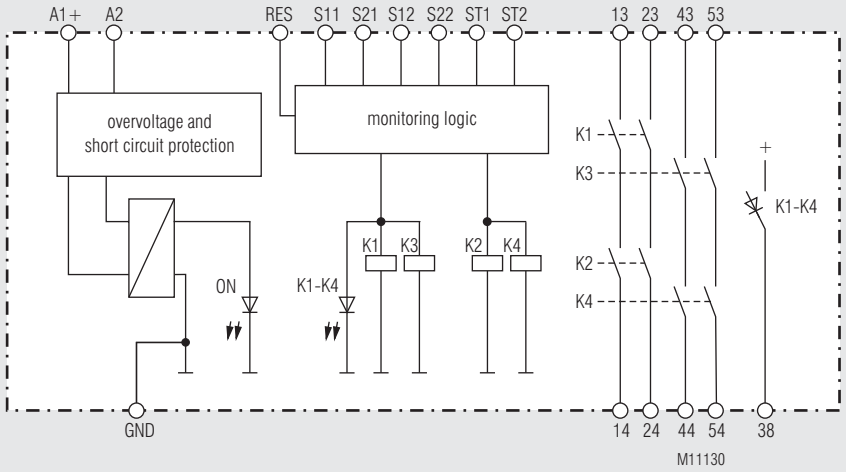
Fault Indication by Flashing Code



Block Diagrams



UG 6980.02



UG 6980.04

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 (3), 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.

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	

Operating Potentiometer

Poti "Fkt"	Adjustment of safety function

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 (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:	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
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:	< 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:	< 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
Simultaneity demand:	< 1 s
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 gG / 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:	- 25 ... + 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	IEC/EN 61 326-3-1, IEC/EN 62 061	
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:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
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

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

- DC 24 V — Nominal voltage
- /61 — UL-approval
- 00 — 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
- UG 6980 — Type

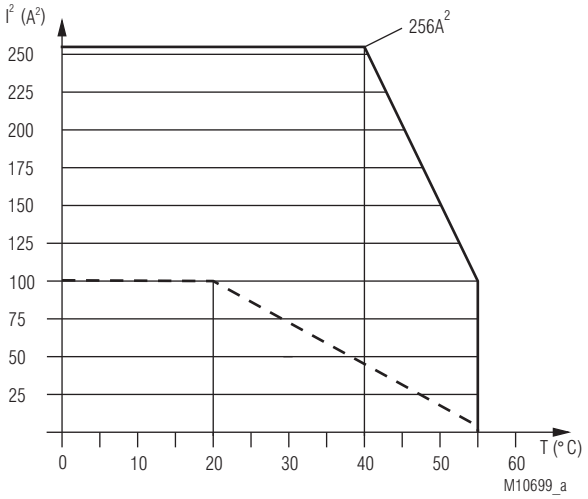
Troubleshooting

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



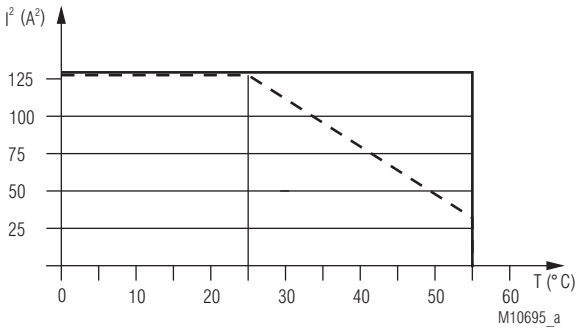
device free-standing
max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

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



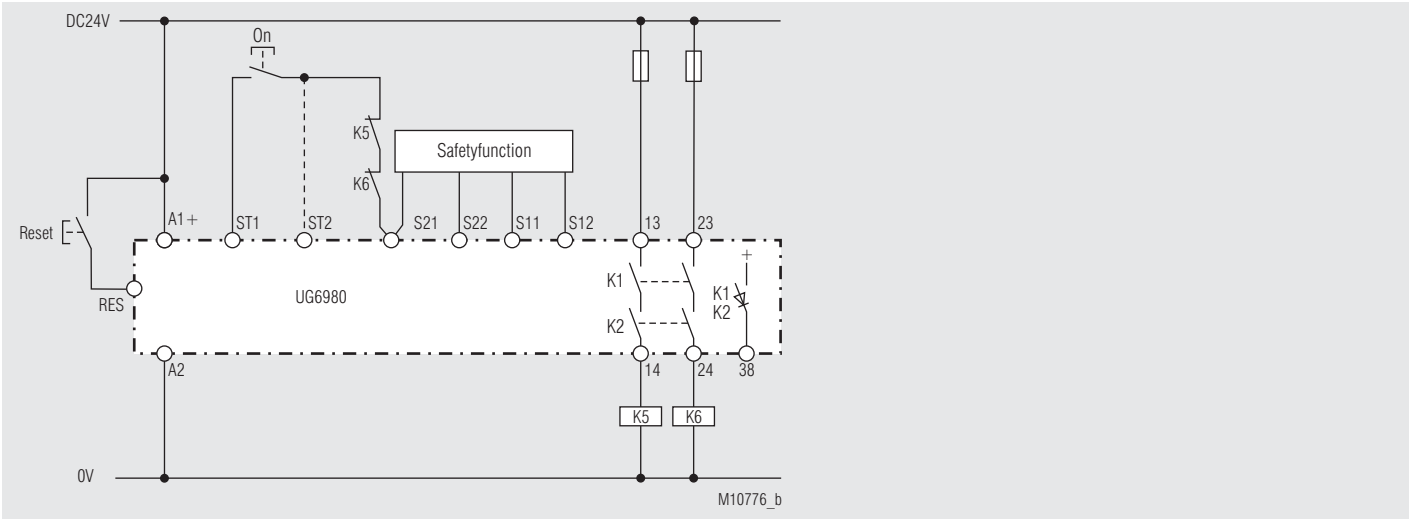
device free-standing
max. current at 55°C over
2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

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

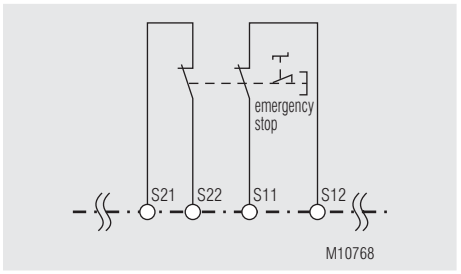
$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - current in contact paths

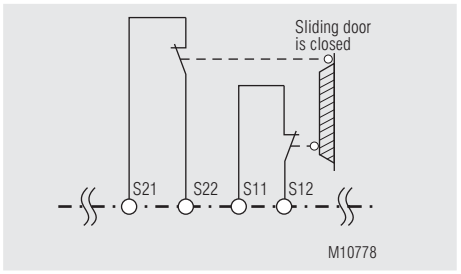
UG 6980.02
Quadratic total current limit curve



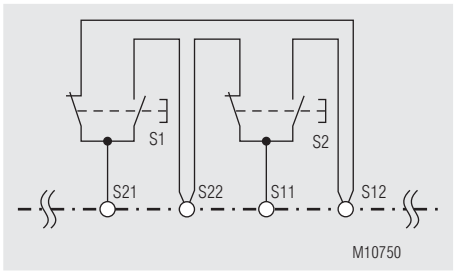
Safetyfunction: see below, Manual-Start (for automatic start make a bridge to ST2 instead of ON button).



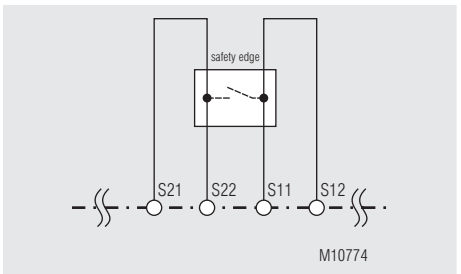
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



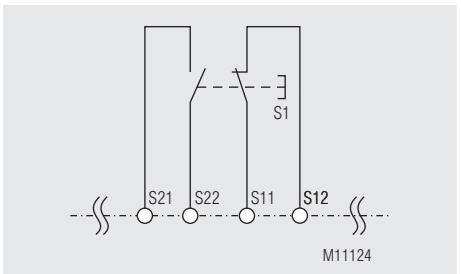
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



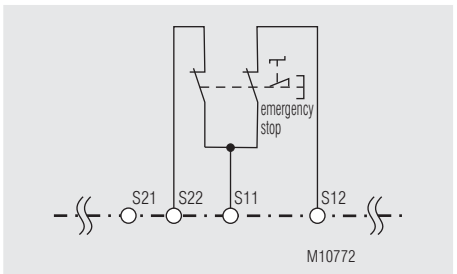
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



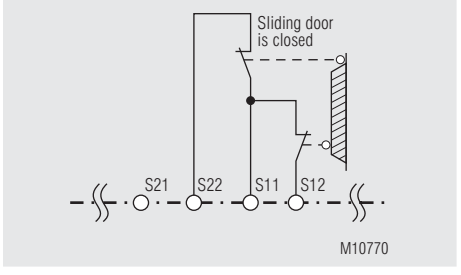
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



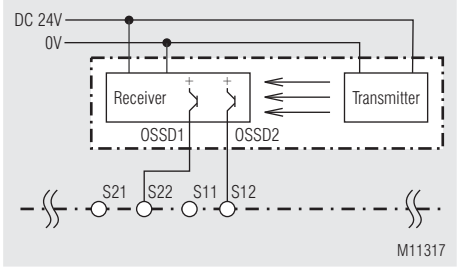
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



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



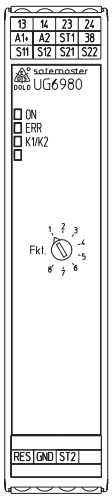
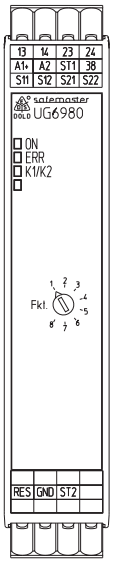
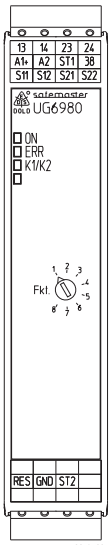
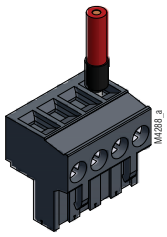
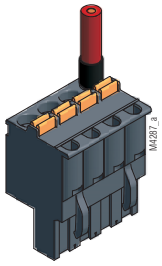
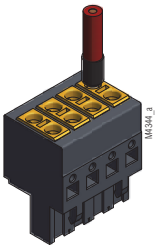
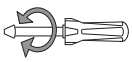
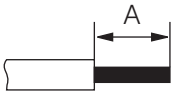
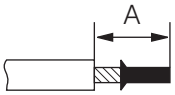
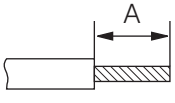
Fct.: Safety gate (7),
without cross fault detection
SIL 3, PL e, Cat. 4 [1]



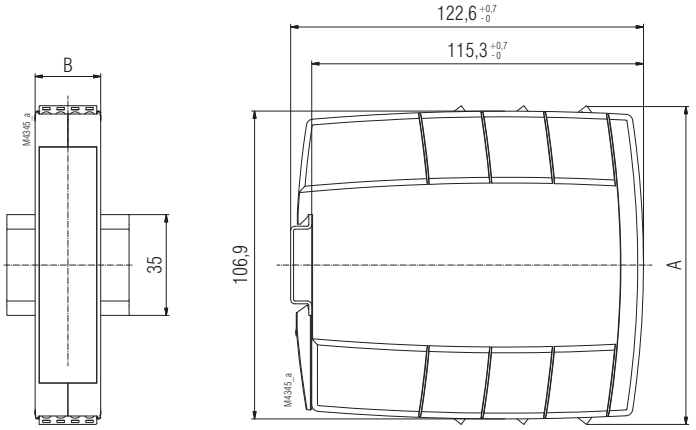
Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4 [2]

[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.

DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

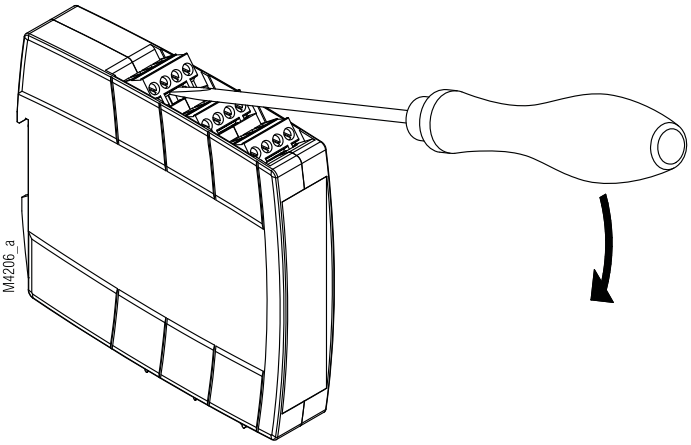
	 M10708	 M10722	 M10723
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



	A	B
UG 6980 PS	110 ± 1	22,5
UG 6980 PC	120 ± 1	
UG 6980 PT		

DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT-terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety related data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / 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)

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:	99,0	%
PFH_D:	1,88E-10	h^{-1}
T_1	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL CL 3, SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL CL 2, SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon EN 61511, EN 50156-1	SIL 3	einmal pro Jahr once per year annuel

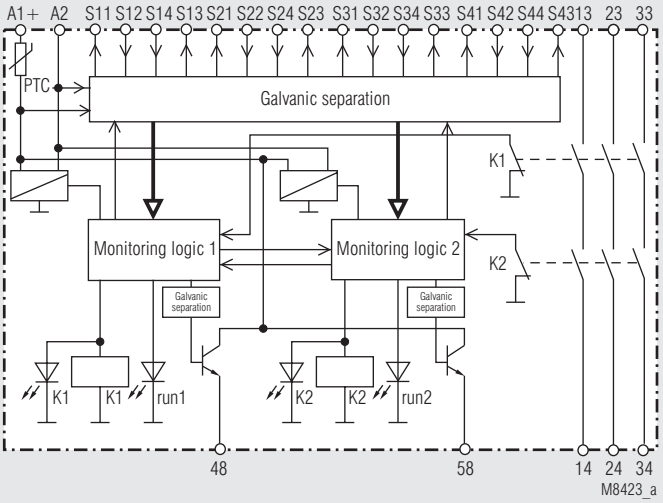
Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER C
Multifunction Safety Module
BH 5910

0240731

Block Diagram



- **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**
  - **Category 4 to EN 954-1**
- Functions selectable via rotational switches to connect max.:
  - 8 E-stop circuits, single channel or
  - 4 E-stop circuits, 2-channel or
  - 4 light curtains or
  - 2 light curtains and 1 E-stop circuit or
  - 4 safety gates or
  - 2 safety gates and 1 E-stop circuit or
  - 4 pairs of 2-hand-buttons or Typ III A according to DIN EN 547 or
  - 2 pairs of 2-hand-buttons Typ III C according to DIN EN 547 and 1 E-stop circuit
- In addition selectable:
  - auto or manual reset (simulation input for gate monitor)
  - continuously monitored feedback circuit to monitor external contactors
- Cross fault detection
- Short circuit and broken wire detection
- Outputs:
  - 3 NO or 2 NO and 1 NC contacts
  - 2 semiconductor outputs short circuit proof and overload protected
- Under- and overvoltage detection and signalling
- LED indication for operation (RUN), channel 1/2
- 45 mm width

Approvals and Markings

CE · TÜVRheinland Functional Safety Type Approved FS · c UL us LISTED * Canada / USA · A025518

* see variants

Applications

- Protection of men and machines

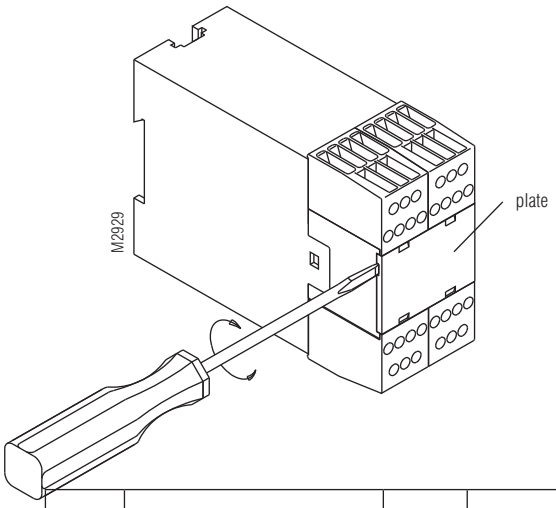
Indicators

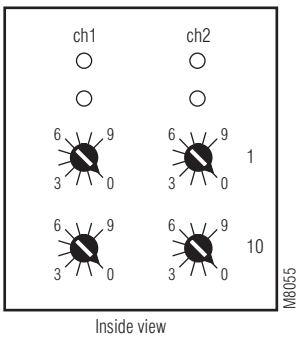
lower green LEDs K1, K2:	On, when relays K1 and K2 are energized
upper yellow LEDs run 1, run 2:	Continuously on on fault free operation. Regular flashing when waiting for external action e.g. release of an E-stop button. Detected faults are indicated with special flashing sequences (see flash codes for fault indication)
Terminal 48:	Flashes, als long as starting condition is not fulfilled.
Terminal 58:	Flashes while waiting for start or simulation input (button). Continuous signal when relay enabled.

Notes

- On BH 5910.22 the NC contact 31 - 32 can only be used as monitoring contact.
- Changes of settings are only permitted when supply voltage is disconnected and have to be made by trained persons only.
- Before removing the front cover please touch ground potential.

Setting





Inside view

The selection of the function of BH 5910 is done via 4 rotational switches behind the front cover of the unit (see drawing on the left). The 2 switches on the left set processor 1 (ch 1) and the 2 switches on the right set processor 2 (ch 2). Both processors must have the same setting. On both upper switches (1) the function is selected, on both lower switches (10) the number of sensor circuits, control and operation mode and the feed back circiuit option is selected.

Switch 1	Function	Switch 1	No / Sensors	Control mode	Operation mode	Feedback circuit for external contacts
0	E-stop	0	4	2 channel	Auto-Start	no
		1	3	2 channel	Manual start	no
		2	8	1 channel	Auto-Start	no
		3	6 E-stop button	1 channel	Manual startt	no
		4	3	2 channel	Auto-Start	yes
		5	3	2 channel	Manual startt	yes
		6	6	1 channel	Auto-Start	yes
		7	6	1 channel	Manual start	yes
1	Light curtains (LC)	0	4	2 channel	Auto-Start	no
		1	3 Light curtains	2 channel	Manual startt	no
		2	3	2 channel	Auto-Start	yes
		3	3	2 channel	Manual start	yes
2	Light curtains + E-stop (1 E-stop button, 2-channel, manual start	0	2	2 channel	Auto-Start	no
		1	2 Light curtains	2 channel	Manual start	no
		2	2	2 channel	Auto-Start	yes
		3	2	2 channel	Manual start	yes
3	Gate monitor	0	4	2 NO contacts	without simulation button	no
		1	3	2 NO contacts	with simulation button	no
		2	2	2 C/O contacts	without simulation button	no
		3	1	2 C/O contacts	with simulation button	no
		4	2 Gate switches	3 NO contacts	with simulation button	no
		5	1	2 C/O contacts, 1 NO	with simulation button	no
		6	3	2 NO contacts	with simulation button	yes
		7	1	2 C/O contacts	with simulation button	yes
		8	2	3 NO contacts	with simulation button	yes
		9	1	2 C/O contacts, 1 NO	with simulation button	yes
4	Gate monitor + E-stop (1 E-stop button, 2-channel, manual start)	0	2	2 NO contacts	with simulation button	no
		1	1	2 C/O contacts	with simulation button	no
		2	1 Gate switches	3 NO contacts	with simulation button	no
		3	2	2 NO contacts	with simulation button	yes
		4	1	2 C/O contacts	with simulation button	yes
		5	1	3 NO contacts	with simulation button	yes
5	2-hand safety	0	1	2 NO contacts		no
		1	2	2 NO contacts		no
		2	3	2 NO contacts		no
		3	4	2 NO contacts		no
		4	1 button pairs	2 NO contacts		no
		5	2	2 C/O contacts		no
		6	1	2 NO contacts		yes
		7	2	2 NO contacts		yes
		8	3	2 NO contacts		yes
		9	1	2 C/O contacts		yes
6	2-hand safety + E-stop (1 E-stop button, 2-channel, manual start)	0	1	2 NO contacts		no
		1	2	2 NO contacts		no
		2	1 button pairs	2 C/O contacts		no
		3	1	2 NO contacts		yes
		4	2	2 NO contacts		yes
		5	1	2 C/O contacts		yes
7	not permitted					
8	not permitted					

Operation Modes

- **Auto start**
  (with function E-stop and light curtain)
  On automatic restart the output contacts are activated when the input condition for the selected function is fulfilled.
  A start-button is only necessary in 2 cases:
  - If the function light curtain, safety gate or 2-hand-safety is combined with E-stop.
  - If a function with feedback circuit is selected and the unit has to be reset after a detected fault without disconnection.

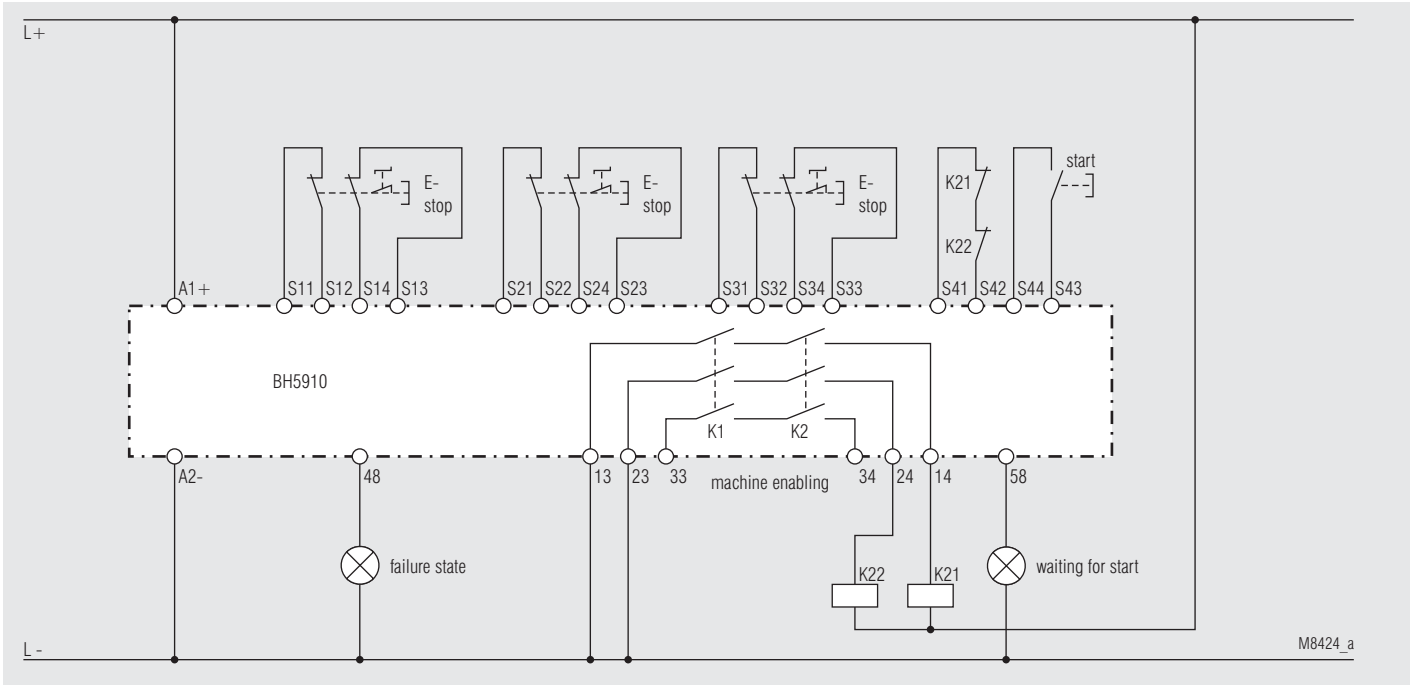
- **Manual start**
  (with function E-stop and light curtain)
  If the unit was deactivated by operating the safety function e.g. by pressing an e-stop button it only can be reset in manual mode by pressing the start button. After voltage failure the unit has to be reset also with the start button. The button has to be pressed not longer then 3 sec. to allow the unit to energise.

  If one of the functions light curtain, safety gate or 2-hand-safety is combined with E-stop the E-stop function always works with manual restart.

  When manual start is selected, the start button is always connected to terminals S43-S44.

If the number of contacts has to be increased or a higher current has to be switched by contactors a feedback circuit with NC contactors can be connected to terminals S41-S42 (see drawing 1). This circuit allows to monitor the state of the external contactors. The BH 5910 monitors continuously if the state of this input corresponds to the state of K1 and K2.
In the case of a fault K1 and K2 switch off or do not switch on at all. If the fault is removed, the BH 5910 has to be reset with the start button.

When operating the unit with feedback circuit the circuit has to be connected to terminal S41 and S42.

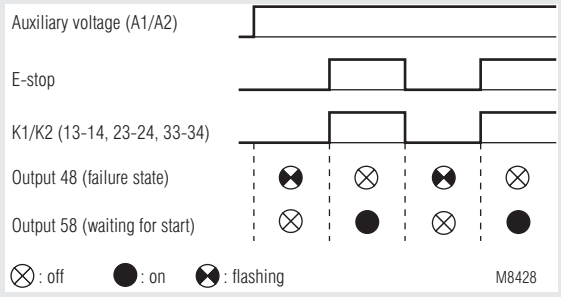


Pic. 1: E-stop, 2-channel, with 3 E-stop buttons, manual start and 2 external contactors with feed back circuits
(Switch 1: position 0, switch 10: position 4 or 5)

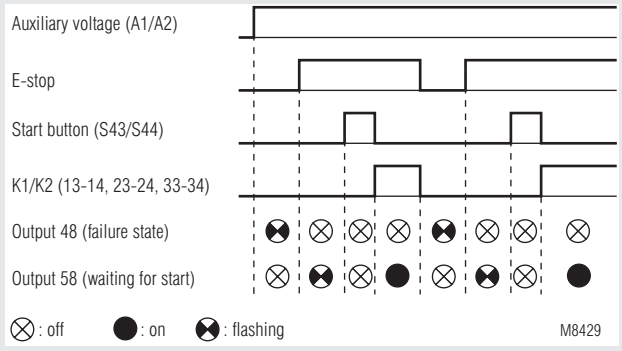
E-Stop (switch 1 in position 0)

With switch 10 the maximum number of e-stop loops is selected. Open (unused) inputs (S_1/S_2 and S_3/S_4) have to be linked with a wire bridge. K1 and K2 can only be activated, if all e-stop buttons are released. The function diagrams show only the action of one e-stop button. We pretend that the others are closed.
When the unit is used with 2-channel e-stop loops, it checks the state of the inputs. If both channels have different signals for more then 50 ms the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.

Function Diagrams



E-stop, 2-channel, auto start



E-stop, 2-channel, manual start

Settings on switch 10

Switch10	Number of E-stop loops	Type of control	Type of start	Feedback circuit for external contactors
0	4	2 channel	Auto-Start	no
1	3	2 channel	Manual start	no
2	8	1 channel	Auto-Start	no
3	6	1 channel	Manual start	no
4	3	2 channel	Auto-Start	yes
5	3	2 channel	Manual start	yes
6	6	1 channel	Auto-Start	yes
7	6	1 channel	Manual start	yes
8	position not allowed (failure code 5			
9	position not allowed (failure code 5			

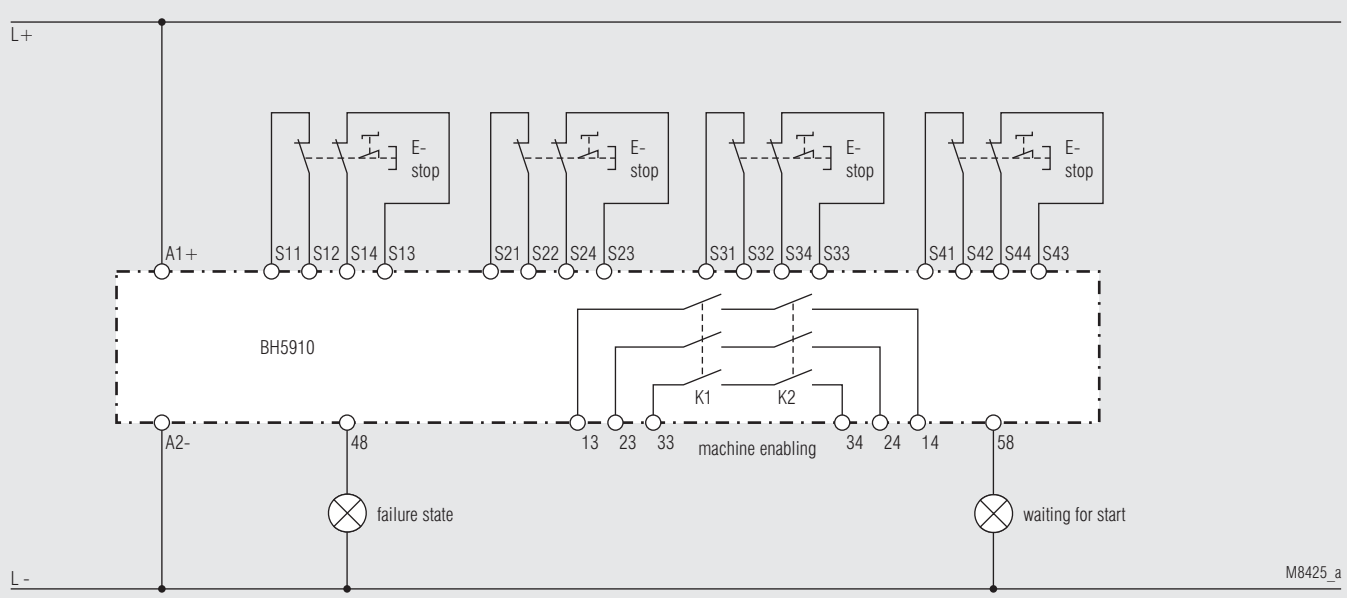
Terminal designation

Ter-minal	E-stop loop, 1 channel	E-stop loop, 2 channel	Feedback circuit and/or manual start
S11 S12	E-stop 1	E-stop 1	
S13 S14	E-stop 2		
S21 S22	E-stop 3	E-stop 2	
S23 S24	E-stop 4		
S31 S32	E-stop 5	E-stop 3	
S33 S34	E-stop 5		
S41 S42	E-stop 7	E-stop 4	Feedback circuit or no connection
S43 S44	E-stop 8		Start button

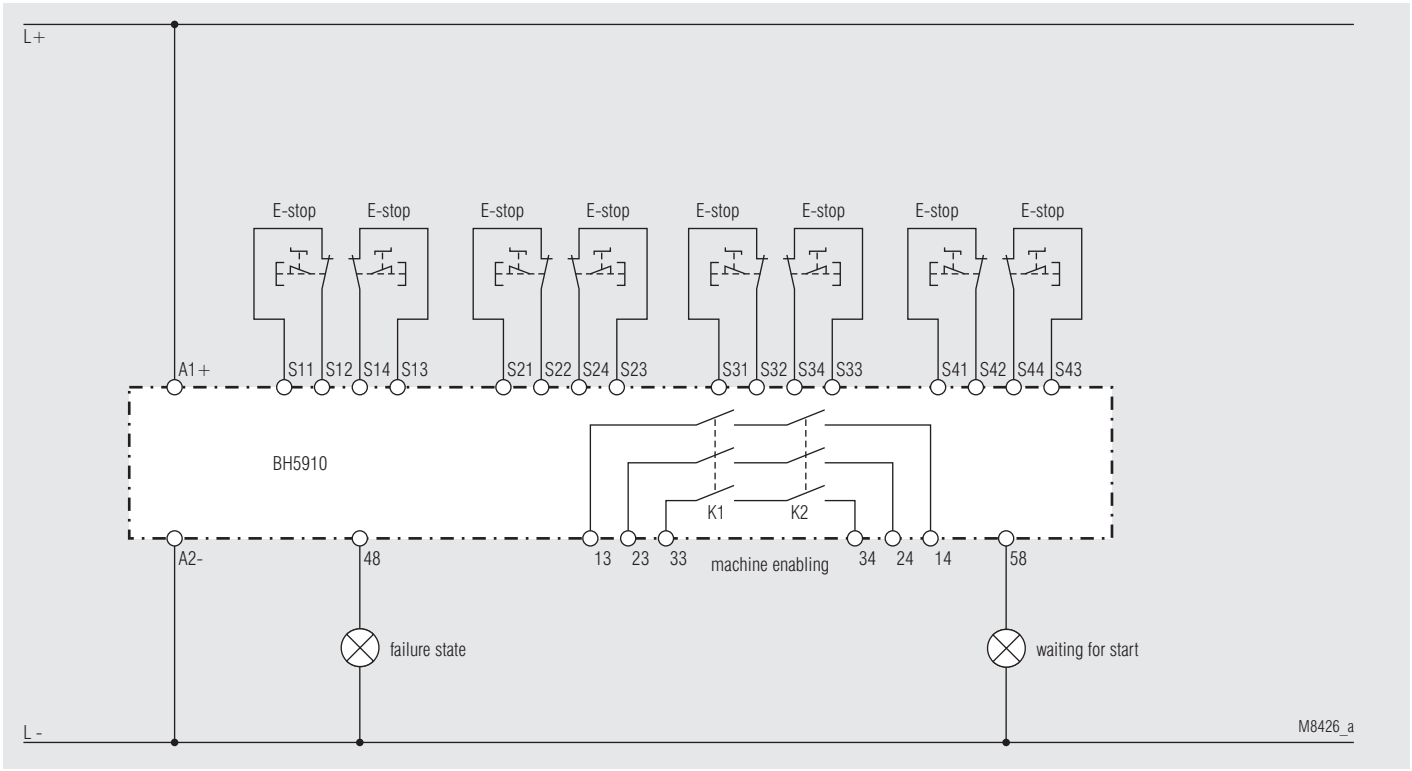
Semiconductor outputs

Output	Flashing signal	Continuous signal
48	E-stop active or failure in feedback circuit or failure on start button	
58	Wait for start button	Relay K1, K2 active

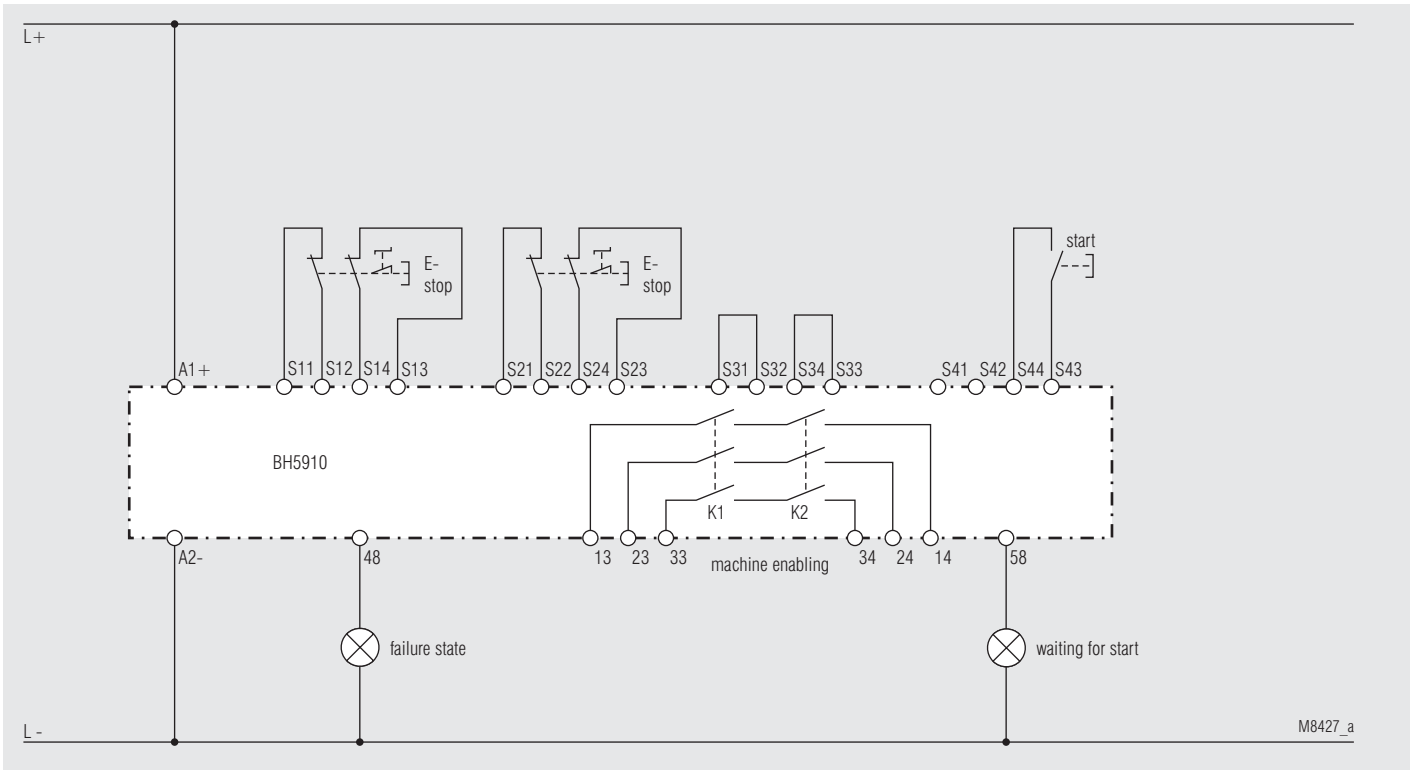
Application Example



Pic. 2: E-stop, 2-channel, with 4 e-stop loops, auto start (switch 1 in position 0, switch 10 in position 0)



Pic. 3: E-stop, 1-channel, with 8 e-stop loops, auto start; (switch 1 in position 0, switch 10 in position 2)

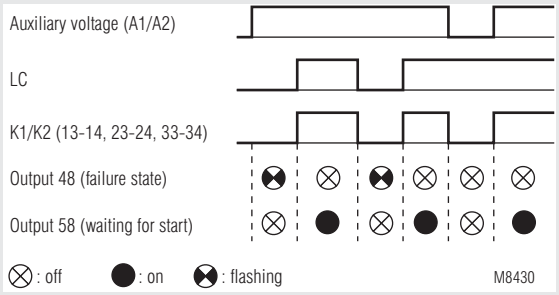


Pic. 4: E-stop, 2-channel, with 2 e-stop loops, manual start; (switch 1 in position 0; switch 10 in position 1)

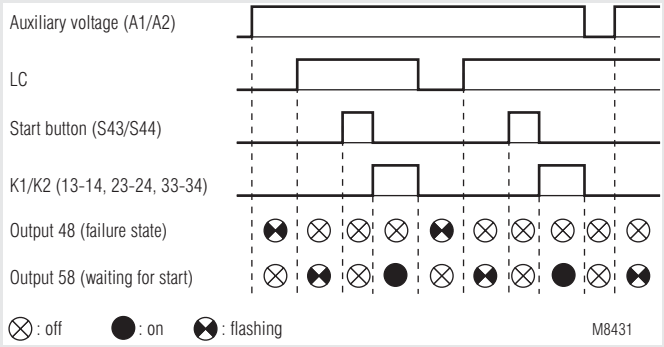
Light Curtains (switch 1 in position 1)

With switch 10 the maximum number of LCs (Light curtains) is selected. Open (unused) inputs (S_1/S_2 and S_3/S_4) have to be linked with a wire bridge.
K1 and K2 can only be activated, if no LC is interrupted.
If both channels of an LC have different signals for more then 50 ms the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.
The BH 5910 can be used on LCs of type 4 (IEC/EN 61 496-1) or type 2 with self test and crossfault monitoring.
The following function diagrams show the function of one LC. We pretend that other connected LCs are not interrupted.

Function Diagrams



Light curtains, auto start



Light curtains, manual start

Settings on switch 10

Switch 10	No. of LCs	Type of control	Type of start	Feedback circuit for external contactors
0	4	2-channel light curtains	Auto-Start	no
1	3	2-channel light curtains	Manual start	no
2	3	2-channel light curtains	Auto-Start	yes
3	3	2-channel light curtains	Manual start	yes
4-9	position not allowed (failure 5)			

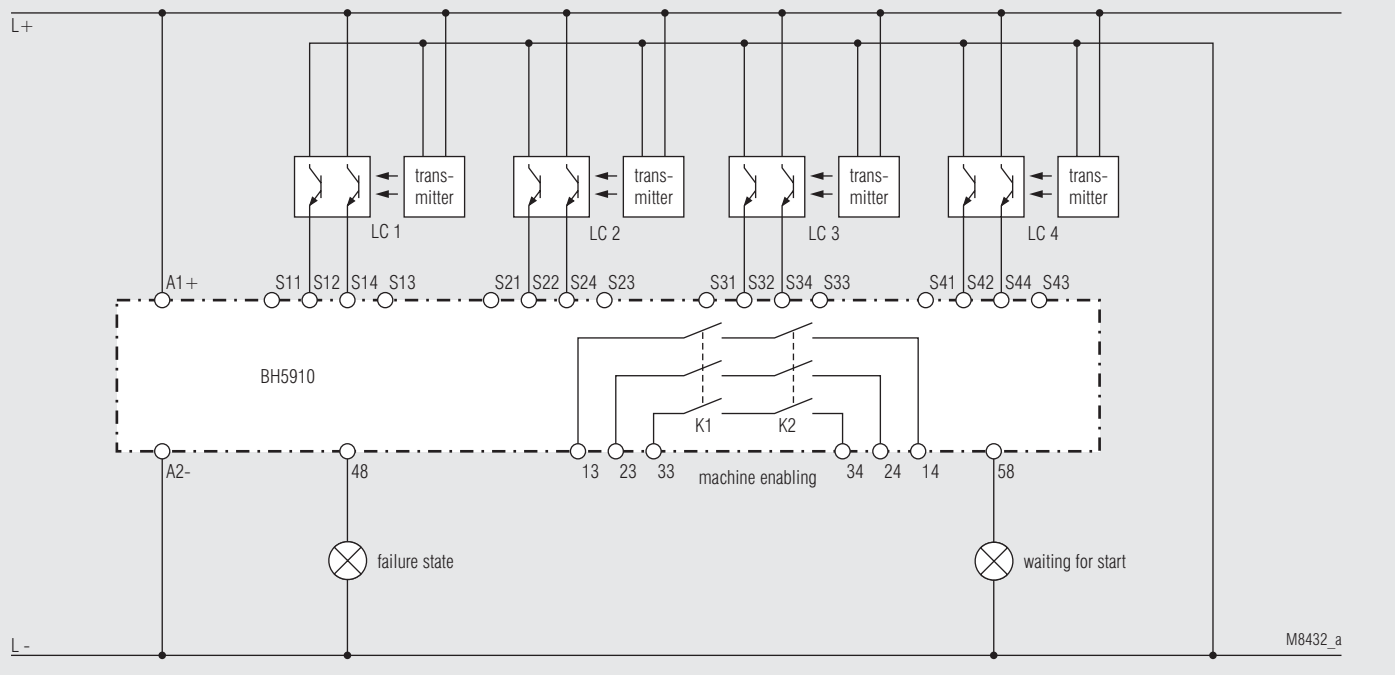
Terminal designation

Ter-minal	Light curtains		Feedback circuit and /or manual start
S11 S12	not connected LC 1	link S11-S12 without LCl 1	
S13 S14	not connected LC 1	link S13-S14 without LC 1	
S21 S22	not connected LC 2	link S21-S22 without LC 2	
S23 S24	not connected LC 2	link S23-S24 without LC 2	
S31 S32	not connected LC 3	link S31-S32 without LC 3	
S33 S34	not connected LC 3	link S33-S34 without LC 3	
S41 S42	not connected LC 4	link S41-S42 without LC 4	Feedback circuit or no connection
S43 S44	not connected LC 4	link S43-S44 without LC 4	Start button

Sorties à semi-conducteurs

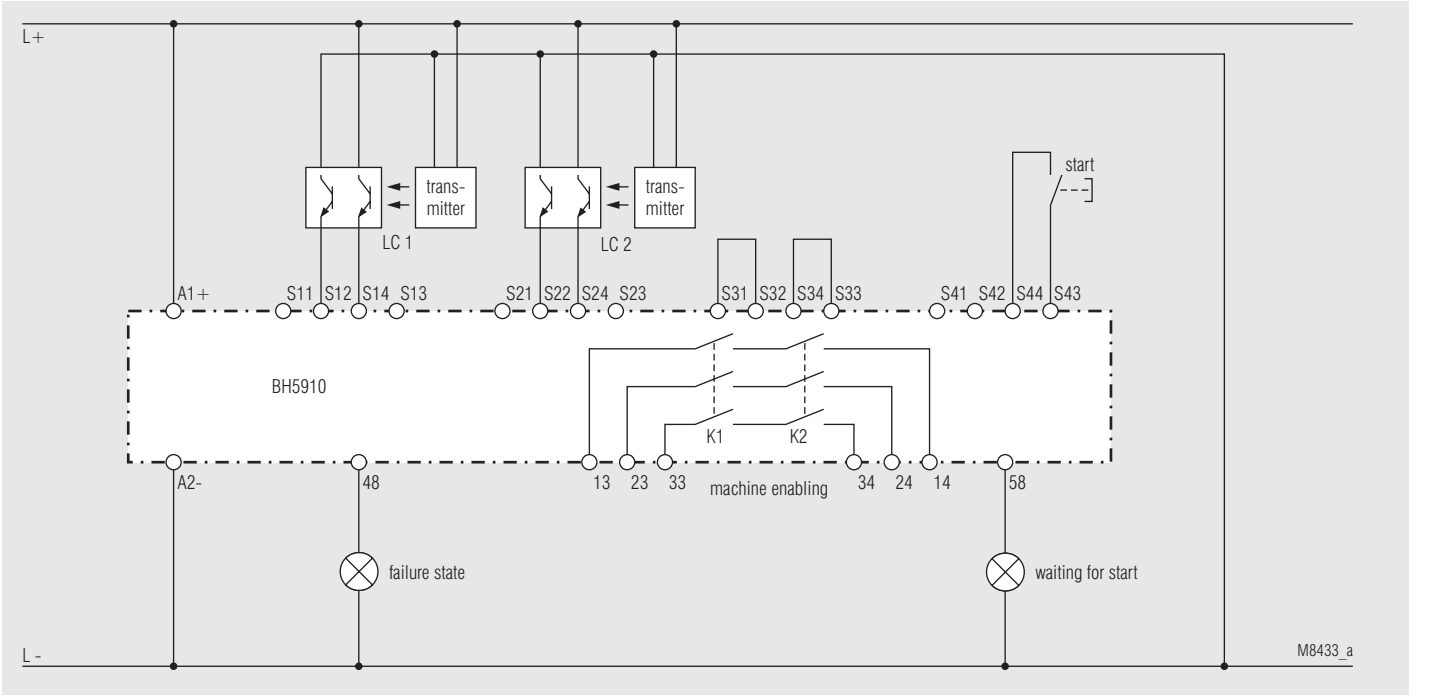
Output	Flashing signal	Continuous signal
48	One LC interrupted or failure in feedback circuit or in start circuit	
58	Wait for start button	Relay K1, K2 active

Application Example



Pic. 5: Light curtains, with 4 LCs, auto start; (switch 1 in position 1, switch 10 in position 0)

Light Curtains (switch 1 in position 1); **Application Example**



Pic. 6: Light curtains, with 2 LCs, manual start; (switch 1 in position 1, switch 10 in position 1)

Light Curtains and E-Stop (switch 1 in position 2)**e**

In this function the unit is always set to 2 LCs and 1 e-stop loop. Open (unused) inputs (S21/S22 and S23/S24) have to be linked with a wire bridge. K1 and K2 can only be activated, if no LC is interrupted and the e-stop loop is closed.
After an e-stop or power failure the unit has to be reset with manual start. If both channels of an LC or e-stop loop have different signals for more then 50 ms the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.

Settings on switch 10

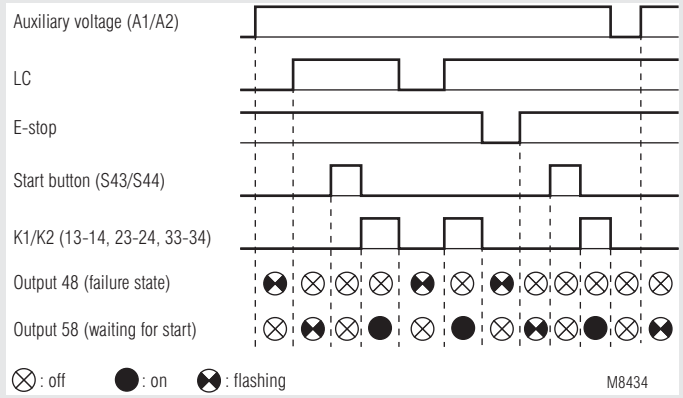
Switch 10	No. of LCs	Type of control	Type of start	Feedback circuit for external contactors
0	4	2-channel light curtains	Auto-Start	no
1	3	2-channel light curtains	Manual start	no
2	3	2-channel light curtains	Auto-Start	yes
3	3	2-channel light curtains	Manual start	yes
4-9	position not allowed (failure 5)			

Terminal designation

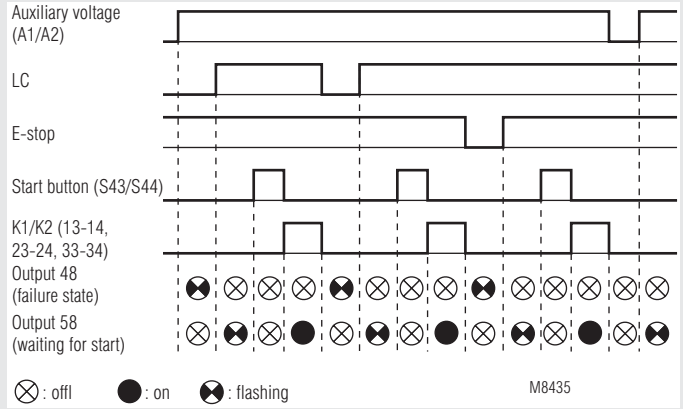
Ter-minal	Light curtains / E-stop		Feedback circuit for external contactors
S11 S12	not connected LC 1	link S11-S12 without LC1	
S13 S14	not connected LC 1	link S13-S14 without LC 1	
S21 S22	not connected LC 2	link S21-S22 without LC 2	
S23 S24	not connected LC 2	link S21-S22 without LC 2	
S31 S32	E-stop		
S33 S34			
S41 S42			Feedback circuit
S43 S44	Start button		

Semiconductor outputs

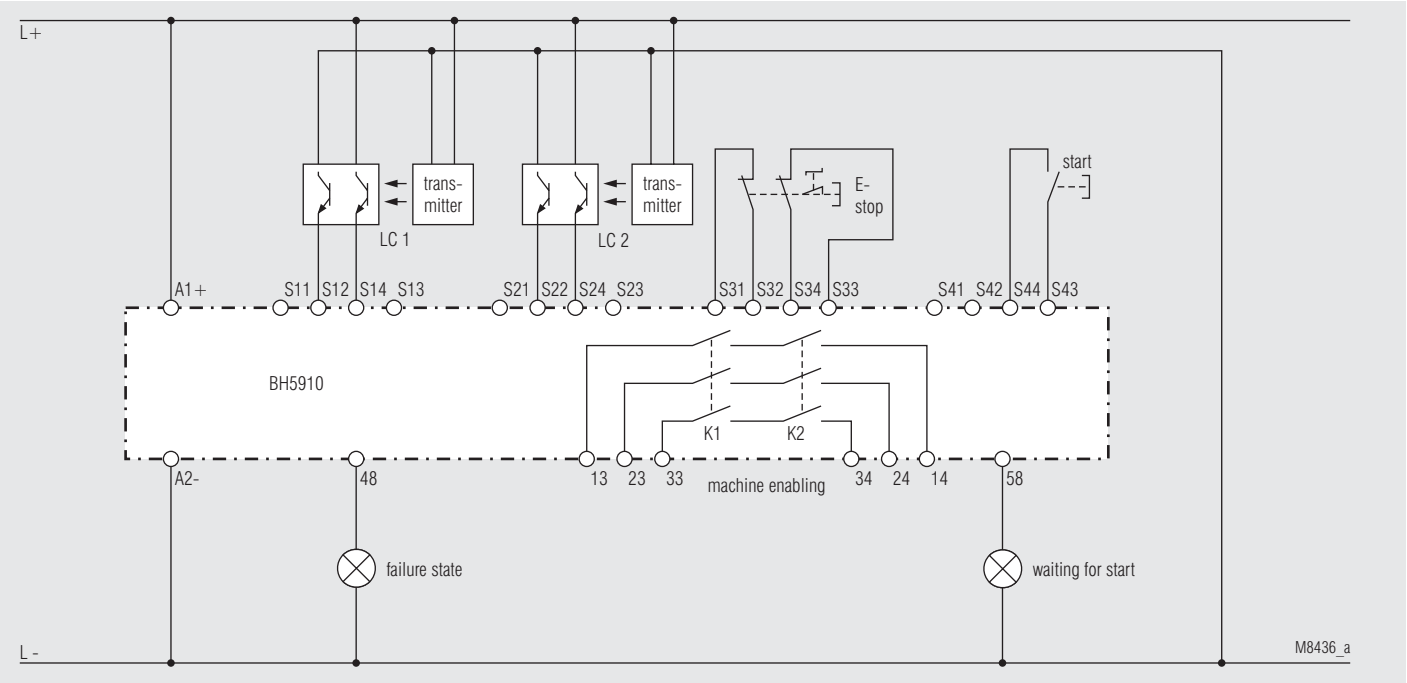
Output	Flashing signal	Continuous signal
48	One LC interrupted or E-stop button pressed or failure in feedback circuit or failure in start circuit	
58	Wait for start button	Relay K1, K2 active



Light curtains and E-stop, auto start



Light curtains and E-stop, manual start

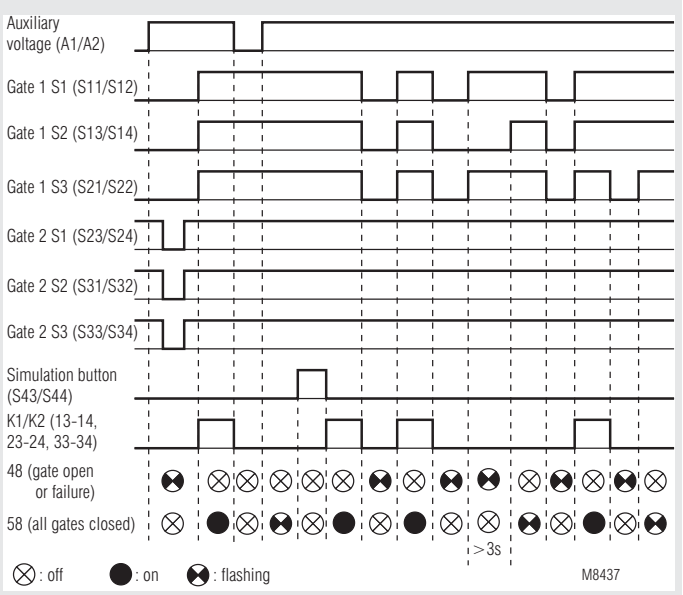


Pic. 7: Light curtains and E-stop, auto start or manual start (switch 1 in position 2, switch 10 in position 0 or 1)

Safety Gates (switch 1 in position 3)

With switch 10 the maximum number of gates is selected. Open (unused) inputs (S_1/S_2 and S_3/S_4) have to be linked with a wire bridge. If gate inputs are not used the type of control has to be with simulation button.
K1 and K2 can only be activated, if all connected gates have been opened and closed again. Both gate contacts have to be operated within 3 s. If the time difference is longer, the gate has to be opened before it can be closed again. When all gates are closed the unit can also be activated by an external connected Simulation button.
If changeover contacts are used on the gate switches the switchover time has to be less then 50 ms. If it is longer the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.

Function Diagram



Gate monitor, 2 gates with 3 NO contacts for each gate, Simulation button

Semiconductor outputs

Output	Flashing signal	Continuous signal
48	Open gate or failure in feedback circuit or in start circuit	
58	Gates are closed but starting conditions not fulfilled	Gates are closed and contacts K1, K2 are active

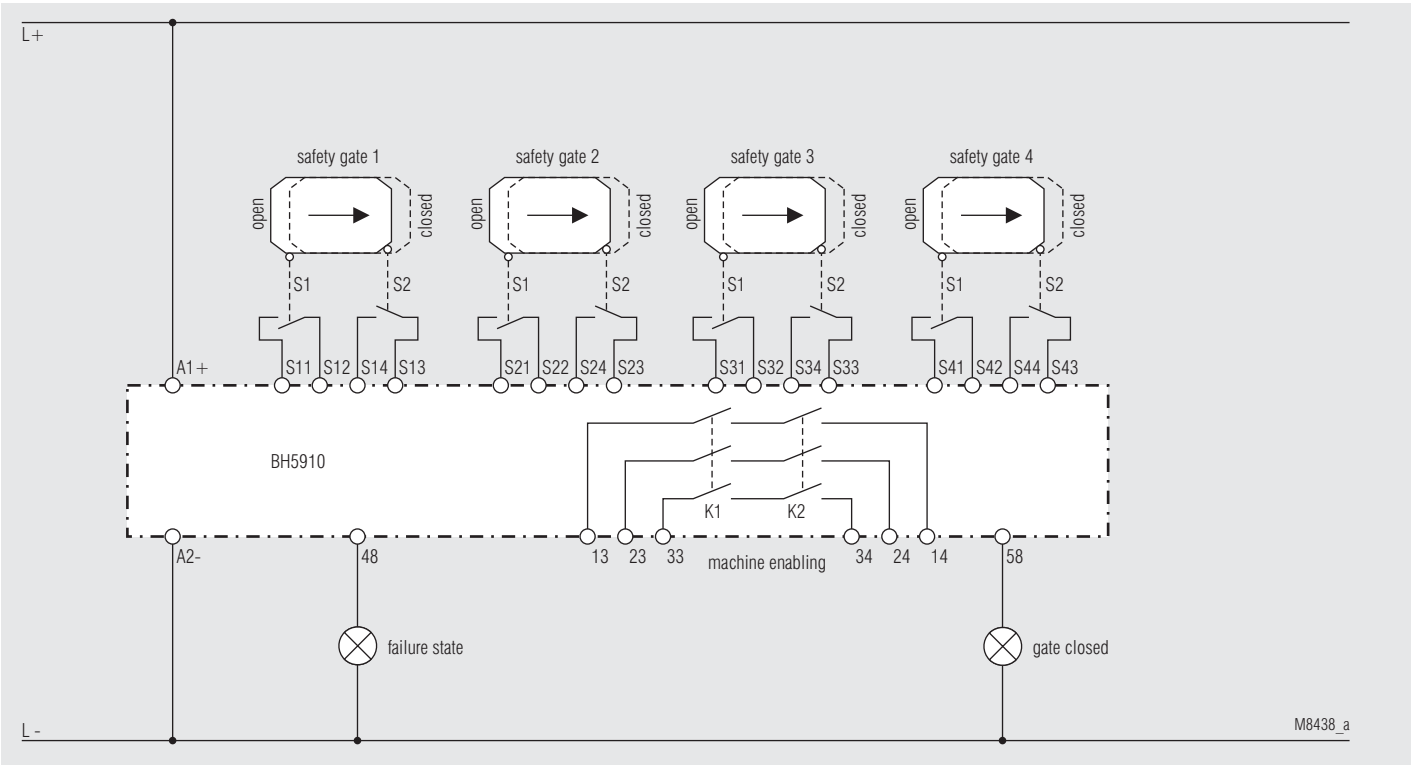
Settings on switch 10

Switch 10	Number of gates	Number and type of gate switches	Simulation button	Feedback circuit for external contactors
0	4	2 NO contacts	no	no
1	3	2 NO contacts	yes	no
2	2	2 C/O contacts	no	no
3	1	2 C/O contacts	yes	no
4	2	3 NO contacts	yes	no
5	1	2 C/O contacts + 1 NO contact	yes	no
6	3	2 NO contacts	yes	yes
7	1	2 C/O contacts	yes	yes
8	2	3 NO contacts	yes	yes
9	1	2 C/O contacts + 1 NO contact	yes	yes

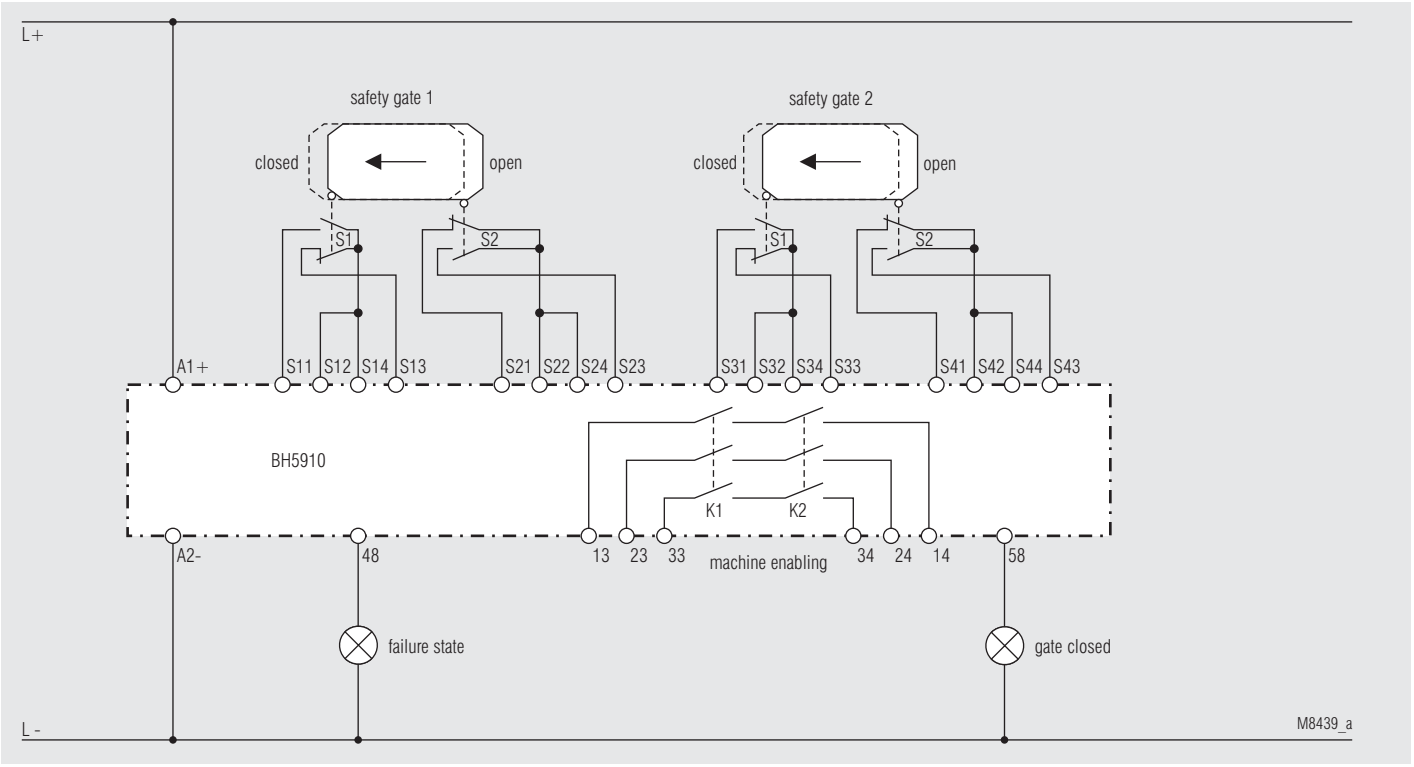
NO contacts must be closed when gate is closed, NC contacts must be open when gate is closed.

Terminal designation

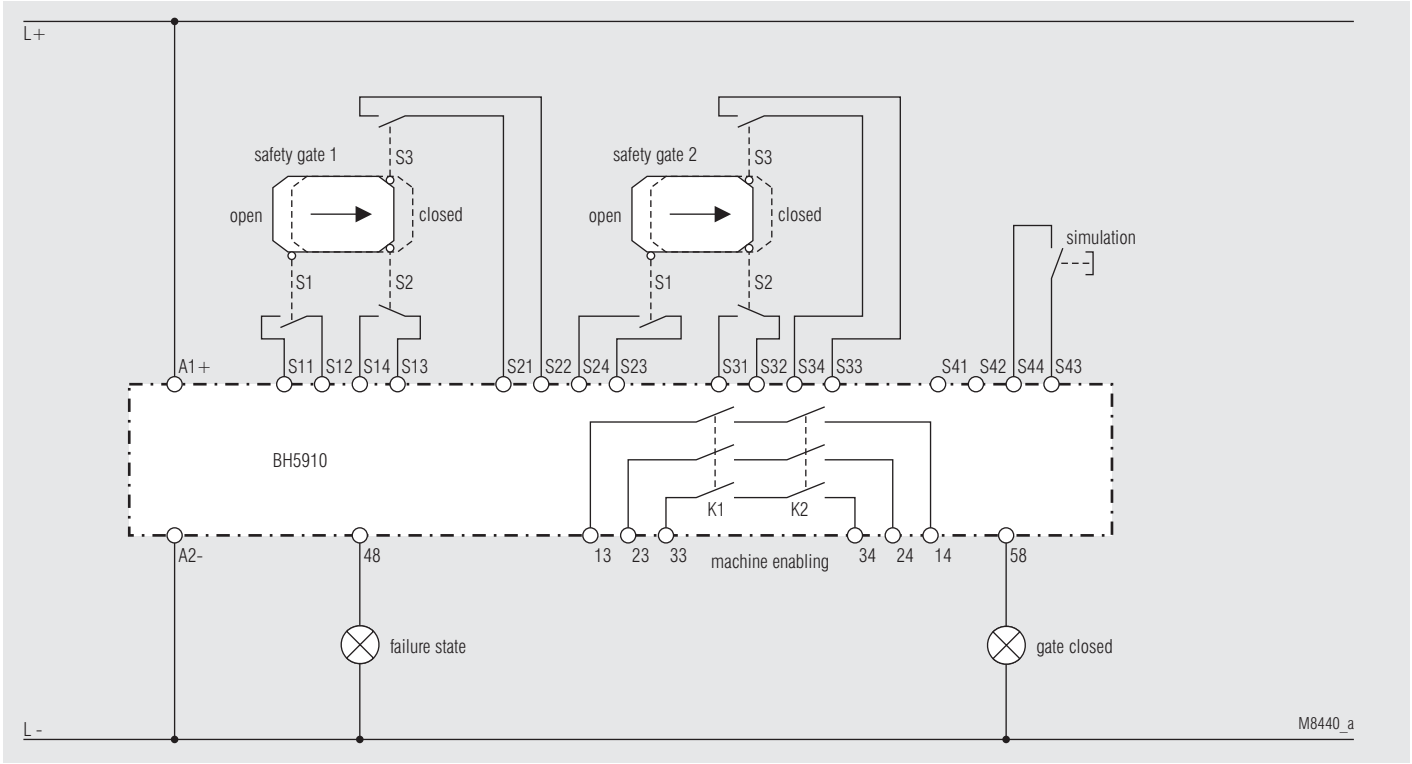
Terminal	Max. 2 gates with 3 NO gate contacts	1 gate with 2 C/O + 1 NO gate contact	Max. 4 gates with 2 NO gate contacts	Max. 2 gates with 2 C/O gate contacts	Feedback circuit for external contacts simulation
S11 S12	gate 1, S1	gate 1, S1 NO contact gate 1, S1 common connector	gate 1, S1	gate 1, S1 NO contact gate 1, S1 common connector	
S14 S13	gate 1, S2	gate 1, S1 common connector gate 1, S1 NC contact	gate 1, S2	gate 1, S1 common connector gate 1, S1 NC contact	
S21 S22	gate 1, S3	gate 1, S2 NC contact gate 1, S2 common connector	gate 2, S1	gate 1, S2 NC contact gate 1, S2 common connector	
S24 S23	gate 2, S1	gate 1, S2 common connector gate 1, S2 NO contact	gate 2, S2	gate 1, S2 common connector gate 1, S2 NO contact	
S31 S32	gate 2, S2	gate 1, S3	gate 3, S1	gate 2, S1 NO contact gate 2, S1 common connector	
S34 S33	gate 2, S3	not connected	gate 3, S2	gate 2, S1 common connector gate 2, S1 NC contact	
S41 S42	not connected	not connected	gate 4, S1	gate 2, S2 NC contact gate 2, S2 common connector	Feedback circuit
S44 S43			gate 4, S2	gate 2, S2 common connector gate 2, S2 contact NO	Simulation button



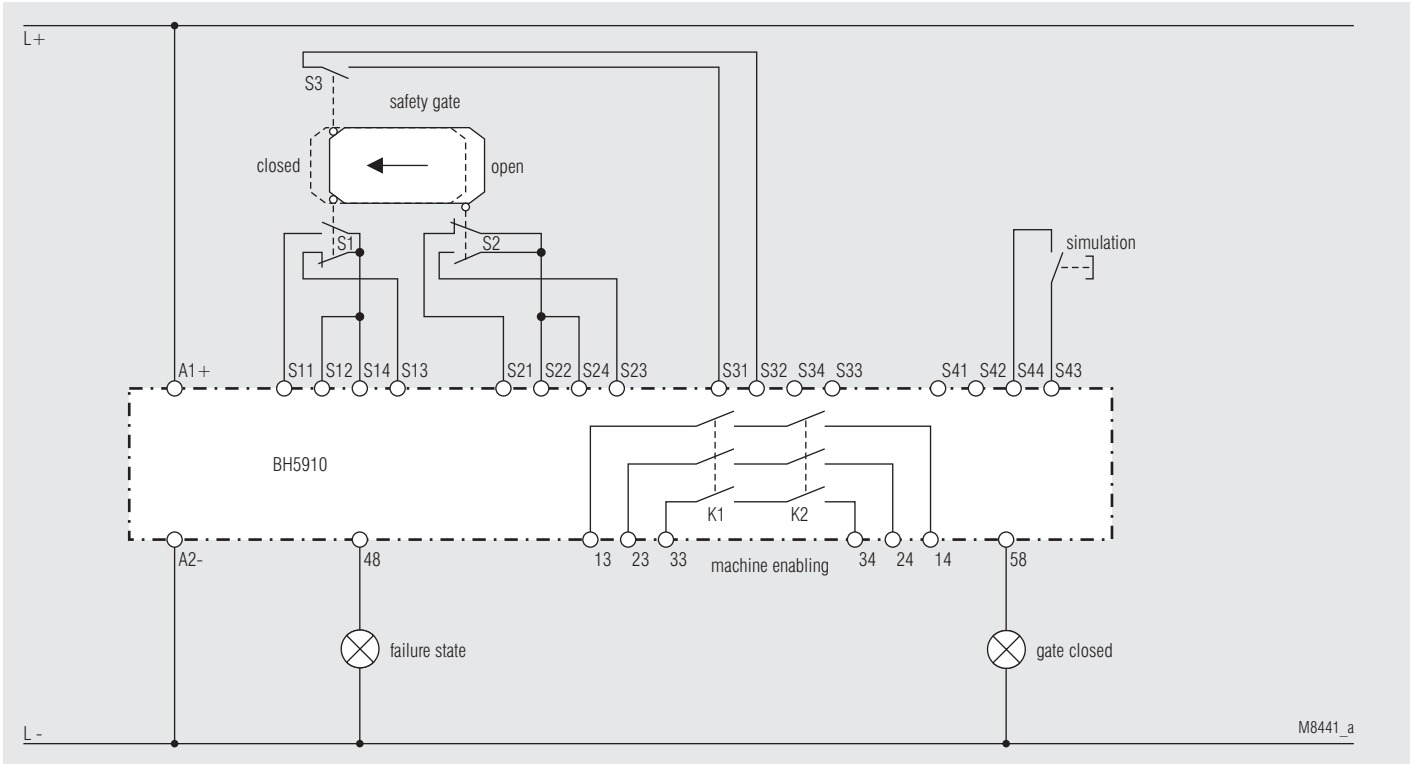
Pic. 8:Gate monitor, 4 gates with 2 NO gate contacts each (switch 1 in position 3; switch 10 in position 0)



Pic. 9: Gate monitor, 2 gates with 2 changeover gate contacts each (switch 1 in position 3; switch 10 in position 2)



Pic. 10: Gate monitor, 2 gates with 3 NO gate contacts each, simulation button (switch 1 in position 3; switch 10 in position 4)



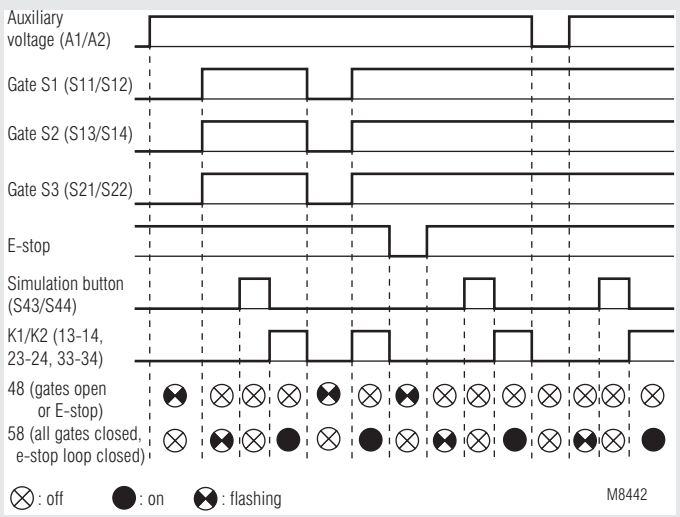
Pic. 11: Gate monitor, 1 gate with 2 changeover gate contacts, simulation button (switch 1 in position 3; switch 10 in position 5)

Safety Gates and E-Stop (switch 1 in position 4)

With switch 10 the maximum number of gates is selected. Open (unused) inputs (S_1/S_2 and S_3/S_4) have to be linked with a wire bridge.
K1 and K2 can only be activated, if the e-stop loop is closed and all connected gates have been opened and closed again.
Both gate contacts have to be operated within 3 s. If the time difference is longer, the gate has to be opened before it can be closed again. When all gates are closed the unit can also be activated by an external connected simulation button.
After e-stop or power failure the unit can only be reset by manual start.

If changeover contacts are used on the gate switches the switchover time has to be less then 50 ms. If it is longer the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.

Function Diagram



Gate monitor and E-stop,
1 gate with 3 NO gate contacts and e-stop loop

Settings on switch 10

Switch 10	No. of gates	Number and type of gate switches	Simulation button	Feedback circuit for external contactors
0	2	2 NO contacts	yes	no
1	1	2 C/O contacts	yes	no
2	1	3 NO contacts	yes	no
3	2	2 NO contacts	yes	yes
4	1	2 C/O contacts	yes	yes
5	1	3 NO contacts	yes	yes
6-9	position not allowed (failure 5)			

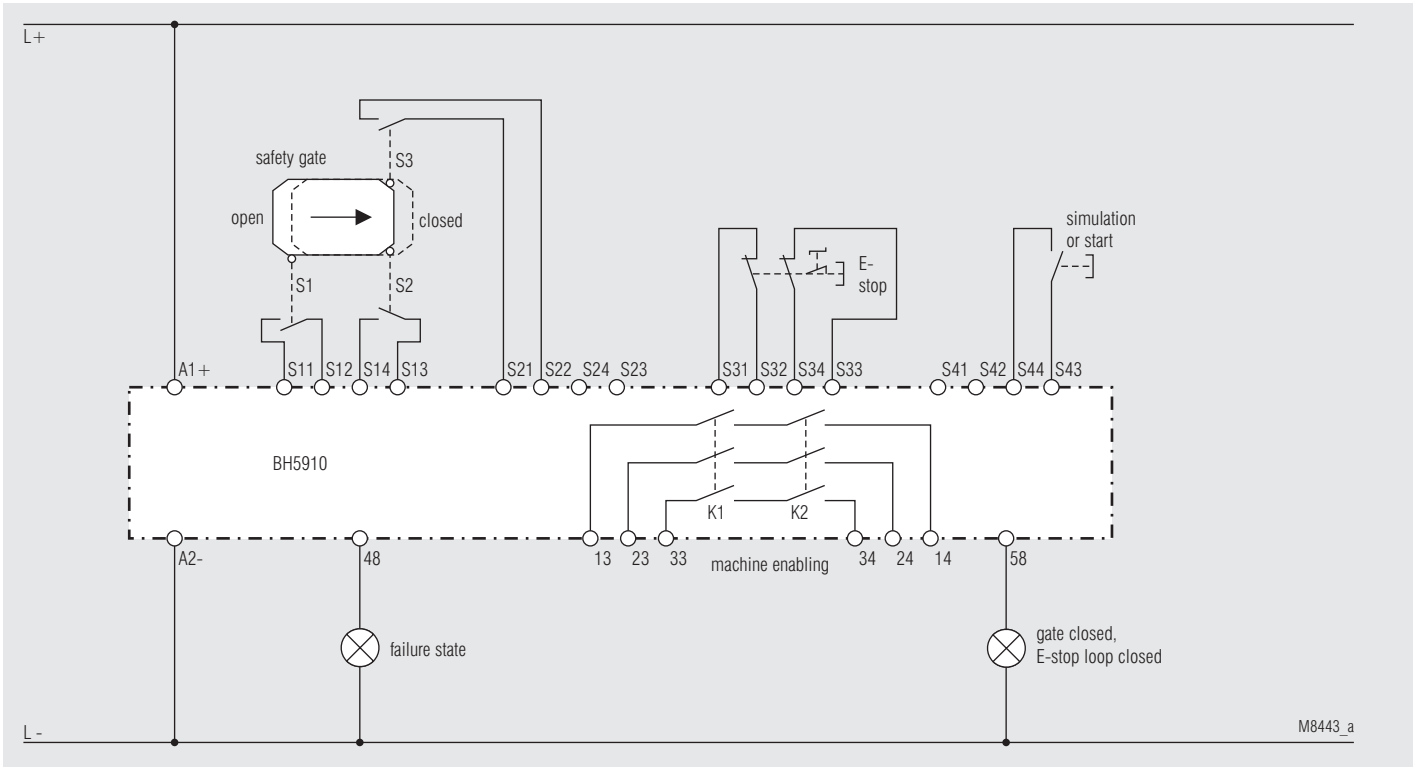
NO contacts must be closed when gate is closed, NC contacts must be open when gate is closed.

Terminal designation

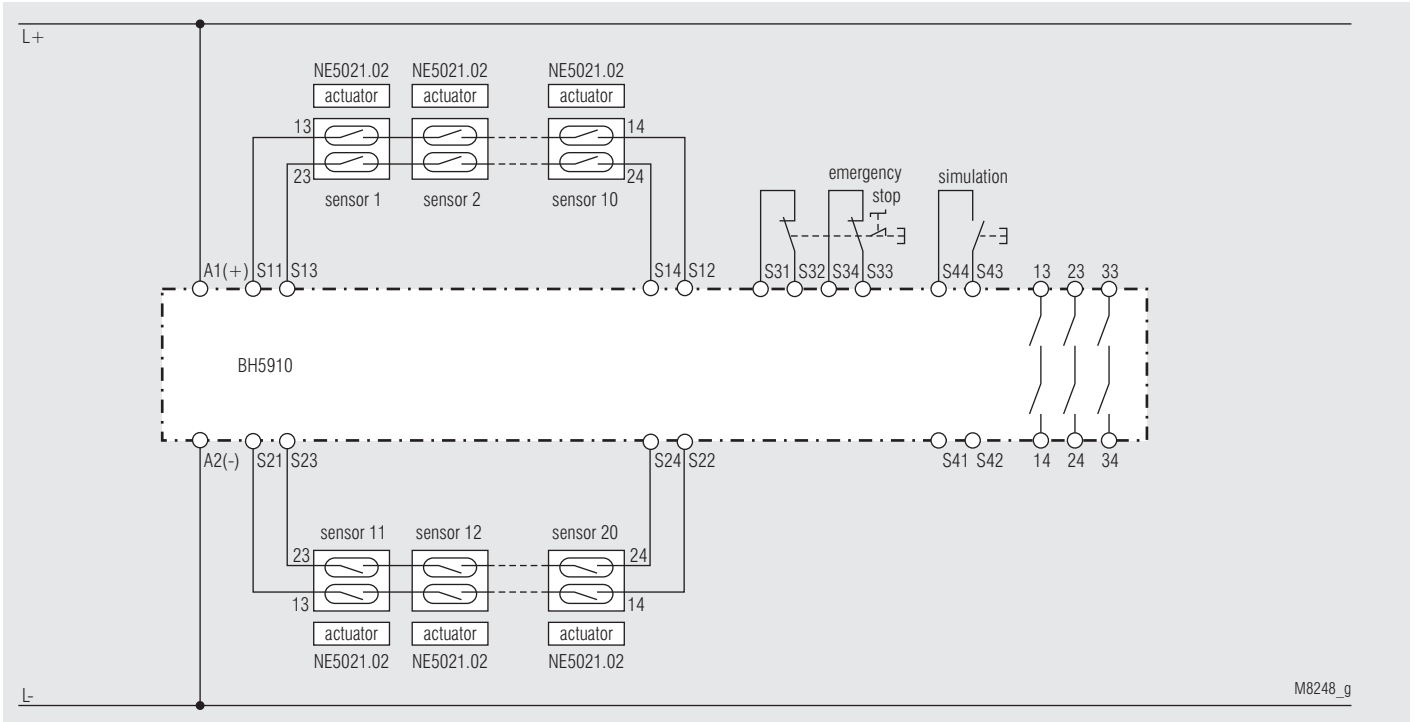
Terminal	1 gate with 3 NO gate contacts	2 gate with 2 NO gate contacts	1 gate with 2 C/O gate contacts	Feedback circuit for external contactors
S11 S12	gate 1, S1	gate 1, S1	gate 1, S1 NO contact gate 1, S1 common connector	
S14 S13	gate 1, S2	gate 1, S2	gate 1, S1 common connector gate 1, S1 NC contact	
S21 S22	gate 1, S3	gate 2, S1	gate 1, S2 NC contact gate 1, S2 common connector	
S24 S23	not connected	gate 2, S2	gate 1, S2 common connector gate 1, S2 NO contact	
	1 E-stop button, 1 Simulation or start button			
S31 S32	E-stop, channel 1			
S34 S33	E-stop, channel 2			
S41 S42				Feedback circuit
S44 S43	Simulation or start button			

Semiconductor outputs

Output	Flashing signal	Continuous signal
48	Open gate, e-stop loop open or failure in feedback circuit or failure on simulation button	
58	Gates are closed but starting conditions not fulfilled or E-stop loop has been opened and closed again. K1, K2 can be activated with the simulation button	Gates are closed and contacts K1, K2 are active



Pic. 12: Gate monitor and E-stop, 1 gate with 3 NO gate contacts and 1 e-stop loop (switch 1 position 4; switch 10 position 2)



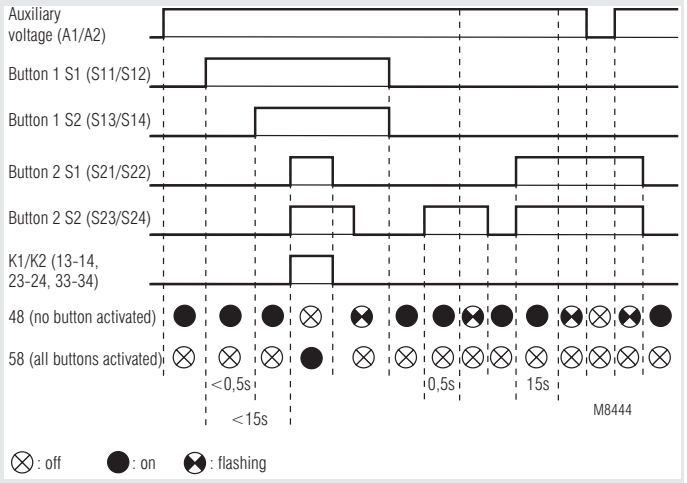
Pic. 13: Gate monitor and E-stop, safety gate monitoring with up to 20 magnetic coded safety switches NE 5021 + 1 e-stop loop (switch 1 position 4; switch 10 position 0 or 3)

Two-Hand Control (switch 1 in position 5)

4 pairs of 2-hand buttons Typ III A or 2 pairs of 2-hand buttons Typ III C according to DIN EN 574 can be connected in this function. The number of connected button pairs has to be selected on the device.
K1 and K2 can only be activated, if 3 conditions are fulfilled:
- First all button pairs have to be in initial position.
- Both buttons of 1 pair have to be pressed within 0.5 sec.
- All connected pairs have to be operated within 15 s.

If changeover contacts are used in the 2-hand buttons the switchover time has to be less then 50 ms. If it is longer the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.

Function Diagram



Two-hand control, 2 pairs of buttons with 2 NO contacts each

Set-Up Instructions

The device has to be connected as shown in the application examples. When connecting the push-buttons in parallel or in series the safe function of the relay is disabled. The buttons must be designed and installed in a way, that it is not possible to manipulate or to operate them without intention.

The distance between push buttons and dangerous area must be chosen in a way that it is not possible to reach the dangerous area after release of one button before the dangerous movement comes to standstill.

The safety distance "S" is calculated with the following formula:
S = V x T + C

a) moving speed of person V = 1 600 mm/s
b) stopping time of the machine T (s)
c) Additional safety distance C = 250 mm

If the risc of accessing the dangerous area is prohibited while the push buttons are pressed e.g. by covering the buttons, C can be 0. The minimum distance has to be in this case 100 mm. See also EN 574.

Settings on switch 10

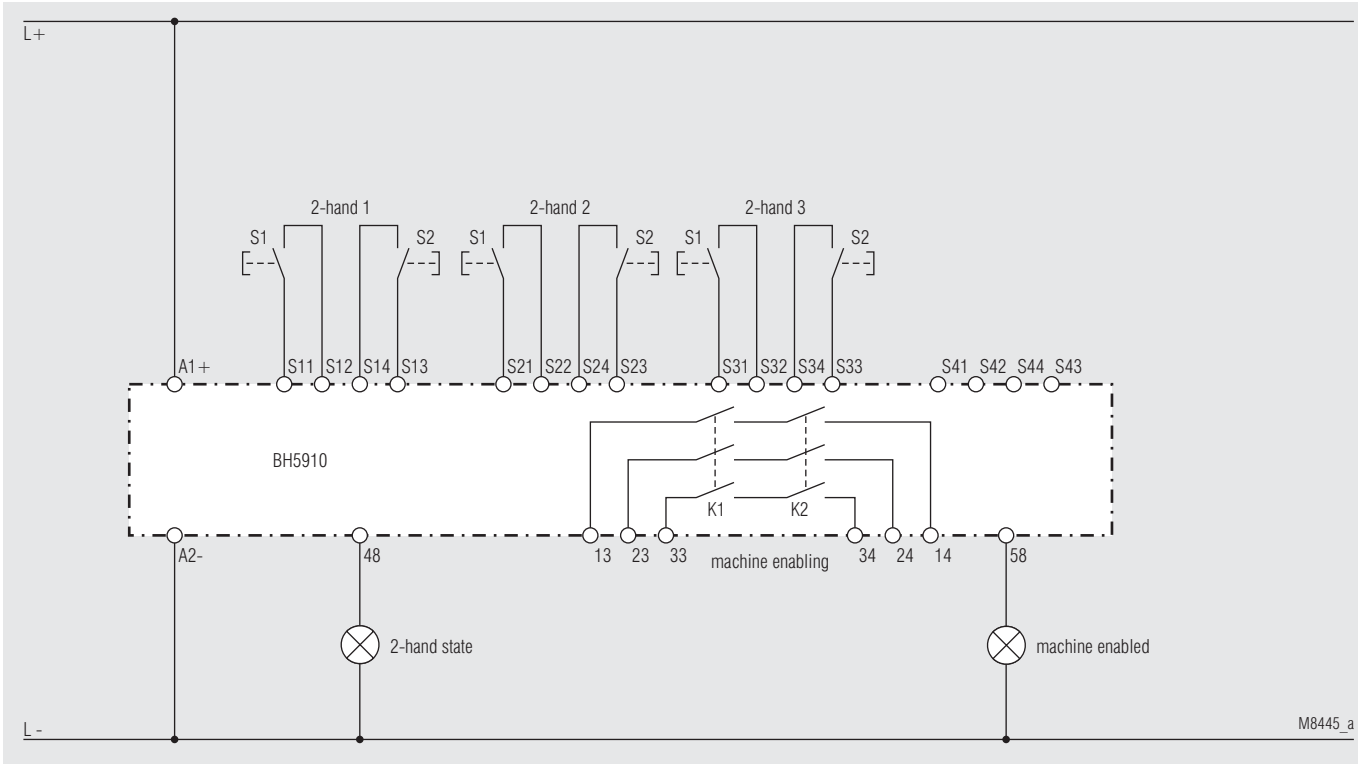
Switch 10	Number of button pairs	Type of button contacts	Feedback circuit for external contactors
0	1	2 NO contacts	no
1	2	2 NO contacts	no
2	3	2 NO contacts	no
3	4	2 NO contacts	no
4	1	2 C/O contacts	no
5	2	2 C/O contacts	no
6	1	2 NO contacts	yes
7	2	2 NO contacts	yes
8	3	2 NO contacts	yes
9	1	2 C/O contacts	yes

Terminal designation

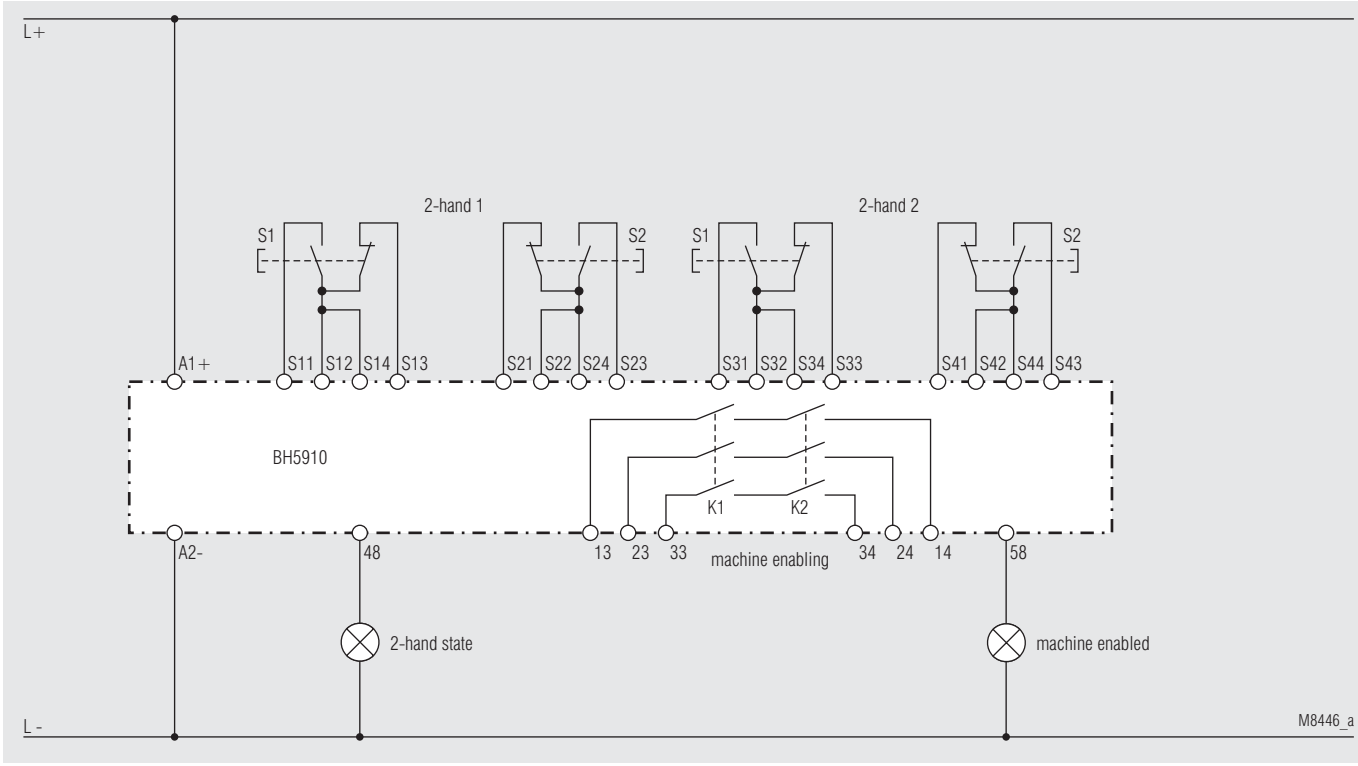
Terminal	Pair of buttons with 2 NO contacts each	Pair of buttons with 2 C/O contacts each	Feedback circuit for external contactors
S11	Pair 1, button S1	Pair 1, button S1, NO contact	
S12		Pair 1, button S1, common connector	
S14	Pair 1, button S2	Pair 1, button S1, common connector	
S13		Pair 1, button S1, contact NF	
S21	Pair 2, button S1	Pair 1, button S2, NC contact	
S22		Pair 1, button S2, common connector	
S24	Pair 2, button S2	Pair 1, button S2, common connector	
S23		Pair 1, button S2, NO contact	
S31	Pair 3, button S1	Pair 2, button S1, NO contact	
S32		Pair 2, button S1, common connector	
S34	Pair 3, button S2	Pair 2, button S1, common connector	
S33		Pair 2, button S1, NC contact	
S41	Pair 4, button S1	Pair 2, button S2, NC contact	Feedback circuit
S42		Pair 2, button S2, common connector	
S44	Pair 4, button S2	Pair 2, button S2, common connector	Acknowledge button
S43		Pair 2, button S2, NO contact	

Semiconductor outputs

Output	Flashing signal	Continuous signal
48	Open gate, e-stop loop open or failure in feedback circuit or failure on simulation button	All buttons in initial position. For a new start **all** buttons have to be activated according to the starting conditions.
58	Press acknowledge button.	All buttons are activated, K1, K2 are energized.



Pic.14: 2-hand control, with 3 pairs of buttons and 2 NO contacts each (switch 1 in position 5; switch 10 in position 2)
Safety switches Typ III A according to DIN EN 574



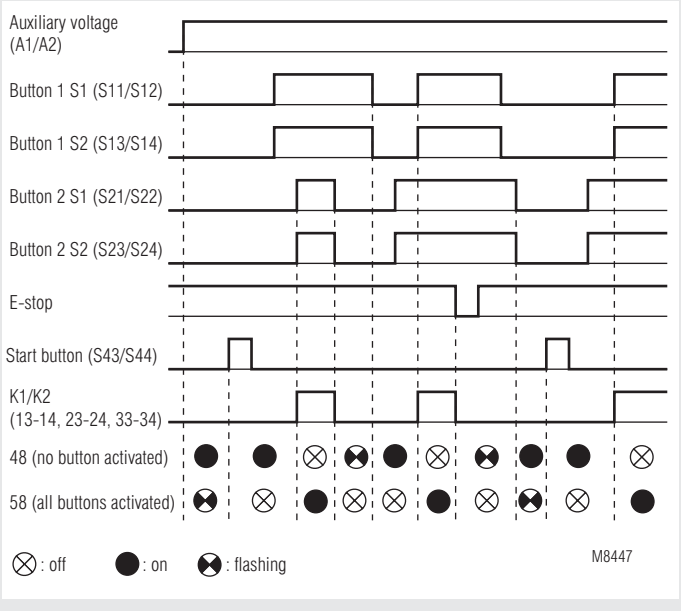
Pic.15: 2-hand control, with 2 pairs of buttons and 2 changeover contacts each (switch 1 in position 5; switch 10 in position 5)
Safety switches Typ III C according to DIN EN 574

Two-Hand Control and E-Stop (switch 1 in position 6)

2 pairs of 2-hand buttons can be connected in this function together with 1 e-stop loop. The number of connected button pairs has to be selected on the device.
K1 and K2 can only be activated, if 4 conditions are fulfilled:
- First all button pairs have to be in initial position.
- The e-stop contacts must be closed and manual start must be activated.
- Both buttons of 1 pair have to be pressed within 0.5 sec.
- All connected pairs have to be operated within 15 sec.

If changeover contacts are used in the 2-hand buttons the switchover time has to be less then 50 ms. If it is longer the outputs K1 and K2 are switched off and the unit gives failure code 7. This failure is stored and can only be reset by disconnecting the auxiliary supply.
After e-stop or power failure the start button must always be activated. The e-stop loop must be closed and all 2-hand button pairs must be in initial position.

Function Diagram



2-hand control and e-stop,
with 2 pairs of buttons with 2 NO contacts each and 1 e-stop loop

Set-Up Instructions

The device has to be connected as shown in the application examples. When connecting the push-buttons in parallel or in series the safe function of the relay is disabled. The buttons must be designed and installed in a way, that it is not possible to manipulate or to operate them without intention.

The distance between push buttons and dangerous area must be chosen in a way that it is not possible to reach the dangerous area after release of one button before the dangerous movement comes to standstill.

The safety distance "S" is calculated with the following formula:
S = V x T + C

a) moving speed of person V = 1 600 mm/s
b) stopping time of the machine T (s)
c) Additional safety distance C = 250 mm

If the risc of accessing the dangerous area is prohibited while the push buttons are pressed e.g. by covering the buttons, C can be 0. The minimum distance has to be in this case 100 mm. See also EN 574.

