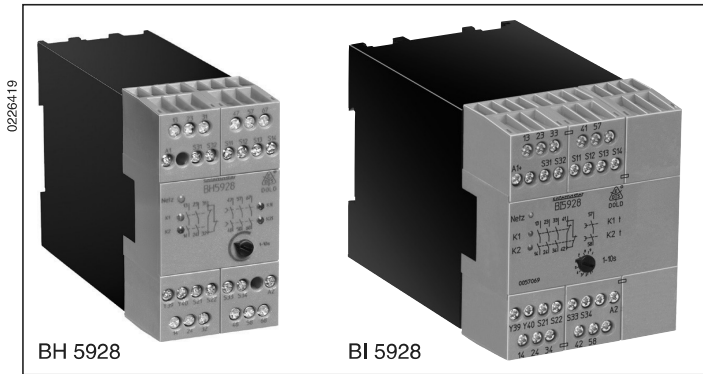


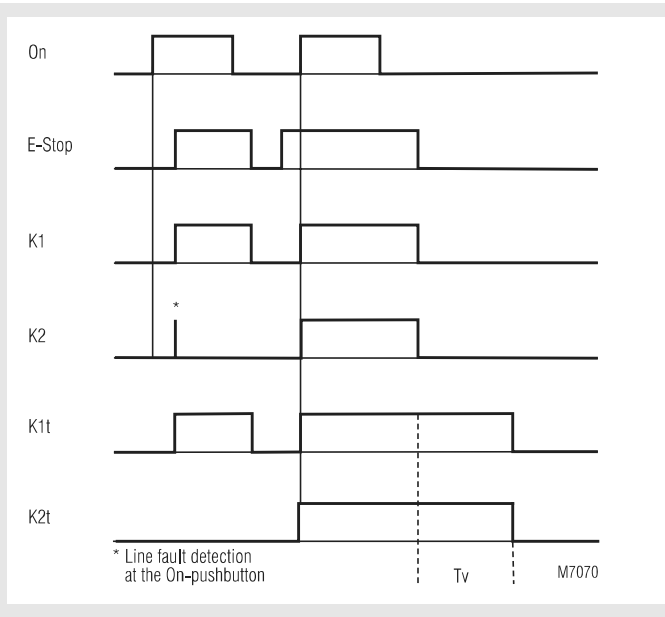
SAFEMASTER Emergency Stop Module With Time Delay BH 5928, BI 5928



0226419

- According to
 - Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008
 - SIL Claimed Level (SIL CL) 3 to IEC/EN 62061
 - Safety Integrity Level (SIL 3) to IEC/EN 61508 and IEC/EN 61511
- 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 Marking



