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

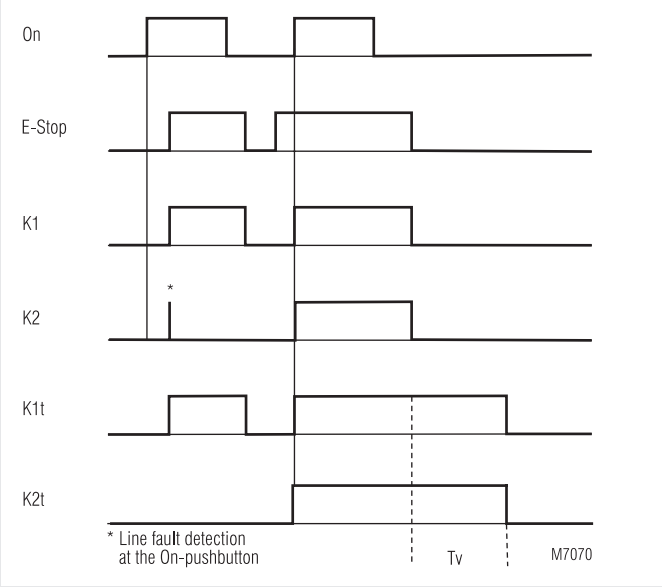
0226419

BH 5928

BI 5928

- **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**
- 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

1) pending; * see variants

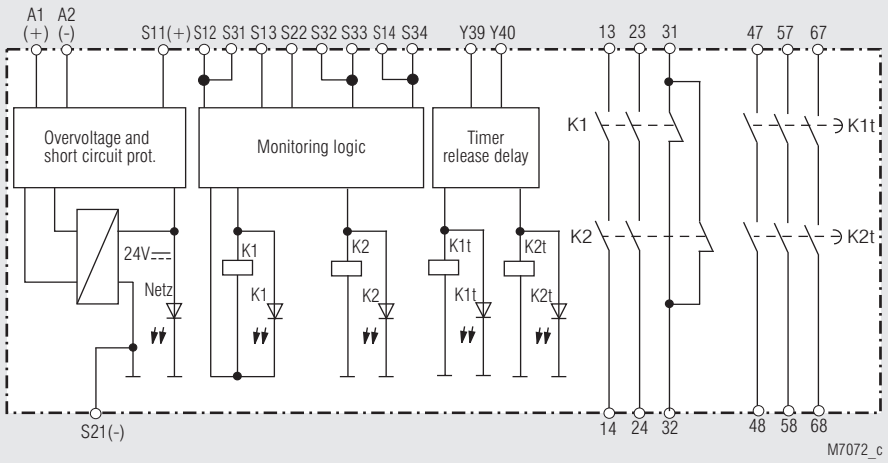
Applications

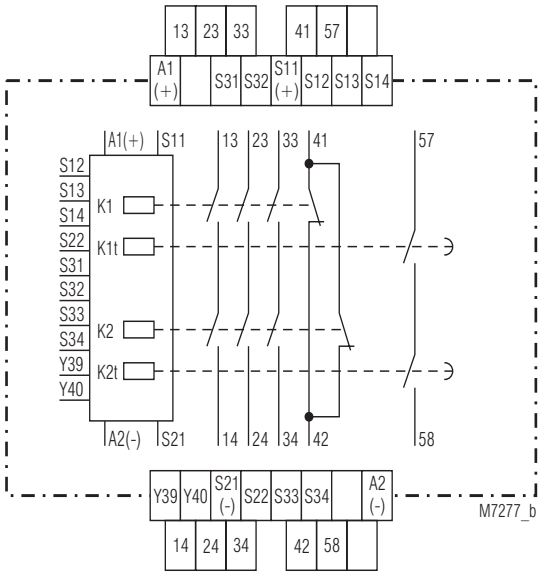
Protection of people and machines
- Emergency stop circuits on machines, stop category 1 can be realised
- Monitoring of safety gates