Settings on switch 10

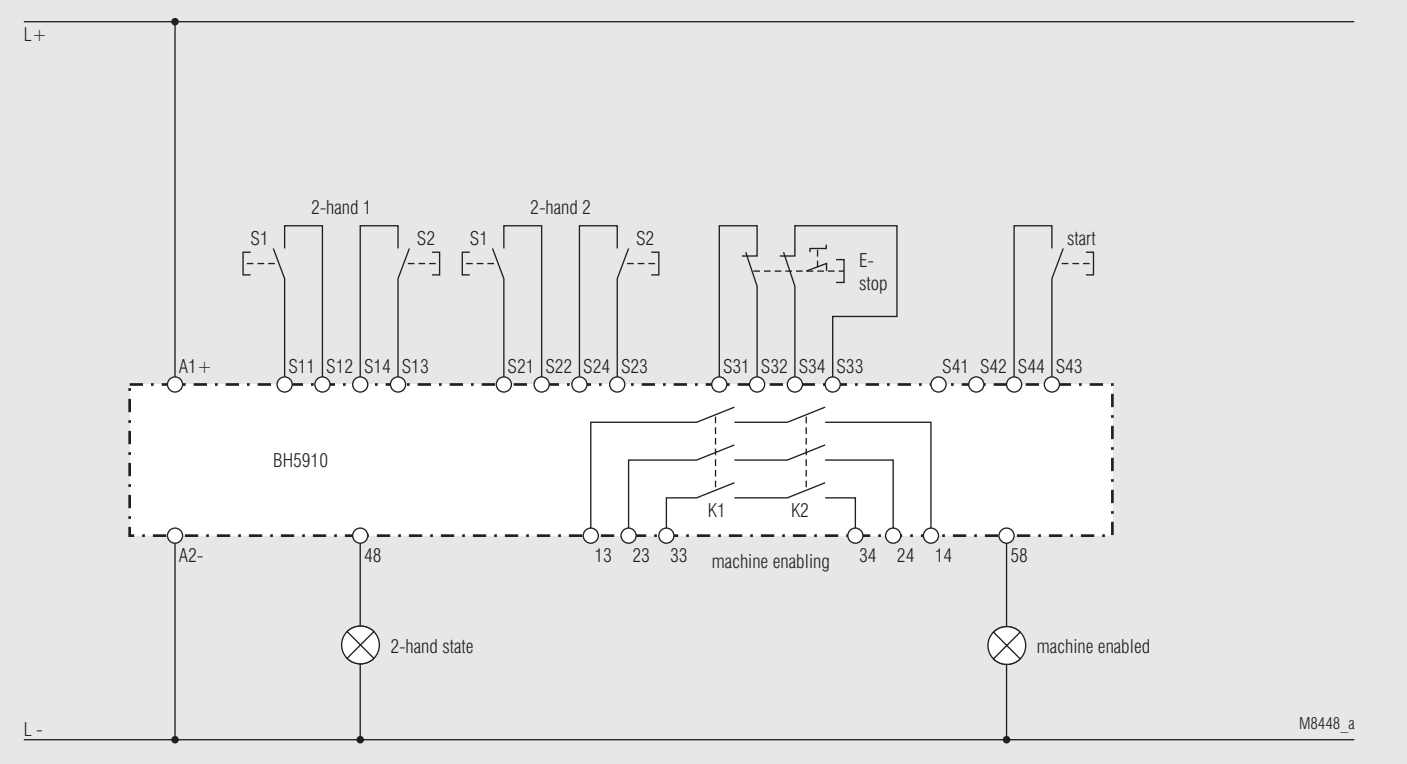
Switch 10	Number of button pairs	Type of button contacts	Feedback circuit for external contactors
0	1	2 NO contacts	no
1	2	2 NO contacts	no
2	1	2 C/O contacts	no
3	1	2 NO contacts	yes
4	2	2 NO contacts	yes
5	1	2 C/O contacts	yes
6-9	position not allowed (failure 5)		

Terminal designation

Terminal	Pair of buttons with 2 NO contacts each	Pair of buttons with 2 C/O contacts each	Feedback circuit for external contactors
S11	Pair 1, button S1	button S1, NO contact	
S12		button S1, common connector	
S14	Pair 1, button S2	button S1, common connector	
S13		button S1, NC contact	
S21	Pair 2, button S1	button S2, NC contact	
S22		button S2, common connector	
S24	Pair 2, button S2	button S2, common connector	
S23		button S2, NO contact	
	1 E-stop loop and 1 Start button		
S31	E-stop, channel 1		
S32			
S34	E-stop, channel 2		
S33			
S41	not connected		Feedback circuit
S42			
S44	Start button		
S43			

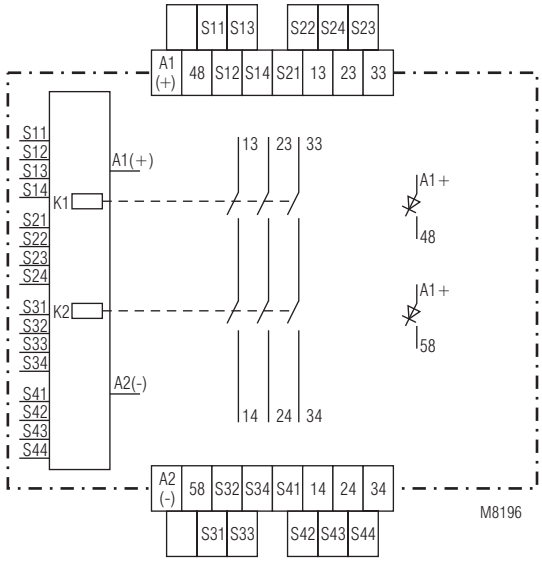
Semiconductor outputs

Output	Flashing signal	Continuous signal
48	E-stop loop open or starting conditions not fulfilled or failure in feedback circuit or on acknowledge button/start button.	All buttons in initial position. For a new start **all** buttons have to be linked according to the starting conditions.
58	Press acknowledge button.	All buttons are activated, K1, K2 are energized.

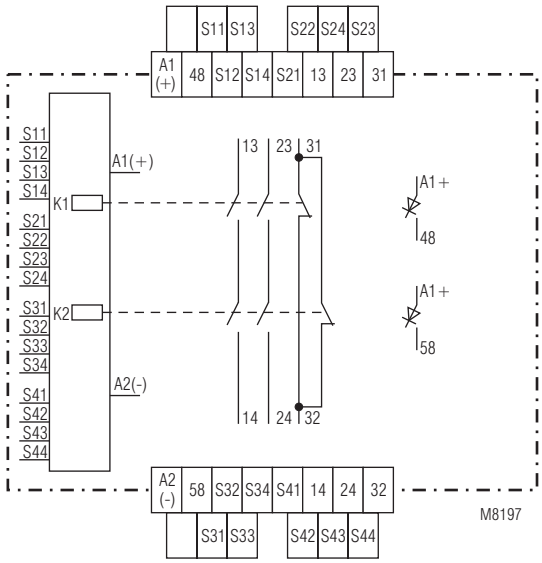


Pic. 16: 2-hand control and e-stop, with 2 pairs of buttons and 2 NO contacts each (switch 1 in position 6; switch 10 in position 1)
2-hand-safety switsches Type III A according to DIN EN 574

Circuit Diagrams



BH 5910.03



BH 5910.22

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2	- / N
S12, S14, S22, S24, S32, S34. S42, S44	Inputs
S11, S13, S21, S23, S31, S33, S41, S43	Outputs
13, 14, 23, 24, 33, 34	Forcibly guided NO contacts for release circuit
31, 32	Forcibly guided NC contacts for monitoring
48, 58	Semiconductor monitoring output

Technical Data

Input

Nominal voltage U_N: DC 24 V
Voltage range
at max. 5 % residual ripple: 0,85 ... 1,15 U_N
Nominal consumption: max. 170 mA
(Semiconductor outputs not connected)

Control voltage on S11, S13, S21, S23, S31, S33, S41, S43, 48, 58: DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, S44: 4,5 mA at U_N each
Min. voltage at terminals S12, S14, S22, S24, S32, S34 S42, S44: DC 16 V
Fusing: internal with PTC

Output

Contacts
BH 5910.03: 3 NO contacts
BH 5910.22: 2 NO contacts, 1 NC contact
The NC contact can only be used as indicator contact.
Contact type: Relay, forcibly guided
Operating time typ. at U_N

Function	Manual start	Auto start	
		Start	Restart
E-stop	45 ms	1,6 s	45 ms
Light curtains	45 ms	1,6 s	45 ms
Safety gates	45 ms (Simulation)		90 ms (TS)*)
2-hand control	54 ms (Activation)		

*) TS = closing of gate

max. switch off time (reaction time)

Function	
E-stop	28 ms
Light curtains	28 ms
Safety gates	28 ms
2-hand control	28 ms

Switching off when failure in feedback circuit: max. 100 ms
Nominal output voltage: AC 250 V
DC: see limit curve for arc-free operation
Switching of low loads: ≥ 100 mV
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 at 0,1 Hz: 8 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 2 A, AC 230 V: 10^5 switching cycles IEC/EN 60 947-5-1
Permissible switching frequency: max. 1 200 switching cycles / h
Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
line circuit breaker: C 8 A
Mechanical life: 10 x 10^6 switching cycles

Semiconductor Outputs

Output (terminal 48 and 58): transistor outputs, switching +
Nominal output voltage: DC 24 V, max. 100 mA continuous current, max. 400 mA for 0,5 s internal short circuit, over temperature and overload protection

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	± 0 ... + 50 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air) (according to test degree 3)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients		
on wires for power supply A1-A2:	2 kV	IEC/EN 61 000-4-4
on signal and control wires:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wireand ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	according to IEC/EN 61 496-1 (1997) the unit has to be mounted in a control cabinet with protection class 54	
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IeC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	according to IEC/EN 61 496-1 (1997) Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Shock proof:		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per ax is on all 3 axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 2,5 mm² stranded wire with sleeve or 1 x 4 mm² solid or 2 x 1,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weigth:	320 g	

Dimensions

Width x height x depth:	45 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	4	
$MTTF_d$:	180.9	a
DC_{avg}:	97.9	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	97.9	%
SFF	99.4	%
PFH_D:	5.57E-10	h^{-1}

Technical Data

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:

Kategorie:	4	
PL:	e	
$MTTF_d$:	31.5	a
DC_{avg}:	98.9	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	144	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	98.9	%
SFF	99.6	%
PFH_D:	7.80E-9	h^{-1}

*) HFT = Hardware-Failure Tolerance

Info 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"

Nominal voltage U_N:	DC 24 V
Ambient temperature:	0 … +50°C
Switching capacity:	
Ambient temperature 50°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Semiconductor outputs:	24Vdc, 100 mA
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

CCC-Data

Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

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

Standard Type

BH 5910.03/00MF2 DC 24 V

Article number: 0054217

- Output: 3 NO contacts
- All functions selectable via rotational switches
- Nominal voltage U_N: DC 24 V
- Width: 45 mm

Ordering Example

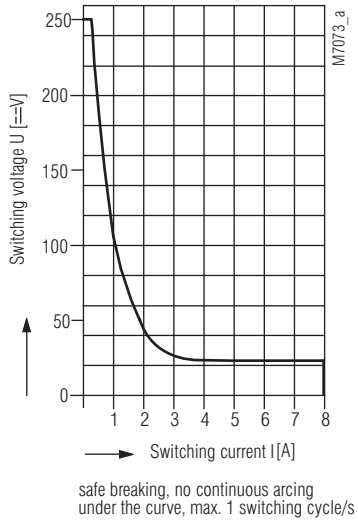
BH 5910 ._ _ /00MF2 DC 24 V

- DC 24 V: Nominal voltage
- ._ _: Contacts
  - .03: 3 NO contacts
  - .22: 2 NO contacts, 1 NC contact
- BH 5910 /00MF2: Type

Variant

BH 5910/61: with UL-approval

Characteristic



Limit curve for arc-free operation

Fault Indication by flashing code

The failure codes are displayed by a flashing sequence of the upper yellow LEDs run 1, run 2. Flashing frequence: env. 0,5 s on, 0,05 s off, end od the sequence: env. 2 s off. It is possible that the two processors show different failure codes.
If a failure is displayed, the relays K1 and K2 are switched off.

These failures are serious and do not allow further operation of the module. They are indicated only by the LEDs run 1 and / or run 2 of the module. The semiconductor outputs 48 and 58 are both switched off. The module can only be reset by switching the power supply off and on again.

N°*)	Description	Mesures et conseils
0	Internal module failure (LEDs are continuously off)	If both LEDs stay off, the module is defective and has to be repaired.
5	Adjustment failure	1) The settings of the 2 channels are not identically. 2) The selected setting is not permitted.
6	Undervoltage detection ou Overvoltage detection	1) Left LED is flashing: The supply voltage dropped below the permitted value (< approx.0.85 U_N) 2) Right LED is flashing: The supply voltage went over the permitted value (> approx.1.15 U_N + 5 % residual ripple)
7	Input failure	1) A short circuit has been detected on the inputs of the unit. 2) The 2 signals of a 2-channel sensor (E-stop button, light curtain) are not identical. (Short circuit, broken wire, other defects).
8	Failure on relays K1 or K2	Check circuit and current. Module has to be repaired.
9 10 11	Internal module failure	Please try to evaluate the circumstances that lead to this10 fault and check with the supplier or manufacturer.
12 13 14	Internal module failure	The module has to be repaired

*) No.: Number of flash pulses in a series

SAFEMASTER M
Multifunction Safety System
System Overview

0261526

- Multifunction, modular safety system with field bus interface

Approvals and Markings

CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | c UL us Canada / USA | A025518

Your Advantages

- Free interconnection of input and output functions
- Group hierarchy easily achieved
- No programming required
- Simple set up via internal switches
- Function selection set by screwdriver
- Control of a large system is possible without complicated wiring
- Flexible on site adjustment available to change functions
- System is easily extended via extender modules
- System indication on all modules via LED and semiconductor monitoring outputs
- Field bus interface option available to signal the system status
- Multifunction allows ease of design and build

Applications

flexible, multi purpose and expandable

The SAFEMASTER M multifunction system offers an ideal solution to control the safety functions for many areas in machine building and plant processing.
For example: Paper and printing industry, Forming machinery, Food, Beverage and Packaging industry, Robot cells, Machine tools and complet production transfer lines.

In many cases this system offers a complete solution to the ever-increasing demand in automation to process more and more safety functions, the SAFEMASTER M offering a highly flexible but cost effective solution compared with conventional safety modules.
This system is suitable to link and control safety functions to safety category up to Cat. 4, PLe (EN ISO 13849-1) resp. SIL 3 (IEC/EN 61508, IEC/EN 62061).

Ideal solutions for mobile and stationary machines and plants with dangerous areas
- during automatic operation e. g. to clear failures
- during set up e. g. to adjust machine parameters, maintenance, set up

Features

- Up to 26 single-channel or 13 2-channel input circuits
- Up to 15 redundant, safety output contacts according to cat. 4 PLe (EN ISO 13849-1) e. g. SIL 3 (IEC/EN 61508, IEC/EN 62061)
- 4 start button-inputs for enabling/acknowledgement
- 2 Semiconductor monitoring output in each input module and control unit
- 1 input for a feed back circuit in output module each
- Manual/Auto-Start
- with/without cross fault detection
- As option with instantaneous or delayed relay outputs
- System indication via optional field bus interface
- 4 output groups operated either separately, together or individually combined.

Additional Information About This Topic

- You will find information about the single modules of SAFEMASTER M in each datasheets (see „system components“)
- You will find detailed information in the System description SAFEMASTER M

More Functions, More Flexibility and High Safety Level

The software free safety system SAFEMASTER M allows individual safety solutions. Monitoring of different safety functions like e-stop, safety gates, light barriers, light curtains, safety mats, 2-hand controls according to EN 574 IIIA/IIIC etc. can be made. Instantaneous stop or controlled disconnection with delayed contacts is possible.

Free Assignment of Input Modules to Output Modules

The SAFEMASTER M includes the most important functions of a small safety plc. It controls as master unit the safety functions of machines and production lines. The input modules can be assigned individually to output modules. A gateway as option allows to connect the system to existing, non-safety bus systems for indication purposes.

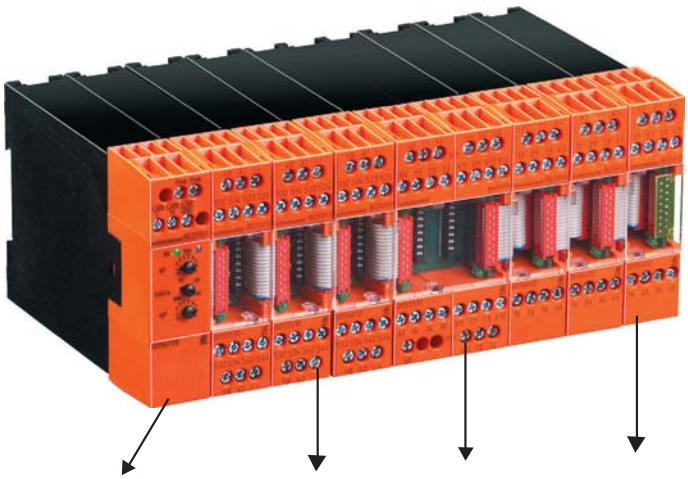
No Software Necessary

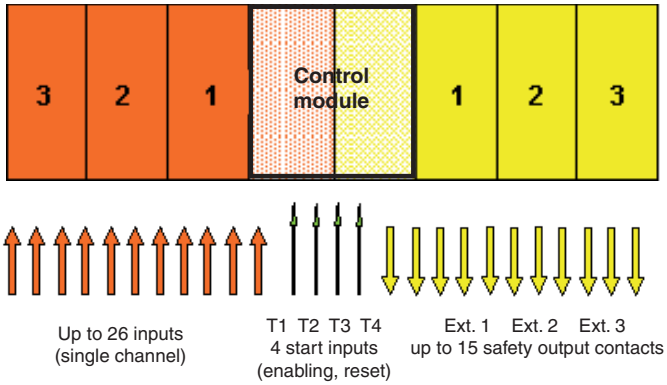
Software is not required. The configuration is made using simple DIP-switches. This means no cost for programming, configuration and service tools, no problems and no cost for updates when new operating systems are introduced. Cost for software training is also saved.

Partner for a Standard PLC

The SAFEMASTER M is an ideal supplement to a standard plc. While the plc is responsible for the machine control, SAFEMASTER M handles all safety related switching functions. Safety relevant states can be transferred by standard semiconductor outputs or via field bus connection to the plc for indication.

The System





Ext. 1-3 = Extension modules 1-3

The Control Module

The heart of SAFEMASTER M is the control module BH 5911. It is the controller of the whole system but includes already input and outputs. A dual channel input for Cat4 e-stop is integrated. When using single channel Cat2 e-stops, 2 e-stop loops are available. 4 start inputs are also integrated in the control module. The assignment of the start buttons to the input modules is made via DIP-switches in each individual input module. Up to 3 input modules can be placed on the left side and up to 3 output modules to the right side of the control module on a DIN rail. The electrical connection is made by a flat type cable.

The Input Module

The safety functions are programmed in the firmware of the input modules. A speciality of the input modules is that up to 4 safety functions of cat. 4, PLe (EN ISO 13849-1) resp. SIL 3 (IEC/EN 61508, IEC/EN 62061) are integrated i. e. 8 safety input channels.

Modules can have 4 identical safety functions, ore mixed functions. DOLD has made a pre-selection of the most common required combinations in practice. To reduce the number of possible combinations to a minimum each module contains up to 4 different combinations of the 4 possible safety functions that can be chosen on site by the user. This multifunction feature reduces stock cost.

The selection of the right input module is very important to get the optimum solution. For demonstration see below example with the modules BG5913.08/01MF0.

Each input module has 2 semiconductor outputs for indication e. g. to a PLC.

BG5913.08/01MF0 **Dual channel safety functions**

-	1 x	3 x	-
-	2 x	2 x	-
-	1 x	1 x	1 x
1 x	-	1 x	1 x
-	3 x	1 x	-

The Output Modules

Each output module has safety related (redundant) outputs according to Cat 4, PLe (EN ISO 13849-1) resp. SIL 3 (IEC/EN 61508, IEC/EN 62061). All contacts in one module switch together. Different contact combinations are available e. g.

- 4 NO contacts
- 3 NO contacts, 1 NC contact
- instantaneous switching
- delayed switching
- combination of instantaneous and delayed

Each output module integrates a feed back input to monitor external contactors.

Set up your customized safety system here [1)]

Device type	Designation	Start inputs	Application, adjustable				Safety output contacts		Non safety auxiliary contacts	Category acc. to EN 13849-1	PL acc. to EN ISO 13849-1	SIL acc. to EN 62061	Width in mm
			E-Stop / E-shut-off	Light barrier	Safety gates	Two-hand	Instantaneous contacts	Delayed contacts	NC contacts max.				
 BH 5911.03/00MF0	Control unit	4 start / 3 start + 1 stopp	x	x			3			4	e	3	45
BH 5911.22/00MF0	Control unit	4 start / 3 start + 1 stopp	x	x			2		1	4	e	3	45
 BG 5913.08/00MF0	Input module		x	x	x	III A, III C				4	e	3	22.5
BH 5913.08/00MF0	Input module, galvanically isolated		x	x	x	III A, III C				4	e	3	45
BG 5913.08/01MF0	Input module		x	x	x	III C				4	e	3	22.5
BG 5913.08/02MF0	Input module		x	x	x	III C				4	e	3	22.5
BG 5913.08/03MF0	Input module		x	x		III C				4	e	3	22.5
 BG 5914.08/00MF0	Input module		x	x						2	d	2	22.5
BH 5914.08/00MF0	Input module, galvanically isolated		x	x						2	d	2	45
 BG 5915.08/00MF0	Input module		x	x	x					4	e	3	22.5
BH 5915.08/00MF0	Input module, galvanically isolated		x	x	x					4	e	3	45
 BG 5912.04	Output module						4			4	e	3	22.5
BG 5912.48	Output module						3		1	4	e	3	22.5
BG 5912.86	Output module, off-delayed							3 (to 20 s)		4	e	3	22.5
BG 5912.95	Output module, off-delayed							2 (to 3 s)	1	4	e	3	22.5
 BG 5551	Feldbusmodul CANopen												22,5
BH 5552	Feldbusmodul PROFIBUS-DP												45
in Vorbereitung	Feldbusmodul PROFINET												

[1)] Additional configurations on request!

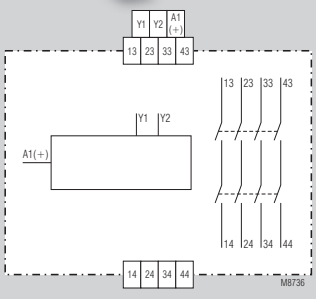
Input Modules - Properties and Application

	Device type	Designation	Application, adjustable				Category acc. to EN 13849-1	PL acc. to EN ISO 13849-1	SIL acc. to EN 62061	Width in mm
			E-Stop / E-shut-off	Light barrier	Safety gates	Two-hand				
	BG 5913.08/00MF0 BH 5913.08/00MF0*)	Input module	4 - - -	- 4 - -	- - 4 -	- - - 4	4	e	3	22.5 45
	BG 5913.08/01MF0	Input module	- - - - 1	1 2 3 1 -	3 2 1 1 1	- - - 1 1	4	e	3	22.5
	BG 5913.08/02MF0	Input module	1 4 - - 2	1 - - 2 -	1 - 1 - -	- - 1 1 1	4	e	3	22.5
	BG 5913.08/03MF0	Input module	3 2 1 2 - 1	1 2 3 - 2 1	- - - - - -	- - - 1 1 1	4	e	3	22.5
	BG 5914.08/00MF0 BH 5914.08/00MF0*)	Input module	1-channel 8 6 6	2-channel - 1 -	- - 1	- - - -	2	d	2	22.5 45
	BG 5915.08/00MF0 BH 5915.08/00MF0*)	Input module	manual 2 or 2 - or - - or - - or - - or 1 enabling swtich	auto - 1 2 3 - - - - -	- - - - - - 1 2 2	- - - - - - - - -	4	e	3	22.5 45

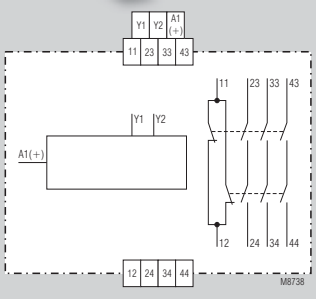
*) with galvanically isolated inputs

Output Modules - Properties and Application

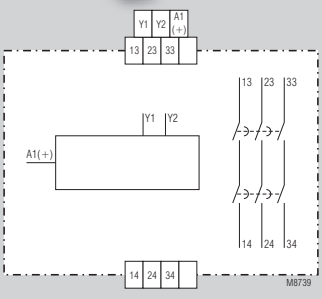
BG 5912.04



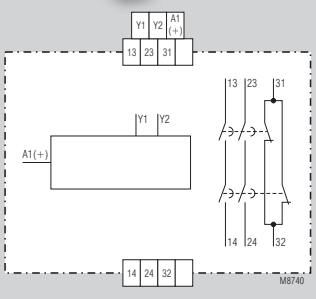
BG 5912.48



BG 5912.86

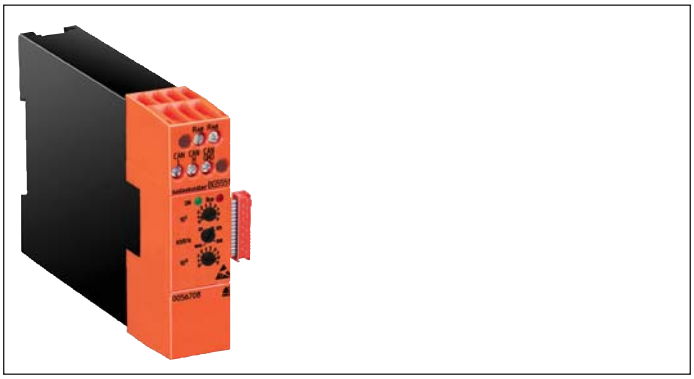


BG 5912.95



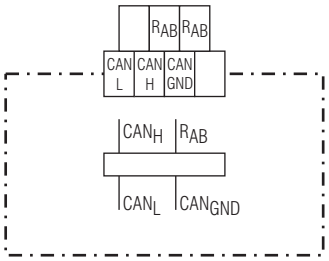
SAFEMASTER M Multi-Function Safety System
Diagnostic Module for CANopen
BG 5551

0272625



- For transmitting the status information from the control unit and the input modules, e.g. input and error states, start button and safety output assignments, to a control system or bus-capable display
- Galvanic separation
- Adjustment of transmission via rotary switch
- LED indicators for operating voltage and status
- Width 22,5 mm

Circuit Diagram



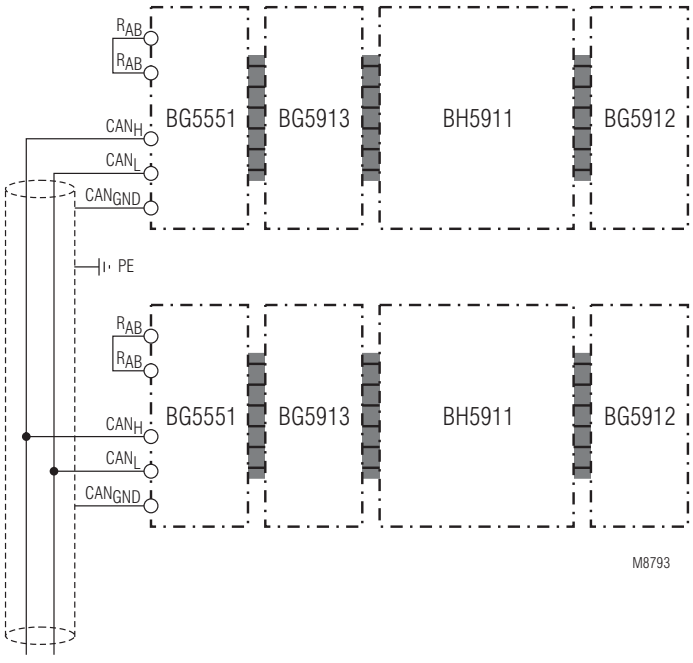
Approvals and Markings

CE

Applications

For connection to a CANopen network for visualizing the status of the multi-function safety system SAFEMASTER M.

Connection Example



Indicators

Green LED „on“:	on when supply connected
Green LED „run“:	Continuously on, when the diagnostic module is accessed by the bus, flashing, when a bus failure is detected

Device Connection

The diagnostic module is simply connected via flatcable instead of the left termination plug of the safety system. This connection is used for the power supply and for receiving the data to be evaluated.
The CANopen-Bus is connected via terminals CAN_L und CAN_H. When the diagnostic module is physically installed at the end of the CAN Bus, the terminals R_{AB} have to be bridged.

Device Setting

The address (01 to 99) of the module in the CANopen system s set on the rotary switches 10^1 and 10^0.
The middle switch allows to set the data transmission rate. 20 Kbit, 125 Kbit, 500 Kbit or 1000 Kbit.
All other configurations is done by software, e.g. Pro CANopen. A configuration file is necessary which can be obtained on CD-Rom PN 5501. It is located in the folder CANopen/EDS.
Order reference: PN 5501, Article number: 0052860

Attention:

Work on the device must be carried out by specialist personnel when the device is in a deenergized state.

Technical Data

Input

Nominal voltage U_N:	DC 24 V (power is supplied - by the SAFEMASTER M)
Voltage range:	
at max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	max. 100 mA
CANopen interface	
Transmission medium:	Twisted, shielded two-wire line
Transmission optionally:	20 Kbit/s 125 Kbit/s 500 Kbit/s 1 Mbit/s
Maximum length:	2500 m at 20 Kbit/s 500 m at 125 Kbit/s 90 m at 500 Kbit/s 15 m at 1 Mbit/s

The screen of the bus cable has to be connected to the terminal CAN_{GND} of all diagnostic modules and at one point also to PE (see connection example).

General Data

Nominal mode of operation:	Continuous operation	
Temperature range:	± 0 ... + 50° C At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.	
EMC		
HF irradiation:	10 V / m	IEC 61 000-4-3
Fast transients		
on supply line A1-A2:	2 kV	IEC 61 000-4-4
on signal and control lines:	2 kV	IEC 61 000-4-4

Technical Data

Surge voltage		
between supply lines:	1 kV	IEC 61 000-4-5
between supply line and ground:	2 kV	IEC 61 000-4-5
HF wire guided:	10 V	IEC 61 000-4-6
Interference suppression:	Grenzwert Klasse B	EN 55 011
Degree of protection		
Housing:	IP 20	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Resistance to shock		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per axis on 3 axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 2.5 mm² stranded wire with sleeve or 1 x 4 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Terminal screws M3,5, box terminals with wire protection	
Mounting:	on DIN rail	IEC/EN 60 715
Weight:	135 g	

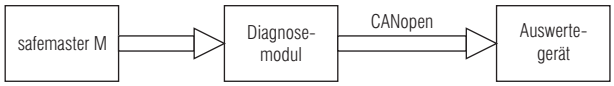
Dimensions

Breite x Höhe x Tiefe	22.5 x 84 x 121 mm

Standard Type

BG 5551 DC 24 V 50 / 60 Hz
Article number: 0056708

Information on System Diagnostics

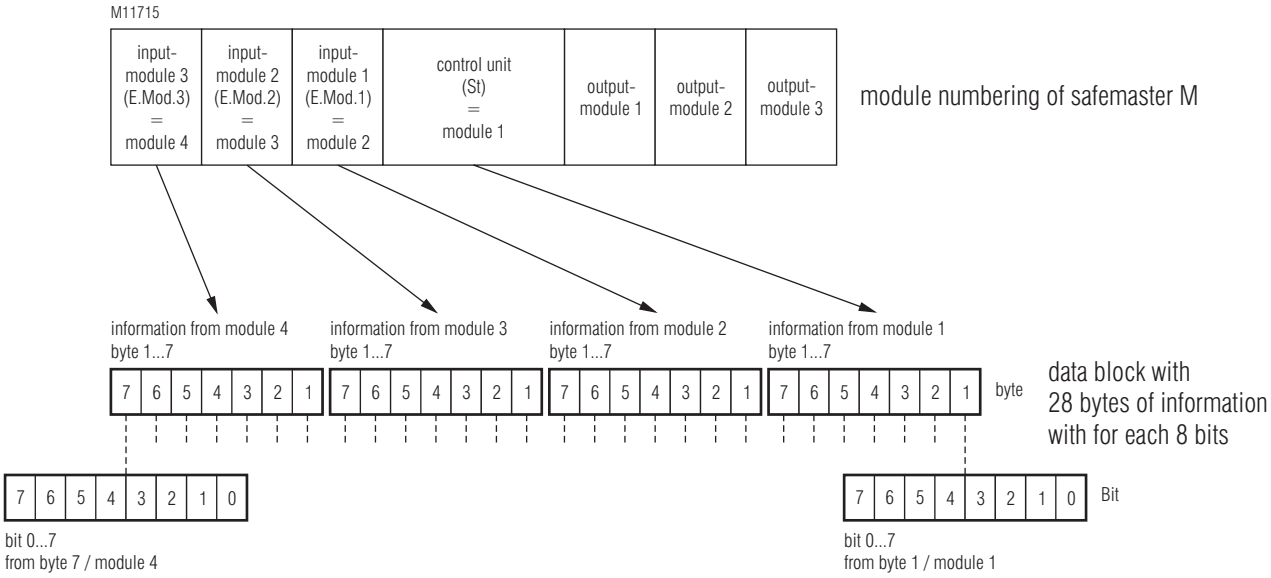


M8807

Flow of information to evaluate data

Information Structure

The diagnostic module delivers depending on the configuration a package of max. 28 information bytes. These are 7 Bytes for the control unit, and 7 Bytes each for the 3 possible input modules. Each byte has 8 information bits (Bit 0 ... Bit 7). The tables below „Structure of Diagnostic Information“ show the assignment of each byte.



Structure of Diagnostic Information

Byte No.	CANopen designation	Module	Informationsbytes							
			Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1	**Modul1 ModulNr** **Modul2 ModulNr** **Modul3 ModulNr** **Modul4 ModulNr**	St* E.Mod.1* E.Mod.2* E.Mod.3*	0	0	0	0 = OK 1 = Systemfehler	Module number, if module available			0001 = Modul 1 0010 = Modul 2 0011 = Modul 3 0100 = Modul 4
			0000 0000: Module not available or another module reports errors. In this case, all 7 bytes have the value 0000 0000.							
2	Modul1 assignements Modul2 assignements Modul3 assignements Modul4 assignements	St* E.Mod.1* E.Mod.2* E.Mod.3*	Which start button effects this module?				Which output module does this module have an effect on?			
			1 = T4	1 = T3	1 = T2	1 = T1	1 = output module 3	1 = output module 2	1 = output module 1	1 = Control unit
			If bit 4 is set in the module number: system error code							
3	Modul1 input status	St*	Only if the button concerned is assigned to the control unit				if T4 = start button: 0	0	1 = input S14 inaktive	1 = input S12 inaktive
			1 = T4 activated	1 = T3 activated	1 = T2 activated	1 = T1 activated	if T4 = stop-button: 1 = Stop activated			
	Modul2 input status Modul3 input status Modul4 input status	E.Mod.1* E.Mod.2* E.Mod.3*	1 = input S42 inactive	1 = input S32 inactive	1 = input S22 inactive	1 = input S12 inactive	1 = input S44 inactive	1 = input S34 inactive	1 = input S24 inactive	1 = input S14 inactive
4	Modul1 output status	St*	1 = output module 3 activated	1 = output module 2 activated	1 = output module 1 activated	1 = safety outputs of control unit activated	0	Status of output 48 (error code)	1 = activation of assigned output modules released (green LEDs left)	Status of yellow LED run 1 (error code)
			Comment: These bits show the activation signal, which is transmitted to the modules. In the case of delayed outputs, the progress of the delay time is not visible.							
	Modul2 input status Modul3 input status Modul4 input status	E.Mod.1* E.Mod.2* E.Mod.3*	0	0	0	0				
5	Modul1 status byte 1	St*	1 = error on a safety output	1 = release of assigned safety outputs enabled	1 = waiting for activation of assi-gned start button (error has been eliminated)	1 = short circuit on the inputs	Position of function switch (0000 bis 1001 for function 0 to 9)			
	Modul2 input status Modul3 input status Modul4 input status	E.Mod.1* E.Mod.2* E.Mod.3*	1 = control unit reports errors (bit 4 or 7 of module status byte 1 set)							
			see comments below							
6	Modul1 status byte 2 Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	St* E.Mod.1* E.Mod.2* E.Mod.3*	The assignment of this byte depends on the function of the control unit or the respective input module (see the following pages)							
7	Modul1 starts and security outputs Modul2 starts and security outputs Modul3 starts and security outputs Modul4 starts and security outputs	St* E.Mod.1* E.Mod.2* E.Mod.3*	start button T4 activated	start button T3 activated	start button T2 activated	start button T1 activated	1 = activation of output module 3 enabled	1 = activation of output module 2 enabled	1 = activation of output module 1 enabled	1 = activation of safety outputs of Ct* enabled

Comment: Bit 7 and bit 4 of the **Modul x status byte 1** (Byte 5) are saved from the time when the error appears until when the module is restarted. DThe fact that the fault was corrected is indicated by bit 5 in the case of a manual start; and by bit 6 in the case of an automatic start. If these errors are detected in the control unit, the entire **SAFEMASTER M** system is locked. f the input modules are error-free in the „automatic start“ mode, their bits 7 and 6 flash in the **status byte 1** (byte 12, 19 or 26) as well as their green LEDs until the error has been corrected in the control unit or in the safety outputs.

Structure of Diagnostic Information

Assignment of bytes 6 in the different modules of SAFEMASTER M

Control unit BH 5911:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul1 status byte 2	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop S14 activated	1 = emergency stop S12 activated	1 = error on output module 3	1 = error on output module 2	1 = error on output module 1	1 = error on the safety outputs of the Ct*

Comment 1: All signals are saved from the time when the error is detected until the safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (byte 5), bits 5 and 6.
Comment 2: In the case of a 2-channel emergency stop, bits 5 and 4 change together. For more precise diagnostics of the input signals, byte 3 (status of the inputs) must be evaluated.

Input module BG 5913.08/_0_ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = time error[2)]	1 = one of the assigned start buttons has been activated	1 = one of the assigned simulation buttons has been activated	0 (unused)	1 = function group 4 of module does not grant release[1)]	1 = function group 3 of module does not grant release[1)]	1 = function group 2 of module does not grant release[1)]	1 = function group 1 of module does not grant release[1)]

BComments: Except for bit 6 and 5, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.
1) The numbers of the different function groups match the numbering of the safety functions in the application examples of the data sheet of input module BG 5913.08/_0_ _ _. If less than 4 functions are possible as a result of the input module setting (e.g. max. 2 with two-hand control type IIIC), the surplus bits are set to 0.
2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Input module BG 5913.08/_1_ _ _, BG 5913.08/_2_ _ _ and BG 5913.08/_3_ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = time error[2)]	1 = one of the assigned start buttons or simulation buttons has been activated	0 (unused)	0 (unused)	1 = function group 4 of module does not grant release[1)]	1 = function group 3 of module does not grant release[1)]	1 = function group 2 of module does not grant release[1)]	1 = function group 1 of module does not grant release[1)]

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.
1) The numbers of the different function groups match the numbering of the safety functions in the applications examples of the data sheet from input module. If a function combination with two-hand type IIIC is set on the input module, only 3 function groups are available and bit 3 is then always 0.
2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Structure of Diagnostic Information

Input module BG 5914.08/_0_ _ _, BH 5914.08/_1_ _ _ and BH 5914.08/_2_ _ _

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Modul2 status byte 2 Modul3 status byte 2 Modul4 status byte 2	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop on S14, S24, S34 or S44 does not grant release[1)]	Double contact error on S42 - S44[2)]	1 = emergency stop on S42 or S44 does not grant release[1)]	1 = emergency stop on S32 or S34 does not grant release[1)]	1 = emergency stop on S22 or S24 does not grant release[1)]	1 = emergency stop on S12 or S14 does not grant release[1)]

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 12, 19 or 26), bits 5 and 6.

1) The emergency stop function which actually prevented the release can only be recognized from the combination of bit 5 with the bits 0 to 3. The current status of the inputs is always visible in byte 10, 17 or 24 (status of the inputs).
2) Bit 4 is only set if S42 and S44 are set for 2-channels for the emergency stop function, and both signals do not match.

Interpretation Example for Diagnostic Information

We have a safemaster M system with the following components:
- 1 control unit BH 5911.03/00MF0
- 1 output module BG 5912.04
- 1 diagnostic module BH 5552 for Profibus DP

The transmitted information from diagnostic module BH 5552 is to be used in order to observe how and why the outputs of output module 1 change.

The available diagnostic information of the control unit and its changes are shown here:

1. Normal state: Safety outputs are activated, all EMERGENCY STOP buttons are released

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: 00	Bin: 00000000
Byte 4: Status of outputs:	Hex: 00	Bin: 00000000
Byte 5: Status byte 1:	Hex: 45	Bin: 01000101
Byte 6: Status byte 2:	Hex: 00	Bin: 00000000
Byte 7: Start button and safety outputs:	Hex: 0B	Bin: 00000011

Module number 01 with deleted bit 4 shows that the entire safemaster M system is working properly.
The set bits 0 to 3 of status byte 1 show that the function switch of the control unit (module1) is set to position “5”. That means that the following mode of operation is set:

2 x 1 channel emergency stop, manual start, 4 start buttons

The set assignments in byte 2 shows you that the control unit is started by the start button 1 (bit 4), and it has an effect on its own outputs (bit 0) and the outputs of output module 1 (bit 1). Since no input module is available, the outputs of both modules must always have the same status.

The set bit 6 in status byte 1 means the control unit grants the release for setting the safety outputs which are assigned to it. The fact that the outputs are actually set can be seen in byte 4.

2. Emergency stop button on S12 activated

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: 01	Bin: 0000000**1**
Byte 4: Status of outputs:	Hex: 0x	Bin: 00**00**0**x0x**x = flash
Byte 5: Status byte 1:	Hex: 05	Bin: 0**0**000101
Byte 6: Status byte 2:	Hex: 10	Bin: 000**1**0000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 000000**00**

Bit 6 in status byte 1 shows that the control unit does not release the safety outputs which are assigned to it.
The reason for this is indicatedby bit 0 in byte 3 (input S12 inactive) and by bit 4 in status byte 2 (emergency stop activated). The set bit 4 in byte 6 is saved until the release is granted again.
Byte 4 signals that the outputs have actually dropped out (bit 4 and 5) and the output 48 (bit 2) as well as the LED run 1 (bit 0) flash.

3. Emergency stop button is unlocked again

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: **00**	Bin: 0000000**0**
Byte 4: Status of outputs:	Hex: 0x	Bin: 00000x0x
Byte 5: Status byte 1:	Hex: **25**	Bin: 00**1**00101
Byte 6: Status byte 2:	Hex: 10	Bin: 00010000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 00000000

Since all inputs are in quiescent state again, only the status bytes 1 and 2 as well as byte 4 (status of outputs) still indicate that safemaster M was switched off. However, the saved bit 4 in status byte 2 still shows the reason for switch-off.

4. Start button T1 is activated

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: **01**	Bin: 000**1**0000
Byte 4: Status of outputs:	Hex: **00**	Bin: 00000**0**0**0**
Byte 5: Status byte 1:	Hex: **05**	Bin: 00100101
Byte 6: Status byte 2:	Hex: **00**	Bin: 000**0**0000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 00000000

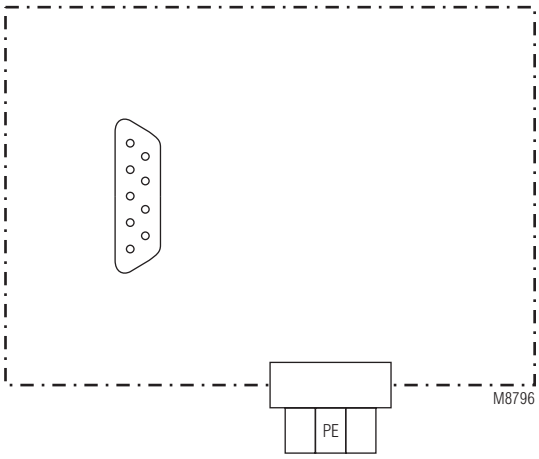
If the start button was activated properly (< 3 s), the system returns to the normal state described under section 1. If the start button is activated for too long (> 3 s), bit 7 would signal in byte 6.

Comment:
If a system was already put into operation, it is often sufficient just to evaluate status bytes 1 and 2.
Depending on the depth and degree of detail of the diagnostics, e.g. in the case of troubleshooting when placing the system into operation, the other bytes can also be included if required.

SAFEMASTER M Multi-Function Safety System
Diagnostic Module for Profibus DP
BH 5552

- For transmitting the status information from the control unit and the input modules, e.g. input and error states, start button and safety output assignments, to a control system or bus-capable display
- Electrical isolation
- Automatic recognition of transmission speed
- LED indicators for operating voltage and status
- Width of 45 mm

Circuit Diagram



Approvals and Markings

CE

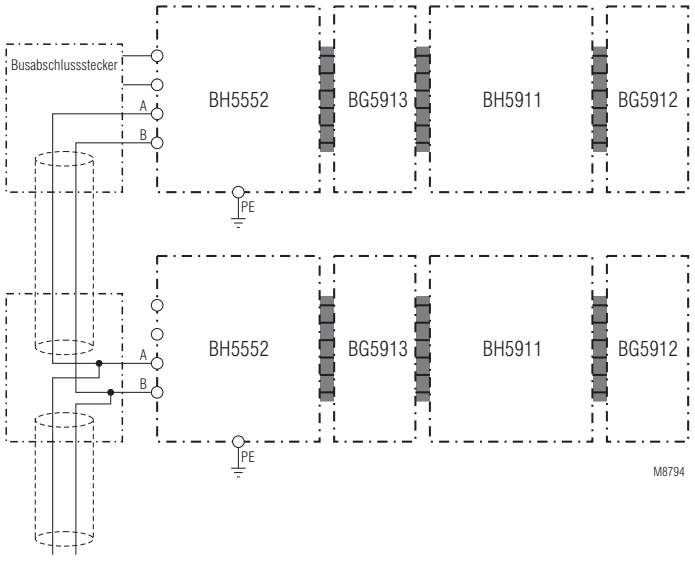
Applications

For connection to a Profibus DP network for visualizing the status of the multi-function safety system SAFEMASTER M.

Indicators

Red LED “err“:	lights in the event of an error
Yellow LED “run”:	lights if data is transmitted correctly
Green LED “rdy”:	to indicate operational readiness
Red and green LED:	flash if device address 0 is set (reserved for master).

Connection Example



Device Connection

The diagnostic module is simply connected via flatcable instead of the left termination plug of the safety system. This connection is used for the power supply and for receiving the data to be evaluated.
The Profibus DP network is connected via the SubD connector on the device. The installation guidelines based on the PNO document “Installation Guideline for Profibus DP/FMS” must be followed.

Device Setting

The address (01 to 99) of the module in the Profibus DP system is set on the rotary switches ADR 10 and ADR 1.
To configure the network, the device master file “EDS080F.gsd” is needed, which is located on the DOLD-CD PN 5501, in directory Profibus/GSD.
Order designation: PN 5501, item number: 0052860

Attention:

Work on the device must be carried out by specialist personnel when the device is in a deenergized state.

Technical Data

Input

Nominal voltage U_N:	DC 24 V (power is supplied - by the safemaster M)
Voltage range:	
at max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	max. 100 mA
Profibus DP interface	
Transmission medium:	Twisted, shielded two-wire line IEC 61 158
Protocol:	Profibus DP-V0
Maximum length:	1200 m at 9.6 Kbit/s...45.45 Kbit/s 1000 m at 93.75 Kbit/s...137.5 Kbits/s 400 m at 500 Kbit/s 200 m at 1500 Kbit/s 100 m at 3000 Kbit/s...12000 Kbit/s

The installation guidelines based on the PNO document “Installation Guideline for Profibus DP/FMS” must be followed for the maximum linear expansion of a bus segment. The PE connector must be grounded.

General Data

Nominal mode of operation:	Continuous operation	
Temperature range:	± 0 ... + 50° C At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.	
EMC		
HF irradiation:	10 V / m	IEC 61 000-4-3
Fast transients		
on supply line:	2 kV	IEC 61 000-4-4
on signal and control lines:	2 kV	IEC 61 000-4-4

Technical Data

Surge voltage		
between supply lines:	1 kV	IEC 61 000-4-5
between supply line and ground:	2 kV	IEC 61 000-4-5
HF wire guided:	10 V	IEC 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 20	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Resistance to shock		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per axis on 3 axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 2.5 mm² stranded wire with sleeve or 1 x 4 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Terminal screws M3,5, box terminals with wire protection	
Mounting:	on DIN rail	IEC/EN 60 715
Weight:	240 g	

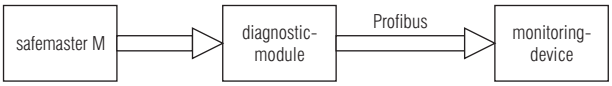
Dimensions

Width x height x depth	45 x 84 x 121 mm

Standard Type

BH 5552 DC 24 V
Article number: 0056874

Information on System Diagnostics

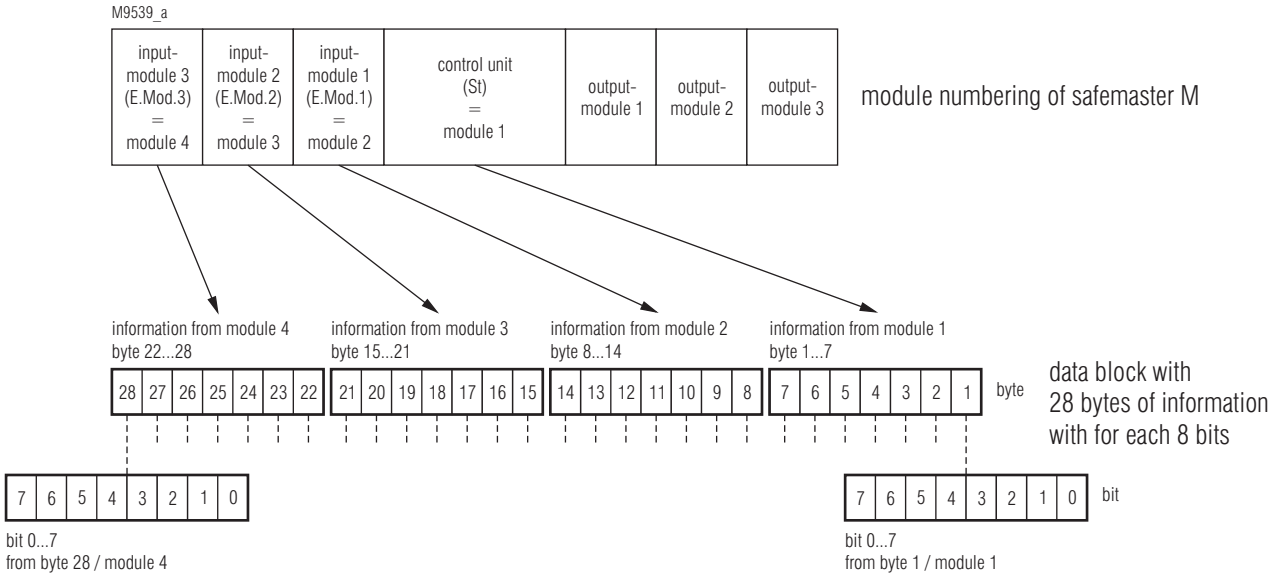


M9538

Information flow for data evaluation

Information Structure

The diagnostic module delivers a packet of 28 information bytes. 7 bytes each for the control unit and the 3 connectable input modules. The assignment of the individual bytes is given in the descriptions of the different control or input modules.



Structure of Diagnostic Information

* Ct = Control Unit, I.Mod. = Input Module

Contents	Profibus DP byte no.	Mod.	Information bytes							
			Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Module number	1 8 15 22	Ct* I.Mod1* I.Mod2* I.Mod3*	0	0	0	0 = OK 1 = system error	Module number, if module available		0001 = module 1 0010 = module 2 0011 = module 3 0100 = module 4	
			0000 0000: Module not available or another module reports errors. In this case, all 7 bytes have the value 0000 0000.							
Assignments	2 9 16 23	Ct* I.Mod1* I.Mod2* I.Mod3*	Which start button effects this module?				Which output module does this module have an effect on?			
			1 = T4	1 = T3	1 = T2	1 = T1	1 = output module 3	1 = output module 2	1 = output module 1	1 = Control unit
			If bit 4 is set in the module number: system error code							
Status of inputs	3	Ct*	Only if the button concerned is assigned to the control unit				if T4 = start button: 0	0	1 = input S14 inactive	1 = input S12 inactive
			1 = T4 activated	1 = T3 activated	1 = T2 activated	1 = T1 activated	if T4 = stop button: 1 = stop activated			
	10 17 24	I.Mod1* I.Mod2* I.Mod3*	1 = input S42 inactive	1 = input S32 inactive	1 = input S22 inactive	1 = input S12 inactive	1 = input S44 inactive	1 = input S34 inactive	1 = input S24 inactive	1 = input S14 inactive
Status of outputs	4	Ct*	1 = output module 3 activated	1 = output module 2 activated	1 = output module 1 activated	1 = safety outputs of control unit activated	0	Status of output 48 (error code)	1 = activation of assigned output modules released (green LEDs left)	Status of yellow LED run 1 (error code)
			Comment: These bits show the activation signal, which is transmitted to the modules. In the case of delayed outputs, the progress of the delay time is not visible.							
	11 18 25	I.Mod1* I.Mod2* I.Mod3*	0	0	0	0				
Status byte 1	5	Ct*	1 = error on a safety output	1 = release of assigned safety outputs enabled	1 = waiting for activation of assigned start button (error has been eliminated)	1 = short circuit on the inputs	Position of function switch (0000 to 1001 for function 0 to 9)			
	12 19 26	I.Mod1* I.Mod2* I.Mod3*	1 = control unit reports errors (bit 4 or 7 of module status byte 1 set)							
			see comments below							
Status byte 2	6 13 20 27	Ct* I.Mod1* I.Mod2* I.Mod3*	The assignment of this byte depends on the function of the control unit or the respective input module (see the following pages)							
Start button and safety outputs	7 14 21 28	Ct* I.Mod1* I.Mod2* I.Mod3*	1 = start button T4 activated	1 = start button T3 activated	1 = start button T2 activated	1 = start button T1 activated	1 = activation of output module 3 enabled	1 = activation of output module 2 enabled	1 = activation of output module 1 enabled	1 = activation of safety outputs of Ct* enabled

Comment: Bit 7 and bit 4 of the bytes 5, 12, 19 or 26 (**status byte 1**) are saved from the time when the error appears until when the module is restarted. The fact that the fault was corrected is indicated by bit 5 in the case of a manual start; and by bit 6 in the case of an automatic start. If these errors are detected in the control unit, the entire **safemaster M** system is locked. If the input modules are error-free in the „automatic start“ mode, their bits 7 and 6 flash in the **status byte 1** (byte 12, 19 or 26) as well as their green LEDs until the error has been corrected in the control unit or in the safety outputs.

Structure of Diagnostic Information

Assignment of "status byte 2" in the different modules of safemaster M

Control unit BH 5911:

* Ct = Control Unit, I.Mod. = Input Module

Contents	Profibus DP byte no.	Mod.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status byte 2	6	Ct*	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop S14 activated	1 = emergency stop S12 activated	1 = error on output module 3	1 = error on output module 2	1 = error on output module 1	1 = error on the safety outputs of the Ct*

Comment 1: All signals are saved from the time when the error is detected until the safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (byte 5), bits 5 and 6.
Comment 2: In the case of a 2-channel emergency stop, bits 5 and 4 change together. For more precise diagnostics of the input signals, byte 3 (status of the inputs) must be evaluated.

Input module BG 5913.08/_0_ _ _:

Contents	Profibus DP byte no.	Mod.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status byte 2	13 20 or 27 dep. on I.Mod. in safemaster M	I.Mod1* I.Mod2* I.Mod3*	1 = time error[2)]	1 = one of the assigned start buttons has been activated	1 = one of the assigned simulation buttons has been activated	0 (unused)	1 = function group 4 of module does not grant release[1)]	1 = function group 3 of module does not grant release[1)]	1 = function group 2 of module does not grant release[1)]	1 = function group 1 of module does not grant release[1]

Comments: Except for bit 6 and 5, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.
1) The numbers of the different function groups match the numbering of the safety functions in the application examples of the data sheet of input module BG 5913.08/_0_ _ _. If less than 4 functions are possible as a result of the input module setting (e.g. max. 2 with two-hand control type IIIC), the surplus bits are set to 0.
2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Input module BG 5913.08/_1_ _ _ and BG 5913.08/_2_ _ _ , BG 5913.08/_2_ _ _ and BG 5913.08/_3_ _ _

Contents	Profibus DP byte no.	Mod.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status byte 2	13 20 or 27 dep. on I.Mod. in safemaster M	I.Mod1* I.Mod2* I.Mod3*	1 = time error[2)]	1 = one of the assigned start buttons or simulation buttons has been activated	0 (unused)	0 (unused)	1 = function group 4 of module does not grant release[1)]	1 = function group 3 of module does not grant release[1)]	1 = function group 2 of module does not grant release[1)]	1 = function group 1 of module does not grant release[1)]

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 19, 20 or 26), bits 5 and 6.
1) The numbers of the different function groups match the numbering of the safety functions in the applications examples of the data sheet from input module. If a function combination with two-hand type IIIC is set on the input module, only 3 function groups are available and bit 3 is then always 0.
2) Time error is detected if the start or simulation buttons (>3s) are activated for too long. A time error message is also generated if two sensors of a function are not activated in the required time window (e.g. in the case of gates or two-hand controls).

Structure of Diagnostic Information

Input module BG 5914.08/_0_ _ _, BH 5914.08_0_ _ _, BG 5914.08_1_ _ _ and BH 5914.08/_1_ _ _

Contents	Profibus DP byte no.	Mod.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status byte 2	13 20 or 27 dep. on I.Mod. in safemaster M	I.Mod1* I.Mod2* I.Mod3*	1 = start button activated for too long (>3s)	1 = one of the assigned start buttons has been activated	1 = emergency stop on S14, S24, S34 or S44 does not grant release[1)]	Double contact error on S42 - S44[2)]	1 = emergency stop on S42 or S44 does not grant release[1)]	1 = emergency stop on S32 or S34 does not grant release[1)]	1 = emergency stop on S22 or S24 does not grant release[1)]	1 = emergency stop on S12 or S14 does not grant release[1)]

Comments: Except for bit 6, all signals are saved from the time when the error is detected until the assigned safety outputs are released for activation again. The fact that the error was corrected is indicated in **status byte 1** (no. 12, 19 or 26), bits 5 and 6.

1) The emergency stop function which actually prevented the release can only be recognized from the combination of bit 5 with the bits 0 to 3. The current status of the inputs is always visible in byte 10, 17 or 24 (status of the inputs).

2) Bit 4 is only set if S42 and S44 are set for 2-channels for the emergency stop function, and both signals do not match.

Interpretation Example for Diagnostic Information

We have a safemaster M system with the following components:
- 1 control unit BH 5911.03/00MF0
- 1 output module BG 5912.04
- 1 diagnostic module BH 5552 for Profibus DP

The transmitted information from diagnostic module BH 5552 is to be used in order to observe how and why the outputs of output module 1 change.

The available diagnostic information of the control unit and its changes are shown here:

1. Normal state: Safety outputs are activated, all EMERGENCY STOP buttons are released

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: 00	Bin: 00000000
Byte 4: Status of outputs:	Hex: 00	Bin: 00000000
Byte 5: Status byte 1:	Hex: 45	Bin: 01000101
Byte 6: Status byte 2:	Hex: 00	Bin: 00000000
Byte 7: Start button and safety outputs:	Hex: 0B	Bin: 00000011

Module number 01 with deleted bit 4 shows that the entire safemaster M system is working properly.
The set bits 0 to 3 of status byte 1 show that the function switch of the control unit (module1) is set to position “5”. That means that the following mode of operation is set:

2 x 1 channel emergency stop, manual start, 4 start buttons

The set assignments in byte 2 shows you that the control unit is started by the start button 1 (bit 4), and it has an effect on its own outputs (bit 0) and the outputs of output module 1 (bit 1). Since no input module is available, the outputs of both modules must always have the same status.

The set bit 6 in status byte 1 means the control unit grants the release for setting the safety outputs which are assigned to it. The fact that the outputs are actually set can be seen in byte 4.

2. Emergency stop button on S12 activated

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: 01	Bin: 0000000**1**
Byte 4: Status of outputs:	Hex: 0x	Bin: 00**00**0**x0x**x = flash
Byte 5: Status byte 1:	Hex: 05	Bin: 0**0**000101
Byte 6: Status byte 2:	Hex: 10	Bin: 000**1**0000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 000000**00**

Bit 6 in status byte 1 shows that the control unit does not release the safety outputs which are assigned to it.
The reason for this is indicatedby bit 0 in byte 3 (input S12 inactive) and by bit 4 in status byte 2 (emergency stop activated). The set bit 4 in byte 6 is saved until the release is granted again.
Byte 4 signals that the outputs have actually dropped out (bit 4 and 5) and the output 48 (bit 2) as well as the LED run 1 (bit 0) flash.

3. Emergency stop button is unlocked again

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: **00**	Bin: 0000000**0**
Byte 4: Status of outputs:	Hex: 0x	Bin: 00000x0x
Byte 5: Status byte 1:	Hex: **25**	Bin: 00**1**00101
Byte 6: Status byte 2:	Hex: 10	Bin: 00010000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 00000000

Since all inputs are in quiescent state again, only the status bytes 1 and 2 as well as byte 4 (status of outputs) still indicate that safemaster M was switched off. However, the saved bit 4 in status byte 2 still shows the reason for switch-off.

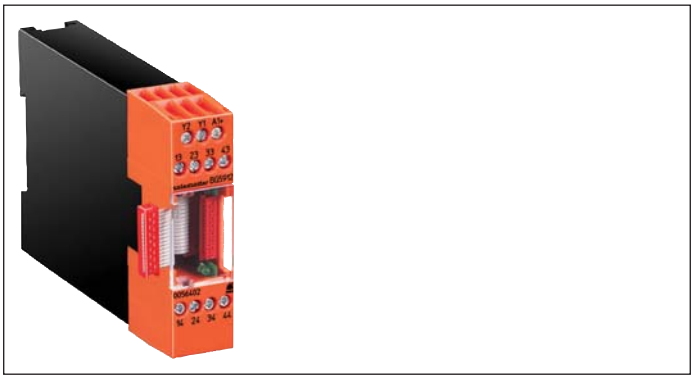
4. Start button T1 is activated

		Bit no. 76543210
Byte 1: Module number:	Hex: 01	Bin: 00000001
Byte 2: Assignments:	Hex: 13	Bin: 00010011
Byte 3: Status of inputs:	Hex: **01**	Bin: 000**1**0000
Byte 4: Status of outputs:	Hex: **00**	Bin: 00000**0**0**0**
Byte 5: Status byte 1:	Hex: **05**	Bin: 00100101
Byte 6: Status byte 2:	Hex: **00**	Bin: 000**0**0000
Byte 7: Start button and safety outputs:	Hex: 00	Bin: 00000000

If the start button was activated properly (< 3 s), the system returns to the normal state described under section 1. If the start button is activated for too long (> 3 s), bit 7 would signal in byte 6.

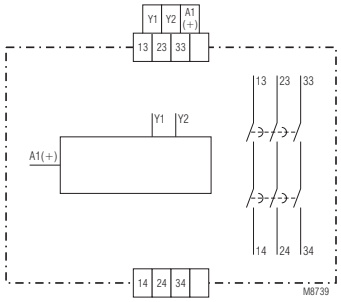
Comment:
If a system was already put into operation, it is often sufficient just to evaluate status bytes 1 and 2.
Depending on the depth and degree of detail of the diagnostics, e.g. in the case of troubleshooting when placing the system into operation, the other bytes can also be included if required.

Multi-Function Safety System SAFEMASTER M
Output Module With Output Contacts
BG 5912

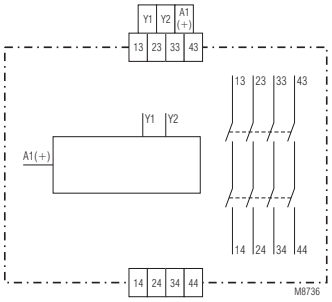


- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Safety outputs can be assigned to one or several function modules (control unit or input modules).
- Outputs:
  - 4 NO contacts
  - 3 NO contacts, 1 NC contact
  - 3 NO contacts 0-3 s delay-release time-delay relay
  - 2 NC contacts, 1 NC contact 0-3 s delay-release time-delay relay
- Permanently monitored feedback loop for external contact reinforcement
- LEDs for status indication
- Width 22.5 mm

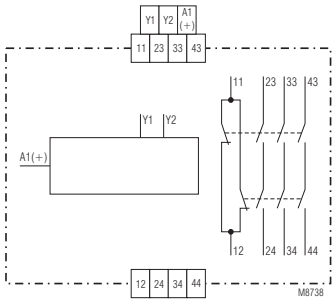
Circuit Diagrams



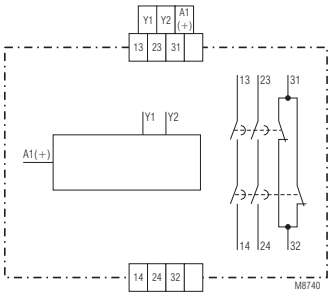
BG 5912.86



BG 5912.04



BG 5912.48



BG 5912.95

Approvals and Markings

CE, TÜVRheinland CERTIFIED, Functional Safety Type Approved, www.tuv.com ID 0600000000, C US Canada / USA

Applications

Realization of fail-safe control circuits for protection of people and machinery

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

Indication

Green LEDs

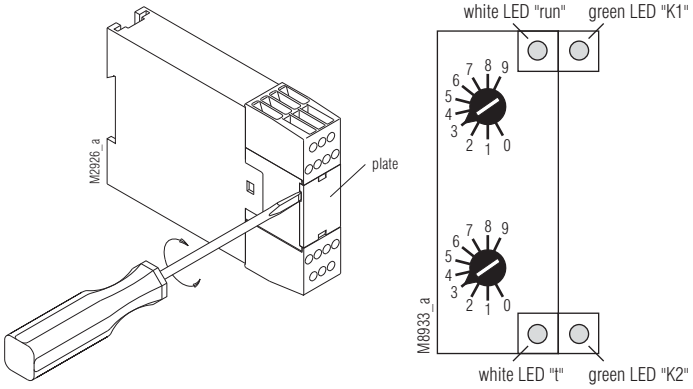
K1 and K2:	on, when the output contacts are activated
Yellow LED "Run":	on, when the unit operates without fault. Function errors are indicated by flashing codes.
Yellow LED "t":	on, while the delay time is elapsing. Only applicable for delayed outputs.

Setting of Functions

The instantaneous output modules are controlled directly be the control unit; no settings are required. The feedback input Y1-Y2 must be linked when no feedback is required. With contact reinforcement by external contactors, their forcibly guided NC contacts must be connected in series between Y1 and Y2.

With the delayed output modules the output contacts are activated immediately.

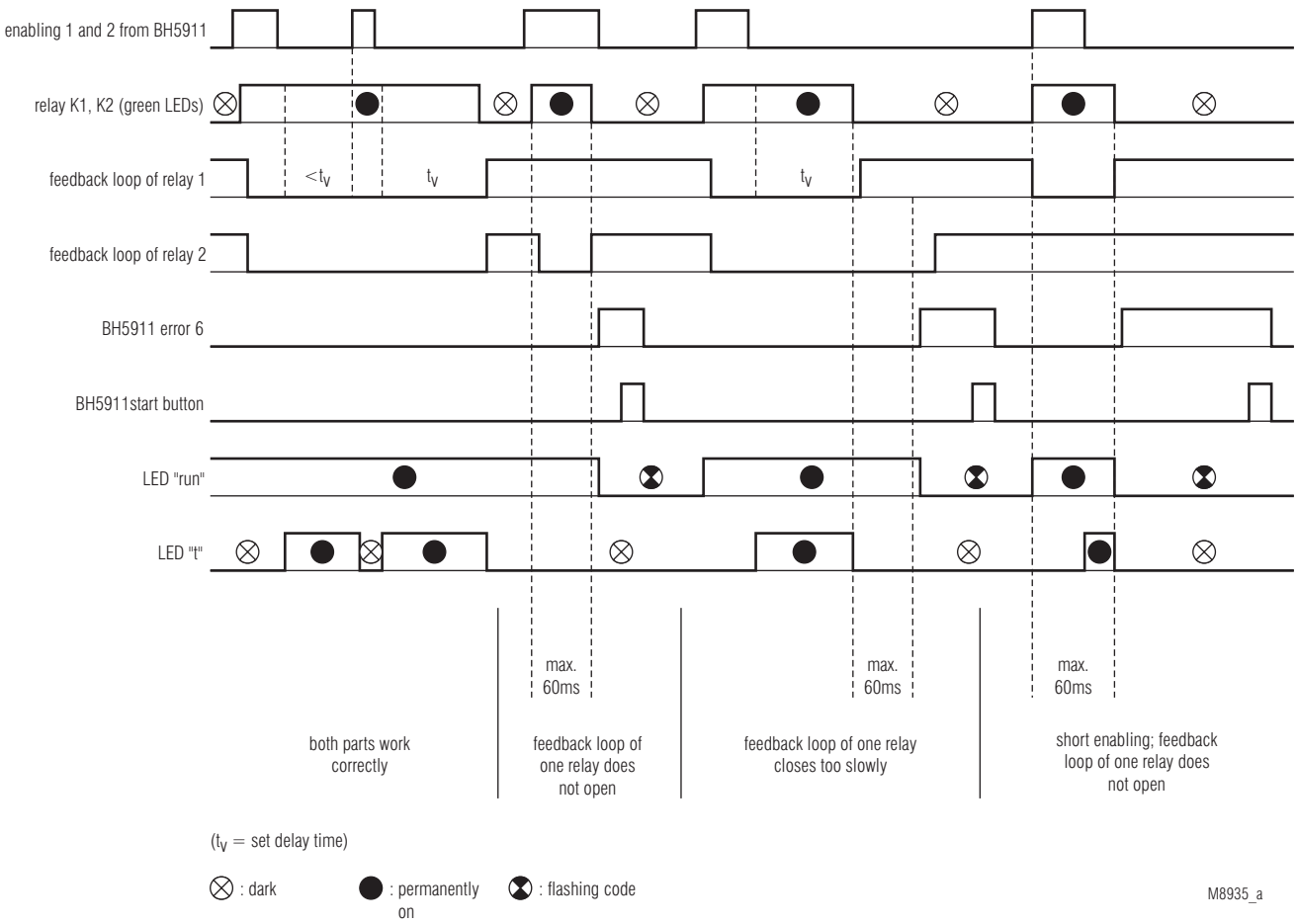
When the control signal is disconnected the outputs switch off after the adjusted time is elapsed (setting with 2 rotary switches).

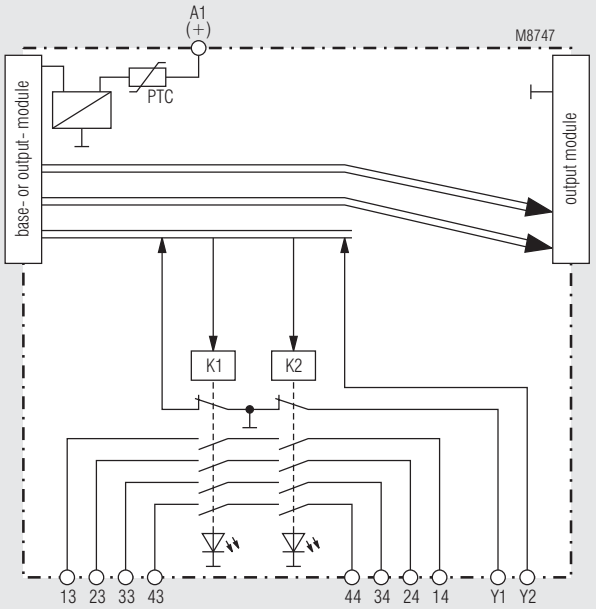


Notes

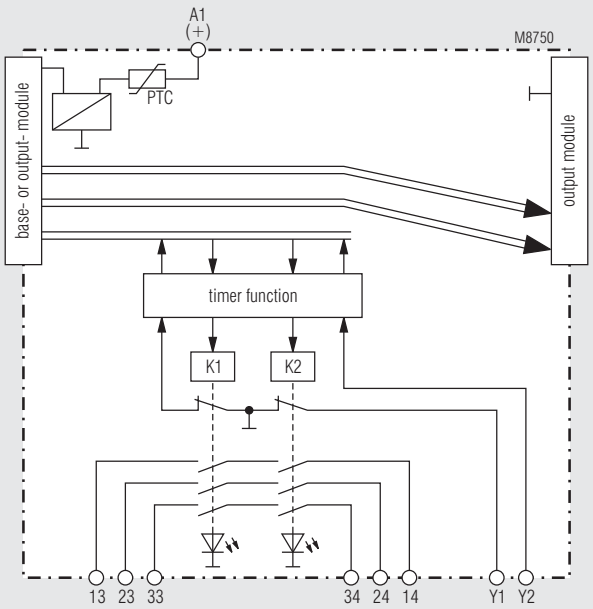
- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Function Diagram for Delayed Outputs

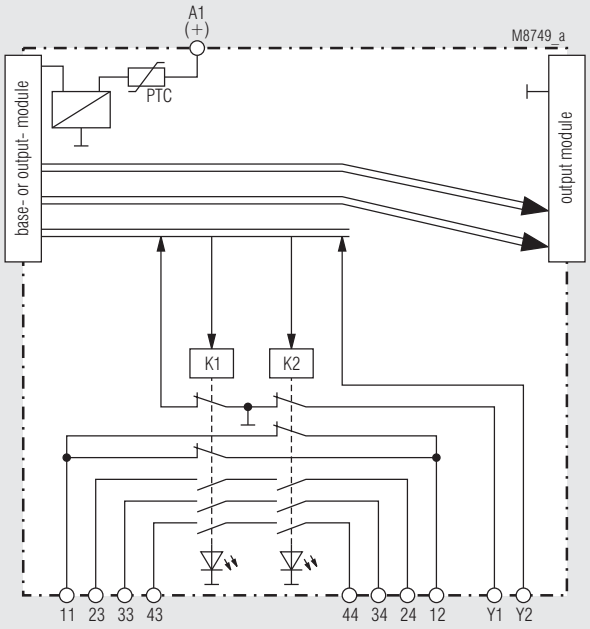




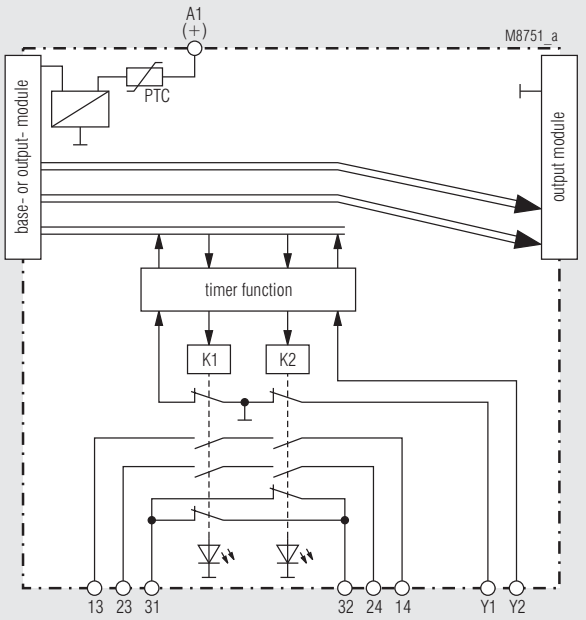
BG 5912.04



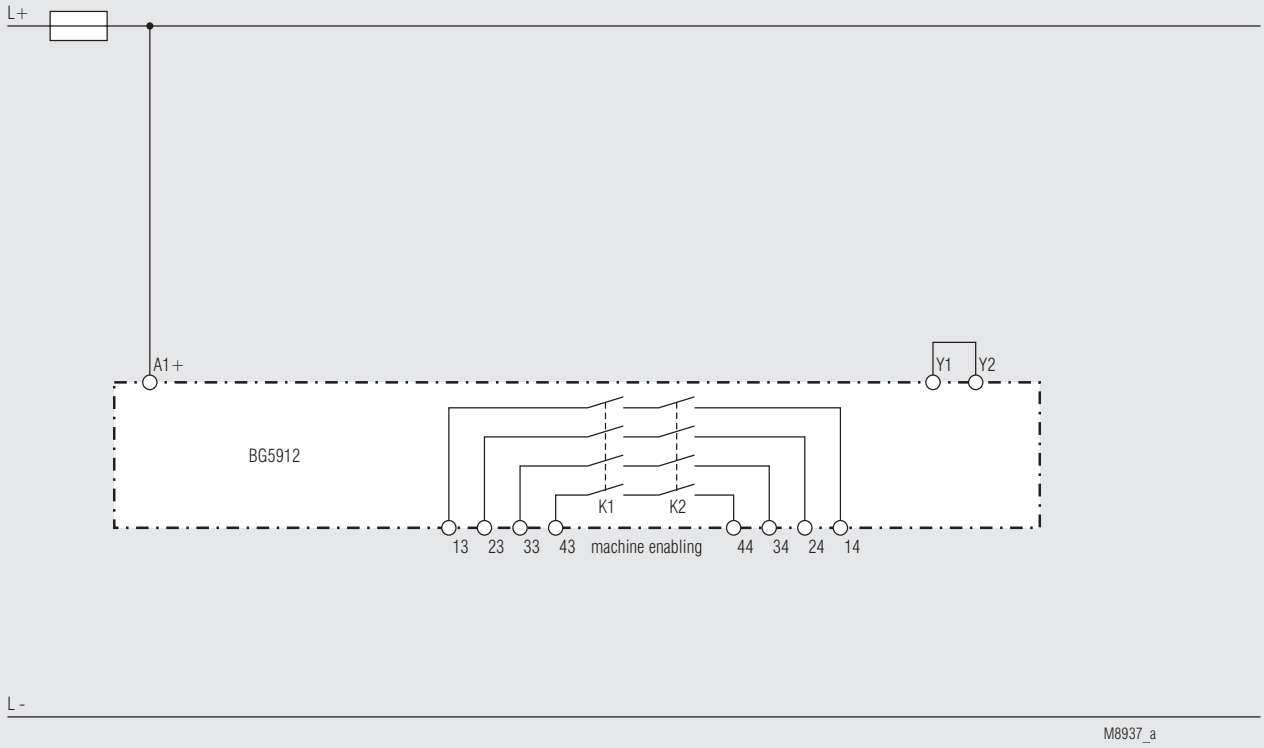
BG 5912.86



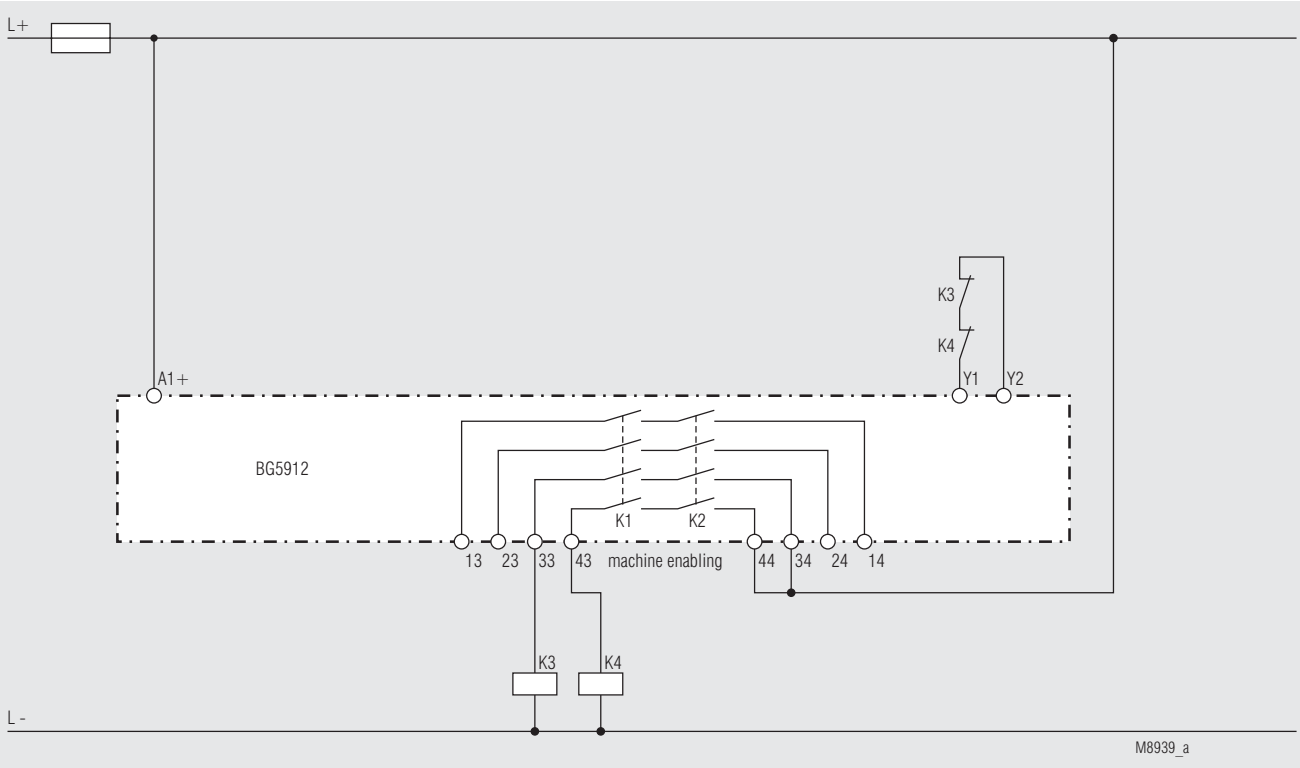
BG 5912.48



BG 5912.95



Without contact reinforcement



With contact reinforcement

Technical Data

Nominal voltage U_N:	DC 24 V	
Voltage range:		
with max. 5% residual ripple:	0.85 ... 1.15 U_N	
Nominal consumption:	max. 120 mA	

Output

Number of contacts provided		
BG 5912.04/00000 DC24V	4 NO contacts	
BG 5912.48/00000 DC24V	3 NO contacts, 1 NC contact	
BG 5912.86/00000 DC24V	3 NO contacts 0-3 s off delay	
BG 5912.95/00000 DC24V	2 NO contacts, 1 NC contact 0-3 s off delay (The NC contacts must not be used as safety outputs)	
Type of contact:	Relay, forcibly guided	
Fault clearing in the feed back loop:	max. 600 ms	
Output nominal voltage:	AC 250 V DC: see limit curve for arc-free operation	
Switching of small loads:	≥ 100 mV	
Thermal current I_{th}:	max. 5 A (see quadratic total current limit curve)	
Switching capacity		
acc. to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
acc. to DC 13 at 0.1 Hz:	DC 8 A / DC 24 V	
Contact life		
acc. to AC 15 with 2 A, AC 230V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	max. 1 200 switching cycles / h	
Short circuit strenght		
max. fuse rating	6 A gL	IEC/EN 60 947-5-1
Line circuit NCer	C 8 A	
Mechanical life	10 x 10^6 switching cycles	

General Data

Operating mode:	Continous operation	
Temperature range:	± 0 ... + 50 °C At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 61 326-3-1, IEC/EN 62 061	
Radio interference suppression:	Limit value class A	EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection		
Housing:	IP 20	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behavior according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Shock resistance:		
Acceleration:	10 g	
Pulse duration:	16 ms	
Number of shocks:	1000 per axis on three axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 2.5 mm² stranded wire with sleeve, or 1 x 4 mm² solid, or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	

Technical Data

Wire fixing:	Box terminal with wire protection, removable terminal strips	
Surge supression:	When connecting inductive loads to the relay outputs (contactor coils, valves, electric brakes) surge supressor elements like diods, capacitros, RC combinations, etc. have to be connected directly to the connection terminals of the controlled devices, keeping the connection wires as short as possible.	
Mounting:	DIN rail	IEC/EN 60 715

Dimensions

Width x height x depth:	22.5 x 84 x 121 mm

Safety Related Data for E-STOP (BG 5912.04, BG 5912.48)

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	178.3	a
DC_{avg}:	99.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)
Values according to IEC EN 62061 / IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	99.0	%
SFF	99.7	%
PFH_D:	2.63E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand (BG 5912.04, BG 5912.48)

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	31.5	a
DC_{avg}:	99.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	189	s/Zyklus
Values according to IEC/EN 62061 / IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	99.0	%
SFF	99.7	%
PFH_D:	7.26E-09	h^{-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.

Technical Data

Safety Related Data for E-STOP (BG 5912.86, BG 5912.95)

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	200.3	a
DC_{avg}:	98.2	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	98.2	%
SFF	99.4	%
PFH_D:	4.18E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand (BG 5912.86, BG 5912.95)

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	30.5	a
DC_{avg}:	99.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	99.0	%
SFF	99.6	%
PFH_D:	7.94E-09	h^{-1}

*) HFT = Hardware-Failure Tolerance

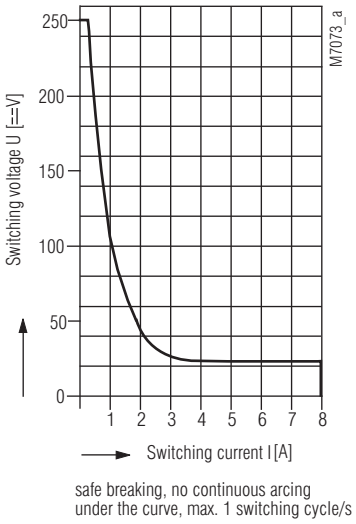
The values stated above are valid for the standard type.
Safety data for other variants are available on request.
The safety relevant data of the complete system has to be determined by the manufacturer of the system.

Ordering Designation

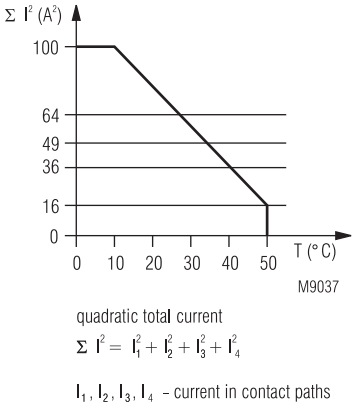
BG 5912.04/00000 DC24V	4 NO contacts
BG 5912.48/00000 DC24V	3 NC contacts, 1 NC contact
BG 5912.86/00000 DC24V	3 NO contacts 0-3 s off delay
BG 5912.95/00000 DC24V	2 NO contacts, 1 NC contact 0-3 s off delay

Note: The NC contacts must not be used as safety outputs!

Characteristics



Limit curve for arc-free operation



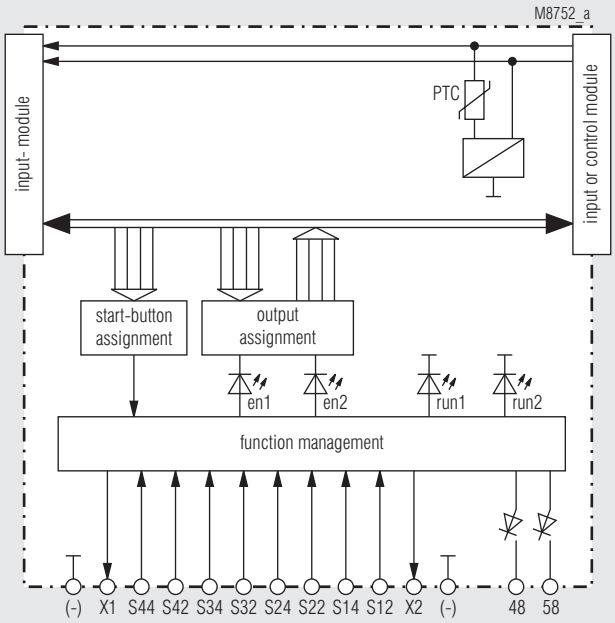
Quadratic total current limit curve

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5913.08/_0_ _ _, BH 5913.08/_0_ _ _

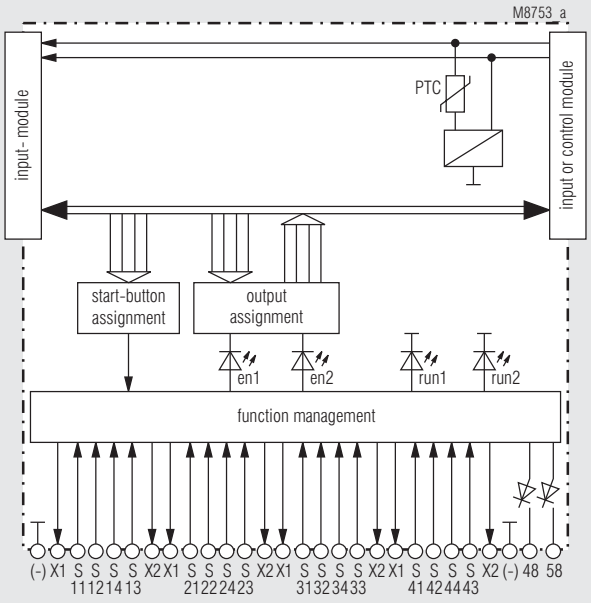
0247337

- **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**
- Input module for realization of
  - 4 similar 2-channel inputs
  - Emergency stop circuits
  - Safety gate monitoring system
  - Two-hand control type IIIA, IIIC acc. to DIN/EN 574
  - Light curtain (LC type 4)
- The functions are selected via rotary switch
- 8 safety inputs
- 2 semiconductor outputs for status indication
- Broken wire and short circuit monitoring function with error indication
- LEDs for status indication
- Width
  BG 5913.08/_0_ _ _: 22.5 mm
  BH 5913.08/_0_ _ _: 45 mm

Block Diagram



BG 5913



BH 5913

Approvals and Markings

CE, TÜVRheinland CERTIFIED Functional Safety Type Approved, c SA us Canada / USA

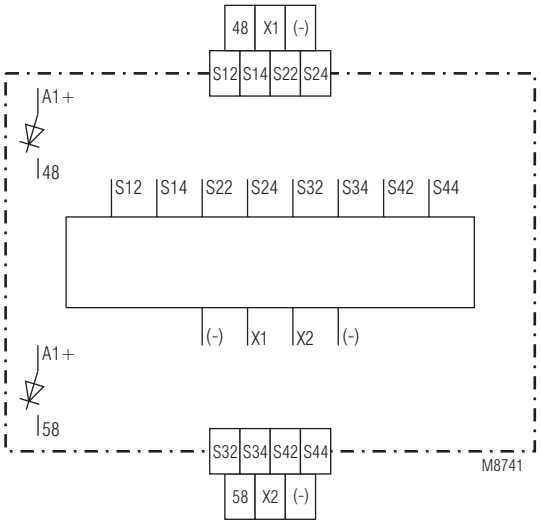
Applications

Realization of fail-safe control circuits for protection of people and machinery.

Note: This module is intended for applications in which mixed safety functions affect one common output.

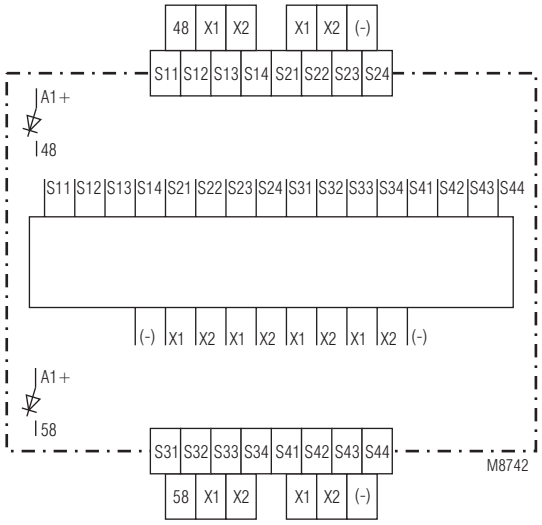
Further input modules with other combinations of functions are provided (e.g. BG 5913.08/_1_ _ _, BG 5913.08/_2_ _ _, BG 5913.08/_3_ _ _ , BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _ or BG 5914.08/_1_ _ _).

Circuit Diagrams



BG 5913

Circuit Diagrams



BH 5913

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

Notes

In respect of function and settings, the modules BG 5913 and BH 5913 are completely identical.

- The modules BG 5913 have 8 inputs with one common ground. This is the ground of the overall system. They are suitable for all applications in which volt free contacts are used, or where there is a common ground (e.g. 2-channel light curtains). They need only 8 terminals and thus only have an overall width of 22.5 mm.

- The modules BH 5913 have 8 completely DC-decoupled inputs. This allows with setting 1 and 3 (4 lightcurtains) to connect also 4 two-channel e-stop buttons with long connection wires with static signal potental. Here, short-circuit monitoring is effected by a certain type of wiring according to the application examples.

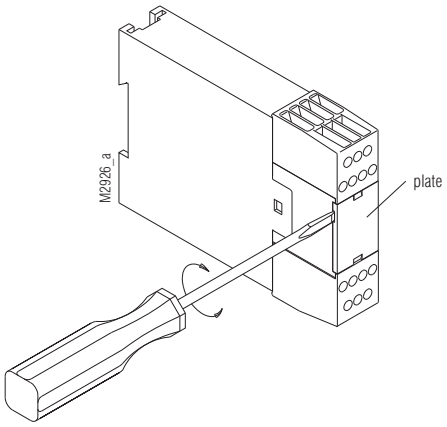
Indication

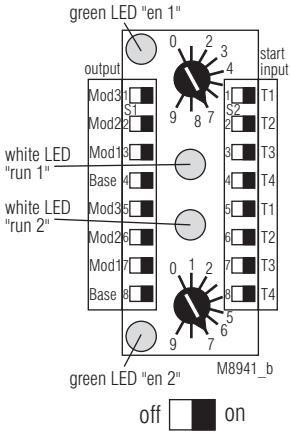
Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Setting of the Module

The module is assigned to the start inputs and the safety outputs via the DIP switches.

The combinations of individual functions are set via the rotary switches. To prevent accidently adjustments, these elements are covered by a front plate and are redundant.





Note:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Setting of the Modules

Sw.	Function
0	4 Emergency stop 2-channel, autostart
1	4 light curtains category 4, autostart
2	4 Emergency stop 2-channel, manual start
3	4 light curtains category 4, manual start
4	4 safety gates with 2 single contacts
5	2 safety gates with 2 changeover contacts
6	1 safety gate with 2 twin contacts and 1 single contact, manual start (plastic injection moulding machines) to EN 201
7	1 safety gate with 3 twin contacts, manual start (plastic injection moulding machines) to EN 201
8	4* two-hand control IIIA acc. to EN 574
9	2* two-hand control IIIC acc. to EN 574

When using setting 8 or 9 the user has to indicate clearly on the device which type of 2-hand function is adjusted (IIIA or IIIC).

Automatic Start

Automatic start is performed only when supply voltage is switched on, or when the emergency stop or stop function has been reset.
All other errors nevertheless require confirmation by a start input.

Manual Start

To start the system, do not keep the start key pressed for more than 3 seconds. A module may also be assigned several start keys.

One-Channel Input

With setting 6), it is imperative to use a voltfree contact for the single contact. A static signal cannot be used.

Simulation Input for Function of Safety Gates

When the unit is set to monitor safety gates according to EN 201 switch position 4, 5, 6 and 7, closing of the assigned safety outputs is only enabled, if every gate has changed from open state (all contacts inactive) to closed state within a maximum period of 3 sec on each gate.

When the system is powered up with some gates open and some closed the open gates can be closed and the system can be started up by the simulation button, simulating an open-close cycle of the previously closed gates.

Only those gates are simulated, that had been closed before the system was powered up.

Simulation is only possible once after the unit is powererd up. After that all contacts of a gate have to be opened and reclosed to enable the outputs again. When closing the gate all contacts of a gate have to close within 3 sec.

Function of the Two-Hand Control

Up to 4 pairs of two-hand safety circuits can be connected with the two-hand safety function. However, no more than one circuit may be activated. To permit enabling of the assigned safety outputs, the following conditions must be fulfilled:

1) First, none of the connected two-hands circuits must be activated.
2) Both buttons of a two-hand control must be pressed within 0.5 s.
3) When changeover contacts (type IIIC acc. to DIN / EN 574) are used for the two-hand-safety buttons, they must effect changeover of contacts within 50 ms.
4) As soon as a button of a second two-hand circuit is pressed, the outputs are disabled, and condition 1) must be fulfilled once more before a new enabling cycle can start.
5) The two-hand buttons habve to be released if an other function module, also assigned to the same outputs disables the outputs.
6) Only one two-hand control module is allowed in one safemaster M system.

The unit must be connected as specified in the application examples. When the operating contacts are connected in parallel or in series, safe functioning of the unit is cancelled.

The two-hand buttons must be designed and arranged in such a way as to ensure that they cannot be disabled easily, or pressed unintentionally.

The safety distance between the push buttons and the place of danger must be large enough to insure that after releasing a button, the place of danger can only be reached after the dangerous movement has stopped. The safety distance “S” is calculated according to the following formula:

Function of the Two-Hand Control

S = V x T + C, where

a) gripping velocity V = 1 600 mm/s
b) overtravel time T (s)
c) and safety factor C = 250 mm.

When any access into the dangerous area, with operating keys pressed, is safely prevented, e.g. by a protective cover for the keys, the safety factor C may be set to the value 0. Generally, the minimum safety distance must be 100 mm. See also DIN/EN 574.

Safety Gate Function

The safety gate function always permits enabling if both contacts change from inactive to active state within 3 seconds. If the second contact reacts later, both changeover contacts must turn inactive before they can be enabled again.

When activating the system, press the start button to simulate the compulsory opening and re-closing of safety gates which have been kept closed since the system has started.

This simulation is possible only before enabling has been permitted for the first time, and as long as both safety gate contacts remain closed as well. As soon as a contact opens, simulation of the safety gate function is no longer possible.

E-Stop or Light Curtain (LC) Function

In the Emergency stop or LC functions, both signals have to change from inactive state into active state within 250 ms. If the second signal reacts later, both changeover contacts must turn inactive before they can be enabled again.

With manual start, all safety inputs must be active before the start button can be pressed to trigger enabling. To start the system, do not keep the start button pressed for more than 3 seconds. A module may also be assigned several start buttons.

Note: Connect only self-testing light curtains of the type 4 acc. to EN 61496 to the module. Short-circuit monitoring of the inputs for the LC must be done in the LC.

Indication of System Errors:

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)

6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Indication

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED Run 1	Two-hand control not activated (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Error exists no more, waiting for Start input	one input function not available
LED Run 2	all relays inactive due to system error	all relays inactive due to system error	No system error

Function Error Indication

Function errors are indicated by the white LED Run 1 and by output 48; the white LED Run 2 remains on. Output 58 is ON as long as the error is pending; it flashes regularly, while waiting for the assigned start signal.