* see variants

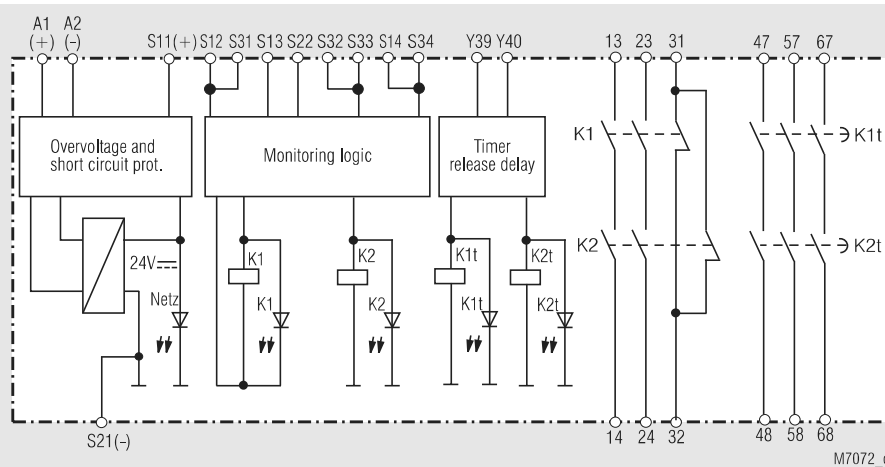
Applications

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

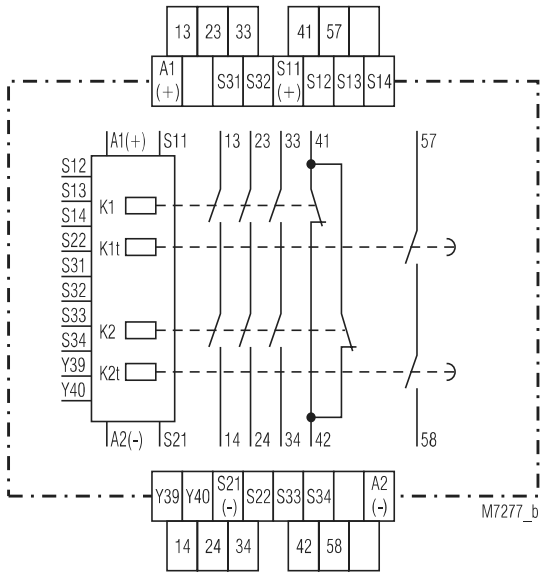
Indication

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

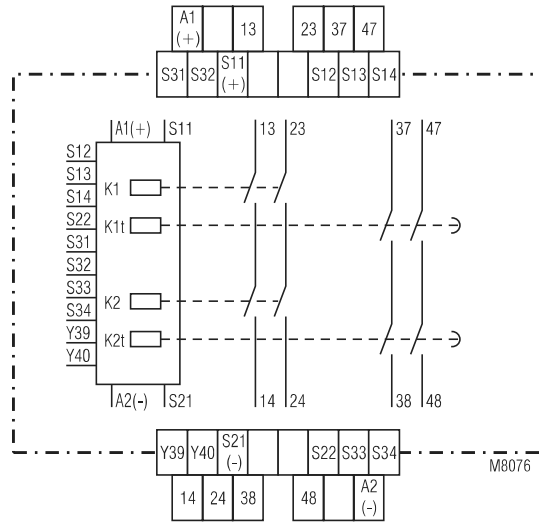
Block Diagram



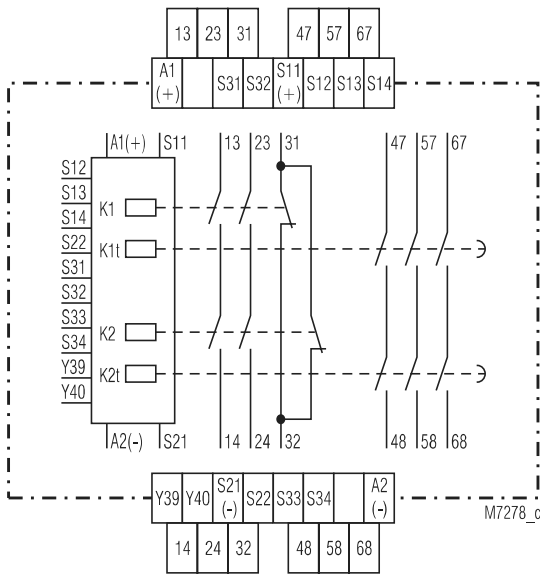
Circuit Diagrams



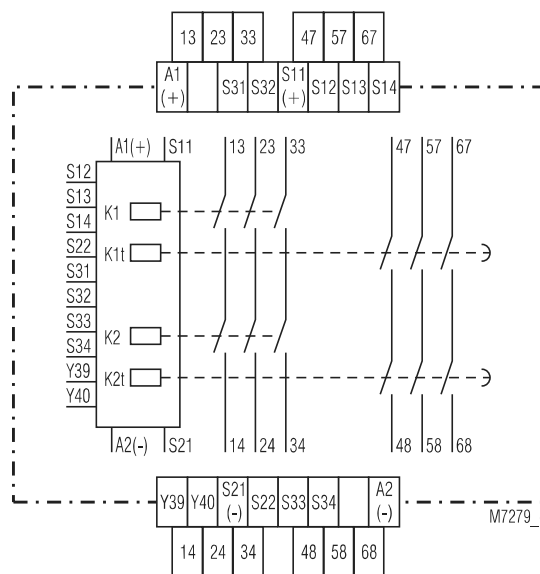
BH 5928.47



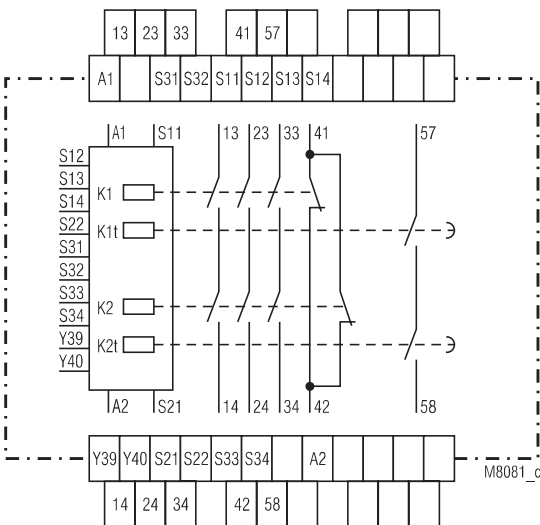
BH 5928.91



BH 5928.92



BH 5928.93



BI 5928.47/100

Connection Terminals	
Terminal designation	Signal designation
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 relays K1₁ and K2₁ 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.