Indication

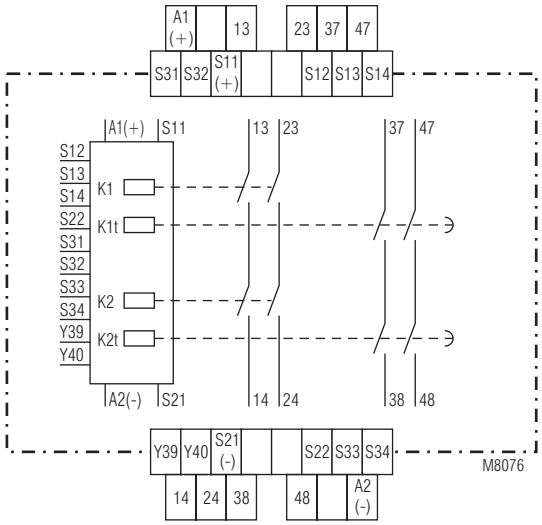
LED power:	on, when supply connected
LEDs K1, K2:	on, when relay K1 and K2 resp. $K1_t$ and $K2_t$ energized

Block Diagram

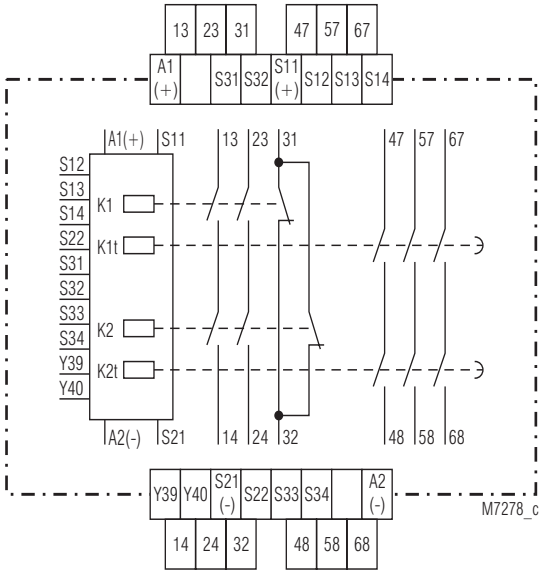




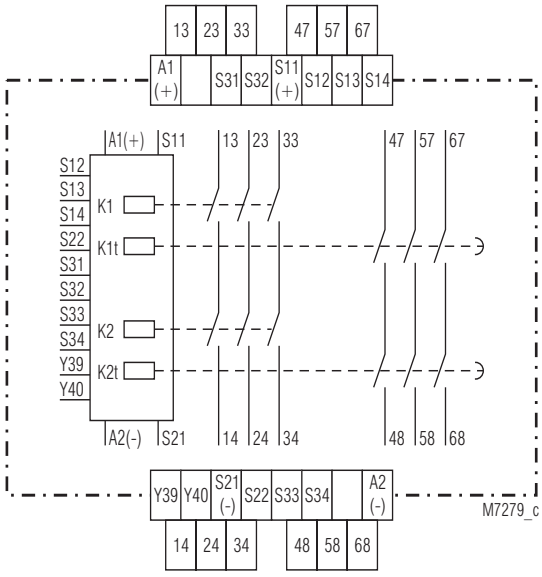
BH 5928.47



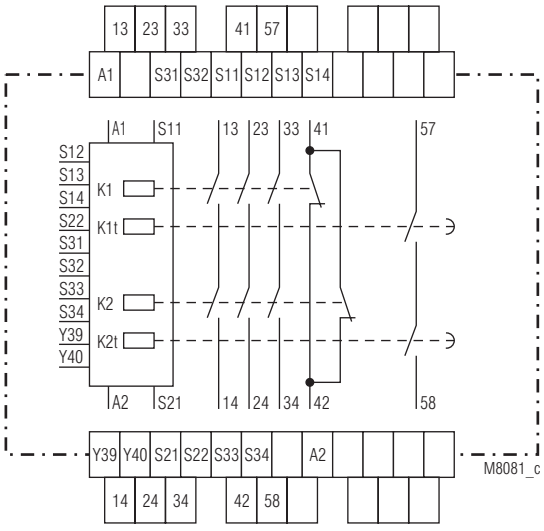
BH 5928.91



BH 5928.92



BH 5928.93



BI 5928.47/100

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.