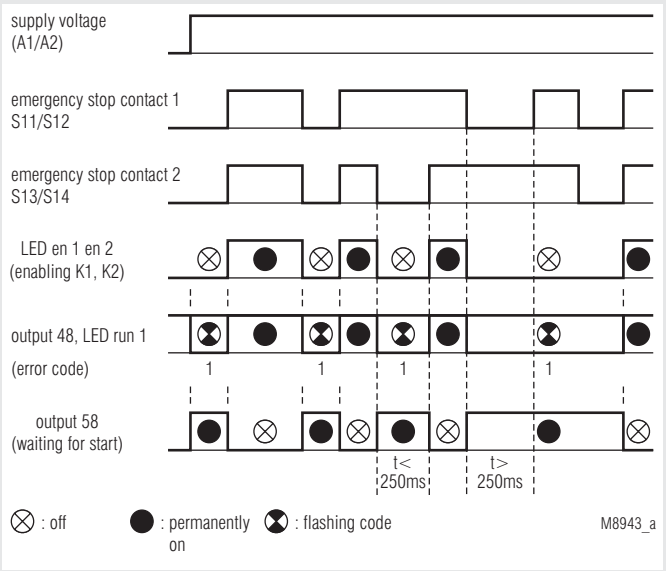
Error codes*

1) Normal interruption of function (e.g. Emergency stop)
2) Time error: (e.g. the second two-hand button is not pressed)
3) With gate monitoring: simulation input error (kept pressed for too long)
4) Error at start input
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error detected in the control unit)

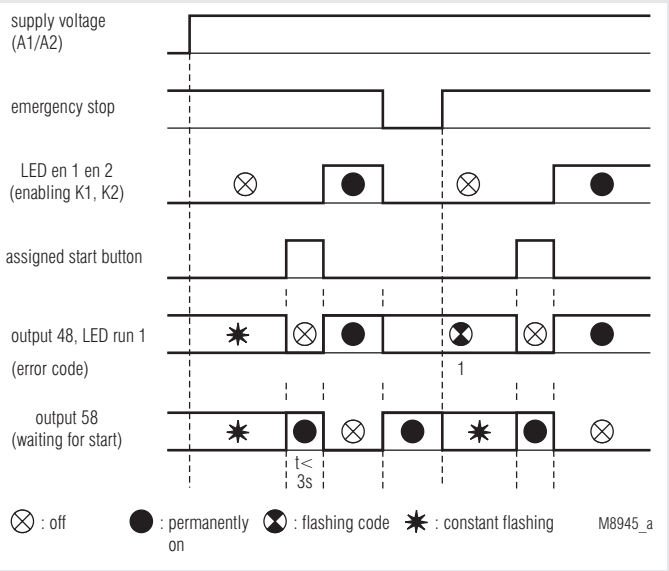
* number of short flashing impulses, followed by a longer space

Special with two-hand control:
When both two-hand buttons of the module are inactive while all other functions are active and enabled either by autostart or via the start button, output 48 and the white LED Run 1 are permanently OFF, and output 58 permanently ON.

Function Diagramms

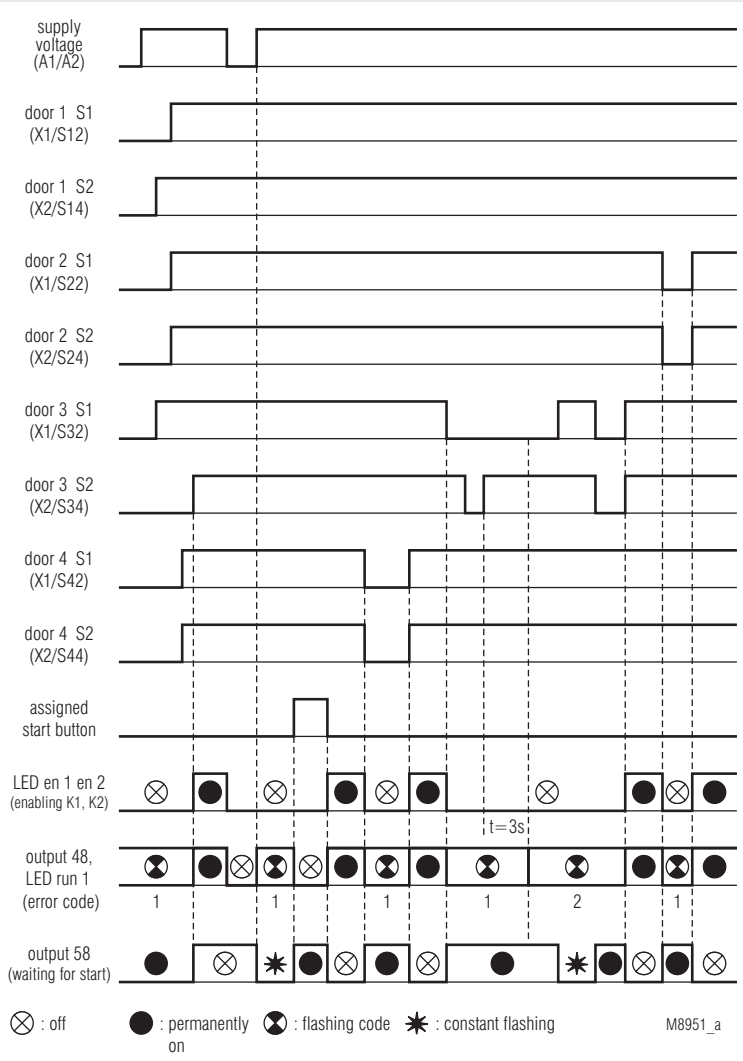


Emergency stop or light curtain, automatic start

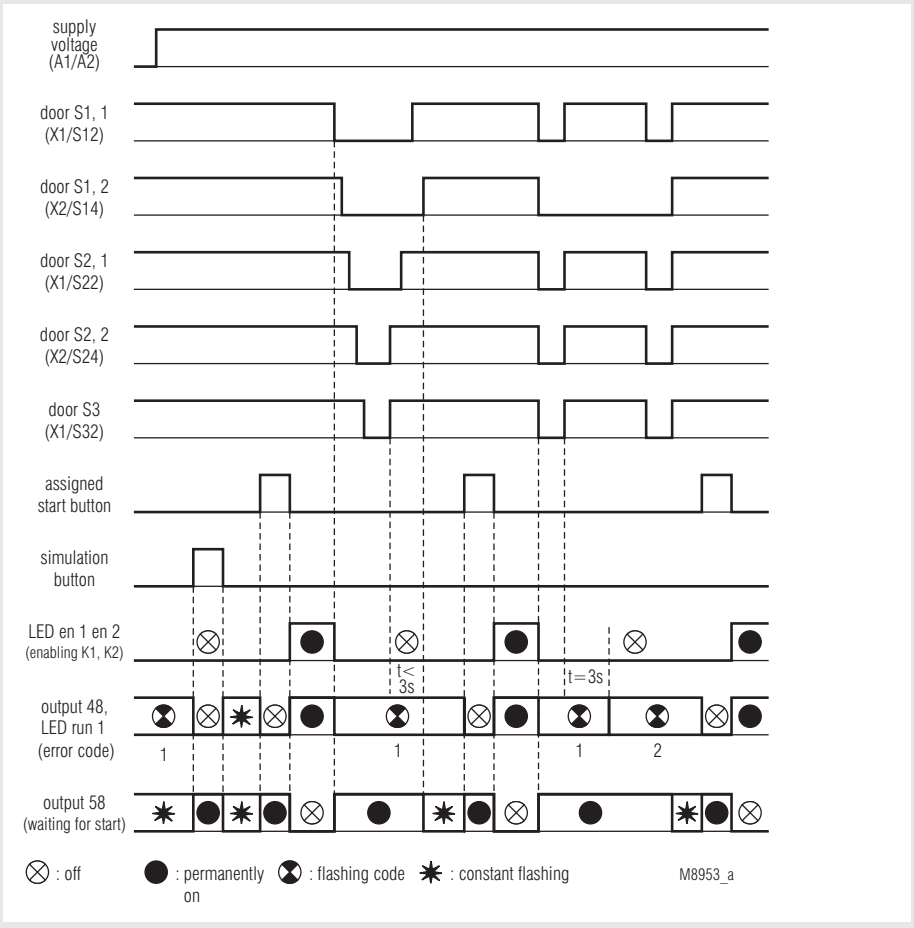


Emergency stop or light curtain, manual start

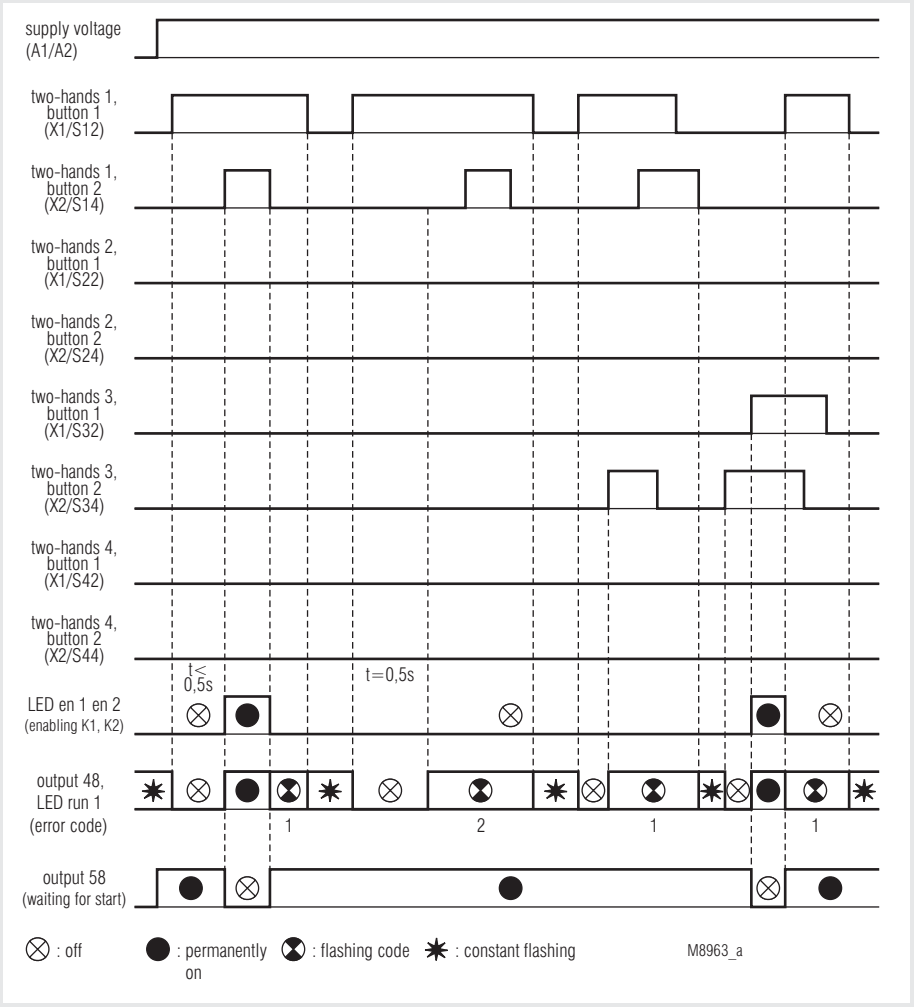
Function Diagramms



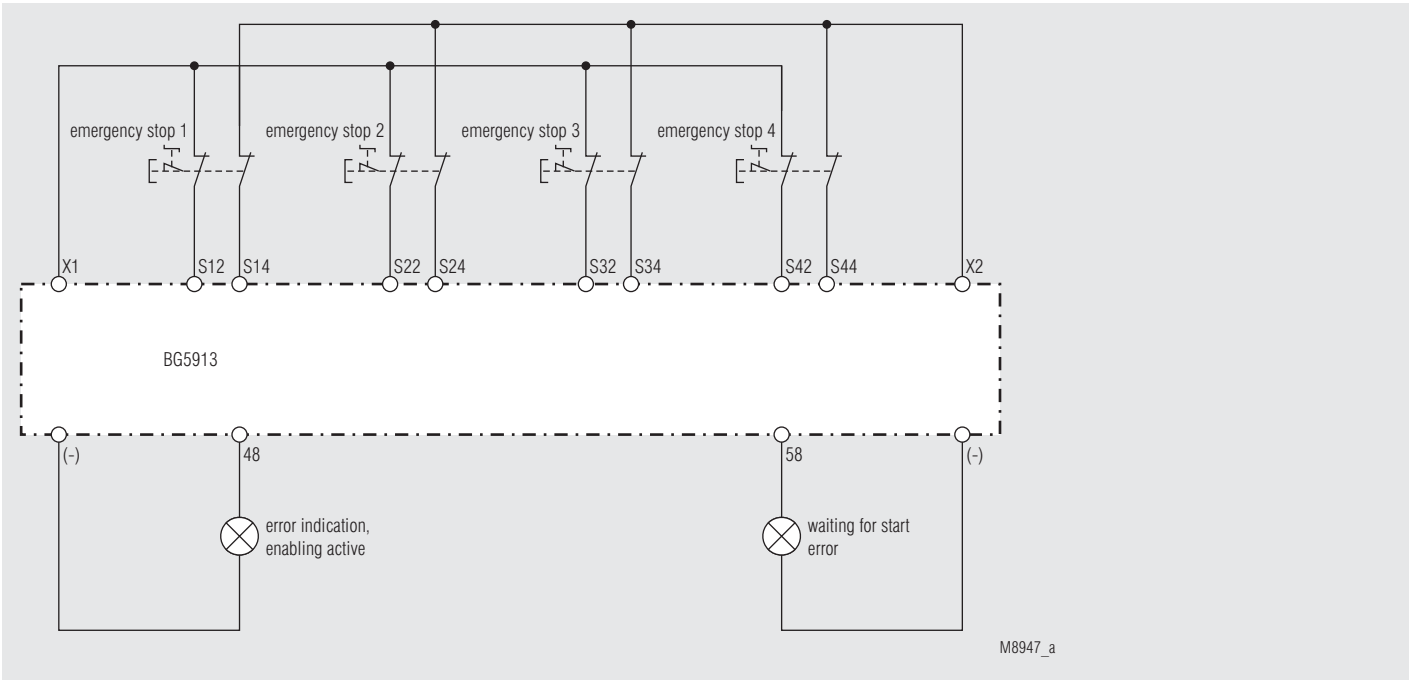
Safety gates (example: 4 gates with 2 single contacts each),
assigned start buttons are also suitable for gate simulation (setting 4 or 5)



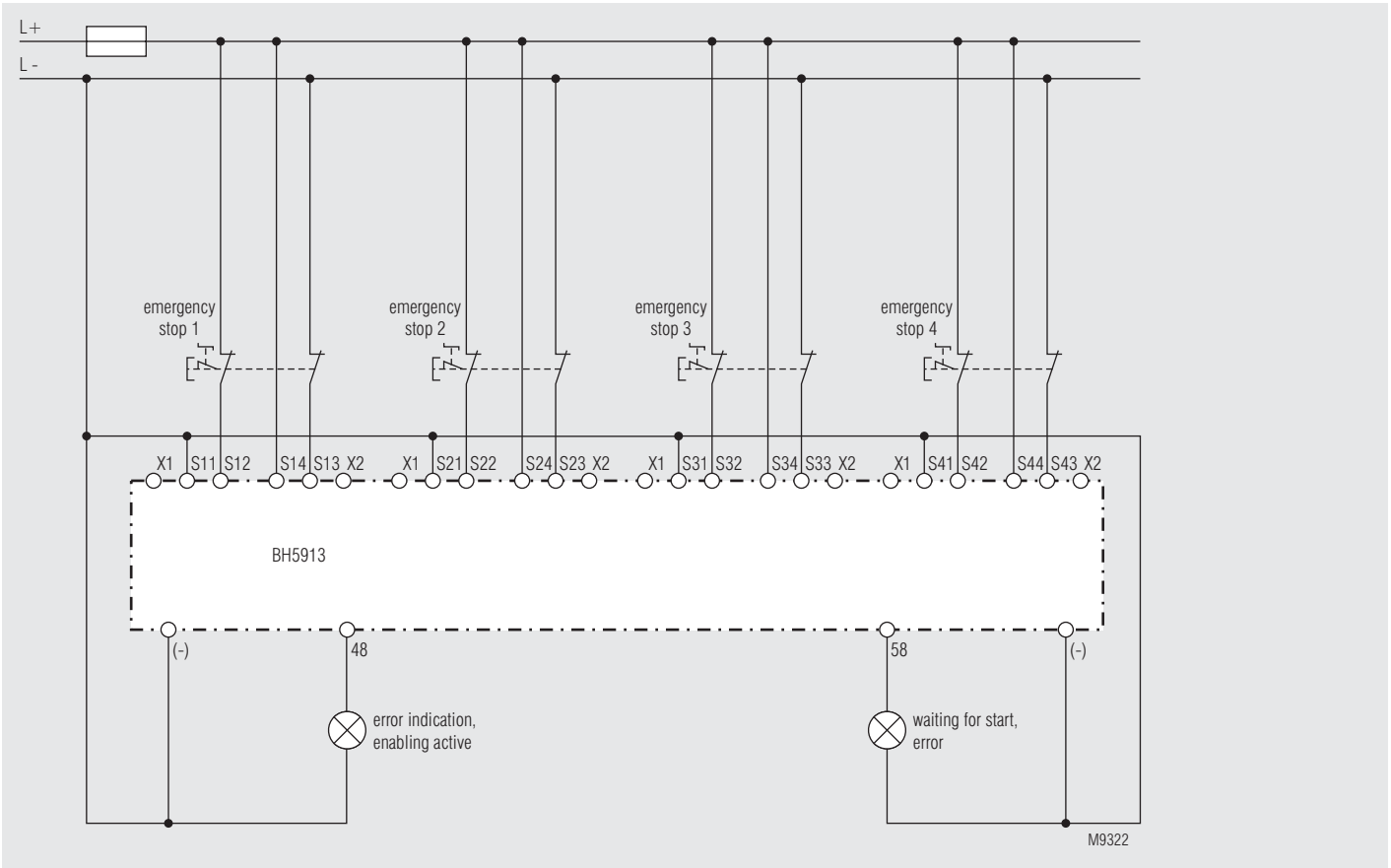
Safety gate for plastic moulding machines (example: 1 gate with double contacts + single contact) (setting 6 or 7)



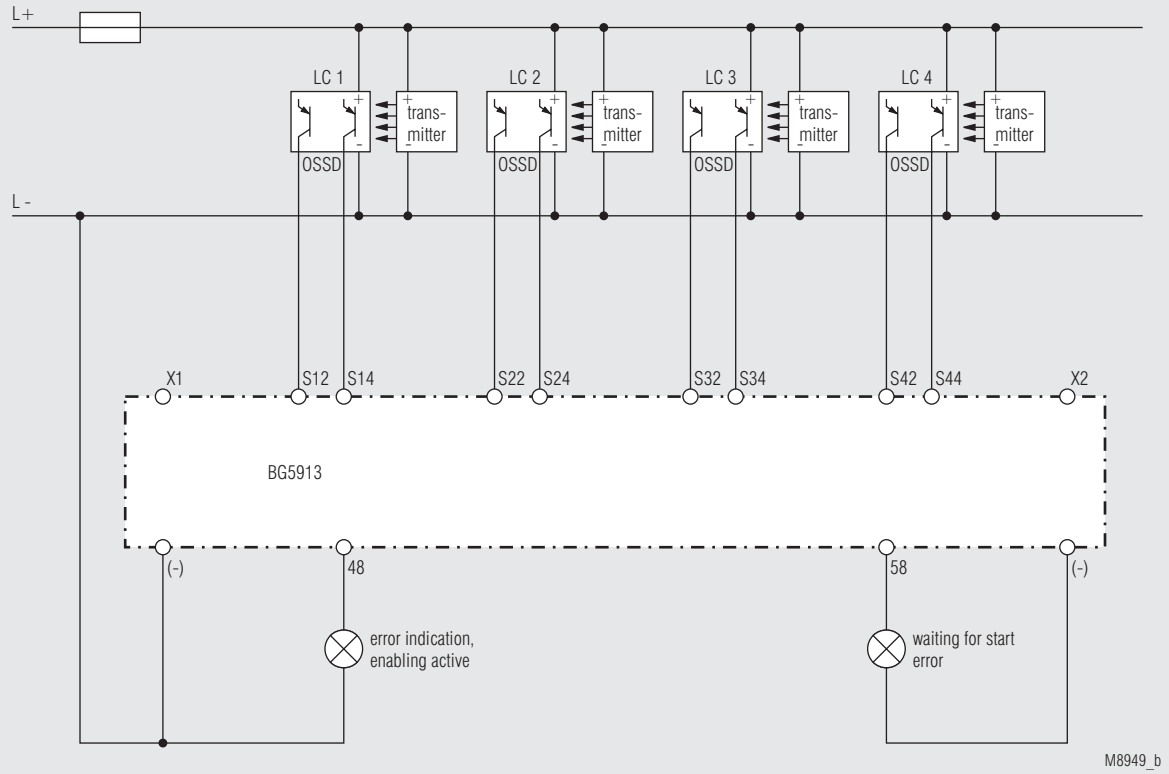
Two-hand control



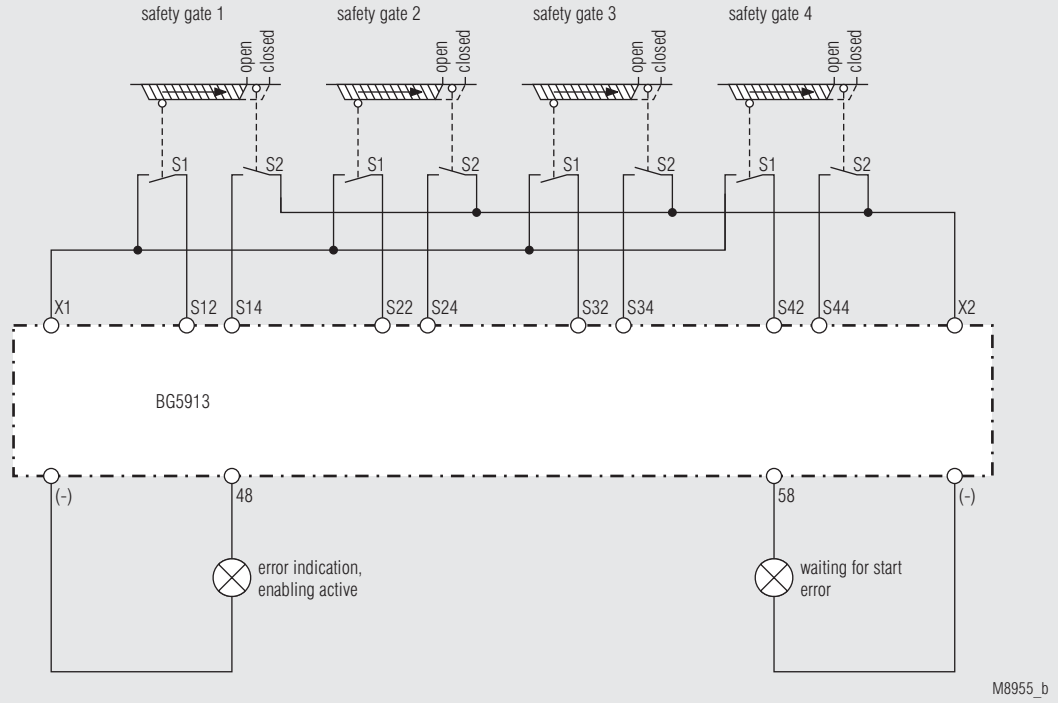
4 Emergency stop circuits, 2-channel, auto/manual start with short circuit monitoring; function: 0, 2



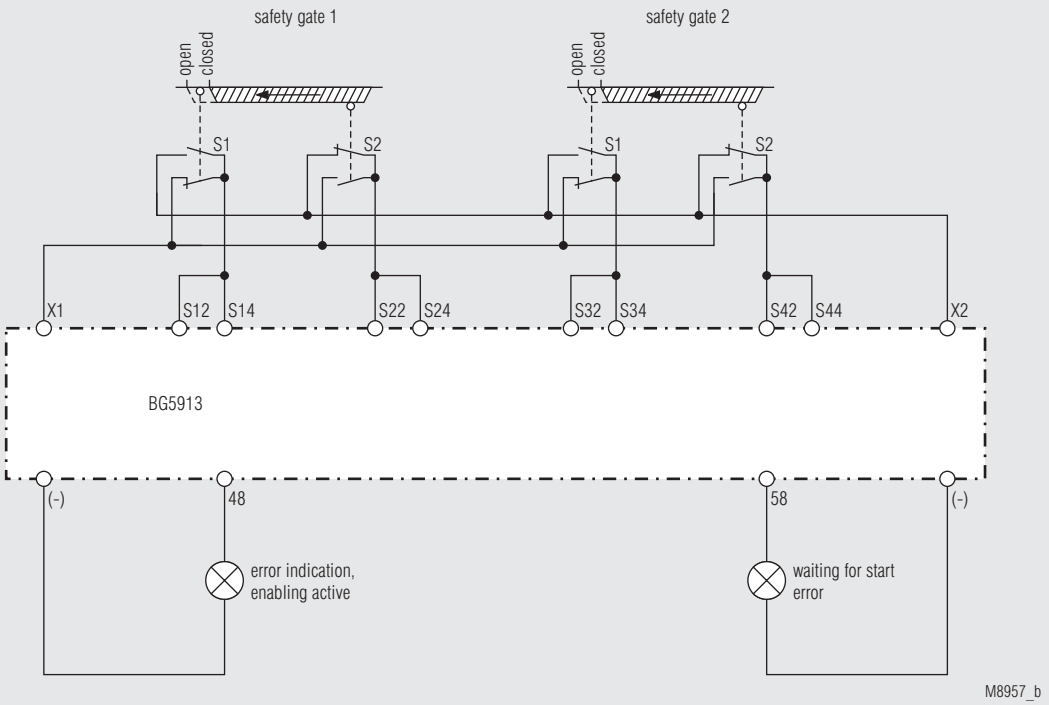
4 Emergency stop circuits, 2-channel, auto/manual start, short circuit monitoring by wiring; function 1, 3



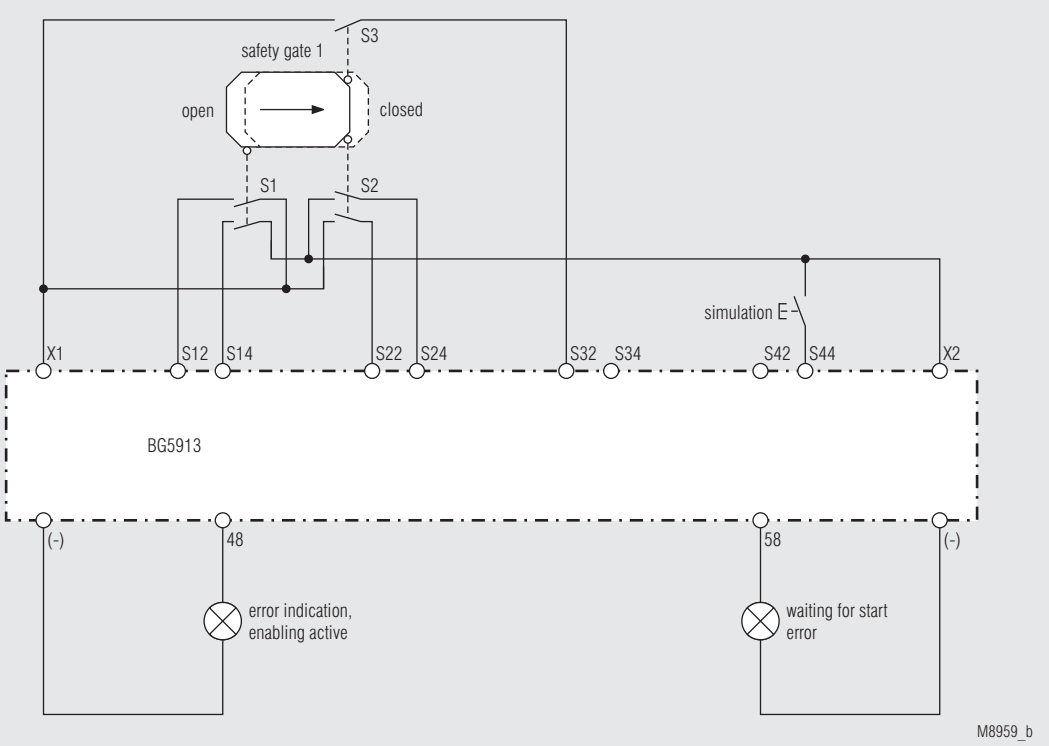
4 light curtains, category 4, auto/manual start; function: 1,3



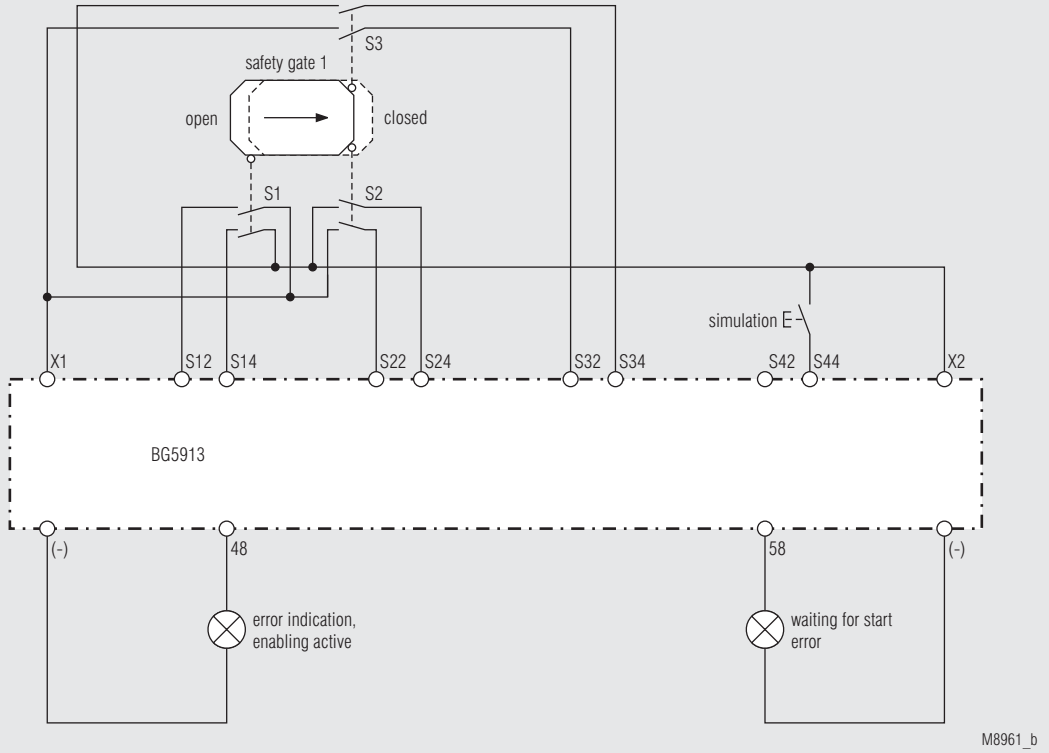
4 safety gates with 2 NO contacts; function: 4



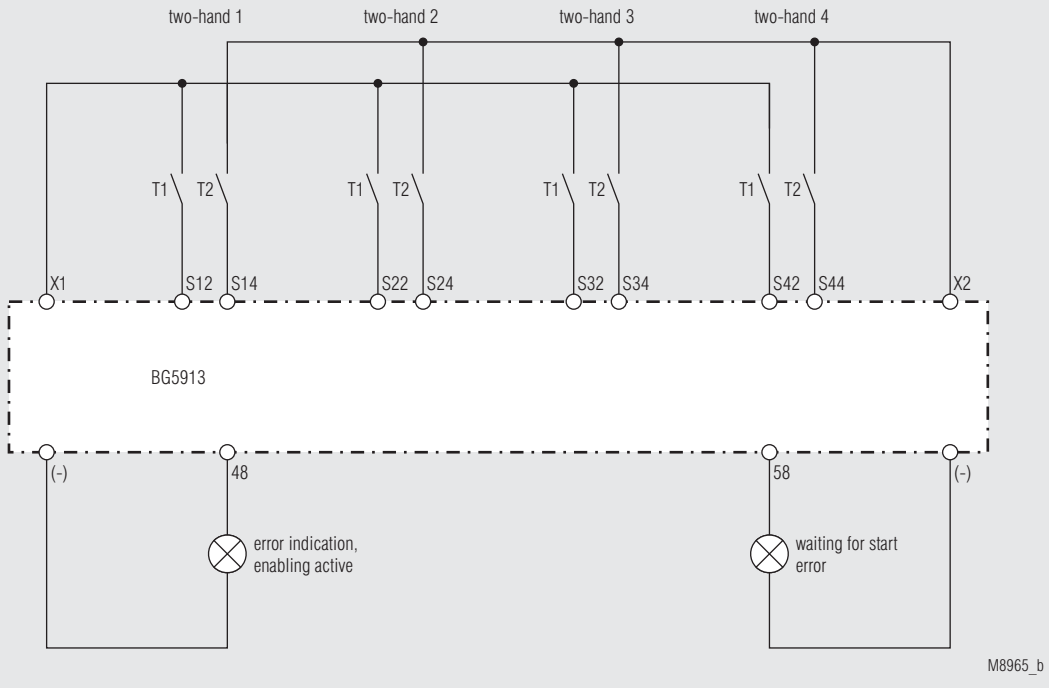
2 safety gates with 2 antivalent changeover contacts each; function: 5



1 safety gate with 2 twin/1 single contact, manual start (plastic injection moulding machines); function: 6

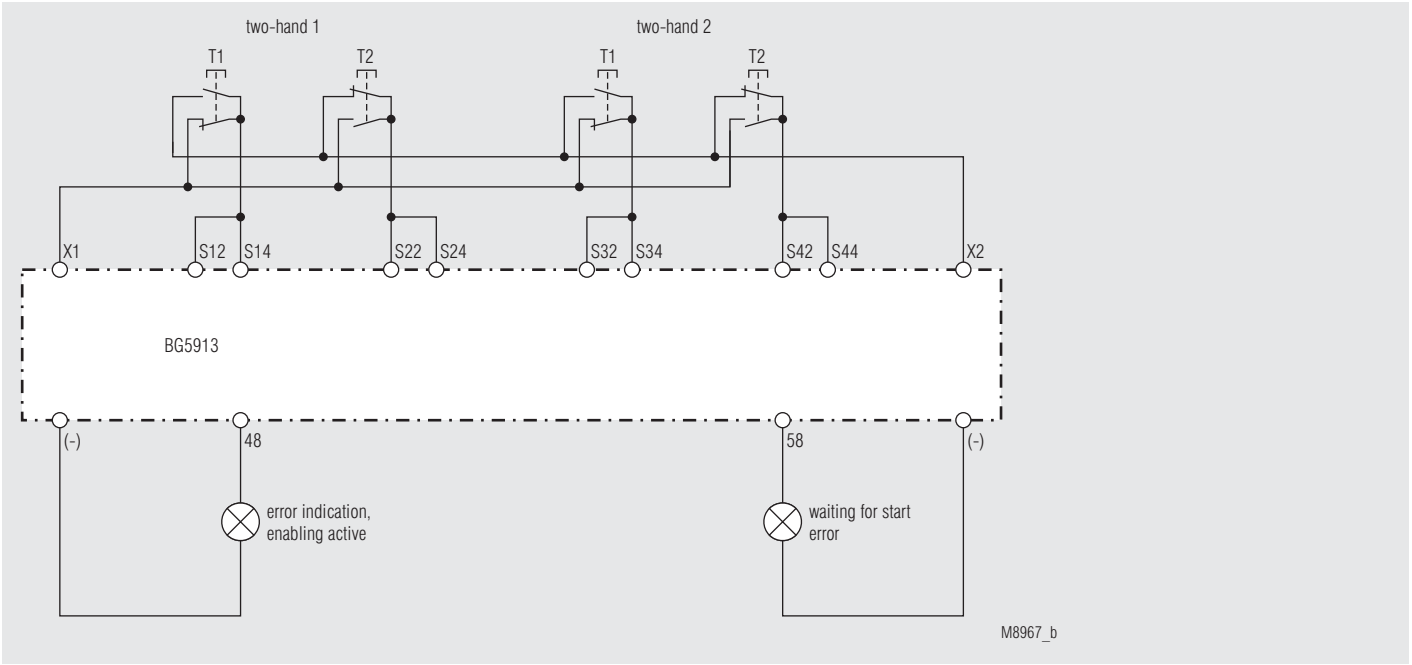


1 safete gate with 3 twin contacts, manual start (plastic injection moulding machines); function: 7



4 two-hand controls type IIIA acc. to DIN/EN 574; function: 8

Application Examples



2 two-hand controls type IIIC acc. to DIN/EN 574; function: 9

Technical Data

Voltage Supply

Nominal voltage U_N: DC 24 V (coming from the basic module BH5911)
Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N
Nominal consumption: max. 60mA
(no load on semiconductor outputs)

Short-circuit protection
of the modules: internally with PTC

Input

Control voltage
via X1, X2, 48.58: DC 23 V at U_N

Control voltage
via S12, S14, S22, S24,
S32, S34, S42, S44: 4.5 mA each at U_N

Minimum voltage
on S12, S14, S22, S24,
S32, S34, S42, S44: DC 16 V

Semiconductor Outputs

Output at terminal 48 and 58: Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0.5 s
Internal short circuit, overtemperature, and overload protection

Reaction Times (time till reaction of the assigned output):

Typ. NO time with U_N:

Input modules BG 5913	Manual start	Automatic start	
		First start	Restart
Emergency stop	max. 80 ms	max. 1 s	max. 115 ms
Light barriers	max. 80 ms	max. 1 s	max. 115 ms
Safety gates	or simulation: max. 80 ms		Gate closing: max. 115 ms
Two-hand control	max. 85 ms		

Technical Data

Break Time (reaction time):

Input modules BG 5913	
Emergency stop	max. 33 ms
Light barriers	max. 33 ms
Safety gates	max. 33 ms
Two-hand control	max. 33 ms

General Data

Operating mode: Continuous operation
Temperature range: ± 0 ...+ 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.

Clearance and creepage distances
rated impulse voltage /
pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behavior according to UL Subject 94
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6
Frequency 10…55 Hz,

Shock resistance
Acceleration: 10 g
Pulse duration: 16 ms
Number of shocks: 1000 per axis on three axes
Climate resistance: 0 / 050/ 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 2.5 mm² stranded wire with sleeve, or
1 x 4 mm² massive or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing: Box terminal with wire protection, removable terminal strips.

Technical Data

Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BG 5913:	193 g	
BH 5913:	255 g	

Dimensions

Width x height x depth

BG 5913:	22.5 x 84 x 121 mm
BH 5913:	45 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	812.8	a
DC_{avg}:	96.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	2697.1	a
DC_{avg}:	96.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

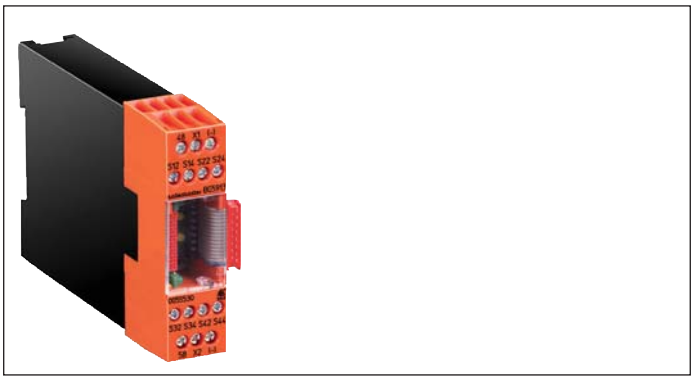
*) HFT = Hardware-Failure Tolerance

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.

Standard Type

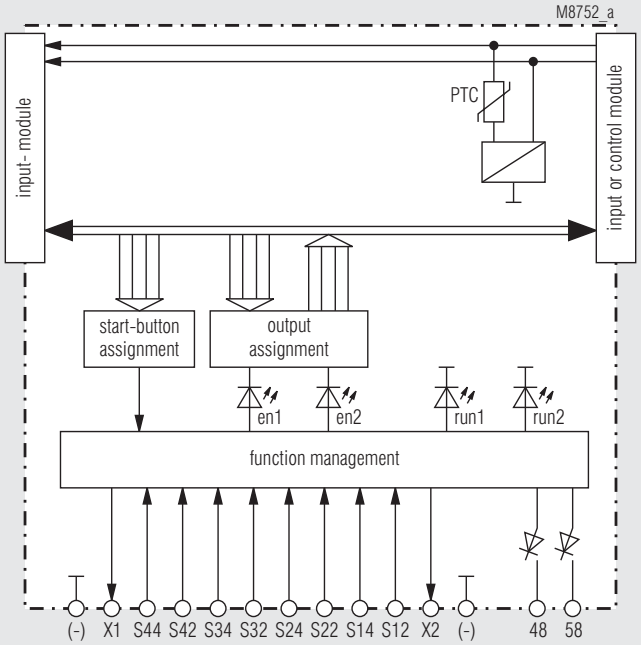
BG 5913.08/00MF0	DC 24 V
Article number:	0055530
BH 5913.08/00MF0	DC 24 V
Article number:	0059242

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5913.08/_1_ _ _

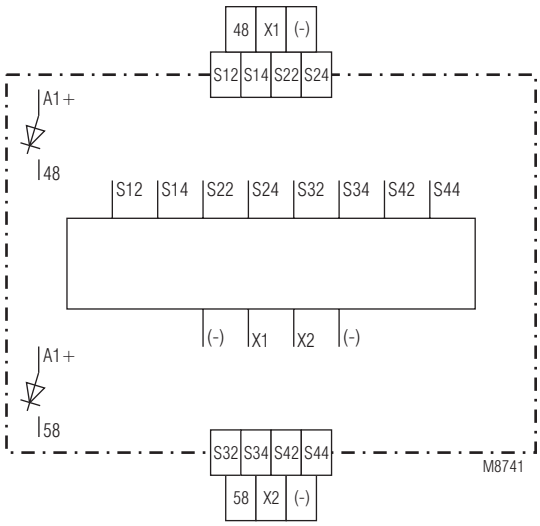


- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Input module for realization of
  - 4 mixed 2-channel inputs
  - Emergency stop circuits
  - Safety gate monitoring system
  - Two-hand control type IIIA, IIIC acc. to DIN/EN 574
  - Light curtain monitoring system (LC type 4)
- The functions are selected via rotary switch
- 8 safety inputs
- 2 semiconductor outputs for status indication
- Broken wire and short circuit monitoring function with error indication
- LEDs for status indication
- Width: 22.5 mm

Block Diagram



Circuit Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED · Functional Safety Type Approved · www.tuv.com ID 0600000000 · C US Canada / USA

Applications

Realization of fail-safe control circuits for protection of people and machinery.

Note: This module is intended for applications in which mixed safety functions affect one common output.

Further input modules with other combinations of functions are provided (e.g. BG 5913.08/_0_ _ _, BG 5913.08/_2_ _ _ , BG 5913.08/_3_ _ _, BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _, BG 5914.08/_1_ _ _, BG 5915/_1_ _ _ or BH 5915.08/_1_ _ _).

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

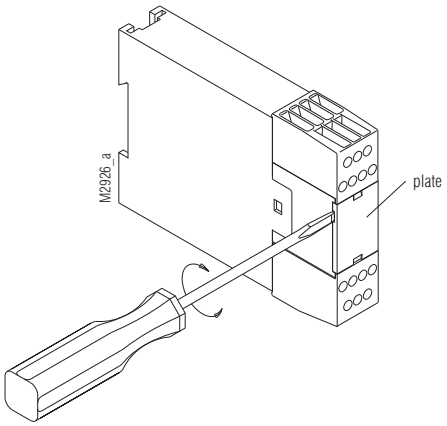
Indicators

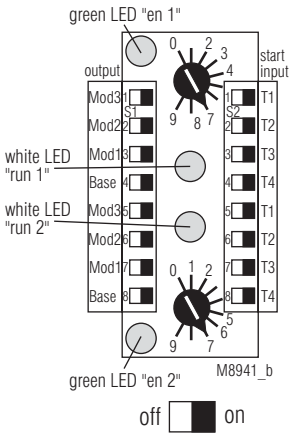
Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Setting of the Module

The module is assigned to the start inputs and the safety outputs via the DIP switches.

The combinations of individual functions are set via the rotary switches. To prevent accidently adjustments, these elements are covered by a front plate and are redundant.





Note:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Setting of the Modules

Sw.	Function at Terminals				Start behavior of the LC / E-Stop
	S12-S14	S22-S24	S32-S34	S22-S24	
0	Gate	Gate	Gate	LC	Autostart
1	Gate	Gate	Gate	LC	Manual Start
2	Gate	Gate	LC	LC	Autostart
3	Gate	Gate	LC	LC	Manual Start
4	Gate	LC	Two-hand IIIC		Autostart
5	Gate	LC	Two-hand IIIC		Manual Start
6	Gate	E-stop	Two-hand IIIC		Autostart
7	Gate	E-stop	Two-hand IIIC		Manual Start
8	Gate	LC	LC	LC	Autostart
9	Gate	LC	LC	LC	Manual Start

Functional Principle of Combined Inputs

Each function activates an enabling signal in the module software. The control unit is permitted to enable the assigned safety outputs only after all 3 (for two-hands control) or 4 enablings have been given.

With the exception of two-hand control, each function works independently. The assigned safety outputs are enabled if the precondition for enabling has been met for all functions.

Function of the Two-Hand Control

This function will only work when the other two functions have already permitted enabling. To provide for enabling, the two buttons must be pressed within 0.5 s. As soon as one of the other function reacts, the two buttons must turn inactive before the others can be enabled again. Only after that, the buttons can be activated once more from an inactivated state.

The unit must be connected as specified in the application examples. When the operating contacts are connected in parallel or in series, safe functioning of the unit is cancelled.

The two-hand buttons must be designed and arranged in such a way as to ensure that they cannot be disabled with easily, or pressed unintentionally.

The safety distance between the push buttons and the place of danger must be large enough to make sure that after releasing a button, the place of danger can only be reached after the dangerous movement has stopped.

The safety distance “S” is calculated according to the following formula:

S = V x T + C, where

a) gripping velocity V = 1 600 mm/s
b) overtravel time T (s)
c) and safety factor C = 250 mm.

When any access into the danger area, with operating keys pressed, is safely prevented, e.g. by a protective cover for the keys, the safety factor C may be set to the value 0. Generally, the minimum safety distance must be 100 mm. In this respect, also see DIN/EN 574.

The two-hand control must be released when another function module which affects the same outputs does not permit enabling.
The system may comprise only one function module with two-hand control.

Safety Gate Function

The safety gate function always permits enabling if both contacts change from inactive to active state within 3 seconds. If the second contact reacts later, both changeover contacts must turn inactive before they can be enabled again.

When activating the system, press the start button to simulate the compulsory opening and re-closing of safety gates which have been kept closed since the system has started.

This simulation is possible only before enabling has been permitted for the first time, and as long as both safety gate contacts remain closed as well. As soon as a contact opens, simulation of the safety gate function is no longer possible.

E-Stop or Light Curtain (LC) Function

In the Emergency stop or LC functions, both signals have to change from inactive state into active state within 250 ms. If the second signal reacts later, both changeover contacts must turn inactive before they can be enabled again.

With manual start, all safety inputs must be active before the start button can be pressed to trigger enabling. To start the system, do not keep the start button pressed for more than 3 seconds. A module may also be assigned several start buttons.

Note: Connect only self-testing light curtains of the type 4 acc. to EN 61496 to the module. Short-circuit monitoring of the inputs for the LC must be done in the LC.

Indication of System Errors:

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)

6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Indicators

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED run 1	Two-hand control not activated (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Error exists no more, waiting for Start input	one input function not available
LED run 2	all relays inactive due to system error	all relays inactive due to system error	No system error

Function Error Indication

Function errors are indicated by the white LED Run 1 and by output 48; the white LED Run 2 remains on. Output 58 is ON as long as the error is pending; it flashes regularly, while waiting for the assigned start signal.

Error codes*

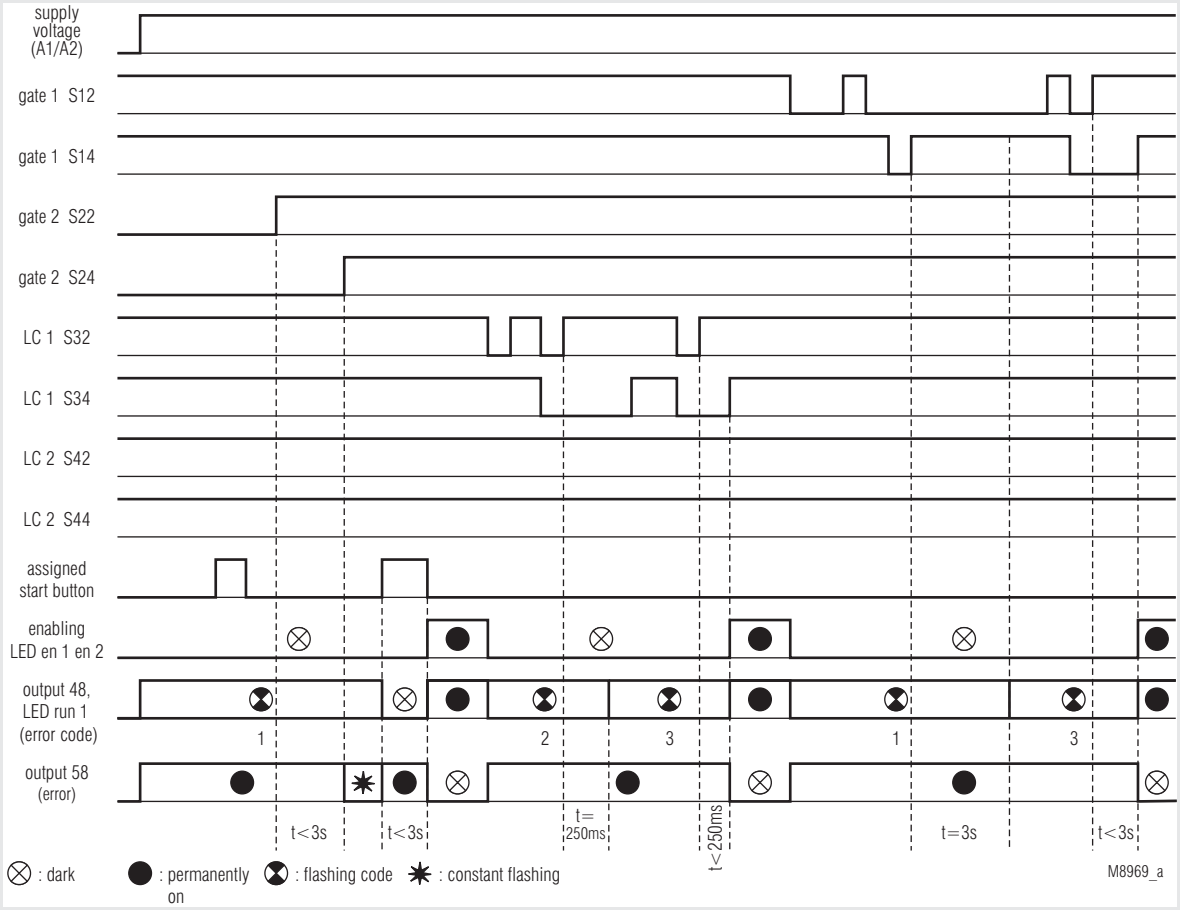
1) Normal interruption of function (e.g. Emergency stop)
2) Time error: (e.g. the second two-hand button is not pressed)
3) With gate monitoring: simulation input error (kept pressed for too long)
4) Error at start input
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error detected in the control unit)

* number of short flashing impulses, followed by a longer space

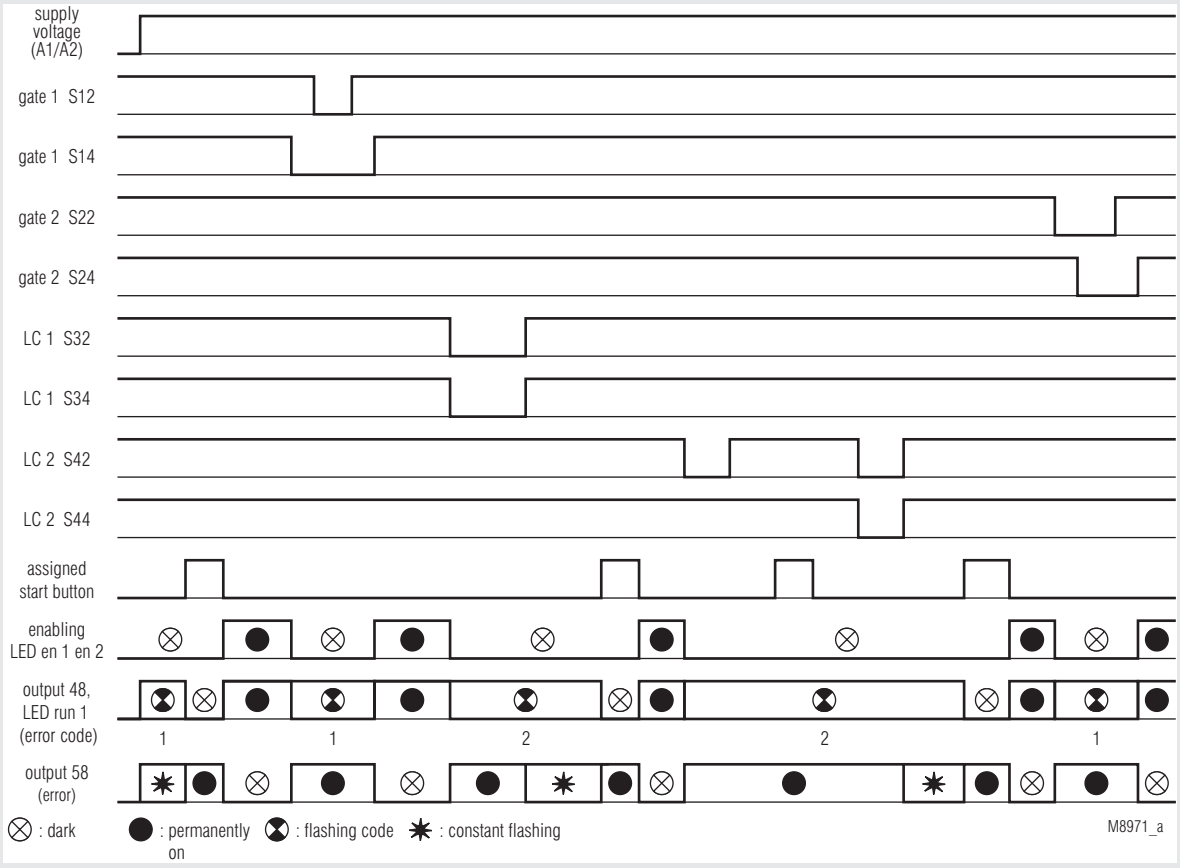
Special with two-hand control:
When both two-hand buttons of the module are inactive while all other functions are active and enabled either by autostart or via the start button, output 48 and the white LED Run 1 are permanently OFF, and output 58 permanently ON.

Function Diagrams

Note: The times specified in a pulse diagram also apply to the same function in other applications.



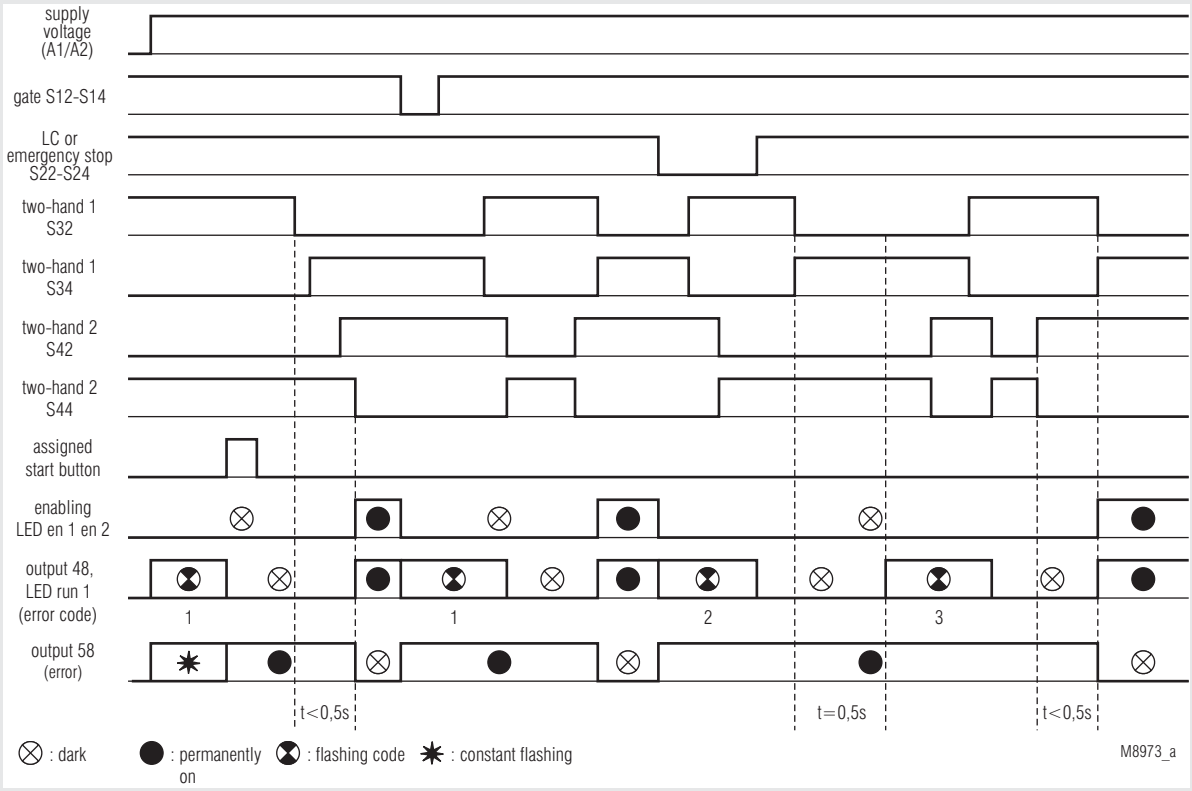
2 safety gates, 2 light curtains (Autostart)



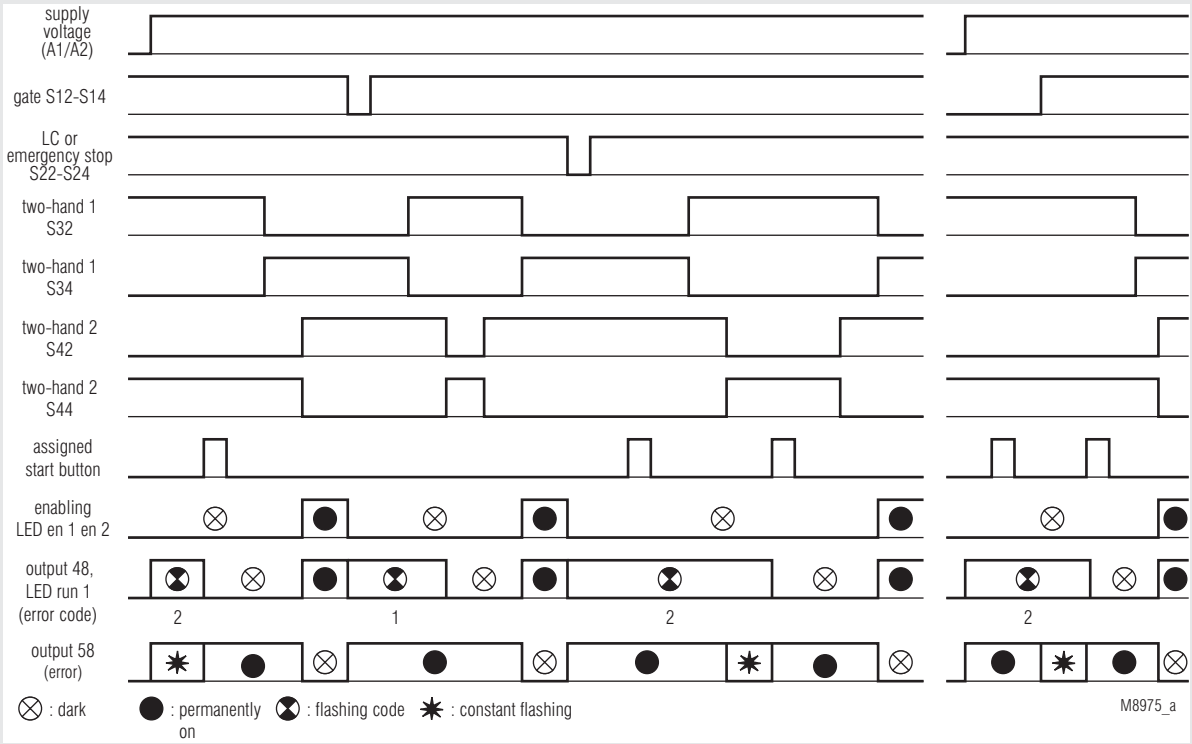
2 safety gates, 2 light curtains (manual start)

Function Diagrams

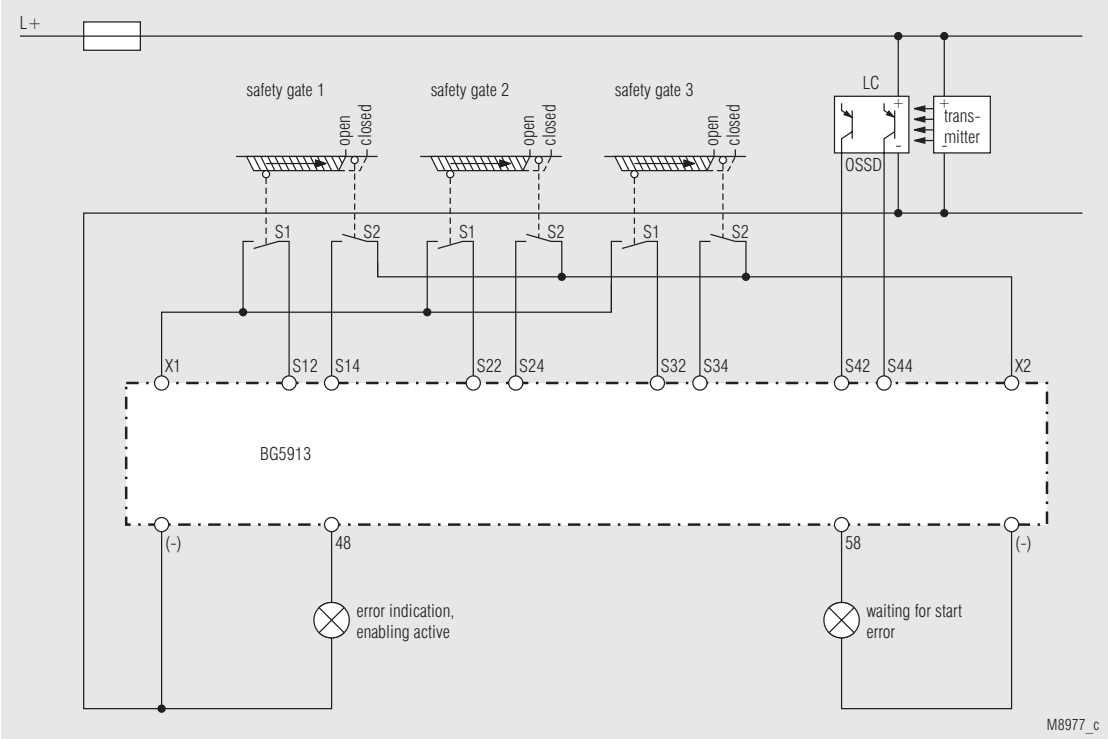
Note: The times specified in a pulse diagram also apply to the same function in other applications.



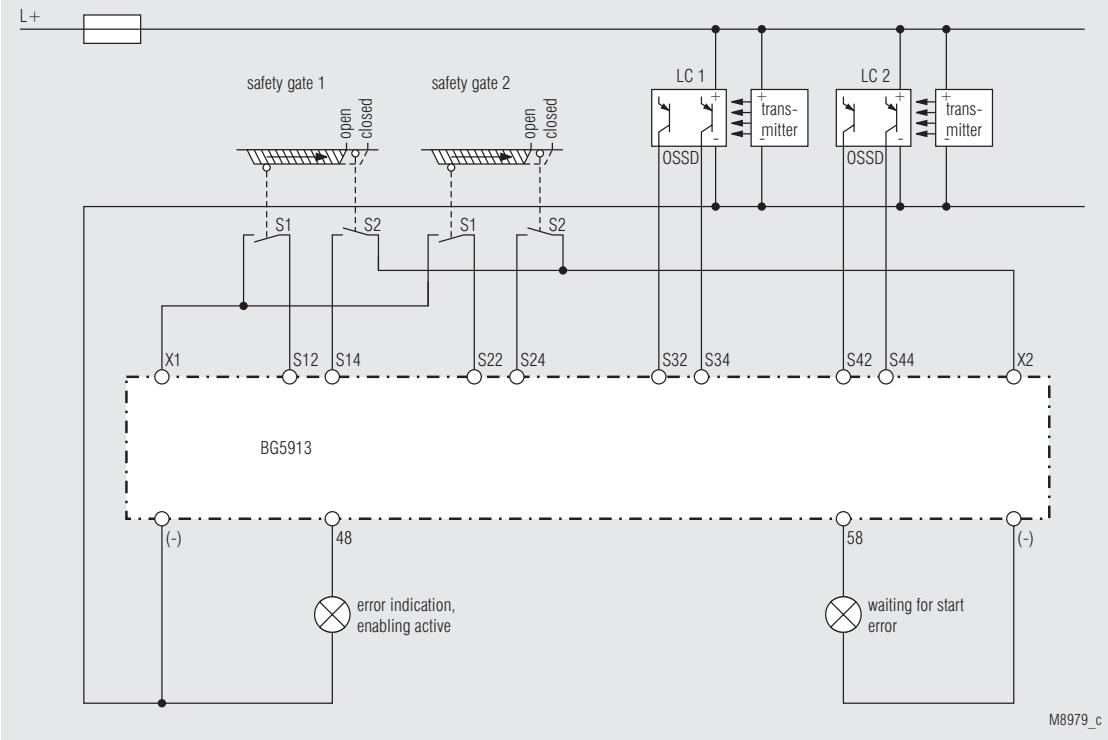
1 safety gate, 1 light curtain or Emergency stop (Autostart), 1 two-hand control (type IIIC)



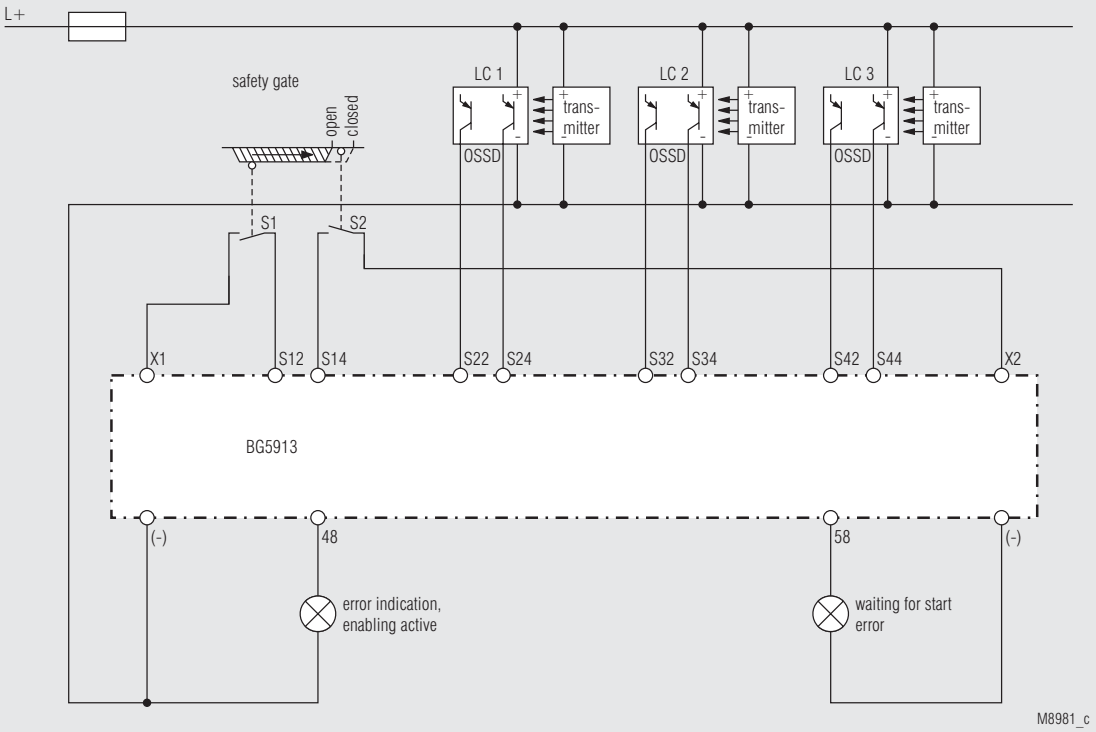
1 safety gate, 1 light curtain or Emergency stop (manual start), 1 two-hand control (type IIIC)



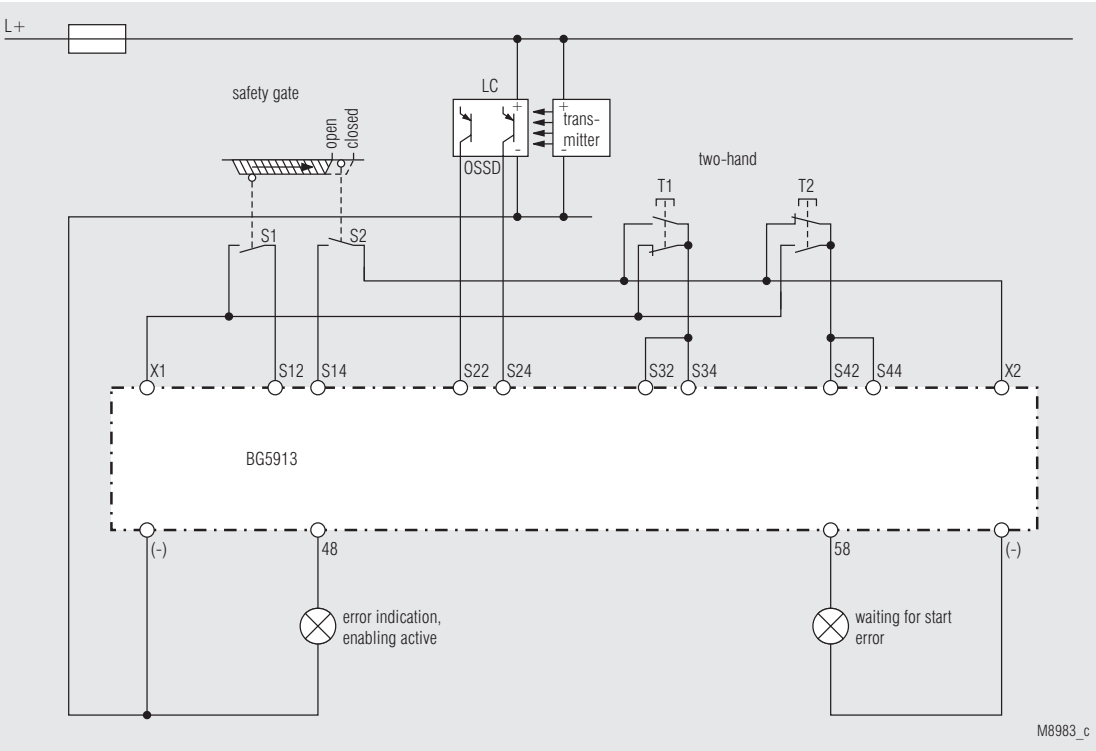
BG 5913.08/_1_ _ _, 3 safety gates, 1 light curtain; functions: 0 or 1



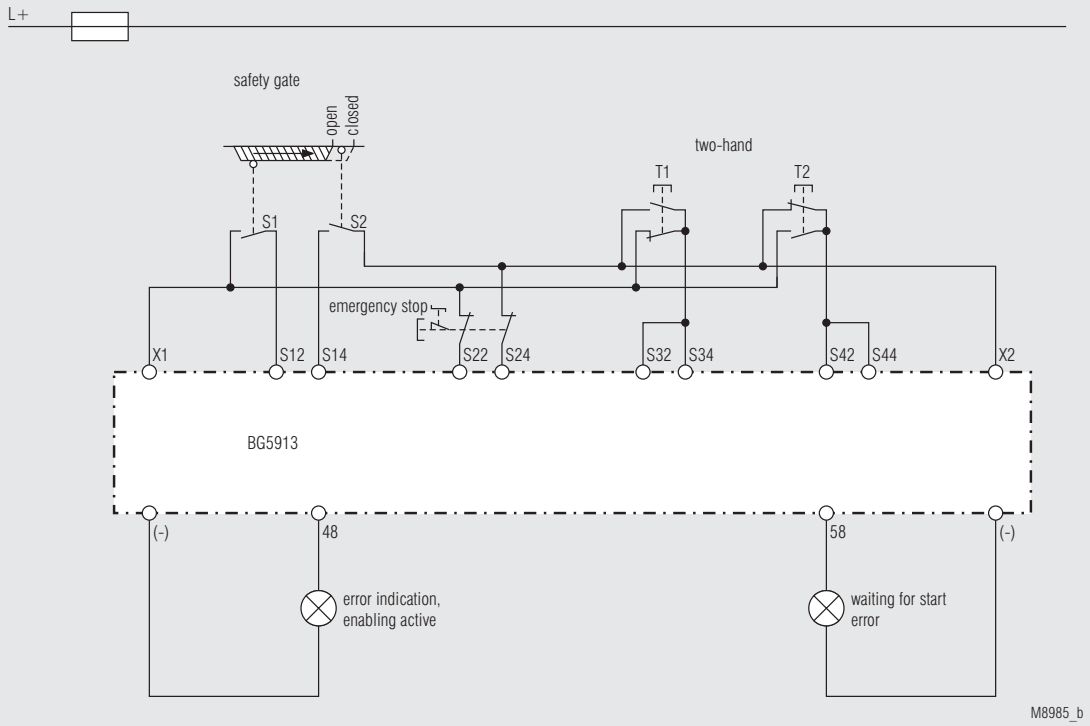
BG 5913.08/_1_ _ _, 2 safety gates, 2 light curtains; functions 2 or 3



BG 5913.08/_1_ _ _, 1 safety gate, 3 light curtains; functions: 8 or 9



BG 5913.08/_1_ _ _, 1 safety gate, 1 light curtain, 1 two-hand control type IIIC (EN 574); functions: 4 or 5



BG 5913.08/_1_ _ _, 1 safety gate, 1 Emergency stop, 1 two-hand control type IIIC (EN 574); functions: 6 or 7

Technical Data

Voltage Supply

Nominal voltage U_N: DC 24 V (coming from the basic module BH5911)
Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N
Nominal consumption: max. 60mA (no load on semiconductor outputs)
Short-circuit protection of the modules: internally with PTC

Input

Control voltage via X1, X2, 48.58: DC 23 V at U_N

Control voltage via S12, S14, S22, S24, S32, S34, S42, S44: 4.5 mA each at U_N

Minimum voltage on S12, S14, S22, S24, S32, S34, S42, S44: DC 16 V

Semiconductor Outputs

Output at terminal 48 and 58: Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0.5 s
Internal short circuit, overtemperature, and overload protection

Reaction Times (time till reaction of the assigned output):

Typ. NO time with U_N:

Input modules BG 5913	Manual start	Automatic start	
		First start	Restart
Emergency stop	max. 80 ms	max. 1 s	max. 115 ms
Light barriers	max. 80 ms	max. 1 s	max. 115 ms
Safety gates	or simulation: max. 80 ms		Gate closing: max. 115 ms
Two-hand control	max. 85 ms		

Break time (reaction time):

Input modules BG 5913	
Emergency stop	max. 33 ms
Light barriers	max. 33 ms
Safety gates	max. 33 ms
Two-hand control	max. 33 ms

General Data

Operating mode: Continuous operation
Temperature range: ± 0 ...+ 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1

EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behavior according to UL Subject 94
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6
Frequency 10…55 Hz,

Technical Data

Shock resistance
Acceleration: 10 g
Pulse duration: 16 ms
Number of shocks: 1000 per axis on three axes
Climate resistance: 0 / 050/ 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 2.5 mm² stranded wire with sleeve, or
1 x 4 mm² massive or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing: Box terminal with wire protection, removable terminal strips.
Mounting: DIN rail IEC/EN 60 715
Weight: 193 g

Dimensions

Width x height x depth: 22.5 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	812.8	a
DC_{avg}:	96.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	2697.1	a
DC_{avg}:	96.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

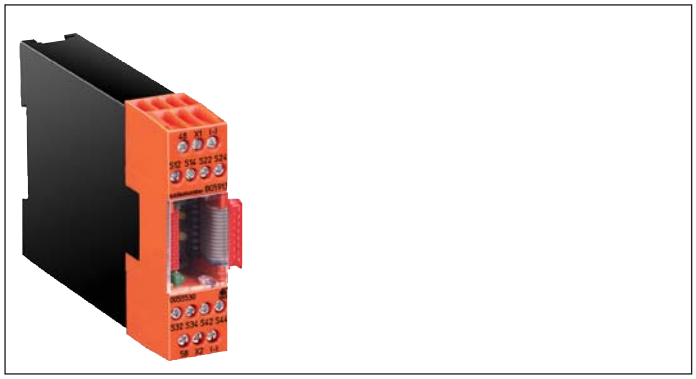
*) HFT = Hardware-Failure Tolerance

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.

Standard Type

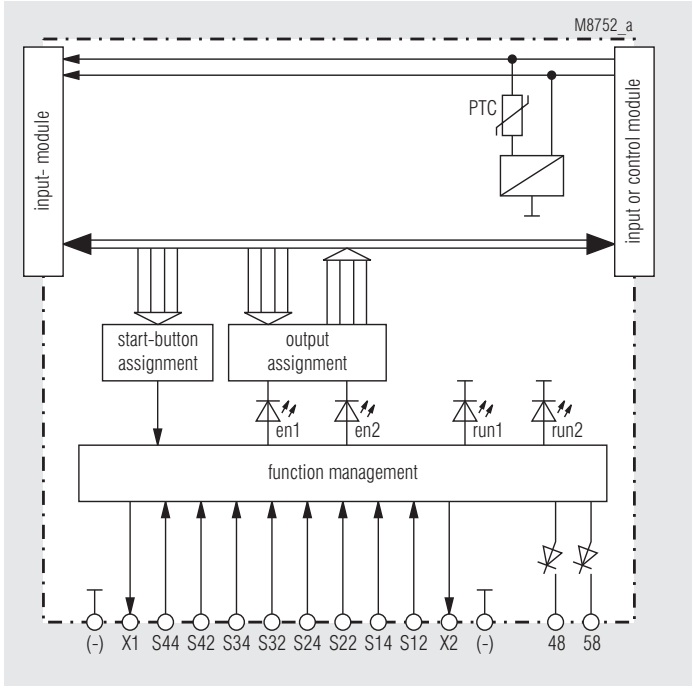
BG 5913.08/01MF0 DC 24 V
Article number: 0055530

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5913.08/_2_ _ _

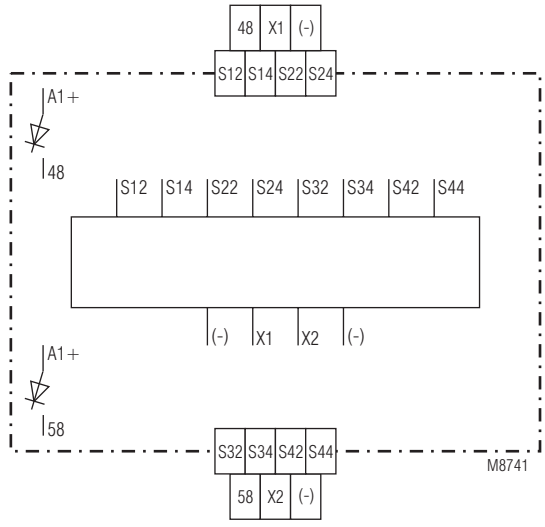


- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Input module for combination of 4 of the following functions to be set via rotary switch:
  - safety gate monitoring function (2 x 2 changeover contacts)
  - Light curtain (LC type 4) with manual or automatic start
  - Emergency stop (2-channel) with manual or automatic start
  - Two-hand controls type IIIC acc. to DIN/EN 574
- Functions can be selected via rotary switches
- 8 inputs for safety sensors
- Broken wire and short circuit monitoring function with error indication
- 2 semiconductor outputs for status indication
- LEDs for status indication
- Width: 22.5 mm

Block Diagram



Circuit Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 · C US Canada / USA

Applications

Realization of fail-safe control circuits for protection of people and machinery.

Note: This module is intended for applications in which mixed safety functions affect one common output.

Further input modules with other combinations of functions are provided (e.g. BG 5913.08/_0_ _ _, BG 5913.08/_2_ _ _ , BG 5913.08/_3_ _ _, BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _, BG 5914.08/_1_ _ _, BG 5915/_1_ _ _ or BH 5915.08/_1_ _ _).

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

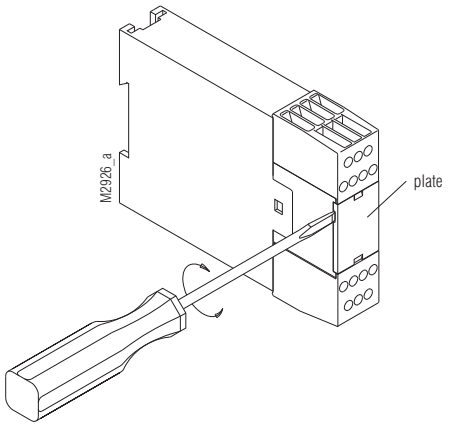
Indicators

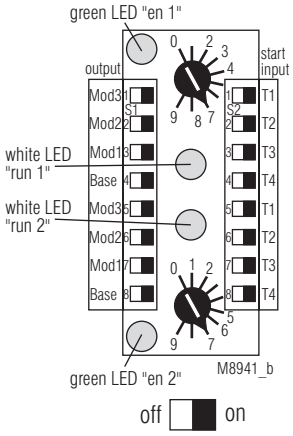
Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Setting of the Module

The module is assigned to the start inputs and the safety outputs via the DIP switches.

The combinations of individual functions are set via the rotary switches. To prevent accidently adjustments, these elements are covered by a front plate and are redundant.





Note:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Setting of the Modules

Sw.	Function at Terminals				Start behavior of the LC / E-Stop	
	S12-S14	S22-S24	S32-S34	S22-S24		
0	Gate	Gate	E-Stop	LC	Autostart	
1	Gate	Gate	E-Stop	LC	Manual Start	
2	E-Stop	E-Stop	E-Stop	E-Stop	Autostart	Enabling only when all other modules permit enabling
3	E-Stop	E-Stop	E-Stop	E-Stop	Manual Start	
4	E-Stop	E-Stop	E-Stop	E-Stop	Autostart	
5	E-Stop	E-Stop	E-Stop	E-Stop	Manual Start	
6	E-Stop	E-stop	Two-hand IIIC		Autostart	
7	E-Stop	E-stop	Two-hand IIIC		Manual Start	
8	Gate	Gate	Two-hand IIIC		Autostart	
9	Gate	LC	Two-hand IIIC		Autostart	

Functional Principle of Combined Inputs

Each function activates an enabling signal in the module software. The control unit is permitted to enable the assigned safety outputs only after all 3 (for two-hands control) or 4 enablings have been given.

With the exception of two-hand control, each function works independently. The assigned safety outputs are enabled if the precondition for enabling has been met for all functions.

Function of the Two-Hand Control

This function will only work when the other two functions have already permitted enabling. To provide for enabling, the two buttons must be pressed within 0.5 s. As soon as one of the other function reacts, the two buttons must turn inactive before the others can be enabled again. Only after that, the buttons can be activated once more from an inactivated state.

The unit must be connected as specified in the application examples. When the operating contacts are connected in parallel or in series, safe functioning of the unit is cancelled.

The two-hand buttons must be designed and arranged in such a way as to ensure that they cannot be disabled with easily, or pressed unintentionally.

The safety distance between the push buttons and the place of danger must be large enough to make sure that after releasing a button, the place of danger can only be reached after the dangerous movement has stopped.

The safety distance “S” is calculated according to the following formula:

S = V x T + C, where

a) gripping velocity V = 1 600 mm/s
b) overtravel time T (s)
c) and safety factor C = 250 mm.

When any access into the danger area, with operating keys pressed, is safely prevented, e.g. by a protective cover for the keys, the safety factor C may be set to the value 0. Generally, the minimum safety distance must be 100 mm. In this respect, also see DIN/EN 574.

The two-hand control must be released when another function module which affects the same outputs does not permit enabling.
The system may comprise only one function module with two-hand control.

Safety Gate Function

The safety gate function always permits enabling if both contacts change from inactive to active state within 3 seconds. If the second contact reacts later, both changeover contacts must turn inactive before they can be enabled again.

When activating the system, press the start button to simulate the compulsory opening and re-closing of safety gates which have been kept closed since the system has started.

This simulation is possible only before enabling has been permitted for the first time, and as long as both safety gate contacts remain closed as well. As soon as a contact opens, simulation of the safety gate function is no longer possible.

E-Stop or Light Curtain (LC) Function

In the Emergency stop or LC functions, both signals have to change from inactive state into active state within 250 ms. If the second signal reacts later, both changeover contacts must turn inactive before they can be enabled again.

With manual start, all safety inputs must be active before the start button can be pressed to trigger enabling. To start the system, do not keep the start button pressed for more than 3 seconds. A module may also be assigned several start buttons.

Note: Connect only self-testing light curtains of the type 4 acc. to EN 61496 to the module. Short-circuit monitoring of the inputs for the LC must be done in the LC.

Indication of System Errors:

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)

6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Indicators

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED run 1	Two-hand control not activated (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Error exists no more, waiting for Start input	one input function not available
LED run 2	all relays inactive due to system error	all relays inactive due to system error	No system error

Function Error Indication

Function errors are indicated by the white LED Run 1 and by output 48; the white LED Run 2 remains on. Output 58 is ON as long as the error is pending; it flashes regularly, while waiting for the assigned start signal.

Error codes*

1) Normal interruption of function (e.g. Emergency stop)
2) Time error: (e.g. the second two-hand button is not pressed)
3) With gate monitoring: simulation input error (kept pressed for too long)
4) Error at start input
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error detected in the control unit)

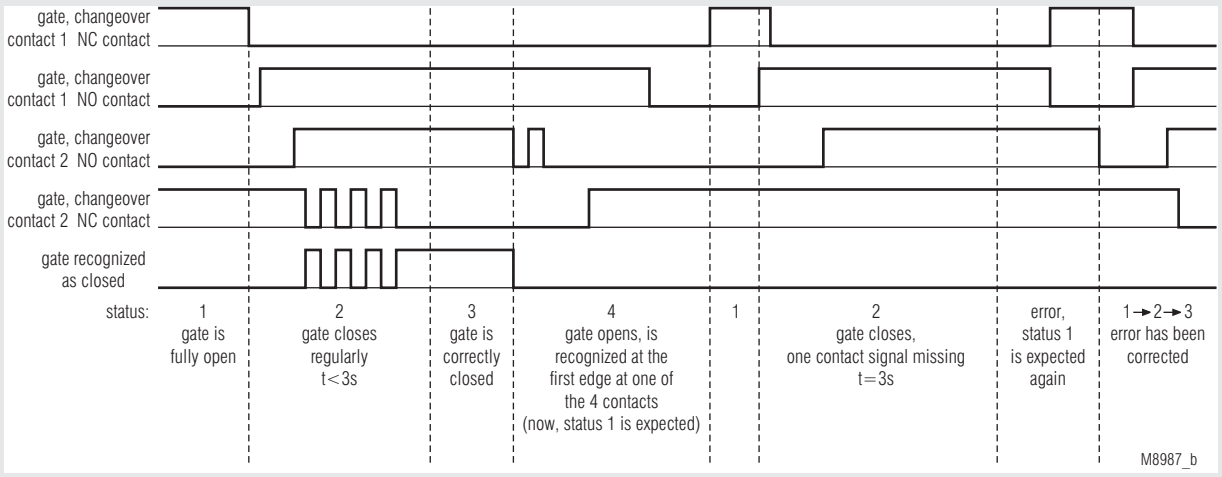
* number of short flashing impulses, followed by a longer space

Special with two-hand control:
When both two-hand buttons of the module are inactive while all other functions are active and enabled either by autostart or via the start button, output 48 and the white LED Run 1 are permanently OFF, and output 58 permanently ON.

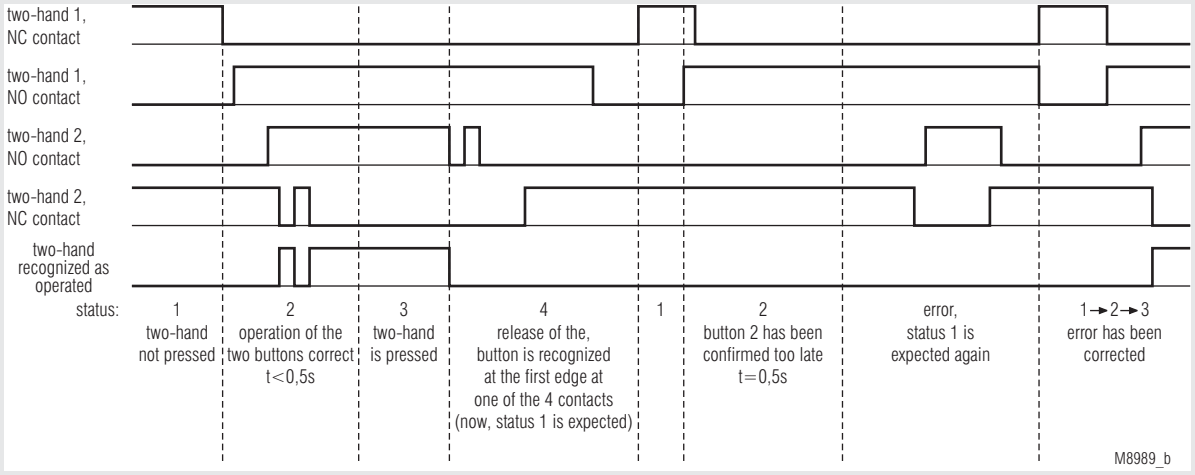
Special behaviour on e-stop (function setting 2 or 3):
Initial state: all e-stop buttons are not activated and the start button has been pressed correctly on manual start. An other module gives no enabling signal independent of the assigned output module. Output 48 and the white run LED 1 are off and output 58 is continuously on.
In this state the module will give the enabling signal automatically as soon as all other modules give their enabling signals together.

Function Diagrams

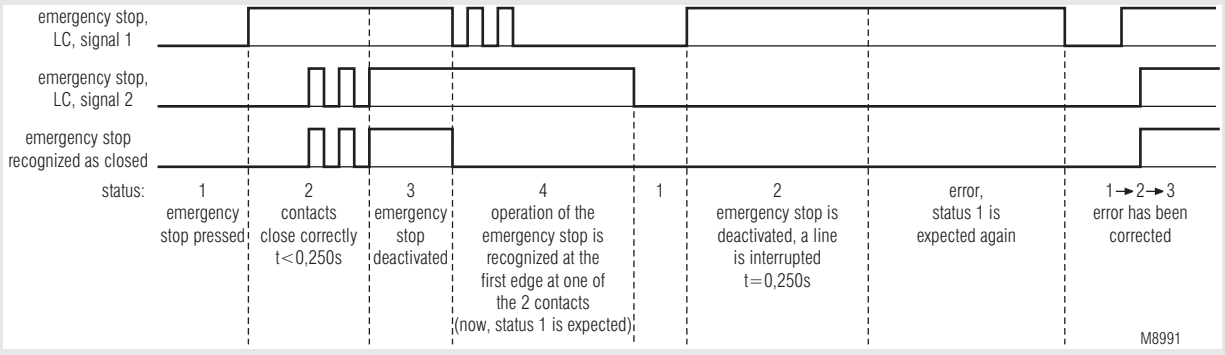
Note: The times specified in a pulse diagram also apply to the same function in other applications.



Safety gate control



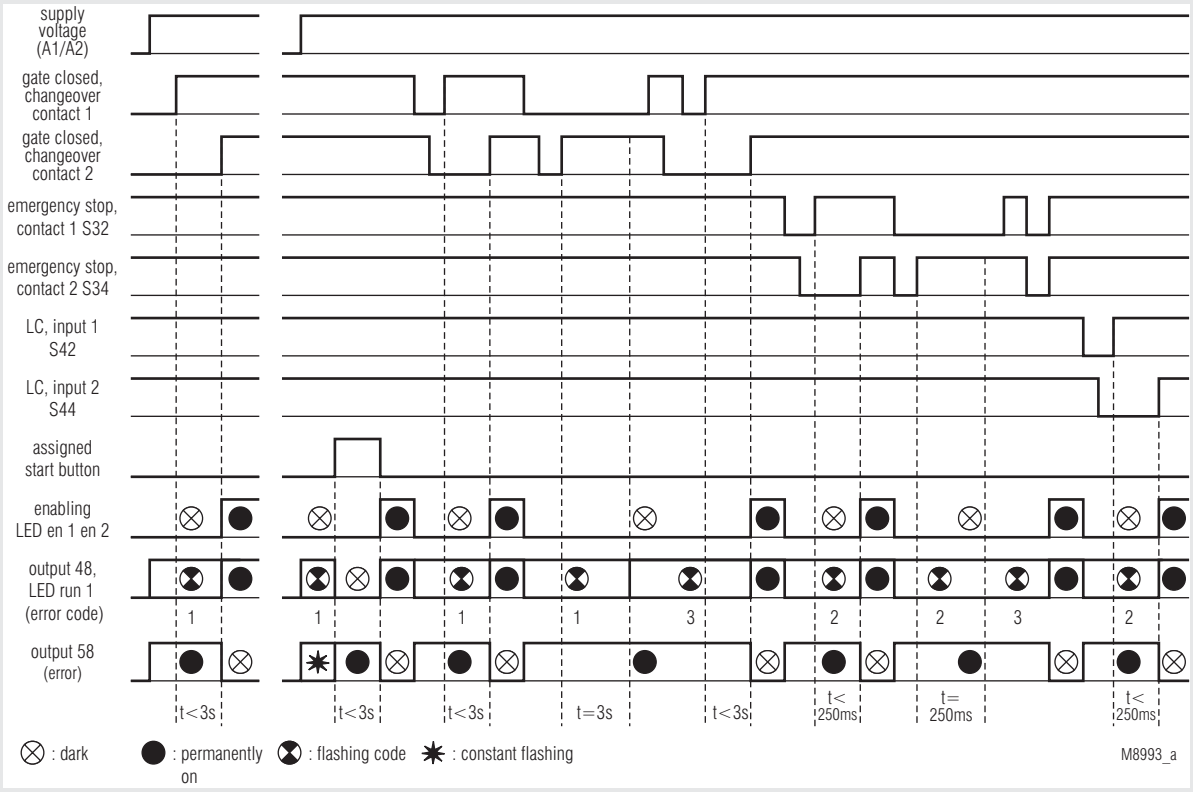
Two-hand control type IIIC



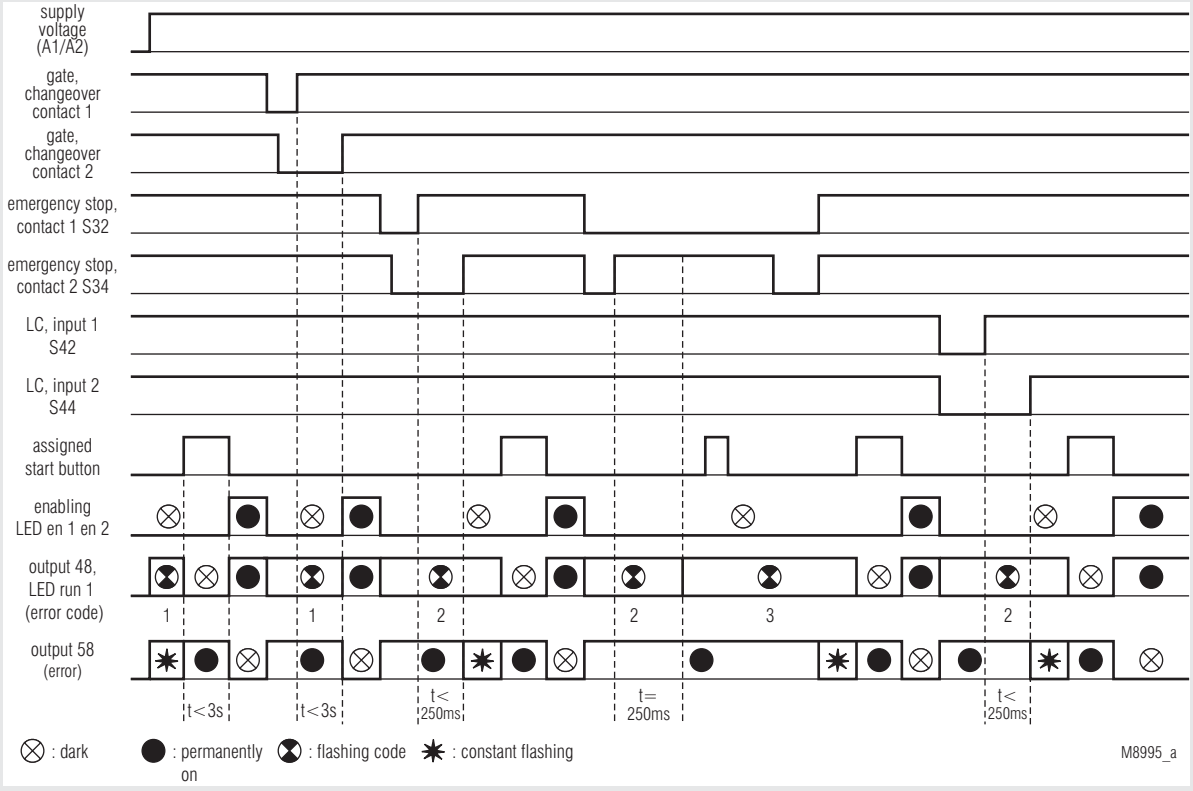
Emergency stop or light curtains

Function Diagrams

Note: The times specified in a pulse diagram also apply to the same function in other applications.