ATTENTION - AUTOMATIC START!



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

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:

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

ATTENTION! The NC contacts 31-32 or 41-42 can only be used for monitoring.

Operate delay t_{yp} at U_N:

Manual start: 40 ms

Automatic start: 500 ms

Release delay t_{yp} at U_N:

Disconnecting the supply: 40 ms

Disconnecting

S12, S22, S31 and S32: 15 ms

Time delay t_v

(release delayed):

Auxiliary 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

± 1 % of setting value

forcibly guided

Nominal output voltage:

AC 250 V

DC: see limit curve for arc-free operation

DC: see limit curve for arc-free operation

≥ 100 mV

≥ 1 mA

Thermal current I_m:

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: 10⁵ 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 10⁶ 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		
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-line-conducted:	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 IEC/EN 60 068-2-6 frequency 10 ... 55 Hz	
Climate resistance:	15 / 055 / 04	IEC/EN 60 068-1 EN 50 005
Terminal designation:		
Wire connection:	1 x 4 mm ² solid or 1 x 2.5 mm ² stranded ferruled (isolated) or 2 x 1.5 mm ² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm ² 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:		
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

Safety Related Data (only instantaneous contacts)

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF _d :	240.5	a (year)
DC / 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 / IEC/EN 61511:

SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508 / IEC/EN 61511
HFT:	1	
DC / DC _{avg} :	99.0	%
SFF:	99.7	%
PFH _D :	2.05E-10	h ⁻¹
PFD:	1.75E-05	
T _i :	20	a (year)

¹⁾ HFT = Hardware-Failure Tolerance

Technical Data

Safety Related Data (only delayed contacts)

Values according to EN ISO 13849-1:

Category:	3	
PL:	d	
MTTF _d :	217,7	a (year)
DC / 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 / IEC/EN 61511:

SIL CL:	2	IEC/EN 62061
SIL:	2	IEC/EN 61508 / IEC/EN 61511
HFT:	1	
DC / DC _{avg} :	99,0	%
SFF:	99,7	%
PFH _D :	2,28E-10	h ⁻¹
PFD:	1,95E-05	
T _i :	20	a (year)

¹⁾ HFT = Hardware-Failure Tolerance



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

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

UL-Data

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

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.

Standard Type

BH 5928.93 DC 24 V 0.5 ... 5 s

Article number:

0050369

• Output:

3 NO contacts instantaneous and
3 NO contacts release delayed

• Nominal voltage U_N :

DC 24 V

• Time delay t_v :

0.5 ... 5 s

• Width:

45 mm

Variants

BH 5928._/_/_/_/61:

with UL approval
with fix time delay
fixed times: 1 s, 3 s, 5 s, 10 s, 300s

BH 5928._/_/001:

other times on request
with adjustable time delay
suitable for light curtains and
reed contacts switches

BH 5928._/_/900:

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

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

Nominal frequency

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)

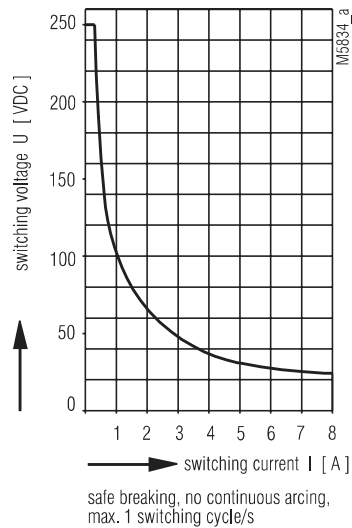
.92 = 2 NO contacts,
1 NC contact instantaneous and
3 NO contacts release delayed

