SAFEMASTER
Emergency Stop Module with time delay
BH 5928, BI 5928

Translation of the original instructions

DOLD

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Before installing, operating or maintaining this device, these instructions must be carefully read and understood.

Keep instructions for future reference

The installation must only be done by a qualified electrican!

Do not dispose of household garbage!
The device must be disposed of in compliance with nationally applicable rules and requirements.

To help you understand and find specific text passages and notes in the operating instructions, we have important information and information marked with symbols.

Symbol and Notes Statement

DANGER:
Indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING:
Indicates that death or severe personal injury can result if proper precautions are not taken.

CAUTION:
Indicates that a minor personal injury can result if proper precautions are not taken.

INFO:
Referred information to help you make best use of the product.

ATTENTION:
Warns against actions that can cause damage or malfunction of the device, the device environment or the hardware / software result.

General 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.

Designated Use

The BH 5928 bzw. BI 5928 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.When used in accordance with its intended purpose and following these operating instructions, this device presents no known residual risks. Nonobservance may lead to personal injuries and damages to property.

Safety Notes

Risk of electrocution!
Danger to life or risk of serious injuries.

- Disconnect the system and device from the power supply and ensure they remain disconnected during electrical installation.
- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed.
- The contact protection of the elements connected and the insulation of the supply cables must be designed in accordance with the requirements in the operating instructions / data sheet.
- Note the VDE and local regulations, particularly those related to protective measures.

Risk of fire or other thermal hazards!
Danger to life, risk of serious injuries or property damage.

- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed. In particular, the current limit curve must be heeded.
- The device may only be installed and put into operation by experts who are familiar with this technical documentation and the applicable health and safety and accident prevention regulations.

Functional error!
Danger to life, risk of serious injuries or property damage.

- The device may only be used for the applications described in the mutually applicable operating instructions / data sheet. The notes in the respective documentation must be heeded. The permissible ambient conditions must be observed.
- The device may only be installed and put into operation by experts who are familiar with this technical documentation and the applicable health and safety and accident prevention regulations.
- The unit should be panel mounted in an enclosure rated at IP 54 or superior. Dust and dampness may lead to malfunction.

Installation fault!
Danger to life, risk of serious injuries or property damage.

- Make sure of sufficient protection circuitry at all output contacts for capacitive and inductive loads.

Attention!

- The safety function must be triggered during commissioning.
- 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 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.
- Switch S1 must not be set while device is under supply voltage.
- AUTOMATIC START !
  According to IEC/EN 60204-1 part 9.2.5.4.2 and 10.8.3 it is not allowed to restart automatically after emergency stop.
  Therefore the machine control has to disable the automatic start after emergency stop.
- Opening the device or implementing unauthorized changes voids any warranty

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

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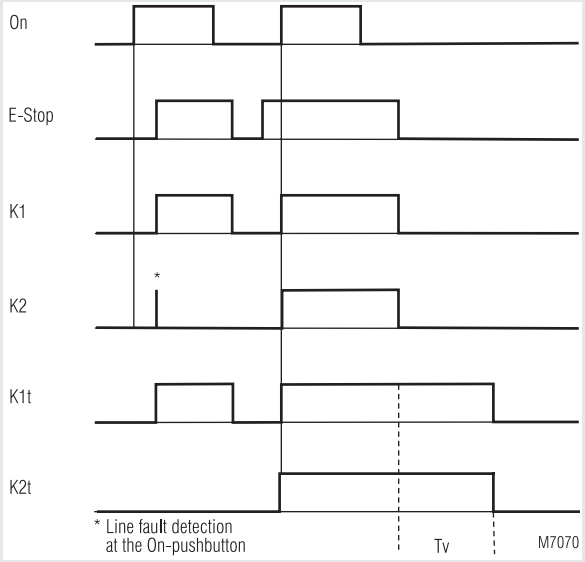
BH 5928 BI 5928