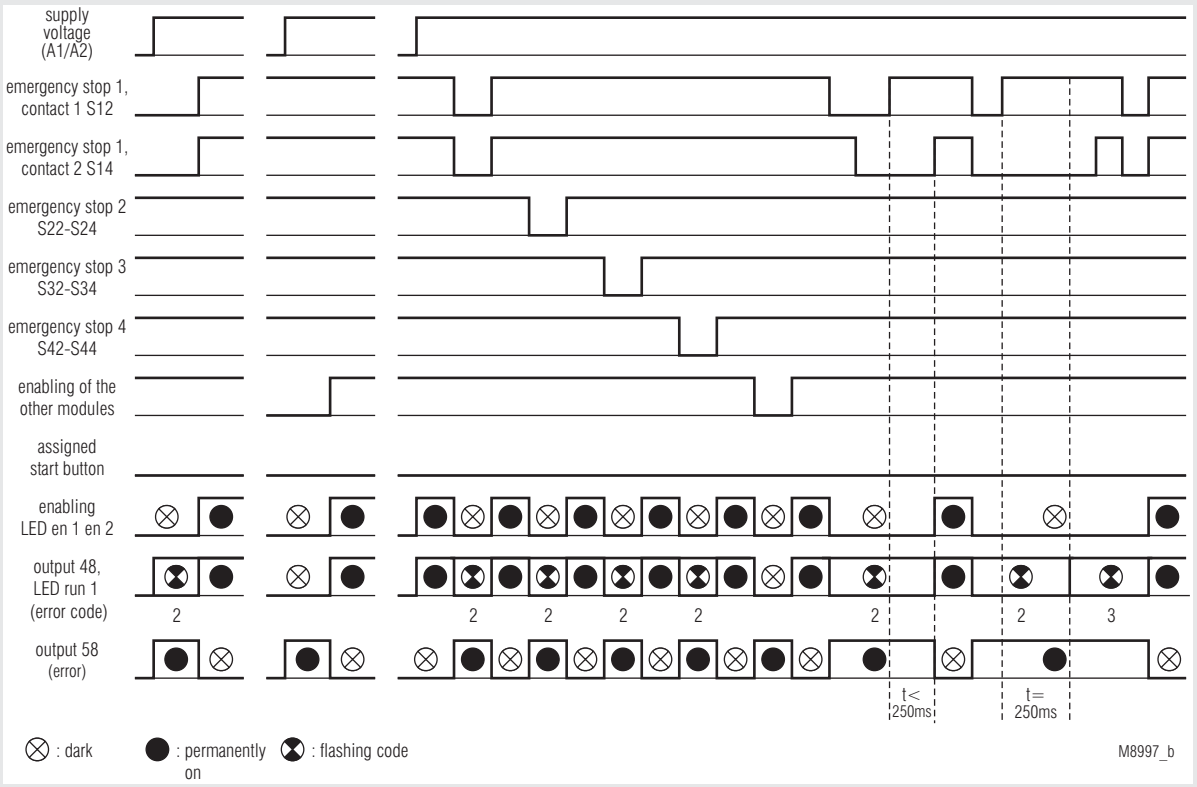
1 Safety gate, 1 Emergency stop, 1 light curtain, Autostart; function: 0



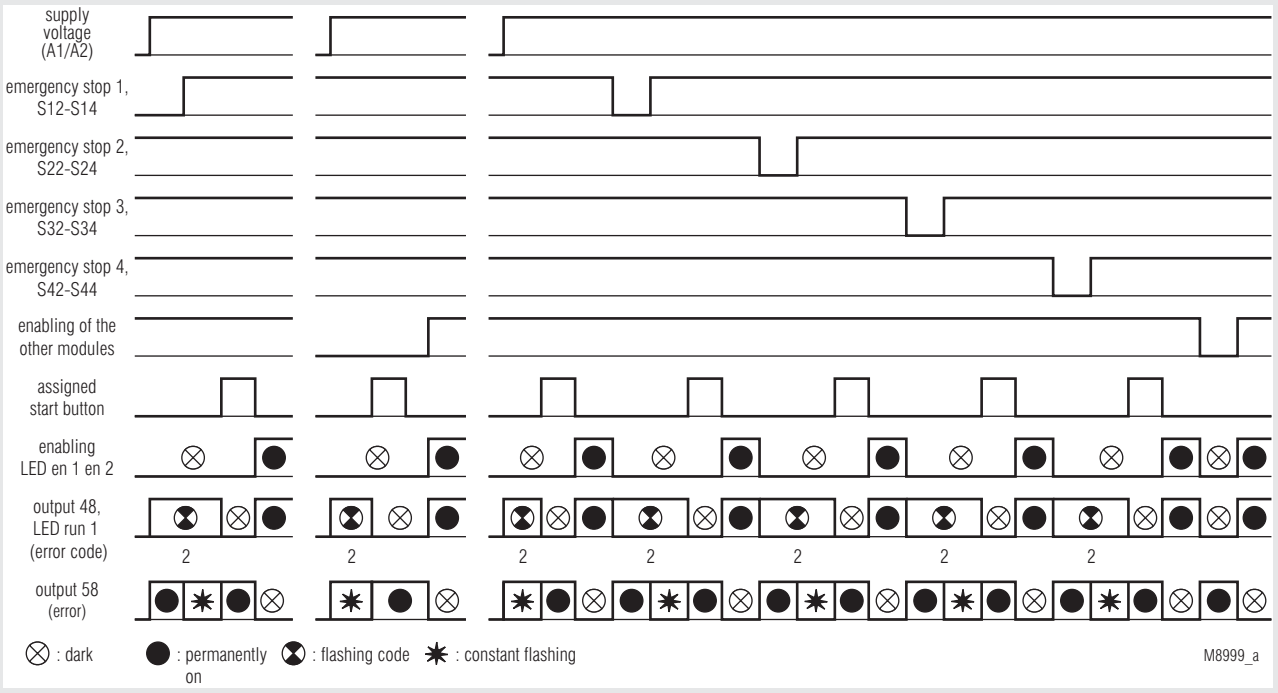
1 Safety gate, 1 Emergency stop, 1 light curtain, manual start; function: 1

Function Diagrams

Note: The times specified in a pulse diagram also apply to the same function in other applications.



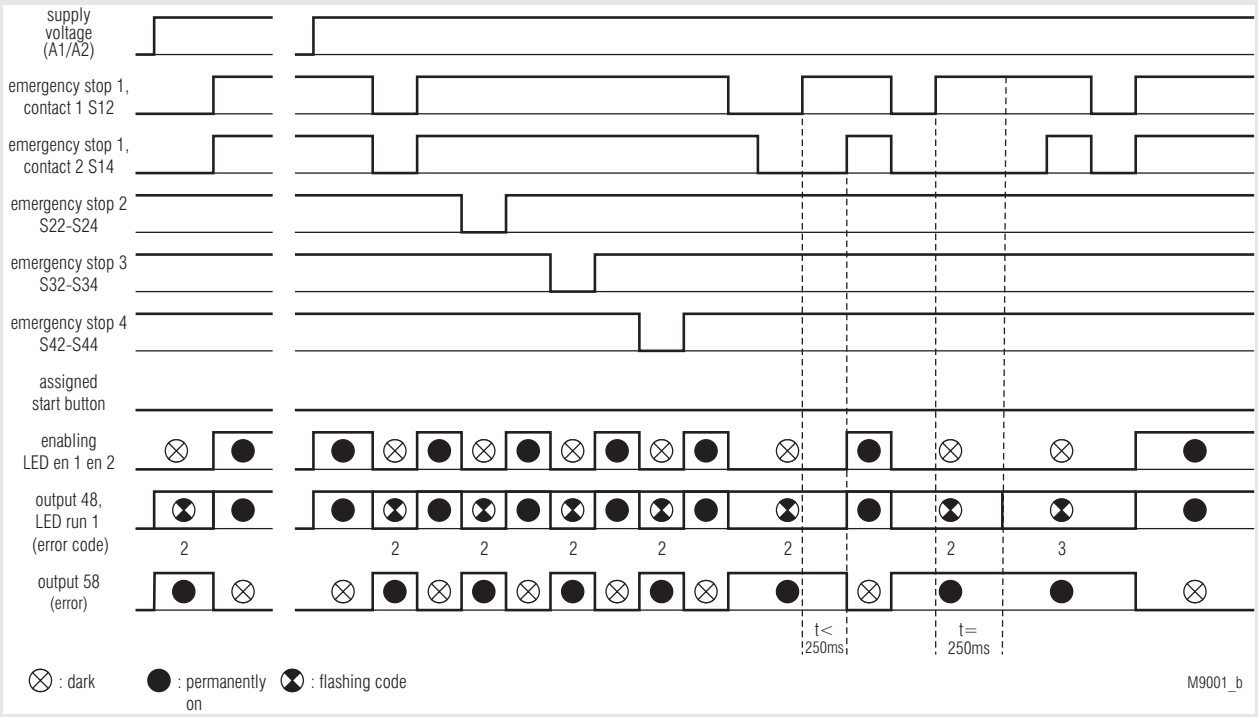
4 Emergency stop, Autostart, only enabling when all the other modules are enabled; function: 2



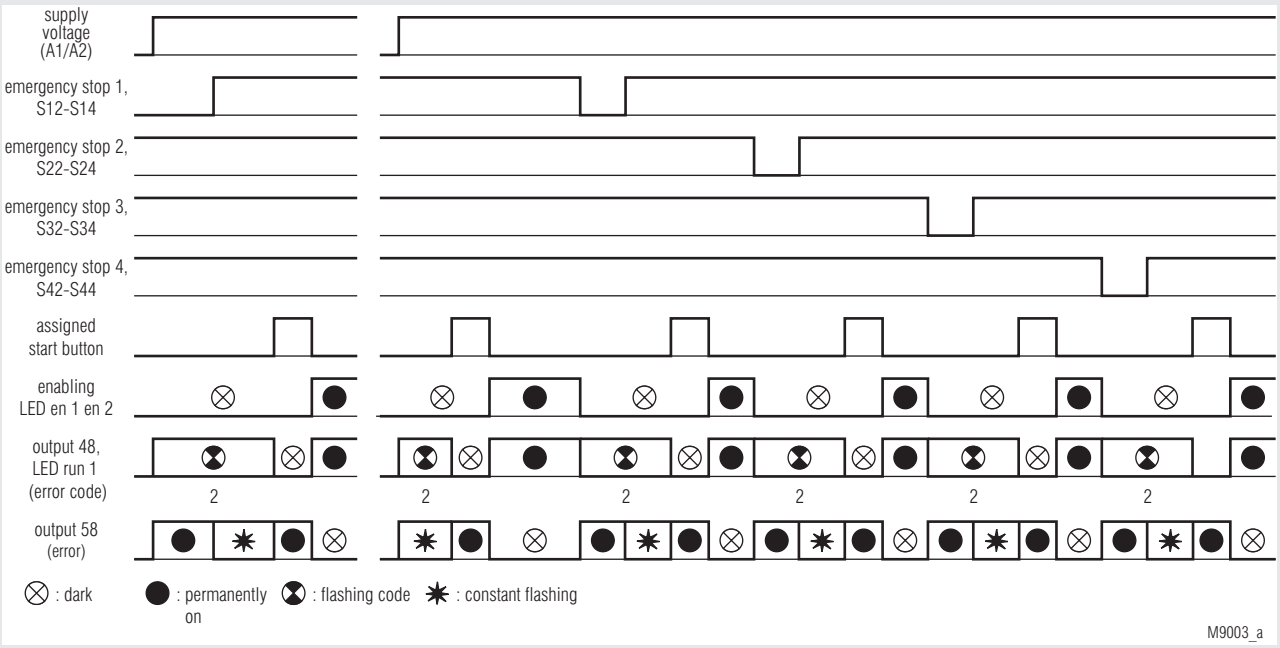
4 Emergency stop, manual start, only enabling when all the other modules are enabled; function: 3

Function Diagrams

Note: The times specified in a pulse diagram also apply to the same function in other applications.



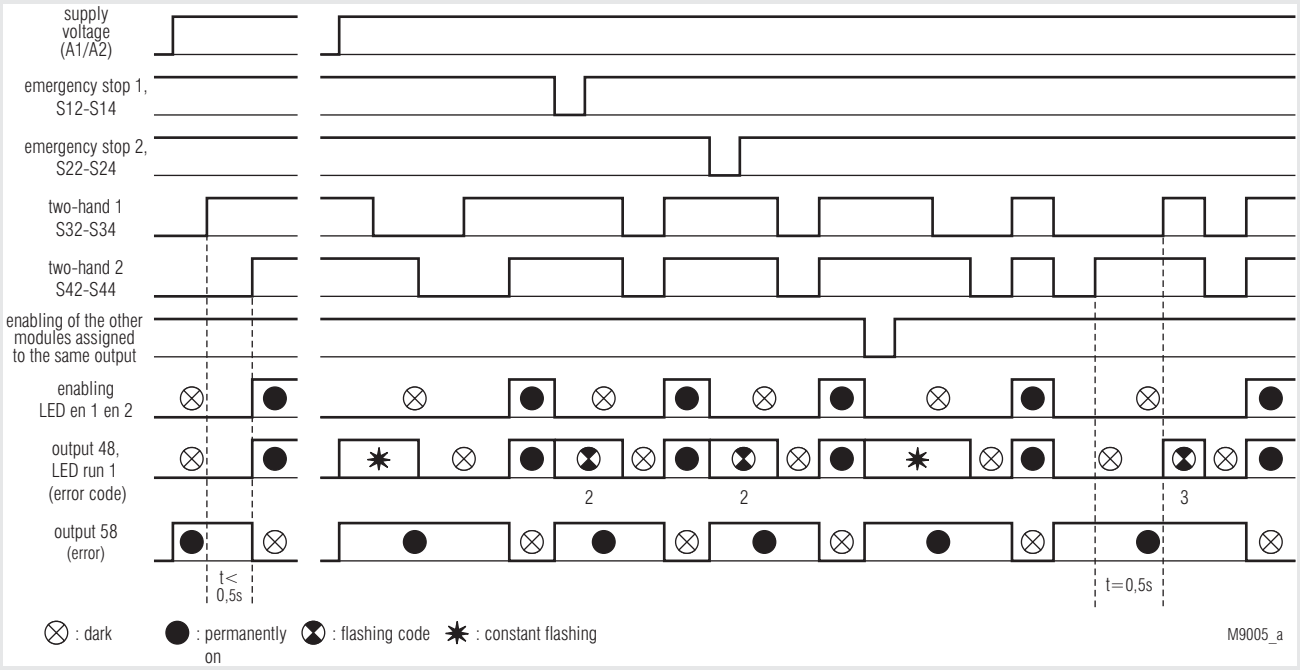
4 Emergency stop, Autostart; function: 4



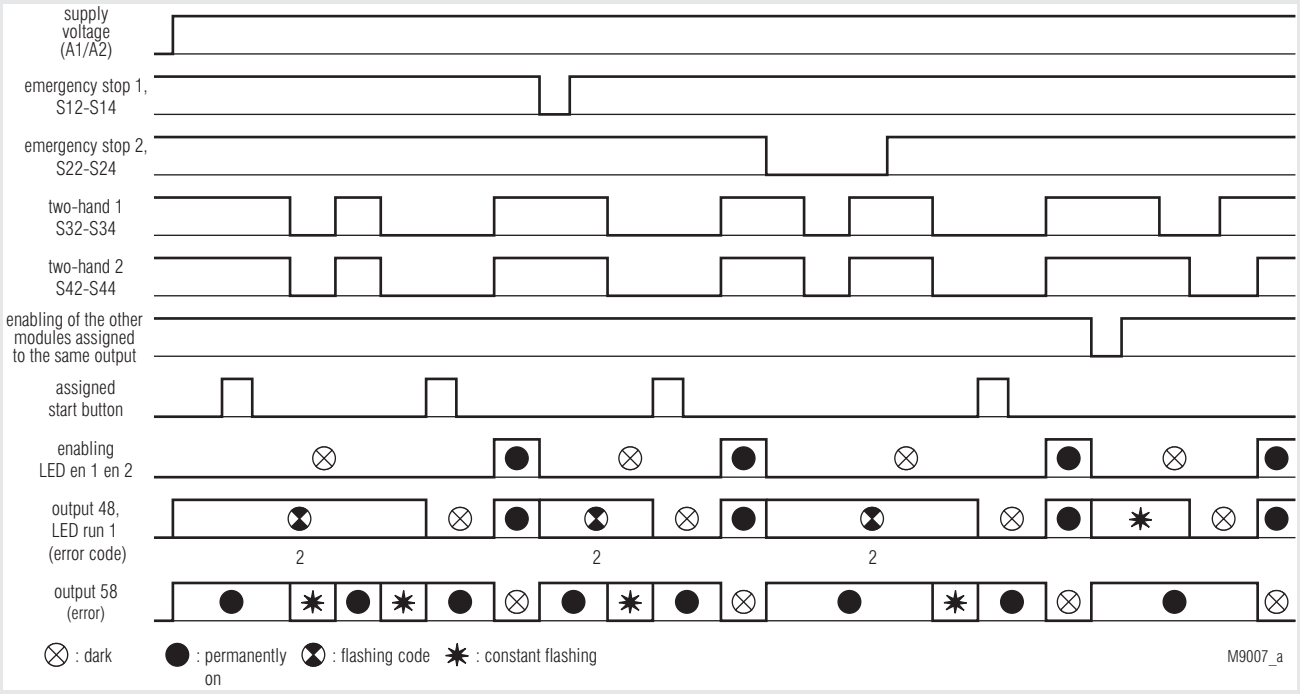
4 Emergency stop, manual start; function 5

Function Diagrams

Note: The times specified in a pulse diagram also apply to the same function in other applications.

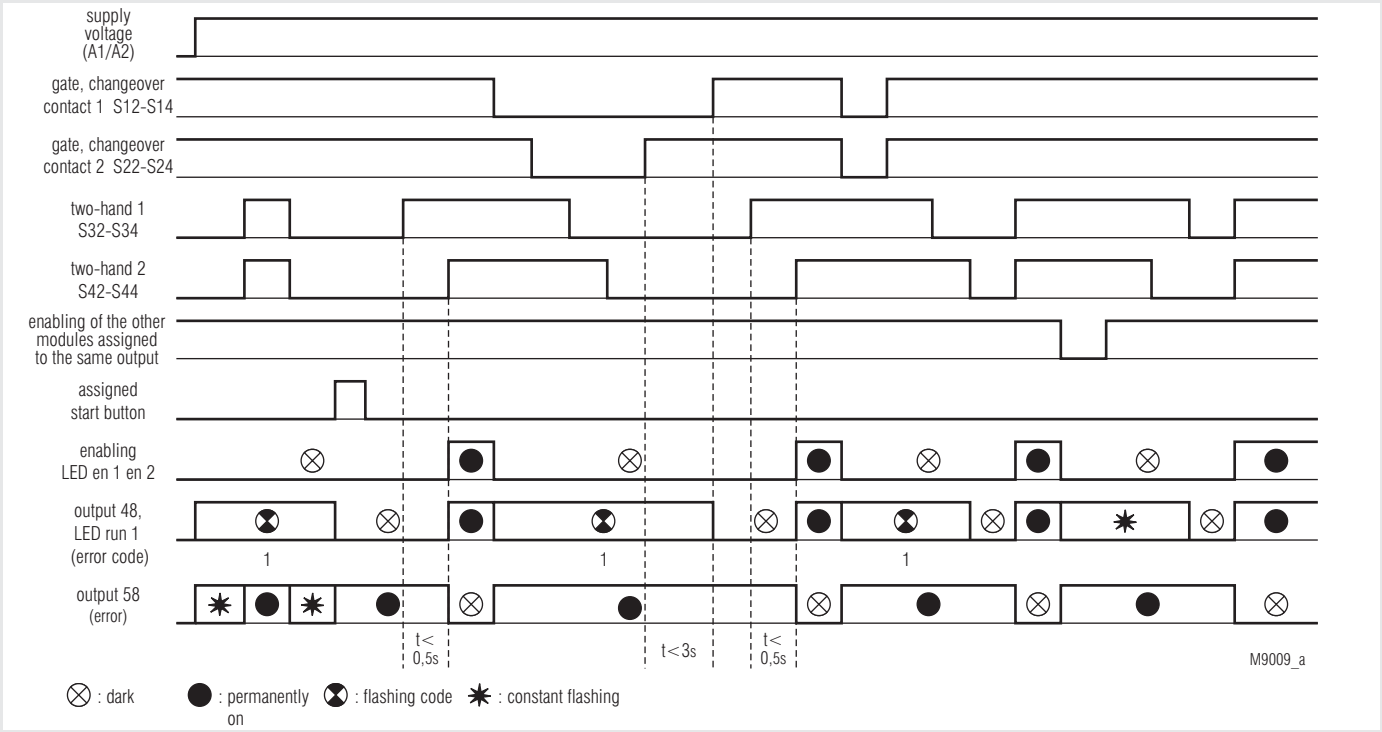


2 Emergency stop, Autostart, 1 two-hand control type IIIC; function: 6



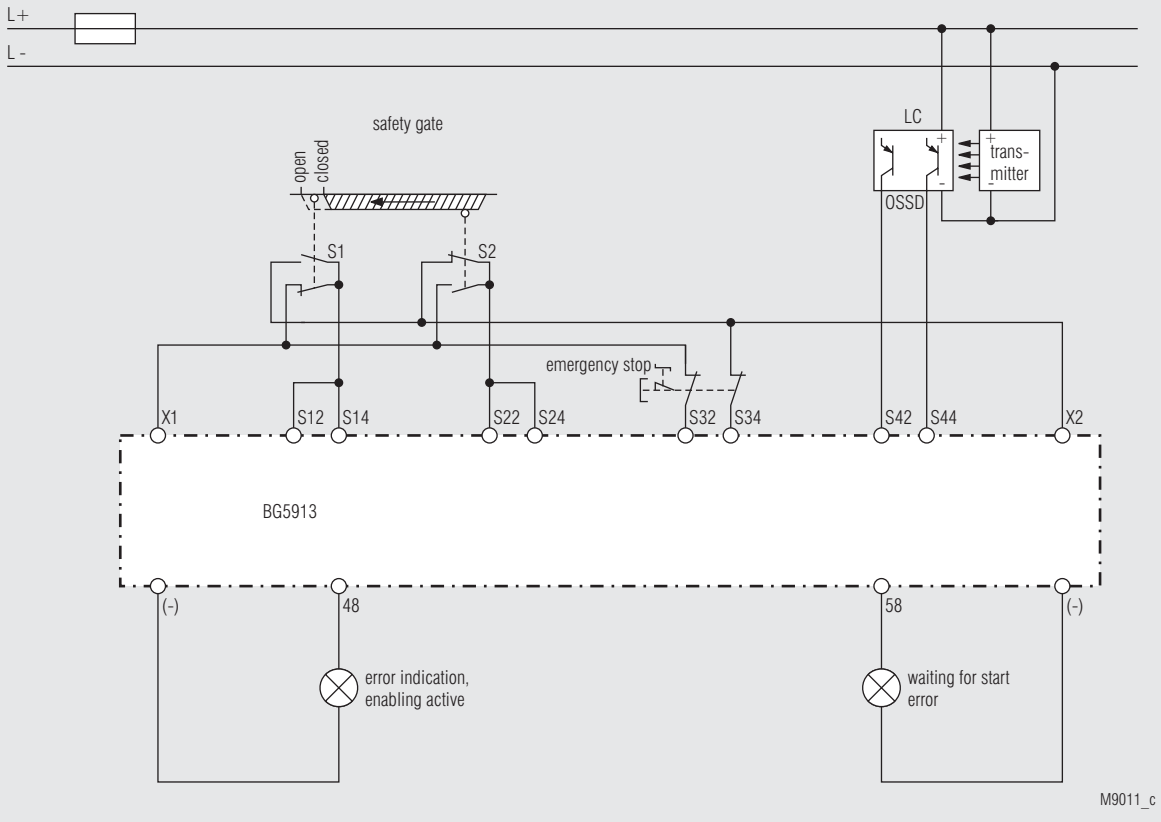
2 Emergency stop, manual start, 1 two-hand control type IIIC; function: 7 or 9

Function Diagram

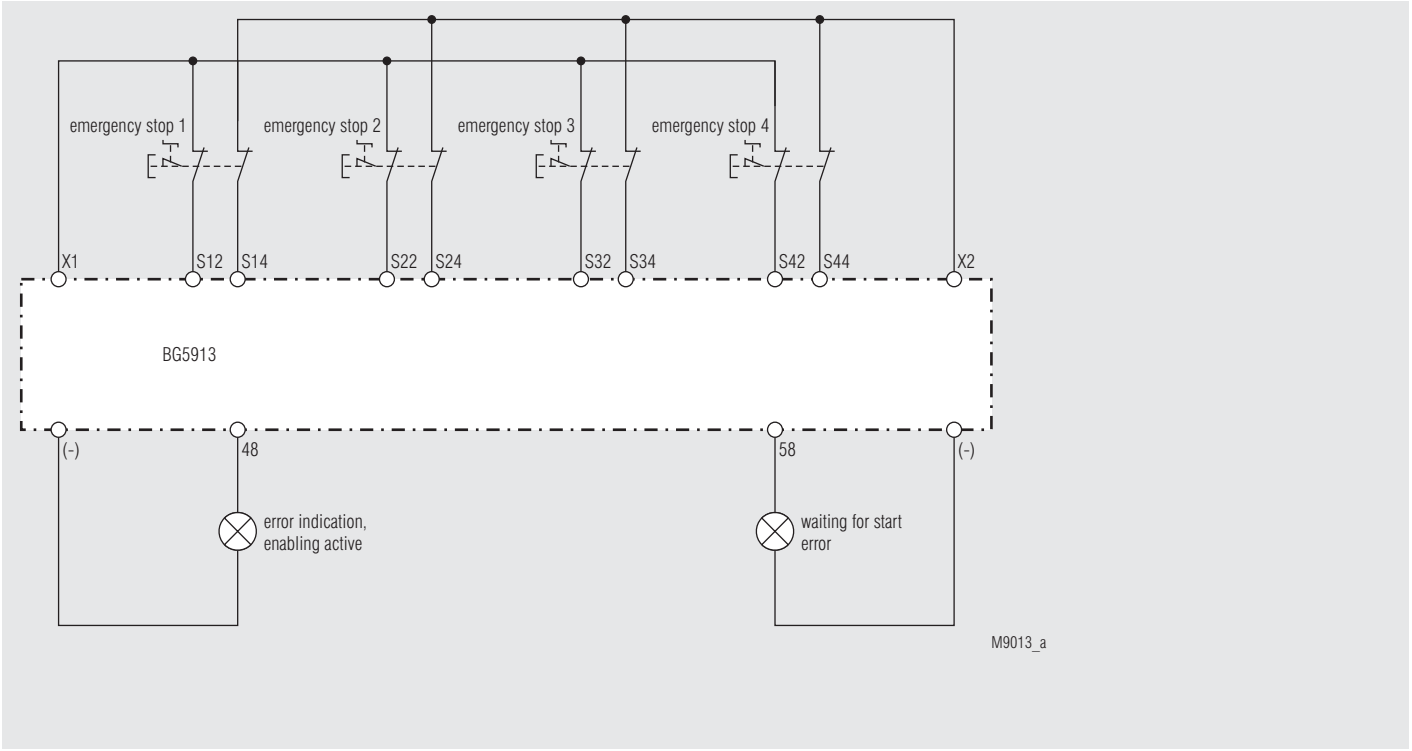


1 Safety gate, 1 two-hand control type IIIC; function: 8

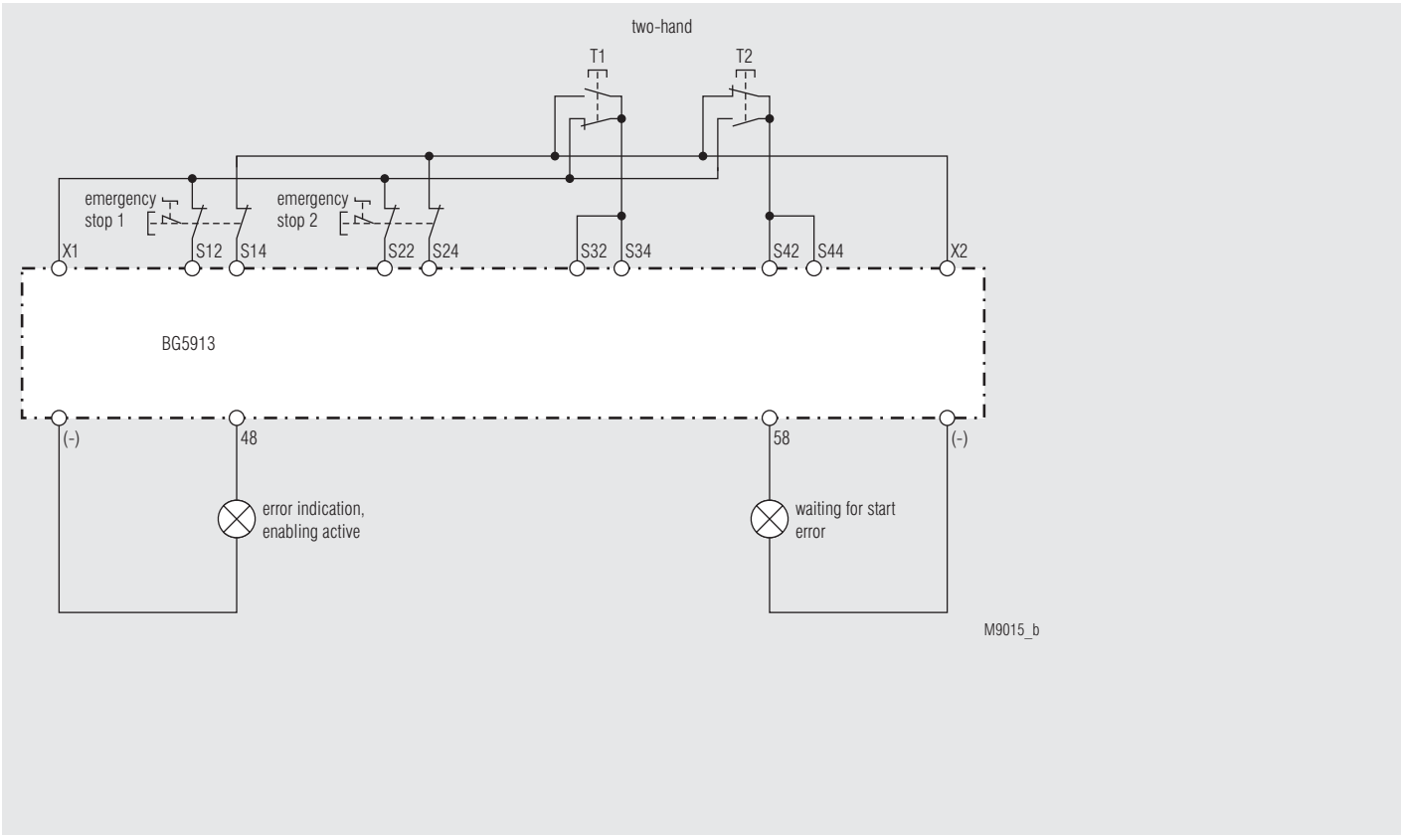
Application Examples



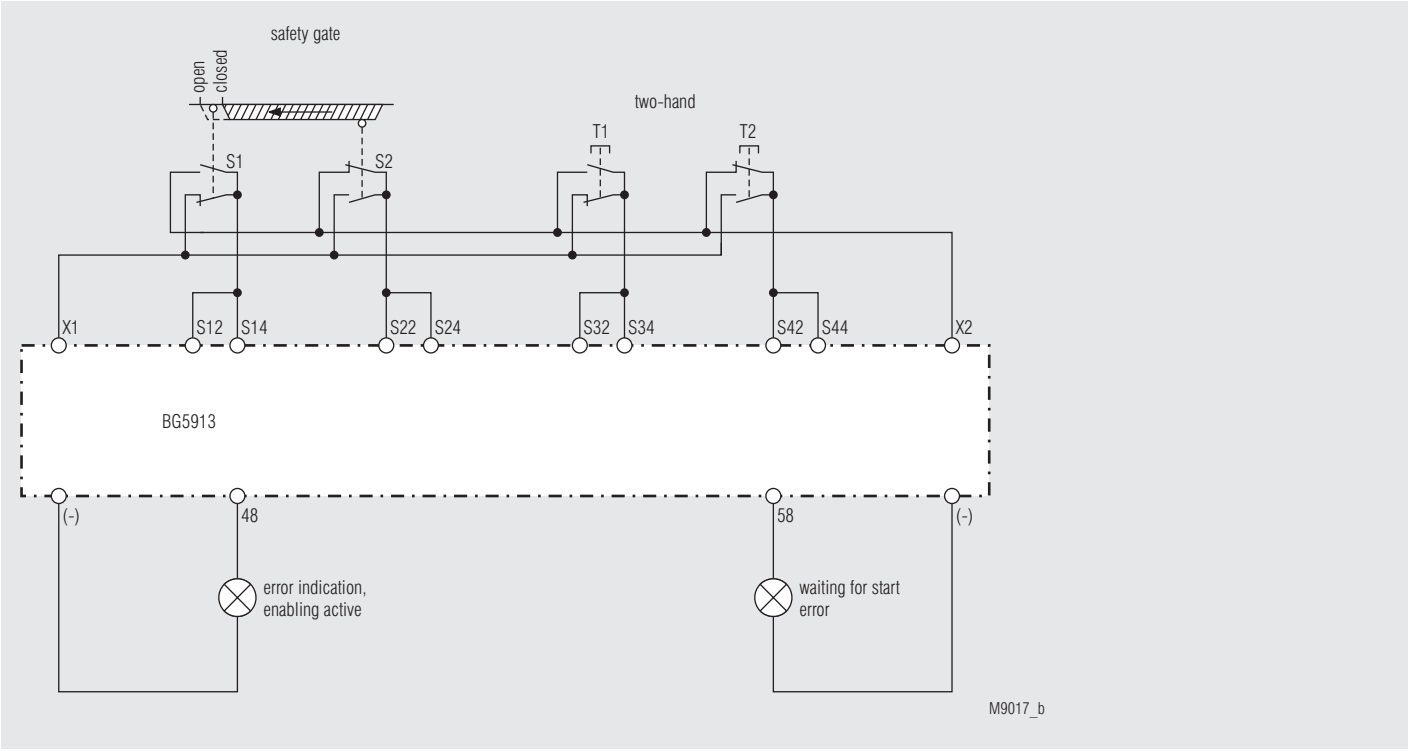
BG 5913.08/_2_ _ _, 1 safety gate, 1 Emergency stop, 1 light curtain; functions: 0 or 1



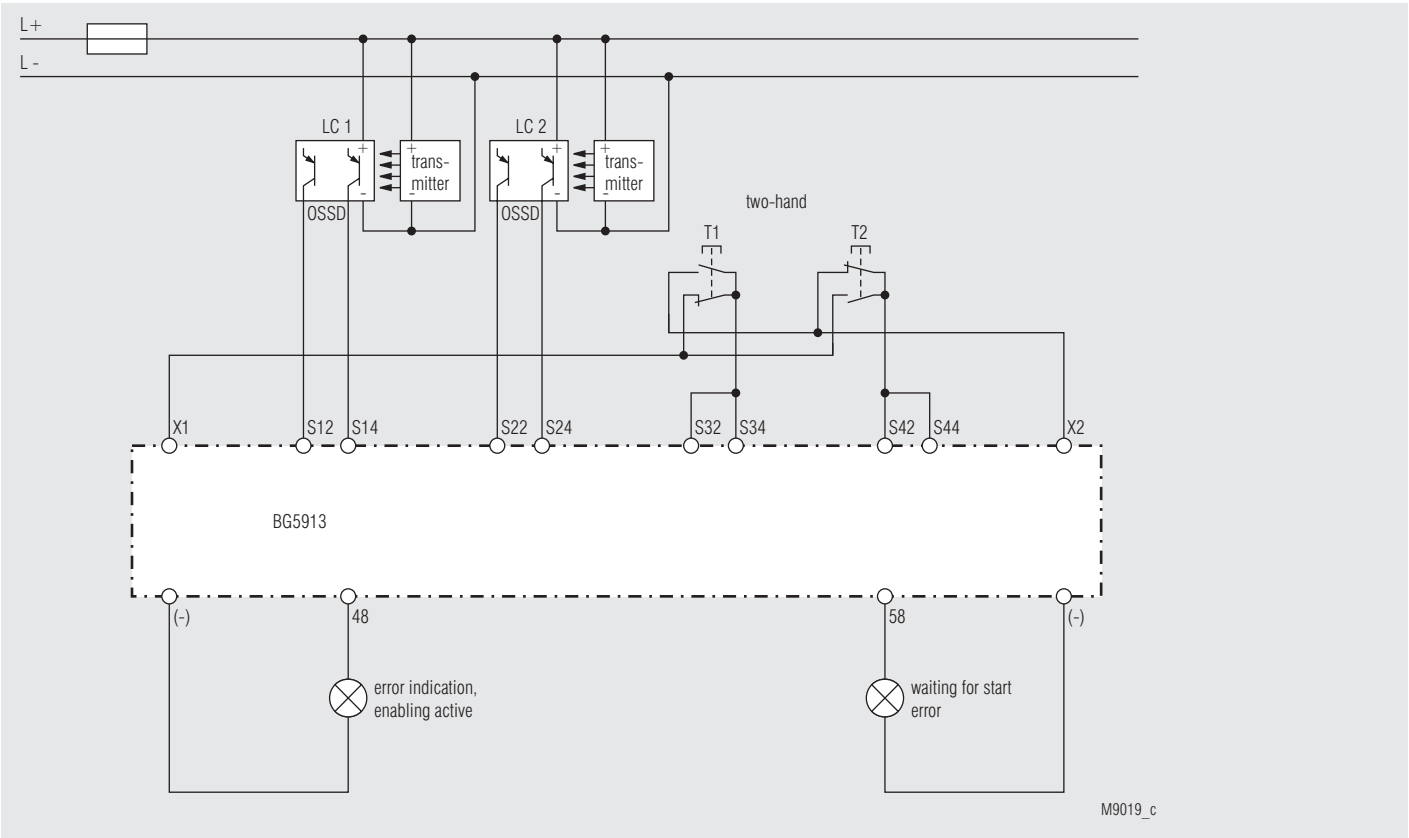
BG 5913.08/_2_ _ _, 4 Emergency stop; functions: 2, 3, 4 or 5



BG 5913.08/_2_ _ _, 2 Emergency stop; 1 two-hand control type IIIC functions: 6 or 7



BG 5913.08/_2_ _ _, 1 safety gate, 1 two-hand control type IIIC (EN 574); function: 8



BG 5913.08/_2_ _ _, 2 light curtains, 1 two-hand control type IIIC (EN 574); function: 9

Technical Data

Voltage Supply

Nominal voltage U_N: DC 24 V (coming from the basic module BH5911)
Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N
Nominal consumption: max. 60mA (no load on semiconductor outputs)
Short-circuit protection of the modules: internally with PTC

Input

Control voltage via X1, X2, 48.58: DC 23 V at U_N

Control voltage via S12, S14, S22, S24, S32, S34, S42, S44: 4.5 mA each at U_N

Minimum voltage on S12, S14, S22, S24, S32, S34, S42, S44: DC 16 V

Semiconductor Outputs

Output at terminal 48 and 58: Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0.5 s
Internal short circuit, overtemperature, and overload protection

Reaction Times (time till reaction of the assigned output):

Typ. NO time with U_N:

Input modules BG 5913	Manual start	Automatic start	
		First start	Restart
Emergency stop	max. 80 ms	max. 1 s	max. 115 ms
Light barriers	max. 80 ms	max. 1 s	max. 115 ms
Safety gates	or simulation: max. 80 ms		Gate closing: max. 115 ms
Two-hand control	max. 85 ms		

Break time (reaction time):

Input modules BG 5913	
Emergency stop	max. 33 ms
Light barriers	max. 33 ms
Safety gates	max. 33 ms
Two-hand control	max. 33 ms

General Data

Operating mode: Continuous operation
Temperature range: ± 0 ...+ 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1

EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behavior according to UL Subject 94
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6
Frequency 10…55 Hz,

Technical Data

Shock resistance
Acceleration: 10 g
Pulse duration: 16 ms
Number of shocks: 1000 per axis on three axes
Climate resistance: 0 / 050/ 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 2.5 mm² stranded wire with sleeve, or 1 x 4 mm² massive or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Wire fixing: Box terminal with wire protection, removable terminal strips.
Mounting: DIN rail IEC/EN 60 715
Weight: 193 g

Dimensions

Width x height x depth: 22.5 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	812,8	a
DC_{avg}:	96,0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	96,0	%
SFF	99,2	%
PFH_D:	2,34E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	2697,1	a
DC_{avg}:	96,0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	96,0	%
SFF	99,2	%
PFH_D:	2,34E-10	h^{-1}

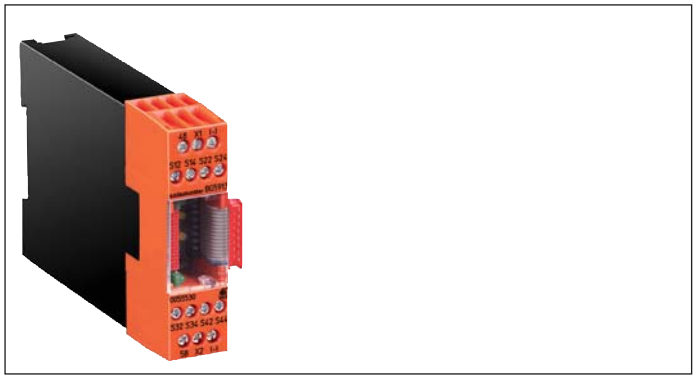
*) HFT = Hardware-Failure Tolerance

Info 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.

Standard Type

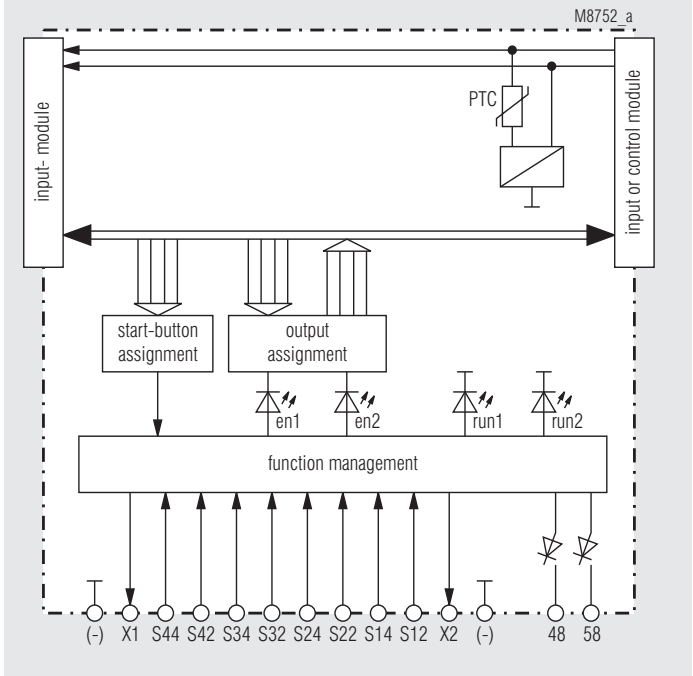
BG 5913.08/02MF0	DC 24 V
Article number:	0056805

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5913.08/_3_ _ _

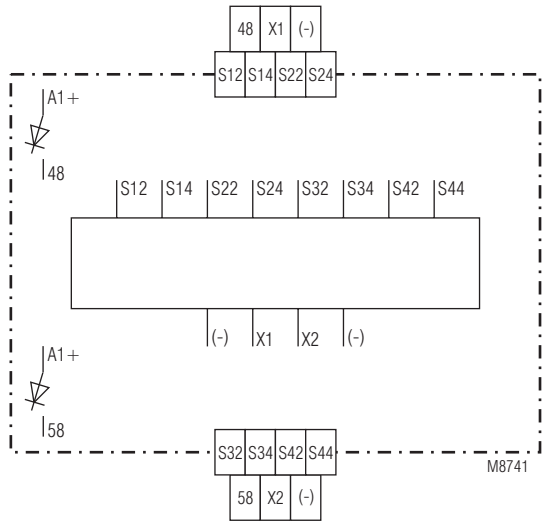


- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Input module mit einer per Stufenschalter einstellbarer Combination of the following 3 functions:
  - Light curtains (LC) type 4 with manual or automatic start
  - E-stop 2-channel and manual or automatic start
  - Two-hand function type IIIC according to DIN/EN 574
- The functions are selected via rotary switch
- 8 safety inputs
- 2 semiconductor outputs for status indication
- Broken wire and short circuit monitoring function with error indication
- LEDs for status indication
- Width: 22.5 mm

Block Diagram



Circuit Diagram



Approvals and Markings

CE · TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 · C US Canada / USA

Applications

Realization of fail-safe control circuits for protection of people and machinery.

Note: This module is intended for applications in which mixed safety functions affect one common output.

Further input modules with other combinations of functions are provided (e.g. BG 5913.08/_0_ _ _, BG 5913.08/_2_ _ _ , BG 5913.08/_3_ _ _, BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _, BG 5914.08/_1_ _ _, BG 5915/_1_ _ _ or BH 5915.08/_1_ _ _).

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

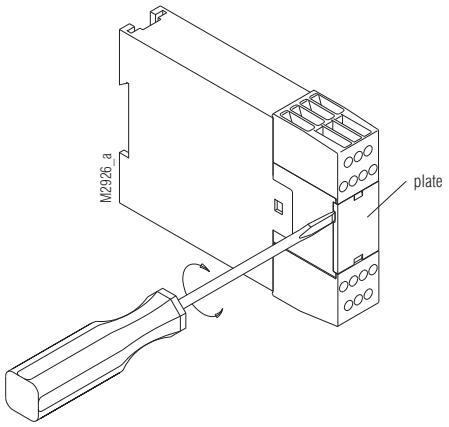
Indicators

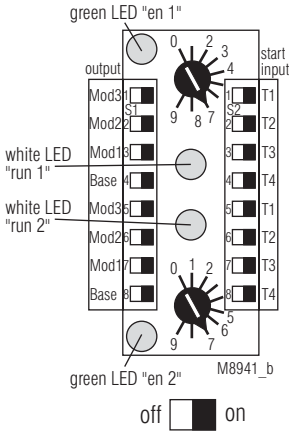
Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Setting of the Module

The module is assigned to the start inputs and the safety outputs via the DIP switches.

The combinations of individual functions are set via the rotary switches. To prevent accidently adjustments, these elements are covered by a front plate and are redundant.





Note:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Setting of the Modules

Sw.	Function at Terminals				Start behavior of the LC / E-Stop
	S12-S14	S22-S24	S32-S34	S22-S24	
0	E-stop	E-stop	E-stop	LC	Autostart
1	E-stop	E-stop	E-stop	LC	Manual Start
2	E-stop	E-stop	LC	LC	Autostart
3	E-stop	E-stop	LC	LC	Manual Start
4	E-stop	LC	LC	LC	Autostart
5	E-stop	LC	LC	LC	Manual Start
6	E-stop	E-stop	Two-hand IIIC		Manual Start
7	LC	LC	Two-hand IIIC		Manual Start
8	E-stop	LC	Two-hand IIIC		Manual Start
9	E-stop	LC	Two-hand IIIC		Autostart

Functional Principle of Combined Inputs

Each function activates an enabling signal in the module software. The control unit is permitted to enable the assigned safety outputs only after all 3 (for two-hands control) or 4 enablings have been given.

With the exception of two-hand control, each function works independently. The assigned safety outputs are enabled if the precondition for enabling has been met for all functions.

Function of the Two-Hand Control

This function will only work when the other two functions have already permitted enabling. To provide for enabling, the two buttons must be pressed within 0.5 s. As soon as one of the other function reacts, the two buttons must turn inactive before the others can be enabled again. Only after that, the buttons can be activated once more from an inactivated state.

The unit must be connected as specified in the application examples. When the operating contacts are connected in parallel or in series, safe functioning of the unit is cancelled.

The two-hand buttons must be designed and arranged in such a way as to ensure that they cannot be disabled with easily, or pressed unintentionally.

The safety distance between the push buttons and the place of danger must be large enough to make sure that after releasing a button, the place of danger can only be reached after the dangerous movement has stopped.

The safety distance “S” is calculated according to the following formula:

S = V x T + C, where

a) gripping velocity V = 1 600 mm/s
b) overtravel time T (s)
c) and safety factor C = 250 mm.

When any access into the danger area, with operating keys pressed, is safely prevented, e.g. by a protective cover for the keys, the safety factor C may be set to the value 0. Generally, the minimum safety distance must be 100 mm. In this respect, also see DIN/EN 574.

The two-hand control must be released when another function module which affects the same outputs does not permit enabling.
The system may comprise only one function module with two-hand control.

E-Stop or Light Curtain (LC) Function

In the Emergency stop or LC functions, both signals have to change from inactive state into active state within 250 ms. If the second signal reacts later, both changeover contacts must turn inactive before they can be enabled again.

With manual start, all safety inputs must be active before the start button can be pressed to trigger enabling. To start the system, do not keep the start button pressed for more than 3 seconds. A module may also be assigned several start buttons.

Note: Connect only self-testing light curtains of the type 4 acc. to EN 61496 to the module. Short-circuit monitoring of the inputs for the LC must be done in the LC.

Indication of System Errors:

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)

6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Indicators

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED run 1	Two-hand control not activated (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Error exists no more, waiting for Start input	one input function not available
LED run 2	all relays inactive due to system error	all relays inactive due to system error	No system error

Function Error Indication

Function errors are indicated by the white LED Run 1 and by output 48; the white LED Run 2 remains on. Output 58 is ON as long as the error is pending; it flashes regularly, while waiting for the assigned start signal.

Error codes*

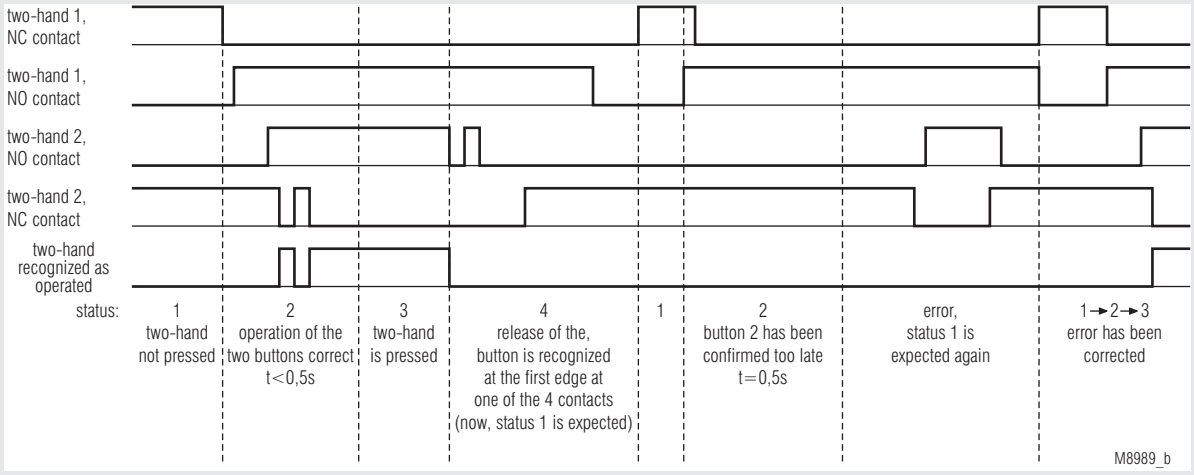
1) Normal interruption of function (e.g. Emergency stop)
2) Time error: (e.g. the second two-hand button is not pressed)
3) With gate monitoring: simulation input error (kept pressed for too long)
4) Error at start input
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error detected in the control unit)

* number of short flashing impulses, followed by a longer space

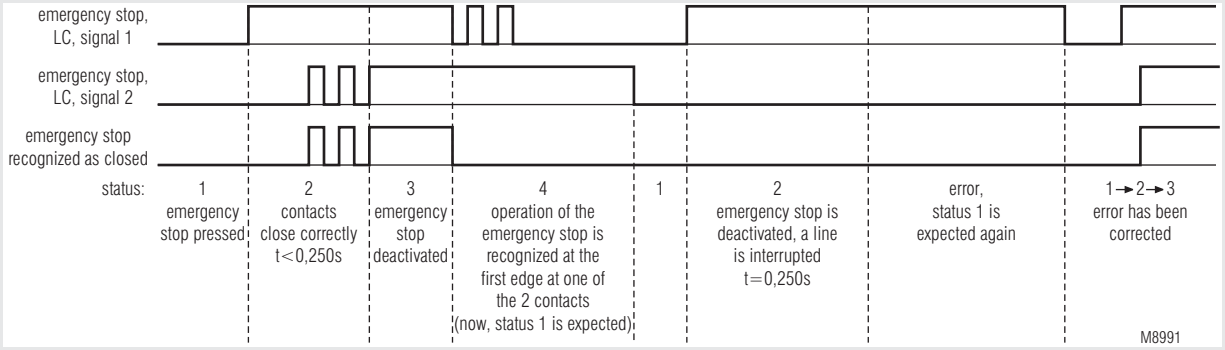
Special with two-hand control:
When both two-hand buttons of the module are inactive while all other functions are active and enabled either by autostart or via the start button, output 48 and the white LED Run 1 are permanently OFF, and output 58 permanently ON.

Function Diagrams

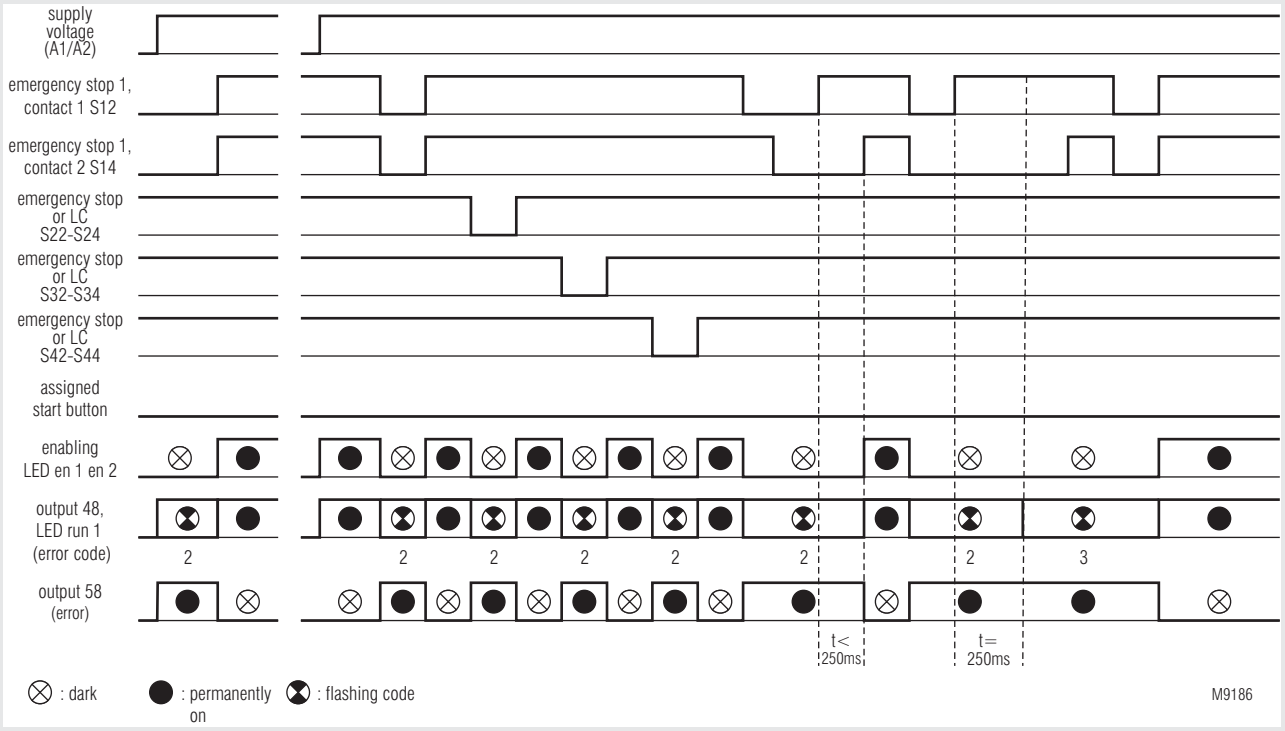
Note: The times specified in a pulse diagram also apply to the same function in other applications.



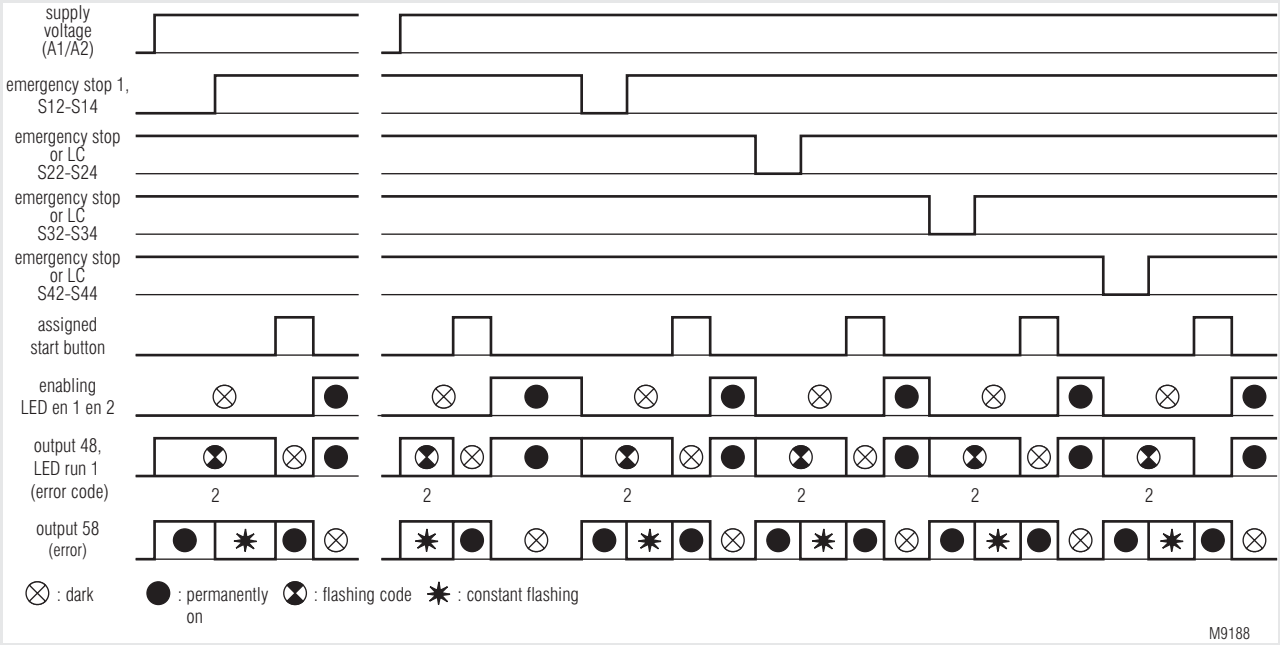
Two-hand control



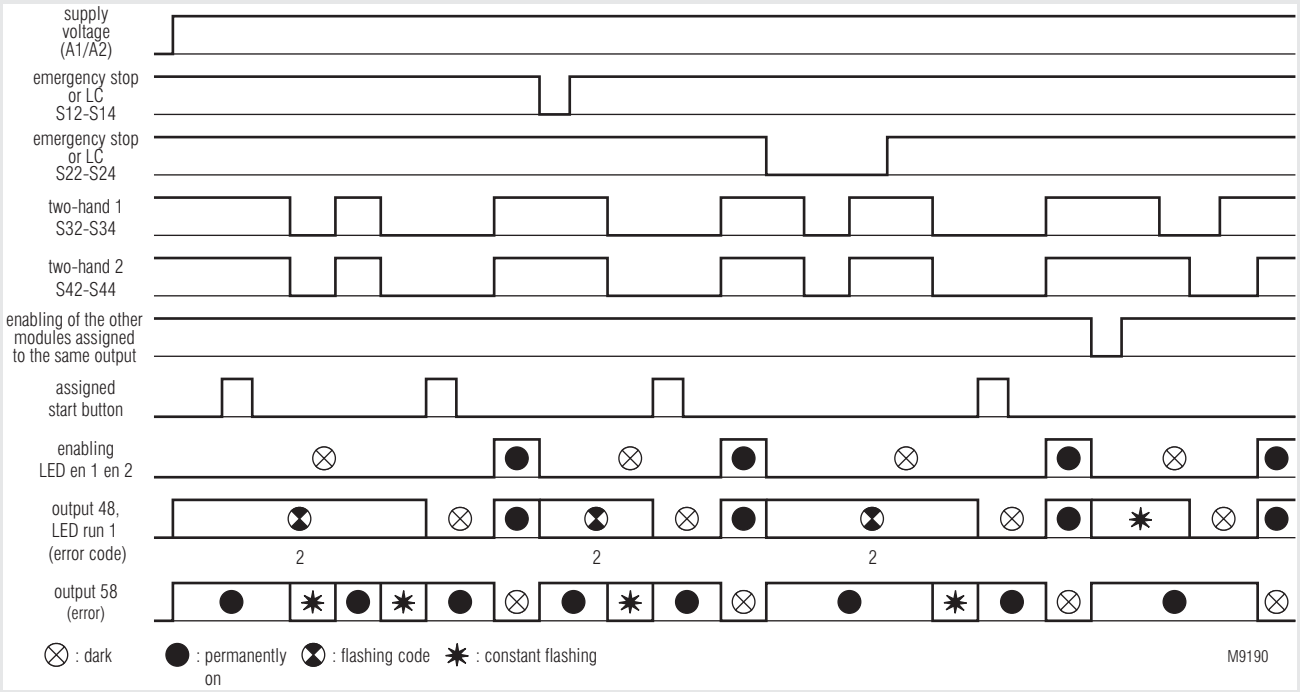
Emergency stop or light curtains



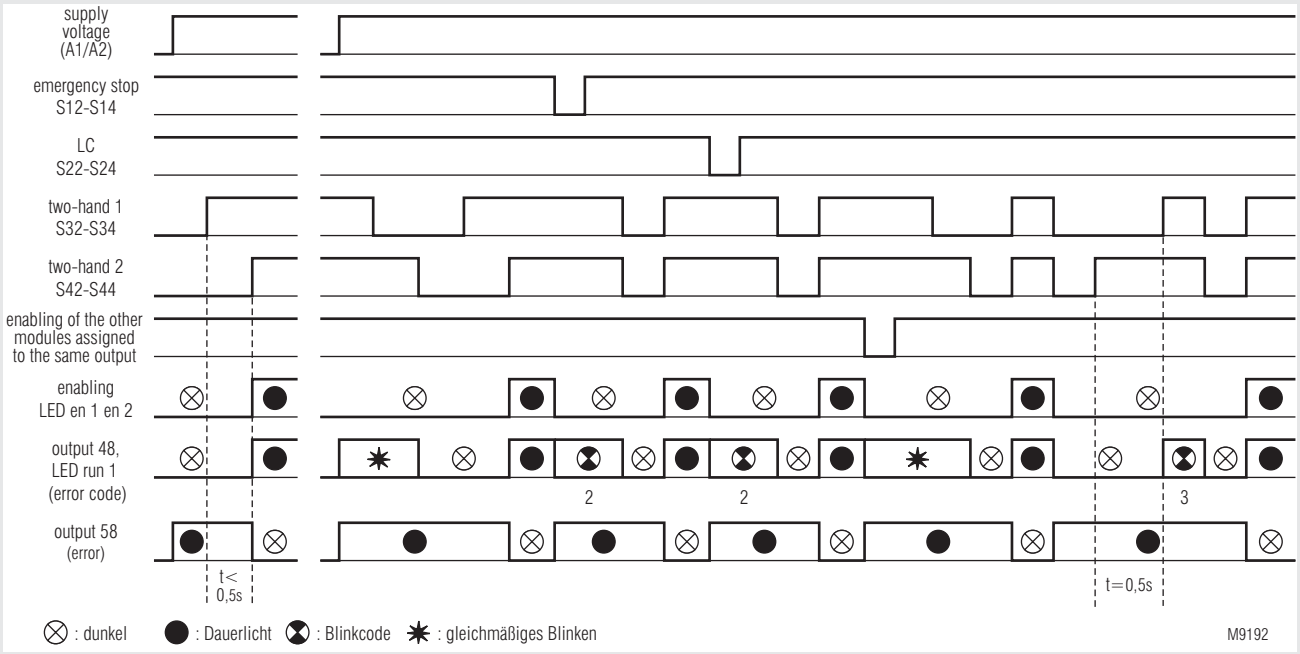
Emergency stop and light curtain, Autostart; functions 0, 2 or 4



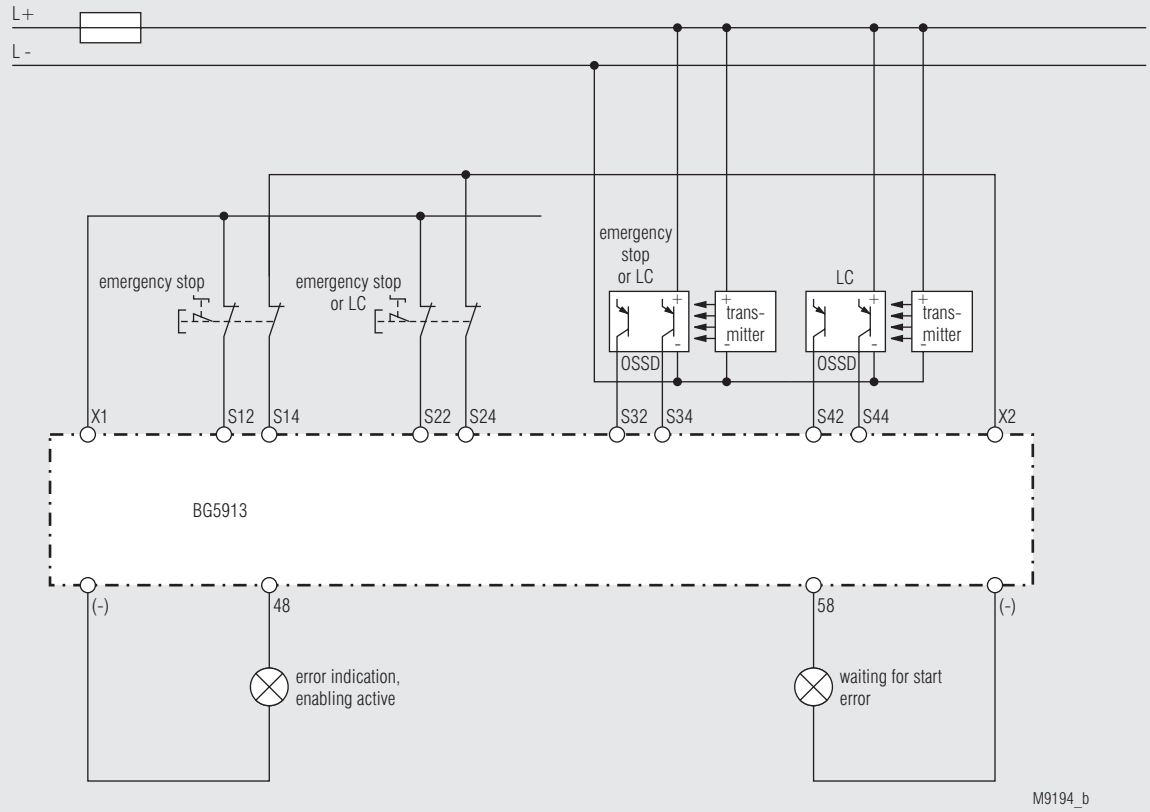
Emergency stop and manual start; functions 1, 3 or 5



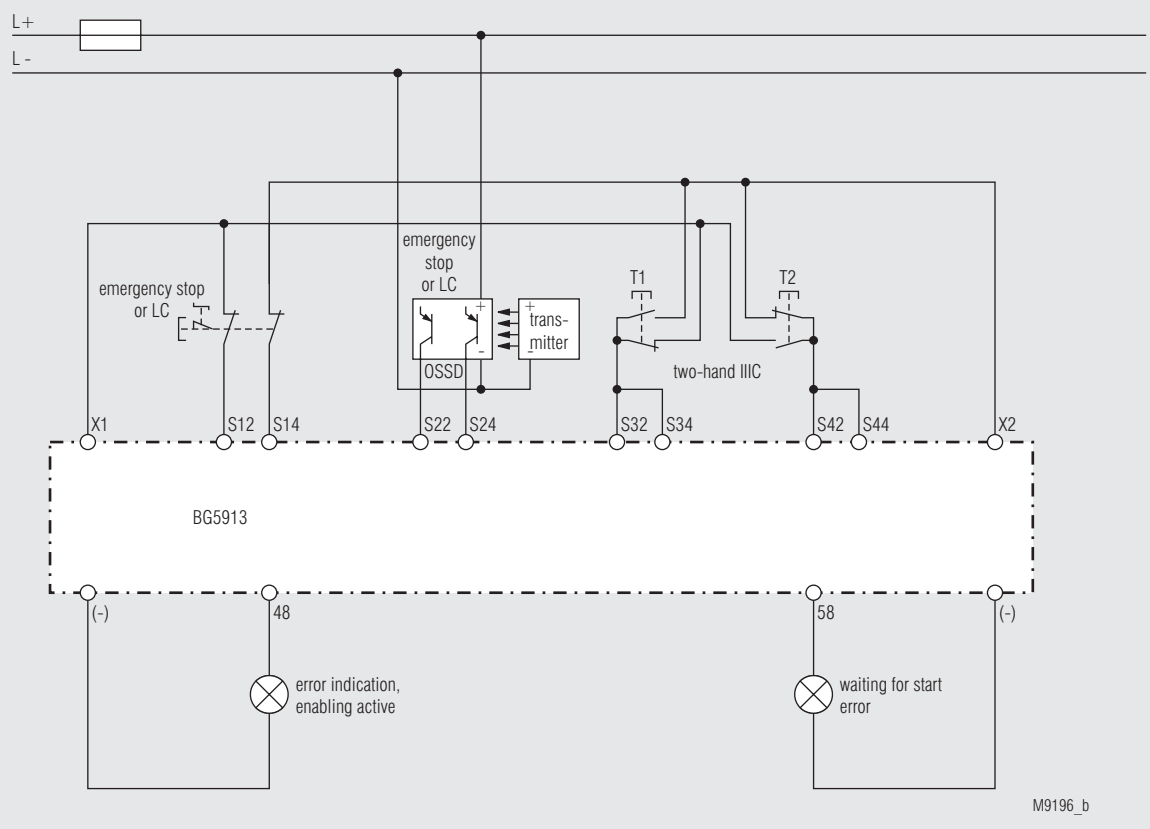
Emergency stop and / or light curtains, manual start, 1 two-hand control type IIIC; functions: 6, 7or 8



1 Emergency stop and 1 light curtain, Autostart, 1 two-hand control type IIIC; function: 9



Emergency stop or light curtains; functions: 0, 1, 2, 3, 4 or 5



Emergency stop or light curtains, two-hand control type IIIC; functions 6, 7, 8 or 9

Technical Data

Voltage Supply

Nominal voltage U_N: DC 24 V (coming from the basic module BH5911)

Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N

Nominal consumption: max. 60mA
(no load on semiconductor outputs)

Short-circuit protection
of the modules: internally with PTC

Input

Control voltage
via X1, X2, 48.58: DC 23 V at U_N

Control voltage
via S12, S14, S22, S24,
S32, S34, S42, S44: 4.5 mA each at U_N

Minimum voltage
on S12, S14, S22, S24,
S32, S34, S42, S44: DC 16 V

Semiconductor Outputs

Output at terminal 48 and 58: Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0.5 s
Internal short circuit, overtemperature, and overload protection

Reaction Times (time till reaction of the assigned output):

Typ. NO time with U_N:

Input modules BG 5913	Manual start	Automatic start	
		First start	Restart
Emergency stop	max. 80 ms	max. 1 s	max. 115 ms
Light barriers	max. 80 ms	max. 1 s	max. 115 ms
Two-hand control	max. 85 ms		

Break time (reaction time): max. 33 ms

General Data

Operating mode: Continuous operation
Temperature range: ± 0 ...+ 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.

Clearance and creepage distances
rated impulse voltage /
pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529

Housing: Thermoplastic with V0 behavior according to UL Subject 94

Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-2-6
Frequency 10…55 Hz,

Technical Data

Shock resistance
Acceleration: 10 g
Pulse duration: 16 ms
Number of shocks: 1000 per axis on three axes
Climate resistance: 0 / 050/ 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 2.5 mm² stranded wire with sleeve, or
1 x 4 mm² massive or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing: Box terminal with wire protection, removable terminal strips.
Mounting: DIN rail IEC/EN 60 715
Weight: 165 g

Dimensions

Width x height x depth: 22.5 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	812.8	a
DC_{avg}:	96.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:

Categorie:	4	
PL:	e	
$MTTF_d$:	2697.1	a
DC_{avg}:	96.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-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.

Standard Type

BG 5913.08/03MF0	DC 24 V
Article number:	0058703

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _

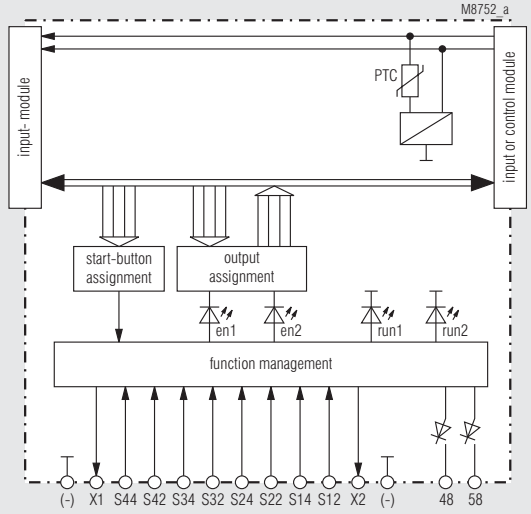
0247389

BG 5914

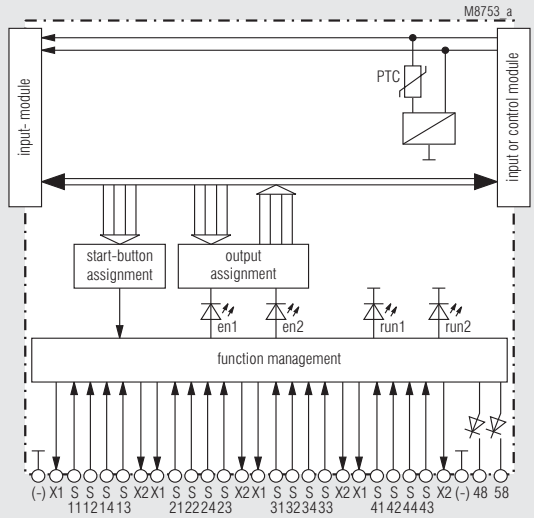
BH 5914

- **According to**
  - **Performance Level (PL) d and category 2 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 2 to IEC/EN 62061**
  - **Safety Integrity Level (SIL 2) to IEC/EN 61508**
- Input module for realization of:
  - 8 E-STOP, single-channel, autostart
  - 6 E-STOP, single-channel, + 1 E-STOP, 2-channel, autostart
  - 5 E-STOP, single-channel, + 1 -STOP, 2-channel + 1 signal inut, autostart
  - 8 E-STOP, single-channel, manual start
  - 6 E-STOP, single-channel, + 1 E-STOP, 2-channel, manual start
  - 5 E-STOP, single-channel, + 1 E-STOP, 2-channel + 1 signal input, manual start
  - As an alternative to the 2-channel E-STOP, a light curtain (LC type 4) according to EN 61496-1 can be connected.
- Broken wire and short circuit monitoring function with error indication
- 2 semiconductor outputs per function module for status indication
- LEDs for status indication
- Width: 22.5 mm (BG 5914) or 45 mm (BH 5914)

Block Diagrams



BG 5914



BH 5914

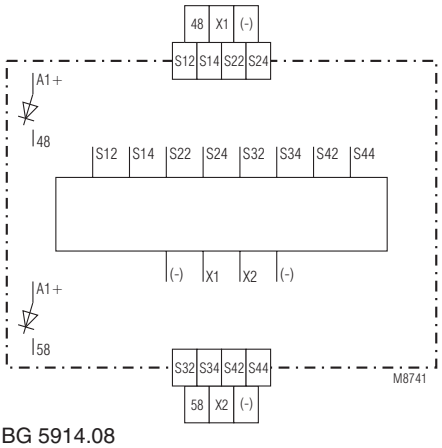
Approvals and Markings

CE | TÜVRheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 0600000000 | C US Canada / USA

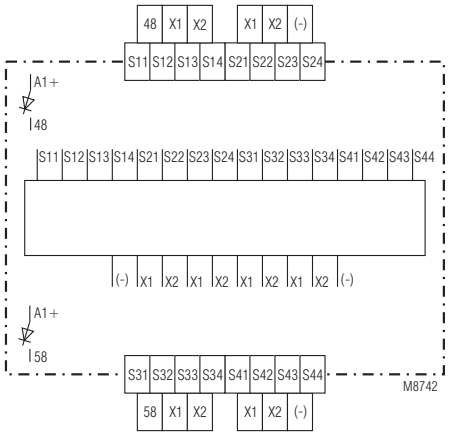
Applications

Realization of fail-safe control circuits for protection of people and machinery The modules BG 5914 and BH 5914 have been developed for applications in which numerous one-channel Emergency stop contacts have to be monitored.

Circuit Diagrams



BG 5914.08



BH 5914.08

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

Notes

In respect of function and settings, the modules BG 5914 and BH 5914 are completely identical.

- The modules BG 5914 have 8 inputs with one common ground. This is the ground of the overall system. They are suitable for all applications in which volt free contacts are used, or where there is a common ground (e.g. 2-channel light curtains). They need only 8 terminals and thus only have an overall width of 22.5 mm.

- The modules BH 5914 have 8 completely DC-decoupled inputs. In the settings for a 2-channel Emergency stop, several systems can be operated from the same E-stop button.

- The modules BH 5914 **must** be used as soon as one Emergency stop contact is executed on several modules. Here, short-circuit monitoring is effected by a certain type of wiring according to the application examples.

Indication

Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run 1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Signal Input

This input does not have a safety function. It is used only to signal the status of a switch (NO contact) and does not affect the safety outputs assigned to the module (e.g. when the machine is set to service mode).

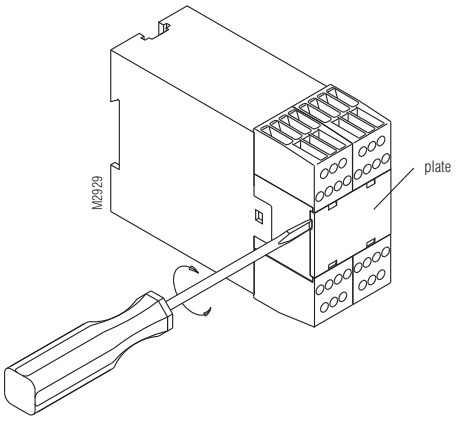
- If voltage is applied to the input, the white LED Run 2 is ON. The semiconductor output 58 is OFF as long as no Emergency stop is active.
- If no voltage is applied to the input, the white LED Run 2 will go out, and the semiconductor output 58 will become conductive.

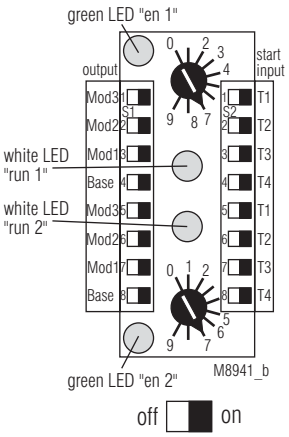
Setting of the Module

In respect of function and settings, the modules BG 5914 and BH 5914 are completely identical.

The modules are assigned to the start buttons and the safety outputs via the DIP switches.

The function is set via the rotary switches. To prevent accidently adjustments, these elements are covered by a front plate and are redundant.





Note:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Sw.	Function
0	8 Emergeny stop single-channel, autostart
1	6 emergency stop, single-channel, + 1 emergency stop, 2-channel with short circuit detection, autostart
2	6 emergency stop, single-channel, + 1 emergency stop, 2-channel without short circuit detection or 1 LC type 4, autostart
3	5 emergency stop, single-channel, + 1 emergency stop, 2-channel without short circuit detection or 1 LC type 4 + 1 signal input, autostart
4	8 Emergeny stop single-channel, manual start
5	6 emergency stop, single-channel, + 1 emergency stop, 2-channel with short circuit detection, autostart
6	6 emergency stop, single-channel, + 1 emergency stop, 2-channel without short circuit detection or 1 LC type 4, manual start
7	5 emergency stop, single-channel, + 1 emergency stop, 2-channel without short circuit detection or 1 LC type 4 + 1 signal input, manual start
8, 9	8, 9 not assigned (error 5)

Setting of the Module

Note:
This module is intended for applications in which numerous one-channel Emergency off contacts are to be monitored.

The settings 2, 3, 6, and 7 are required for example when several modules are connected to a common Emergency stop sensor. Short-circuit recognition can be realized externally by means of proper wiring.

With a LC type 4 (according to IEC/EN 61496-1), short-circuit monitoring takes place in the light curtain itself.

Single-Channel Emergency-Stop

With single-channel safety inputs, safety function can only be realized when voltfree contacts are used (see wiring examples).

With static, voltage signals, it is imperative to use 2-channel signal sensors.

Automatic Start

Automatic start is performed only when supply voltage is switched on, or when enabling has been cancelled by pressing Emergency stop.

All other errors nevertheless require confirmation by a start key.

Manual Start

To start the system, do not keep the start key pressed for more than 3 seconds. A module may also be assigned several start keys.

Indication of System Errors:

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)

6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Indicators

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED Run 1	all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Wait for start	one input function not available or K1 and K2 active and indicator contact inactive
LED Run 2	all relays inactive due to system error or K1 and K2 active and indicator contact inactive	all relays inactive due to system error	No system error

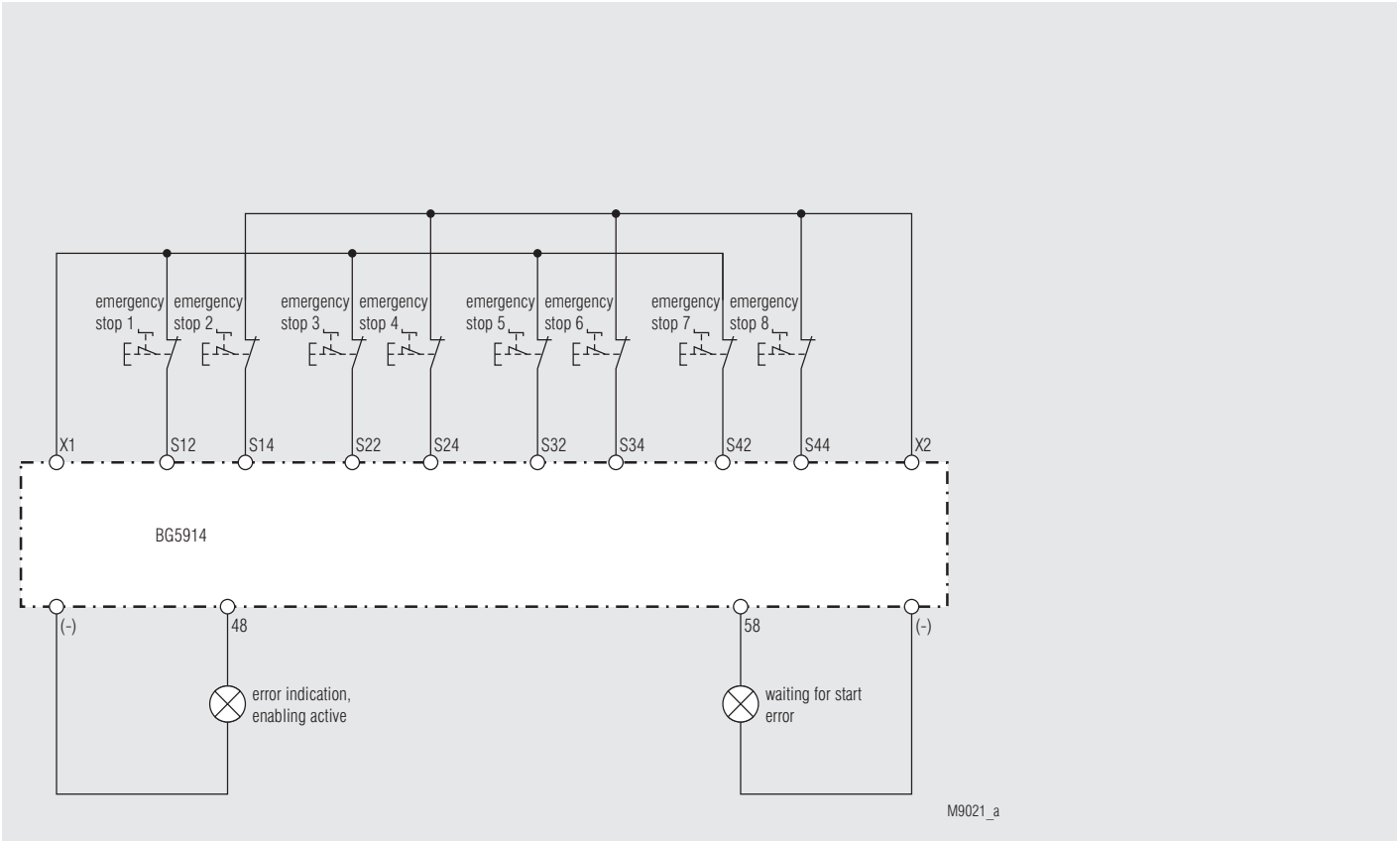
Function Error Indication

Function errors are indicated by the white LED Run 1 and by output 48; the white LED Run 2 remains on. Output 58 remains on as long as the error is pending; it flashes regularly as soon as enabling via the assigned start button is possible again:

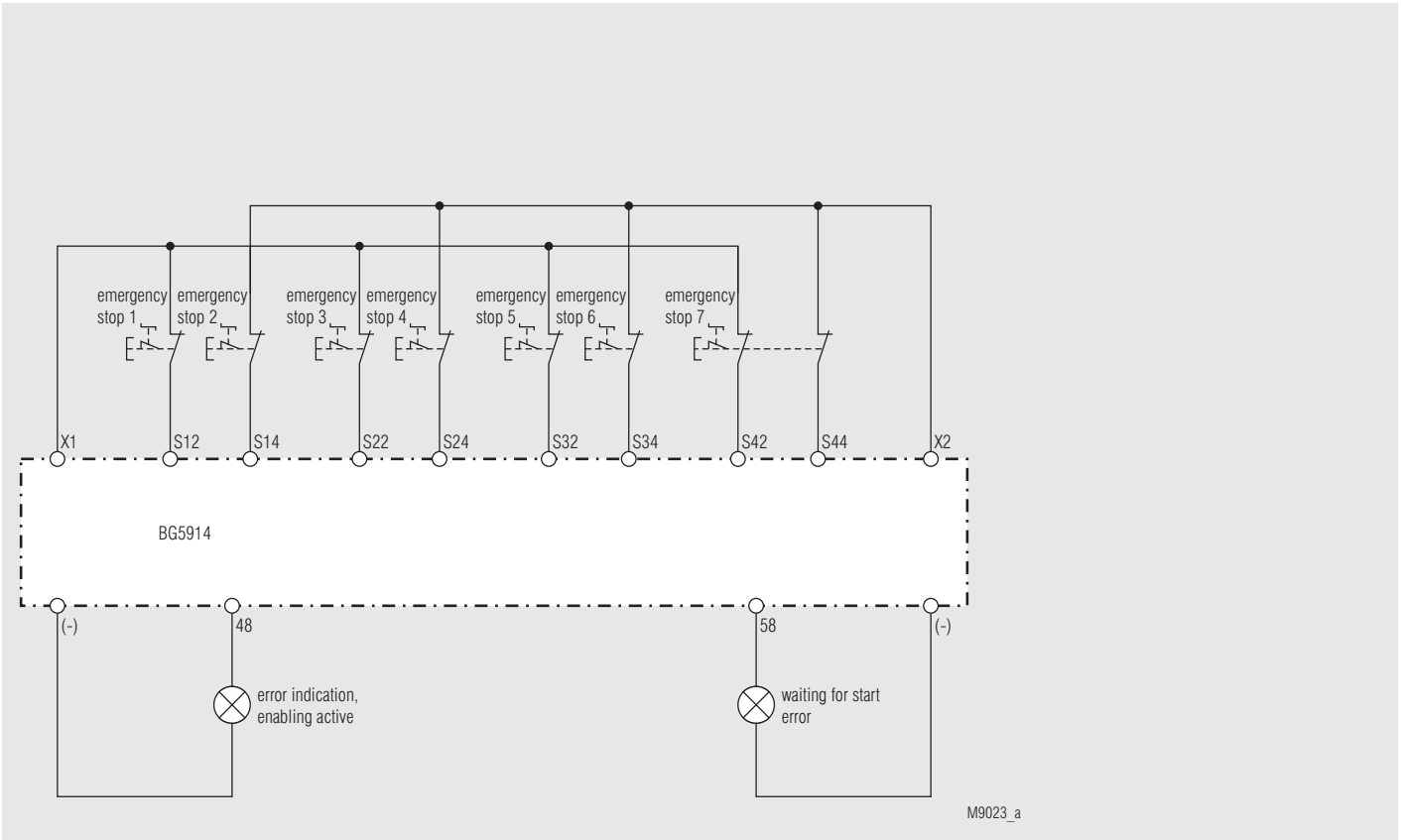
Error codes*

1) Emergency stop
2) Time error: Start button has been kept pressed for more than 3 seconds
3) Time error: The 2 signals of the 2-channel Emergency stop fail to correspond for too long (250 ms)
4) Error on start button (kept permanently pressed)
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error recognized in the control unit)

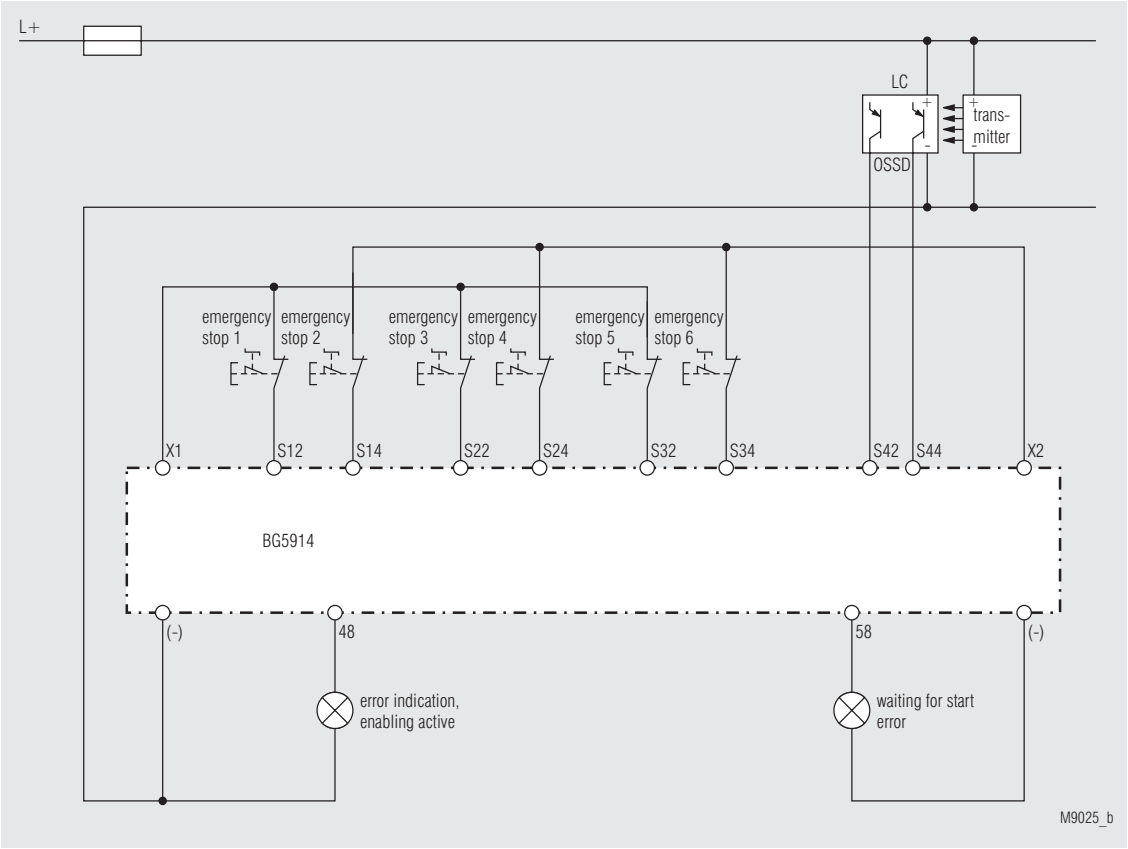
* number of short flashing impulses, followed by a longer space



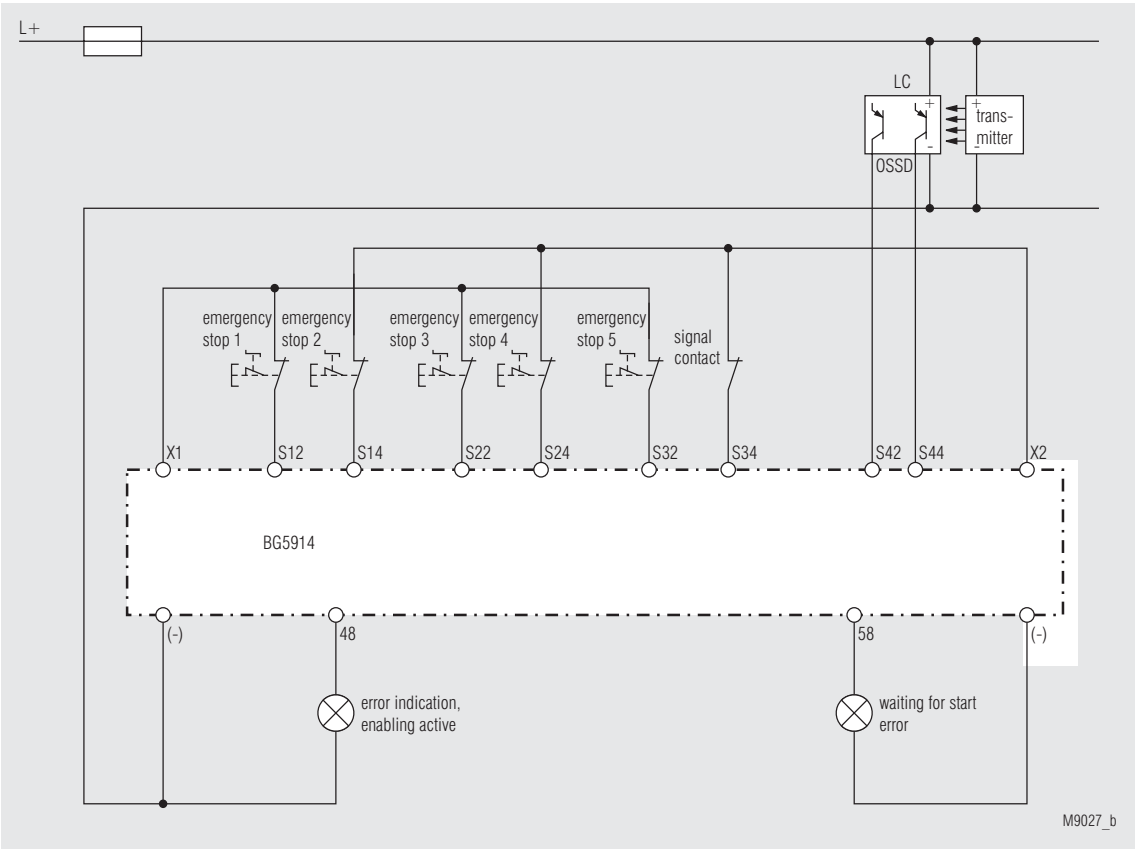
BG 5914, 8 Emergency stop, single-channel, voltfree contacts; functions: 0 or 4



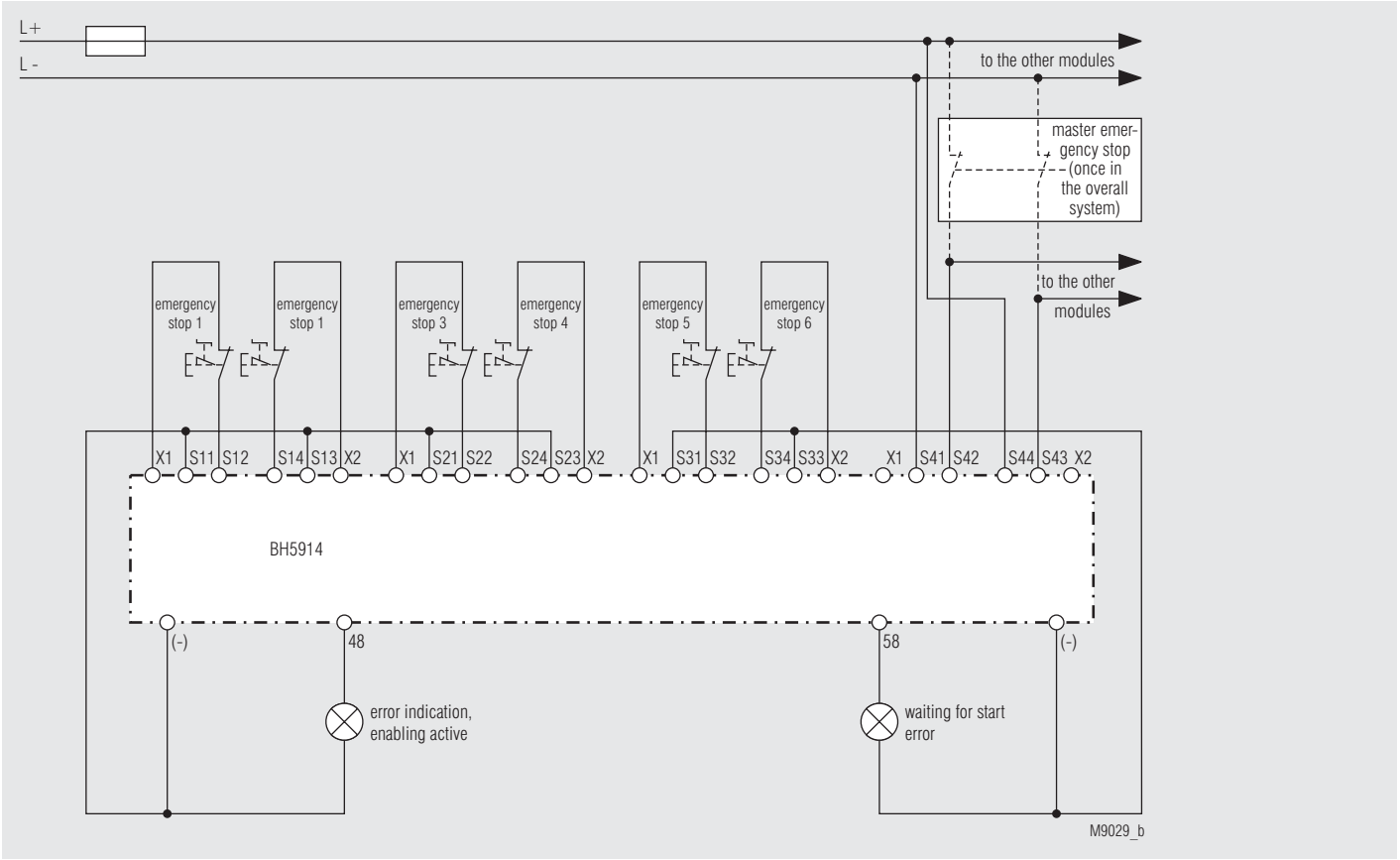
BG 5914, 6 Emergency stop single-channel, + 1 Emergency stop, 2-channel with short-circuit detection; functions: 1 or 5



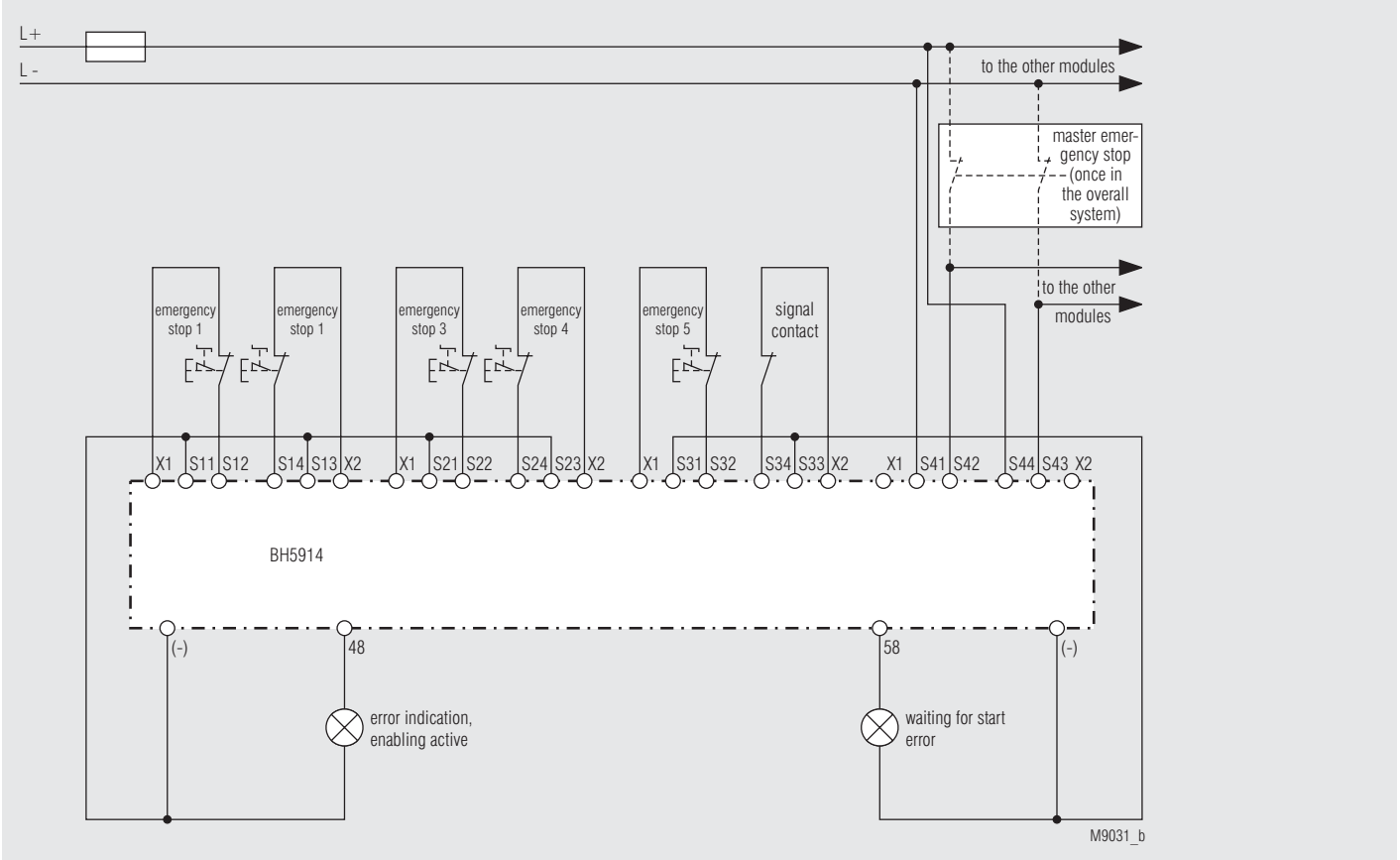
BG 5914, 6 Emergency stop single-channel + 1 light curtain type 4; functions 2 or 6



BG 5914, 5 Emergency stop single-channel + 1 light curtain type 4 + 1 signal contact;
functions 3 or 7



BH 5914, 6 Emergency stop single-channel + 1 Master Emergency stop 2-channel with short-circuit detection by means of wiring; functions: 2 or 6



BH 5914, 5 Emergency stop single-channel + 1 Master Emergency stop 2-channel with short-circuit detection by means of wiring + 1 signal contact; functions 3 or 7

Technical Data

Voltage Supply

Nominal voltage U_N: DC 24 V
(comes from basic module BH 5911)
Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N
Nominal consumption: max. 60 mA
(no load on semiconductor outputs)
Short-circuit protection of the modules: internally with PTC

Inputs

Control voltage over
X1, X2, X42, 48, 58: DC 23 V at U_N
Control current over
S11, S12, S13, S14, S21, S22, S23, S24, S31, S32, S33, S34, S41, S42, S43
S44: 4.5 mA each at U_N
Minimum voltage at S12, S14, S22, S24, S32, S34 S42, S44 DC 16 V

Outputs

Output on terminal 48 and 58: Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0.5 s
Internal overtemperature and overload protection

Reaction Times (time till reaction of the assigned output):

Typ. operating time with U_N:

Input modules BG 5914 and BH 5914	Manual start	Automatic start	
		First start	Restart
Emergency stop	max. 75 ms	max. 1 s	max. 75 ms

Break time (reaction time):

Input modules BG 5914 and BH 5914	
Emergency stop	max. 33 ms

General Data

Operating mode: Continuous operation
Temperature range: ± 0 ... + 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplast with V0 behavior according to UL Subject 94
Vibration resistance: Amplitude 0.35 mm
Shock resistance
Acceleration: 10 g
Pulse duration: 16 ms
Number of shocks: 1000 per axis on three axes

Technical Data

Climate resistance: 0 / 050/ 04 IEC/EN 60 068-1

Terminal designation: EN 50 005
Wire connection: 1 x 2.5 mm² stranded wire with sleeve, or
1 x 4 mm² massive or
2 x 1.5 mm² litz with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing: Box terminal with wire protection, removable terminal strips
Mounting: DIN rail IEC/EN 60715

Dimensions

Width x height x depth:
BG 5914: 22.5 x 84 x 121 mm
BH 5914: 45 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:

Category:	2	
PL:	d	
$MTTF_d$:	1207,5	a (year)
DC_{avg}:	92,7	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	2	IEC EN 62061
SIL	2	IEC EN 61508
HFT*):	0	
DC_{avg}:	92,7	%
SFF	99,0	%
PFH_D:	3,53E-09	h^{-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.