.93 = 3 NO contacts instantaneous and
3 NO contacts release delayed

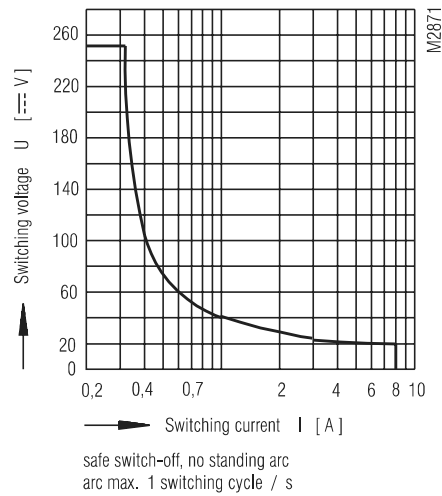
H: width 45 mm

I: width 67.5 mm

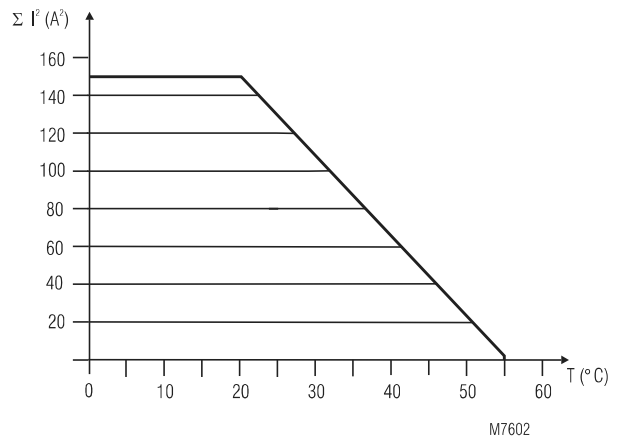
Characteristics



Arc limit curve for resistive load (instantaneous contact)



Arc limit curve for resistive load (delayed contact)



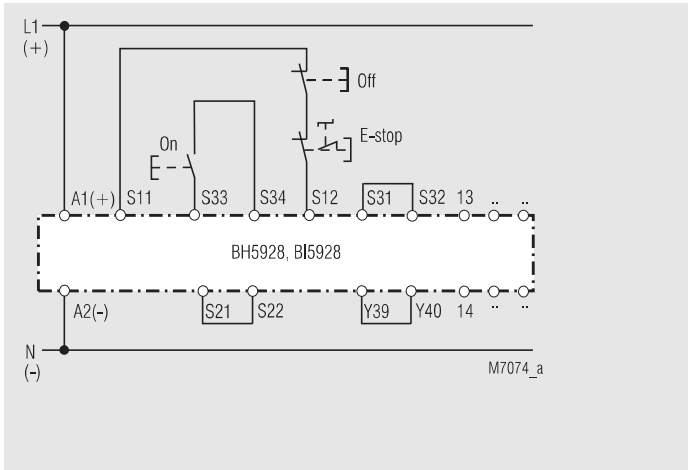
$$\Sigma I^2 = I_1^2 + I_2^2 + \dots + I_6^2$$

$I_i \div I_6$ - Current in contact paths

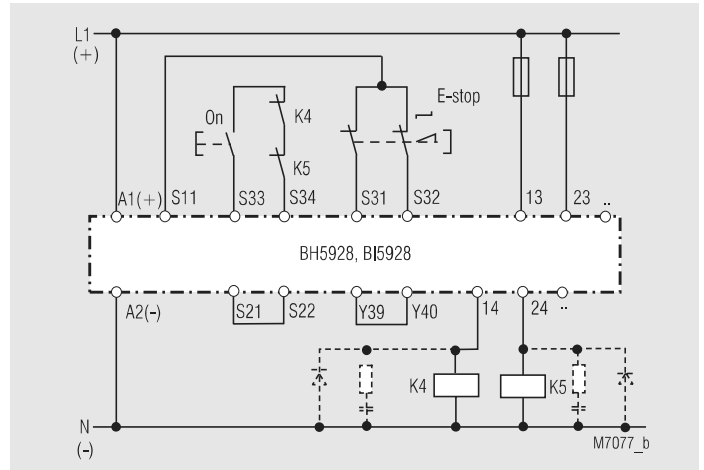
Max. current at 55°C over 3 contact paths = 0,5 A $\cong 0,5^2 \times 6 = 1,5 A^2$