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:	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 not delayed NO contacts are safety contacts.
	ATTENTION! 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
Disconnecting S12, S22, S31 and S32:	15 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:	AC 3 A / 230V IEC/EN 60 947-5-1
NC contact:	AC 2 A / 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 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
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		
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 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:	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:

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	99.0	%
SFF	99.9	%
PFH_D:	2.05E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Failure Tolerance

Technical Data

Safety Related Data (only delayed contacts)

Values according to EN ISO 13849-1:

Category:	3	
PL:	d	
$MTTF_d$:	219.4	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:

SIL CL:	2	IEC/EN 62061
SIL	2	IEC/EN 61508
HFT:	1	
DC / DC_{avg}:	99.0	%
SFF	99.7	%
PFH_D:	2.26E-10	h^{-1}
T_1:	20	a (year)

*) HFT = Hardware-Failure Tolerance

Info At delayed contacts: Performance Level (PL) d, category 3 to EN ISO 13849 and SIL CL 2 to IEC EN 62061 for delays up to max. 30 s. For longer delays Performance Level (PL) c, category 1 and SIL CL 1.

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

Info **Technical data that is not stated in the UL-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 tv:	0.5 ... 5 s
• Width:	45 mm

Variants

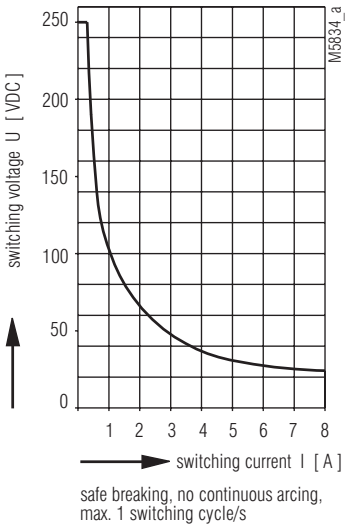
BH 5928._ _/_ _ _ /61: with UL approval
BH 5928._ _/001: with fix time delay
fixed times: 1 s, 3 s, 5 s, 10 s, 300s
other times on request
BH 5928._ _/900: with adjustable time delay
suitable for light curtains and
reed contacts switches
BI 5928.47/100: with adjustable time delay
tolerates voltage drop
up to 6 V in e-stop circuit

Ordering example for variants:

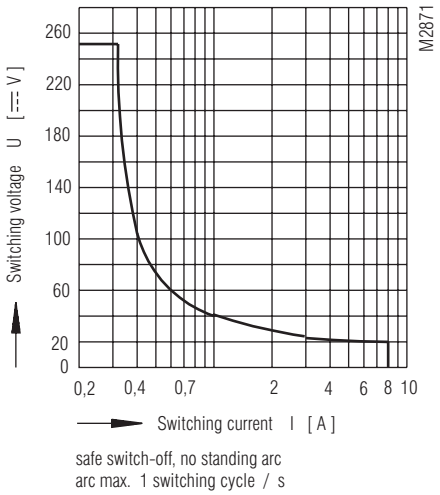
B_ 5928. _ _ / _ _ _ DC 24 V 50/60 Hz 1 ... 10 s