Standard Types

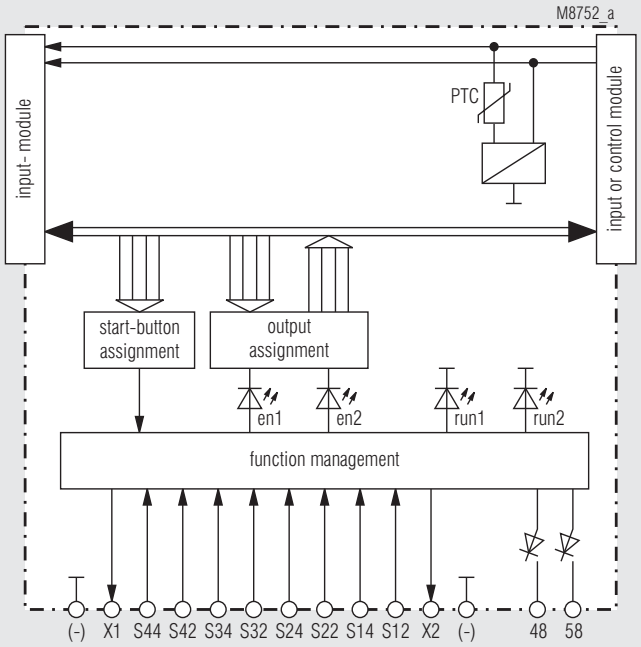
BG 5914.08/00MF0:	8 floating inputs
Article Number:	0056633
• Width:	22.5 mm
BH 5914.08/00MF0:	8 floating or non-floating inputs
Article Number:	0056460
• Width:	45 mm

Multi-Function Safety System SAFEMASTER M
Input Module
BG 5915.08/_1_ _ _, BH5915.08/_1_ _ _

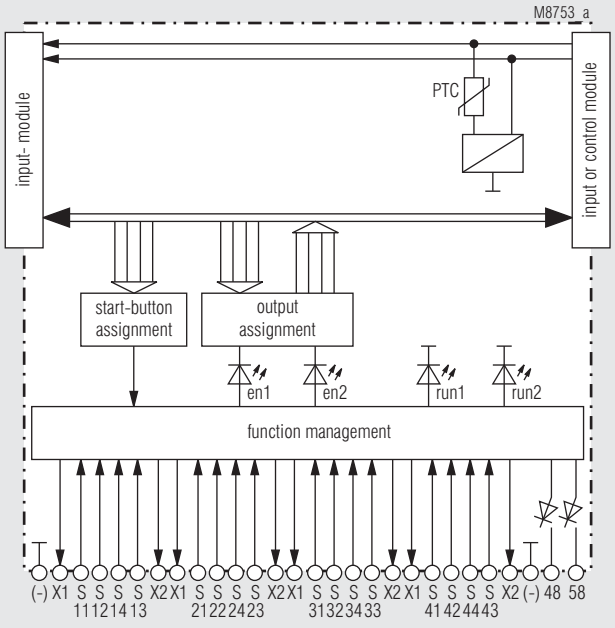
0260347

- **According to**
  - **Performance Level (PL) d 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**
- Input module with enabling inputs
- for connection of 2 channel
  - safety gates
  - e-stop buttons
  - light curtain (LC) Type 4
  - change over switch
  - enabling swtich
- Function combination and behaviour of enabling inputs selectable on rotary switches
- Broken wire and short circuit monitoring function with error indication
- 2 semiconductor outputs for status indication
- LEDs for status indication
- Width: 22.5 mm (BG 5915) or 45 mm (BH 5915)

Block Diagrams



BG 5915



BH 5915

Approvals and Markings

CE

TÜVRheinland CERTIFIED — Functional Safety Type Approved — www.tuv.com ID 0000000000

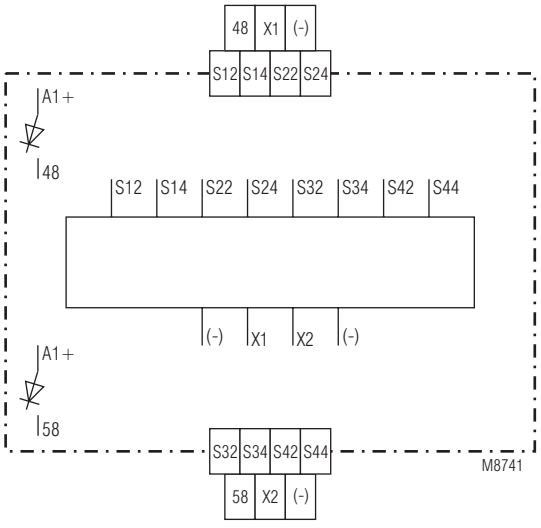
Applications

Realization of fail-safe control circuits for protection of people and machinery.

Note: This module is intended for applications in which mixed safety functions affect one common output.

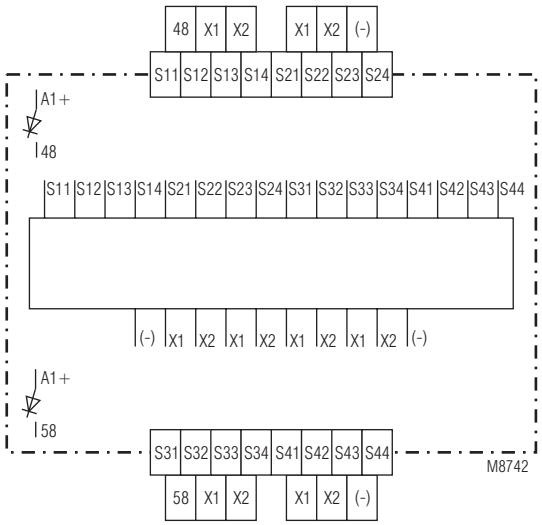
Further input modules with other combinations of functions are provided (e.g. BG 5913.08/_0_ _ _, BH 5913.08/_0_ _ _, BG 5913.08/_1_ _ _, BG 5913.08/_2_ _ _, BG 5913.08/_3_ _ _, BG 5914.08/_0_ _ _, BH 5914.08/_0_ _ _ oder BG 5914.08/_1_ _ _).

Circuit Diagram



BG 5915

Circuit Diagram



BH 5915

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BG/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

Function

The input module operates several functions (e.g. 3 e-stop or 2-e-stop+1 enabling input) independant of each other. The module activates if for a selected function all enabling conditions are fulfilled.
within a group functions can be selected that behave differently (see description of function)

Notes

The modules BG 5915 and BH 5915 differ as follows:

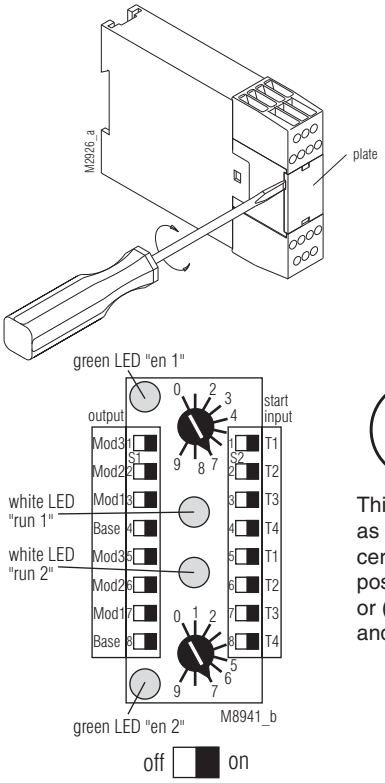
- The modules BG 5915 have 8 inputs with one common ground (A2) and a width of only 22.5 mm.
- For applications that require fully galvanic separated inputs the BH 5915 with 45 mm width is designed.

Indication

Green LEDs:	on, when all inputs are present and start button activated.
White LEDs Run 1/ Run 2 and outputs 48 and 58:	indicate the current status of the module.

Setting of the Module

The control unit is assigned to the start inputs T1…T4 and the safety outputs via the DIP switches. The input function is set by means of the rotary switches. To prevent accidently adjustments the setting switches are covered by a front plate and are redundant.



base = Output of control Unit
mod = Output of output module

This module is enabled as soon as all conditions are fulfilled at a certain function. E.g. at setting position 2 enabled when (gate 1) or (gate 2 and gate 3) or (gate 2 and gate 4) are closed.

Notes:

- Settings to the unit must be performed by skilled personnel while the unit is off-load.
- Before the front cover is removed, potential equalization must be provided.

Maximum 3 input modules can be connected in series to the left connecteor of a control unit. the termination plug moves always from the control unit to the last module in the chain.

Function setting

Poti	S12 | S14	S22 | S24	S32 | S34	S42 | S44
0	E-stop 1 or LC 1 (Manual-Start)	E-stop 2 oder LC (Manual-Start)	change over switch closed	
	E-stop 1 or LC 1 (Manual-Start)	E-stop 2 or LC (Manual-Start)		E-stop 3 or LC 3 (Automatic-start)
1	E-stop 1 or LC 1 (Automatic-Start)	E-stop 2 or LC (Automatic-Start)	change over switch closed	
	E-stop 1 or LC 1 (Automatic-Start)	E-stop 2 or LC (Automatic-Start)		E-stop 3 or LC 3 (Automatic-Start)
2	Gate 1 (250 ms)			
		Gate 2 (250 ms)	Gate 3 (250 ms)	
		Gate 2 (250 ms)		Gate 4 (250 ms)
3	Double contact 1 (3s) Manual-Start	Double contact 2 (3s) Manual-Start	LC (250 ms) Manual-Start	
				Enabling switch (250 ms) (Automatic-Start)
4	Setting not allowed (faliure 5)			
5	Setting not allowed (faliure 5)			
6	Setting not allowed (faliure 5)			
7	Setting not allowed (faliure 5)			
8	Setting not allowed (faliure 5)			
9	Setting not allowed (faliure 5)			

Notes:

With a LC type 4 (according to IEC/EN 61496-1), short-circuit monitoring takes place in the light curtain itself.

* **LC** **L**ight **c**urtain

Description of the different functions

Note: In this section all possible functions are descibed, that are available on the module. Which function is active depends on the setting of the selector switches of the module.

Function Safety Gate

To detect a closed the following sequence has to be used:
1. All door contacts have to be open
2. All door contacts have to be activated in the required time span. If one contact comes to late all contacts have to be opened before they can be closed again.
3. The module is enabled as soon as all single functions in a group allow enabling.
4. The module is disabled as soon as one contact in the group is opened.

If no time is specified in the Table „Function setting“ the the default time to close the contacts is 3 s.

The required reclosing of already closed doors can be simulted by a start button that is assigned to the input module.

Function E-Stop

An E-stop is operated as follows:
1. All contacts of the e-stop button must change from all open to all closed within the required time span or have to be closed already on power up of the module to enable the unit. If one contact is delayed all contacts have to be opened before a restart can be done.
2. If autostart is selected the unit is enabled as soon as all contacts are closed. If manual start is selcted the assigned start button has to be pressed in addition.
3. The module is enabled as soon as all single functions in a group fulfill the enabling conditions.
4. The module is disabled as soon as one contact in the group is opened.

If no time is specified in the Table „Function setting“ the the default time to close the contacts is 250 ms.

Function Light Curtain (LC)

The function is equal to the estop function, only the wiring is different as the e-stop has contacts and the light curtain semiconductor outputs

Note: The module must only be used as safety device for light curtains with selftesting type 4 according to EN 61496. The short-circuit detection of the input circuit has to be done by the light curtain.

Function Push Button or Selector Switch

The behavior is the same as with e-stop in automatic start mode. If no time is specified in the Table „Function setting“ the the default time to close the contacts is 250 ms.

Function Enabling Switch (only for override function)

To enable a module the following sequence has to be operated:

1. Before detection activated signal from the enabling switch all its contacts have to be open
2. All contacts must be activated within the required time span.
3. A soon as one contact of the enabling switch gets inactive the module is disabled and condition 1. must be fulfilled again. If no time is stated in the function table the the time span to close all contacts is 500 ms.

Note: During override with the enabling switch the overridden function is active in the background. I.e. that the safety outputs open after end of override, when during override e.g. the contact of a door with manual reset are opened and closed again.

Function Start- or Simulation Button

the start or simulation button must not be oerated longer then 3 sec to activate the module. The start button to be used is selected via dip switch setting from the available start inputs of the control unit and assigned to the module.
It is possible to assign several start buttons to one module.

Connection of Actuators

The actuators have to be connected as stated in the connection diagrams. When actuators with semiconductor outputs are used the module does not detect any crossfaults between the signals. The crossfault then must be detected by the actuator itself. E.g. light barrier type 4 to EN 61469).

Indicators

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	one input function not available	Activation of the assigned safety outputs is permissible
LED Run 1	Two-hand control not active (LED run 2 ON) or all relays inactive due to system error	one input function not available (LED run 2 ON) or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety out-puts is permis-sible or system error	Wait for start	one input function not available
LED Run 2	all relays inactive due to system error	all relays inactive due to system error	no system error

Indication of System Errors

These errors are indicated by flashing codes of the white LEDs Run 1 and/ or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)
6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Function Error Indication

Function errors are indicated by the white LED Run 1 and by the output 48. During this time, the white LED Run 2 remains on. Output 58 remains on as long as the error is pending; it flashes regularly while waiting for the assigned start signal.

Error codes*

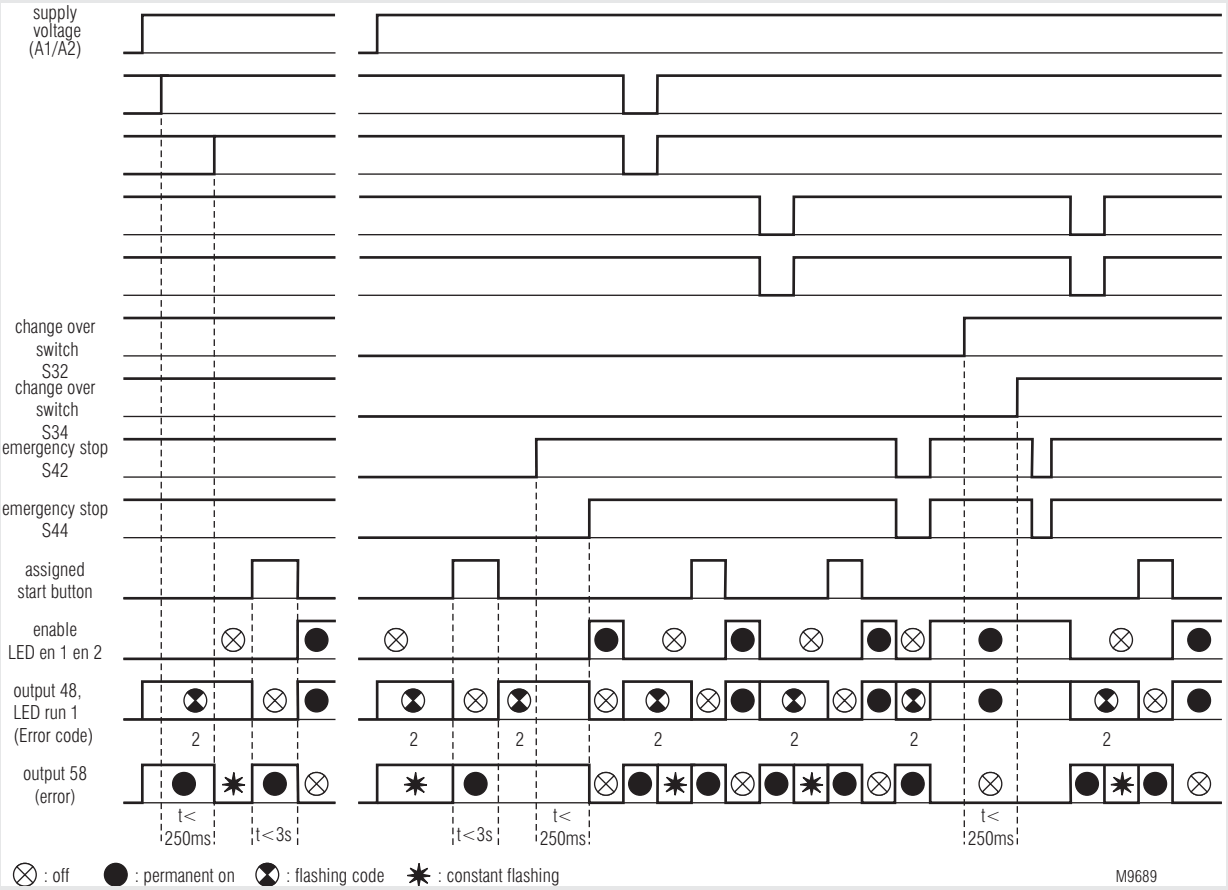
1) Gate open
- Enabling switch open, all other protection contacts closed operating mode 3, only on start-up
2) E-stop contacts or double contact open, light curtain interrupted
3) Timing error: The signals of a selected function are not activated in the required time (250ms with e-stop or light curtain and gate function). For a new activation both channels must be off.
4) Error at start or simulation input (kept pressed to long) activated on power up or during a failure.
5) Input error (short-circuit, interruption)
6) Error in the control unit (input or output error detected in the control unit)

* number of short flashing impulses, followed by a longer space

Function Diagram

Potentiometer = 0

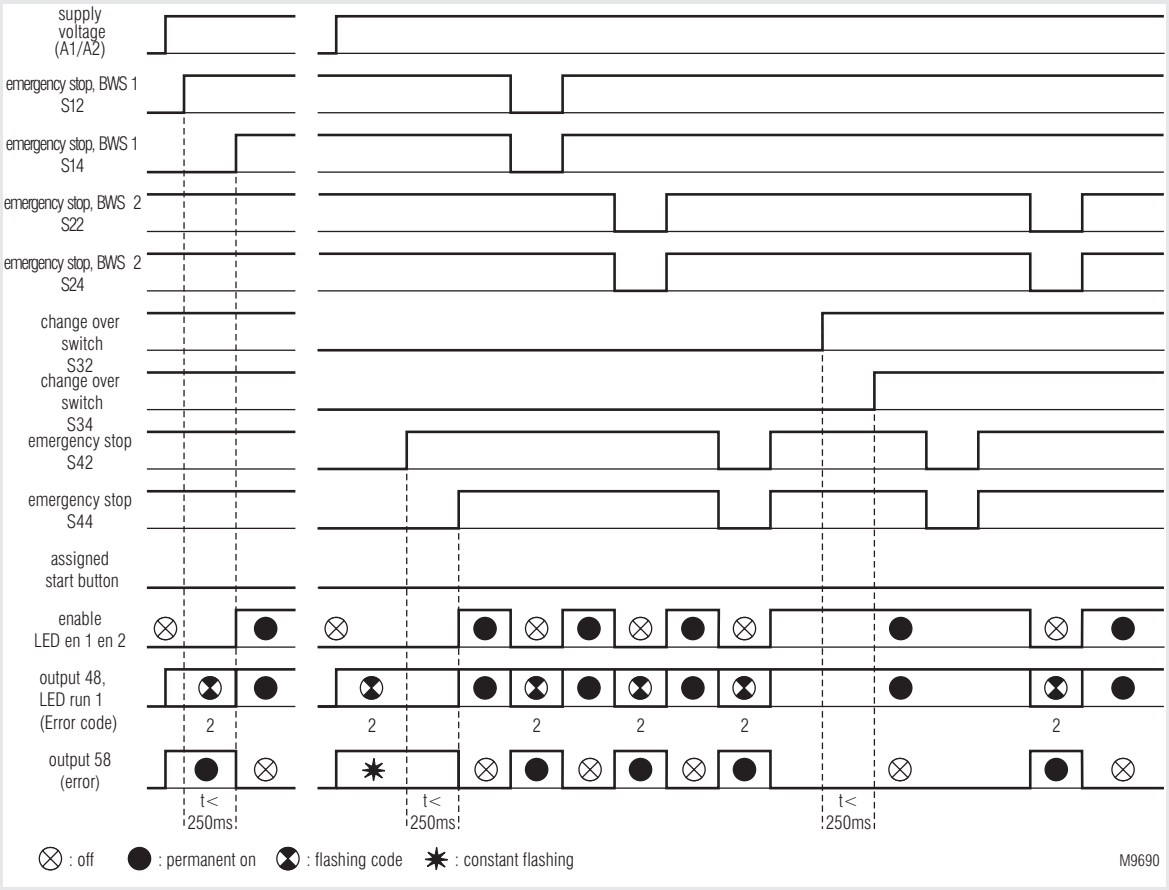
Function 1	S12, S14: E-Stop, manual start	S22, S24: E-Stop, manual start	S32, S34: change over switch closed	
Function 2	S12, S14: E-Stop, manual start	S22, S24: E-Stop, manual start	S32, S34: change over switch open	S42, S44: E-Stop, automatic start



Function Diagram

Potentiometer = 1

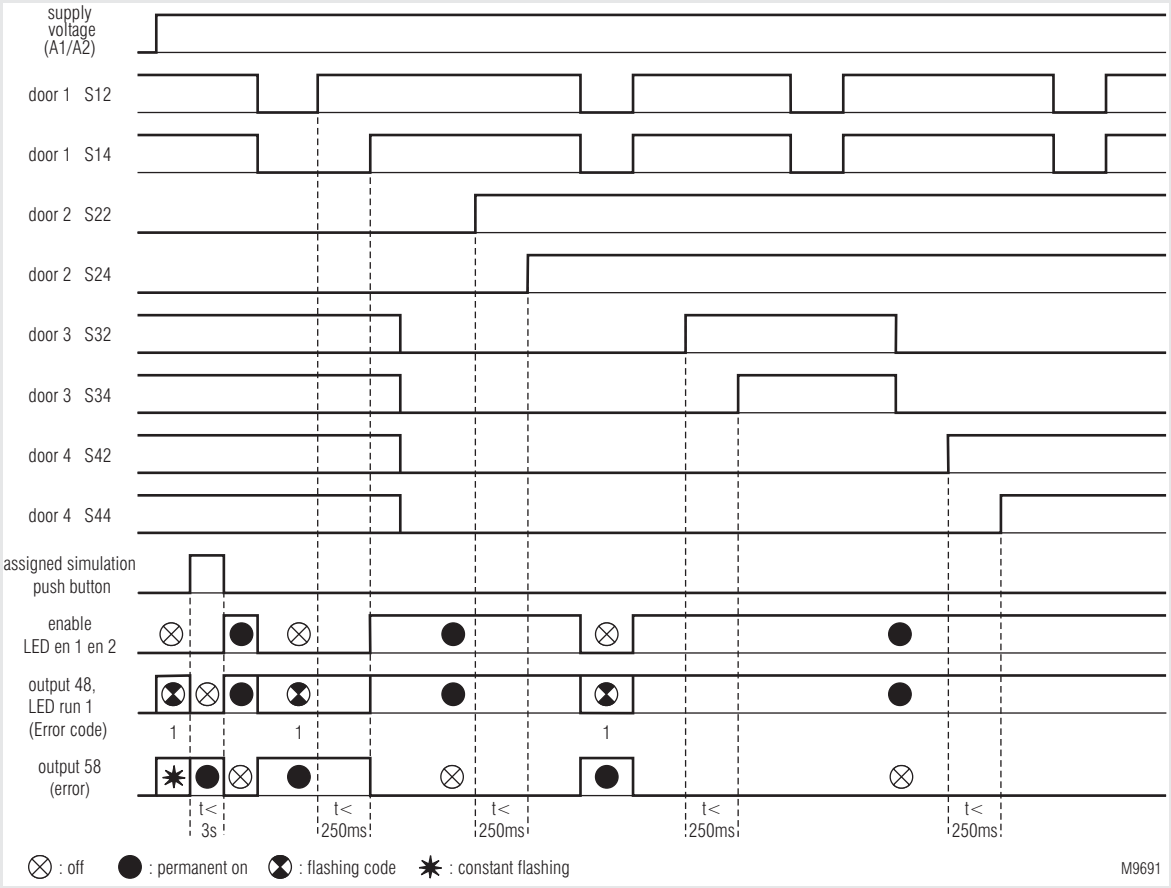
Function 1	S12, S14: E-Stop, automatic start	S22, S24: E-Stop, automatic start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, automatic start	S22, S24: E-Stop, automatic start	S32, S34: Change over switch open	S42, S44: E-Stop, automatic start



Function Diagram

Potentiometer = 2

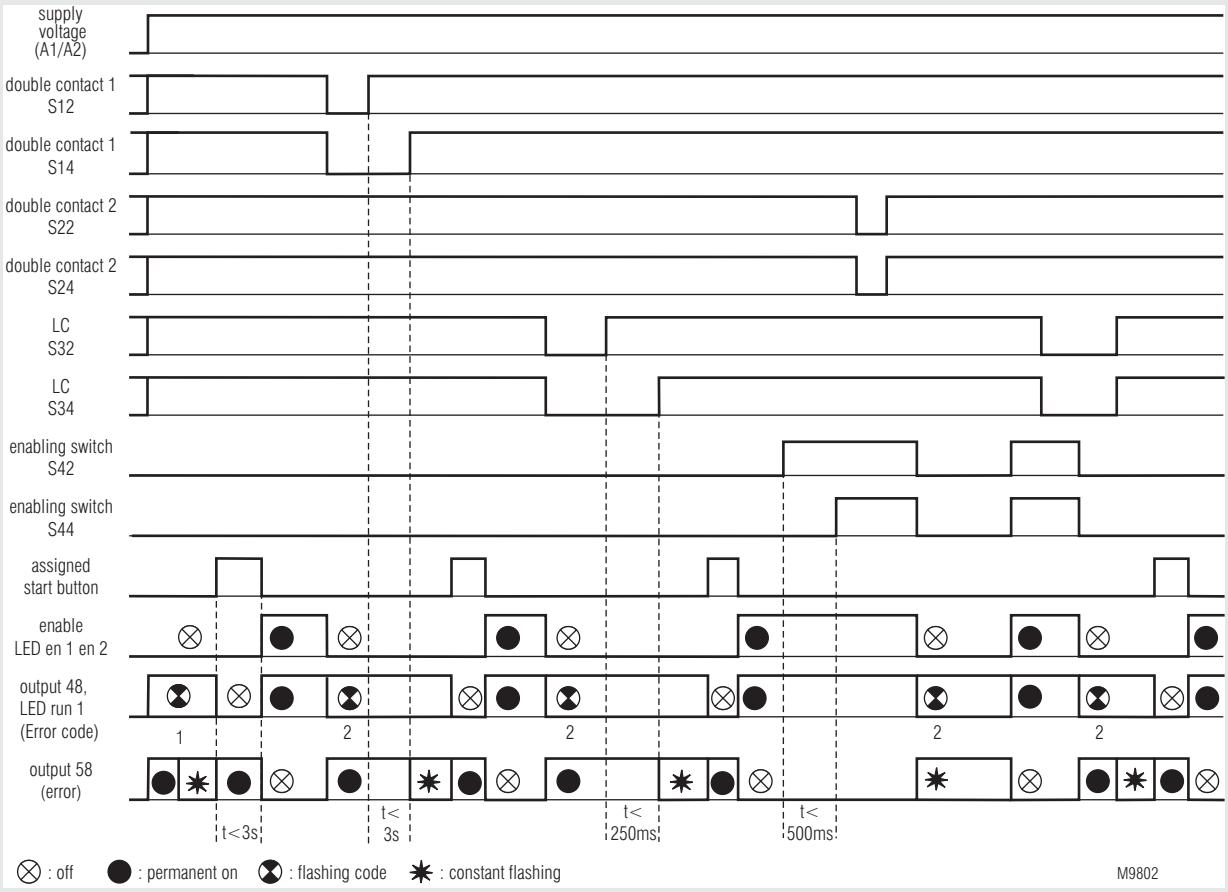
Function 1	S12, S14: door 250 ms monitoring time			
Function 2		S22, S24: door 250 msmonitoring time	S32, S34: door 250 ms monitoring time	
Function 3		S22, S24: door 250 ms monitoring time		S42, S44: door 250 ms monitoring time



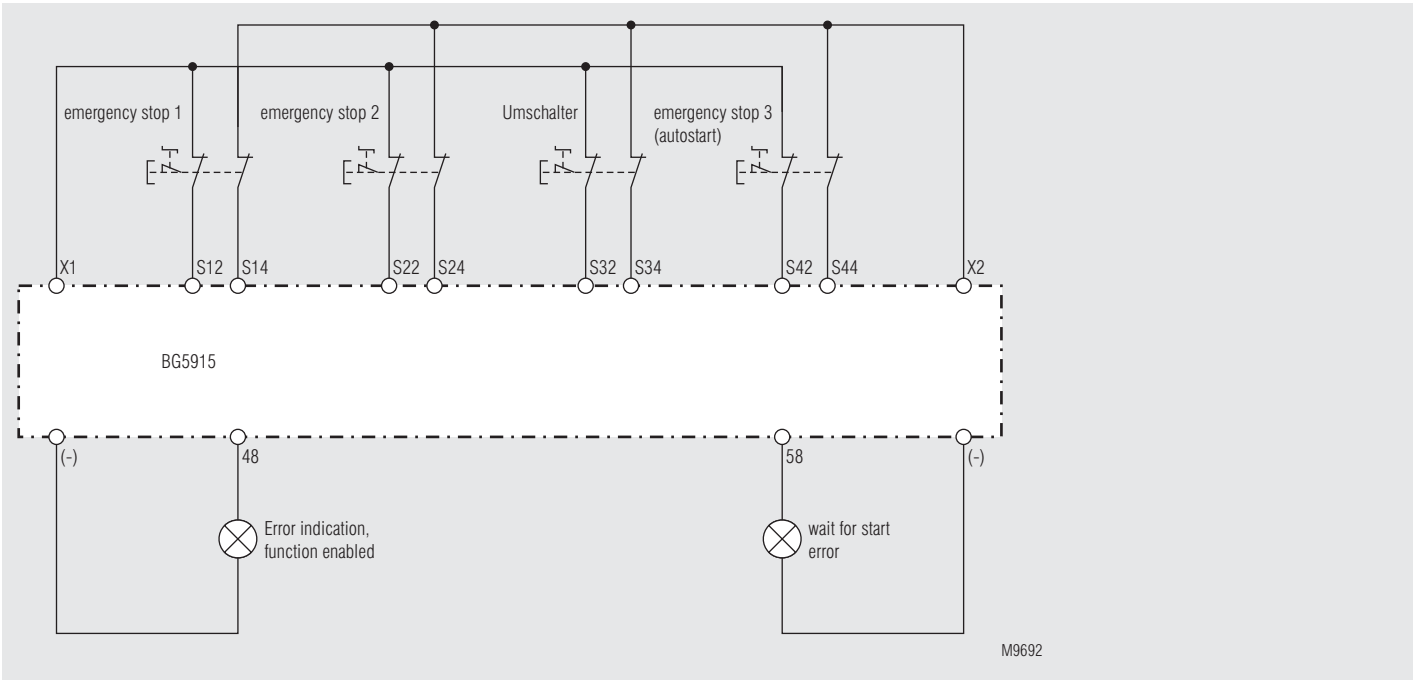
Function Diagram

Potentiometer = 3

Function 1	S12, S14: double contact 1	S22, S24: double contact 2	S32, S34: (LC) manual start	
Function 2				S42, S44: enabling switch



Potentiometer= 4 to Potentiometer = 9: These settings are not used at the moment. they are reserved for possible applications in future. When one of these settings is selected, the module goes in error state indicating system failure 5.



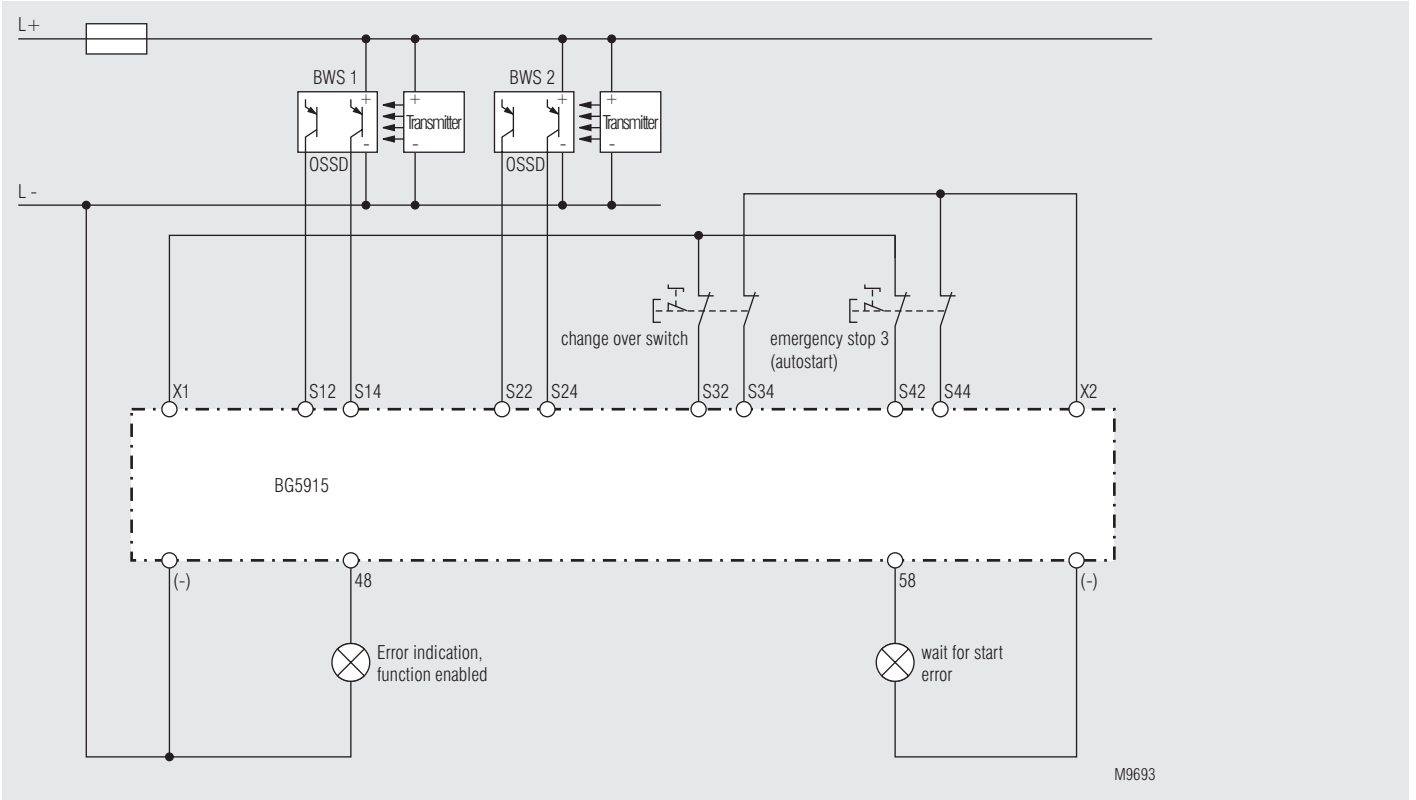
BG 5915.08/01MF0, Connection of E-Stop-buttons

Potentiometer = 0

Function 1	S12, S14: E-Stop, manual start	S22, S23: E-Stop, manual start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, Manual start	S22, S23: E-Stop, manual start	S32, S34: Change over switch open	S42, S44: E-Stop, Auto start

Potentiometer = 1

Function 1	S12, S14: E-Stop, Auto start	S22, S23: E-Stop, Auto start	S32, S34: Change over switch closed	
Function 2	S12, S14: E-Stop, Auto start	S22, S23: E-Stop, Auto start	S32, S34: Change over switch open	S42, S44: E-Stop, Auto start



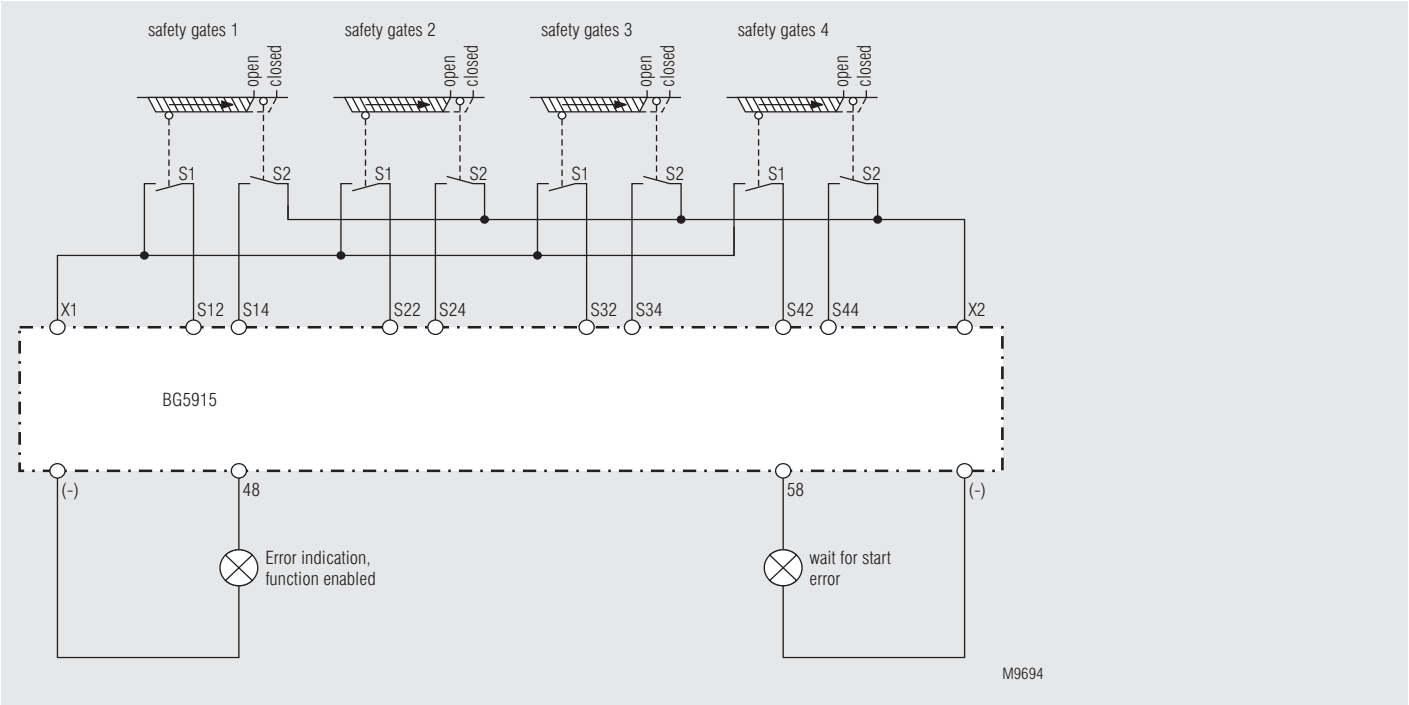
BG 5915.08/01MF0, connection at OSSD's of LC Typ 4 according to EN 61496

Potentiometer = 0

Function 1	S12, S14: LC, Manual start	S22, S23: LC, Manual start	S32, S34: Change over switch closed	
Function 2	S12, S14: LC, Manual start	S22, S23: LC, Manual start	S32, S34: Change over switch open	S42, S44: E-stop, Auto start

Potentiometer = 1

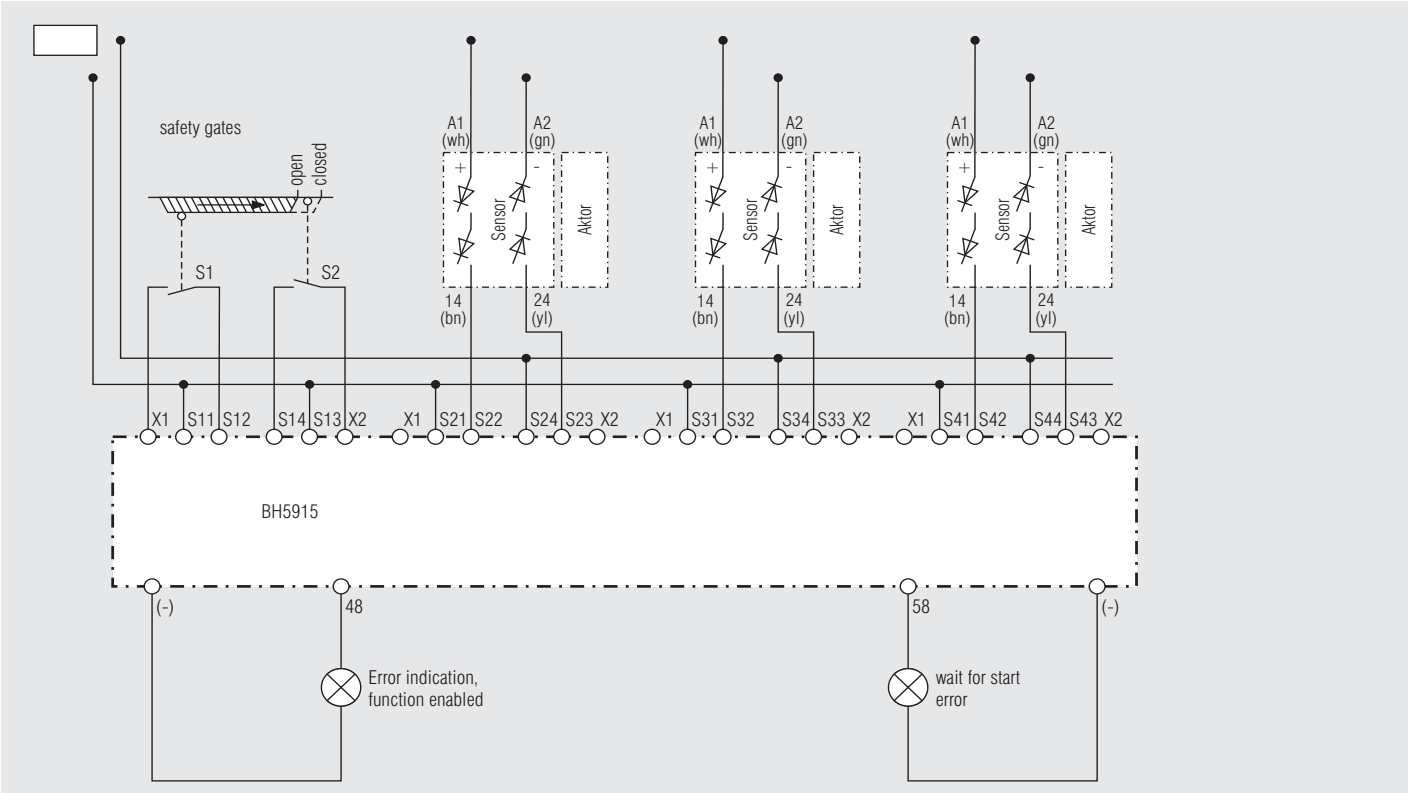
Function 1	S12, S14: LC, Auto start	S22, S23: LC, Auto start	S32, S34: Change over switch closed	
Function 2	S12, S14: LC, Auto start	S22, S23: LC, Auto start	S32, S34: Change over switch open	S42, S44: E-stop, Auto start



BG 5915.08/01MF0, volt free contacts

Potentiometer = 2

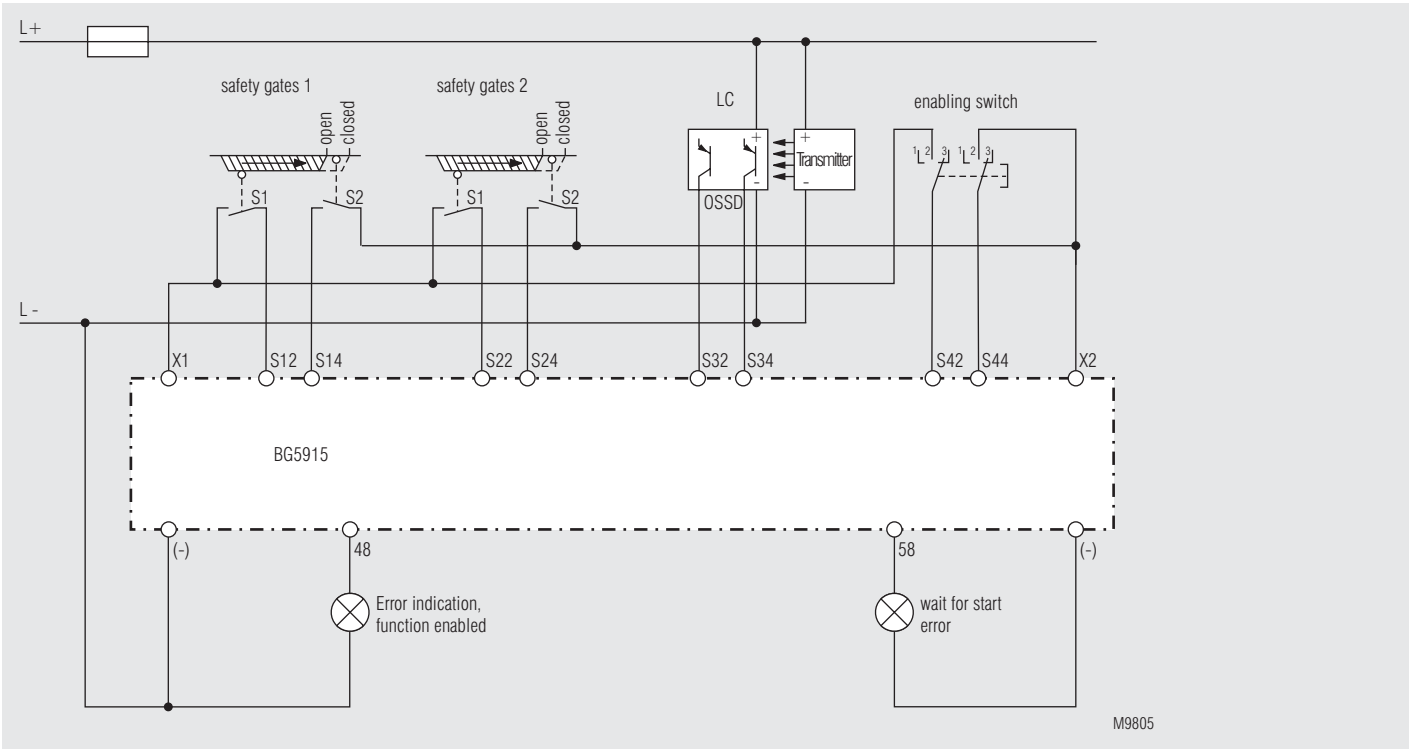
Function 1	S12, S14: door 250 ms monitoring time			
Function 2		S22, S24: door 250 ms monitoring time	S32, S34: door 250 ms monitoring time	
Function 3		S22, S24: door 250 ms monitoring time		S42, S44: door 250 ms monitoring time



BH 5915.08/01MF0, Connection at sensors with semiconductor outputs

Potentiometer = 2

Function 1	S11-S14: door 250 ms monitoring time			
Function 2		S21-S24: door 250 ms monitoring time	S31-S34: door 250 ms monitoring time	
Function 3		S21-24: door 250 ms monitoring time		S41-S44: door 250 ms monitoring time



Potentiometer = 3

Function 1	S12, S14: safety gate 1	S22, S24: safety gate 2	S32, S34: (LC) Manual start	
Function 2				S42, S44: enabling swich

Technical Data

Voltage Supply

Nominal voltage U_N:	DC 24 V (comes from basic module BH 5911)
Voltage range:	
with max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	max. 60 mA (no load on semiconductor outputs)
Short-circuit protection of the modules:	internally with PTC

Inputs

Control voltage over X1, X2:	DC 23 V at U_N
Control current over S11-S12, S13-S14, S21-S22, S23-S24, S31-S32, S33-S34, S41-S42, S43-S44:	4.5 mA each at U_N
max. wire length to sensors with contacts:	100 m
Minimum voltage at S12, S14, S22, S24, S32, S34 S42, S44:	DC 16 V

Outputs

Output on terminal 48 and 58:	Transistor outputs, plus-connected internal short circuit, overtemperature and overload protection
Output nominal voltage:	DC 23 V at U_N
Output current:	max. 100 mA continuous current max. 400 mA for 0.5 s

Safety outputs (at control unit or output modules)

Reaction times (time till reaction of the assigned output)

Typ. operating time with U_N	
Manual-Start:	max. 110 ms
First start at automatic start:	max. 1 s
Restart at automatic start:	max. 115 ms
Break time (reaction time):	max. 33 ms

General Data

Operating mode:	Continuous operation	
Temperature range:	± 0 ... + 50 °C At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC:	IEC/EN 61 326-3-1, IEC/EN 62 061	
Radio interference suppression:	Limit value class A	EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection		
Housing:	IP 20	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behavior according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm	
Shock resistance		
Acceleration:	10 g	
Pulse duration:	16 ms	
Number of shocks:	1000 per axis on three axes	
Climate resistance:	0 / 050/ 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:	1 x 2.5 mm² stranded wire with sleeve, or 1 x 4 mm² massive or 2 x 1.5 mm² litz with sleeve	DIN 46 228-1/-2/-3/-4
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60715
Weight		
BG 5915:	165 g	
BH 5915:	255 g	

Dimensions

Width x height x depth:	
BG 5915:	22.5 x 84 x 121 mm
BH 5915:	45 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	812.8	a
DC_{avg}:	96.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-1}

Safety Related Data for LC, Safety Gate or Two-Hand

Values according EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	2697.1	a
DC_{avg}:	96.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

Values according IEC/EN 62061 / IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	96.0	%
SFF	99.2	%
PFH_D:	2.34E-10	h^{-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.

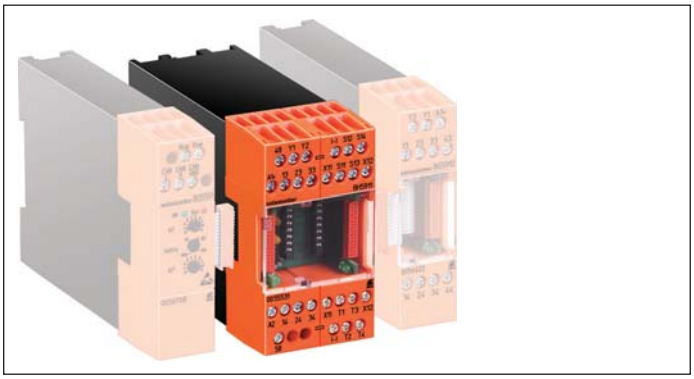
Standard Types

BG 5915.08/01MF0
Article Number: 0058869
- 8 inputs
- Width: 22.5 mm

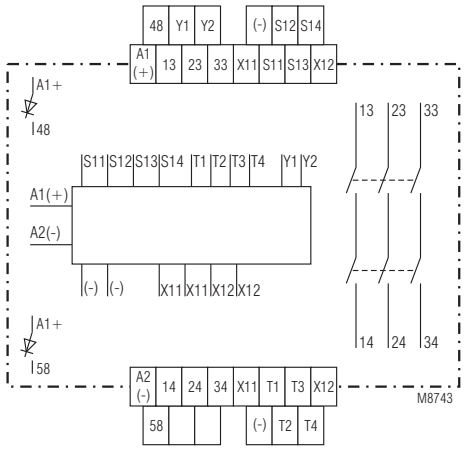
BH 5915.08/01MF0
Article Number: 0058874
- 8 inputs
- Width: 45 mm

Multi-Function Safety System SAFEMASTER M
Control Unit
BH 5911

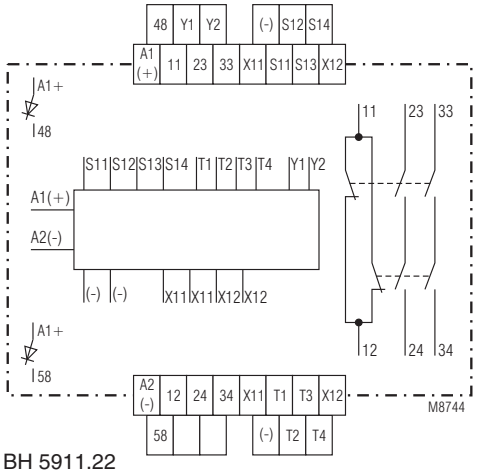
0247385



Circuit Diagrams



BH 5911.03



BH 5911.22

- **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**
- For emergency stop function, the following inputs and outputs are available:
  Inputs: 4 monitored start inputs, or
  3 start inputs and 1 stop input and
  2 Emergency stop inputs
  Outputs: 3 NO contacts, or
  2 NO contacts/1 NC monitoring contact
- Parallel connection of several SAFEMASTER M-systems possible
- The functions are selected via rotary switch
  - 1 Emergency stop circuit, 2-channel
  - 2 Emergency stop circuits, single-channel
  - 1 Emergency stop circuit, 2-channel + 1 stop single channel
- Auto or manual start
- 2 semiconductor outputs for status indication
- LEDs for status indication
- Overvoltage and undervoltage monitoring function with error indication
- Permanently monitored feedback loop to connect external contactors
- Broken wire and short circuit monitoring function with error indication
- Width: 45 mm

Approvals and Markings

CE · TÜVRheinland CERTIFIED Functional Safety Type Approved · C US Canada / USA · A025518

Applications

Realization of fail-safe control circuits for protection of people and machinery

Input Terminal Assignment

Terminal	Signal
S11	Emergency stop button 1
S12	
S13	Emergency stop button 2
S14	
X11-T1	Start button 1
X11-T2	Start button 2
X12-T3	Start button 3
X12-T4	Start button 4 or stop
Y1-Y2	Feedback loop for external contact extensions

General Information SAFEMASTER M

The maximum configuration of the SAFEMASTER M multi-function safety system is as follows:

- the control unit BH 5911
- up to 3 input modules BG/BH 5913, or BG/BH 5914, BH/BH 5915
- up to 3 output modules BG 5912
- 1 diagnostic module BG 5551 for CANopen, or
- 1 diagnostic module BG 5552 for Profibus-DP

The BH 5911 controls the whole system.

The input/output modules can be used to expand the control unit in a modular way into a multi-functional safety system.

To transmit status messages of the individual modules to a monitoring or control unit, one of the following diagnostic modules may be connected:

- BG 5551 for CANopen
- BH 5552 for Profibus-DP

Indication

Green LEDs (left): on, when all inputs are present and start button activated.

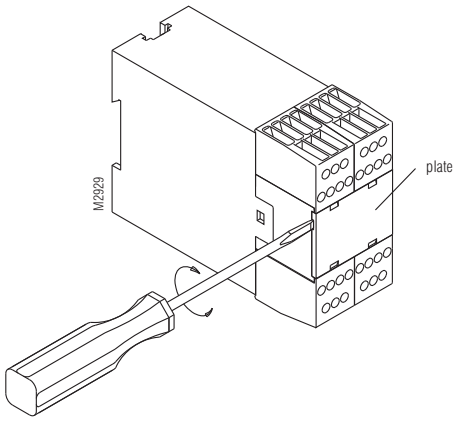
Green LEDs (right): on, when the safety outputs of the control unit are activated.

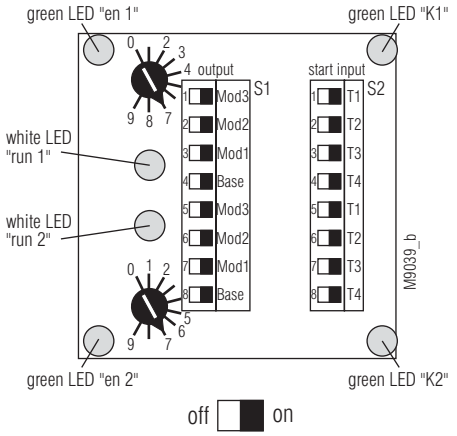
White LEDs Run 1 and Run 2 and semiconductor outputs 48 and 58: Indicate the current status of the control unit.

Setting of Functions

The control unit is assigned to the start inputs T1…T4 and the safety outputs via the DIP switches. The input function is set by means of the rotary switches. To prevent accidently adjustments the setting switches are covered by a front plate and are redundant.

The control unit is supplied with two fitted terminating connectors. When the control unit is equipped with extension modules, remove these ter-minating connectors and plug them to the last interconnected device. When a diagnostic module is used, it is connected instead of the terminating con-nector.





base = Output of control Unit
mod = Output of output module

Notes:

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Notes

- Settings to the unit must be performed by skilled personnel while the unit is disconnected.
- Before the front cover is removed, antistatic precautions must be observed.

Sw	Function	Start input selection	Start function s etting conditions
0	1 E-stop or 1 LC* 2 channel	4 start inputs	Automatic start lock-out following undervoltage
1	2 E-stop 1 channel	4 start inputs	
2	1 E-stop or 1 LC* 2 channel	3 start inputs 1 Stop	
3	not permitted (error 5)		
4	1 E-stop or 1 LC* 2 channel	4 start inputs	Manual start
5	2 E-stop 1 channel	4 start inputs	
6	1 E-stop or 1 LC* 2 channel	3 start inputs 1 Stop	
7	1 E-stop or 1 LC* 2 channel	3 start inputs 1 Stop	Automatic start following undervoltage, restart after the voltage has returned to the permissible value
8	1 E-stop or 1 LC* 2 channel	4 start inputs	
9	2 E-stop 1 channel	4 start inputs	

* LC = light curtain

Automatic Start

Automatic start is only performed when the supply voltage is switched on or when the Emergency stop or stop function has been reset (with switch positions 7 to 9, also after undervoltage).
All other errors nevertheless require confirmation by a start input.

Manual Start

The start input must not be pressed for more than 3 seconds to start the system. Alternatively, several start inputs may be assigned to one module.

Stop

Instead of the fourth start button, an additional stop input (NC contact) can be connected. It is assigned only to the control unit and treated like an additional single-channel emergency stop button.
This means that the safety outputs assigned to the control unit can only be activated if neither the emergency stop or the stop button are activated.

If operating function 2, 6 or 7 is selected, an assignment to the start input 4 will remain ineffective in all connected modules.

Lock-Out after Undervoltage

When an undervoltage is detected, the whole system (including any extension modules) turns off (auto reset). There are two different options of auto restart:

1. The system de-energises the safety outputs as soon as undervoltage has been detected.
There after the system will only reset after complete removal of voltage.

2. The system de-energises the safety outputs and remains de-energized until supply voltage is back to a permissible value. Then, the system is restarted.

Shortcircuit and Crossfault Detection

The control unit has an integrated dynamic shortcircuit and crossfault detection. This feature can only be used when the inputs are switched by contacts and if they are only connected to one safemaster input.
To connect light curtains of type 4 or to operate several safemaster M units from common sensors a special wiring has to be chosen.

Indication of System Errors

These errors are indicated by flashing codes of the white LEDs Run 1 and/or Run 2. The green LEDs and all outputs turn inactive. The system will only restart after the supply voltage has been switched off and on again.

Error codes*

0) (both white LEDs are off):
Another input module indicates a system error.
1) To 4): not used
5) Incorrect setting of function:
- The rotary switches for channel 1 and 2 has different or incorrect positions
- The setting of the 4 upper Dip-switches (channel 1) are not identically to the 4 lower Dip-switches (channel 2)
6) LED Run 1 flashes: Undervoltage
LED Run 2 flashes: Overvoltage
7), 8) Not used
9) Connection error between the input modules
No terminating connector available.
· Control or input module defective
10), 11), 12), 13) a. 14) Internal errors

* number of short flashing impulses, followed by a longer space

Status Indicator

	Permanently OFF	Pulsing	Permanent ON
Output 48	all relays inactive due to system error	Function error	Activation of the assigned safety outputs is permissible
LED run 1	all relays inactive due to system error	Function error when LED Run 2 is ON, or system error when LED Run 2 is OFF or flashing	Activation of the assigned safety outputs is permissible
Output 58	Activation of the assigned safety outputs is permissible or system error	Waiting for start signal	Function error
LED run 2	all relays inactive due to system error	all relays inactive due to system error	No system error

Indication of Function Errors

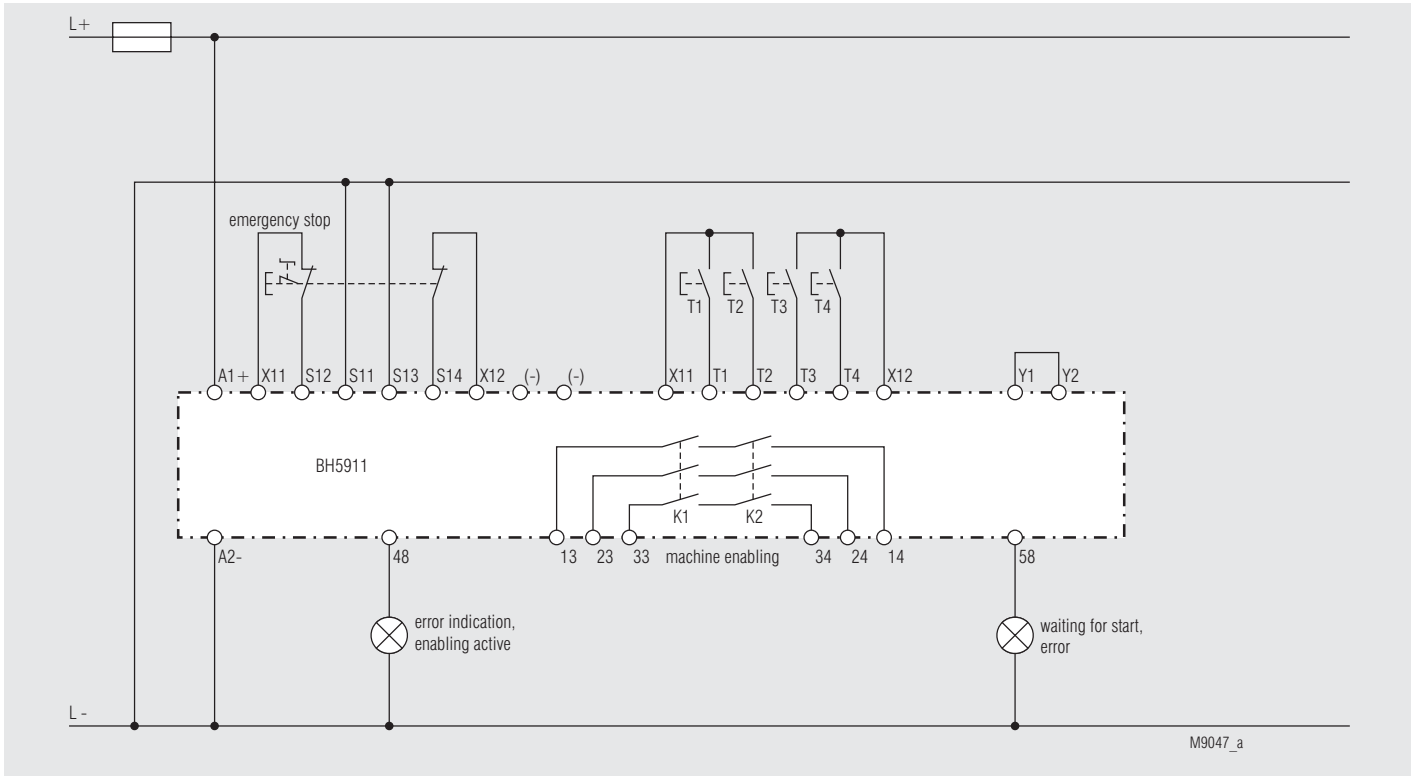
Function errors are indicated by the white LED Run 1 and by the output 48. During this time, the white LED Run 2 remains on. Output 58 remains on as long as the error is pending; it flashes regularly while waiting for the assigned start signal.

Error codes*

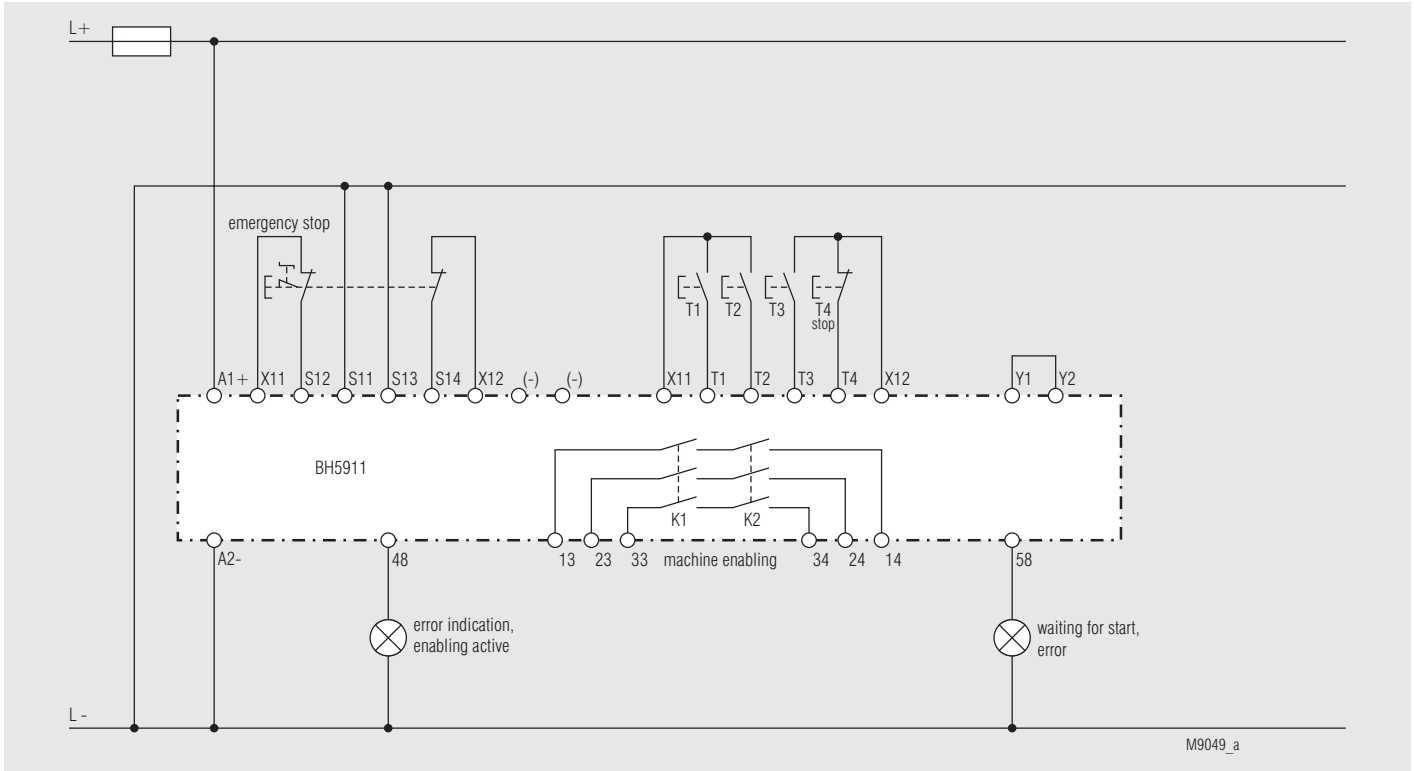
1) First Emergency stop contact open
2) Second Emergency stop contact open
3) Stop contact open
4) Error start input
5) Input error (interruption or short-circuit)
6) Output error at the safety output of the control unit or at the safety outputs of the extension modules (feedback loop interrupted, assigned output module does not exist).
7) Error at the twin contacts of the Emergency stop button

* number of short flashing impulses, followed by a longer space

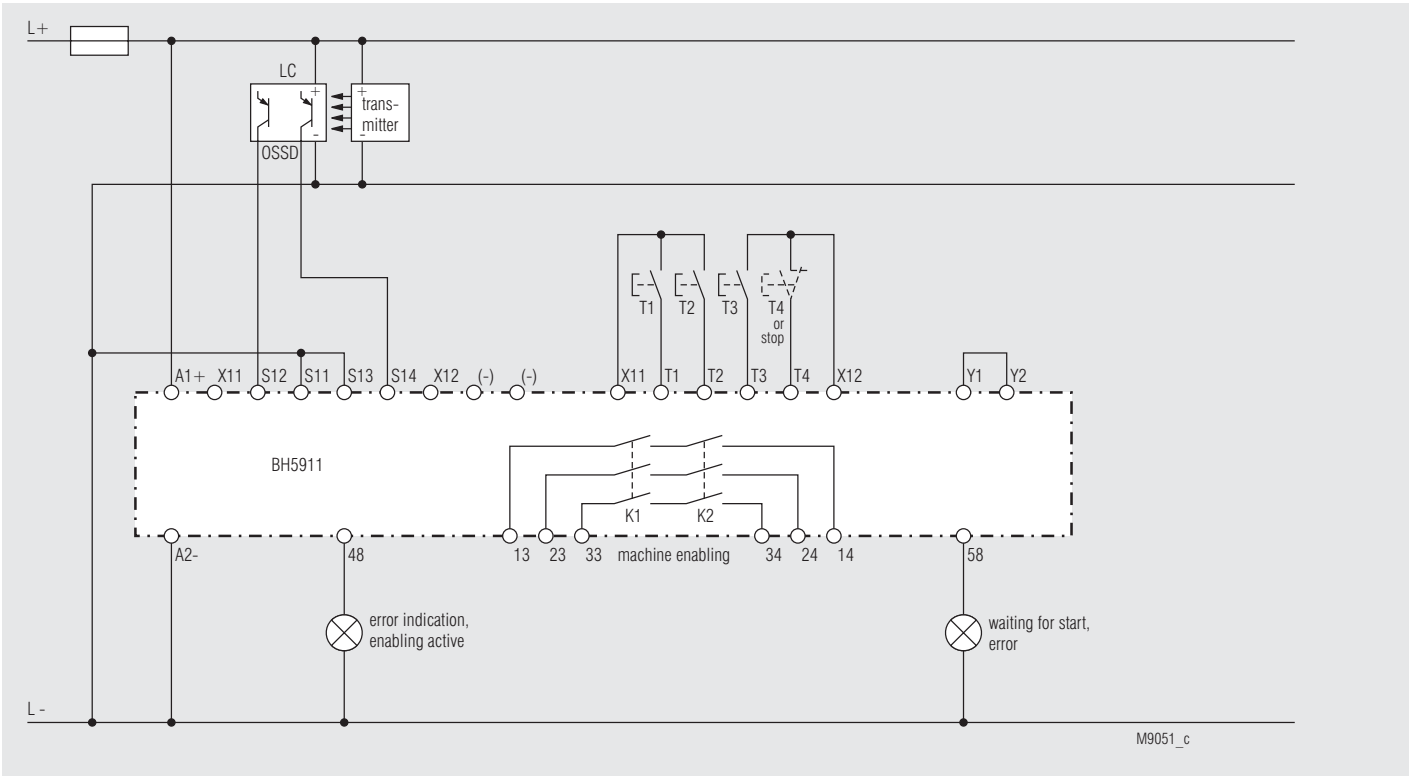
In case of error 5) and 6), the LEDs Run 1 and the outputs 48 to 58 of the inputs modules which permit activation of the safety outputs flash fast and regularly until the error is remedied and acknowledged by a start signal assigned to the control unit.



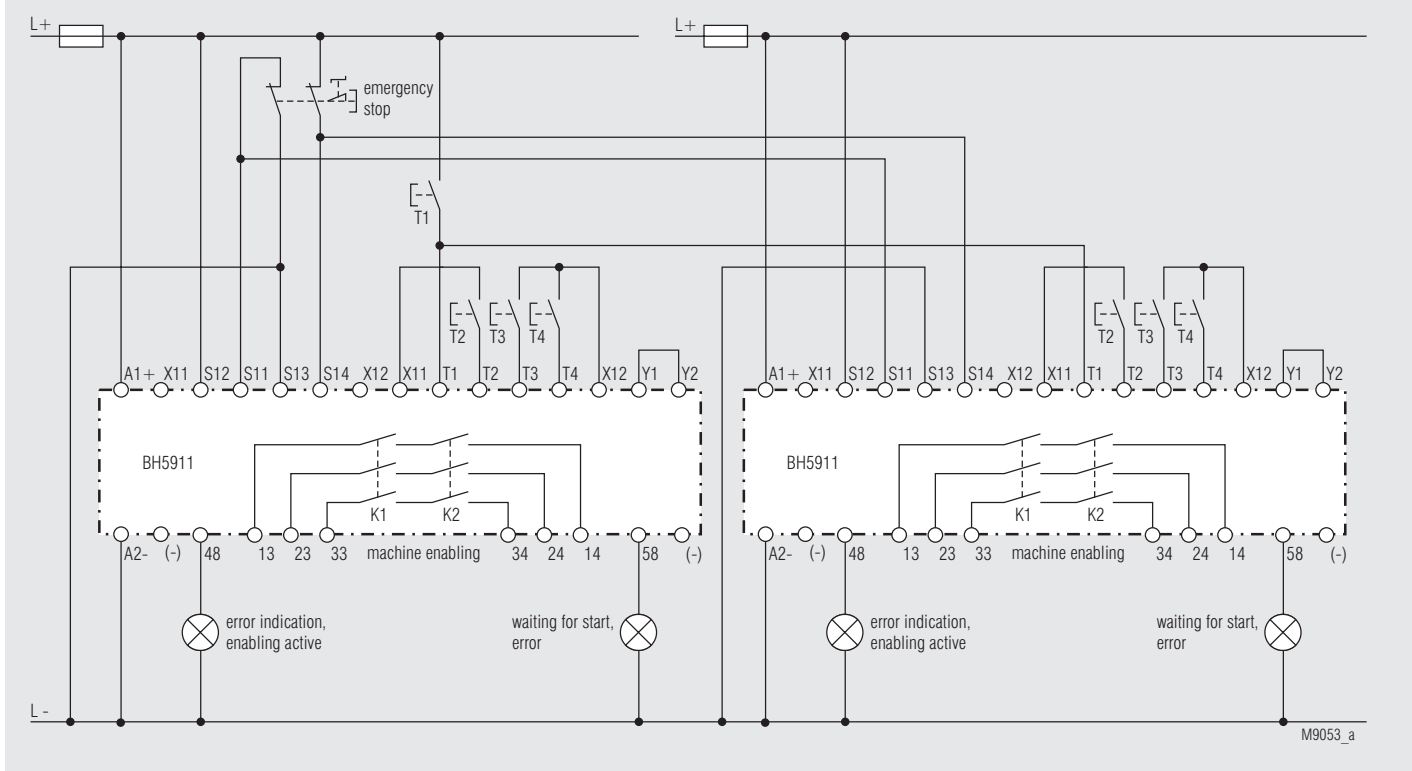
1 Emergency stop, 2-channel; setting: 0, 4 or 8



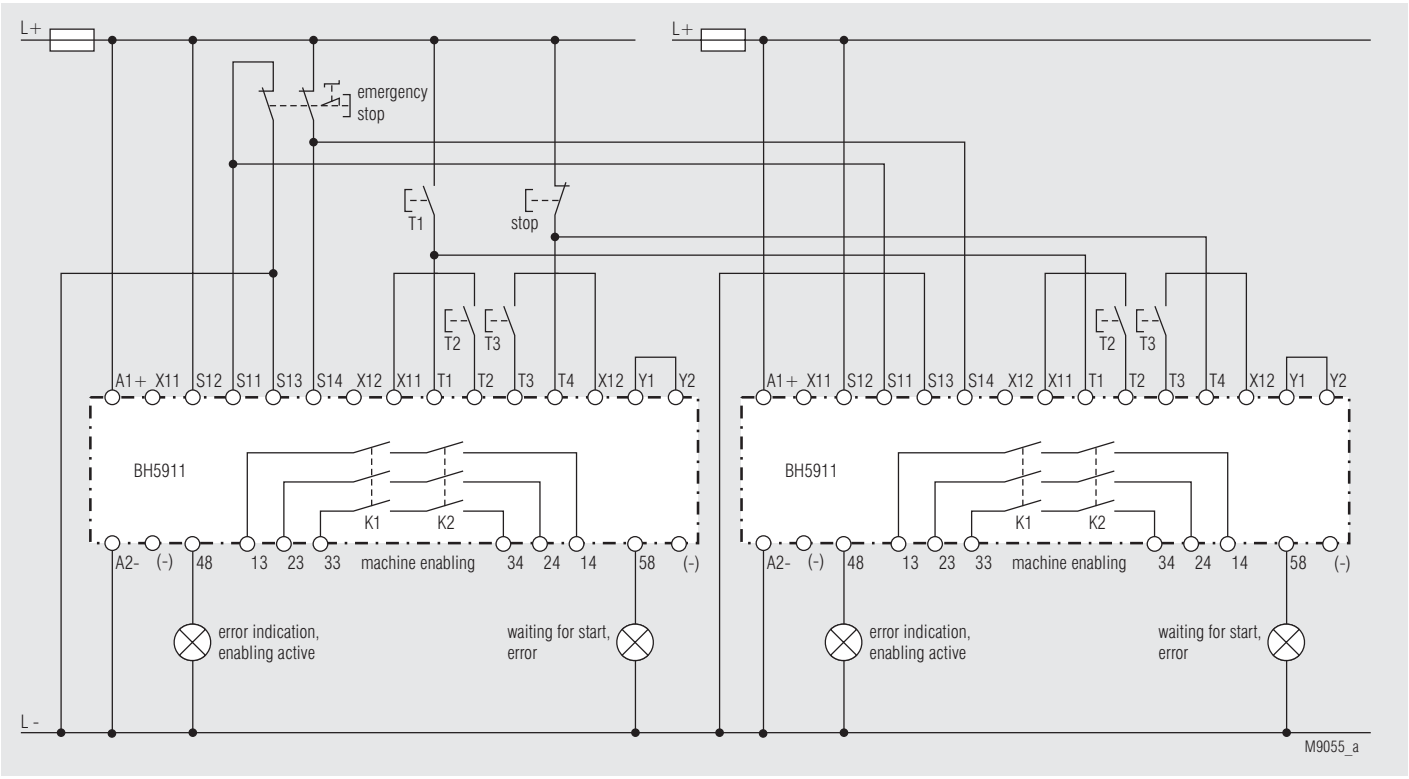
1 Emergency stop, 2-channel + stop, only 3 start inputs; setting: 2, 6 or 7



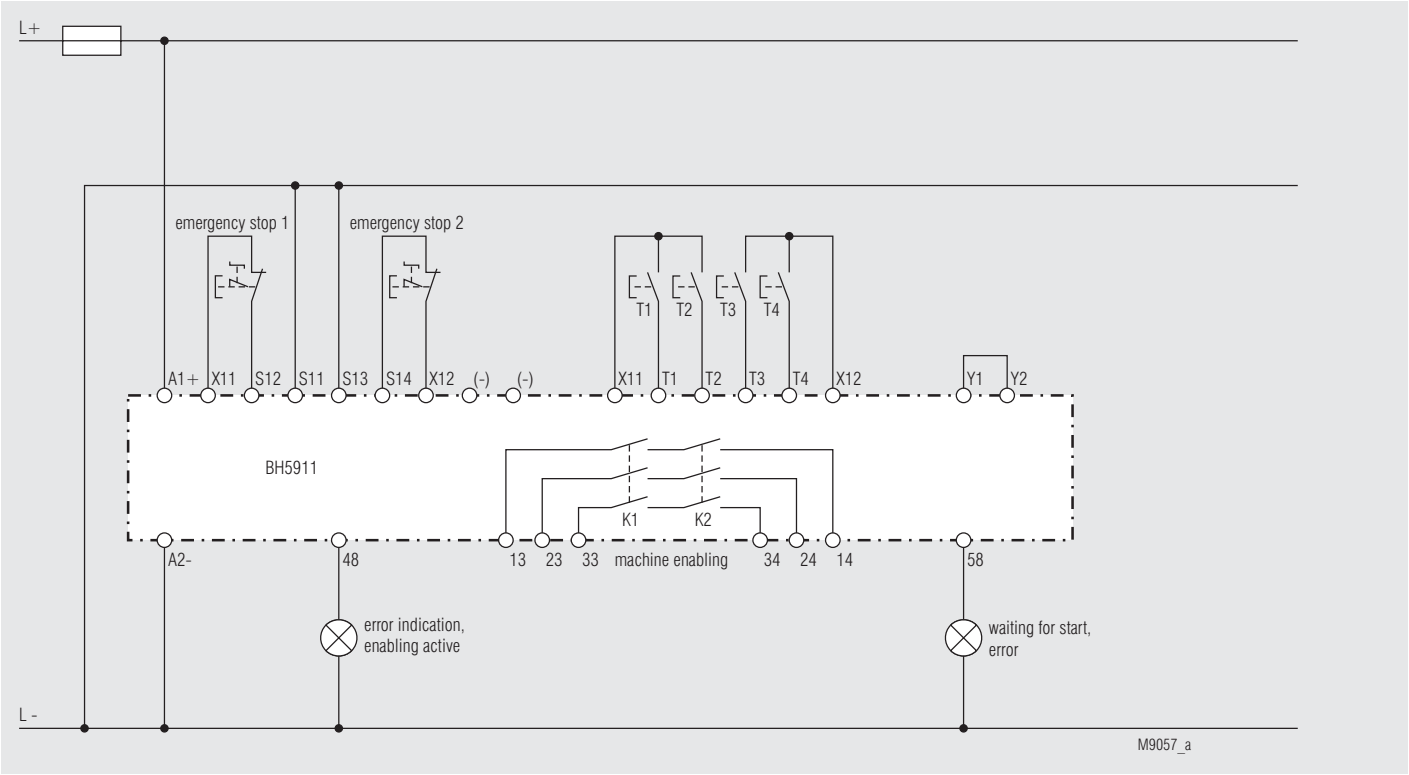
Light curtain type 4 + stop, only 3 start inputs; setting: 2, 6 or 7



Emergency stop, 2-channel and 1 start input operating 2 safemaster M in parallel; setting: 0, 4, or 8

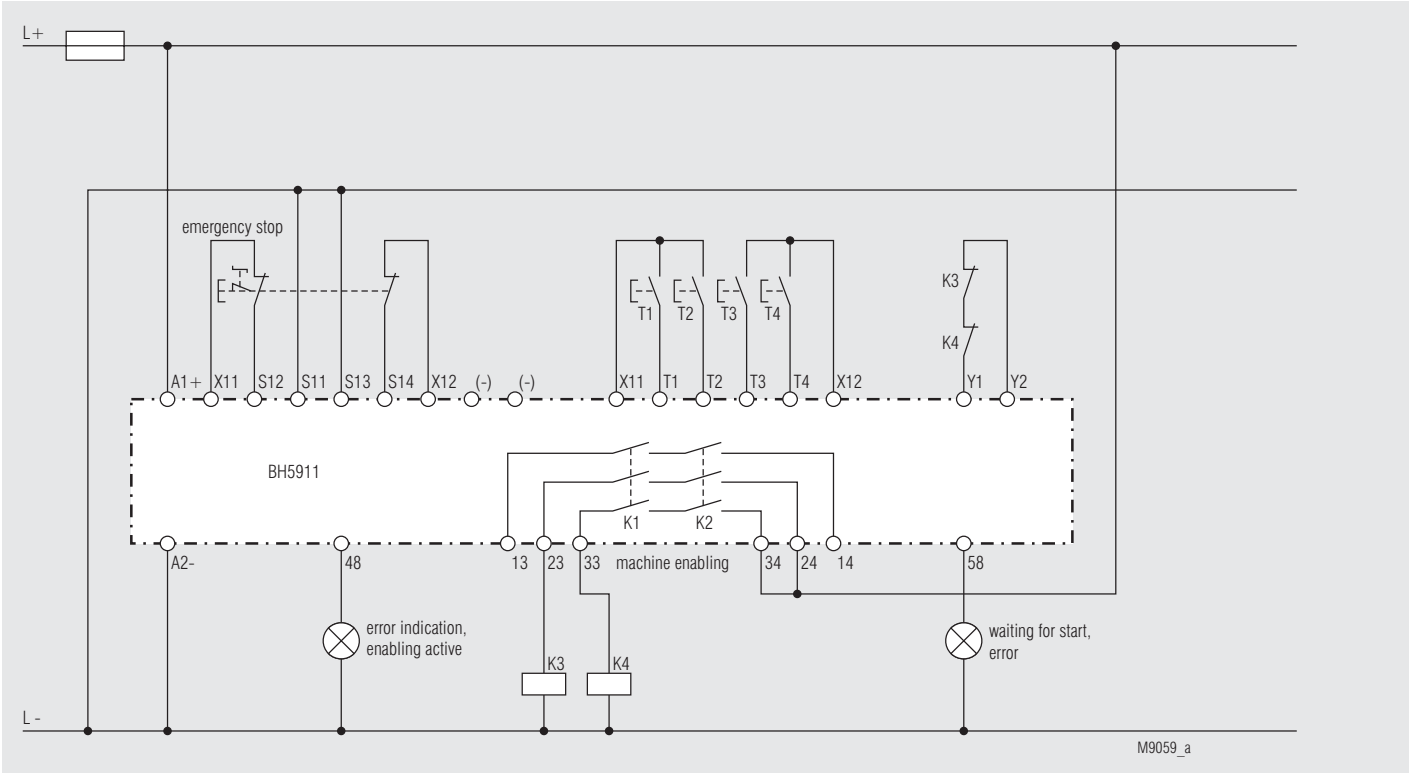


Emergency stop, 2-channel, 1 start button + 1 stop button operating 2 safemaster M in parallel; setting: 2, 6, or 7



2 Emergency stop, single-channel; setting: 1, 5 or 9

Application Examples



Emergency stop, 2-channel, 4 start inputs, contact reinforcement; setting: 0, 4 or 8

Technical Data

Nominal voltage U_N: DC 24 V
Voltage range:
with max. 5% residual ripple: 0.85 ... 1.15 U_N
Nominal consumption
BH 5911: max. 140 mA
(no load on semiconductor outputs)

Input

Control voltage on
X11, X12, 48, 58: DC 23 V at U_N
Control voltage on
S11, S12, S13, S14,
T1, T2, T3, T4: 4.5 mA each at U_N
max. wire length to
sensors with contacts: 100 m
Minimum voltage at
terminals S12, S14
T1, T2, T3, T4: DC 16 V
Short-circuit protection
of the modules: Internally with PTC

Output

Contacts
BH 5911.03: 3 NO contacts
BH 5911.22: 2 NO contacts, 1 NC contact
(The NC contact must not be used as a safety output!)
Contact type: Relay, forcibly guided

Typ. make time with U_N:

Control unit BH 5911	Manual start	Auto start	
		First start	Restart
Emergency stop	max. 75 ms	max. 1 s	max. 90 ms

Break time (reaction time):

Control unit BH 5911	
Emergency stop	max. 27 ms

Fault clearing
in the feed back loop: max. 600 ms
Output nominal voltage: AC 250 V
DC: see limit curve for arc-free operation
Switching of small loads: ≥ 100 mV

Thermal current I_{th}: max. 5 A (see quadratic total current limit curve)

Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: DC8 A / DC 24 V
at 0.1 Hz IEC/EN 60 947-5-1
Contact life
acc. to AC 15 with 2 A, AC 230V: 10^5 switching cycles IEC/EN 60 947-5-1
Permissible switching
frequency: max. 1 200 switching cycles / h
Short circuit strenght
max. fuse rating 6 A gL IEC/EN 60 947-5-1
Line circuit breaker C 8 A
Mechanical life: 10 x 10^6 operating cycles

Semiconductor Outputs

Output (terminal 48 and 58): Transistor outputs, plus-connected
Output nominal voltage: DC 24 V, max. 100 mA constant current, max. 400 mA for 0,5 s internal short circuit, overtemperature and overload protection

General Data

Operatinng mode: Continuous
Temperature range: ± 0 ... + 50 °C
At an operating temperature of 50 °C the modules must be mounted with a distance of 3 - 5 mm.
Clearance and creepage
distances
rated impulse voltage /
pollution degree: 4 kV / 2 (basis insulation) IEC 60 664-1
EMC: IEC/EN 61 326-3-1, IEC/EN 62 061
Radio interference suppression: Limit value class A EN 55011

Remark: This device is designed for industrial ambient conditions. When used in other environment, it is possible that wire bound or radiated interference occurs.

Degree of protection
Housing: IP 20 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplast with V0 behavior according to UL Subject 94

Technical Data

Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Shock resistance:		
Acceleration:	10 g	
Pulse duration:	16 ms	
Number of shocks:	1000 per axis on three axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection:	1 x 2.5 mm² stranded wire with sleeve, or 1 x 4 mm² massive, or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Surge supression:	When connecting inductive loads to the relay outputs (contactor coils, valves, electric brakes) surge supressor elements like diods, capacitros, RC combinations, etc. have to be connected directly to the connection terminals of the controlled devices, keeping the connection wires as short as possible.	
Mounting:	DIN rail	IEC/EN 60 715

Dimensions

Width x height x depth:	45 x 84 x 121 mm

Safety Related Data for E-STOP

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	193.3	a
DC_{avg}:	98.3	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3600	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC EN 62061 / IEC EN 61508:		
SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
HFT*):	1	
DC_{avg}:	98.3	%
SFF	99.6	%
PFH_D:	4.06E-10	h^{-1}

Safety Related Data for light curtains ,safety gates or two-hand

Values according to EN ISO 13849-1:		
Categorie:	4	
PL:	e	
$MTTF_d$:	30.4	a
DC_{avg}:	99.0	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	138	s/Zyklus

Values according to IEC/EN 62061 / IEC/EN 61508:		
SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	99.0	%
SFF	99.6	%
PFH_D:	7.91E-09	h^{-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.

CSA-Data

Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

CCC-Data

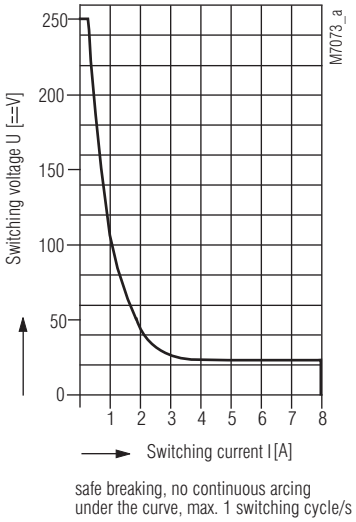
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

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

Ordering Example

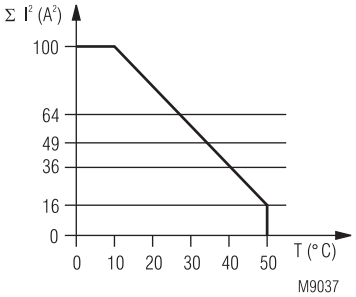
BH 5911.03/00MF0 DC24V	3 NO contacts
BH 5911.22/00MF0 DC24V	2 NO contacts, 1 NC contact

Characteristics



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Limit curve for arc-free operation



quadratic total current

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

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

Quadratic total current limit curve

SAFEMASTER W Wireless Safety System
Radio Controlled Safety Module
UH 6900

Product Description

The radio controlled safety module UH 6900 is an innovative wireless safety system to protect man and machine. A feature of the wireless safety system is its safety-oriented bi-directional radio transmission for transmitting signals between two wireless safety modules so that the two separate safety devices, each of them installed on a different machine part that is not connected to the other by wires (for example, moving machine parts), work together as one system.

Therefore SAFEMASTER W radio controlled safety modules are intended for the wireless remote control of machines and plant parts that used to be controlled by cable. Their usage is only restricted by valid safety instructions that prohibit, for example, staying under suspended loads.

Typical applications are:
- Hazard areas where protective equipment is necessary for the safety of persons but where wiring is impossible or not reasonable, for example in applications with extremely wide-spread, extensive hazard zones;
- Mobile and stationary plants and equipment, for example large machines, assembly halls and scaffolds, conveyor belts, high-rack warehouses, warehouses, forklifts, etc.
- The radio transmission range is up to 800 m

Notes

Before installing, operating or maintaining this device, the user manual must be carefully read an understood on the enclosed CD.