- **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

* See variants

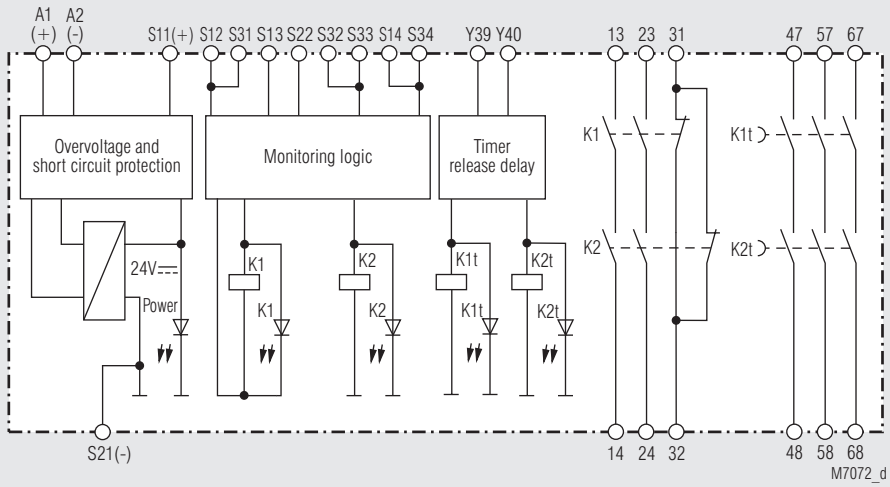
ApplicationS

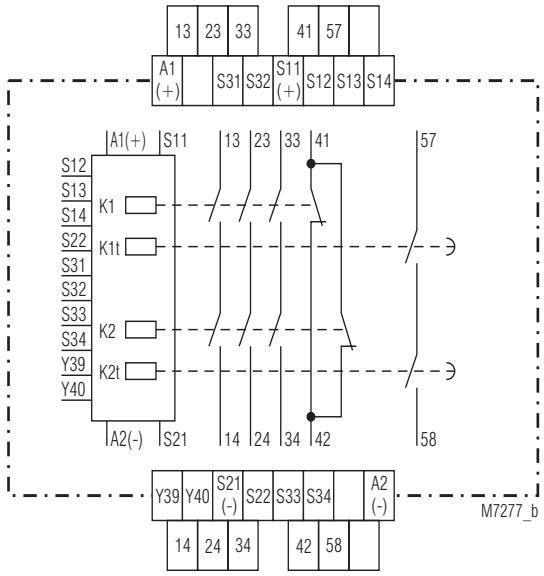
Protection of people and machines
- Emergency stop circuits on machines, stop category 1 can be realised
- Monitoring of safety gates

Indicators

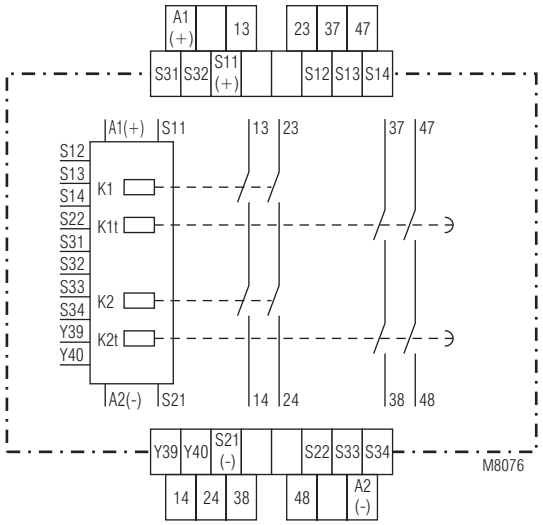
LED Power:	On, when supply connected
LEDs K1, K2:	on, when relay K1 and K2 resp. $K1_t$ and $K2_t$ energized