- 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

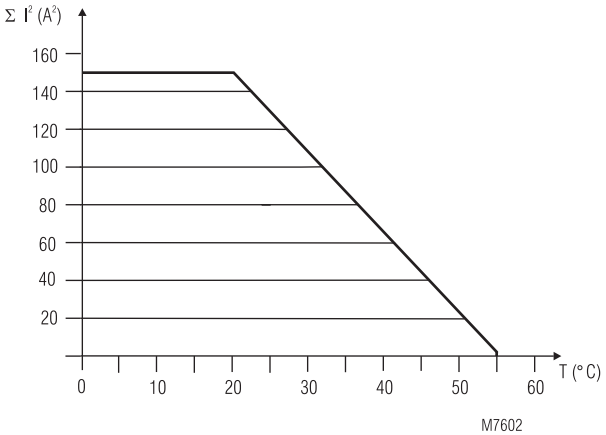
Characteristics



Arc limit curve for resistive load (instantaneous contact)



Arc limit curve for resistive load (delayed contact)

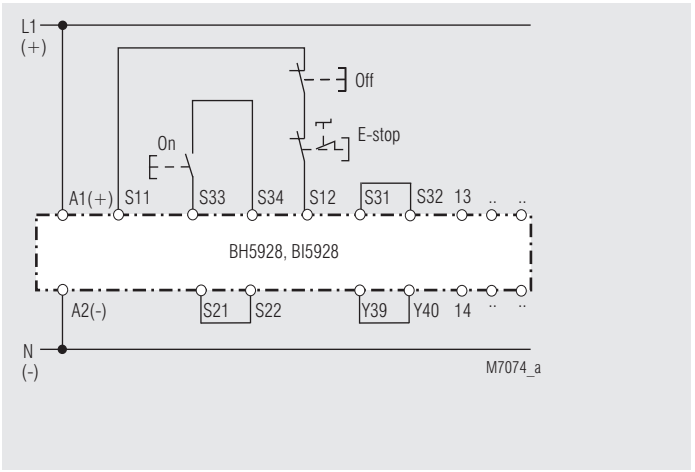


$\Sigma I^2 = I_1^2 + I_{2...}^2 + I_6^2$

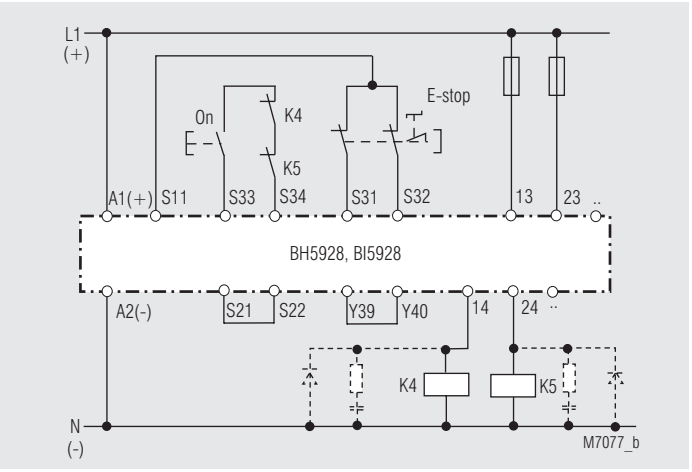
$I_1 \div I_6$ - Current in contact paths