Please note: Validation according to DIN EN ISO 13849-2 is always required for the complete system

Your Advantages
- Higher safety in dangerous areas
- More efficiency and economy by wireless communication
- Compact, easy to install devices
- DIN rail mounting
- Removable terminal blocks
- Adjustable functions via rotary switch:
  - Full safety operation with different start modes (two-hand type IIIA and/or manual start, auto start)
  - Cross-operation with different start modes (two-hand type IIIA and/or manual start, auto start)
  - Safety operation with optional radio control with different start modes (manual start on S42, manual start via radio, or auto start)
- Valid for all operating modes:
  - Start function via radio with or without detection of an additional start signal at the IIR input.
- Frequency range 433 MHz or 869 MHz (license-free radio frequencies)
- Radio channel, transmitter power, and module name can be set by means of a parameterization software
- Status indicator for the devices connected via radio, by means of the parameterization software including status of radio transmission quality

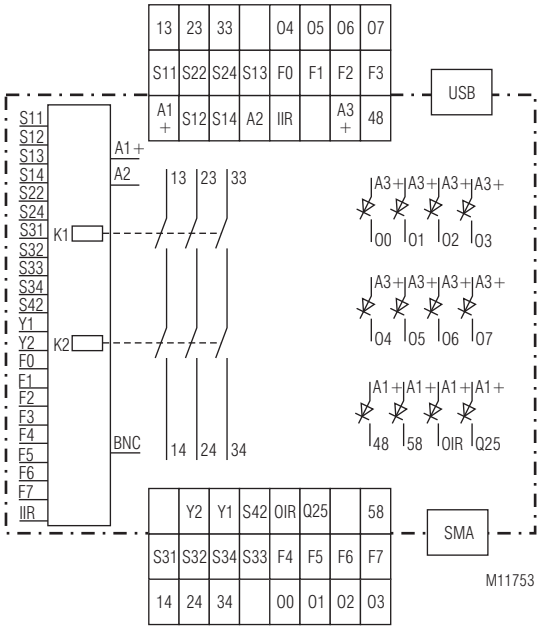
Features
- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61508 and IEC/EN 61511**
- Machine directive 2006/42/EG
- DIN EN 574: Safety of machinery - Two-hand control devices -
- DIN EN 300 220: Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices (SRD) - Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW
- Depending on the operating mode, to connect:
  - E-stop push-button (2-channel), safety gate, LC (non-contact safety system, for example light curtain) of the type 4 in accordance with EN 61 496 or the two-hand type IIIA in accordance with DIN EN 574.
  - 1 start button
  - Changeover switch (2-channel) to indicate radio use in the Safety operation with optional radio control operating mode
- For two-way communication via radio:
  - Safety shut-down commands
  - Signals from 8 non-safety-relevant DC 24 V inputs at 8 non-safety-relevant DC 24 V semiconductor outputs
- Broken wire and short circuit monitoring function with error indication
- Semiconductor output to indicate poor or missing radio control
- 2 semiconductor outputs for status indication
- LEDs to indicate
  - status of module
  - status of all inputs and outputs
  - the radio transmission and its quality
- Width: 45 mm

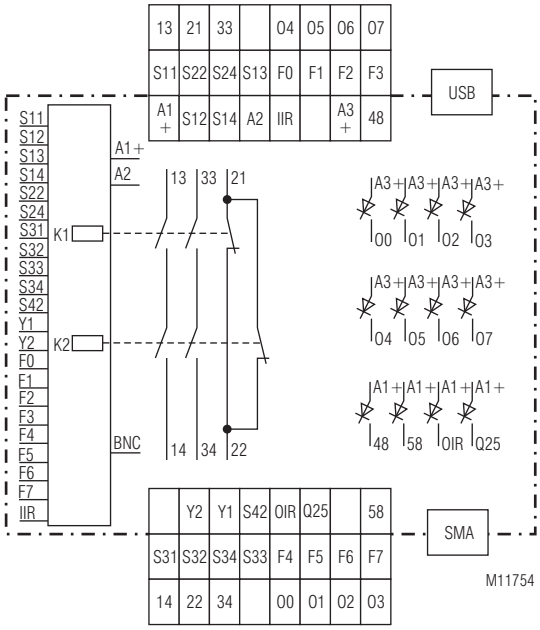
Approvals and Markings

Functions

Each UH 6900 radio controlled safety module is installed in a switch cabinet or on a mobile device and is operated with a plug-in or external antenna. It detects the signals of up to three wired safety elements plus the signals from the related second active radio controlled safety module that are sent through a safe radio transmission. Safety-relevant switching commands are switched by relay outputs, non-safety-relevant control signals through semiconductor outputs.
In addition, a non-contact sender and a non-contact receiver (for example, light curtain or infrared sender and receiver) may be connected to force the system to start from a specific location via radio.

Circuit Diagrams





Connection Terminals

Terminal designation	Signal description
A1+	DC 24 V supply voltage for radio controlled safety module
A2	Common earth
48/58	Non-safety DC 24 V semiconductor outputs: State of radio controlled safety module
S11, S31	Test outputs for short circuit detection of the safety inputs Sx2
S13, S33	Test outputs for short circuit detection of the safety inputs Sx4
S12, S14	Inputs of the two-channel safety input 1
S22, S24	Inputs of the two-channel safety input 2
S32, S34	Inputs of the two-channel safety input 3
S42	Input for hard-wired start button
Y1/Y2	Input for feedback loop of external contact reinforcement
13/14	1st safety output, safety NO contact
23/24 or 21/22	2nd safety output, safety NO contact monitoring output (NC contact)
33/34	3rd safety output, safety NO contact
IIR	Input for enabling the received start signal
OIR	Output with image of sent start signal
Q25	Output for input signal quality < -80 dBm
F0 to F7	Non-safety function inputs
O0 to O7	Non-safety DC 24 V function outputs
A3+	DC 24 V power supply of the function outputs O0 to O7

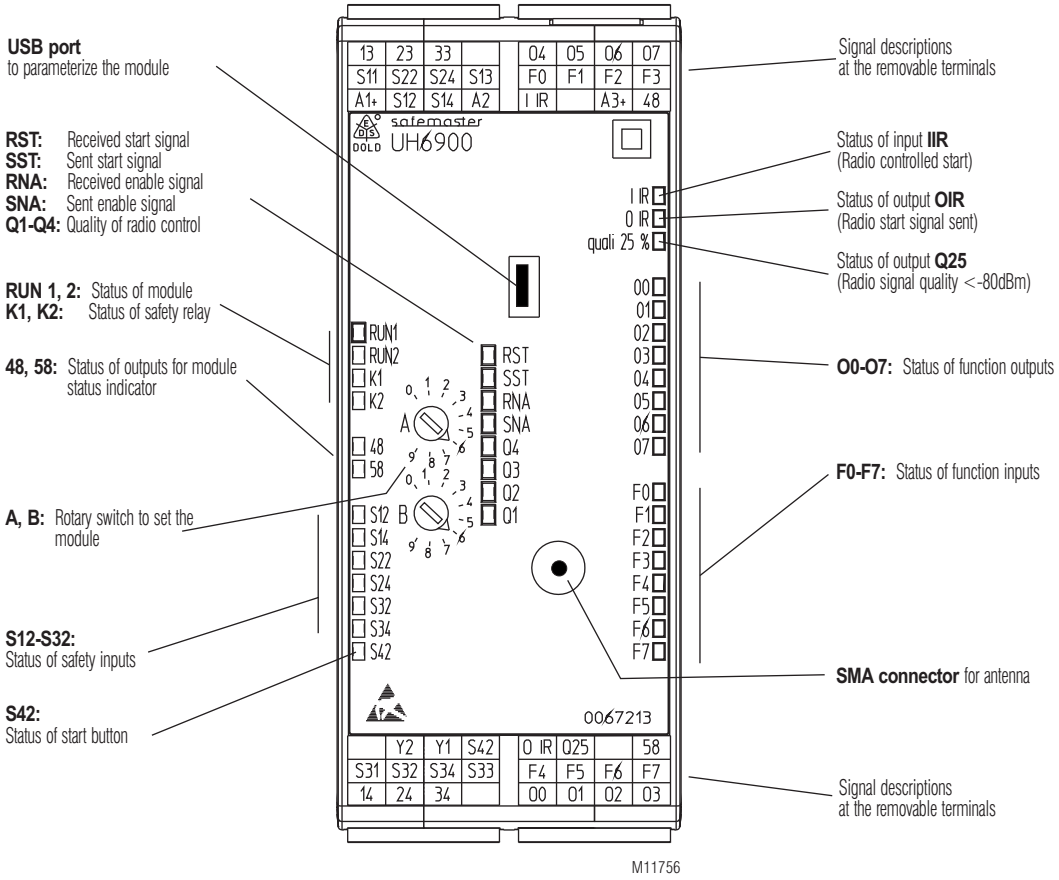
Inputs and Outputs

Inputs

- 3 two-channel safety inputs DC 24 V
- 1 DC 24 V input for start button
- 1 feedback circuit to monitor external relays
- 1 DC 24 V input that can be used as start signal in addition to the start signal received via radio
- 8 non-safety-relevant DC 24 V functional inputs, the status of which is sent to the opposite side

Outputs

- 3 safety-relevant NO contacts or 2 safety-relevant NO contacts + 1 NC contact
  (can only be used as an indicator contact)
- 1 DC 24 V semiconductor output that reproduces the start signal sent via radio as an additional start signal for the release of the safety relay on the opposite side
- 8 non-safety-relevant DC 24 V semiconductor outputs that are controlled by the opposite side
- 2 DC 24 V semiconductor outputs to display the status of the radio-controlled safety module
- 1 non-safety-relevant DC 24 V semiconductor output to indicate poor or missing radio control


USB port
to parameterize the module
RST: Received start signal
SST: Sent start signal
RNA: Received enable signal
SNA: Sent enable signal
Q1-Q4: Quality of radio control
RUN 1, 2: Status of module
K1, K2: Status of safety relay
48, 58: Status of outputs for module status indicator
A, B: Rotary switch to set the module
S12-S32: Status of safety inputs
S42: Status of start button
Signal descriptions at the removable terminals
Status of input IIR (Radio controlled start)
Status of output OIR (Radio start signal sent)
Status of output Q25 (Radio signal quality <-80dBm)
O0-O7: Status of function outputs
F0-F7: Status of function inputs
SMA connector for antenna
Signal descriptions at the removable terminals
safemaster
UH6900
0067213
M11756

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, ifrequency modulated (FM)
Frequencies:	64 channels in the 433 MHz frequency band 12 channels in the 869 MHz frequency band
Frequency range (without licence):	433.1000 ... 434.6750 MHz in the 433 MHz frequency band 869.7125 ... 869.9875 MHz in the 869 MHz frequency band
Max. HF transmitter power:	10 dBm (10 mW) in the 433 MHz frequency band 7 dBm (5 mW) in the 869 MHz frequency band integrated aerial
Min. HF transmitter power:	-40 dBm (0,0001 mW)
Distance:	up to 800 m in open area *)
Aerial:	1/2 aerial, impedance 50 Ω, plug in as accessory
Sensitivity:	< -100 dBm

*) The distance can vary with the ambient conditions of the remote control and the receiver aerial (roof construction, metal walls etc.)

Power supply

Nominal voltage U_N:	DC 24 V
Voltage range	
at max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	3.6 W (semiconductor outputs not connected)
Control voltage on S11, S13, S31, S33:	approx. DC 23 V pulses, mean value approx. 7 V at U_N
Control voltage on 48, 58, OIR, Q25, O0, O1, O2, O3, O4, O5, O6, O7:	approx. DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, IIR, F0, F1, F2, F3, F4, F5, F6, F7:	each approx. 4 mA at U_N
Min. voltage for active signals on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 12 V
Max. voltage for inactive signal on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 4 V
Max. input voltage on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 30 V
Fusing:	Internal with PTC
Max. time differece between input signals of one fuction	
E-stop, Light curtains, Gates:	3 s
Two-hand:	500 ms

Safety output

Contacts

UH 6900.03:	3 NO contacts
UH 6900.22:	2 NO contacts, 1 NC contact

The NO contacts are safety contacts.
The NC contact can only be used as indicator contact!!

Contact type:	Relais, forcibly guided
Operating time typ. at U_N:	
Ready for start after power is turned on:	max. 2,5 s
automatic start:	no operating mode with automatic start
Operating modes	
Full safety operation	
Manual Start:	max. 1 s [1]
automatic restart:	max. 1,1 s [1]
Cross-operation	
Manual Start:	max. 650 ms [1]
automatic restart:	max. 650 ms [1]
Safety operation with optional radio control S32, S34 supplied with power:	
Manual Start:	max. 70 ms
automatic restart:	max. 80 ms
S32, S34 not supplied with power:	
Reset through S42 (after reset on control device):	max. 70 ms
Reset through S42 on control device:	max. 700 ms[1]
Reset through auto start on control device:	max. 700 ms[1]

[1] For the start options with additional detection of the IIR input, the delay time of the safety element connected to this input must be added to the pick-up times

Switching off time (reaction time)	
S12-S14, S22-S24, S32-S34:	max. 30 ms
Disconnection with active radio signal (S12-S14, S22-S24, S32-S34 of 2nd device):	max. 200 ms
Passive disconnection because of interrupted radio signal:	max. 500 ms
Nominal output voltage:	max. AC 250 V DC: see limit curve for arc-free operation
Switching of low loads	
Min. switching voltage:	> 5 V
Min. switching current:	> 5 mA
Min. switching capacity:	> 25 mW
Thermal current I_{th}:	max. 5 A per contact see quadratic total current limit curve
Switching capacity	
to AC 15:	
NO contacts:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles
Permissible switching frequency:	max. 1 200 switching cycles / h
Short circuit strength	
max. fuse rating:	6 A gG / gL IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles

Technical Data

Semiconductor outputs

Outputs (terminals 48, 58, O0 bis O7, OIR, Q25):	transistor outputs, switching +
Nominal output voltage (A3+):	DC 24 V
Nom. output voltage at U_N:	min. DC 23 V, max. 100 mA cont. current max. 400 mA für 0.5 s internal short circuit,over temperature and overload protection. For inductive loads, arrange the necessary safety measures
Min. operating current:	min. 1 mA
Residual current:	min. 0.1 mA

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 55 °C	
Storage:	- 40 ... + 80 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impuls voltage / pollution degree:		
circuit / contact:	6 kV / 2	IEC 60 664-1
contact / contact:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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
Enclosure:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Test Fc EN 60068-2-6 Amplitude, constant 0,075 mm; 10 ... 57 Hz Acceleration, constant 1 g; 57 ... 150 Hz	
Shock proof:	Test Ea EN 60068-2-27	
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks each polarity and each axes:	1000	
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	captive slotted screw or cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	380 g	

Dimensions

Width x height x depth:	45 x 107 x 121 mm

Standard Type

UH 6900.03PS / 00MF0 DC 24 V

Article number:	0067213
• Output:	3 NO contacts
• Nominal voltage U_N:	DC 24 V
• Frequency band:	433 MHz
• Width:	45 mm

Ordering Example

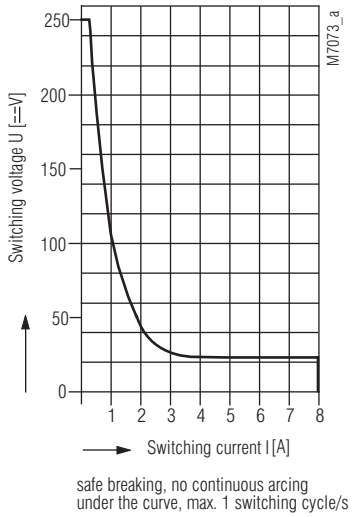
UH 6900 . _ _ _ _ / 0 0 M F 0 DC 24 V

- DC 24 V: Nominal voltage
- 0: Frequency band
  - 0: 433 MHz (Standard)
  - 1: 869 MHz
- M: Software version
- F: 0: Standard version
- 0: Type of terminals
  - PC (plugin cageclamp): removable terminal blocks, with cageclamp
  - PS (plugin screw): removable terminal blocks, with screw terminals
  - PT (plugin TWIN cageclamp): removable terminal blocks, with TWIN cage clamp
- _ _: Contacts
- UH 6900 . _ _ _ _ / 0 0 M F 0: Type

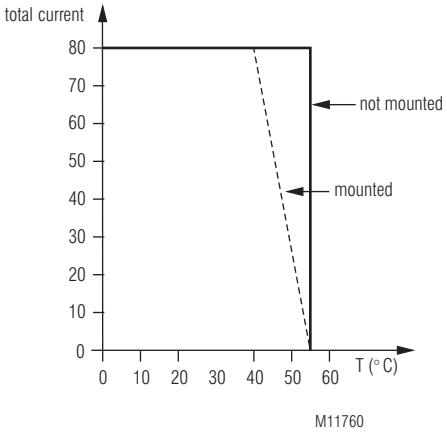
Maintenance and Repairs

- 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

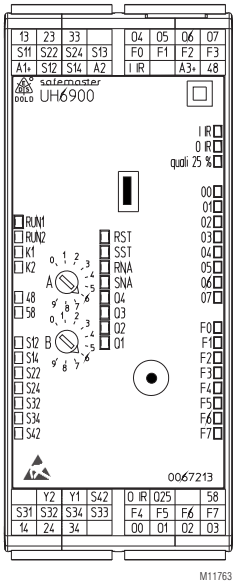
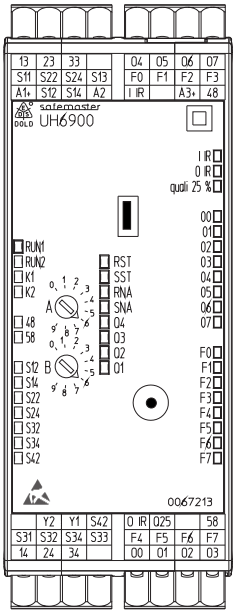
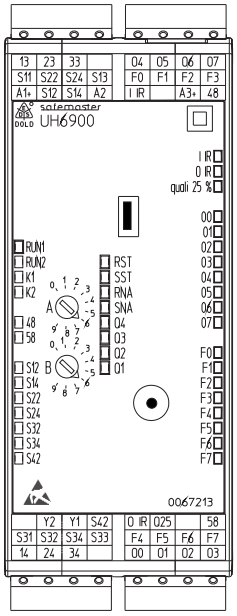
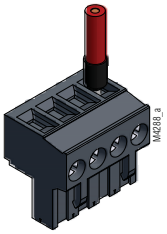
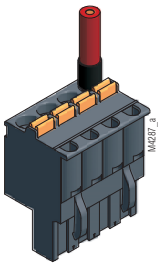
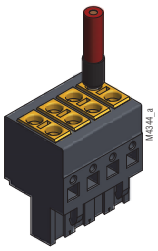
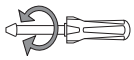
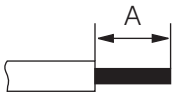
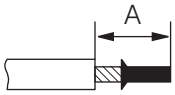
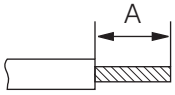


Arc limit curve under resistive load

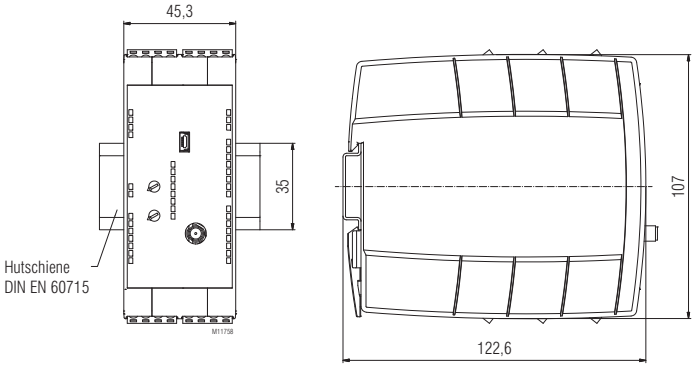


Quadratic total current limit curve

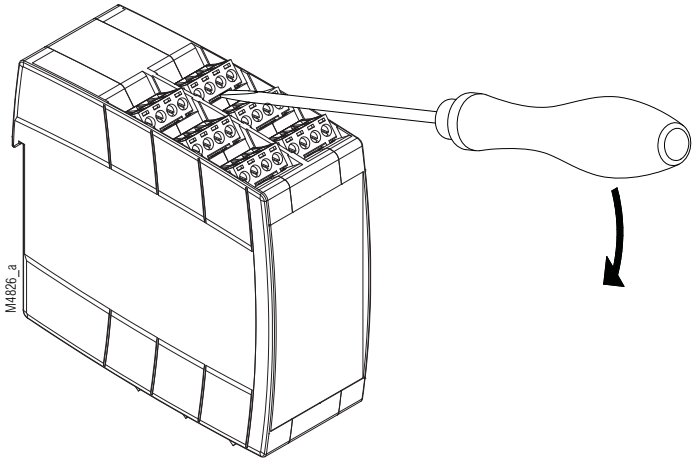
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M11763	 M11764	 M11765
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT -terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	187,6	a (year)
DC_{avg}:	97,6	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

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:	97,6	%
PFH_D:	3,6E-10	h^{-1}
PFD_{avg}:	1,2E-4	Low Demand Mode
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 61511	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER W Wireless Safety System
Radio Controlled Safety Module (Group Controller)
UH 6900

0276282

Product Description

The radio controlled safety module UH 6900 in group mode is an innovative wireless safety system to protect man and machine. A feature of the wireless safety system is its safety-oriented uni-directional radio transmission for transmitting signals between one wireless safety module as group control device and one ore more group receivers so that the two separate safety devices, each of them installed on a different machine part that is not connected to the other by wires (for example, moving machine parts), work together as one system.

Therefore SAFEMASTER W radio controlled safety modules are intended for the wireless remote control of machines and plant parts that used to be controlled by cable. Their usage is only restricted by valid safety instructions that prohibit, for example, staying under suspended loads.

The radio controlled safety module UH 6900 group controller always works together with one or more UH 6900 group receivers actuating their safety related output contactsvia an uni-directional radio connection. The loacal output contacts of the group controller must not be used as safety contacts.They are only used for monitoring purposes.

Typical applications are:
- Hazard areas where protective equipment is necessary for the safety of persons but where wiring is impossible or not reasonable, for example in applications with extremely wide-spread, extensive hazard zones;
- Mobile and stationary plants and equipment, for example large machi nes, assembly halls and scaffolds, conveyor belts, high-rack warehouses, warehouses, forklifts, etc.
- The radio transmission range is up to 800 m

Notes

Before installing, operating or maintaining this device, the user manual must be carefully read an understood on the enclosed CD.

Please note: Validation according to DIN EN ISO 13849-2 is always required for the complete system

Your Advantages
- Higher safety in dangerous areas
- More efficiency and economy by wireless communication
- Compact, easy to install devices
- DIN rail mounting
- Removable terminal blocks
- Adjustable functions via rotary switch:
  - Cross-operation with different start modes (two-hand type IIIA and/or manual start, auto start)
- Valid for all operating modes:
  - Start function via radio with or without detection of an additional start signal at the IIR input.
- Frequency range 433 MHz or 869 MHz (license-free radio frequencies)
- Radio channel, transmitter power, and module name can be set by means of a parameterization software
- Status indicator for the devices connected via radio, by means of the parameterization software including status of radio transmission quality

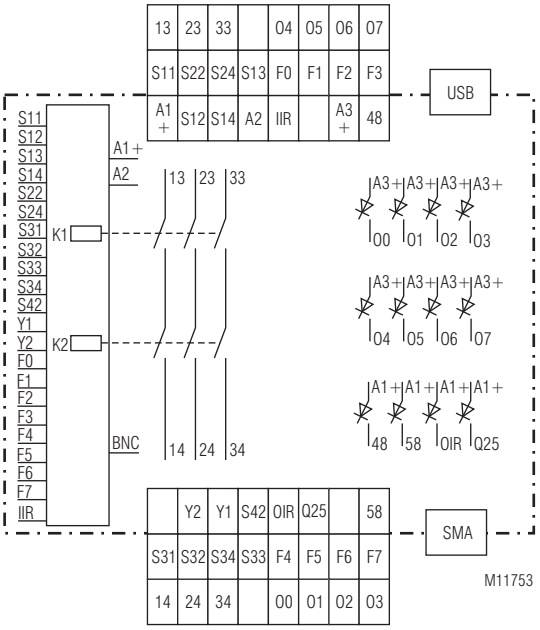
Features
- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61508 and IEC/EN 61511**
- Machine directive 2006/42/EG
- DIN EN 574: Safety of machinery - Two-hand control devices -
- DIN EN 300 220: Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices (SRD) - Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW
- Depending on the operating mode, to connect:
  - E-stop push-button (2-channel), safety gate, LC (non-contact safety system, for example light curtain) of the type 4 in accordance with EN 61 496 or the two-hand type IIIA in accordance with DIN EN 574.
  - 1 start button
  - Changeover switch (2-channel) to indicate radio use in the Safety operation with optional radio control operating mode
- For transmission via radio:
  - Safety shut-down commands
- For two-way communication via radio:
  - Signals from 8 non-safety-relevant DC 24 V inputs at 8 non-safety-relevant DC 24 V semiconductor outputs
- Broken wire and short circuit monitoring function with error indication
- Semiconductor output to indicate poor or missing radio control
- 2 semiconductor outputs for status indication
- LEDs to indicate
  - status of module
  - status of all inputs and outputs
  - the radio transmission and its quality
- Width: 45 mm

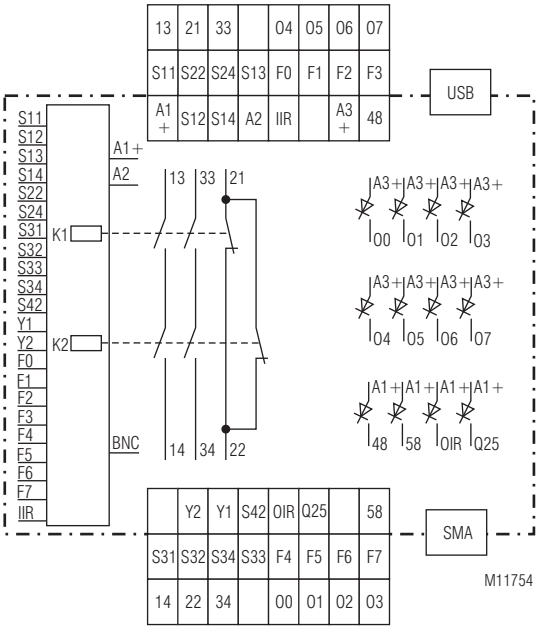
Approvals and Markings

Functions

Each UH 6900 radio controlled safety module is installed in a switch cabinet or on a mobile device and is operated with a plug-in or external antenna. It monitors the signals of up to 3 safety sensors and transmits safety related control signals via radio to the corresponding group receivers. Non- safe monitoring signals can be received via radio and switch relay or transistor outputs.
In addition, a non-contact sender and a non-contact receiver (for example, light curtain or infrared sender and receiver) may be connected to force the system to start from a specific location via radio.

Circuit Diagrams





Connection Terminals

Terminal designation	Signal description
A1+	DC 24 V supply voltage for radio controlled safety module
A2	Common earth
48/58	Non-safety DC 24 V semiconductor outputs: State of radio controlled safety module
S11, S31	Test outputs for short circuit detection of the safety inputs Sx2
S13, S33	Test outputs for short circuit detection of the safety inputs Sx4
S12, S14	Inputs of the two-channel safety input 1
S22, S24	Inputs of the two-channel safety input 2
S32, S34	Inputs of the two-channel safety input 3
S42	Input for hard-wired start button
Y1/Y2	Input for feedback loop of external contact reinforcement
13/14	1st safety output, safety NO contact
23/24 or 21/22	2nd safety output, safety NO contact monitoring output (NC contact)
33/34	3rd safety output, safety NO contact
IIR	Input for enabling the received start signal
OIR	Output with image of sent start signal
Q25	Output for input signal quality < -80 dBm
F0 to F7	Non-safety function inputs
O0 to O7	Non-safety DC 24 V function outputs
A3+	DC 24 V power supply of the function outputs O0 to O7

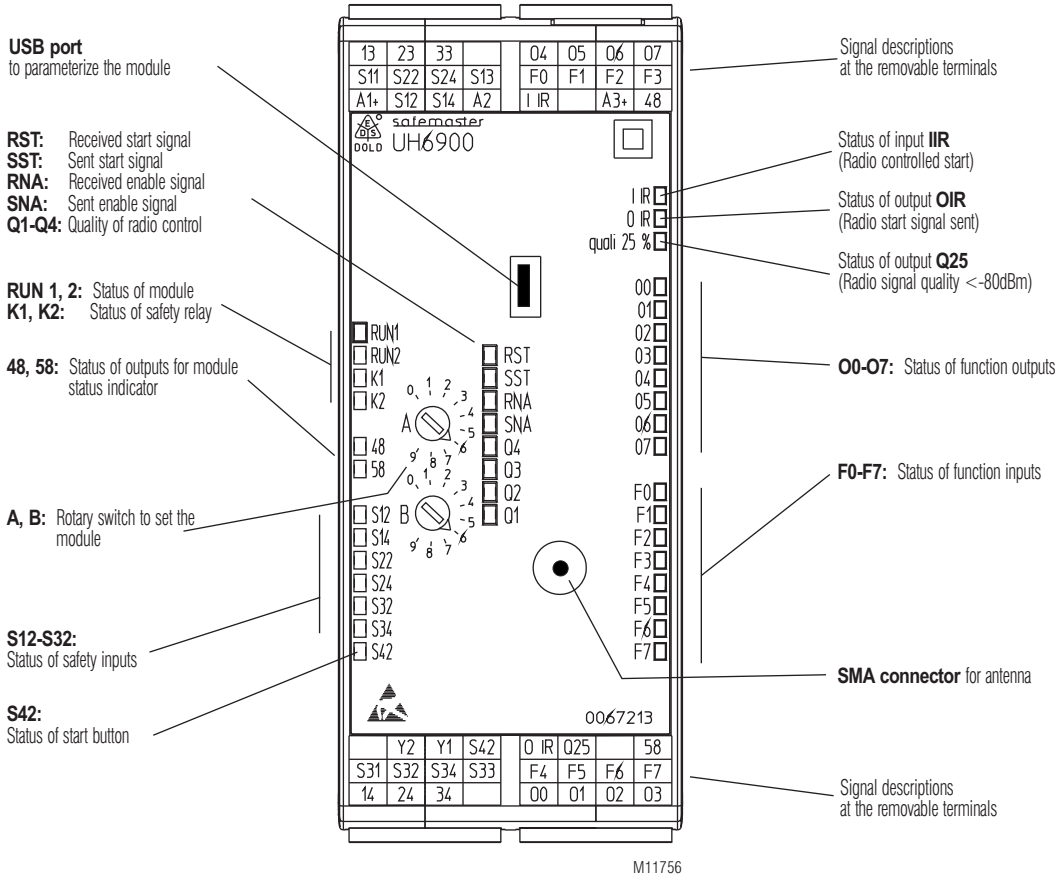
Inputs and Outputs

Inputs

- 3 two-channel safety inputs DC 24 V
- 1 DC 24 V input for start button
- 1 feedback circuit to monitor external relays
- 1 DC 24 V input that can be used as start signal in addition to the start signal received via radio
- 8 non-safety-relevant DC 24 V functional inputs, the status of which is sent to the opposite side

Outputs

- 3 NO contacts or 2 NO contacts + 1 NC contact (can only be used as indicator contacts)
- 1 DC 24 V semiconductor output that reproduces the start signal sent via radio as an additional start signal for the release of the safety relay on the opposite side
- 8 non-safety-relevant DC 24 V semiconductor outputs that are controlled by the opposite side
- 2 DC 24 V semiconductor outputs to display the status of the radio-controlled safety module
- 1 non-safety-relevant DC 24 V semiconductor output to indicate poor or missing radio control


USB port
to parameterize the module
RST: Received start signal
SST: Sent start signal
RNA: Received enable signal
SNA: Sent enable signal
Q1-Q4: Quality of radio control
RUN 1, 2: Status of module
K1, K2: Status of safety relay
48, 58: Status of outputs for module status indicator
A, B: Rotary switch to set the module
S12-S32: Status of safety inputs
S42: Status of start button
Signal descriptions at the removable terminals
Status of input IIR (Radio controlled start)
Status of output OIR (Radio start signal sent)
Status of output Q25 (Radio signal quality <-80dBm)
O0-O7: Status of function outputs
F0-F7: Status of function inputs
SMA connector for antenna
Signal descriptions at the removable terminals
safemaster
UH6900
0067213
M11756

Technical Data

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, ifrequency modulated (FM)
Frequencies:	64 channels in the 433 MHz frequency band 12 channels in the 869 MHz frequency band
Frequency range (without licence):	433.1000 ... 434.6750 MHz in the 433 MHz frequency band 869.7125 ... 869.9875 MHz in the 869 MHz frequency band
Max. HF transmitter power:	10 dBm (10 mW) in the 433 MHz frequency band 7 dBm (5 mW) in the 869 MHz frequency band integrated aerial
Min. HF transmitter power:	-40 dBm (0,0001 mW)
Distance:	up to 800 m in open area*)
Aerial:	1/2 aerial, impedance 50 Ω, plug in as accessory
Sensitivity:	< -100 dBm

*) The distance can vary with the ambient conditions of the remote control and the receiver aerial (roof construction, metal walls etc.)

Power supply

Nominal voltage U_N:	DC 24 V
Voltage range	
at max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	3.6 W (Semiconductor outputs not connected)
Control voltage on S11, S13, S31, S33:	approx. DC 23 V pulses, mean value approx. 7 V at U_N
Control voltage on 48, 58, OIR, Q25, O0, O1, O2, O3, O4, O5, O6, O7:	approx. DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, IIR, F0, F1, F2, F3, F4, F5, F6, F7:	each approx. 4 mA at U_N
Min. voltage for active signals on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 12 V
Max. voltage for inactive signal on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 4 V
Max. input voltage on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 30 V
Fusing:	Internal with PTC
Max. time differece between input signals of one fuction	
E-stop, Light curtains, Gates:	3 s
Two-hand:	500 ms

Technical Data

Safety output

Contacts

UH 6900.03:	3 NO contacts
UH 6900.22:	2 NO contacts, 1 NC contact

The NO contacts are non safety contacts (only indicator contacts).
The NC contact can only be used as indicator contact!!

Contact type:	Relais, forcibly guided
Operating time typ. at U_N:	
Ready for start after power is turned on:	max. 2,5 s
automatic start:	no operating mode with automatic start
Operating modes	
Full safety operation	
Manual Start:	max. 1 s 1)
automatic restart:	max. 1,1 s 1)
Cross-operation	
Manual Start:	max. 650 ms 1)
automatic restart:	max. 650 ms 1)
Safety operation with optional radio control S32, S34 supplied with power:	
Manual Start:	max. 70 ms
automatic restart:	max. 80 ms
S32, S34 not supplied with power:	
Reset through S42 (after reset on control device):	max. 70 ms
Reset through S42 on control device:	max. 700 ms1)
Reset through auto start on control device:	max. 700 ms1)

1) For the start options with additional detection of the IIR input, the delay time of the safety element connected to this input must be added to the pick-up times

Switching off time (reaction time)	
S12-S14, S22-S24, S32-S34:	max. 30 ms
Disconnection with active radio signal (S12-S14, S22-S24, S32-S34 of 2nd device):	max. 200 ms
Passive disconnection because of interrupted radio signal:	max. 500 ms
Nominal output voltage:	max. AC 250 V DC: see limit curve for arc-free operation
Switching of low loads	
Min. switching voltage:	> 5 V
Min. switching current:	> 5 mA
Min. switching capacity:	> 25 mW
Thermal current I_{th}:	max. 5 A per contact see quadratic total current limit curve

Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	
Permissible switching frequency:	max. 1 200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

Technical Data

Semiconductor outputs

Outputs (terminals 48, 58, O0 bis O7, OIR, Q25):	transistor outputs, switching +
Nominal output voltage (A3+):	DC 24 V
Nom. output voltage at U_N:	min. DC 23 V, max. 100 mA cont. current max. 400 mA für 0.5 s internal short circuit,over temperature and overload protection. For inductive loads, arrange the necessary safety measures
Min. operating current:	min. 1 mA
Residual current:	min. 0.1 mA

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 55 °C	
Storage:	- 40 ... + 80 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impuls voltage / pollution degree:		
circuit / contact:	6 kV / 2	IEC 60 664-1
contact / contact:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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
Enclosure:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Test Fc EN 60068-2-6 Amplitude, constant 0,075 mm; 10 ... 57 Hz Acceleration, constant 1g; 57 ... 150 Hz	
Shock proof:	Test Ea EN 60068-2-27	
Acceleration:	10g	
Impulse length:	16 ms	
Number of shocks each polarity and each axes:	1000	
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	captive slotted screw or cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	380 g	

Dimensions

Width x height x depth:	45 x 107 x 121 mm

Standard Type

UH 6900.03PS / 00GC 0 DC 24 V

Article number:	0067955
• Output:	3 NO contacts
• Nominal voltage U_N:	DC 24 V
• Frequency band:	433 MHz
• Width:	45 mm

Ordering Example

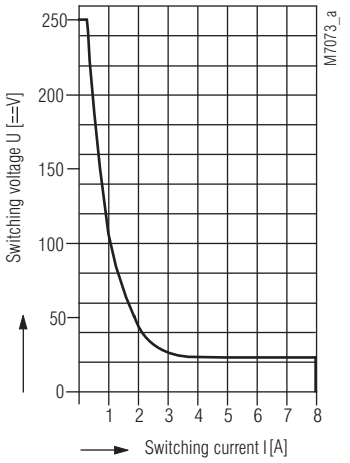
UH 6900 . _ _ _ _ / 0 0 GC 0 DC 24 V

- DC 24 V: Nominal voltage
- 0: Frequency band
  - 0: 433 ... 434 MHz (Standard)
  - 1: 869 MHz
- GC: Group Controller
- 0: Software version
  - 0: Standard version
- Type of terminals
  - PC (plugin cageclamp): removable terminal blocks, with cageclamp
  - PS (plugin screw): removable terminal blocks, with screw terminals
  - PT (plugin TWIN cageclamp): removable terminal blocks, with TWIN cage clamp
- Contacts
- Type

Maintenance and Repairs

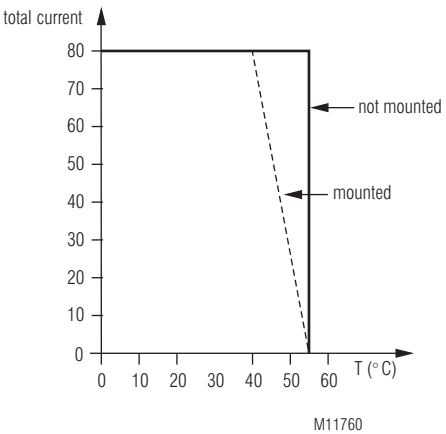
- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



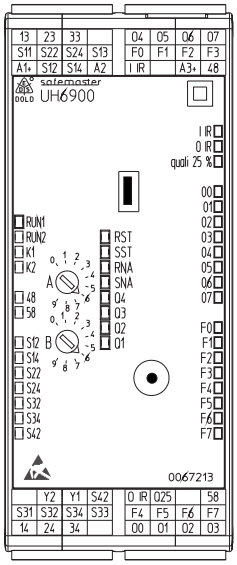
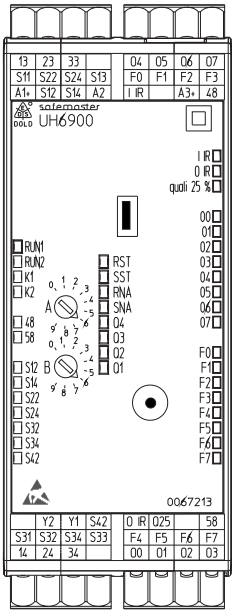
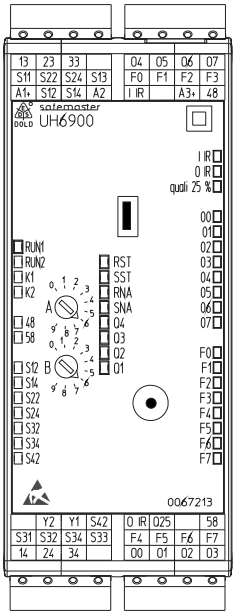
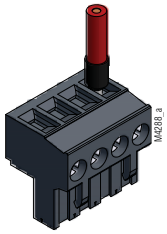
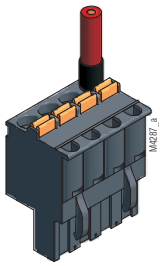
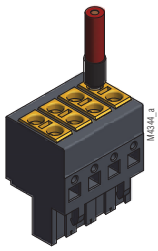
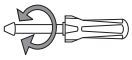
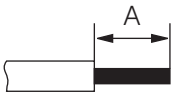
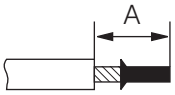
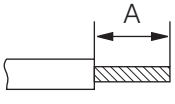
safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Arc limit curve under resistive load

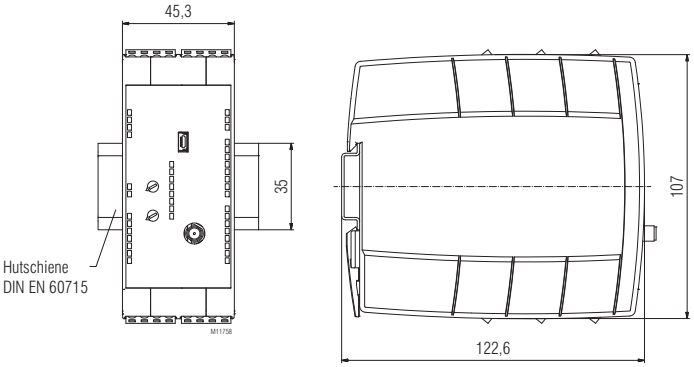


Quadratic total current limit curve

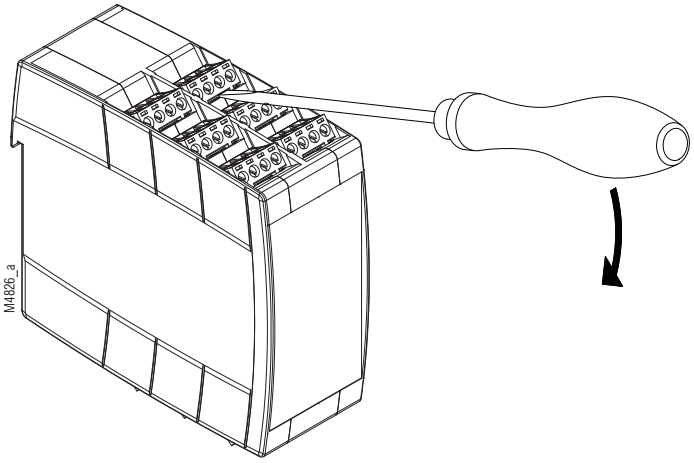
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M11763	 M11764	 M11765
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT -terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	187,6	a (year)
DC_{avg}:	97,6	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

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:	97,6	%
PFH_D:	3,6E-10	h^{-1}
PFD_{avg}:	1,2E-4	Low Demand Mode
T_1:	20	a (year)
*) HFT = Hardware-Fehlertoleranz Hardware failure tolerance Tolérance défauts Hardware		

Anforderung seitens der Sicherheits-funktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 61511	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER W Wireless Safety System
Radio Controlled Safety Module (Group Receiver)
UH 6900

Product Description

The radio controlled safety module UH 6900 in group mode is an innovative wireless safety system to protect man and machine. A feature of the wireless safety system is its safety-oriented uni-directional radio transmission for transmitting signals between one wireless safety module as group control device and one ore more group receivers so that the two separate safety devices, each of them installed on a different machine part that is not connected to the other by wires (for example, moving machine parts), work together as one system.

Therefore SAFEMASTER W radio controlled safety modules are intended for the wireless remote control of machines and plant parts that used to be controlled by cable. Their usage is only restricted by valid safety instructions that prohibit, for example, staying under suspended loads.

The radio controlled safety module UH 6900 group receiver always works together with a UH 6900 group control device. The safety related output contacts are either controlled via radio from the group controller or by local e-stop systems.

Typical applications are:
- Hazard areas where protective equipment is necessary for the safety of persons but where wiring is impossible or not reasonable, for example in applications with extremely wide-spread, extensive hazard zones;
- Mobile and stationary plants and equipment, for example large machi nes, assembly halls and scaffolds, conveyor belts, high-rack warehouses, warehouses, forklifts, etc.
- The radio transmission range is up to 800 m

Notes

Before installing, operating or maintaining this device, the user manual must be carefully read an understood on the enclosed CD.

Please note: Validation according to DIN EN ISO 13849-2 is always required for the complete system

Your Advantages
- Higher safety in dangerous areas
- More efficiency and economy by wireless communication
- Compact, easy to install devices
- DIN rail mounting
- Removable terminal blocks
- Adjustable functions via rotary switch:
  - Cross-operation with different start modes (two-hand type IIIA and/or manual start, auto start)
- Valid for all operating modes:
  - Start function via radio with or without detection of an additional start signal at the IIR input.
- Frequency range 433 MHz or 869 MHz (license-free radio frequencies)
- Radio channel, transmitter power, and module name can be set by means of a parameterization software
- Status indicator for the devices connected via radio, by means of the parameterization software including status of radio transmission quality

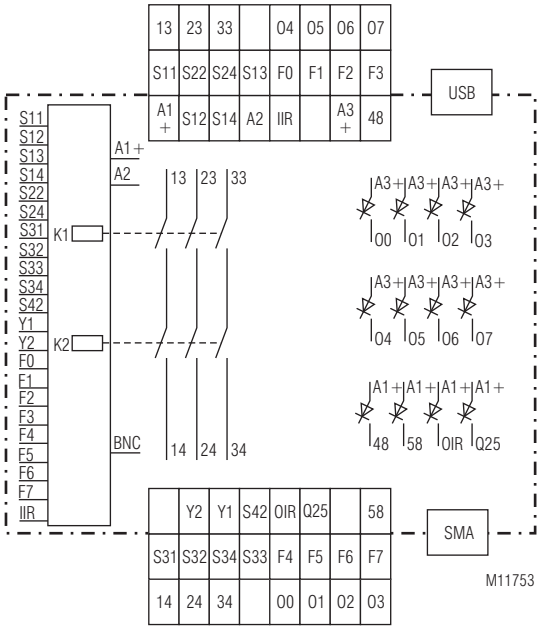
Features
- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61508 and IEC/EN 61511**
- Machine directive 2006/42/EG
- DIN EN 574: Safety of machinery - Two-hand control devices -
- DIN EN 300 220: Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices (SRD) - Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW
- Depending on the operating mode, to connect:
  - E-stop push-button (2-channel), safety gate, LC (non-contact safety system, for example light curtain) of the type 4 in accordance with EN 61 496 or the two-hand type IIIA in accordance with DIN EN 574.
  - 1 start button
  - Changeover switch (2-channel) to indicate radio use in the Safety operation with optional radio control operating mode
- For receiving via radio:
  - Safety shut-down commands
- For two-way communication via radio:
  - Signals from 8 non-safety-relevant DC 24 V inputs at 8 non-safety-relevant DC 24 V semiconductor outputs
- Broken wire and short circuit monitoring function with error indication
- Semiconductor output to indicate poor or missing radio control
- 2 semiconductor outputs for status indication
- LEDs to indicate
  - status of module
  - status of all inputs and outputs
  - the radio transmission and its quality
- Width: 45 mm

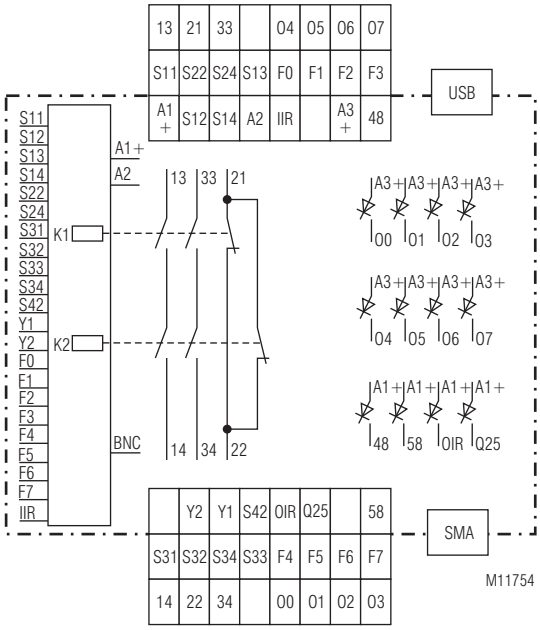
Approvals and Markings

Functions

Each UH 6900 radio controlled safety module is installed in a switch cabinet or on a mobile device and is operated with a plug-in or external antenna. It detects the signals of up to three wired safety elements plus the signals from the related active group controller that are sent through a safe radio transmission. Safety-relevant switching commands are switched by relay outputs, non-safety-relevant control signals through semiconductor outputs.
In addition, a non-contact sender and a non-contact receiver (for example, light curtain or infrared sender and receiver) may be connected to force the system to start from a specific location via radio.

Circuit Diagrams





Connection Terminals

Terminal designation	Signal description
A1+	DC 24 V supply voltage for radio controlled safety module
A2	Common earth
48/58	Non-safety DC 24 V semiconductor outputs: State of radio controlled safety module
S11, S31	Test outputs for short circuit detection of the safety inputs Sx2
S13, S33	Test outputs for short circuit detection of the safety inputs Sx4
S12, S14	Inputs of the two-channel safety input 1
S22, S24	Inputs of the two-channel safety input 2
S32, S34	Inputs of the two-channel safety input 3
S42	Input for hard-wired start button
Y1/Y2	Input for feedback loop of external contact reinforcement
13/14	1st safety output, safety NO contact
23/24 or 21/22	2nd safety output, safety NO contact monitoring output (NC contact)
33/34	3rd safety output, safety NO contact
IIR	Input for enabling the received start signal
OIR	Output with image of sent start signal
Q25	Output for input signal quality < -80 dBm
F0 to F7	Non-safety function inputs
O0 to O7	Non-safety DC 24 V function outputs
A3+	DC 24 V power supply of the function outputs O0 to O7

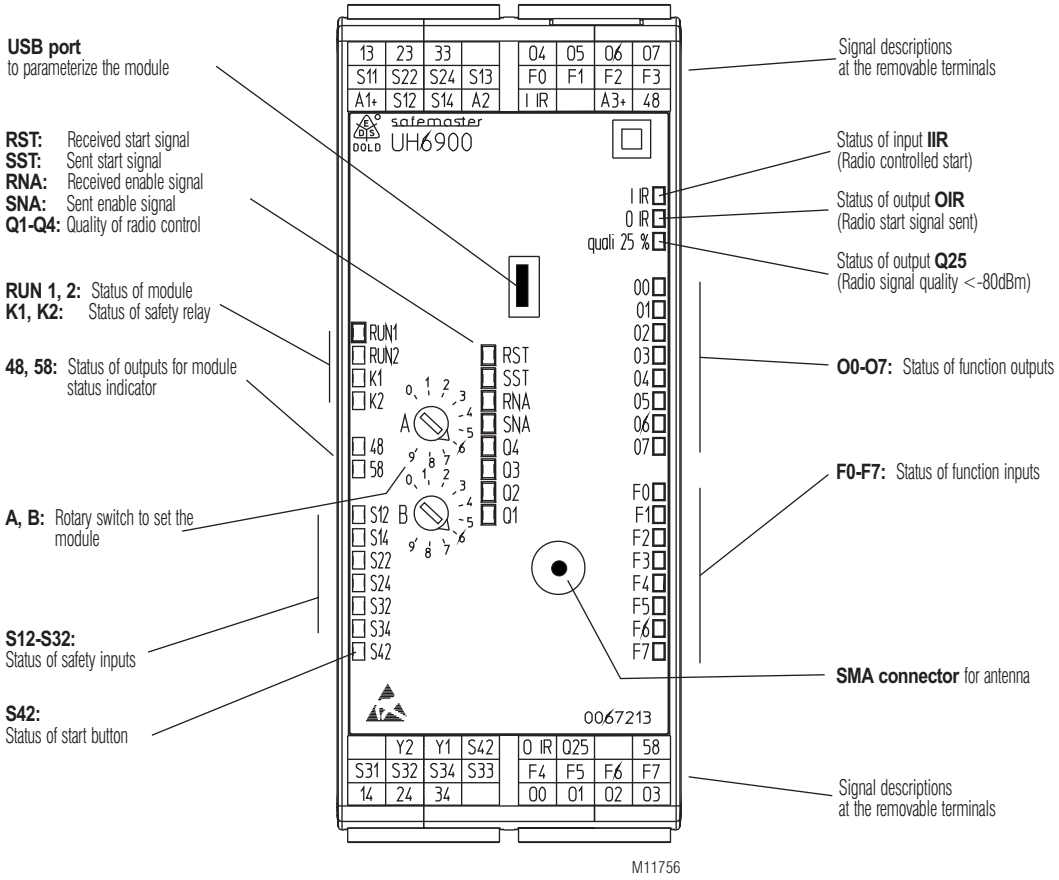
Inputs and Outputs

Inputs

- 3 two-channel safety inputs DC 24 V
- 1 DC 24 V input for start button
- 1 feedback circuit to monitor external relays
- 1 DC 24 V input that can be used as start signal in addition to the start signal received via radio
- 8 non-safety-relevant DC 24 V functional inputs, the status of which is sent to the opposite side

Outputs

- 3 safety-relevant NO contacts or 2 safety-relevant NO contacts + 1 NC contact (can only be used as an indicator contact)
- 1 DC 24 V semiconductor output that reproduces the start signal sent via radio as an additional start signal for the release of the safety relay on the opposite side
- 8 non-safety-relevant DC 24 V semiconductor outputs that are controlled by the opposite side
- 2 DC 24 V semiconductor outputs to display the status of the radio-controlled safety module
- 1 non-safety-relevant DC 24 V semiconductor output to indicate poor or missing radio control


USB port
to parameterize the module
RST: Received start signal
SST: Sent start signal
RNA: Received enable signal
SNA: Sent enable signal
Q1-Q4: Quality of radio control
RUN 1, 2: Status of module
K1, K2: Status of safety relay
48, 58: Status of outputs for module status indicator
A, B: Rotary switch to set the module
S12-S32: Status of safety inputs
S42: Status of start button
Signal descriptions at the removable terminals
Status of input IIR (Radio controlled start)
Status of output OIR (Radio start signal sent)
Status of output Q25 (Radio signal quality <-80dBm)
O0-O7: Status of function outputs
F0-F7: Status of function inputs
SMA connector for antenna
Signal descriptions at the removable terminals
safemaster
UH6900
0067213
M11756

Technical Data

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, ifrequency modulated (FM)
Frequencies:	64 channels in the 433 MHz frequency band 12 channels in the 869 MHz frequency band
Frequency range (without licence):	433.1000 ... 434.6750 MHz in the 433 MHz frequency band 869.7125 ... 869.9875 MHz in the 869 MHz frequency band
Max. HF transmitter power:	10 dBm (10 mW) in the 433 MHz frequency band 7 dBm (5 mW) in the 869 MHz frequency band integrated aerial
Min. HF transmitter power:	-40 dBm (0,0001 mW)
Distance:	up to 800 m in open area*)
Aerial:	1/2 aerial, impedance 50 Ω, plug in as accessory
Sensitivity:	< -100 dBm

*) The distance can vary with the ambient conditions of the remote control and the receiver aerial (roof construction, metal walls etc.)

Power supply

Nominal voltage U_N:	DC 24 V
Voltage range	
at max. 5% residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	3,6 W (Semiconductor outputs not connected)
Control voltage on S11, S13, S31, S33:	approx. DC 23 V pulses, mean value approx. 7 V at U_N
Control voltage on 48, 58, OIR, Q25, O0, O1, O2, O3, O4, O5, O6, O7:	approx. DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42, IIR, F0, F1, F2, F3, F4, F5, F6, F7:	each approx. 4 mA at U_N
min. voltage for active signals on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 12 V
Max. voltage for inactive signal an S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 4 V
Max. input oltage on S12, S14, S22, S24, S32, S34, S42, F0, F1, F2, F3, F4, F5, F6, F7:	DC 30 V
Fusing:	Internal with PTC
Max. time differece between input signals of one fuction	
E-stop, Light curtains, Gates:	3 s
Two-hand:	500 ms

Technical Data

Safety output

Contacts

UH 6900.03:	3 NO contacts
UH 6900.22:	2 NO contacts, 1 NC contact

The NO contacts are safety contacts.
The NC contact can only be used as indicator contact!!

Contact type:	Relais, forcibly guided
Operating time typ. at U_N:	
Ready for start after power is turned on:	max. 2,5 s
automatic start:	no operating mode with automatic start
Operating modes	
Full safety operation	
Manual Start:	max. 1 s [1)]
automatic restart:	max. 1,1 s [1)]
Cross-operation	
Manual Start:	max. 650 ms [1)]
automatic restart:	max. 650 ms [1)]
Safety operation with optional radio control S32, S34 supplied with power:	
Manual Start:	max. 70 ms
automatic restart:	max. 80 ms
S32, S34 not supplied with power:	
Reset through S42 (after reset on control device):	max. 70 ms
Reset through S42 on control device:	max. 700 ms[1)]
Reset through auto start on control device:	max. 700 ms[1)]

[1)] For the start options with additional detection of the IIR input, the delay time of the safety element connected to this input must be added to the pick-up times

Switching off time (reaction time)

S12-S14, S22-S24, S32-S34:	max. 30 ms
Disconnection with active radio signal (S12-S14, S22-S24, S32-S34 of 2nd device):	max. 200 ms
Passive disconnection because of interrupted radio signal:	max. 500 ms
Nominal output voltage:	max. AC 250 V DC: see limit curve for arc-free operation
Switching of low loads	
Min. switching voltage:	> 5 V
Min. switching current:	> 5 mA
Min. switching capacity:	> 25 mW
Thermal current I_{th}:	max. 5 A per contact see quadratic total current limit curve
Switching capacity	
to AC 15:	
NO contacts:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles
Permissible switching frequency:	max. 1 200 switching cycles / h
Short circuit strength	
max. fuse rating:	6 A gG / gL IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles

Technical Data

Semiconductor outputs

Outputs (terminals 48, 58, O0 bis O7, OIR, Q25):	transistor outputs, switching +
Nominal output voltage (A3+):	DC 24 V
Nom. output voltage at U_N:	min. DC 23 V, max. 100 mA cont. current max. 400 mA für 0.5 s internal short circuit,over temperature and overload protection. For inductive loads, arrange the necessary safety measures
Min. operating current:	min. 1 mA
Residual current:	min. 0.1 mA

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 55 °C	
Storage:	- 40 ... + 80 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impuls voltage / pollution degree:		
circuit / contact:	6 kV / 2	IEC 60 664-1
contact / contact:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
EMC	IEC/EN 61 326-3-1, IEC/EN 62 061	
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
Enclosure:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Test Fc EN 60068-2-6 Amplitude, constant 0,075 mm; 10 ... 57 Hz Acceleration, constant 1 g; 57 ... 150 Hz	
Shock proof:	Test Ea EN 60068-2-27	
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks each polarity and each axes:	1000	
Climate resistance:	25 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	captive slotted screw or cage clamp terminals	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	380 g	

Dimensions

Width x height x depth:	45 x 107 x 121 mm

Standard Type

UH 6900.03PS / 00GR 0 DC 24 V

Article number:	0067957
• Output:	3 NO contacts
• Nominal voltage U_N:	DC 24 V
• Frequency band:	433 MHz
• Width:	45 mm

Ordering Example

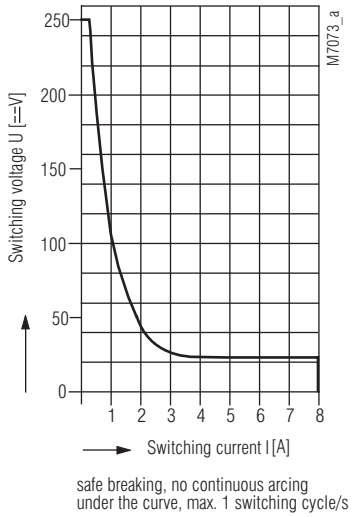
UH 6900 ._ _ _ _ /0 0 GR 0 DC 24 V

- DC 24 V: Nominal voltage
- 0: Frequency band
  - 0: 433 ... 434 MHz (Standard)
  - 1: 869 MHz
- GR: Group Receiver
- 0: Software version
  - 0: Standard version
- _ _: Type of terminals
  - PC (plugin cageclamp): removable terminal blocks, with cageclamp
  - PS (plugin screw): removable terminal blocks, with screw terminals
  - PT (plugin TWIN cageclamp): removable terminal blocks, with TWIN cage clamp
- _ _: Contacts
- ._ _: Type

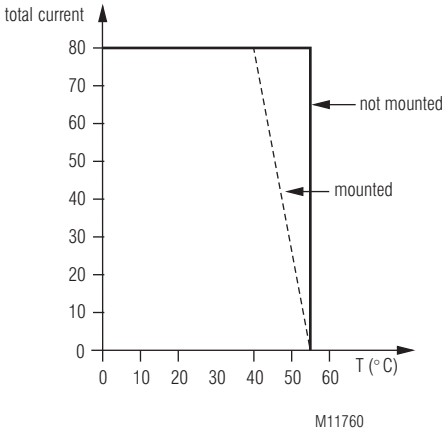
Maintenance and Repairs

- 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

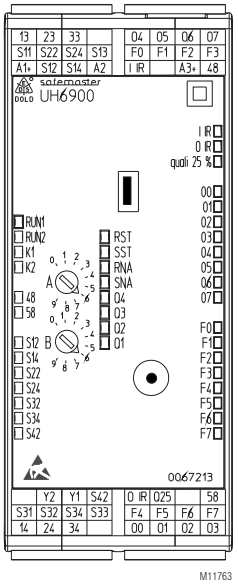
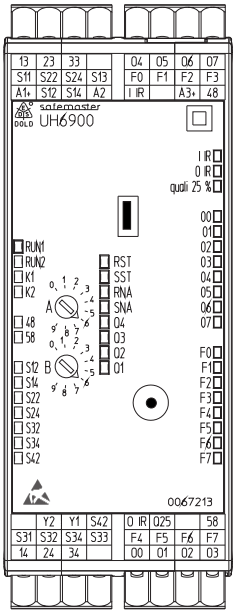
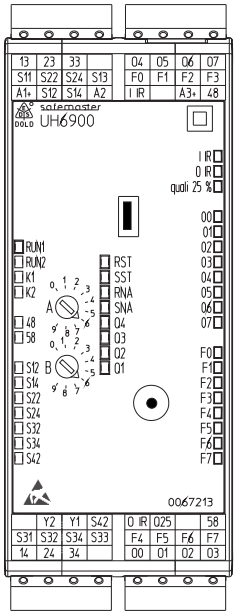
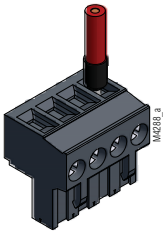
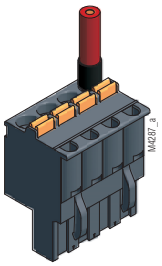
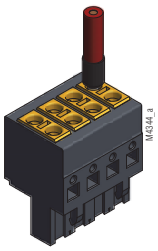
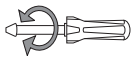
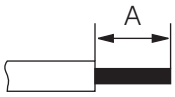
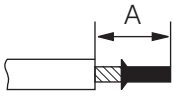
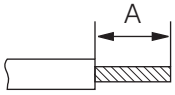


Arc limit curve under resistive load

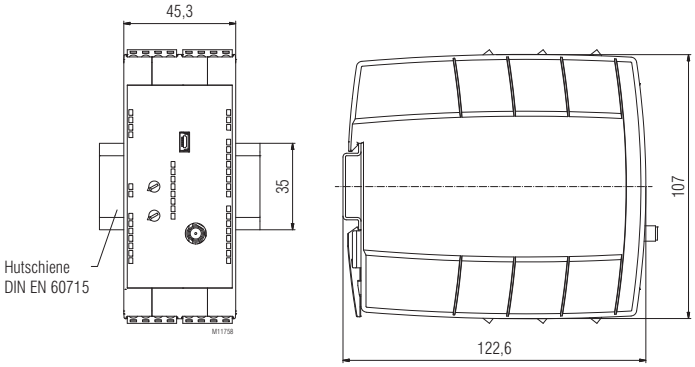


Quadratic total current limit curve

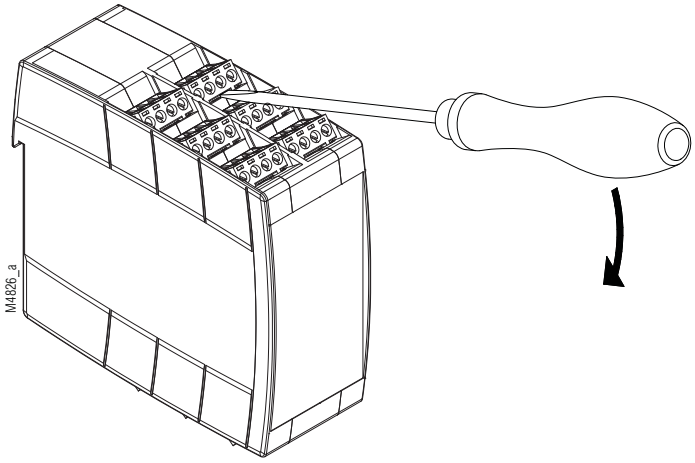
DE	**Beschriftung und Anschlüsse**
EN	**Labeling and connections**
FR	**Marquage et raccordements**

	 M11763	 M11764	 M11765
	 PS	 PC	 PT
	DIN 5264-A; 0,6 x 3,5 0,5 Nm 5 LB. IN	DIN 5264-A; 0,6 x 3,5	DIN 5264-A; 0,4 x 2,5
 M10248	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16
 M10249	A = 7 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,0 mm² 2 x AWG 24 to 18	A = 10 mm 1 x 0,25 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,25 ... 1,5 mm² mit TWIN-Aderendhülse	A = 8 mm 1 x 0,25 ... 1,5 mm² 1 x AWG 24 to 16
 M10250	A = 7 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12 2 x 0,2 ... 1,5 mm² 2 x AWG 24 to 16	A = 10 mm 1 x 0,2 ... 2,5 mm² 1 x AWG 24 to 12	A = 8 mm 1 x 0,2 ... 1,5 mm² 1 x AWG 24 to 16

DE	**Maßbild (Maße in mm)**
EN	**Dimensions (dimensions in mm)**
FR	**Dimensions (dimensions en mm)**



DE	**Montage / Demontage der PS / PC / PT-Klemmenblöcke**
EN	**Mounting / disassembly of the PS / PC / PT -terminal blocks**
FR	**Montage / Démontage des borniers PS / PC / PT**



DE	**Sicherheitstechnische Kenndaten**
EN	**Safety Related Data**
FR	**Données techniques sécuritaires**

EN ISO 13849-1:		
Kategorie / Category:	4	
PL:	e	
$MTTF_d$:	187,6	a (year)
DC_{avg}:	97,6	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

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:	97,6	%
PFH_D:	3,6E-10	h^{-1}
PFD_{avg}:	1,2E-4	Low Demand Mode
T_1:	20	a (year)

*) HFT = Hardware-Fehlertoleranz
Hardware failure tolerance
Tolérance défauts Hardware

Anforderung seitens der Sicherheitsfunktion an das Gerät Demand to our device based on the evaluated neccessary safety level of the application. Consigne résultant de la fonction sécuritaire de l'appareil		Intervall für zyklische Überprüfung der Sicherheitsfunktion Intervall for cyclic test of the safety function Interval du contrôle cyclique de la fonction sécuritaire
nach, acc. to, selon EN ISO 13849-1	PL e with Cat. 3 or Cat. 4	einmal pro Monat once per month mensuel
	PL d with Cat. 3	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 62061, IEC/EN 61508	SIL 3 with HFT = 1	einmal pro Monat once per month mensuel
	SIL 2 with HFT = 1	einmal pro Jahr once per year annuel
nach, acc. to, selon IEC/EN 61511	SIL 3	einmal pro Jahr once per year annuel

Info

DE	Die angeführten Kenndaten gelten für die Standardtype. Sicherheitstechnische Kenndaten für andere Geräteausführungen erhalten Sie auf Anfrage. Die sicherheitstechnischen Kenndaten der kompletten Anlage müssen vom Anwender bestimmt werden.
EN	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.
FR	Les valeurs données sont valables pour les produits standards. Les valeurs techniques sécuritaires pour d'autres produits spéciaux sont disponibles sur simple demande. Les données techniques sécuritaires de l'installation complète doivent être définies par l'utilisateur.

SAFEMASTER W
Wireless Safety System, Enabling Switch
System Overview

xxxxxxx

BI 6910

RE 6910

... Wireless escort for your safety
- For access in hazardous areas with enabling switch
- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
  - **Cat. 4 acc. to EN 954-1**
  - Acc. to DIN EN ISO 13850
  - Safety radio transmission

Your Advantages

- Maximum mobility and flexibility with maximum safety
- For higher availybility of your machines and plants
- Ideal solutions for mobile and stationary machines and plants with dangerous areas
  - During automatic operation e. g. to clear failures
  - During set up e. g. to adjust machine parameters, maintenance, set up
- Optimised sight on operating area during set up
- Individually configurable control buttons for up to 20 control functions
- Comfortable one-hand operation
- Clearly arranged control panel with clearly legible display
- Fast frequency adjustment directly on the enabling switch
- High operational reliability due to dynamic and redundant data transmission protocol

Approvals and Markings

Additional Information About This Topic

- You will find information about the radio controlled safety modul in the datasheet BI 6910
- You will find information about the remote control in the datasheet RE 6910

Options for Control

				PLC
1 x	2 x	-	-	-
1 x	-	2 x	-	-
1 x	1 x	-	1 x	-
1 x	1 x	1 x	-	-
1 x	-	1 x	1 x	-
1 x	-	-	-	1

Applications

- Setup and maintenance of robot cells
- Interventions in machine areas during setup operation
- Maintenance of dangerous machines
- Manual intervention in automated production processes
- Maintenance of automatic warehouses
- For all applications with access options in hazardous areas

Also for control tasks, e. g. for:
- Gradual regulation
- Start and stop functions
- Speed adjustments
- Positioning and selection of actuators

Description

SAFEMASTER W includes a very compact and ergonomic enabling switch RE 6910 and a safety module with radio control BI 6910. The enabling switch provides personal protection when entering dangerous areas and allows besides the emergency stop function also control functions with the integrated push buttons and switches. The safety outputs of the BI 6910 guarantee safe disconnection. For control functions it includes 7 semiconductor outputs.

The System Components

Enabling switch RE 6910

Radio Controlled Safety Module BI 6910

Infrared sensor (as option)

Charger Station

Aerial (as option)

Extension for Aerial (as option)

Radio controlled enabling switch RE 6910

The radio controlled eanbling switch RE 6910 includes a LCD displayto indicate the function settings as well as über 4 function buttons for radio remote control. It does not replace conventional safety circuits, but offers additional features. I.e. wired safety circuits remain active, although a remote control is used.

Radio Controlled Safety Module BI 6910

The radio safety module BI 6910 reacts on the signals of the corresponding enabling switch and the wired safety components. To detect the corresponding enabling switch frequency and identity code must be identical.

Infrared Module RE 5910/060

If the start of a plant must only be possible from a certain area, e.g. to have a view on the dangerous zone, the option with infrared start is the ideal solution. Accidents can be avoided by starting from defined zones.

Charger Station RE 6910/010

If the enabling switch is not used it has to be placed in the charger and switched off. This starts the charging process for the battery. The charger has 2 monitoring contacts. These are used to detect the removal of the enabling switch.

Aerials

The receiver unit requires an aerial that can be mounted directly on the front of BI 6910. If the receiver is mounted in a metal enclosure the aerial has to be placed outside. For the outside mounting a special coaxial cable is available.

SAFEMASTER W Wireless Safety System
Radio Controlled Safety Module
BI 6910

0263015

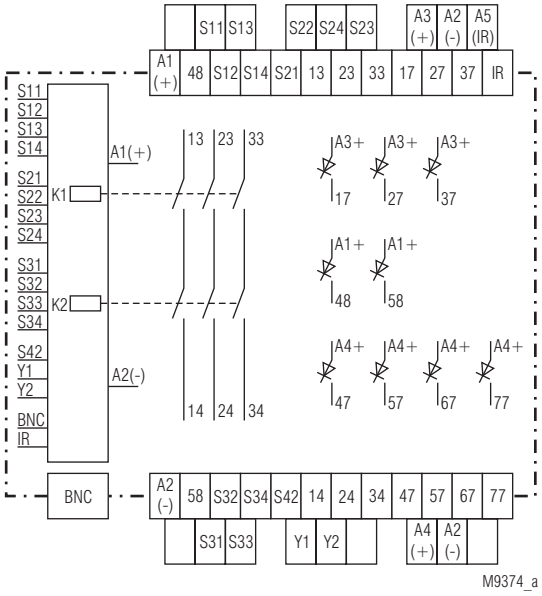
- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Safety radio transmission
- Radio receiver for:
  - Radio controlled enabling switch
  - Control signals for 6 non-safety semiconductor outputs
- Multifunction safety modul with additional control input to connect:
  - E-stop pushbutton (2-channel), safety gate or LC type 4 according to EN 61496
  - 1 Start button
  - 1 or 2 monitoring contacts to signal the use of radio
- Adjustable functions with step switch for:
  - Manual start or automatic start
  - when removing the enabling switch from the charger (open control contact) manual start is possible by enabling switch
  - possibility of disabling the access protection (gate) with active enabling switch
- Broken wire and short circuit monitoring with error indication
- Feedback circuit Y1/Y2 for monitoring of exernal contactors
- 2 semiconductor outputs for status indication
- LEDs for status indication
- Easy connection
- DIN rail mounting
- Removable terminal blocks allow fast exchange of module
- Also as input modul for multifunction, modular safety system SAFEMASTER M available
- Compact unit, only 67.5 mm width

Additional Information About This Topic

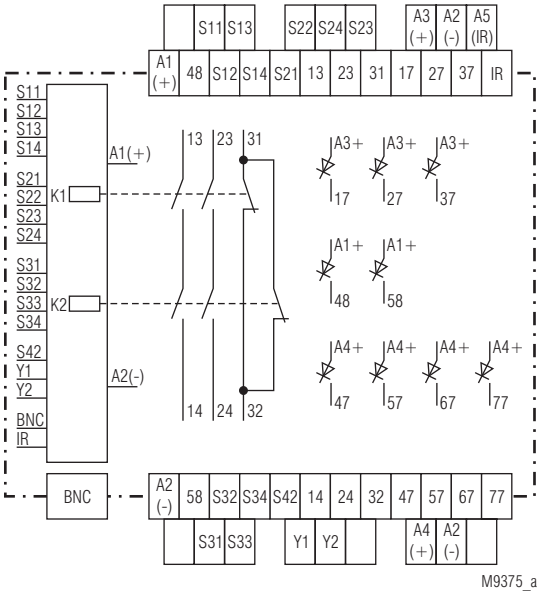
- Informations about the additional enabling switch see datasheet RE 6910

Approvals and Markings

Circuit Diagrams



BI 6910.03/00MF9



BI 6910.22/00MF9

Indication for Enabling Switch

The BI 6910 is equipped with a safety radio receiver to operate the signals from a enabling switch. It has 1 or 2 inputs depending on the operation mode (S31-S32and S33-S34) to connect the indication contacts of a battery charger for the remote control.

Aerial Connection

The radio connection of the radio controlled safety module to the renabling switch is made via an aerial that is mounted directly on the front of the BI 6910. If the unit is built into a metal cabinet the aerial has to be mounted outside. The connection is made via DOLD coax cable (e.g. RE 5910/042; Article number: 0059653). Special functions like activity monitoring and selection of radio frequency can be adjusted on the enabling switch.

Indications

green LEDs K1 and K2:	on when safety relay activated
green LED reception:	on at radio receive
yellow LEDs run 1, run 2 and outputs 48 and 58:	indicate the actual status of the modul
red LED receiver error:	indicate errors on radio-receiver

⚠ Notes

A machine must only be started from a location from which one can see that no person is present in the dangerous area.

To solve this there are 2 variants of the BI 5910:

BI 6910._ _/00MF9

This unit is used in applications where start is only possible from a hard-wired start button.

BI 6910._ _/01MF9

This unit has in addition to the radio control also an infrared function. The reset of the enabling switch is only accepted if the reset signal is received via radio and via infrared. This means that the enabling switch must be pointed at the infrared receiver for reset.

Technical Data

Radio

Conformity:	ETS 300 220
Aerial:	1/4 λ aerial, plug in as accessory
Frequency:	64 programmable frequencies 433.1 ... 434.675 MHz
Sensitivity:	< -100 dBm
Nominal voltage U_N:	DC 24 V
Voltage range:	0.85... 1.15 U_N at max. 5% residual ripple
Nominal consumption:	max. 120 mA (Semiconductor outputs not connected)
Control voltage on S11, S13, S21, S23, S31, S33,48, 58:	DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42:	each 4.5 mA at U_N
Max. voltage for active signals on: S12, S14, S22, S24, S32, S34, S42:	DC 16 V
Max. Voltage for inactive signals on: S12, S14, S22, S24, S32, S34, S42:	DC 9 V
Max. inputvoltage on S12, S14, S22, S24, S32, S34, S42:	DC 30 V
Fusing:	Internal with PTC
Max. time differece between input signals of one fuction	
E-stop, Light curtains:	250 ms
Gates:	3 s

Technical Data

Safety Output

Contacts

BI 6910.03:	3 NO contacts
BI 6910.22:	2 NO contacts, 1 NC contact **The NC contact can only be used as indicator contact!!**
Contact type:	Relais, forcibly guided
Operating time typ. at U_N	
automatic start:	max. 1000 ms
manual start:	max. 110 ms
automatic restart:	max. 70 ms
Swithing off time (reaction time)	
S12-S14, S22-S24, S32-S34:	max. 25 ms
E-stop (Radio):	max. 170 ms
Passive disconnection because of interrupted radio signal:	max. 500 ms
Disconnection with active radio signal and closed charge control contact:	adjustable from 5 to 30 s
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation
Switching of low loads:	> 100 mV
Thermal current I_{th}:	5 A
Switching capacity	
to AC 15	
NO contacts:	AC 3 A /230 V IEC/EN 60 947-5-1
NC contacts:	AC 2 A /230 V IEC/EN 60 947-5-1
to DC 13:	DC 8A / 24V at 0.1Hz IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 2 A, AC 230 V:	100000 switching cycles IEC/EN 60 947-5-1
Permissible switching frequency:	max. 1200 switching cycles / h
Short circuit strength	
Max. fuse rating:	6 A gL IEC/EN 60 947-5-1
Line circuit breaker:	C 8 A
Mechanical life:	10 x 10^6 switching cycles

Semiconductor Outputs

Outputs (terminals 48, 58, 17, 27, 37, 47, 57, 67, 77):	transistor outputs, switching +
Nominal output voltage (A3+, A4+):	DC 24 V
Nom. output voltage at U_N:	min. DC 23 V, max. 100 mA cont. current max. 400 mA für 0.5 s internal short circuit,over temperature and overload protection
Min. operating current:	min. 0.5 mA
Residual current:	min. 0.1 mA

General Data

Operating mode:	Continuous operation
Temperature range	
operation:	0 ... 50°C
storage :	- 25 ... + 85 °C
altitude:	< 2.000 m
Clearance and creepage distance	
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1
EMC	
HF-irradiation:	10 V / m IEC/EN 61 000-4-3
Fast transients	
on wires for power supply A1-A2:	2 kV IEC/EN 61 000-4-4
on signal and control wires:	2 kV IEC/EN 61 000-4-4
Surge voltages	
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 IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection:	acc. to EN 61 496-1 (1997) the unit has to be mountedin a control cabinet with protection class 54
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Enclosure:	Thermoplastic with V0 behaviour according to UL subject 94

Technical Data

Vibration resistance:	according to EN 61496-1 (1997) Amplitude 0.35 mm IEC/EN 60 068-2-6 Frequency 10 ... 55 Hz	
Shock proof		
Acceleration:	10g	
Impulse length: 16 ms		
Number of shocks:	1000 per ax is on all 3 axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60068-1
Terminal designation:		EN 50 005
Wire connection:	1 x 2.5 mm^2 strand. wire with sleeve or 1 x 4 mm^2 solid or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Leiterbefestigung:	Plus- minus- terminal srews M 3.5 box terminals with wire protection	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	495g	

Dimensions

Width x height x depth:	67.5 x 84 x 129 mm

Safety Related Data for E-STOP via wired e-stop button

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	> 100	a
DC_{avg}:	98.4	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3.60E+03	s/Zyklus
	≙ 1	/h (hour)
Values according to IEC/EN 61508:		
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	98.4	%
SFF	99.5	%
PFH_D:	1.20E-9	h^{-1}

Safety Related Data for E-STOP via radio control

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	> 100	a
DC_{avg}:	98.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	2	h (hours)
Values according to IEC/EN 61508:		
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	98.4	%
SFF	99.5	%
PFH_D:	2E-9	h^{-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.

Standard Types

BI 65910.22/00MF9 DC 24 V
Article number: 0062571
Safety outputs: 2 NO contacts, 1 NC contact*)

BI 6910.03/00MF9 DC 24 V
Article number: 0062570
Safety outputs: 3 NO contacts

- Function with rotational switches adjuistable
- Nominal voltage U_N: DC 24 V
- Width: 62.5 mm

*) The NC contact can only be used as indicator contact!

Ordering Example

BI 6910 ._ _ /0_ MF9 _ _

Special behaviour:
00[1]: for enabling switch at command- or function mode with max. 8 functions (F1-F8) on 6 outputs of 1 receiver
01: Special version for enabling switch at function mode with max. 8 functions (F2-F9) on 6 outputs of 1 receiver
10: max. 10 functions on 6 outputs of 1 receiver
11: Pairs of 2 receivers with the same identity code for max. 10 functions on 12 outputs
12: Pairs of 2 receivers with the same identity code for max. 10 functions on 12 outputs

Option start by infrared
0: without start by infrared
I: with start by infrared

Contacts
.03: 3 NO contacts
.22: 2 NO contacts, 1 NC contacts[2]

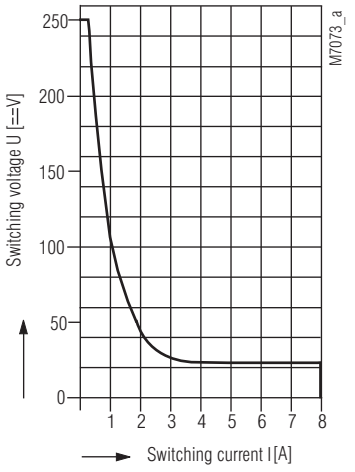
Type

[1] The designation „00“ can be dropped
[2] The NC contact is not a safety contact

Accessories

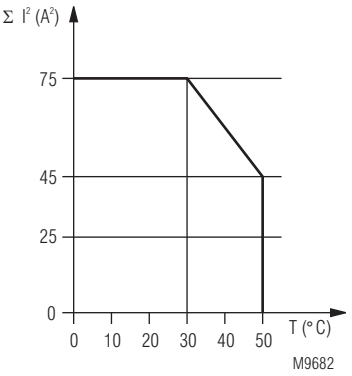
RE 6910/001:	Enabling switch 1 mW 64 channels Article number: 0062631
RE 6910/002:	Enabling switch 10 mW 25 channels Article number: 0063283
RE 5910/040:	1/4 λ aerial 433 - 434 MHz - BNC Article number: 0059573
RE 5910/041:	1/2 λ aerial 433 - 434 MHz - BNC Article number: 0059652
RE 5910/042:	2 m extension for aerial + trough hole connector - BNC fixing angle Article number: 0059653
RE 5910/043:	5 m extension for aerial + trough hole connector - BNC fixing angle Article number: 0059654
RE 5910/045:	Extension 50 cm Article number: 0059656
RE 5910/046:	90° adapter for aeriall Article number: 0059685
RE 5910/060:	1 infra red receiver with 10 m wire Article number: 0059665
RE 5910/061:	10 m extension wire for infra red module Article number: 0059666

Characteristics



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Limit curve for arc-free operation



Quadratic total current

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

I_1, I_2, I_3 - current in contact paths

Quadratic total current limit curve

SAFEMASTER W Wireless Safety System
Radio Controlled Enabling Switch
RE 6910

0263013

- with DOLD Wireless Safety System
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
- Safety radio transmission
- User friendly, compact enabling switch for radio controlled safety modul BI 6910
- programmable for
  - Command mode with 4 command buttons or
  - Function mode with max. 10 functions and 2 command buttons each
- with LCD-display to indicate the function settings, battery charging, transmitting e.g.
- Indications of the function settings can be uploaded as „bitmap“
- Protection against unintentional activation
- Speed charging and high battery capacity
- Fast change of frequency
- Pocket for remote control as option

Additional Information

- Information about the receiver unit you find in the data sheet BI 6910

Approvals and Markings

Technical Data

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, frequency modulated (FM)
Frequency:	64 (transmitting power 1mW) or 25 (transmitting power 10mW)
Frequency range:	433.100 ... 434.675 MHz or 434.075 ... 434.675 MHz
HF-power:	< 10 mW (without licence),
integrated aerial distance*):	approx. 150- 200 m under industrial ambient conditions *) approx. 600 m in open area

*) The distance can vary with the ambient conditions of the enabling switch and the receiver aerial (roof construction, metal walls etc.)

Battery

Type:	Lithium-ion
Service life:	min. 500 cycles (charge/discharge cycles)
Charging time:	2 h, bei +20°C (80%) (for completely discharged battery)
Full charging time:	2 h 30 min (100%)

Charge capacity

- Normal operation of push buttons:	40 h, at 50% operation and + 20°C
- after 10 minutes charging of discharged battery:	approx. 1 h

The charge capacity of the enabling switch is depending on operation conditions (continuously or temporary utilization, ambient temperature e.g.)

Storage temperature:	-20°C ... +45°C
Charging temperature:	0°C ... +35°C **Attention!** Slow charging outside temperature range may damage the battery

Enclosure

Material:	ABS
Degree of protection:	IP 54
Ambient temperature:	-20°C ... +50°C
Storage temperature:	-20°C ... +45°C
Holder for non-operation:	Charger unit
Weight (with battery):	340 g

Dimensions

Width x height x depth:	75 x 93 x 260 mm

Standard Type

RE 6910/001
Article number: 0062631
- 64 channels (1-64), max. transmitting power 1mW

Ordering Example

RE 6910/00_

1: 64 channels (1-64), max. transmitting power 1mW
2: 25 channels (40-64), max. transmitting power 10mW

Accessories

RE 6910/010: Industrial charger unit
Article number: 0062632

RE 6910/020: Replacement SIM-Card
Article number: 0062633

RE 6910/051: Replacement rechargeable battery
Article number: 0062634

RE 6910/070: Remote control holster for RE5910;
Material: leather,
- metal clip to fix it on belt.
Article number: 0062635

SAFEMASTER W
Wireless Safety System, E-Stop
System Overview

0261524

... Wireless escort for your safety
- For E-Stop and control functions
- According to EN 13849 PL e, safety category 4 to EN 954-1
- According to DIN EN ISO 13850
- Safety radio transmission

Your Advantages

- For higher availybility of your machines and plants
- Ideal solutions for mobile and stationary machines and plants with dangerous areas
  - during automatic operation e. g. to clear failures
  - during set up e. g. to adjust machine parameters, maintenance, set up
- SAFEMASTER W offers as wireless system all advantages of radio control e.g.:
  - Higher availability of machines because damage of trailing cables is avoided
  - Higher mobility of the operator by easy moving around with wireless control
  - Cost saving by replacing wire bound operating panels
  - Less mounting, installation and wiring time
  - No wearing on trailing cables, slip rings etc.
  - Easy retrofit and modernising of machines
  - Higher flexibility
  - Excellent ergonomics
- Optimised sight on operating area during set up
- Easy grouping of different production machines with common e-stop and separate or common start
- User legitimating with electronic key on remote control possible

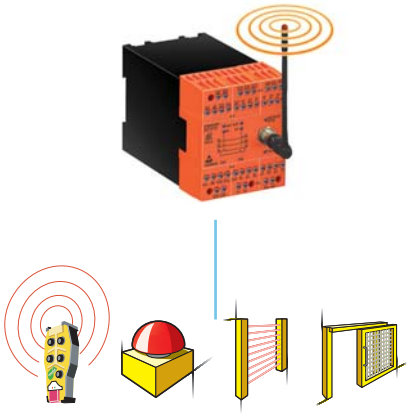
Approvals and Markings

CE | TÜVRheinland Functional Safety Type Approved FS | BG ET

Additional Information About This Topic

- You will find information about the radio controlled safety modul in the datasheet BI 5910
- You will find information about the remote control in the datasheet RE 5910
- You will find information about SAFEMASTER M in the separate catalogue „system description SAFEMASTER M“

Options for Control



1x	2 x	-	-
1x	-	2 x	-
1x	1 x	-	1 x
1 x	1 x	1 x	-
1 x	-	1 x	1 x

Applications of SAFEMASTER W

E-Stop
Protection of men and machines in mobile and large plants where a fixed wiring is not possible, e.g. production halls, mounting scaffolds, plants and dangerous accessible areas.

Also for control functions for e. g. :
- Step control
- Start-stop functions
- Speed adjustment
- Positioning and actuator selection

Description

SAFEMASTER W includes a very compact and ergonomic remote control RE 5910 and a safety module with radio control BI 5910. The remote control provides personal protection when entering dangerous areas and allows besides the emergency stop function also control functions with the integrated push buttons and switches. The safety outputs of the BI 5910 guarantee safe disconnection. For control functions it includes 7 semiconductor outputs.

The System Components

Remote Control
RE 5910
with electronik key

Replace-
ment key
(as option)

Radio Controlled Safety Module
BI 5910

Infrared
sensor
(as option)

Charger Station

Aerial
(as option)

Extension for
Aerial
(as option)

Remote Control RE 5910

The remote control includes 1 e-stop and 1 start button as well as 4 function buttons for radio remote control. It does not replace conventional safety circuits, but offers additional features. I.e. wired safety circuits remain active, although a remote control is used.

Electronic Key for Remote Control

The electronic key enables the activation of the remote control and offers personal access permission to a certain configuration of the remote control. It contains the following information:

- frequency that is used for transmission
- Identity code of the system
- Time interval for activity monitoring
- Configuration of function keys

Radio Controlled Safety Module BI 5910

The radio safety module reacts on the signals of the corresponding remote control and the wired safety components. To detect the corresponding remote control frequency and identity code must be identical.

Infrared Module RE 5910/060

If the start of a plant must only be possible from a certain area, e.g. to have a view on the dangerous zone, the option with infrared start is the ideal solution. Accidents can be avoided by starting from defined zones.

Charger Station RE 5910/010

If the remote control is not used it has to be placed in the charger and switched off. This starts the charging process for the battery. The charger has 2 monitoring contacts. These are used to detect the removal of the remote control.

Aerials

The receiver unit requires an aerial that can be mounted directly on the front of BI 5910. If the receiver is mounted in a metal enclosure the aerial has to be placed outside. For the outside mounting a special coaxial cable is available.

SAFEMASTER W Wireless Safety System
Radio Controlled Safety Module
BI 5910

0255173

BI 5910

RE 5910

- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
  - **Category 4 to EN 954-1**
- Safety radio transmission
- Radio receiver for:
  - E-stop
  - Control signals for 6 non-safety semiconductor outputs
- Multifunction safety modul with additional control input to connect:
  - E-stop pushbutton (2-channel), safety gate or LC type 4 according to EN 61496
  - 1 Start button
  - 1 or 2 monitoring contacts to signal the use of radio
- Adjustable functions with step switch for:
  - Manual start or automatic start
  - when removing the remote control from the charger (open control contact) manual start is possible by remote control
  - possibility of disabling the access protection (gate) with active remote control
- Broken wire and short circuit monitoring with error indication
- 2 semiconductor outputs for status indication
- Feedback circuit Y1/Y2 for monitoring of exernal contactors
- LEDs for status indication
- Easy connection
- DIN rail mounting
- Removable terminal blocks allow fast exchange of module
- Compact unit, only 67.5 mm width

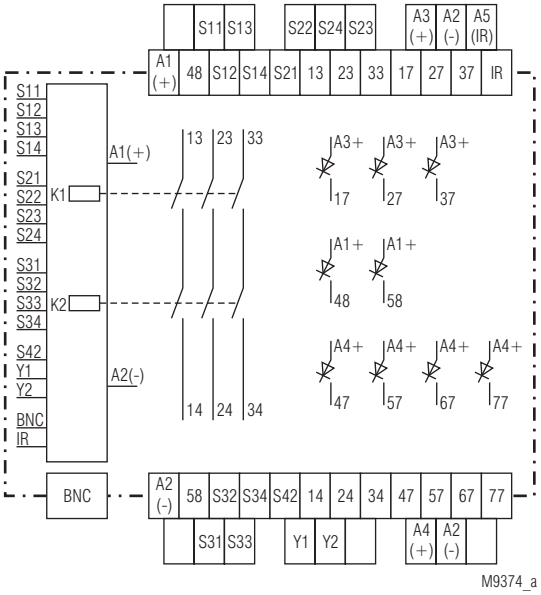
Additional Information About This Topic

- Informations about the additional remote control see datasheet RE 5910

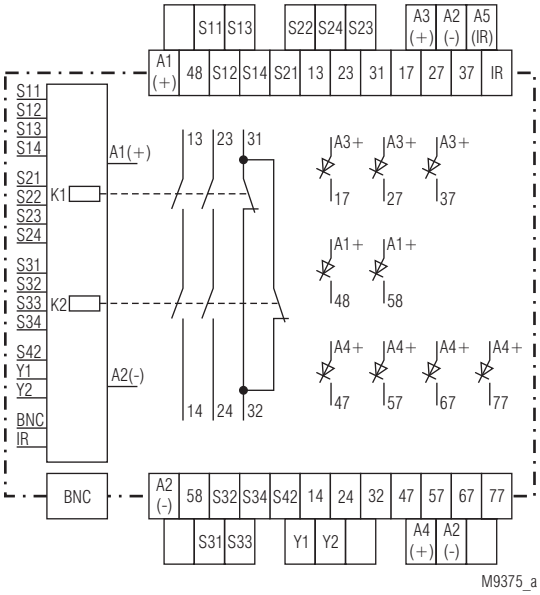
Approvals and Markings

CE TÜVRheinland Functional Safety Type Approved FS

Circuit Diagrams



BI 5910.03/00MF9



BI 5910.22/00MF9

Indication for Remote Control

The device is equipped with a safety radio receiver to operate the signals from a remote control with remote e-stop. It has 1 or 2 inputs depending on the operation mode (S31-S32and S33-S34) to connect the indication contacts of a battery charger for the remote control.

Aerial Connection

The radio connection of the radio controlled safety module to the remote control is made via an aerial that is mounted directly on the front of the BI 5910. If the unit is built into a metal cabinet the aerial has to be mounted outside. The connection is made via DOLD coax cable (e.g. RE 5910/042; Article number: 0059653). Special functions like activity monitoring and selection of radio frequency can be adjusted on the remote control.

Indications

green LEDs K1 and K2:	on when safety relay activated
green LED reception:	on at radio receive
yellow LEDs run 1, run 2 and outputs 48 and 58:	indicate the actual status of the modul
red LED receiver error:	indicate errors on radio-receiver

Notes

A machine must only be started from a location from which one can see that no person is present in the dangerous area.

To solve this there are 2 variants of the BI 5910:

BI 5910._ _/00MF9

This unit is used in applications where start is only possible from a hard-wired start button.

BI 5910._ _/01MF9

This unit has in addition to the radio control also an infrared function. The reset of the remotecontrol is only accepted if the reset signal is received via radio and via infrared. This meansthat the remote control must be pointed at the infrared receiver for reset.

Technical Data

Radio

Conformity:	ETS 300 220
Aerial:	1/4 aerial, plug in as accessory
Frequency:	64 programmable frequencies 433.1 ... 434.675 MHz
Sensitivity:	< -100 dBm
Nominal voltage U_N:	DC 24 V
Voltage range:	0.85... 1.15 U_N at max. 5% residual ripple
Nominal consumption:	max. 120 mA (Semiconductor outputs not connected)
Control voltage on S11, S13, S21, S23, S31, S33,48, 58:	DC 23 V at U_N
Control current on S12, S14, S22, S24, S32, S34, S42:	each 4.5 mA at U_N
Max. voltage for active signals on: S12, S14, S22, S24, S32, S34, S42:	DC 16 V
Max. Voltage for inactive signals on: S12, S14, S22, S24, S32, S34, S42:	DC 9 V
Max. inputvoltage on S12, S14, S22, S24, S32, S34, S42:	DC 30 V
Fusing:	Internal with PTC
Max. time differece between input signals of one fuction	
E-stop, Light curtains:	250 ms
Gates:	3 s

Technical Data

Safety output

Contacts

BI 5910.03:	3 NO contacts
BI 5910.22:	2 NO contacts, 1 NC contact The NC contact can only be used as indicator contact!!
Contact type:	Relais, forcibly guided
Operating time typ. at U_N	
automatic start: max. 800 ms	
manual start:	max. 110 ms
automatic restart:	max. 70 ms
Swithing off time (reaction time)	
S12-S14, S22-S24, S32-S34:	max. 25 ms
E-stop (Radio):	max. 170 ms
Passive disconnection because of interrupted radio signal:	max. 500ms
Disconnection with active radio signal and closed charge control contact:	max. 1 s
Nominal output voltage:	AC 250 V DC: see limit curve for arc-free operation
Switching of low loads:	> 100 mV
Thermal current I_{th}:	5 A
Switching capacity	
to AC 15	
NO contacts:	AC 3 A /230 V IEC/EN 60 947-5-1
NC contacts:	AC 2 A /230 V IEC/EN 60 947-5-1
to DC 13:	DC 8A / 24V at 0.1Hz IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 2 A, AC 230 V:	100000 switching cycles IEC/EN 60 947-5-1
Permissible switching frequency:	max. 1200 switching cycles / h
Short circuit strength	
Max. fuse rating:	6 A gL IEC/EN 60 947-5-1
Line circuit breaker:	C 8 A
Mechanical life:	10 x 10^6 switching cycles

Semiconductor outputs

Outputs (terminals 48, 58, 17, 27, 37, 47, 57, 67, 77):	transistor outputs, switching +
Nominal output voltage (A3+, A4+):	DC 24 V
Nom. output voltage at U_N:	min. DC 23 V, max. 100 mA cont. current max. 400 mA für 0.5 s internal short circuit,over temperature and overload protection
Min. operating current:	min. 0.5 mA
Residual current:	min. 0.1 mA

General Data

Operating mode:	Continuous operation
Temperature range	
operation:	0 ... 50°C
storage :	- 25 ... + 85 °C
altitude:	< 2.000 m
Clearance and creepage distance	
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation) IEC 60 664-1
EMC	
HF-irradiation:	10 V / m IEC/EN 61 000-4-3
Fast transients	
on wires for power supply A1-A2:	2 kV IEC/EN 61 000-4-4
on signal and control wires:	2 kV IEC/EN 61 000-4-4
Surge voltages	
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 IEC/EN 61 000-4-6
Interference suppression:	Limit value class B EN 55 011
Degree of protection:	acc. to EN 61 496-1 (1997) the unit has to be mountedin a control cabinet with protection class 54
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Enclosure:	Thermoplastic with V0 behaviour according to UL subject 94

Technical Data

Vibration resistance:	according to EN 61496-1 (1997) Amplitude 0.35 mm IEC/EN 60 068-2-6 Frequency 10 ... 55 Hz	
Shock proof		
Acceleration:	10 g	
Impulse length:	16 ms	
Number of shocks:	1000 per ax is on all 3 axes	
Climate resistance:	0 / 050 / 04	IEC/EN 60068-1
Terminal designation:		EN 50 005
Wire connection:	1 x 2.5 mm^2 strand. wire with sleeve or 1 x 4 mm^2 solid or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Plus- minus- terminal srews M 3.5 box terminals with wire protection	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	495g	

Dimensions

Width x height x depth:	67.5 x 84 x 129 mm

Safety Related Data for E-STOP via wired e-stop button

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	> 100	a
DC_{avg}:	98.4	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	3.60E+03	s/Zyklus
	≙ 1	/h (hour)

Values according to IEC/EN 61508:		
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	98.4	%
SFF	99.5	%
PFH_D:	1.20E-9	h^{-1}

Safety Related Data for E-STOP via radio control

Values according to EN ISO 13849-1:		
Category:	4	
PL:	e	
$MTTF_d$:	> 100	a
DC_{avg}:	98.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{Zyklus}:	2	h (hours)

Values according to IEC/EN 61508:		
SIL	3	IEC/EN 61508
HFT*):	1	
DC_{avg}:	98.4	%
SFF	99.5	%
PFH_D:	2E-9	h^{-1}

*) HFT = Hardware-Failure Tolerance

Info

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.