Block Diagram

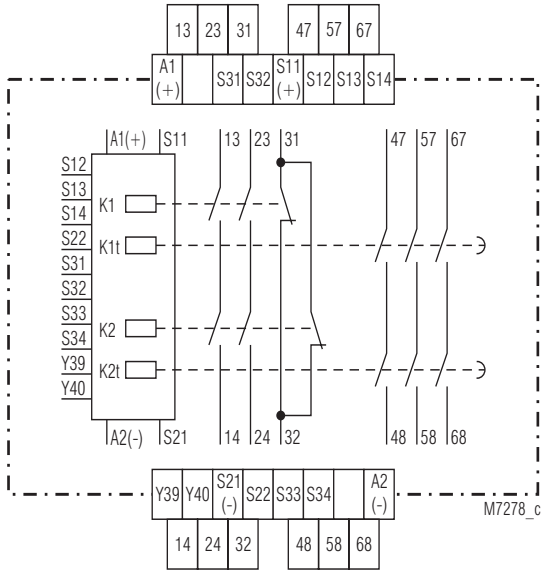




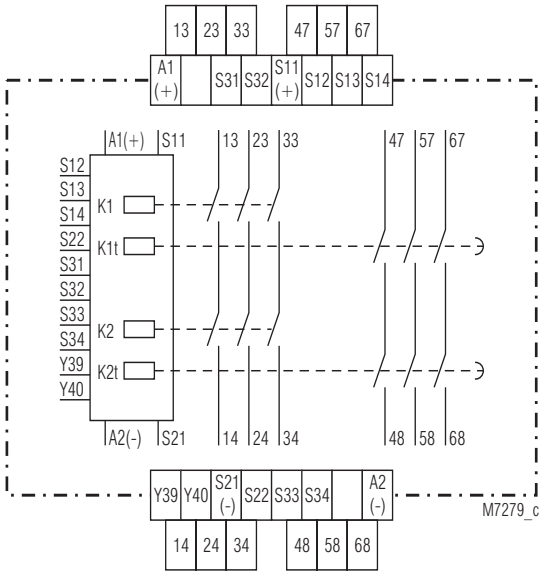
BH 5928.47



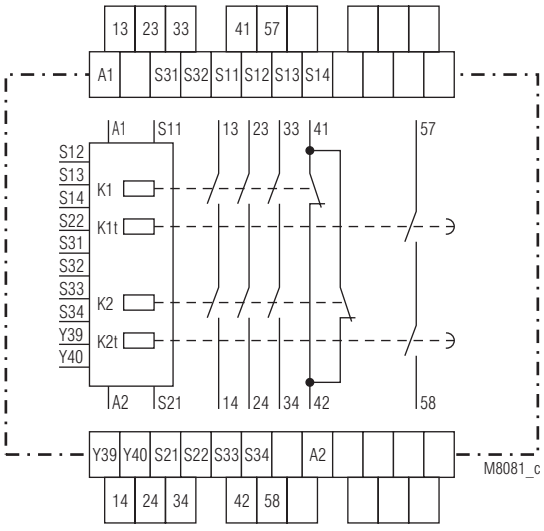
BH 5928.91



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 arc limit curve
Max switching current: DC: see arc limit curve
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 60947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60947-5-1
BH 5928.47, BI 5928.47/100		
NO contact 57/58:	2 A / DC 24 V	IEC/EN 60947-5-1
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
at AC 230 V, 5 A, cos φ = 1: 2×10^5 switch. cycl. IEC/EN 60947-5-1
Permissible operating frequency: Max. 1200 switching cycles / h with manual restart and short release delay time

Short circuit strength
max. fuse rating: 6 A gG / gL IEC/EN 60947-5-1
Mechanical life: 10×10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 25 ... + 55 °C	
storage :	- 25 ... + 85 °C	
altitude:	≤ 2000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2 (basis insulation)	IEC 60664-1
EMC	IEC/EN 62061	
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Climate resistance:	25 / 055 / 04	IEC/EN 60068-1
Terminal designation:	EN 50005	
Wire fixing:	Box terminal with wire protection, removable terminal strips	
Mounting:	DIN rail	IEC/EN 60715
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:

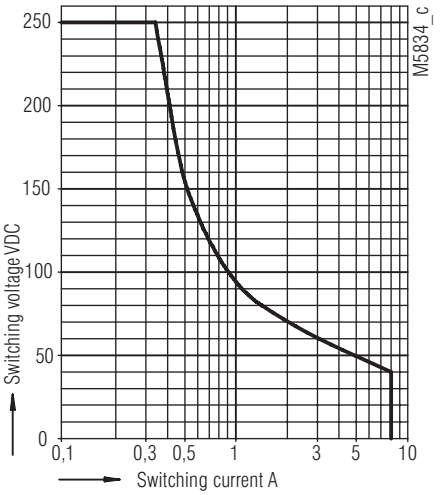
B_ 5928. _ _ / _ _ _ DC 24 V 50/60 Hz 1 ... 10 s