Quadratic total current limit curve

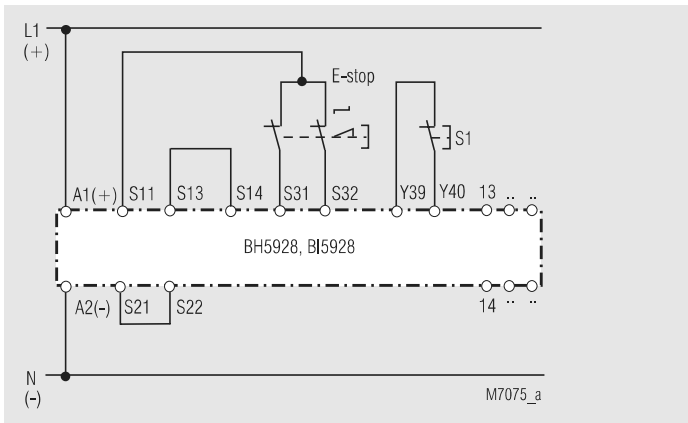
Application Examples



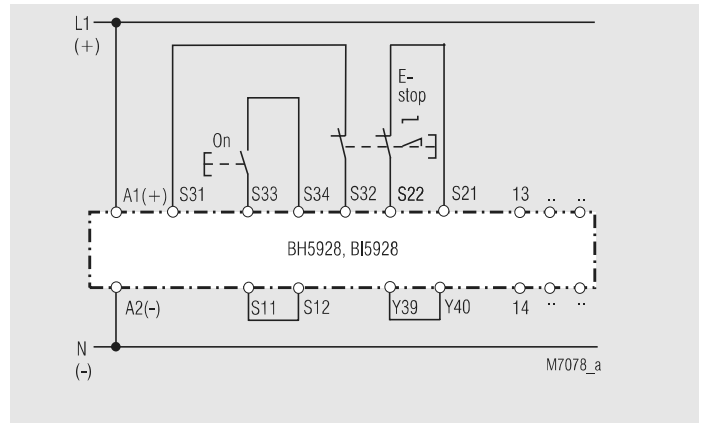
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit
Suited up to SIL2, Performance Level d, Cat. 3



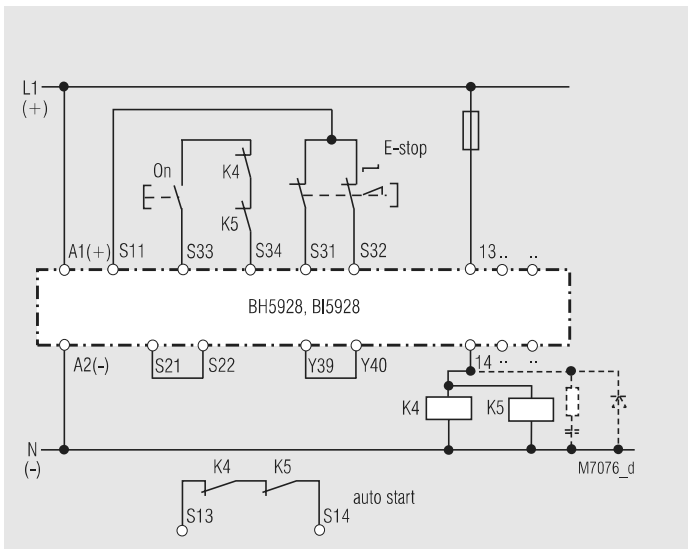
Contact reinforcement by external contactors, 2-channel controlled. The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 5 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals S13-S14 or S33-S34)
Suited up to SIL3, Performance Level e, Cat. 4



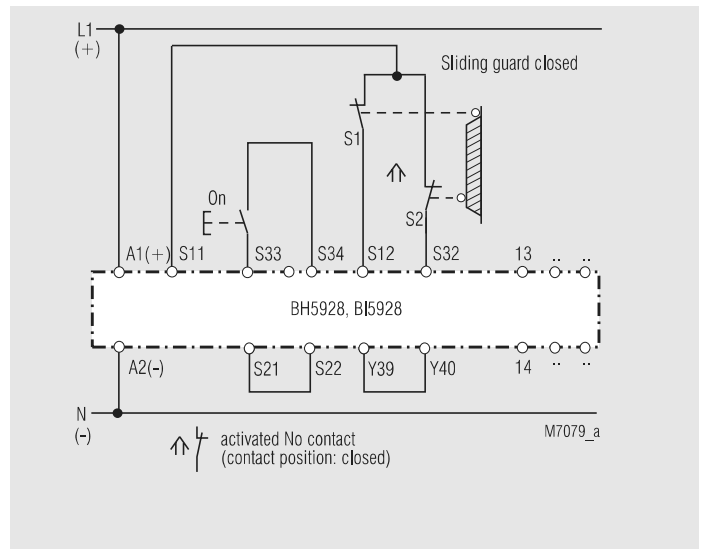
2-channel emergency stop circuit without cross fault monitoring autostart and interruption of time by S1
Suited up to SIL3, Performance Level e, Cat. 4



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