Standard Types

BI 5910.22/00MF9 DC 24 V
Article number: 0059002
Safety outputs: 2 NO contacts, 1 NC contact*)

BI 5910.03/00MF9 DC 24 V
Article number: 0059003
Safety outputs: 3 NO contacts

- Function with rotational switches adjuistable
- Nominal voltage U_N: DC 24 V
- Width: 62.5 mm

*) The NC contact can only be used as indicator contact!

Ordering Example

BI 5910 ._ _ /0_MF9____ DC 24 V

- Nominal voltage
- Option start by infrared
  - 0: without start by infrared
  - I: with start by infrared
- Contacts
  - .03: 3 NO contacts
  - .22: 2 NO contacts, 1 NC contacts*)
- Type

*) The NC contact is not a safety contact

Accessories

RE 5910/040: 1/4 λ aerial 433 - 434 MHz - BNC
Article number: 0059573

RE 5910/041: 1/2 λ aerial 433 - 434 MHz - BNC
Article number: 0059652

RE 5910/042: 2 m extension for aerial + trough hole connector - BNC fixing angle
Article number: 0059653

RE 5910/043: 5 m extension for aerial + trough hole connector - BNC fixing angle
Article number: 0059654

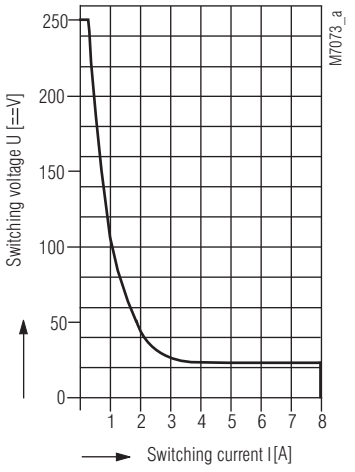
RE 5910/045: Extension 50 cm
Article number: 0059656

RE 5910/046: 90° adapter for aeriall
Article number: 0059685

RE 5910/060: 1 infra red receiver with 10 m wire
Article number: 0059665

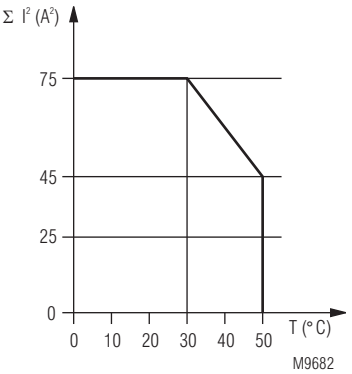
RE 5910/061: 10 m extension wire for infra red module
Article number: 0059666

Characteristics



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Limit curve for arc-free operation



Quadratic total current

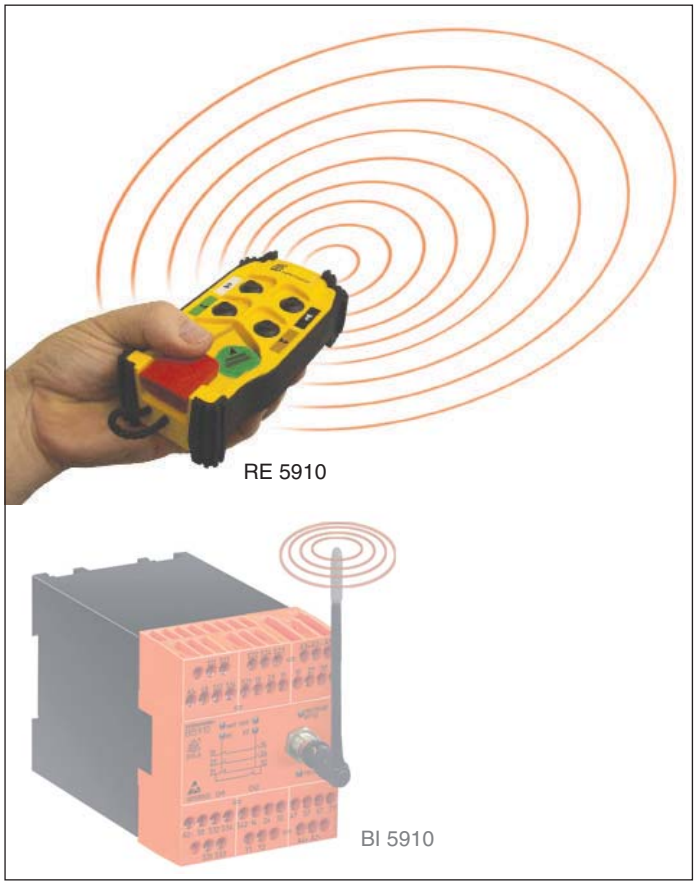
$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2$

I_1, I_2, I_3 - current in contact paths

Quadratic total current limit curve

SAFEMASTER W Wireless Safety System
Remote Control for E-Stop
RE 5910

0255382



- with DOLD Wireless Safety System
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **Safety Integrity Level (SIL 3) to IEC/EN 61508**
  - **Category 4 to EN 954-1**
  - **DIN EN ISO 13850**
- Safety radio transmission
- User friendly, compact transmitter
  - for radio controlled safety modul BI 5910
  - for multifunction, modular safety system SAFEMASTER® M
- Comfortable single hand operation
- Options with 4 configurable push buttons or rotational switches for control functions
- With perceptible 2 step push buttons
- With marking space besides the push buttons
- Protection against unintentional activation
- Speed charging and high battery capacity
- Fast change of frequency
- Pocket for remote control as option

Additional Information

- Information about the receiver unit you find in the data sheet BI 5910

Approvals and Markings

CE TÜVRheinland Functional Safety Type Approved FS

Notes

A visible e-stop button must be active all the time.
This means that the e-stop button of the remote control must not be visible when it is inactive. Therefore the charger must be mounted in a way that the remote control is not visible while charging.

Technical Data

Radio

Conformity:	ETS 300 220
Carrier frequency:	UHF, frequency modulated (FM)
Frequency:	64 programmable frequencies
Frequency range:	433.1 ... 434.675 MHz
HF-power:	< 10 mW (without licence), integrated aerial
Distance:	approx. 150- 200 m under industrial ambient conditions *) approx. 600 m in open area

*) The distance can vary with the ambient conditions of the remote control and the receiver aerial (roof construction, metal walls etc.)

Battery

Type:	Lithium-ion
Service life:	min. 500 cycles (charge/discharge cycles)
Charging time:	2 h, bei +20°C (80%) (for completely discharged battery)
Full charging time:	2 h 30 min (100%)

Charge capacity

- Normal operation of push buttons:	20 h, at 50% operation and + 20°C
- after 10 minutes charging of discharged battery:	approx. 1 h
Storage temperature:	-20°C ... +50°C
Charging temperature:	0°C ... +40°C **Attention!** Slow charging outside temperature range may damage the battery

Technical Data

Enclosure

Material:	ABS
Degree of protection:	IP 65
Ambient temperature:	-20°C ... +50°C
Holder for non-operation:	Charger unit
Weight (with battery):	240 g

Dimensions

Width x height x depth: 46 x 78 x 143 mm

Standard Type

RE 5910/001
Article number: 0060610
- with 4 2 step push buttons
- without infrared
- with electronic key

Ordering Example

RE 5910/00_

Variant
- 1: with 4 2 step push buttons, without IR
- 2: with 4 2 step push buttons, with IR
- 3: with 4 1 step push buttons, without IR
- 4: with 4 1 step push buttons, with IR
- 5: B1-B3: step push button (BPSV), B4: rotational switch with auto return (COM3R)
- 6: B1-2: 1 step pushbutton (BPSV), B3-B4: rotational switch (COM3), with IR
- 7: B1-B2: 1 step pushbutton (BPSV) B3-B4: rotational switch (COM3), without IR, with electronical key
- 8: B1-B2: 2 step pushbutton (BPDV) B3-B4: rotational switch (COM2), without IR, without electronical key

9114: B1-B3: 1 step pushbutton (BPSV), B4: rotational switch (COM3R), with IR

others on request

Accessories

RE 5910/010: Industrial charger unit
Article number: 0060616

RE 5910/011: Power supply for charger AC 230 V (Euro connector)
Article number: 0060617

RE 5910/012: Power supply for charger DC 24 V
Article number: 0060618

RE 5910/013: Power supply for charger AC 230 V (U.K. connector)
Article number: 0061323

RE 5910/030: Set with 6 colour stickers “movements” for 2-step push buttons
Article number: 0059660

RE 5910/031: Set with 90 black and white stickers
Article number: on request

RE 5910/033: Set with 48 white stickers + 48 transparent protection stickers forindividual marking
Article number: 0059663

RE 5910/051: Replacement rechargeable battery
Article number: 0060621

RE5910/070: Remote control holster for RE5910;
Material: leather,
- metal clip to fix it on belt.
- with rings to clip in the personal mounting harness RE 5910/071

Article number: 0060490

RE 5910/071: Personal mounting harness with elastic straps to carry the remote control in the holster RE5910/070 on the body of the operator.
Article number: 0060491

Electrical replacement key

RE 5910/020: Green electronic key with program
Article number: 0060619

RE 5910/021: Orange electronic key with program
Article number: 0060620

Important: Please state the following details on order:
- Number of electronic key (6 figure number, noted on page 2 of this manual)
- Frequency channel, if it should be programmed by manufacturer
- Time delay for activity control (01-99 sec or 01-98 min)

SAFEMASTER W Wireless Safety System
Power supply for industrial charger unit AC 230V
RE 5910/011 und RE 5910/013

0270558

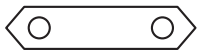
RE 5910/011

Charger

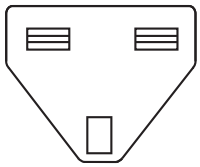
- According to EN 60950
- Input voltage AC 230 V
- Output voltage DC 5 V / 1 A
- Short circuit strength-, overload- and overvoltage protection

Plug Variants

plug EU RE5910/011



plug UK RE5910/013



M11197

Approvals and Markings

CE

Additional information about this topic

- Informations about the charger see User Manual BI 5910

Application

For charger connection of the remote control RE 5910 at AC 230 V.

Standard Type

RE 5910/011	EU plug
Article number:	0060617
RE 5910/013	UK plug
Article number:	0061323

Technical Data

Input

Nominal voltage:	AC 230 V
Voltage range:	AC 90 ... 264 V
Efficiency:	> 70 %

Output

Voltage:	DC 5 V
Voltage control:	4,8 - 5,2 V
Residual ripple:	< 150 mV p-p 100 Hz
Output current:	0 ... 1 A
Power:	5 W
Input control:	< 0,1 %
Load control:	< 1 % von 0 bis Volllast
Overload protection:	typ. 110 %

General Data

Nominal operating mode:	continuous operation
Temperature range:	- 10 ... + 40 °C
Insulation class:	II
EMC	
EMC irradiation:	according to EN 61000-6-3, FCC15B
EMC proof:	according to EN 61000-6-1
Weight:	65 g

Dimensions

Length x width x height:	75 x 32 x 40 mm

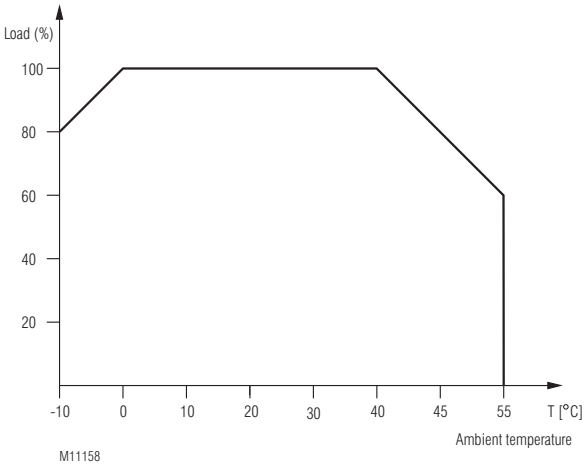
SAFEMASTER W Wireless Safety System
Power supply for industrial charger unit DC 24 V
RE 5910/012

0270561

RE 5910/012 Charger

- According to EN 55022, EN 55024
- Input voltage DC 24 V
- Output voltage DC 5 V / 3 A
- Short circuit strength-, overload- and overvoltage protection

Characteristic



derating curve

Standard Type

RE 5910/012	Power supply for industrial charger
Article number:	0060818

Approvals and Markings

CE

Additional information about this topic

- Informations about the charger see User Manual BI 5910

Application

For charger connection of the remote control RE 5910 at DC 24 V.

Technical Data

Input

Nominal voltage:	DC 24 V
Voltage range:	DC 18 ... 36 V
Input current:	0.9 A / DC 24 V
Efficiency:	> 70 %

Output

Voltage:	DC 5 V
Voltage control:	4.75 - 5.5 V
Residual ripple:	< 100 mV p-p
Output current:	0 ... 3 A (see derating curve)
Power:	15 W
Input and load control:	± 0.5 %
Overload protection:	105 % ... 160 % selfrecovering when failure removed
Overvoltage protection:	5.75 V ... 6.75 V

General Data

Nominal operating mode:	continuous operation
Temperature range:	- 10 ... + 55 °C (see derating curve)
Insulation class:	II
EMC and protection	
Input / Output:	2 kV AC
Input / Earth:	1 kV AC
Output / Earth:	0.5 kV AC
Insulating resistance:	
Input / Output, Input / Earth, Output / Earth:	100 MΩ / 500 V DC / 25 °C / 70 % RH
EMC irradiation:	according to EN 55022 (CISPR22)
EMC proof:	according to EN 61000-4-2,3,4,6,8 EN 55024 light industry level, criteria A
Weight:	200 g

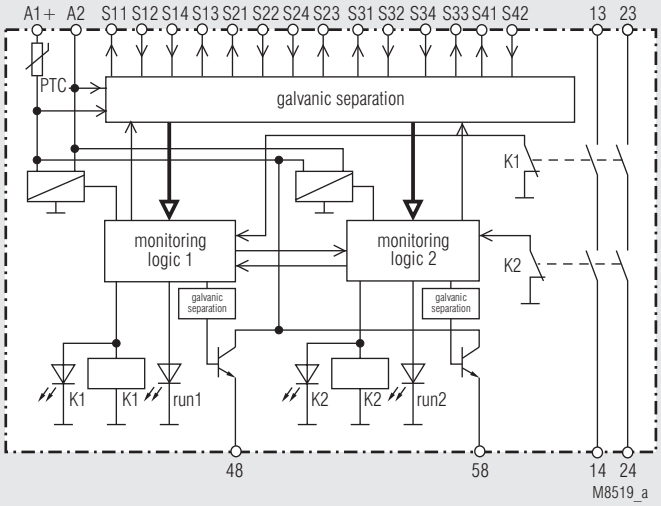
Dimensions

Width x height x depth:	91 x 51 x 37 mm

SAFEMASTER
Valve Monitoring Module
BH 5904.02/00MF2

0241405

Block Diagrams



Indicators

green LED's K1, K2: On, when relays K1 and K2 are energized.

yellow LED run 1: On continuously, when no fault and the valve is in initial position.
Off, when no fault and the valve is in end position.
Indicates faults by different flashing sequences (see flashing codes for fault indication).

yellow run 2: On continuously, when no fault.
Indicates internal faults by different flashing sequences (see flashing codes for fault indication).

Output 48 and 58:

48	58	
+24Volt	+24Volt	No fault or feed back circuit open
0 Volt	0 Volt	Other fault then valve failure or feed back circuit open
+24Volt	0 Volt	Starting failure of valve
0 Volt	+24Volt	Reset failure of valve

- **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**
  - **Category 4 to EN 954-1**
- Way of valve monitoring adjustable (2 NC, 2NO, 1 changeover contact)
- Reset button to acknowledge after fault detection
- Available with continuous monitoring of the valve or just with one check per cycle
- Contact reinforcement by external contactors possible
- Short circuit and cross fault detection
- Broken wire detection
- Outputs: 2 NO contacts
- 2 semiconductor outputs with short circuit, overload and temperature protection to monitor the status
- Under and overvoltage detection
- Reaction time: max. 28 ms
- LED operation indicators (run 1, run 2)
- Width 45 mm

Approvals and Markings

CE TÜVRheinland Functional Safety Type Approved FS c UL us LISTED * Canada / USA

* see variants

Applications

- Protection of people and machines.
  The module BH 5904 monitors the positions of valve lifter in standard hydraulic blocks for presses.

Function

The module BH 5904 monitors the position of the valve at the beginning of a machine cycle by checking a position sensor. The output contacts are only activated if on start signal from the safety controller the valve is in it´s initial position, the feed back circuit from the safety controller is closed and no fault is stored.
The output contacts are deactivated or cannot be activated again, when after an adjustable time delay the valve position does not correspond to the start signal.
Two types of machine cycles can be selected:

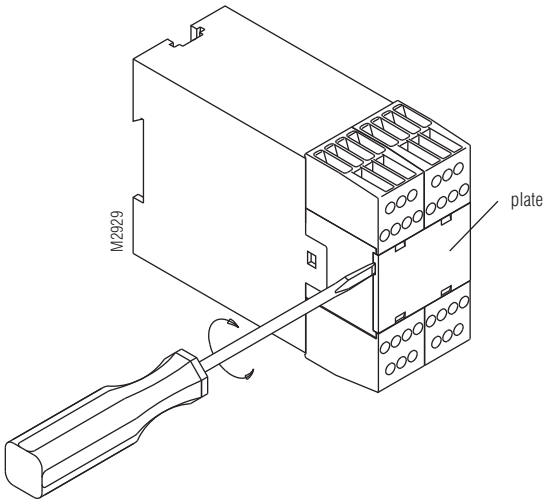
- The cycle ends when feed back circuit of the safety controller is interrupted. The valve will only be monitored when switching the start signal for the first time.
- The cycle ends when switching off the start signal by the safety controller. In this case the valve will be monitored continuously.

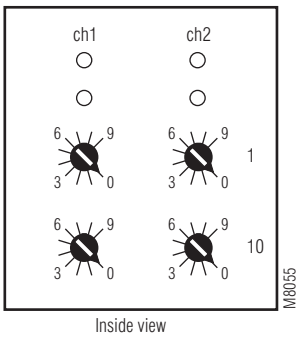
Because of the potential free inputs it is possible to connect as many modules BH 5904 as required, which monitor different valves to the same feed back circuit.

Notes

- Adjustments on the unit may only be carried out by qualified specialist staff when the unit is disconnected from the supply.
- Before removing the front plate of the unit potential equalisation must be made.
- The module is a passive monitoring device which does not start any dangerous movement. It prevents against dangerous movement together with the safety controller it when it detects a failure in its monitoring area. The safety controller therefore has to have a feed back circuit.

Setting





Inside view

The setting of the function of the BH 5904 is done with 4 rotational switches located behind the front plate shown in the picture. The switches on the left select the function on processor 1 and the switches on the right of processor 2. For both processors the setting must be the same.

Example for setup:
Function to be selected: status sensor on valve is C/O contact,
1 valve test per machine cycle, max. 1 s.
Set both upper switches to 5
Set both lower switches to 1

	Time in which the valve has to react									
SW 1	0	1	2	3	4	5	6	7	8	9
(s)	0,5	0,61	0,72	0,83	0,94	1,05	1,16	1,27	1,38	1,49

SW. 10 :	Selection of operating mode		
	Valve status sensor	**Valve monitoring mode**	**Contact reinforcement**
0	S21-S22 : NC, S23-S24: NC	1 test per machine cyclic	Without contact reinforcement
1	S21-S22 : NO, S23-S24: NC		
2	S21-S22 : NO, S23-S24: NO		
3	S21-S22 : NC, S23-S24: NC	Continuous monitoring of the valve	
4	S21-S22 : NO, S23-S24: NC		
5	S21-S22 : NO, S23-S24: NO		
6	S21-S22 : NC, S23-S24: NC		With contact reinforcement
7	S21-S22 : NO, S23-S24: NC		
8	S21-S22 : NO, S23-S24: NO		
9	not allowed		

Operation Modes

At the beginning of a machine cycle the following conditions for the initial state of the module have to be fulfilled, before the start signal of the safety controller can activate the relays K1 and K2:

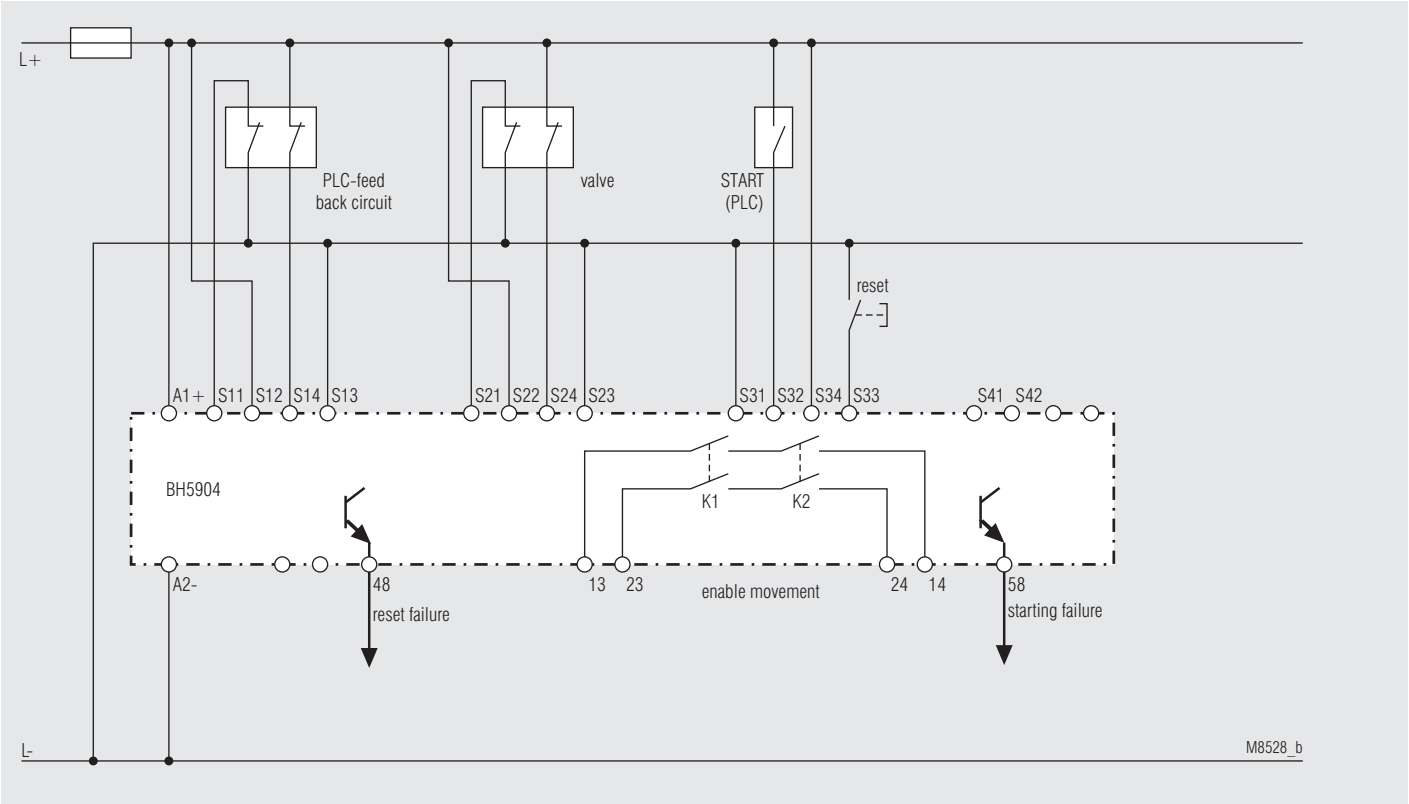
- The feed back circuit of the safety controller must be closed.
- The starting signal must be inactive.
- At the end of the previous cycle the valve has to have returned to it´s initial position within the required time.
- The module must not show any stored fault.

The relays K1 and K2 are activated with the positive edge of the starting signal of the controller.
The relaisy de-energise and the module locks out if the valve has not reached it´s end position in the required maximum time or if the starting signal is switched off before the valve has reached its end position. The momentary state of the valve is indicated by the LED run 1.

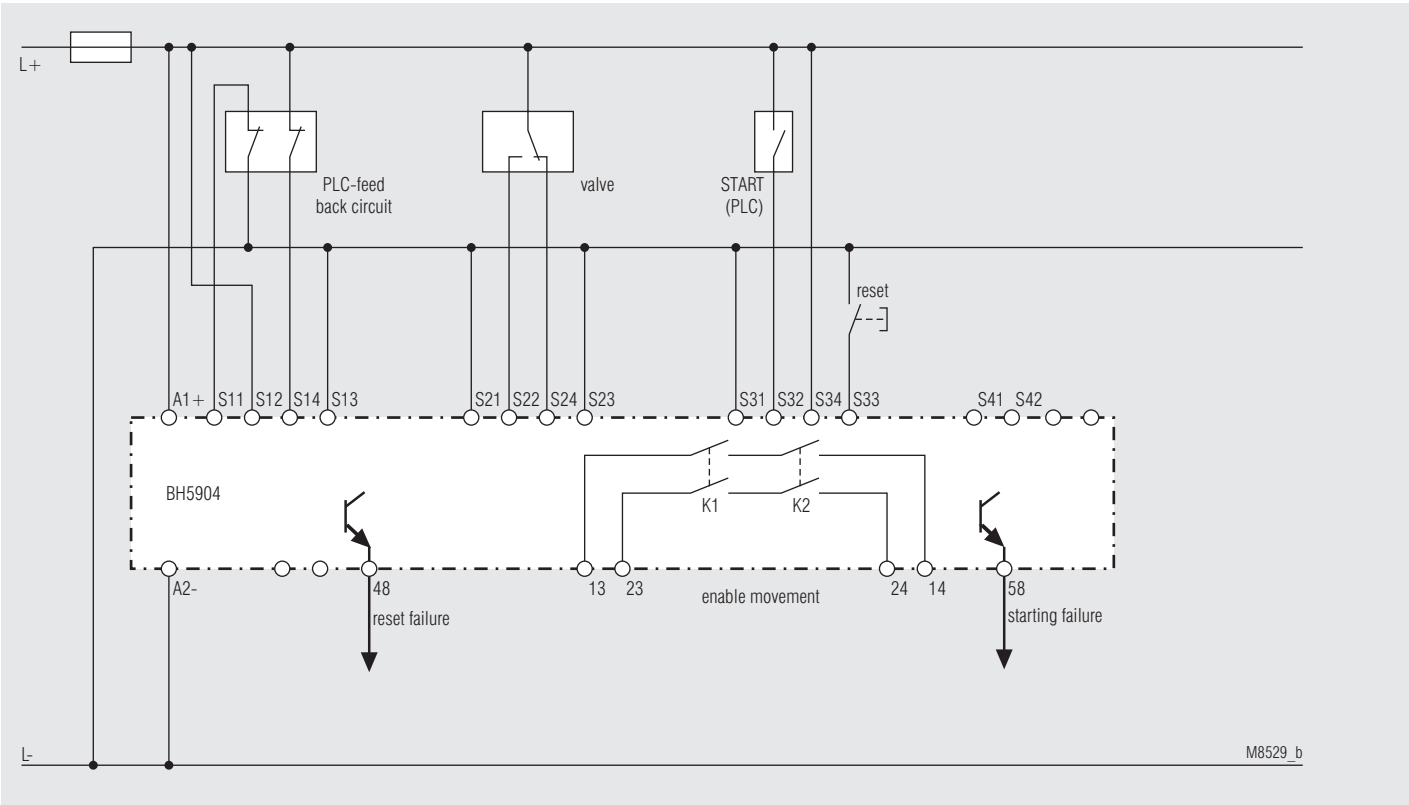
A started cycle is finished in all operating modes by interrupting the feed back circuit.

Reset button
A reset button can be connected to terminals S33-S34 to reset the module without disconnecting the supply voltage.
The reset requires pressing and releasing of the push button and all other signals to be in initial state. Reset is only made if the push button is not longer activated then 3 seconds.

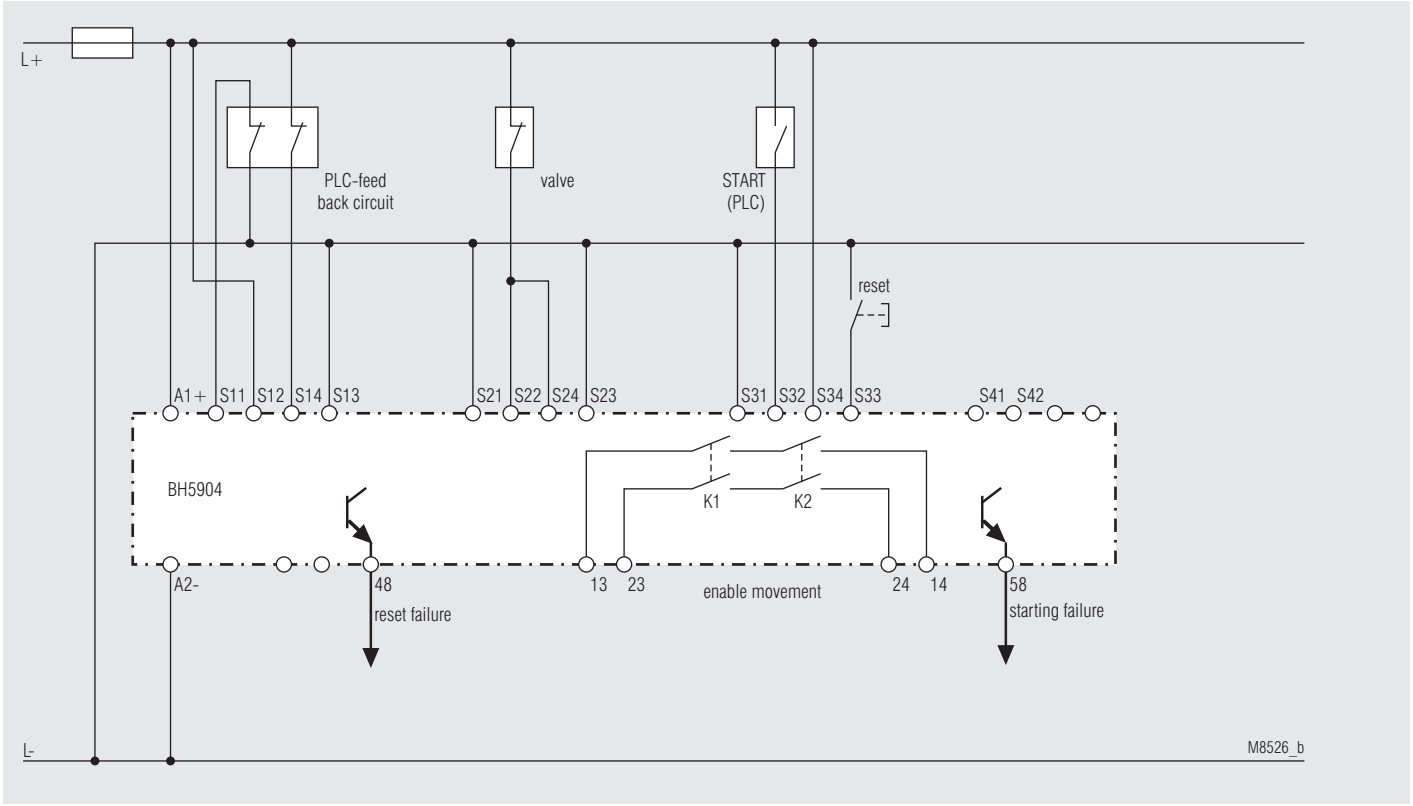
Contact reinforcement
If more contacts are needed or higher currents have to be switched then the unit can handle on K1, K2, the feed back contacts of external contactors can be connected to terminals S41-S42 (2 NC contacts, see pic. 2), which signal the status of these contactors to the BH 5904. The BH 5904 monitors continuously if this input corresponds to the state fo K1 and K2. On failure (more then 100 ms after switching K1 and K2 no equivalent status) K1 and K2 disconnect or do not energise at all. The module BH 5904 can only be reset after removing of the failure by pressing the reset button. Contact reinforcement is only available with functions having continuous valve monitoring (switch 10 = 6, 7 and 8).
If contact reinforcement is not used, terminals S41-S42 remain open.



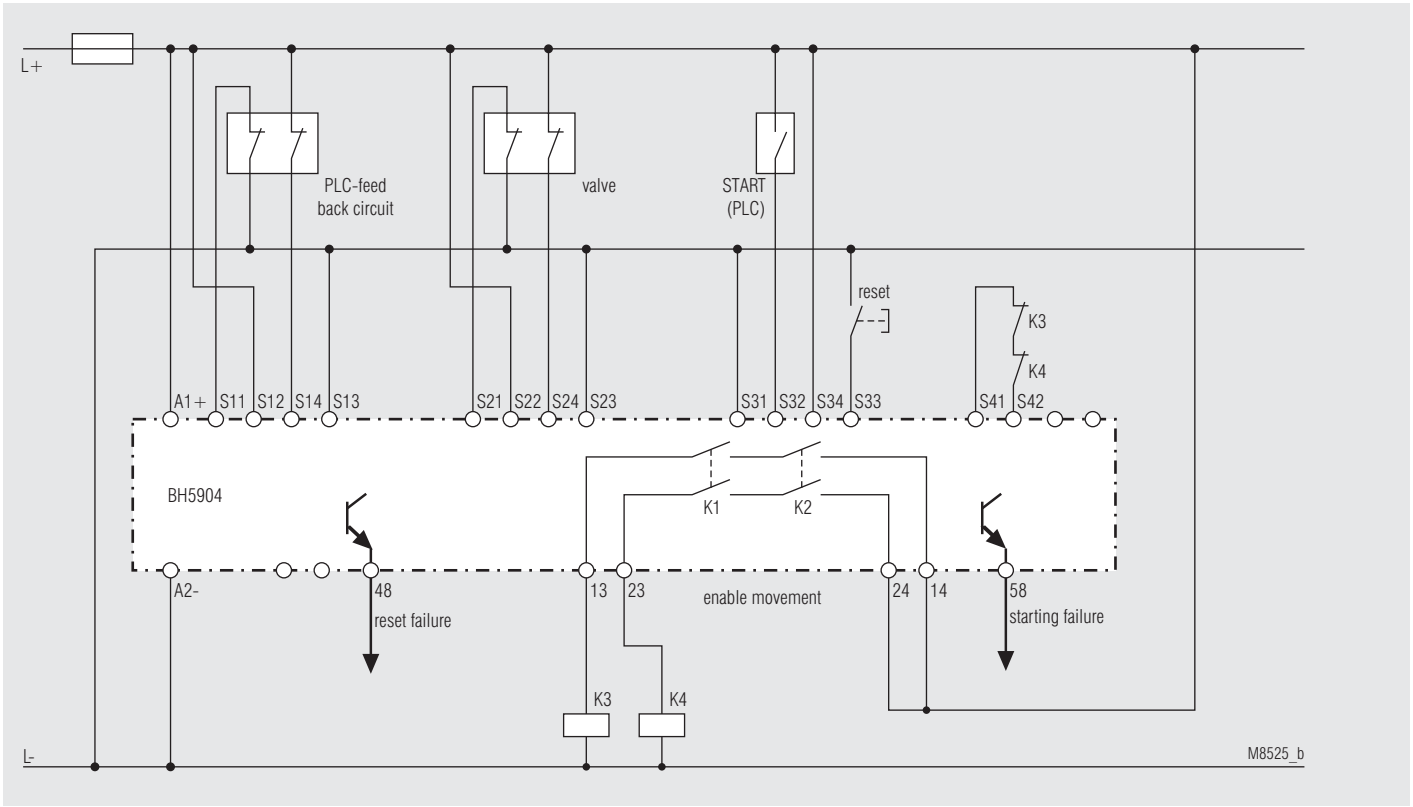
Pic.: 1
Connection without contact reinforcement of contacts, valve sensor 2 NC contacts (same connection as for 2 NO contacts)
(switch 10: posititon 0, 2, 3 or 5)



Pic.: 2
Connection without contact reinforcement of contacts, valve sensor 1 changeover contact (switch 10: position 1, 4 or 7)

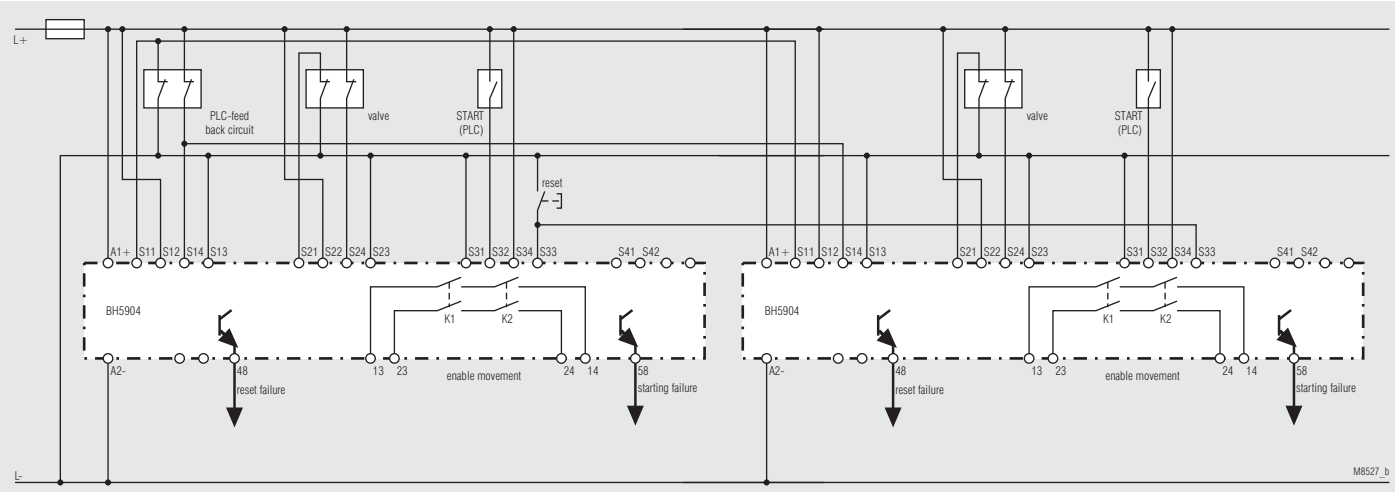


Pic.: 3
Connection without contact reinforcement of contacts, valve sensor 1 NC contact (same connection as for 1 NO contact)
(switch 10: position 0, 2, 3 or 5)



Pic.: 4
Connection with contact reinforcement of contacts (switch 10: position 6)
(when using 2 NO contacts (switch 10: position 8) or 1 changeover contact (switch 10: position 7) the connection of contact reinforcement is identically)

Application Example



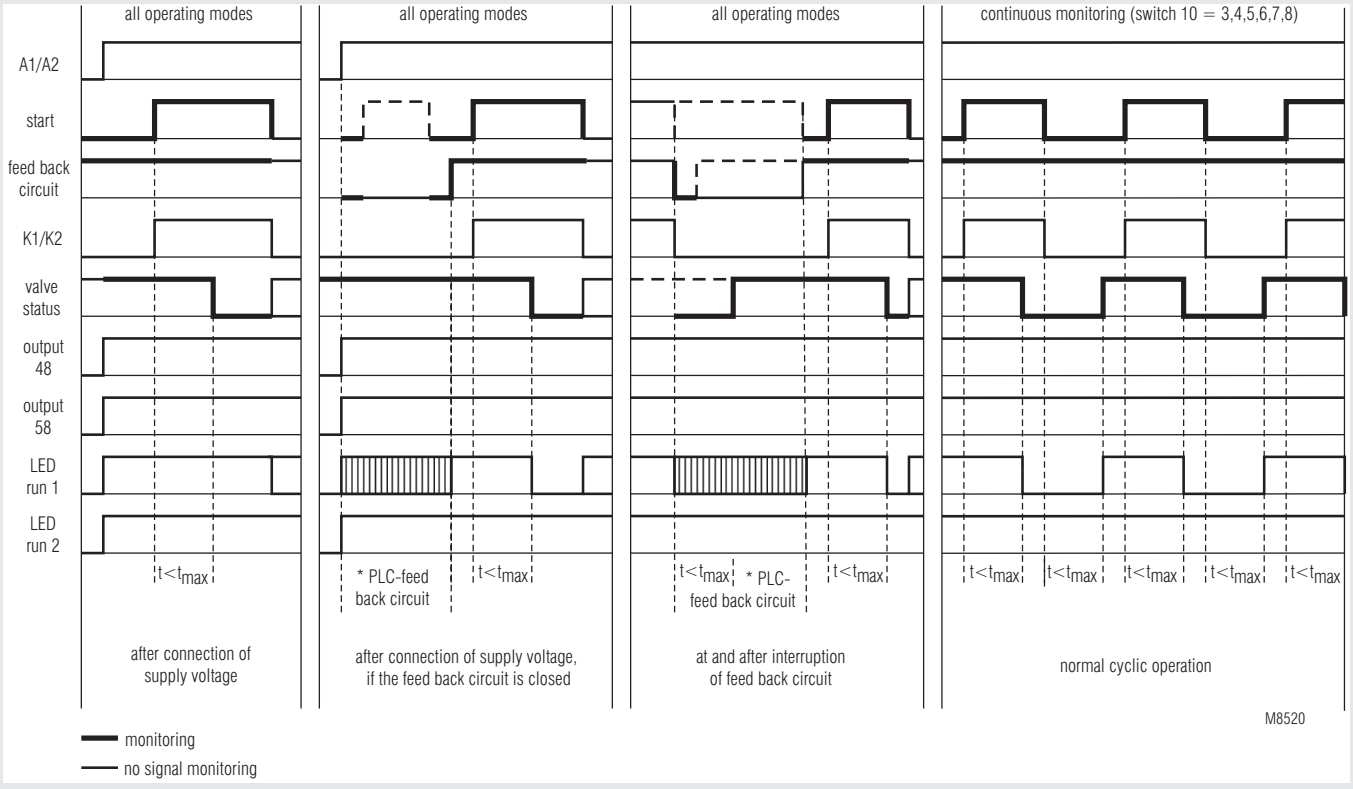
Pic.: 5
Connection when several modules are connected to one feed back circuit and one reset button.

Operation Modes

The valves are continuously monitored, and failures are only during test cycles indicated by the semiconductor outputs 48 (release failure) and 58 (starting failure). In the following cases the relays K1 and K2 are de-energized or do not energise at all:

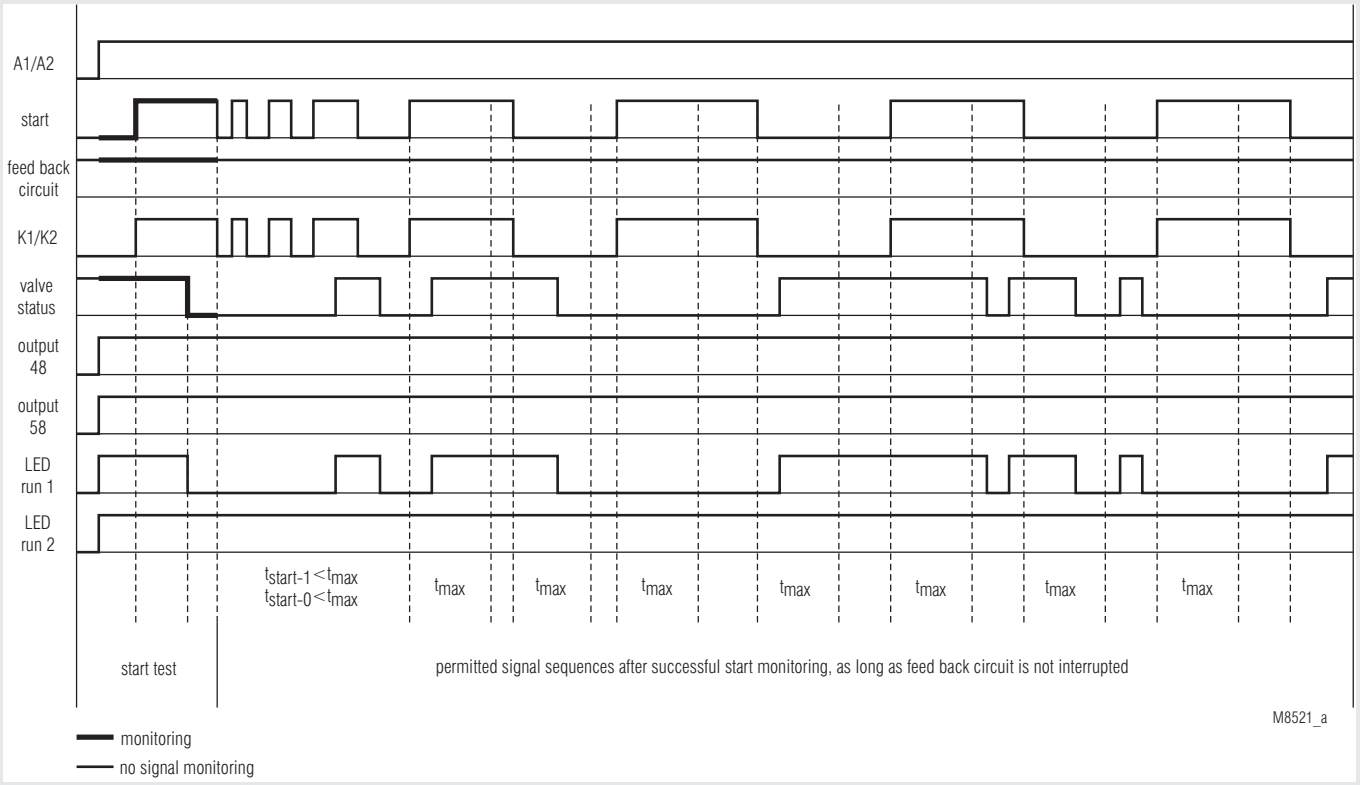
- If all signals except feed back circuit are not in initial state when auxiliary supply is connected.
- If at the beginning of a machine cycle after the first activation by the starting signal the valve does not reach the end state within adjusted time. With the first activation the starting signal has to stay so long that the end position can be indicated.
- If at the beginning of a machine cycle after the first activation by the starting signal the valve does reach the end position and leaves this position before the starting signal gets inactive.
- If at the end of a machine cycle (interruption of feed back circuit or, when continuous monitoring, negative edge of the starting signal) the valve does not go back into initial position.
- If the signal on S41-S42 does not correspond after max. 100 ms to the state of the relays, when reinforcement of the contacts is selected.

Function Diagram (valve status sensed by NC contacts)

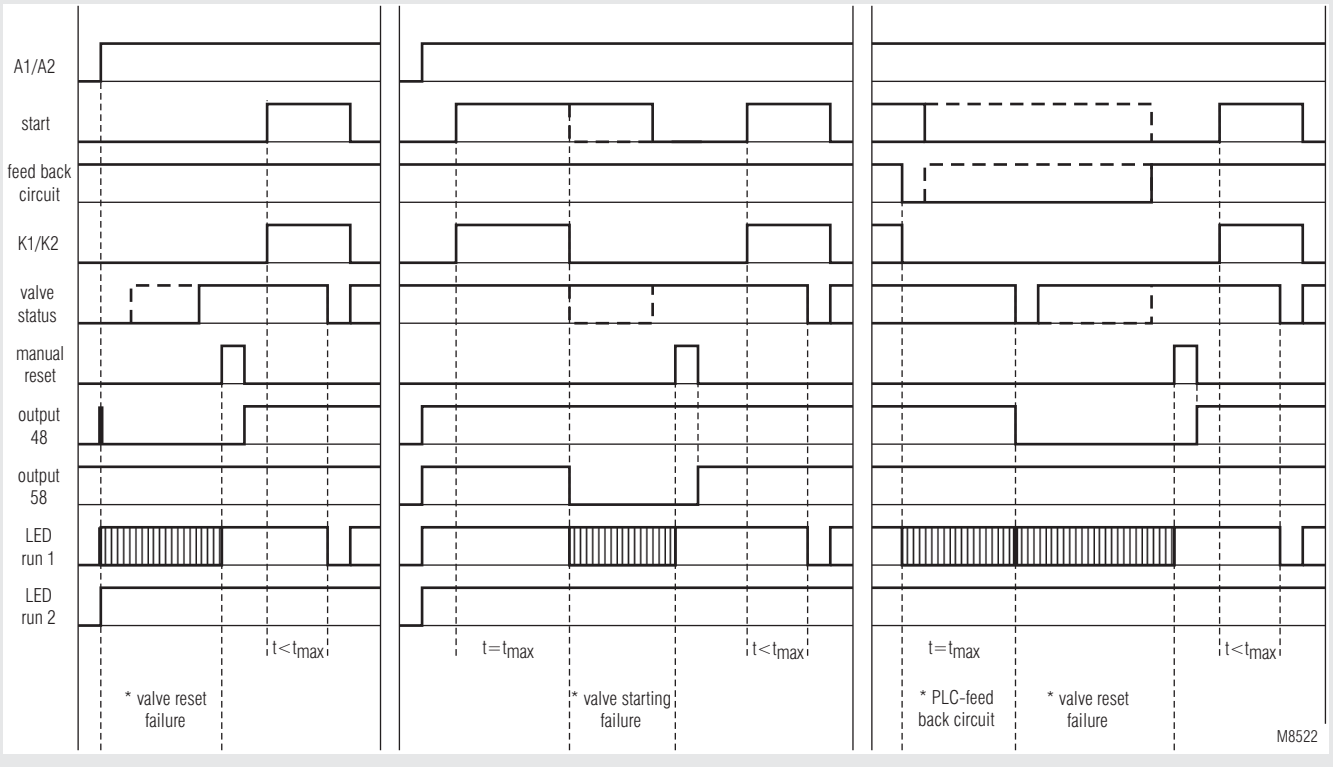


Phases of valve monitoring

Function Diagrams

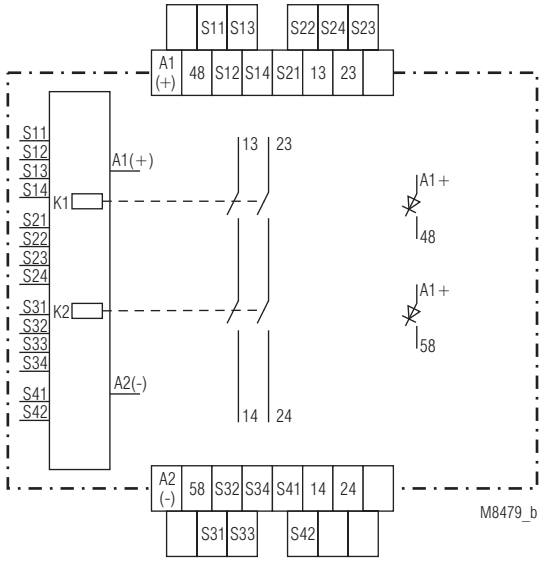


Operating modes without continuous valve monitoring (switch 10 = 0, 1 or 2)



Behaviour when failure detected

Circuit Diagram



BH 5904.02

Connection Terminals

Terminal designation	Signal description
A1+	+ / L
A2 -	- / N
S12, S14, S22, S24, S32, S34, S42	Inputs
S11, S13, S21, S23, S31, S33, S41	Outputs
13, 14, 23, 24	Forcibly guided NO contacts for release circuit
48, 58	Semiconductor monitoring output

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range:	
at max. 5 % residual ripple:	0.85 ... 1.15 U_N
Nominal consumption:	max. 170 mA (semiconductor outputs without load)
Control voltage via S41, 48, 58:	DC 23 V at U_N
Control current via S11-S12, S13-S14, S21-S22, S23-S24, S31-S32, S33-S34, S41-S42:	each 4.5 mA at U_N
Minimum voltage for active signal between terminals S11-S12, S13-S14, S21-S22, S23-S24, S31-S32, S33-S34 und S42:	DC 16 V
Maximum voltage for inactive signal between terminals S11-S12, S13-S14, S21-S22, S23-S24, S31-S32, S33-S34 und S42:	DC 7V
Fusing:	Internal with PTC
Max. discrepancy of the signals of the feed back circuit	
S12-S14 agains S22-24:	100 ms

Output

Contacts		
BH 5904.02:	2 NO contacts	
Type of contact:	Relay, forcibly guided	
Reaction times at U_N		
Start of controller		
when start signal applied:	max. 41 ms	
Drop out time		
at interruption of start signal:	max. 28 ms	
Drop out time		
at interruption of feed back circuit:	max. 28 ms at U_N	
Nominal output voltage:	AC 250 V DC: see arc limit curve	
Switching of low loads:	≥ 100 mV	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	8 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 2 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible operating frequency:	max. 1 200 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
line circuit breaker:	C 8 A	
Mechanical life:	10 x 10^6 switching cycles	

Semiconductor Outputs

Output (terminal 48 and 58):	Transistor outputs, plus-switching
Output voltage:	DC 24 V, max. 100 mA continuous current, max. 400 mA for 0.5 s internal short circuit, overtemperature and overload protection.

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	± 0 ... + 50 °C	
storage :	- 25 ... + 85 °C	
altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1

Technical Data

EMC

Electrostatic discharge:	8 kV (contact) (Test degree 3)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:		
on wires for supply A1-A2:	2 kV	IEC/EN 61 000-4-4
on signal and control wires:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for 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	IEC/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 V0-behaviour to UL subject 94
Vibration resistance:	according to IEC/EN 61 496-1 (1997) Amplitude 0.35 mm IEC/EN 60 068-2-6 Frequency 10 ... 55 Hz
Shock resistance:	
Acceleration:	10 g
Impulse length:	16 ms
Number of shocks:	1000 per axis on all three axes
Climate resistance:	0 / 050 / 04 IEC/EN 60 068-1
Terminal designation:	EN 50 005
Wire connection:	1 x 2.5 mm² stranded wire with sleeve or 1 x 4 mm² massive or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Wire fixing:	Box terminals with self lifting wire Protection and plus-minus scews M3.5
Mounting:	DIN rail IEC/EN 60 715
Weight:	320 g

Dimensions

Width x height x depth:	45 x 84 x 121 mm

Safety Related Data

Values according to EN ISO 13849-1:

Kategorie:	4	
PL:	e	
$MTTF_d$:	31.9	a
DC / DC_{avg}:	98,9	%
d_{op}:	220	d/a (days/year)
h_{op}:	12	h/d (hours/day)
t_{Zyklus}:	97	s/Zyklus

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	98.9	%
SFF	99.6	%
PFH_D:	7.66E-9	h^{-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"

Nominal voltage U_N:	DC 24 V
Ambient temperature:	0 … +50°C
Switching capacity:	
Ambient temperature 50°C:	Pilot duty B300 5A 250Vac G.P. 5A 24Vdc
Semiconductor outputs:	24Vdc, 100 mA
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

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

Standard Type

BH 5904.02/00MF2 DC 24 V

Article number:	0055225
• Output:	2 NO contacts
• All functions settable via rotational switches	
• Nominal voltage U_N:	DC 24 V
• Width:	45 mm

Ordering Example

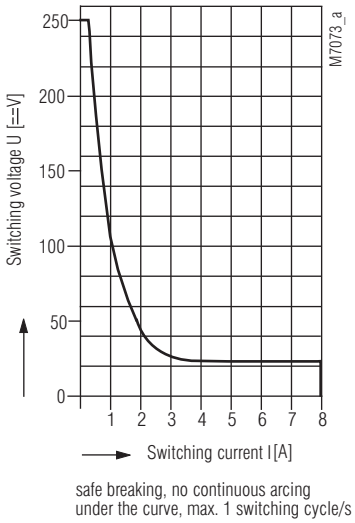
BH 5904 .02 /00MF2 DC 24 V

- DC 24 V — Nominal voltage
- .02 — Contacts
- BH 5904 — Type

Variant

BH 5904.02/00MF2/61:	With UL approval

Characteristic



safe breaking, no continuous arcing
under the curve, max. 1 switching cycle/s

Arc limit curve

Fault Indication By Flashing Code

The failure codes are displayed by a flashing sequence of the upper yellow LEDs run 1, run 2. Flashing frequence: env. 0,5 s on, 0,05 s off, end od the sequence: env. 2 s off. It is possible that the two processors show different failure codes.
If a failure is displayed, the relays K1 and K2 are switched off.
The module BH 5904 shows 2 types of failure codes:

1. FAILURE type 1:
These failures are serious and do not allow further operation of the module. They are indicated only by the LEDs run 1 and / or run 2 of the module. The semiconductor outputs 48 and 58 are both switched off. The module can only be reset by switching the power supply off and on again.

2. FAILURE type 2:
This failure is concerning the function faults in conjunction with the safety controller and / or the monitored valve. These faults are only indicated on LED run 1, the LED run 2 stays on. The module locks out except in the case when the feed back circuit of the controller is interrupted. It can only be reset by switching the power supply off and on again or by pressing the reset button.

Failure type 1

N°*)	Description	Mesures et conseils
0	Internal module failure (LEDs are continuously off)	If both LEDs stay off, the module is defective and has tobe repaired.
5	Adjustment failure	1) The settings of the 2 channels are not identically. 2) The selected setting is not permitted.
6	Undervoltage detection ou Overvoltage detection	1) Left LED is flashing: The supply voltage dropped below the permitted value (< approx.0.85 U_N) 2) Right LED is flashing: The supply voltage went over the permitted value (> approx.1.15 U_N + 5 % residual ripple)
7	Input failure	1) A short circuit has been detected on the inputs of the unit. 2) The 2 signals of a 2-channel feed back circuitdo not correspond (shortcircuit, broken wire or other fault)
8	Failure on relays K1 or K2	Check circuit and current. Module has to be repaired.
9 10 11	Internal module failure	Please try to evaluate the circumstances that lead to this10 fault and check with the supplier or manufacturer.
12 13 14	Internal module failure	The module has to be repaired

*) No.: Number of flash pulses in a series

Failure type 2

No.*)	Description	Measures and notes
1	Valve starting failure (no end position)	The valve has not reached it´s end position within the adjusted time. The unit has locked out.
2	Setting failure	The valve is not in initial position when starting or has not reached the initial position after de-activation within the adjusted time. The unit has locked out.
3	Feed back circuit interrupted from safety controller	The unit is again ready for start as the feed back circuit is closed, the valve has returnded back to initial position within the adjusted time and the starting signal is off.
4	Contact reinforcement failure	The reaction time for the external relays was too long. The unit has locked out.
5	PLC-starting failure	Start is active, while it should be inactive.
6	Failure on reset button	Reset button was activated while switching on or has been pressed for more then 3 s. The unit has locked out. It can be reset by releasing and pressing again the reset button or by switching the supply off and on again.

*) No.: Number of flash pulses in a series

VARIBOX
Emergency-Stop-Device
NI 5061

0269383

Your advantages
- easy to xchange due to plug connector and profile frame mounting
- slim design, easy to mount on safety guards wit only one screw in profile frame

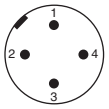
Features
- NI 5061.06: Emergency stop with 2 NC contacts (forced opening)
  NI 5061.43: Emergency stop with 2 NC contacts (forced opening) + 1 NO contact
- M12-connection
  NI 5061.06: 4-poles
  NI 5061.43: 8-poles
- Twist release left or right
- Foolproof acc. to EN ISO 13850
- According to EN 60947-5-1, EN 60947-5-5

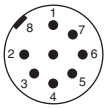
Approvals and Markings

CE

Technical Data

Contacts	4-poles 2 NC contacts (forced opening)	8-poles 2 NC cont. (forced opening) + 1 NO cont.
Thermal current I_{th}: AC 15 at 40 °C: DC 13:	 4 A 2.5 A	
Switching capacity	to AC 15: IEC/EN 60 947-5-1 1.5 A / AC 240 V 3 A / AC 120 V	1 V ... 36 V
	to DC 13: 0.27 A / DC 250 V 0.55 A / DC 125 V 1 A / DC 60 V 2 A / DC 24 V	1 mA ... 250 mA
Electrical life:	50.000 at rated load	
Mechanical life:	50.000 operations (ambient temperature = 20 °C)	
Bouncing time:	< 10 ms	
Forcible NC:	acc. to EN 60947-5-1, appendix K	
Force opening distance:	> 3 mm	
Overvoltage category:	II	
Test voltage M12-plug:	2.0 kV	
Contact material:	AgNi	AgNi, gold plated 5 µm
Temperature range Operation: Storage:	 - 25 ... + 70 °C - 25 ... + 85 °C	
Altitude:	< 2.000 m	
Degree of protection:	IP 65	
Connection:	M12; 4-poles (m)	M12; 8-poles (m)





Pin	Description	Pin	Description
1	NC contact 1	1	NC contact 1
2		2	
3	NC contact 2	3	NC contact 2
4		4	
		5	NO contact
		6	
		7	n. c.
		8	

Fixation:	with fastening clip	

Application

The VARIBOX emergency-stop Minibox is a electromechanical switchgear serving to protect persons working with machinery or close to it. It is used to stop or switch off machinery and equipments in order to avert impending or minimise existing dangers to persons or damages on machines /material.

The following (inter)national statutory provisions apply to installation, commissioning and regular technical inspections:
- Directive 2006/42/EG
- Low-Voltage Directive 2006/95/EG
- Safety Regulations as well as
- Regulations of the Accident Prevention / Safety Rules

Manufacturers and operators of machines using E-stops or emergency switch-off devices should retain the responsibility for the adherence of these instructions as well as for compliance with the relevant Safety Regulations and Rules

For the application of E-stops /emergency switch-off devices as directed the respective requirements for installation and operation must be observed:
- EN60204-1:2006
- EN13849-1/-2:2008
- EN ISO 13850:2008

Function

The VARIBOX has been designed for M12-connection. The button is actuated by pushing and reset by turning into both directions.

Standard Type

VARIBOX Not-Halt-Gerät NI 5061.06
Article number: 0065346

Variant

VARIBOX Not-Halt-Gerät NI 5061.43
8-poles; 2 NC contacts (forced opening) + 1 NO contact
Article number: 0065694

Operating instructions ENGLISH

0269383

VARIBOX
Emergency-Stop-Device
NI 5061

Original

DOLD

DANGER

Dangerous voltage.

Electric shock will result in death or serious injury.

Disconnect all power supplies before servicing equipment.

CAUTION

Safe operation of the device is only guaranteed when using certified components!

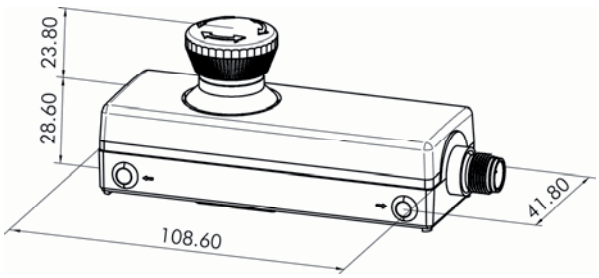
Safety notes

The product hereby described was developed to perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors, evaluation units, signals and logical modules for safe disconnections. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. DOLD cannot guarantee all the specifications of an installation or machine that was not designed by DOLD. The total concept of the control system into which the device is integrated must be validated by the user. DOLD also takes over no liability for recommendations which are given or implied in the following description. The following description implies no modification of the general DOLD terms of delivery, warranty or liability claims.

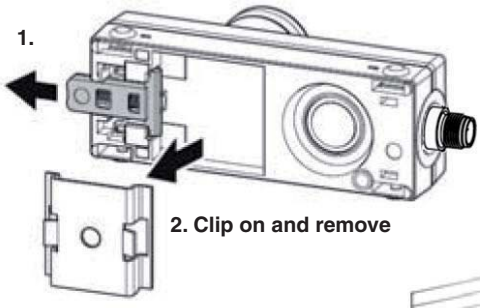
ATTENTION

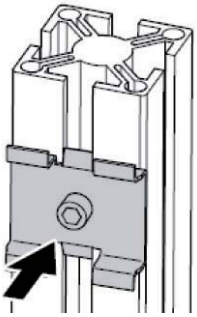
- This device must be installed and operated by trained staff who are familiar with these instructions and with the current regulations for safety at work and accident prevention.
- Pay attention to applicable local regulations, especially regarding safety measures.
- E-stops/ emergency switch-off devices fulfil the function of personal protection. Improper installation or unauthorised modification may lead to severe personal injuries
- E-stops /emergency switch-off devices should not be bypassed, removed or otherwise disabled
- Improper installation or tampering may result in machine and material damages!
- The E-stop / emergency switch-off function should not replace the applicable safety precautions or other safety functions but should rather be used as a back-up safeguarding measure
- The E-stop /emergency switch-off function should not impair the effectiveness of other safety devices or equipment with other safety functions.
- Based on his hazard analysis the design engineer must ensure that in combination with the control system the E-stop /emergency switch-off device meets the required safety category

Dimension [mm]

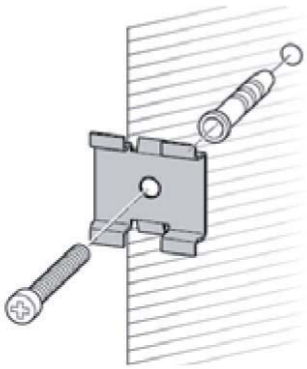


Assembly and Commissioning





Mounting on profile



Wall mounting

Testing Before First Operation

Mechanical Test:	E-stop/switch-off device latches when operated
Electrical Test:	Machine stops / switches off

Disassembling

Before disassembling disconnect equipment and device from the mains!!

Note

A „click“ must be heard when closing the box

- Check whether the two Minibox parts are snapped together properly.
- Make sure that the E-stop is always easily accessible.

Maintenance

- Based on his risk assessment, the machine designer has to determine the inspection interval. It is, however, recommended that the competent safety officer activates and tests the E-stop or switch-off device at least once a year to ensure its proper functioning.
- Mechanical and electrical functional testing acc. to paragraph 4
- Secure mounting
- No visible unauthorised modifications or damages
- No loose connections

Incident Management

Mechanical overload or external impact damage may impair the function of the E-stop / switch-off device. Make functional tests as mentioned under „**Maintenance**“.

SAFEMASTER
Emergency Stop Monitor
BH 5922, BL 5922

CANopen
Profibus

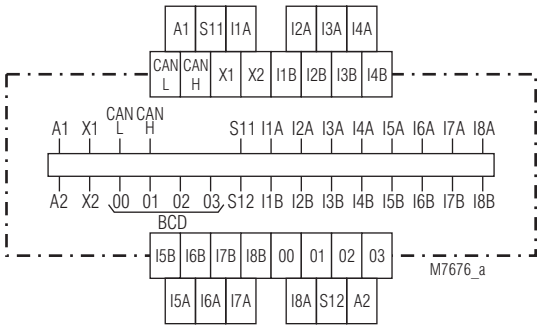
DOLD

0234656

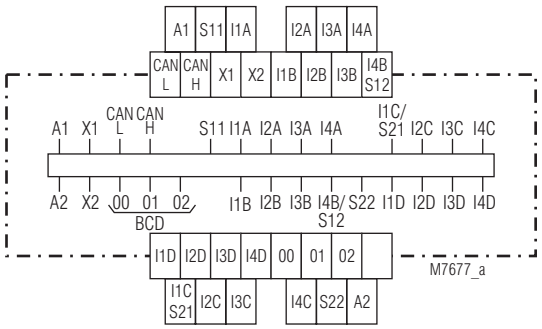
BH 5922 BL 5922

- To monitor max. 16 single-channel e-stop buttons or 8 2-channel e-stop buttons
- E-stop button can be connected directly to BH 5922
- Simple wiring of e-stop buttons
- Extendable in steps of 8 e.g. 16 inputs
- No influence on e-stop system
- Adjustable
  - with manual reset (without link X1 / X2)
  - with automatic reset (with link X1 / X2)
- Reset button and remote reset
- LED indicators to show the state of the e-stop buttons
- As option direct connection of 2-channel e-stop buttons to BH 5922 / BL 5922
- As option with BCD output (high or low active) or CANopen
- As option with CANopen according to DS301 version 3.0
- as option with Profibus DP-V0
- BH 5922: width 45 mm
  BL 5922: width 90 mm

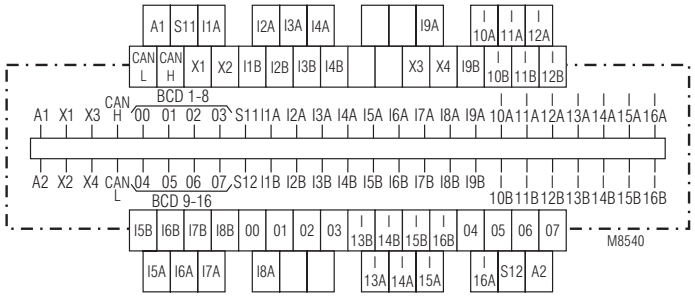
Circuit Diagrams



E-stop button single-channel connection (8 inputs)
BH 5922.08, BH 5922.08/00_, BH 5922.08/10_



E-stop button 2-channel connection (4 inputs)
BH 5922.04/01_, BH 5922.04/11_

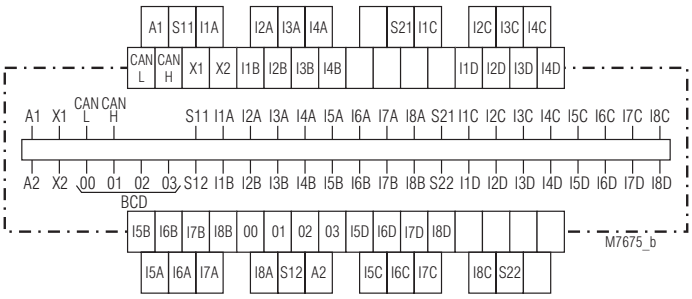


E-stop button single-channel connection (16 inputs)
BL 5922.16/00_, BL 5922.16/10_

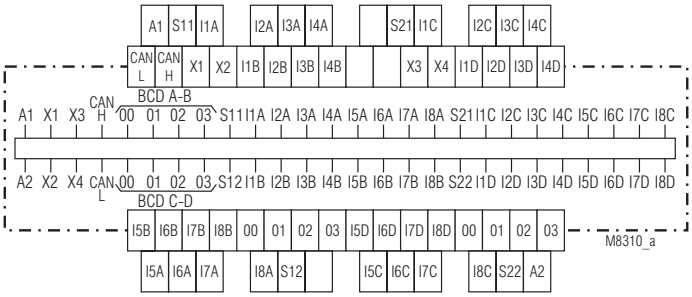
Approvals and Markings

CE

Circuit Diagrams

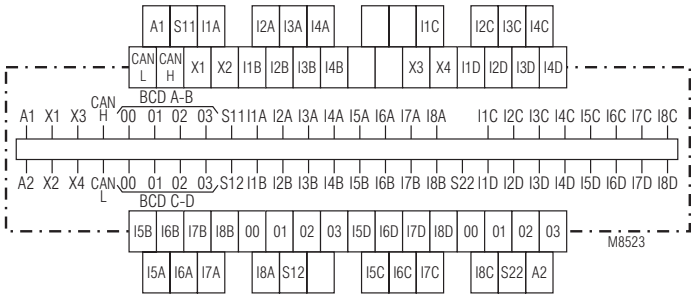


E-stop button 2-channel connection (8 inputs)
BL 5922.08/01_, BL 5922.08/11_

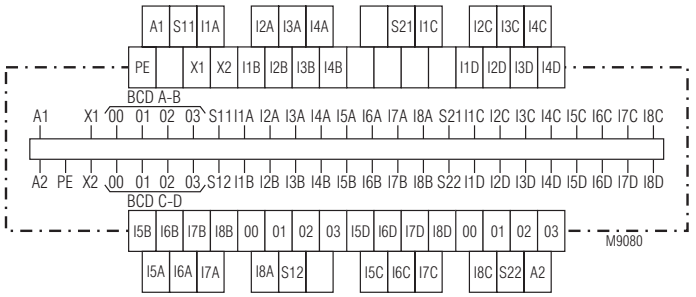


E-stop button 2-channel connection, 2-channel reset for cross fault monitoring systems (8 inputs)
BL 5922.08/03_, BL 5922.08/13_

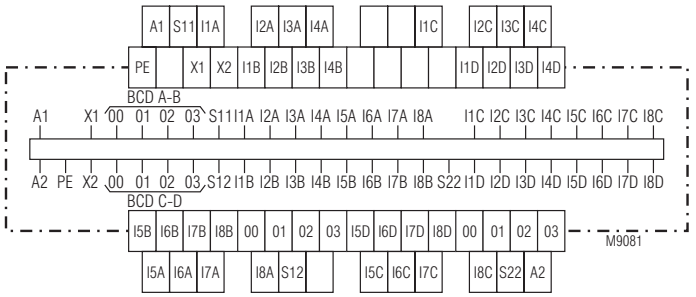
Circuit Diagrams



E-stop button 2-channel connection, 2-channel reset for systems without cross fault monitoring (8 inputs)
BL 5922.08/02_, BL 5922.08/12



E-stop button 2-channel connection, 2-channel reset for systems without cross fault monitoring (8 inputs)
BL 5922.08/23_



E-stop button 2-channel connection, 2-channel reset for systems without cross fault monitoring (8 inputs)
BL 5922.08/22_

Application

Indication of the status of e-stop buttons in an e-stop chain. We recommend to use the BH 5922 together with DOLD E-stop modules (approval).

Function

If all the e-stop buttons are closed all green LEDs are on. If one button is activated the corresponding LED goes off.

The e-stop buttons are connected in series, therefore only one LED goes off even if several buttons are pressed. Only the first activated button in the row is indicated. When this e-stop button is released again the LED lights up again and the LED of the next activated button in the row goes off.

If the variant B_ 5922/0_2, B_ 5922/0_4, B_ 5922/0_5, B_ 5922/1_2, B_ 5922/1_4, B_5922/1_5 is connected to a IP 5503 in Plug and Play modus the outputs show the state of the E-stop buttons and the LEDs the state of the status LEDs I1 - I8 on the e-stop monitor.

Indicators

Green LED "On":	on, when supply connected
Green LED "RDY":	on, when ready for operation (only with B_ 5922/2_ _)
Yellow LED:	on, when bus active (only with variants with fieldbus)
rote LED "ERR":	on, when indicating failure (only with B_ 5922/2_ _)
Green status LEDs:	Continuous: when all e-stop buttons are closed Off: when corresponding e-stop button is pressed Flashing of one status LED only when: - manual reset and - released e-stop buttons and - signal not reset Reset can be made with button on front or with remote reset-button. Flashing of all status LEDs: The input S11 of the e-stop monitor is not connected. A reason could be a broken wire between this terminal and S11 of the e-stop module. When several e-stop monitors are connected in series this status also occurs when the previous shows an activated e-stop button.

Notes

When using B_ 5922/00_ or B_ 5922/01_ for single channel monitoring or 2-channel connection of the e-stop chain the e-stop monitor has to be conected to the loop between S11 and S12 of the e-stop module. In this way channel AB is monitored.

In a 2-channel e-stop loop, the e-stop monitor has to be connected to the channel which normally is between the terminals S11 and S12 of the e-stop module. The E-stop monitor and the e-stop module have to be connected to the same DC 24 V power supply. When using an E-stop module with AC-supply the minus-terminal of the e-stop monitor (A2) must be connected to the minus-terminal of the e-stop control voltage (S21 or PE) on the e-stop module.

CANopen mode (B_ 5922 /0_ _, B_ 5922/1_ _)
With switch position "CANopen" the CANopen protocol is active on the interface. The configuration is made with the programming software PN 5501 in conjunction with minimaster IL 5504 / IN 5504 or e.g. with ProCANopen. The corresponding configuration file on CD can be ordered under order no. PN 5501, article no. 0052860

Plug and Play mode (B_ 5922 /0_ _, B_ 5922/1_ _)
With switch position "Plug and Play" a variant of the CANopen protocol is active on the interface. The unit setting is done with a switch on the front, see picture below. If a system is on plug and play mode it can be switched over to CANopen protocol at any time.

Address setting Plug and Play mode
To allow the E-stop monitor to communicate with a corresponding device via the CAN-bus the addresses have to be set with the 2 rotational switches on the front according to the table below. Adresses between 1...49, 51...99 are possible. Adress 0 and 50 cannot be chosen in Plug and Play mode.

E-stop monitor BH/BL 5922 with address	**transmits to**	**output module IP 5503 with address**
1	→	51
.		.
.		.
49	→	99

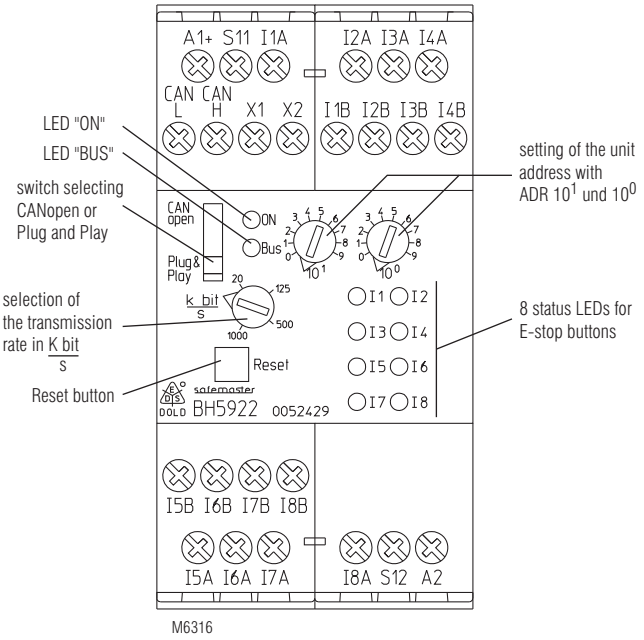
Example of setting:
left switch 10^1:
right switch 10^0:

Address 14
to position 1 x 10^1
to position 4 x 10^0

Notes for Plug and Play mode
On the BL-models with 2-channel monitoring of the e-stop loop 2 addressees and 2 transmission rates can be chosen (channel AB and channel CD). For correct operation the adress settings must be different and the transmisson rate settings must be the same.
The screen of the bus wire has to be connected to A2 of the e-stop monitor.

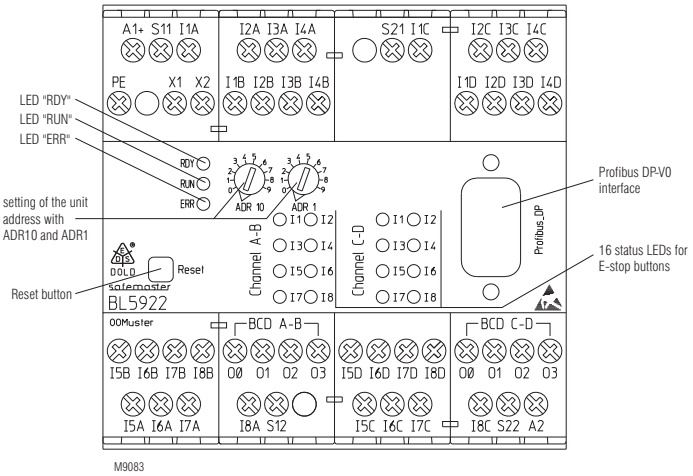
Set-up procedure
1.) Connect CAN-bus to terminals CAN_L and CAN_H
2.) Terminate the physical end of the bus by connecting a termination resistor of 120 Ω between CAN_L and CAN_H on the first and last module of the bus
3.) Connect screen of bus wire to A2
4.) Select transmission rate (e.g. 20 K bit/sec) using the rotational switch on the front (see drawing)
5.) Select address of the module using rotational switches on the front (see drawing and above example)

Attention:
- To communicate in a system configured for Plug and Play modus it is necessary to connect one BH/BL 5922 with adress 1 to the CAN-bus.
- The device adress, the transmission rate and the change of operating mode between CANopen and Plug and Play will only be accepted when the device is powered up.



Connection with Profibus (BL 5922 /2_ _)
The connection to Profibus DP is made via a Sub D connector socket on the front of the device. The standard for installation according to the PNO-document "Installation Guideline for Profibus DP/FMS" have to be observed.

Configuration of the device
The address (01 to 99) of the module for the Profibus System is adjusted with the rotary switches ADR10 and ADR1. To configure the network the device configuration file "EDSO8E8.lsd" is necessary. It can be found on the DOLD-CD PN 5501 in the directory Profibus/GSD.
Order number: PN 5501, article number 0052860



Description of Data Transmission for units with bus interface

a) CANopen
The transmit PDO has follow structure:

Read8Inputs	Read8Inputs_old	Status8Inputs	Saved8Inputs	Dummy1	Dummy2	Dummy3	Device_ID

b) Profibus

Kanal A - B			Kanal C - D		
Read8Inputs	Status8Inputs	Saved8Inputs	Read8Inputs	Status8Inputs	Saved8Inputs

The bytes in the data string have the following content:

Read8Inputs: State of the e-stop buttons
Bit x = 0 e-stop button
Bit x = 1 e-stop button not active

Read8Inputs_old
(only with CANopen): State of e-stop button at time t-1. The designation of the bits is the same as with Read8Inputs

Saved8Inputs: Latched state of the e-stop buttons, if the e-stop monitor is operated in manual reset mode.
To detect that the manual reset mode is selected bit 1 in byte Status8Inputs can be used.

Status8Inputs: Actual state of e-stop monitor
Bit 0 = 1 One e-stop button is activated
Bit 1 = 1 E-stop monitor aperated in manual reset mode
Bit 2 = 1 The e-stop monitor was acknowledgement (activation of reset button or remote reset)
Bit 3 = 1 At the beginning of the e-stop loop (terminal S11 or S21) the correct voltage is present. If bit 3 is 0 then the wire between e-stop modul and e-stop monitor is interrupted.

Device_ID
(only with CANopen): Device Id = 0 x 0 C E-stop monitor for connection of 4 e-stop buttons (.04)
Device Id = 0 X 0 D E-stop monitor for connection of 8 e-stop buttons (.08)

Dummy 1-3
(only with CANopen): not used Bytes

Possible state of the bytes depending on the activation of the e-stop buttons:

Mode	actuation	active			not active			reset		
		E*	ST*	SP	E*	ST*	SP	E*	ST*	SP
auto reset mode	Initial position	FF	0C	FF	FF	0C	FF			
	no S11	FF	04	FF	FF	0C	FF			
	S1 active	FE	0D	FE	FF	0C	FF			
	S2 active	FD	0D	FD	FF	0C	FF			
	S3 active	FB	0D	FB	FF	0C	FF			
	S4 active	F7	0D	F7	FF	0C	FF			
	S5 active	EF	0D	EF	FF	0C	FF			
	S6 active	DF	0D	DF	FF	0C	FF			
	S7 active	BF	0D	BF	FF	0C	FF			
	S8 active	7F	0D	7F	FF	0C	FF			
manual reset mode	Initial position	FF	0E	FF	FF	0E	FF	FF	0E	FF
	no S11	FF	06	FF	FF	0E	FF	FF	0E	FF
	S1 active	FE	0B	FE	FF	0A	FE	FF	0E	FF
	S2 active	FD	0B	FD	FF	0A	FD	FF	0E	FF
	S3 active	FB	0B	FB	FF	0A	FB	FF	0E	FF
	S4 active	F7	0B	F7	FF	0A	F7	FF	0E	FF
	S5 betätigt	EF	0B	EF	FF	0A	EF	FF	0E	FF
	S6 active	DF	0B	DF	FF	0A	DF	FF	0E	FF
	S7 active	BF	0B	BF	FF	0A	BF	FF	0E	FF
	S8 active	7F	0B	7F	FF	0A	7F	FF	0E	FF

*) E = Value for Read8Inputs
ST = Value for Status8Inputs
SP = Value for Saved8Inputs

Technical Data

BCD output, high active: (only with B_ 5922/001, B_ 5922/011)

O3	O2	O1	O0	description
0	0	0	0	input S11 without voltage
0	0	0	1	E-stop 1 active
0	0	1	0	E-stop 2 active
0	0	1	1	E-stop 3 active
0	1	0	0	E-stop 4 active
0	1	0	1	E-stop 5 active
0	1	1	0	E-stop 6 active
0	1	1	1	E-stop 7 active
1	0	0	0	E-stop 8 active
1	1	1	1	no E-stop active

BCD output, low active: (only with B_ 5922/003, B_ 5922/013)

O3	O2	O1	O0	description
1	1	1	1	input S11 without voltage
1	1	1	0	E-stop 1 active
1	1	0	1	E-stop 2 active
1	1	0	0	E-stop 3 active
1	0	1	1	E-stop 4 active
1	0	1	0	E-stop 5 active
1	0	0	1	E-stop 6 active
1	0	0	0	E-stop 7 active
0	1	1	1	E-stop 8 active
0	0	0	0	no E-stop active

BCD output, high active: (only with B_ 5922/021, B_ 5922/031)

O7	O6	O5	O4	O3	O2	O1	O0	description
0	0	0	0	0	0	0	0	input S11 without voltage
0	0	0	1	0	0	0	1	E-stop 1 active
0	0	1	0	0	0	1	0	E-stop 2 active
0	0	1	1	0	0	1	1	E-stop 3 active
0	1	0	0	0	1	0	0	E-stop 4 active
0	1	0	1	0	1	0	1	E-stop 5 active
0	1	1	0	0	1	1	0	E-stop 6 active
0	1	1	1	0	1	1	1	E-stop 7 active
1	0	0	0	1	0	0	0	E-stop 8 active
1	1	1	1	1	1	1	1	no E-stop active

BCD output, low active: (only with B_ 5922/023, B_ 5922/033)

O7	O6	O5	O4	O3	O2	O1	O0	description
1	1	1	1	1	1	1	1	input S11 ist without voltage
1	1	1	0	1	1	1	0	E-stop 1 active
1	1	0	1	1	1	0	1	E-stop 2 active
1	1	0	0	1	1	0	0	E-stop 3 active
1	0	1	1	1	0	1	1	E-stop 4 active
1	0	1	0	1	0	1	0	E-stop 5 active
1	0	0	1	1	0	0	1	E-stop 6 active
1	0	0	0	1	0	0	0	E-stop 7 active
0	1	1	1	0	1	1	1	E-stop 8 active
0	0	0	0	0	0	0	0	no E-stop active

0 = voltage on output: 0 V
1 = voltage on output: 24 V

CANopen interface (B_5922/0_ _, B_5922/1_ _)

B_5922/1_ _:	according to ISO 11 898-1, galvanic separation
wiring:	screened twisted pair
transmission rate:	settable 20 K bit/s, 125 K bit/s, 500 K bit/s, 1 M bit/s,
max. length:	20 K bit/s = 2500 m 125 K bit/s = 500 m 500 K bit/s = 100 m 1 M bit/s = 25 m

Plug and Play
transmission rate: 20 K bit / sec (recommended)

Attention:

Both physical ends of the 2-wire system must be terminated with a 120 Ω resistor between the terminals CAN_L and CAN_H.

Technical Data

Profibus-interface (B_ 5922/2_ _)

Wire:	screened twisted pair IEC 61 158
Protokoll:	Profibus DP-V0
max. lengt:	1200 m at 9,6 Kbit/s ... 45,45 Kbit/s 1000 m at 93,75 Kbit/s ... 137,5 Kbit/s 400 m at 500 Kbit/s 200 m at 1500 Kbit/s 100 m at 3000 Kbit/s ... 1200 Kbit/s

The installation guidelines according to the PNO-document "Installation Guideline for the Profibus DP/FMS" have to be observed in respect to the max. length of a bus segment. The PE terminal has to be connected to ground.

Input

Nominal voltage U_N (A1/A2):	DC 24 V
Voltage range:	0,8 ... 1,1 U_N
Control voltage on S11/S12:	DC 24 V
Reset input X_1, X_2:	Voltfree contact
BCD interface:	
Output (O0,O1,O2, O3):	Transistor switching +
switched /auxiliary voltage:	DC 24 V
Switching capacity:	40 mA short circuit proof
Residual voltage:	typ. 0,6 V

General Data

Operating mode:	Continuous operation
Temperature range:	- 20 ... + 60 °C
EMC	
Electrostatic discharge:	8 kV (air) IEC/EN 61 000-4-2
Surge proof against wire bound surges, induced by high frequency fields:	10 V class 3, f = 150 kHz - 80 MHz IEC/EN 61 000-4-6
Fast transients:	2 kV IEC/EN 61 000-4-4
Surge voltages 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
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 V0-behaviour to UL subject 94
Vibration resistance:	Amplitude 0,35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz
Climate resistance:	20 / 060 / 04 IEC/EN 60 068-1
Terminal designation:	EN 50 005
Wire connection:	1 x 4 mm² solid or 1 x 2,5 mm² stranded ferruled or 2 x 1,5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4 or 2 x 2,5 mm² stranded ferruled DIN 46 228-1/-2/-3
Wire fixing:	Terminal screws M3.5, box terminals with wire protection
Mounting:	DIN rail IEC/EN 60 715
Weight:	approx. 255 g (BH 5922); approx. 470 g (BL 5922)

Dimensions

Width x height x depth:

BH 5922:	45 x 86 x 121 mm
BL 5922:	90 x 86 x 121 mm

Safety Related Data

Safety data are available on request

Standard Types

BH 5922.08 DC 24 V
Article number: 0052427
- for 8 e-stop-buttons, single channel connection
- Nominal voltage U_N: DC 24 V
- Width: 45 mm

BL 5922.08/010 DC 24 V
Article number: 0052430
- for 8 e-stop buttons, 2-channel connection
- Nominal voltage U_N: DC 24 V
- BH 5922: 45 mm width
  BL 5922: 90 mm width

Variants

B_ 5922 ._ _ / _ _ _

0 = without BCD output and without fieldbus interface
1 = with BCD output, high active
2 = with fieldbus interface
3 = with BCD output, low active
4 = with fieldbus interface and BCD output, high active
5 = with fieldbus interface and BCD ouput, low active

Connection of e-stop buttons
0 = single channel
1 = 2-channel
2 = 2-channel, 2-channel monitoring when no cross fault monitoring (only with BL 5922)
3 = 2-channel, 2-channel monitoring when cross fault monitoring (only with BL 5922)

0 = CANopen interface not galvanic separated or without fieldbus interface
1 = CANopen interface galvanic separated
2 = Profibus DP-V0 (only with BL 5922)

Number of e-stop buttons that can be connected
04 = 4 e-stop buttons, 2-channel connection with BH 5922
08 = 8 e-stop buttons
16 = 16 e-stop buttons only for BL 5922._ _/00_

H width 45 mm
L width 90 mm

Ordering example for variants

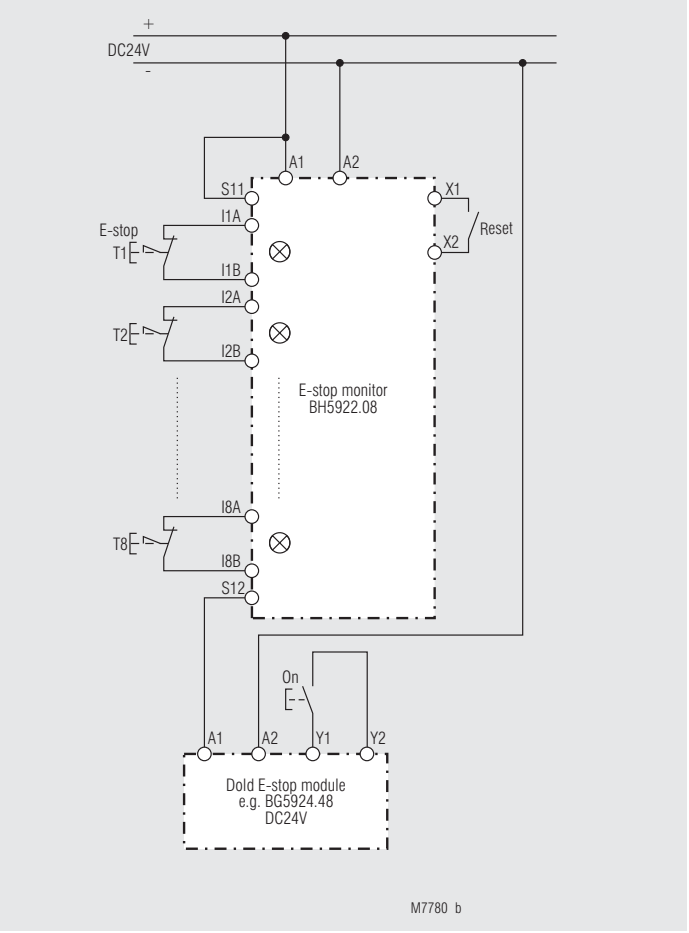
BH 5922. 08 / _ _ _ DC 24 V

Nominal voltage
Variant, if required
Number of e-stop buttons that can be connected
Type

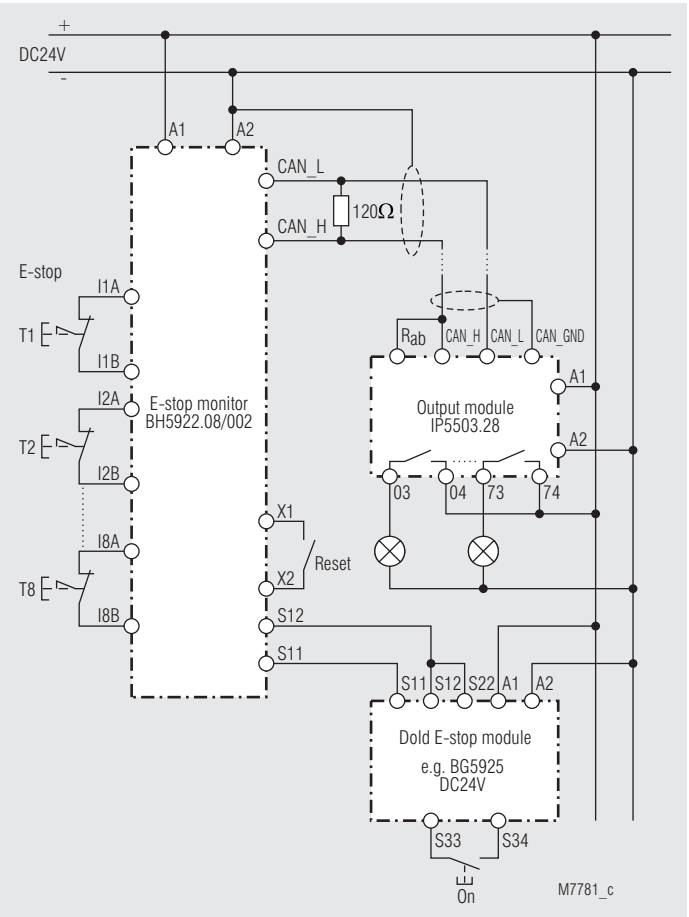
Acessories

- CANopen PLC IL 5504
- Input / Output Module IN 5509
- Input Module, Digital IP 5502
- Output Module, Digital IP 5503
- Input Module, Analogue IL 5508
- Output Module, Analogue IL 5507

Application Examples

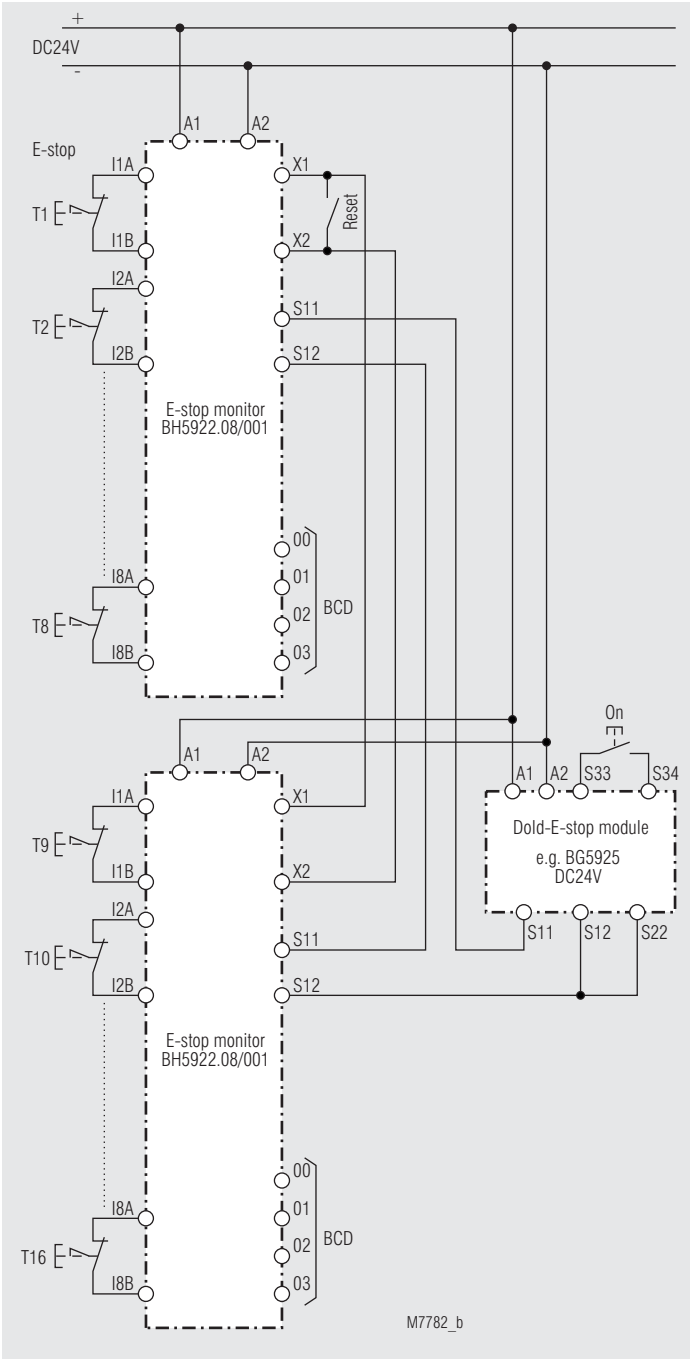


Pic 1: Monitoring of 8 e-stop buttons with e-stop monitor, single-channel connection, e-stop module single channel. Display via 8 LEDs on frontside of the module

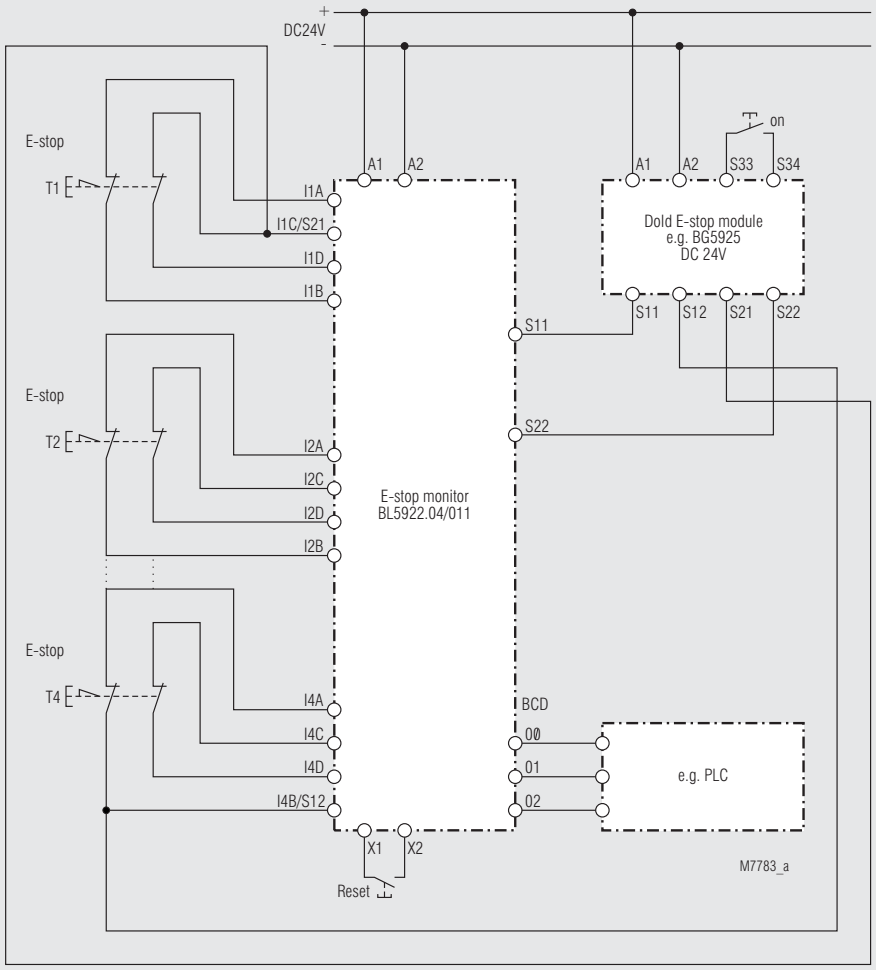


Pic 2: Monitoring of 8 e-stop buttons with e-stop monitor, single-channel connection, e-stop module 2-channel. Remote display of the status of e-stop buttons via CANopen interface.