- 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

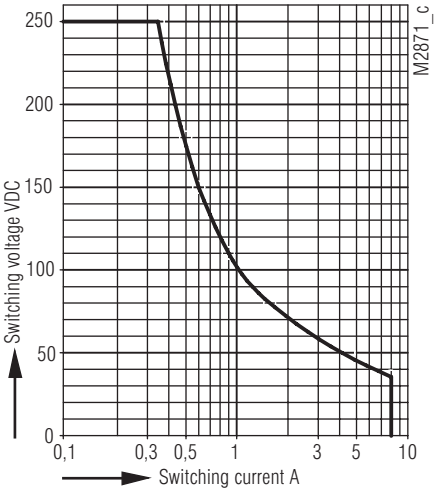
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contacts
  - .47 = 3 NO contacts, 1 NC contact instantaneous and 1 NO contact release delayed
  - .91 = 2 NO contacts instantaneous and 2 NO contacts release delayed (only at BH 5928)
  - .92 = 2 NO contacts, 1 NC contact instantaneous and 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



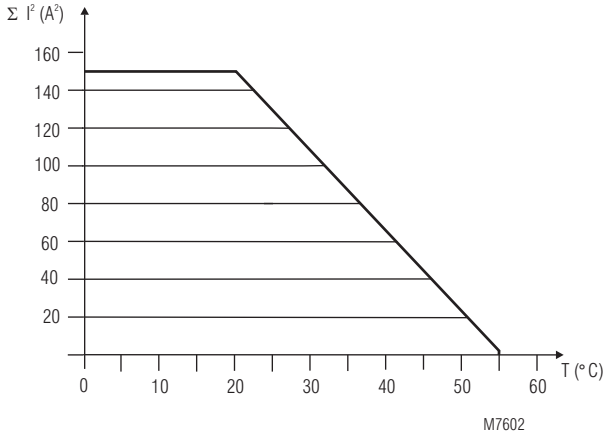
Safe breaking, no continuous arcing, max. 1 switching cycle / s

Arc limit curve (instantaneous contact)



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

Arc limit curve (delayed contact)

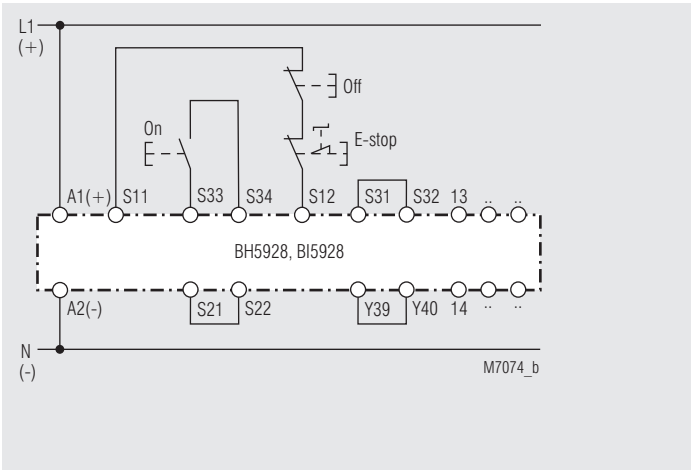


$\Sigma I^2 = I_1^2 + I_{2\ldots}^2 + I_6^2$

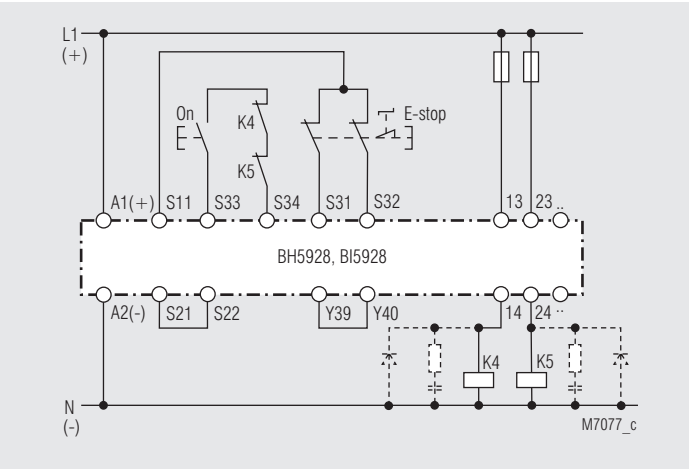
$I_1 \div I_6$ - Current in contact paths