Max. current at 55°C over 3 contact paths = 0,5 A ≙ $0{,}5^2$ x 6 = 1,5 A^2

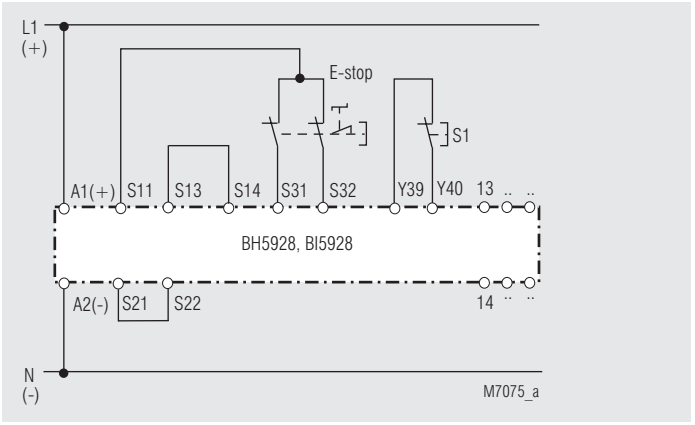
Quadratic total current limit curve



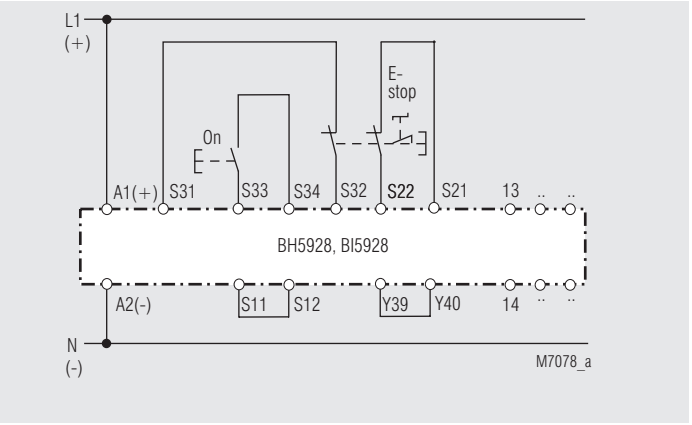
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit



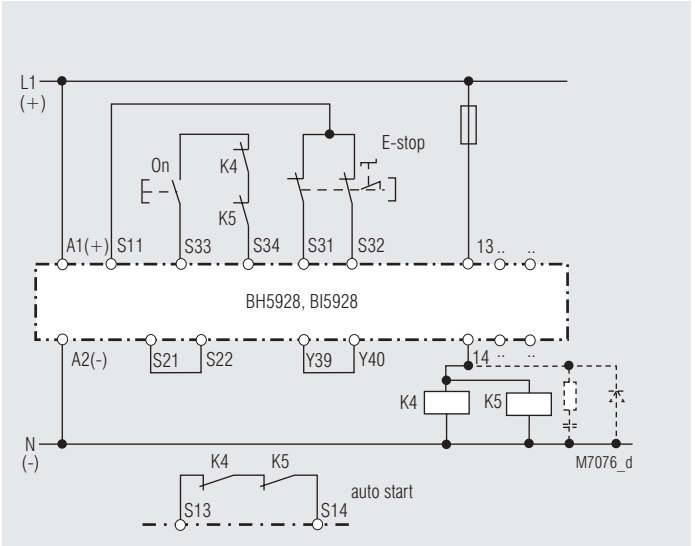
Contact reinforcement by external contactors, 2-channel controlled. The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 5 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals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



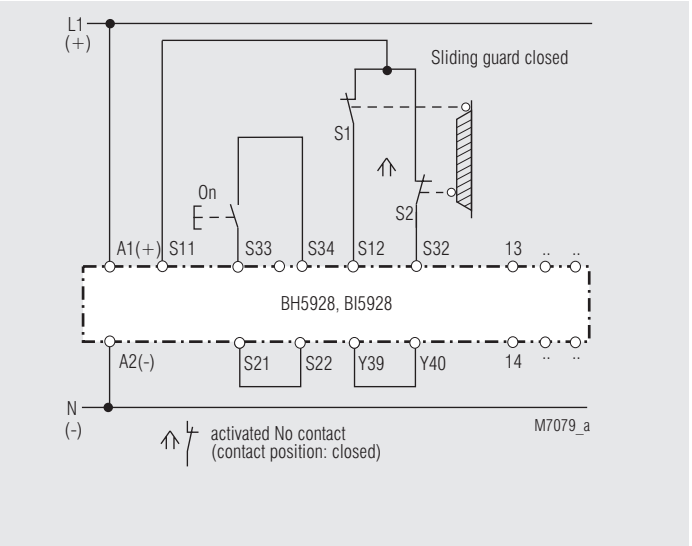
2-channel emergency stop circuit without cross fault monitoring autostart and interruption of time by S1



2-channel emergency stop circuit with cross fault detection



Contact reinforcement by external contactors controlled by one contact path. S33 - S34 must be opened.



2-channel safety gate monitoring