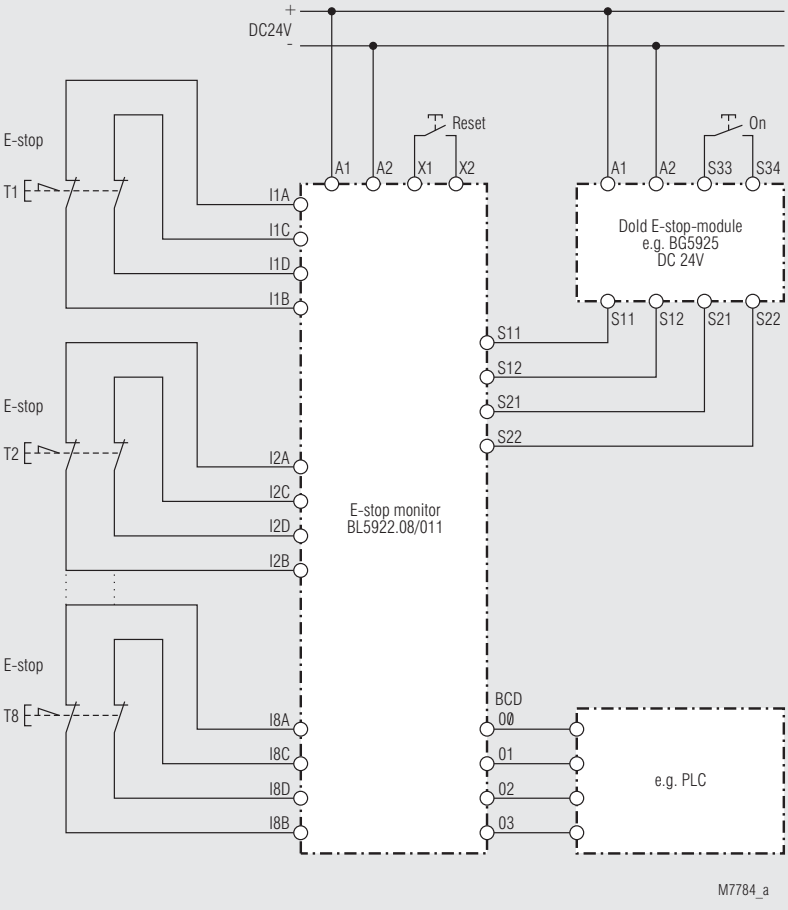
Application Example



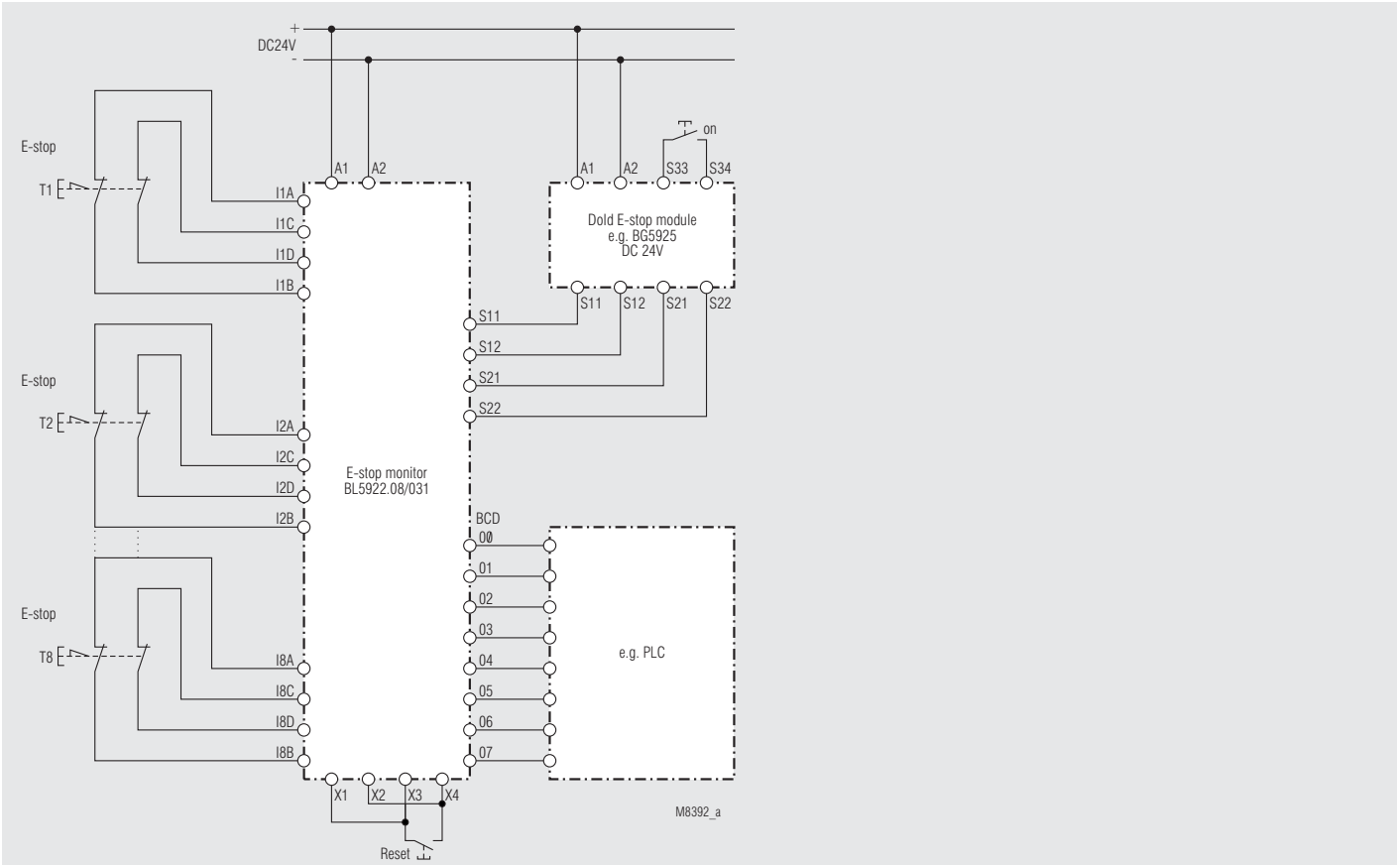
Pic 3: Monitoring of 16 e-stop buttons with e-stop monitor, single-channel connection, e-stop module 2-channel. BCD-output for remote display of the status of the e-stop buttons



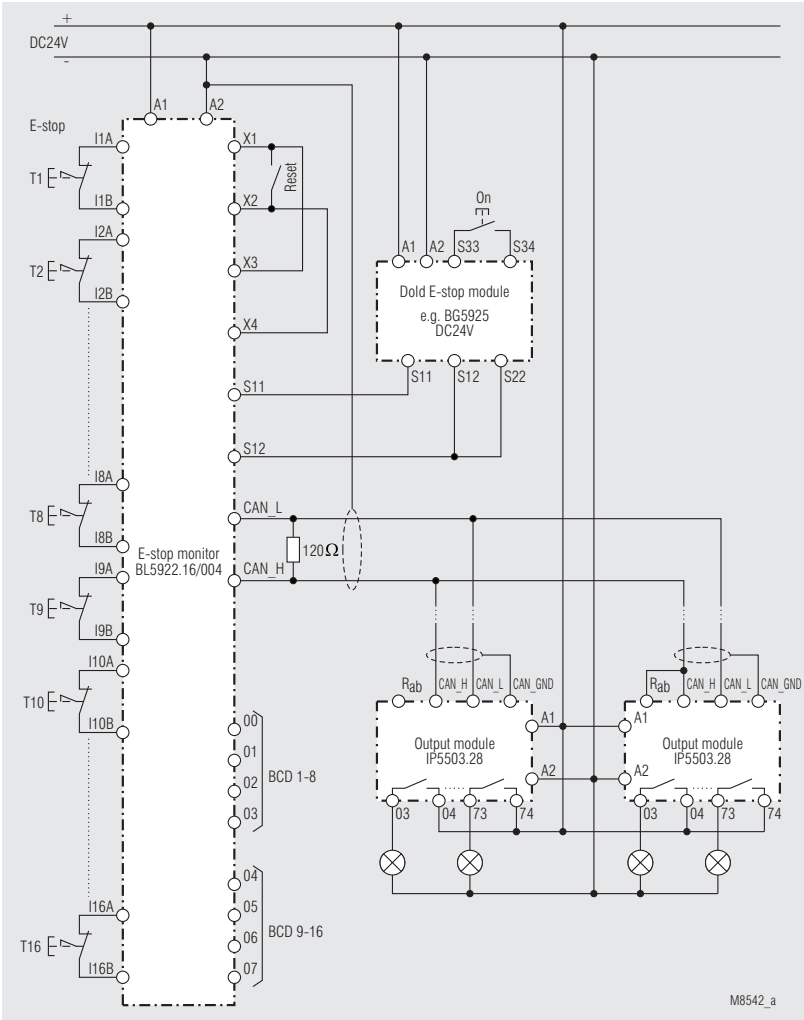
Pic 4: Monitoring of 4 e-stop buttons with e-stop monitor, 2-channel connection, BCD output, single-channel monitoring



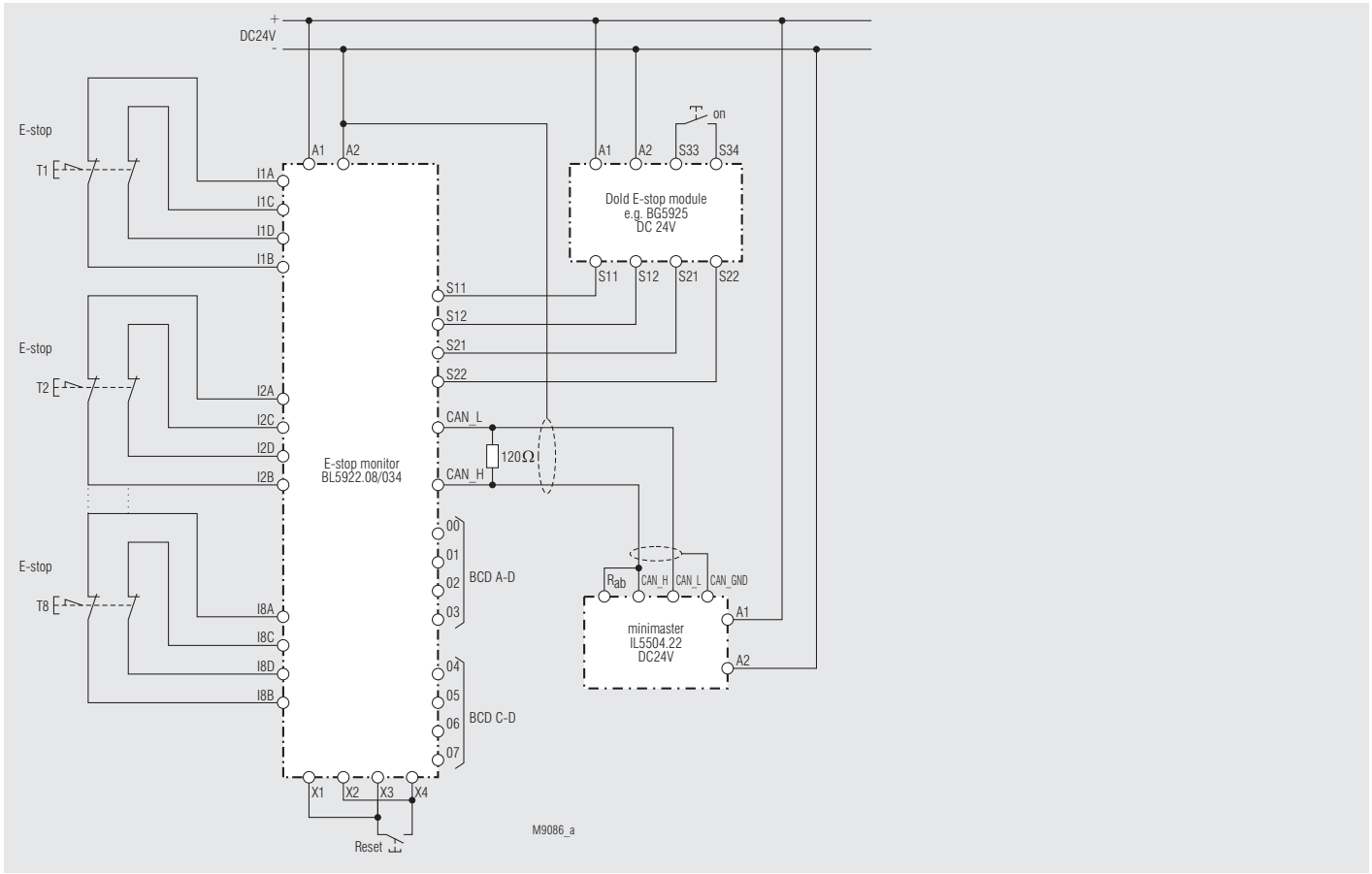
Pic 5: Monitoring of 8 e-stop buttons with e-stop monitor, 2-channel connection, BCD output, single-channel monitoring



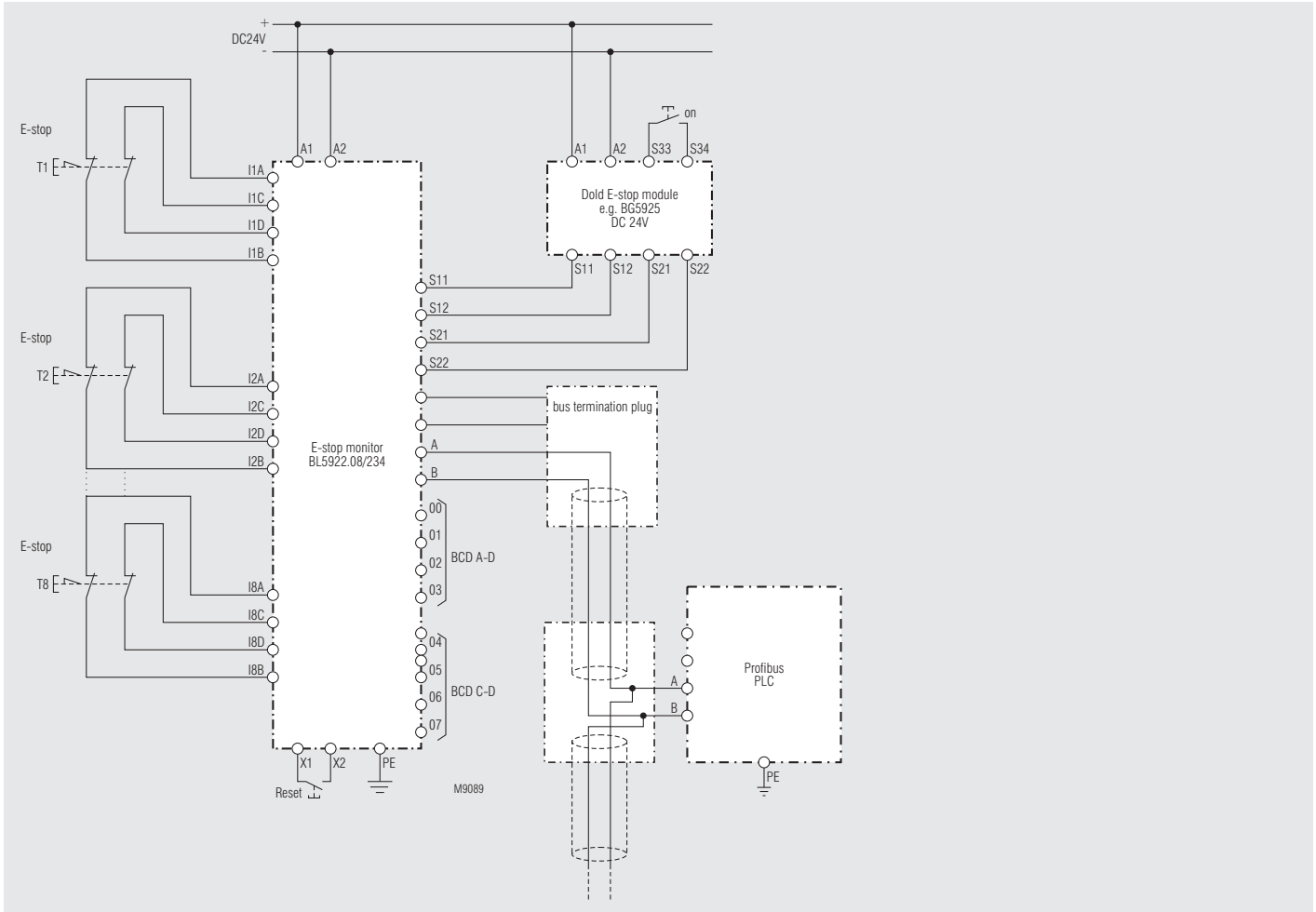
Pic 6: Monitoring of 8 e-stop buttons with e-stop monitor, 2-channel connection, 2-channel monitoring (2. channel with cross fault monitoring), BCD output



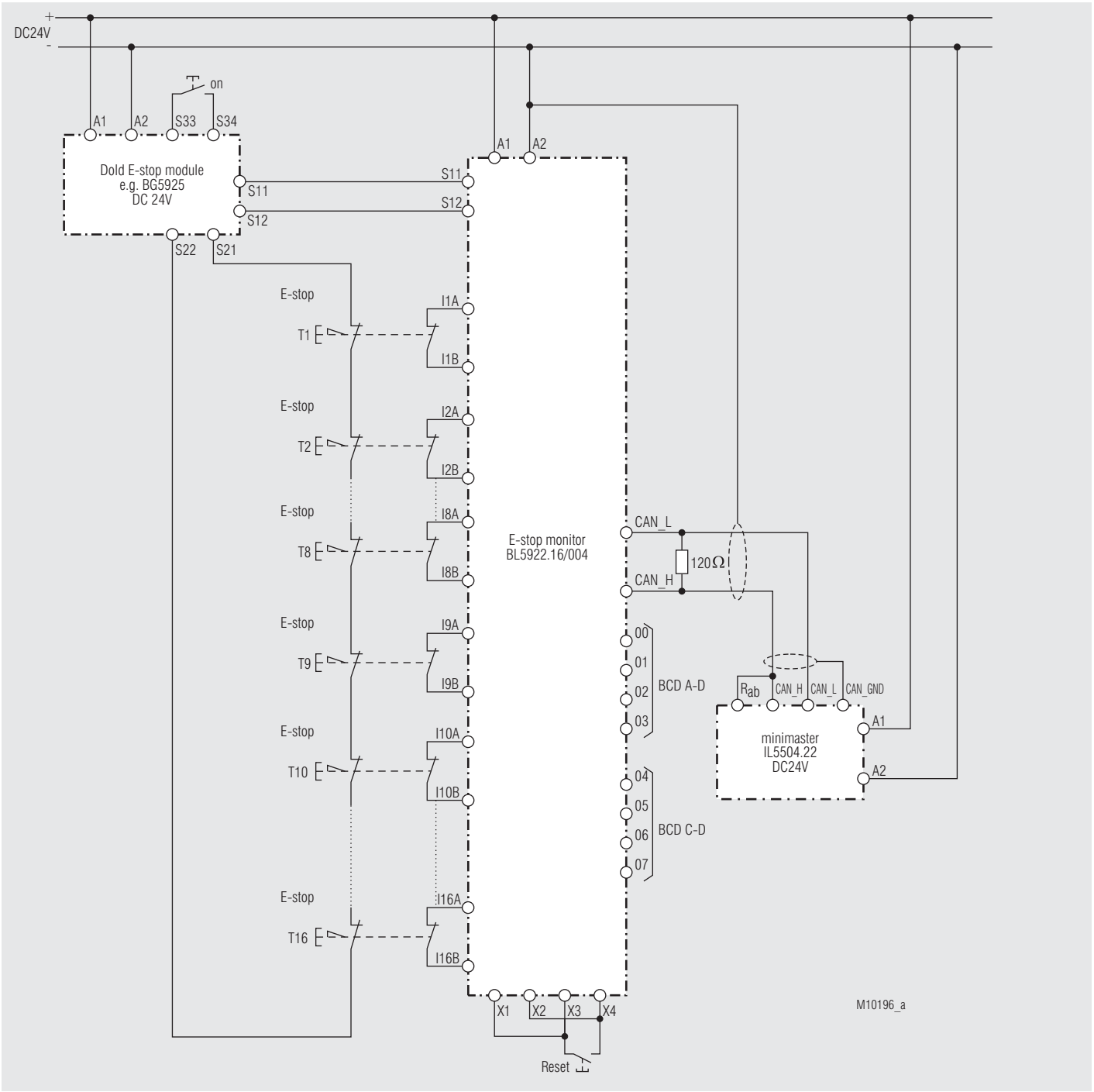
Pic 7: Monitoring of 16 e-stop buttons with e-stop monitor, single-channel connection, single-channel monitoring



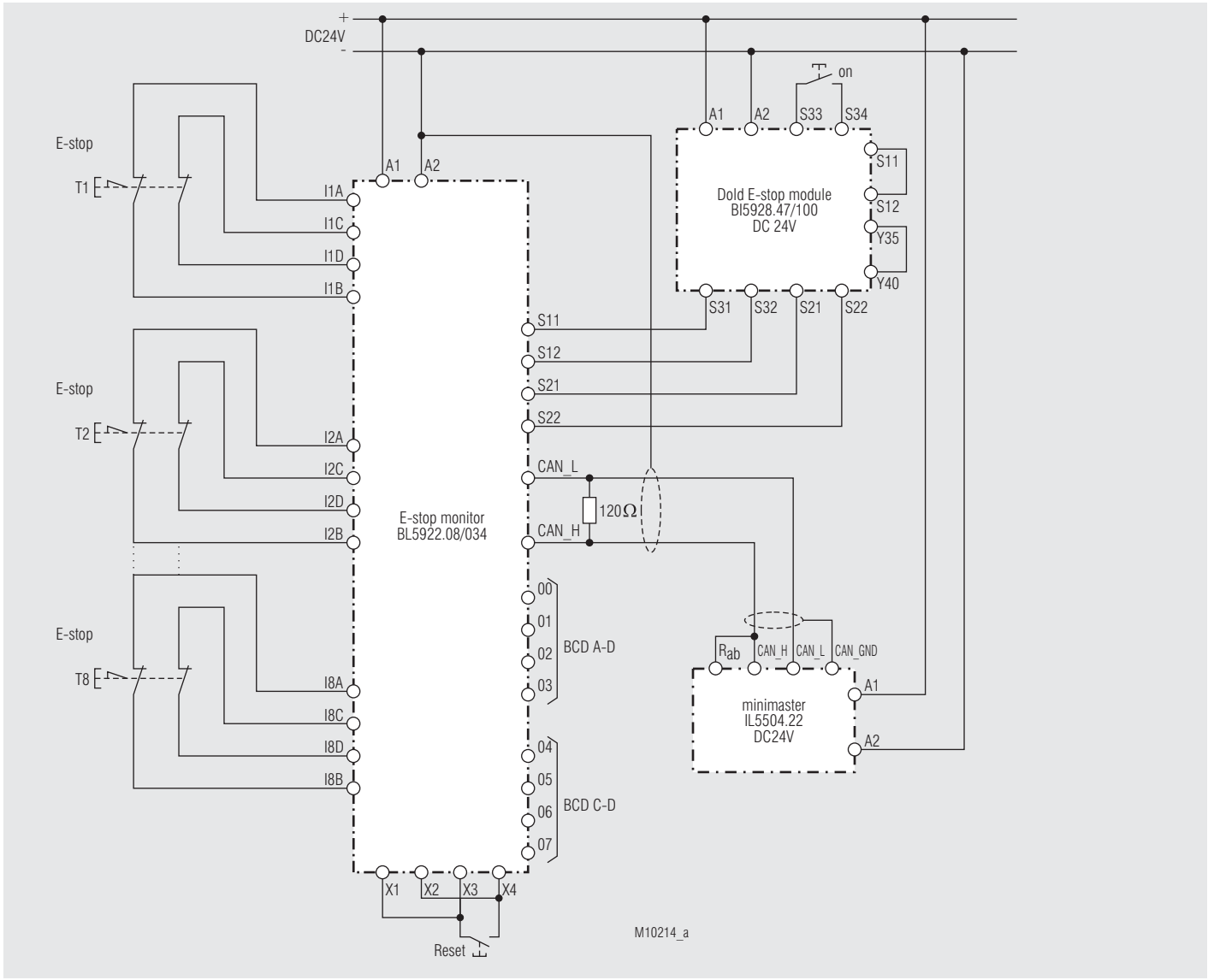
Pic 8: Monitoring of 8 e-stop buttons with e-stop monitor, 2-channel connection, 2-channel monitoring cross fault monitoring with CANopen minimaster IL 5504, IN 5504



Pic 9: Monitoring of 8 e-stop buttons with e-stop monitor, 2-channel connection, 2-channel monitoring cross fault monitoring with Profibus DP-PLC



Pic 10: Monitoring of 16 e-stop buttons with e-stop monitor, single-channel connection, e-stop-module 2-channel, cross fault monitoring. BCD-output for remote display of the status of the e-stop buttons.



Pic 11: Monitoring of 8 e-stop buttons, dual channel connection, in conjunction with BI5928 2-channel with crossfault monitoring.
An application corresponding to above wiring diagram has performance level (PL) e according to DIN EN ISO 13849-1.
When more than one e-stop button is used in series the wiring of the e-stop loop must be done failsafe or the individual e-stop buttons have to be tested regularly.

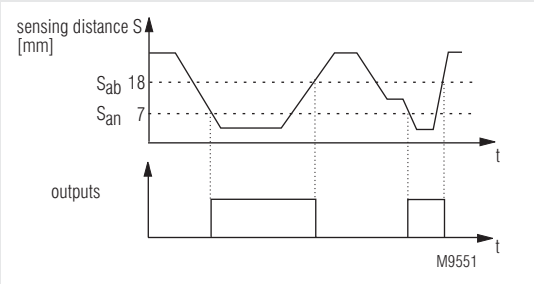
Accessories for Safety Applications
Magnetic Switch coded
NE 5021

DOLD

0239133

- **Usable for safety application by using a correctly installed and connected, security module (e. g. BG 5925/920 or LG 5925/920)**
- **According to IEC/EN 60 204-1**
- Standard switching distance: $S_{an} \leq 7$ mm
  $S_{ab} \geq 18$ mm
- Max. number of switches in series:
  - 6 NE 5021 on control unit BG 5925/920 or LG 5925/920
  - 10 NE 5021 on multifunctional safety timer UG 6960 and UG 6961
  - 10 NE 5021 on multifunctional safety module UG 6980
  - 20 NE 5021 on multifunctional safety module UG 6970
  - 20 NE 5021 on multifunction module BH 5910
- 2 NO contacts or 2 NO contacts / 1 NC contact
- Contacts protected against welding
- Very long service life
- Easy to mount and service
- Manipulation is difficult due to coded sensor
- Protection class IP 67

Function Diagram



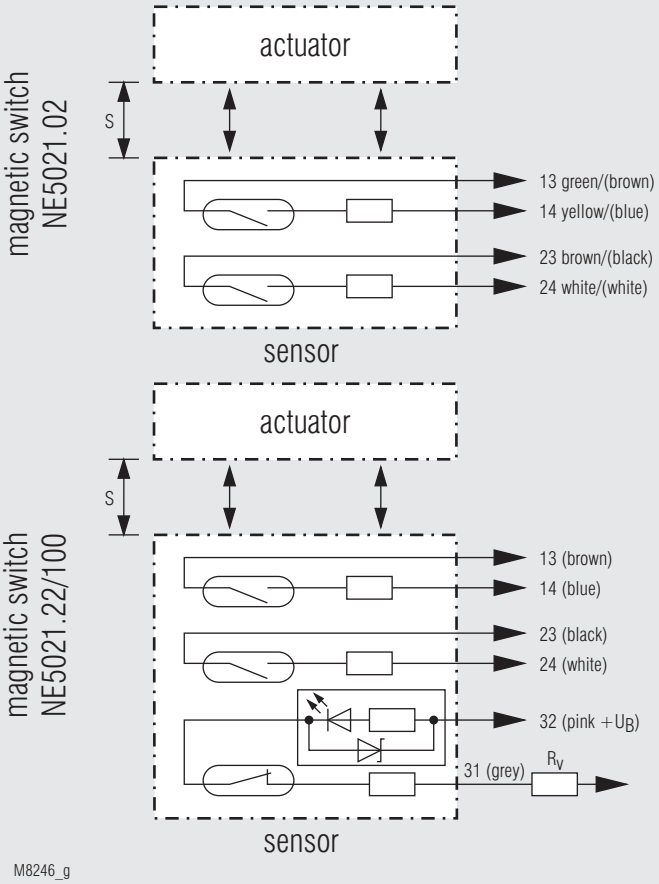
Additional information to this subject

- Data sheet control unit BG 5925/920 or LG 5925/920 for safety switch

Approvals and Markings

CE

Block Diagram



Application

The magnetic switch NE 5021 is suitable to detect the closed state of safety gates, sliding gates and removable covers also under rough ambient conditions or for special hygienic requirements. The magnetic switch can also be used at sluggish or inaccurate positioned doors.

To be used with:
- BG 5925/920 or LG 5925/920 control unit.
  Max. 6 NE 5021 and 1 E-stop button in series can be connected
- UG 6960 and UG 6961 multifunctional safety timer.
  Max. 10 NE 5021 and 1 E-stop button in series can be connected
- UG 6980 multifunctional safety module.
  Max. 10 NE 5021 and 1 E-stop button in series can be connected
- UG 6970 multifunctional safety module.
  Max. 10 NE 5021 for each safety function and 1 E-stop button can be connected
- BH 5910 multifunction safety relay.
  Max. 2 x 10 NE 5021 and 1 E-stop button can be connected

Function

The magnetic switch consists of an transmitter and a receiver. The transmitter is magnetic coded. The contacts of the receiver switch when it detects the coding of the transmitter.

Manipulation with a standard magnet will not make the contact switching. The contacts are protected against short circuit currents by series resistors, so they cannot weld.

Indication

red LED: on, when NC contact not activated at NE 5021.22/100.

Connections

The NE 5021 magnetic switch has to be connected according to the application examples below.

Connection Desigantion

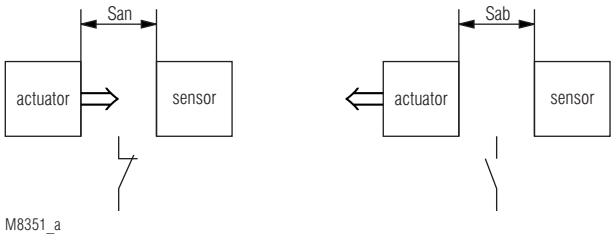
Connection	Signal description
13, 14, 23, 24	Output NO
31	Output NC Connection for DC 24 V
32	Output NC Connection for R_V

Technical Data

Switching distances

Safe switching distances without mounting difference

S_{an}: ≤ 7 mm
S_{ab}: ≥ 18 mm
undefined situation: 7.1 ... 17.9 mm

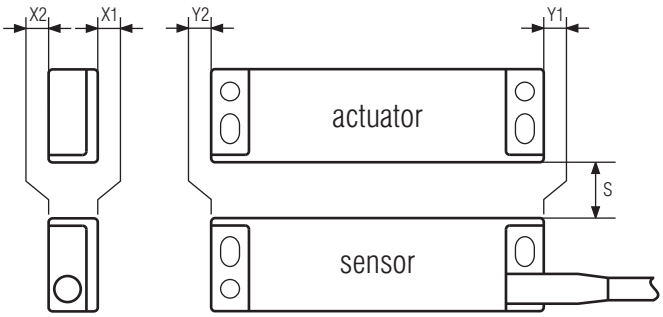


M8351_a

Safe switching distances with mounting difference

The switching distance S_{an} is valid for mounting method A and B when the switch is mounted on non ferromagnetic material. The min. distance between transmitter and receiver should be 3 mm. The receiver must not be used as mechanical stop for the transmitter.

Mounting Difference / Switching Distance S_{an} Mounting Method A

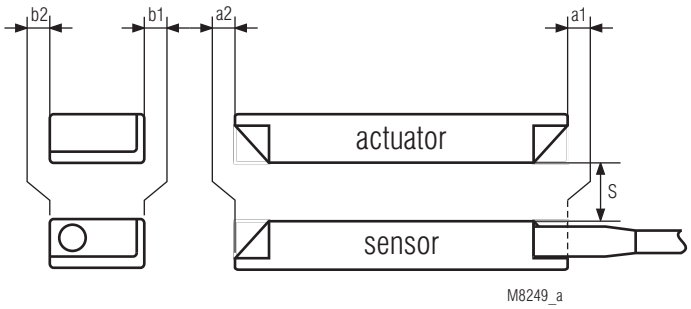


M8250_a

NE 5021.22/100	
Mounting diff.	**S_{an}**
Y_1 = max. 7 mm	≤ 9 mm
Y_2 = max. 5 mm	≤ 6 mm
X_1 = max. 7 mm	≤ 6 mm
X_2 = max. 7 mm	≤ 6 mm

NE 5021.02
Mounting diff.
Y_1 = max. 2 mm
Y_2 = max. 2 mm
X_1 = max. 3 mm
X_2 = max. 3 mm

Mounting Difference / Switching Distance S_{an} Mounting Method B



M8249_a

NE 5021.22/100	
Mounting diff.	**S_{an}**
a_1 = max. 5 mm	≤ 11 mm
a_2 = max. 5 mm	≤ 9 mm
b_1 = max. 5 mm	≤ 8 mm
b_2 = max. 5 mm	≤ 8 mm

NE 5021.02
Mounting diff.
a_1 = max. 2 mm
a_2 = max. 2 mm
b_1 = max. 3 mm
b_2 = max. 3 mm

Technical Data

Output

Contacts

NE 5021.02:	2 NO contacts
NE 5021.22/100:	2 NO / 1 NC contacts
Contact type:	Reed contacts
NO contact	
Switching voltage:	typ. DC 24 V max. DC 30 V
Switching current:	max. 100 mA
Series resistor for contacts:	10 Ω
Electrical life:	> 2 x 10^6 switching cycles at DC 24 V / 100 mA
NC contact	
Switching voltage U_B adjusted by R_V and I_n:	$R_V = \frac{(U_B - 3.3)\ V}{I_n}$
U_B max:	DC 30 V
I_n typ.:	6 mA
I_n max.:	10 mA

General Data

Temperature range:	- 25 ... + 75 °C
Shock resistance:	30 g / 11 ms
Vibration resistance:	10 g, 10 ... 150 Hz
Protection class:	IP 67 IEC/EN 60 529
Housing:	Polyamid, glas-fibre reinforced with V0 behaviour according to UL subj. 94
Connection of cable:	0.25 mm^2 with tinned wire ends
Length of cable:	5 m
Mounting:	Screw M4 with plain washer EN ISO 7092
Weight:	
Transmitter:	45 g
Receiver:	120 g

Dimensions

Width x height x depth:	
Transmitter:	88 x 14 x 25 mm
Receiver:	88 x 14 x 25 mm

Statistic related data

λ_{total} :	500	FIT
MTTF:	228,3	a
d_{op} :	365	days/a
h_{op} :	24	h/day
t_{cycle} :	3600	s/cycle
n_{op} :	8760	cycles/a
B_{10} **:**	200000	cycles

Standard Type

NE 5021.02

Article number:	0054695 (for Transmitter and Receiver)
• Output:	2 NO contacts
• Connection cable:	5 m

Variant

NE 5021.22/100: External series resistor R_V is necessary in series to NC contact

The connector 32 (pink) is designed for + U_B.
The connector 31 (grey) has to be connected via a series resistor R_V.
R_V is depending on the connected voltage.
R_V is calculated as follows:

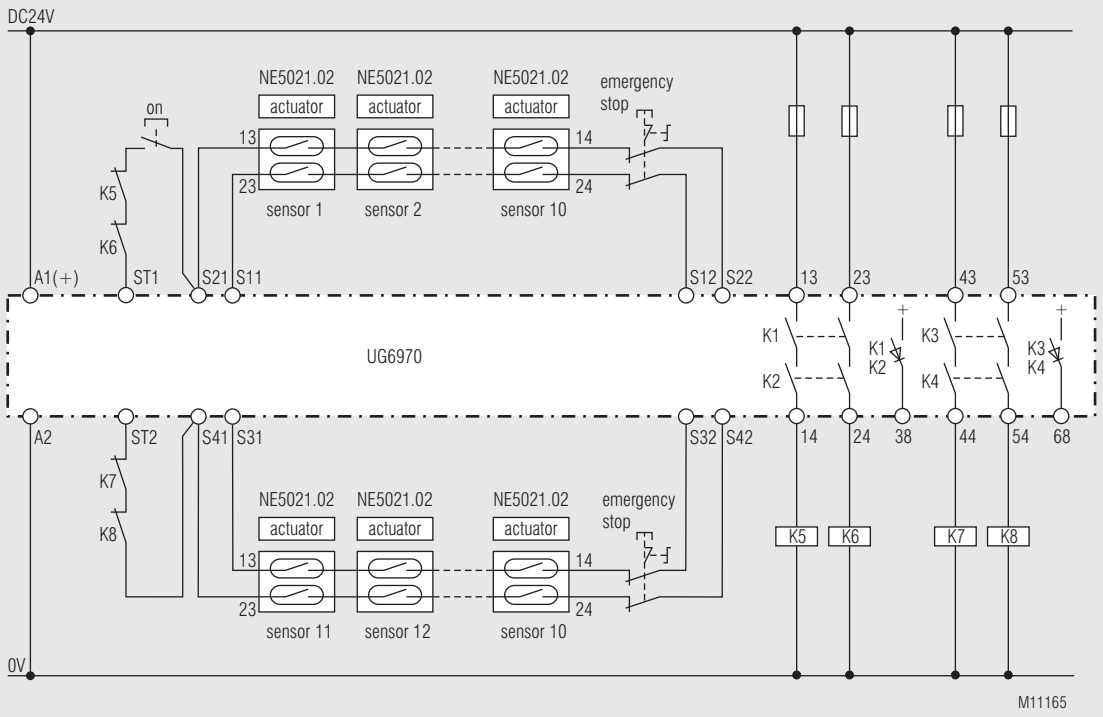
$$R_V = \frac{(U_B - 3.3)\ V}{I_n}$$

U_B max. = DC 30 V
I_n typ. = 6 mA
I_n max. = 10 mA

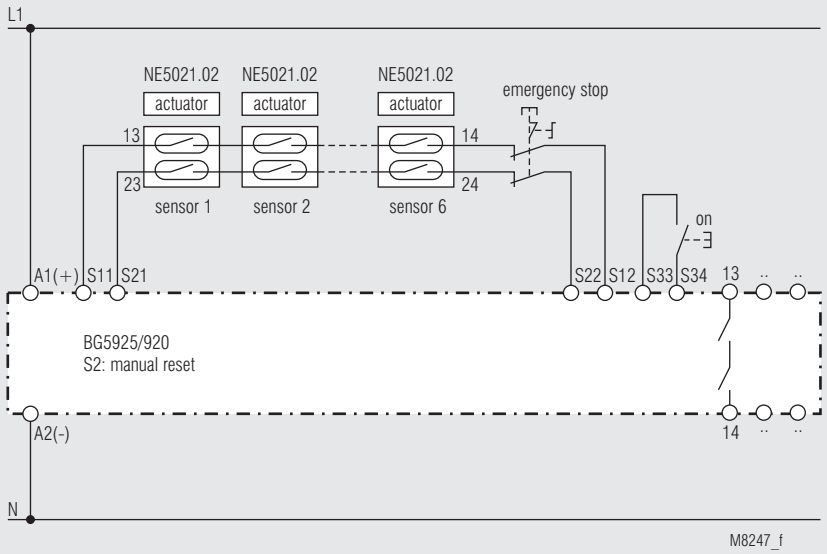
Ordering example for variant:

NE 5021 ._ _ /_ _ _
- _ _ _ Variant, if required
- ._ _ Contact
- NE 5021 Type

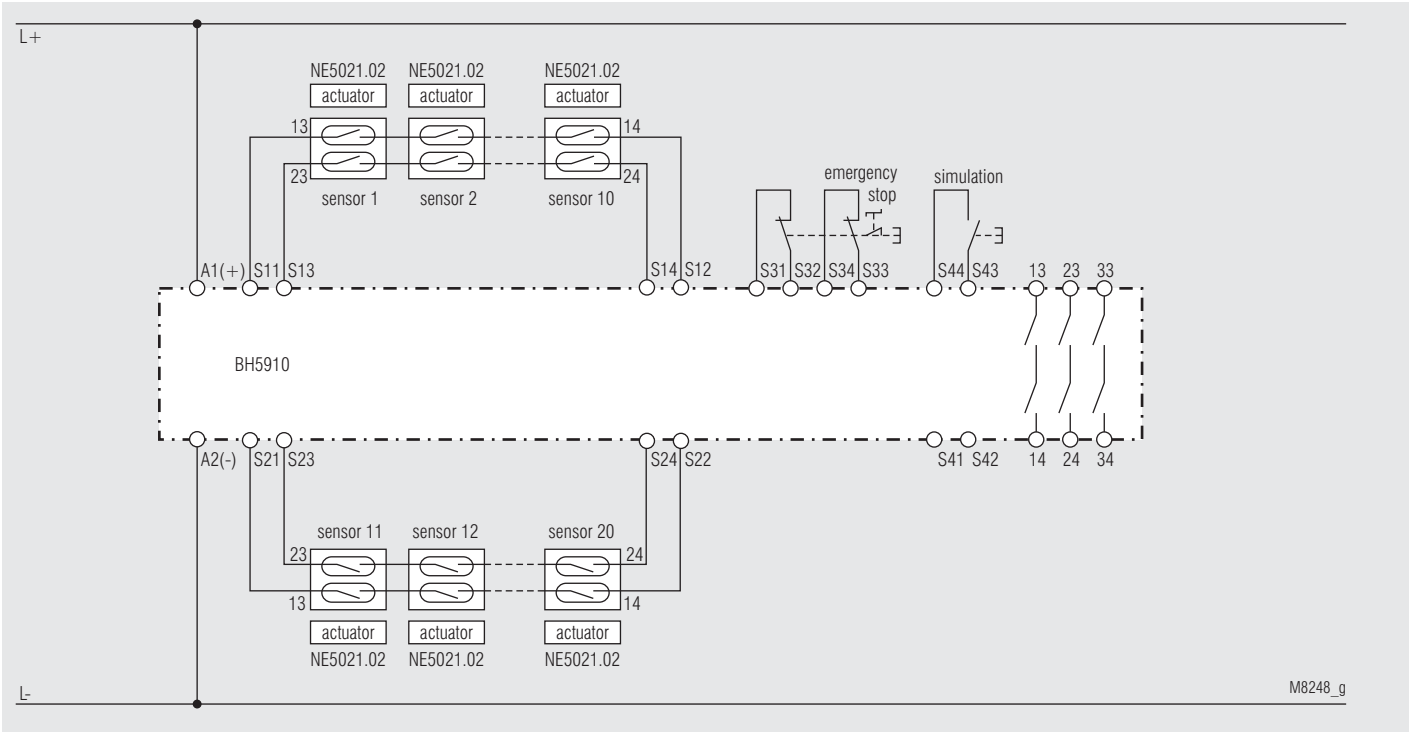
Connection Examples



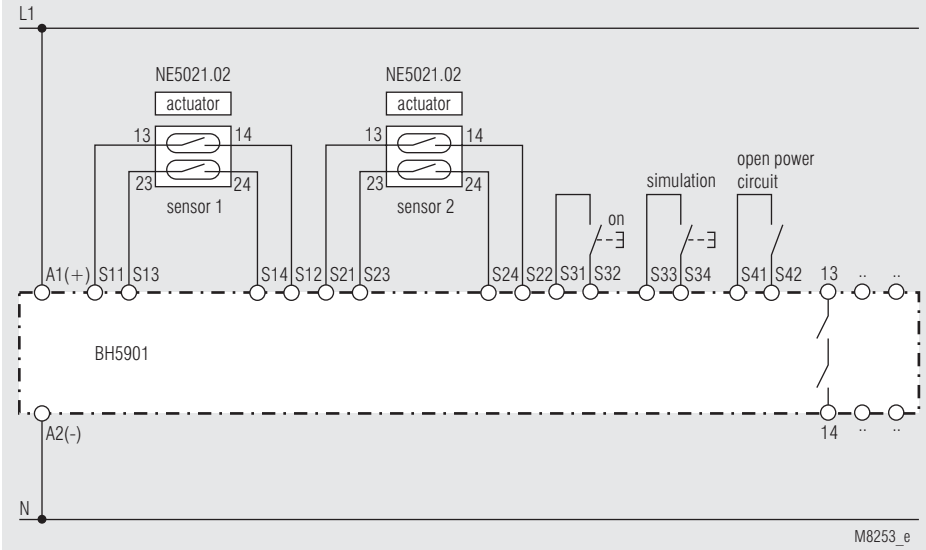
Safety function each 10 magnetic switches NE 5021 +1 E-stop button in series on multifunction safety relay UG6970
Operation mode: 2 (Fkt1 = MANUAL ; Fkt2 = AUTO)
Safety function 1: E-stop with cross fault detection (1) , Manual-Start
Safety function 2: E-stop with cross fault detection (1) , Auto-Start



6 magnetic switches NE 5021 + 1 E-stop button in series on 1 control unit BG 5925/920, with manual reset

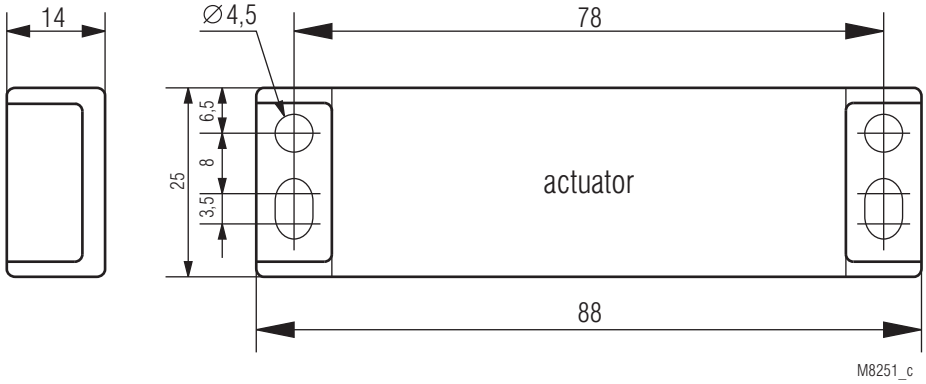


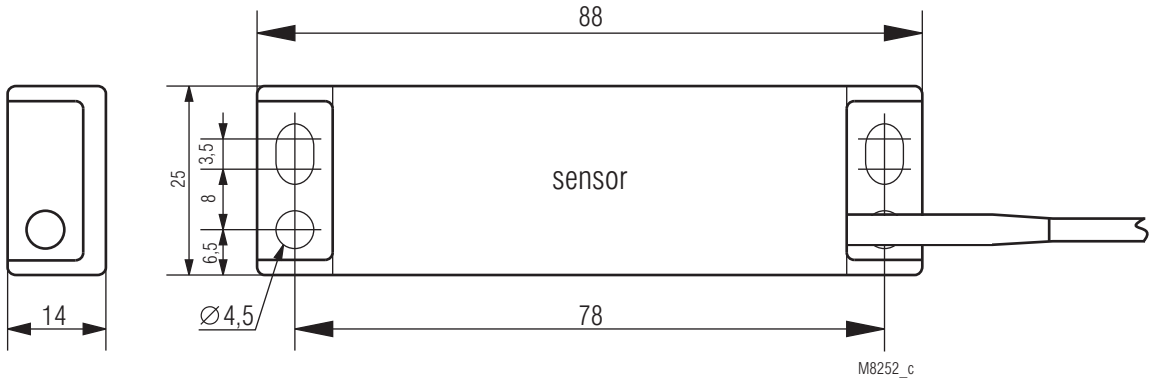
20 magnetic switches NE 5021 + 1 E-stop button, 1 simulation button on multifunction safety module BH 5910



2 magnetic switches NE 5021 on Gate monitor BH 5901 with manual restart and simulation button according to EN 201. The sensors are shown in non active state.

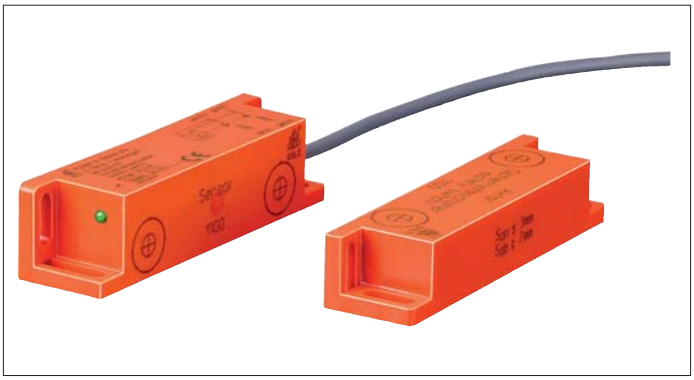
Dimensions


14
∅4,5
78
6,5
8
3,5
25
actuator
88
M8251_c


88
3,5
8
6,5
25
sensor
14
∅4,5
78
M8252_c

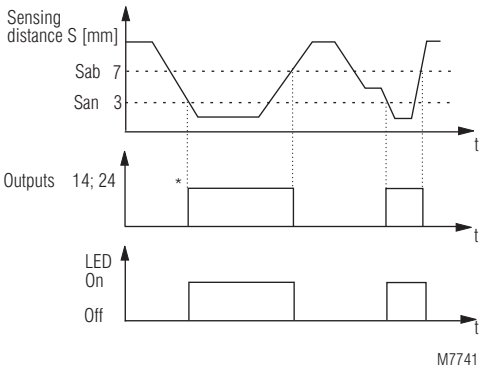
Accessories for Safety Applications
Magnetic Switch coded
NE 5020

0233459



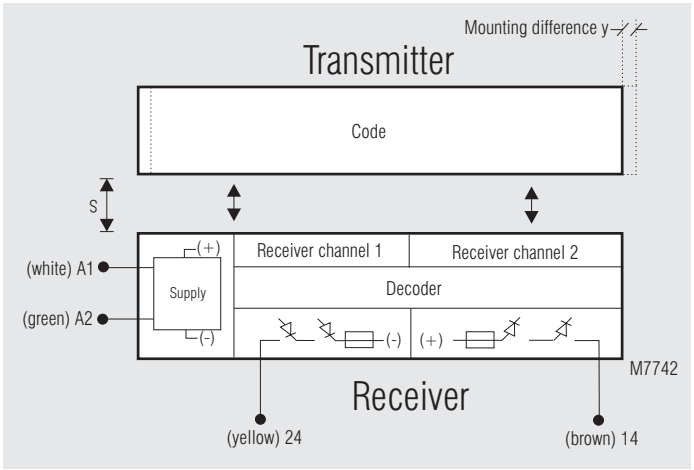
- **Usable for safety application by using a correctly installed and connected, security module (e. g. BG 5925/920 or LG 5925/920)**
- **According to IEC/EN 60 204-1, EN 1088**
- 2 channel system
- Standard switching distance: $S_{an} \leq 5.5$ mm
  $S_{ab} \geq 13$ mm
- 2 NO semiconductor outputs providing diversity and redundancy
- Magnetic coded, safe against manipulation
- Open end connection wires
- M8 or M12 connector as option
- Long service life
- Easy to mount
- Resistant against vibration
- Not sensitive to external magnetic fields
- Protection class IP 67
- LED indicator

Function Diagram



* only when transmitter is used with the corresponding code

Block Diagram



Drawing shows contacts in inactive state

Approvals and Markings

CE

Additional Information about this topic

- Data sheet control unit BG 5925/920 or LG 5925/920 for safety switch

Application

The magnetic switch NE 5020 is suitable to detect the closed state of safety gates, sliding gates and removable covers also under rough ambient conditions or for hygienic requirements. The corresponding control unit is BG 5925/920 or LG 5925/920.

Function

The magnetic switch NE 5020 includes a magnetic coded transmitter and a receiver as decoder. The semiconductor outputs close, when the receiver recognises the right code from the transmitter. The control unit detects cross faults on the lines 14 and 24. The control unit is switched off when a fault is detected and inhibits a new start. The switch is protected against short circuits and peak voltages.

Connections

The NE 5020 is connected to the control unit BG 5925/920 or LG 5925/920 according to the application example below.

Indication

green LED: switch is active, outputs switched on

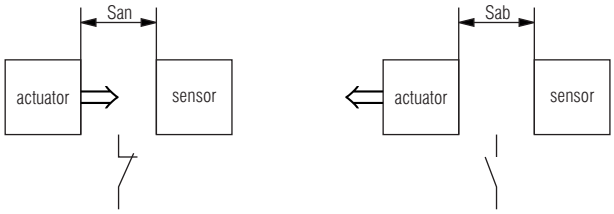
Notes

The code of transmitter and receiver are identically on delivery. This can be verified by a mark on the test sticker.

Technical Data

Input

Nominal voltage A1/A2 U_N:	DC 24 V
Voltage range:	0.9 ... 1.1 U_N
Nominal consumption:	27 mA
Operating distance	
S_{on}:	≤ 5.5 mm
S_{off}:	≥ 13 mm
undefined situation:	5.6 ... 12.9 mm
Max. mounting difference:	y = ± 1 mm



M8351_a

Output

NE 5020.92	2 semiconductor outputs
Output 14:	+ DC 24 V (+ switching)
Output 24:	0V (- switching)
Reaction time:	max. 50 ms
Thermal current I_{th}:	max. 200 mA
Electrical life:	50 x 10^6 switching cycles
Permissible switching frequency:	3 600 switching cycles / h

General Data

Operating mode:	Continuous operation	
Temperature range:	- 25 ... + 60 °C	
Strain relieve:	VDE 0623, IEC/EN 60 669-1 (appendix B)	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	0.5 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IeC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 67	IEC/EN 60 529
Housing:	Thermoplast with V0-behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 060 / 04	IEC/EN 60 068-1
Wire connection:	4 wires with open end white: + 24 V green: 0 V brown: +24 V switched signal yellow: 0 V switched signal or M8/M12-connector, pin configuration see drawing	
Length of cable:	4 m, according to UL Style 2464	
Mounting:	Screw M4 with plain washer	EN ISO 7092
Mounting torque:	max. 1.1 Nm	
Weight:		
Transmitter:	45 g	
Receiver:	95 g	

Dimensions

Width x height x depth:	
Transmitter:	92 x 24 x 18 mm
Receiver:	92 x 24 x 23.5 mm

Technical Data

Statistic related data

λ_{total} :	408	FIT
MTTF:	279,8	a
d_{op} :	365	days/a
h_{op} :	24	h/day
t_{cycle} :	3600	s/cycle
n_{op} :	8760	cycles/a
B_{10} :	245098	cycles

Standard Type

NE 5020.92 DC 24V	
Article number:	0051641 (for Receiver and Transmitter)
• Output:	2 semiconductor outputs
• Nominal voltage U_N:	DC 24 V
• Connection cable:	4 m, open wire

Variants

NE 5020.92/001	Connection cable with M12 connector (on request)
NE 5020.92/002	Connection cable with M8 connector (on request)
NE 5020.92/01_:	S_{an}: 3 mm S_{ab}: 7 mm

Ordering example for variants

NE 5020 .92 /_ _ _ /_ _ _ _ DC 24 V

- DC 24 V: Nominal voltage
- /_ _ _ _: **Coded, safe against manipulation**
  - 0011
  - 0110
  - 1001
  - 1100
- /_ _ _: **Connection cable**
  - 0: Standard
  - 1: with M12 connector
  - 2: mit M8 connector
- /_ _: **Switching distance**
  - 0: S_{an} = 5,5 mm; S_{ab} = 13 mm
  - 1: S_{an} = 4 mm; S_{ab} = 10 mm
- /_: **Cable length**
  - 0: 300 mm
  - 1: 1000 mm
  - Q: 100 mm
- .92: Output
- NE 5020: Type

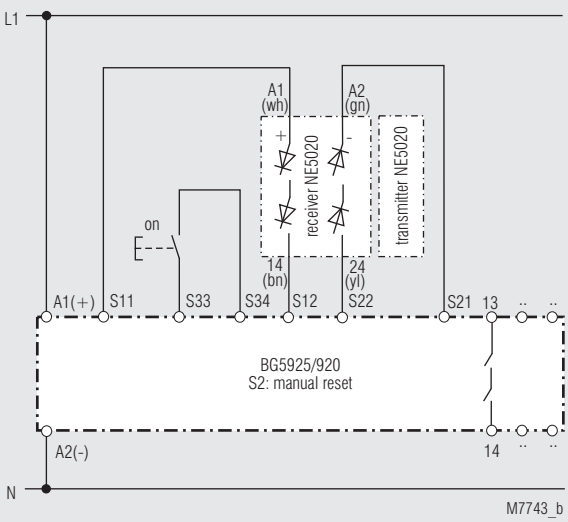
Accessories

Control units for magnetic switch NE 5020

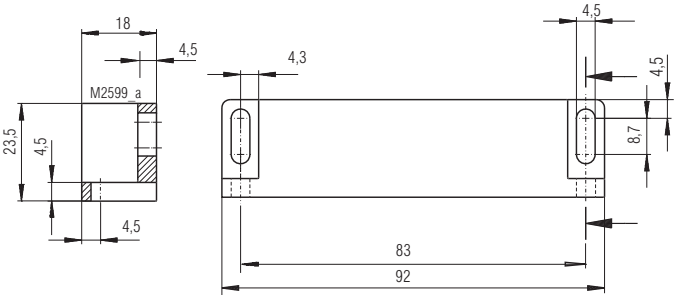
BG 5925.22/920
Article number: 0052272

LG 5925.48/920
Article number: 0063683

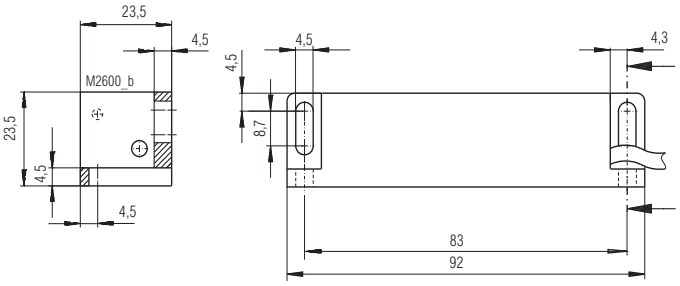
Connection Example



Dimension Diagrams



Transmitter



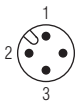
Receiver

Pin Configuration for variant with connector

Pin configuration M8-connector:

1: + 24 V	(white)
2: 0 V switched signal	(yellow)
3: 0 V	(green)
4: + 24 V switched signal	(brown)

Pin configuration M12-connector:



1: + 24 V	(white)
2: 0 V switched signal	(yellow)
3: 0 V	(green)
4: + 24 V switched signal	(brown)

M7744_a

Pin configuration M8/M12-connector

SAFEMASTER PRO
Configurable Safety System
System Overview

0266171

- Configurable, modular safety system with field bus

Short Description

SAFEMASTER PRO is a configurable, modular safety system consisting of a controller and 0-14 extension modules. To optimise the system according to the application input modules, output modules and combination input/output modules are available. These can be used in various combination with max. 4 units of the same type. In addition diagnostic modules allow to connect the system to a fieldbus. The communication between the modules is done via a 5 pole bus in the DIN rail (DOLD IN-RAIL-BUS). To extend the system, the extension modules are just clipped on the DIN rail.
In addition to the mentioned components relay extension modules UG 6912.14 and UG 6912.28 are available with 1 or 2 safety related relay outputs to extend the OSSDs with voltfree contacts. These extension modules are wired to the OSSDs of the output modules (take care of the total current).

Applications

With larger installations and more complex solutions the number of safety related functions is increasing. Also often logic interconnections, e. g. to connect or disconnect parts of a larger system are required. The modular configurable safety system SAFEMASTER PRO monitors all safety related parts of a machine or plant, simple, flexible and safe.

Additional Information about this topic

- Information about the single modules of the SAFEMASTER PRO series (see „System Components“) can be found in the User Manual.
- Information about the fieldbus modules of the SAFEMASTER PRO series (see „System Components“) can be found in the User Manual Fieldbus modules.

Advantages of SAFEMASTER PRO

- For safety applications to PLe / cat. 4 and SIL 3
- Less wiring because of configuration software SAFEMASTER PRO Designer
- Easy planning because of Drag & Drop via graphic configuration software
- Safe speed monitoring
- Time and cost saving installation
- Reduced wiring and space saving in cabinets
- Flexible extension with safety input and output modules
- Easy extendable via BUS-Rail
- Comprehensive fault localisation and diagnostic
- Memory card as option for simple maintenance
- Coded connecting blocks for non-interchangeable connection increase assembly reliability.
- Compact design: Base- and extension modules with only 22.5 mm width

Features

- Monitoring of opto electronical sensors, light curtains, magnetic actuated sensors, E-stop buttons, safety mats, mechanical switches, two-hand control
- up to 128 safety, single-channel inputs, dual-channel connection in pairs
- up to 16 separate safety, dual-channel outputs (OSSD),
- up to 32 separate test outputs for sensor monitoring
- 1 Feedback circuit each für every safety output with individual configurable reset
- Configuration by PC via Mini USB Port
- Using of control unit UG 6911 as stand alone unit possible
- Flexible safety logic to create and amend the safety functions
- Safe integrated logic testing
- Communication of the modules via 5 pole DIN-rail bus at the back of the units (In-Rail Bus)
- Indicator outputs, status-LEDs and bus connection via field bus modules for comprehensive diagnostics
- With pluggable terminal block for easy exchange of device

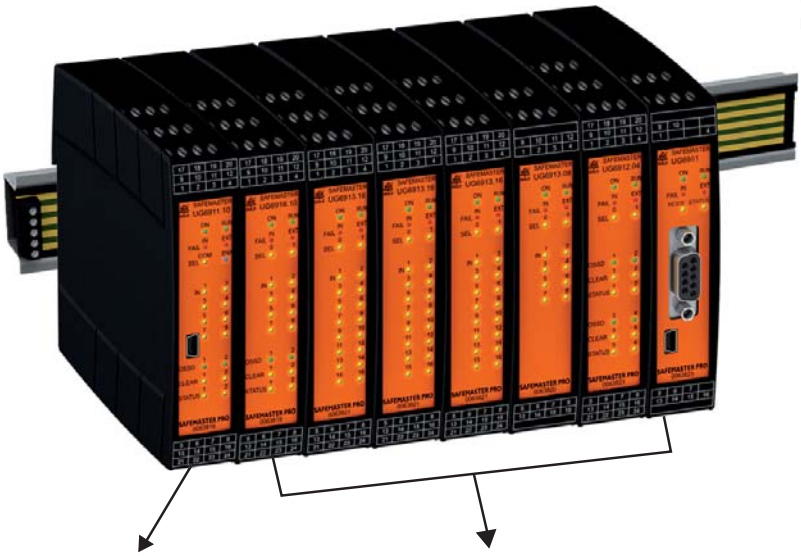
Approvals and Markings

CE | TÜV SÜD * | c UL us LISTED * Canada / USA

*) see separate datasheet

The System Mounting

DOLD In-Rail-Bus
replaces individual wiring



Control Unit
UG 6911.10
8 safety inputs and
2 safety dual-channel
OSSD oututs

Up to 14 extension module, possible:
- Input /Output module UG 6916.10
- Input module UG 6913.08, UG 6913.12 and UG 6913.16
- Output module OSSD UG 6912.02 and UG 6912.04
- Field bus modules for diagnostic-connetcion on field bus systems
  UG 6951 (CANopen), UG 6952 (PROFIBUS DP),
  UG 6954 (PROFINET), UG 6955 (Ethernet/IP), UG 6956 (EtherCAT),
  UG 6957 (USB)
- Output module relay UG 6914.04
- Speed monitor module UG 6917
- Bus extender module UG 6918
- with up to 128 inputs and 16 safety dual-channel outputs

Output Module Relay with 1 e.g.
2 safety relay outputs for volt free contact
multiplication of the OSSDs
UG 6912.14 and UG 6912.28

The Control Unit

The UG 6911.10 can be used as stand alone safety monitor without extensions or as control unit for the flexible system SAFEMASTER PRO. The highly integrated flexibility allows nearly any combination between control unit and extension modules. Up to 72 safety inputs and 8 safety outputs (OSSD) are available. Field bus modules as option offer extensive diagnostic functions and simple integration to the conventional control.

The Input Modules

If the 8 inputs of the control unit are not sufficient an extension with input modules of 8, 12 or 16 inputs can be made. as alternative to only input modules a module with 8 inputs and 2 OSSD outputs is available. Depending on the input configuration all sorts of safety actuators can be connected. These could be optoelectronic safety scanners, light curtains, magnetic coded sensors, e-stop buttons, safety mats, mechanical switches, 2-hand controls etc.

The Output Modules OSSD

To extend the 2 safety outputs of the controller output modules with 2 or 4 dual channel semiconductor outputs are available. Also the combination input/output module with 8 safety inputs and 2 OSSD outputs can extend the number of outputs. The output modules also provide a feed back circuit input per safety output. This allows to monitor external contacts e.g. of relay modules UG 6912.14 or UG 6912.28.

The Output Modules Relay

For simple realization of relay outputs and for potential-free contact multiplication of the OSSDs, output module relays UG 6912.14 and UG 6912.28 are available. These optionally provide 1 or 2 relay outputs, each with 2 safety-related NO contacts and one NC contact as an indicator output.

The inputs of the output module relays are wired to the OSSDs of SAFEMASTER PRO. In order to monitor the relay contacts, these are bridged across into the feedback circuits of the relevant OSSD output module.

If more relay outputs are needed, output module relays UG 6914.04 are available. These have 4 independent safe relay outputs, each of which has an NO contact. Each of the 4 safety relays is also equipped with an input for the external feedback contacts (EDM). Depending on the version, up to 8 programmable non-safe semiconductor outputs can also be used for status indication.

The bus extender module
The UG 6918 is an extension module with which a SAFEMASTER PRO system consisting of the UG 6911.10 control unit and its extension modules, can be divided up into several module groups over longer distances (up to 50m between 2 groups).
The individual groups are each connected via 2 UG 6918 bus extender modules and a shielded cable (with 4 twisted-pair lines). Each bus extender module has 2 independent connecting channels Ch1 and Ch2.
2 bus extender modules are connected using either of these 2 channels.

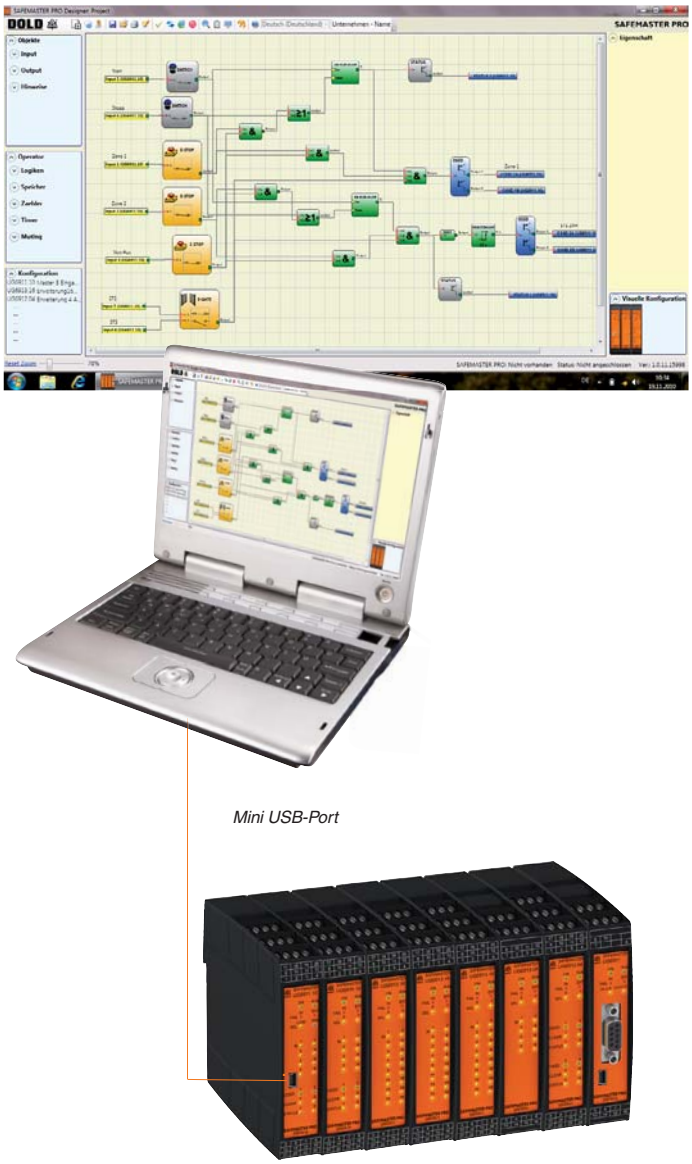
The bus extender module
The UG 6918 is an extension module with which a SAFEMASTER PRO system consisting of the UG 6911.10 control unit and its extension modules, can be divided up into several module groups over longer distances (up to 50m between 2 groups).
The individual groups are each connected via 2 UG 6918 bus extender modules and a shielded cable (with 4 twisted-pair lines). Each bus extender module has 2 independent connecting channels Ch1 and Ch2.
2 bus extender modules are connected using either of these 2 channels.

The Diagnostic Modules

3 different field bus modules for diagnostic-connetcion on field bus systems are available: UG 6951 (CANopen), UG 6952 (PROFIBUS DP), UG 6954 (PROFINET), UG 6955 (Ethernet/IP) and UG 6956 (EtherCAT). The connection between the modules is done by snapping the units on the DIN rail bus of SAFEMASTER PRO.

System Configuration

The configuration of the TUEV approved system is done very simple on a PC with the free configuration software SAFEMASTER PRO Designer. Using complex logic circuits can be designed with logic operators and safety functions like muting, timer, counter etc. This is handled by a simple graphic configuration tool.
The configuration designed on the PC is transferred via USB connection to the control unit UG 6911. Using the optional memory card OA 6911 (accessory) easy transfer of the configuration to a replacement unit is possible.



Mini USB-Port

Simple configuration in only 3 steps:

1. Select and configure safety functions
2. Assign in- and outputs and connect them comfortably on the PC
3. Test safety logic and transfer it via USB cable to the safety module - ready!

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	30 ... 100	a
DC_{avg}:	high	
Service life:	20	a (year)

Values according to IEC EN 62061 / IEC EN 61508:

SIL CL:	3	IEC EN 62061
SIL	3	IEC EN 61508
DC_{avg}:	high	
PFH_D:	10^{-8} ... 10^{-7}	h^{-1}

UL-Data

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

Nominal voltage U_N:	DC 24 V ± 20 % / current supply class II or voltage and current limits.
Nominal consumption:	max. 3 W
Switching capacity:	
OSSD semiconductor outputs:	24Vdc, 400mA
OSSD relay output:	6A 250Vac, resistive
Status output:	24Vdc, 100 mA
Wire connection:	60°C / 75°C copper conductors only 0,5 ... 2,5 mm^2 AWG 12 - 30 Sol/Str Torque 5-7 lb-in
Note:	For use in pollution degree 2 overvoltage category II environment only

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

General Technical Data

Inputs max.	128		
OSSD-outputs max.	16 2-channel-outputs		
Indicator output max.	16		
Extension modules max. (not UG 6912.14 - UG 6912.28)	14		
Extension modules of the same type (not UG 6912.14 - UG 6912.28)	4		
Nominal voltage	DC 24 V ± 20%		
Digital INPUTS	„Type B“ according to EN 61131-2; I_N: 7...10 mA at DC 24 V		
OSSD (UG 6911.10, UG 6916.10, UG 6912.02, UG 6912.04)	PNP active high – max. 400mA at 24VDC		
Indicator outputs (UG 6911.10, UG 6916.10, UG 6912.02, UG 6912.04, UG 6914.04)	PNP active high – max. 100mA at 24VDC		
Relay output (UG 6912.14, UG 6912.28, UG 6914.04)	250 V, 6 A, resistive (ohmic)		
Response time	UG 6911.10	10 ms	+ T_{Filter}_Input
	UG 6911.10 + 1 extension	19,5 ms	+ T_{Filter}_Input
	UG 6911.10 + 2 extensions	22 ms	+ T_{Filter}_Input
	UG 6911.10 + 3 extensions	24 ms	+ T_{Filter}_Input
	UG 6911.10 + 4 extensions	26 ms	+ T_{Filter}_Input
	UG 6911.10 + 5 extensions	28 ms	+ T_{Filter}_Input
	UG 6911.10 + 6 extensions	30,5 ms	+ T_{Filter}_Input
	UG 6911.10 + 7 extensions	32,5 ms	+ T_{Filter}_Input

System Components for SAFEMASTER PRO and Accessories

Type	Safety inputs	Safety semicond. outputs	Safety relay outputs	Unit	Article number
Control unit with Designer Software	8	2		UG 6911.10	0063818
Input module	8			UG 6913.08	0063820
Input module	12			UG 6913.12	0064865
Input module	16			UG 6913.16	0063821
Output module OSSD		2		UG 6912.02	0063822
Output module OSSD		4		UG 6912.04	0063823
Input / Output module	8	2		UG 6916.10	0063819
Output module Relay			1 x 2 NO, 1 NC	UG 6912.14	0063824
Output module Relay			2 x 2 NO, 2 x 1 NC	UG 6912.28	0063825
Output module Relay			4 independend NO	UG 6914.04/000	0066057
Output module Relay			4 independend NO	UG 6914.04/008	0065990
Speed monitor module				UG 6917/002	0066059
Speed monitor module				UG 6917/102	0066060
Speed monitor module				UG 6917/112	0066061
Speed monitor module				UG 6917/202	0066062
Speed monitor module				UG 6917/222	0066063
Speed monitor module				UG 6917/302	0066064
Speed monitor module				UG 6917/332	0065992
Bus Extender				UG 6918	0064866
Fieldbus module PROFIBUS DP				UG 6952	0063826
Fieldbus module CANopen				UG 6951	0063828
Fieldbus module PROFINET				UG 6954	0064861
Fieldbus module Ethernet/IP				UG 6955	0064862
Fieldbus module EtherCAT				UG 6956	0064863
Fieldbus module USB				UG 6957	0064864
Memory chip				OA 6911	0063829
USB-cable for PC connection				OA 6920	0064160
Mounting kit IN-RAIL-Bus 250 mm for DIN-rail 7.5 mm				BU 6921	0064244
Mounting kit IN-RAIL-Bus 250 mm for DIN-rail 15 mm				BU 6922	0064245

Type	Function
BA	
BA 7924	Delay module, release delay
BD	
BD 5935	Emergency stop module
BD 5980N	Two-hand safety relay
BD 5987	Emergency stop module
BG	
BG 5551	Diagnostic module for CANopen
BG 5912	Output module with output contacts
BG 5913.08/_0_ _ _	Input module
BG 5913.08/_1 _ _	Input module
BG 5913.08/_2_ _ _	Input module
BG 5913.08/_3_ _ _	Input module
BG 5914.08/_0_ _ _	Input module
BG 5915.08/_1_ _ _	Input module
BG 5924	Emergency stop module
BG 5925	Emergency stop module
BG 5925/900	Light curtain controller
BG 5925/910	Safety-mat switch gear
BG 5925/920	Switch gear for safety switch
BG 5929	Extension module
BG 5933	Two-hand safety relay
BG 7925	Delay module, release delay
BG 7926	Delay module, release delay
BH	
BH 5552	Diagnostic module for CANopen
BH 5902/01MF2	Light curtain controller
BH 5903	Emergency stop module with voltage failure detection
BH 5904/00MF2	Valve monitoring module
BH 5910	Multifunction safety module
BH 5911	Control unit
BH 5913.08/_0_ _ _	Input module
BH 5914.08/_0_ _ _	Input module
BH 5915.08/_1_ _ _	Input module
BH 5922	Emergency stop monitor
BH 5928	Emergency stop module with time delay
BH 5932	Speed or standstill monitor
BH 5933	Two-hand safety relay
BH 7925	Delay module, release delay

Type	Function
BI	
BI 5910	Radio controlled safety module
BI 5928	Emergency stop module with time delay
BI 6910	Radio controlled safety module
BL	
BL 5903	Emergency stop module with voltage failure detection
BL 5922	Emergency stop monitor
BN	
BN 3081	Extension module
BN 5930.48	Emergency stop module
BN 5930.48/203	Emergency stop module
BN 5930.48/204	Emergency stop module
BN 5983	Emergency stop module
BO	
BO 5988	Emergency stop module
HC	
HC 3096N	Interface module
HC 3098	Interface module
HK	
HK 3087N	Interface module
HL	
HL 3094	Interface module
HL 3096N	Interface module
HO	
HO 3094	Interface module
HO 3095	Interface module
IK	
IK 3079	Interface module
IL	
IL 7824	Delay module, release delay
IN	
IN 7824	Delay module, release delay
IP	
IP 3078	Interface module
IP 5924	Emergency stop module

Type	Function
LG	
LG 3096	Interface module
LG 5924	Emergency stop module
LG 5925	Emergency stop module
LG 5925/034	Safety module for elevator controls
LG 5925/900	Light curtain controller
LG 5925/920	Safety module for safety switches
LG 5928	Emergency stop module with time delay
LG 5929	Extension module
LG 5933	Two-hand safety relay
LG 5944	Safety edge module
LG 7927	Delay module, on delayed
LG 7928	Delay module, release delay
LH	
LH 5946	Standstill monitor
MK	
MK 3096N	Interface module
NE	
NE 5020	Magnetic switch coded
NE 5021	Magnetic switch coded
RE	
RE 5910	Remote control for e-stop
RE 5910/011,	
RE 5910/013	Industrial charger unit AC 230 V
RE 5910/012	Industrial charger unit DC 24 V
RE 6910	Radio controlled enabling switch
RK	
RK 5942	Emergency stop module

Type	Function
S	
SAFEMASTER M	System overview
SAFEMASTER PRO	System overview
SAFEMASTER STS/K	System overview
SAFEMASTER STS	System overview
SAFEMASTER W	System overview
	Wireless safety system, e-stop
SAFEMASTER W	System overview
	Wireless safety system, enabling switch
SP	
SP 3078	Interface module
UF	
UF 6925	Emergency stop module
UG	
UG 3088	Interface module
UG 3096	Interface module
UG 6929	Extension module
UG 6960	Multifunctional safety timer
UG 6961	Multifunctional safety timer
UG 6970	Multifunctional safety module
UG 6980	Multifunctional safety module
UH	
UH 3096	Interface module
UH 5947	Speed monitor
UH 6900	Radio controlled safety module
UH 6932	Speed monitor
UH 6937	Frequency monitor

Type	Function
AA	
AA 9050	Speed monitor
AA 9837	Frequency relay
AA 9838	Frequency relay
AA 9943	Undervoltage relay
AD	
AD 5960	Fault annunciator system
AD 5992	Fault annunciator system
AD 5998	Fault annunciator system
AI	
AI 938	Thermistor motor protection relay
AI 941N	Phase sequence relay
AI 942	Asymmetry relay
AK	
AK 9840	Asymmetry relay
BA	
BA 9036	Voltage relay
BA 9037	Voltage relay
BA 9038	Thermistor motor protection relay
BA 9040	Asymmetry relay
BA 9041	Phase sequence relay
BA 9042	Asymmetry relay
BA 9043	Undervoltage relay
BA 9053	Current relay
BA 9054	Voltage relay
BA 9055	Speed monitor
BA 9054/331	Battery symmetry monitor
BA 9054/332	Battery symmetry monitor
BA 9065	Underload monitor (cos φ)
BA 9094	Temperature monitoring relay
BA 9837	Frequency relay
BC	
BC 9190N	Voltage drop detector
BD	
BD 5936	Standstill monitor
BD 9080	Phase monitor
BH	
BH 9097	Motor load monitor
BH 9098	Motor load transmitter
BH 9140	Reverse power monitoring
EH	
EH 5990	Display unit
EH 5991	Display unit
EH 5994	Display unit
EH 5995	Display unit
EH 5996	Text display unit
EH 9997	Fault annunciator system

Type	Function
EP	
EP 5966	Fault annunciator system
EP 5967	Fault annunciator system
IK	
IK 8839	Current monitor
IK 9044	Voltage monitor
IK 9046	Voltage monitor
IK 9055	Speed monitor
IK 9065	Underload monitor (cos φ)
IK 9076	Valve monitor
IK 9094	Temperature monitoring relay
IK 9143	Frequency relay
IK 9144	Standstill monitor
IK 9168	Phase indicator
IK 9169	Phase monitor
IK 9170	Overvoltage relay, 3-phase
IK 9171	Undervoltage relay, 3-phase
IK 9172	Overvoltage relay, single phase
IK 9173	Undervoltage relay, single phase
IK 9178	Phase sequence indicator
IK 9179	Phase sequence monitor /-relay
IK 9270	Overcurrent relay
IK 9271	Undercurrent relay
IK 9272	Overcurrent relay
IK 9273	Undercurrent relay
IL	
IL 5201/20007	Overcurrent relay
IL 5880	Insulation monitor
IL 5881	Insulation monitor
IL 5882	Residual current monitor
IL 5990	Fault annunciator system
IL 5991	Fault annunciator system
IL 8839	Current monitor
IL 9055	Speed monitor
IL 9059	Phase sequence module
IL 9069	Neutral monitor
IL 9071	Undervoltage relay
IL 9075	Fuse monitor
IL 9077	Over- and undervoltage relay
IL 9079	Undervoltage relay to detect auto-reclosing
IL 9086	Phase monitor with thermistor motor protection
IL 9087	Phase monitor
IL 9094	Temperature monitoring relay
IL 9144	Standstill monitor
IL 9151	Level sensing relay
IL 9163	Thermistor motor protection relay

Type	Function
IL 9171	Undervoltage relay, 3-phase
IL 9176	Undervoltage relay, 3-phase with test key
IL 9270	Overcurrent relay
IL 9271	Undercurrent relay
IL 9277	Over- and undercurrent relay
IL 9837	Frequency relay
IN	
IN 5880/710	Insulation monitor
IN 5880/711	Insulation monitor
INFOMASTER B	System overview
IP	
IP 5880	Insulation monitor
IP 5880/711	Insulation monitor
IP 9075	Fuse monitor
IP 9077	Over- and undervoltage relay
IP 9270	Overcurrent relay
IP 9271	Undercurrent relay
IP 9277	Over- and undercurrent relay
IP 9278	Current asymmetry relay with integrated current transformer up to 15 A
IR	
IR 5882	Residual current monitor
LG	
LG 5130	Noise filter
LK	
LK 5894	Insulation monitor
LK 5895	Insulation monitor
LK 5896	Insulation monitor
MH	
MH 5880	Insulation monitor
MH 9055	Speed monitor
MH 9064	Voltage relay
MH 9143	Mains frequency monitor
MH 9300	Multifunction measuring relay
MH 9397	Motor load monitor
MH 9837N	Frequency relay
MH 9837/5_0	Frequency relay

Type	Function
MK	
MK 5130N	Noise filter
MK 5880N	Insulation monitor
MK 9003-ATEX	Thermistor motor protection relay
MK 9040N	Asymmetry relay
MK 9053N	Current relay
MK 9054N	Voltage relay
MK 9055N	Speed monitor
MK 9056N	Phase sequence relay
MK 9064N	Voltage relay
MK 9065	Underload monitor (cos φ)
MK 9143N	Mains frequency monitor
MK 9151N	Level sensing relay
MK 9163N	Thermistor motor protection relay
MK 9163N-ATEX	Thermistor motor protection relay
MK 9300N	Multifunction measuring relay
MK 9397N	Motor load monitor
MK 9837N	Frequency relay
MK 9837N/5_0	Frequency relay
MK 9994	Lamp tester
MK 9995	Lamp tester
ND	
ND 5015	Residual current transformer
ND 5016	Residual current transformer
ND 5017	Residual current transformer
ND 5018	Residual current transformer
ND 5019	Residual current transformer
OA	
OA 9059	Phase sequence module
RK	
RK 9169	Phase monitor
RK 9179	Phase sequence monitor /-relay
RK 9871	Undervoltage relay
RK 9872	Phase monitor
RL	
RL 9836	Voltage relay
RL 9853	Current relay
RL 9854	Voltage relay
RL 9075	Fuse monitor
RL 9877	Phase monitor
RN	
RN 5883	Residual current monitor, type B for AC and DC systems
RN 5897/010	Insulation monitor
RN 5897/300	Insulation monitor
RN 9075	Fuse monitor
RN 9877	Phase monitor

Type	Function
RP	
RP 5812	SMS-Telecontrol module
RP 5888	Insulation monitor
RP 5990	Common alarm annunciator
RP 5991	Common alarm annunciator
RP 5994	New- / First- /Common signal annunciator
RP 5995	New- / First- /Common signal annunciator
RP 9140	Reverse power monitoring
RP 9800	Voltage and frequency monitor
RP 9810	Voltage and frequency monitor acc. to VDE-AR-N 4105
RP 9811	Voltage and frequency monitor
RR	
RR 5886	Locating current injector
RR 5887	Insulation fault locator
SK	
SK 9055	Speed monitor
SK 9065	Underload monitor (cos φ)
SK 9076	Valve monitor
SK 9094	Temperature monitoring relay
SK 9143	Frequency relay
SK 9144	Standstill monitor
SK 9168	Phase indicator
SK 9169	Phase monitor
SK 9170	Overvoltage relay, 3-phase
SK 9171	Undervoltage relay, 3-phase
SK 9172	Overvoltage relay, single phase
SK 9173	Undervoltage relay, single phase
SK 9178	Phase sequence indicator
SK 9179	Phase sequence monitor /-relay
SK 9270	Overcurrent relay
SK 9271	Undercurrent relay
SK 9272	Overcurrent relay
SK 9273	Undercurrent relay
SL	
SL 5201/20007CT	Overcurrent relay
SL 5880	Insulation monitor
SL 5881	Insulation monitor
SL 5882	Residual current monitor
SL 5990	Fault annunciator system
SL 5991	Fault annunciator system
SL 9055	Speed monitor
SL 9059	Phase sequence module
SL 9065	Underload monitor (cos φ)
SL 9069	Neutral monitor
SL 9071	Undervoltage relay

Type	Function
SL 9075	Fuse monitor
SL 9077	Over- and undervoltage relay
SL 9079	Undervoltage relay to detect auto-reclosing
SL 9086	Phase monitor with thermistor motor protection
SL 9087	Phase monitor
SL 9094	Temperature monitoring relay
SL 9144	Standstill monitor
SL 9151	Level sensing relay
SL 9163	Thermistor motor protection relay
SL 9171	Undervoltage relay, 3-phase
SL 9270	Overcurrent relay
SL 9270CT	Overcurrent relay
SL 9271	Undercurrent relay
SL 9271CT	Undercurrent relay
SL 9277	Over- and undercurrent relay
SL 9277CT	Over- and undercurrent relay
SL 9837	Frequency relay
SP	
SP 5880	Insulation monitor
SP 9075	Fuse monitor
SP 9077	Over- and undervoltage relay
SP 9270	Overcurrent relay
SP 9270CT	Overcurrent relay
SP 9271	Undercurrent relay
SP 9271CT	Undercurrent relay
SP 9277	Over- and undercurrent relay
SP 9277CT	Over- and undercurrent relay
SP 9278	Current asymmetry relay with integrated current transformer up to 15 A
SP 9278CT	Current asymmetry relay with integrated current transformer up to 100 A
UG	
UG 9075	Fuse monitor
UH	
UH 5892	Insulation monitor

Type	Function
BA	
BA 9010	Softstarter
BA 9019	Softstarter with softstop
BA 9026	Softstarter with softstop
BA 9034N	Motor brake relay
BF	
BF 9250	Solid-state contactor
BF 9250/_ _8	Solid-state contactor
BF 9250/002	Semiconductor contactor with analogue input for pulsed output
BF 9250/042	Solid-state contactor with burst control
BH	
BH 9250	Solid-state contactor
BH 9251	Semiconductor contactor with current monitoring
BH 9253	Reversing contactor
BH 9255	Reversing contactor with current monitor
BI	
BI 9025	Softstarter
BI 9028	Softstarter with DC-brake
BI 9028/900	Softstarter for 1-phase motors
BI 9034	Motor brake relay
BI 9254	Reversing contactor with softstart and active power monitoring
BL	
BL 9025	Softstarter
BN	
BN 9011	Softstarter
BN 9034	Motor brake relay
GB	
GB 9034	Motor brake relay
GF	
GF 9016	Softstarter and softstop device
GI	
GI 9014	Softstart- / softstop device
GI 9015	Softstart- / softstop device
IL	
IL 9017	Softstarter
IL 9017/300	Softstarter with softstop
IN	
IN 9017	Phase controller

Type	Function
PF	
PF 9029	Softstarter for heating pumps
PH	
PH 9260	Solid-state relay / - contactor
PH 9260.92	Solid-state relay / - contactor
PH 9260/042	Solid-state relay / - contactor with analogue input for pulse package control
PH 9270	Solid-state relay / - contactor with load circuit monitoring
PH 9270/003	Solid-state relay / - contactor with load current measurement
PI	
PI 9260	Solid-state relay / - contactor
PK	
PK 9260	Solid-state relay / - contactor for resistive load
RP	
RP 9210/300	Softstart / softstop with reverse function
SL	
SL 9017	Softstarter
SX	
SX 9240.01	Speed controller 1-phase
SX 9240.03	Speed controller 3-phase
UG	
UG 9019	Softstarter with softstop
UG 9256	Smart motorstarter
UG 9256/804	Smart motorstarter with autom. phase sequence correction
UG 9256/807	Smart motorstarter with autom. phase sequence correction
UG 9410	Smart motorstarter
UG 9411	Smart motorstarter
UH	
UH 9018	Softstarter

Type	Function
AD	
AD 866	Switching Relay
AD 8851	Latching relay
BA	
BA 7632	Stepping relay
BA 7961	Contact protection relay
BD	
BD 3083/100	Interface module
BG	
BG 5595	Switched power supply
CA	
CA 3056	Input-Output interface relay
CB	
CB 3056	Input-Output interface relay
CB 3057	Output interface relay
CC	
CC 3056	Input-Output interface relay
HC	
HC 3093	Interface relay pluggable
HC 3093.__/3__	Interface relay pluggable
HC 3096N	Interface module
HC 3098	Interface module
HK	
HK 3087N	Interface module
HL	
HL 3094	Interface module
HL 3096N	Interface module
HL 3096N.__C/400	Interface module
HO	
HO 3094	Interface module
HO 3095	Interface module

Type	Function
IG	
IG 3051	Input-Output interface relay
IK	
IK 3050	Interface relay
IK 3070	Input-Output interface relay
IK 3076	Input-Output interface relay
IK 3079	Interface module
IK 5121	Protective diode module
IK 8701	Input-Output interface relay / Switching relay
IK 8802	Input-Output interface relay
IL	
IL 5504	CANopen PLC
IL 5507	Output module, analogue
IL 5508	Input module, analogue
IL 8701	Input-Output interface relay / Switching relay
IN	
IN 5509	Input- / Output module, digital
IN 8701	Input-Output interface relay / Switching relay
IP	
IP 3070/022	Output interface relay
IP 3078	Interface module
IP 5502	Input module, digital
IP 5503	Output module, digital
LG	
LG 3096	Interface module
MK	
MK 3046	Interface relay
MK 3096N	Interface module
MK 8804N	Interface relay
MK 8852	Latching relay
ML	
ML 3045	Input-Output interface relay
ML 3059	Input interface relay

Type	Function
RL	
RL 5596	Switched power supply
SK	
SK 3076	Input-Output interface relay
SP	
SP 3078	Interface module
UG	
UG 3076/007	Interface relay
UG 3088	Interface module
UG 3091	Interface module
UG 3096	Interface module
UG 5122	Diode module
UG 5123	Resistor module
UG 8851	Latching relay
UG 9460	Input- / Output module digital, for Modbus
UG 9461	Input- / Output module analogue, for Modbus
UH	
UH 3096	Interface module

Type	Function
AA	
AA 7512	Timer
AA 7562	Timer
AA 7610	Timer
AA 7616	Timer
AA 7666	Timer
AA 9906/200	Timer
BA	
BA 7864	Cyclic timer
BA 7903	Timer
BA 7905	Timer
BA 7954	Timer
BA 7962	Timer
BA 7981	Flasher relay
BC	
BC 7930N	Timer
BC 7931N	Fleeting action relay
BC 7932N	Flasher relay
BC 7933N	Timer
BC 7934N	Timer
BC 7935N	Multifunction relay
BC 7936N	Star-delta timer
BC 7937N	Cyclic timer
BC 7938N	Timer
BC 7939N	Timer
EC	
EC 7610	Timer
EC 7616	Timer
EC 7666	Timer
EC 7801	Timer
EC 9621	Timer
EF	
EF 7610	Timer
EF 7616	Timer
EF 7666	Timer
EH	
EH 7610	Timer
EH 7616	Timer
EH 7666	Timer
EO	
EO 7864	Cyclic timer

Type	Function
IK	
IK 7813	Timer
IK 7814	Timer
IK 7815	Fleeting action relay
IK 7816	Flasher relay
IK 7817N/200	Multifunction relay
IK 7818	Fleeting action relay
IK 7819	Timer
IK 7820	Fleeting action relay
IK 7823	Timer
IK 7825	Timer
IK 7826	Fleeting action relay
IK 7827	Flasher relay
IK 7854	Cyclic timer
IK 8808	Timer
IK 9906	Timer
IK 9962	Timer
MK	
MK 7830N	Multifunction relay, digital
MK 7850N/200	Multifunction relay
MK 7851	Flasher relay
MK 7852	Flasher relay
MK 7853N	Star-delta timer
MK 7854N	Cyclic timer
MK 7858	Timer
MK 7863	Timer
MK 7873N	Timer
MK 9906	Timer
MK 9906N	Timer
MK 9906N/600	Timer
MK 9908	Timer
MK 9961	Timer
MK 9962	Timer
MK 9962N	Timer
MK 9988	Fleeting action relay
MK 9989	Fleeting action relay

Type	Function
RK	
RK 7813	Timer
RK 7814	Timer
RK 7815	Fleeting action relay
RK 7816	Flasher relay
RK 7817	Multifunction relay
SK	
SK 7813	Timer
SK 7814	Timer
SK 7815	Fleeting action relay
SK 7816	Flasher relay
SK 7817N/200	Multifunction relay
SK 7819	Timer
SK 7820	Fleeting action relay
SK 7823	Timer
SK 7854	Cyclic timer
SK 9906	Timer
SK 9962	Timer
SN	
SN 7920	Multifunction relay

Type	Function
IK	
IK 3070/200	Hybrid relay
IK 3071	Input interface relay
IK 5115	Display unit
IK 8701	Switching relay
IK 8702	Remote switch (Impulse relay)
IK 8702/200	Remote switch (Impulse relay)
IK 8715	Priority relay
IK 8717	Remote switch (Impulse relay)
IK 8717/110	Remote switch (Impulse relay)
IK 8800	Remote switch (Impulse relay)
IK 8805	Remote switch f. central switch. op.
IK 8807	Remote switch f. central switch. op.
IK 8810	Staircase lighting time switch
IK 8810/001	Staircase lighting time switch
IK 8810/002	Staircase lighting time switch
IK 8810/003	Staircase lighting time switch
IK 8810/004	Staircase lighting time switch
IK 8810/005	Fan control timer
IK 8813	Energy saving time switch
IK 8814	Light timing switch
IK 8825	Light timing switch
IK 8830	Stepping switch
IK 8832	Buzzer
IK 9078	Mains relay
IK 9171	Undervoltage relay, 3-phase
IL	
IL 7824	Delay module
IL 8701	Switching relay
IL 8800	Remote switch (Impulse relay)
IL 8805	Remote switch f. central switch. op.
IL 8809	Remote switch for central and group switching operation
IL 9171	Undervoltage relay, 3-phase
IN	
IN 7824	Delay module
IN 8701	Switching relay
OA	
OA 8823	Energy saving time switch
OA 8824	Light timing switch
OA 8825	Light timing switch

Type	Function
RK	
RK 8810/001	Staircase lighting time switch
RK 8810/002	Time switch with pre-warning
RK 8810/003	Light timing switch
RK 8810/004	Energy saving time switch
RK 8810/005	Fan control timer
RK 8810/006	Energy saving time switch
RK 8810/100	Staircase lighting time switch
RK 8832	Buzzer
SK	
SK 8702	Remote switch (Impulse relay)
SK 8702/200	Remote switch (Impulse relay)
SK 8832	Buzzer
SK 9078	Mains relay
SK 9171	Undervoltage relay, 3-phase
SL	
SL 9171	Undervoltage relay, 3-phase

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**

DE	**Notizen**
EN	**Notice**
FR	**Note**