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

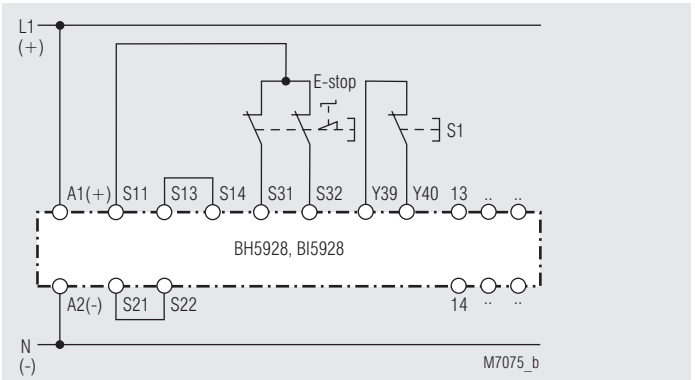
Quadratic total current limit curve



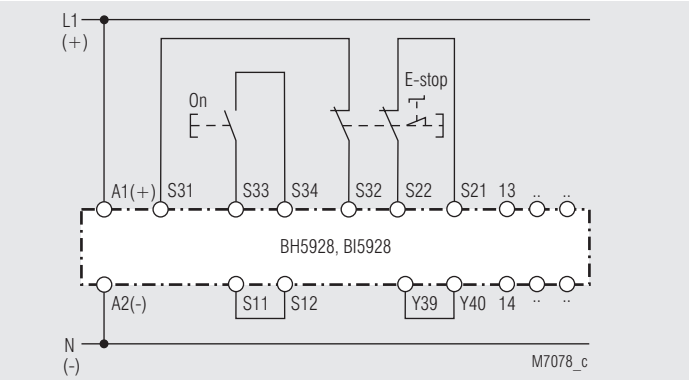
Single channel emergency stop circuit. This circuit does not have any redundancy in the emergency-stop control circuit
Suited up to SIL2, Performance Level d, Cat. 3



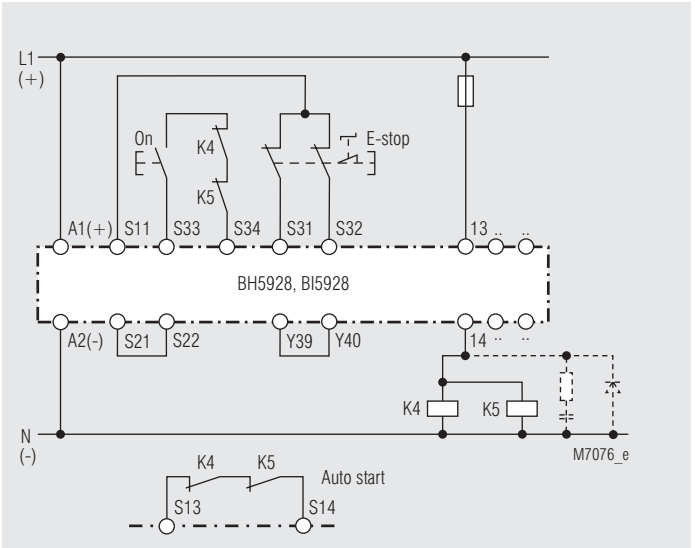
Contact reinforcement by external contactors, 2-channel controlled. The output contacts can be reinforced by external contactors with forcibly guided contacts for switching currents > 5 A.
Functioning of the external contactors is monitored by looping the NC contacts into the closing circuit (terminals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



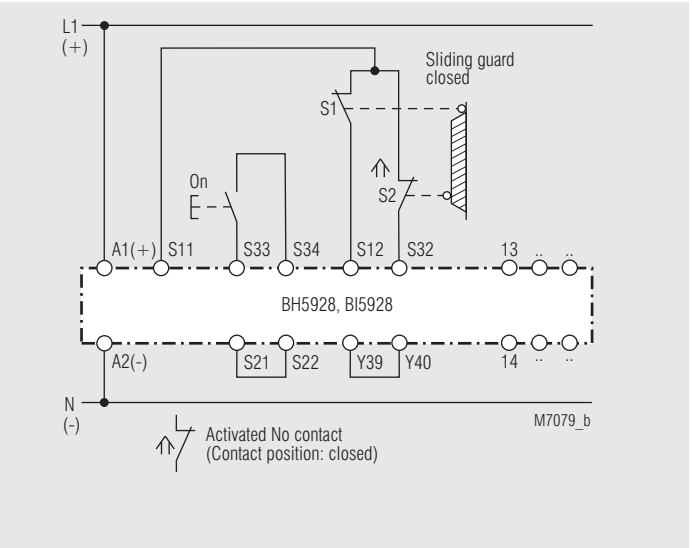
2-channel emergency stop circuit without cross fault monitoring autostart and interruption of time by S1
Suited up to SIL3, Performance Level e, Cat. 4



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