

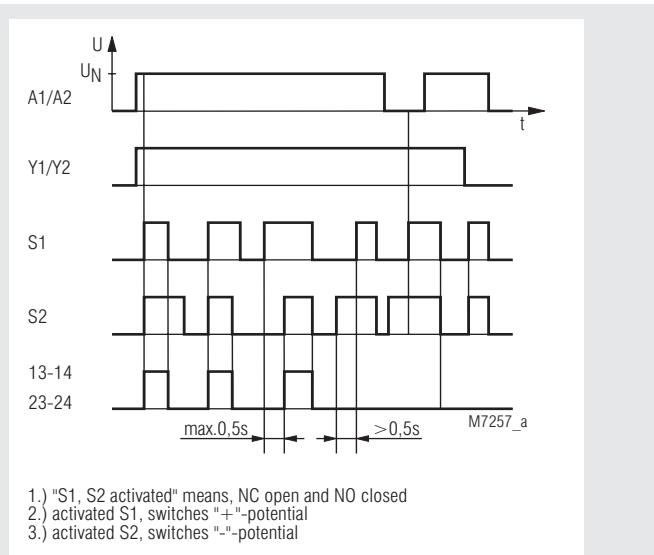
# Safety Technique

## SAFEMASTER Two-Hand Safety Relay BG 5933, BH 5933

**DOLD** 



### Function 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
- Safety Level Type III-C according to EN 574 (02-1997)
- 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
- Feedback circuit Y1 - Y2 to monitor external contactors used for reinforcement of contacts
- Overvoltage and short circuit protection
- Wire connection: also 2 x 1.5 mm<sup>2</sup> stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm<sup>2</sup> stranded ferruled DIN 46 228-1/-2/-3
- BG 5933: width 22.5 mm  
BH 5933: width 45 mm

### Approvals and Marking



\* see variants

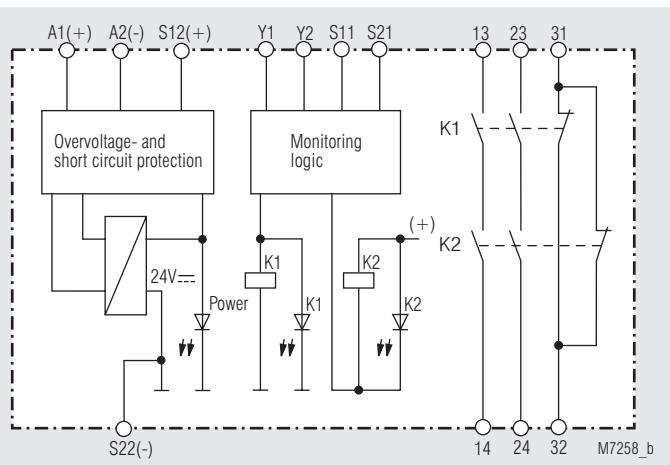
### Applications

Designed for press controls in metalworking as well as in other working machines with dangerous closing movements.

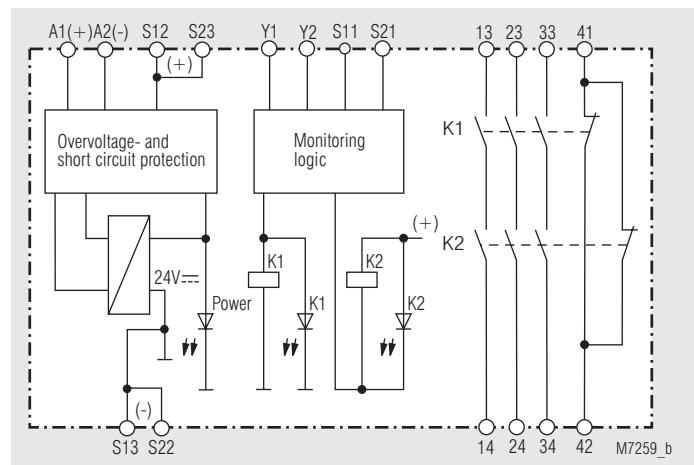
### Indication

LED power-supply: on, when operating voltage applied  
LED K1: on, when relay K1 active  
LED K2: on, when relay K2 active

### Block Diagram

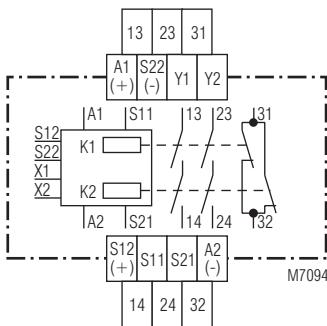


BG 5933

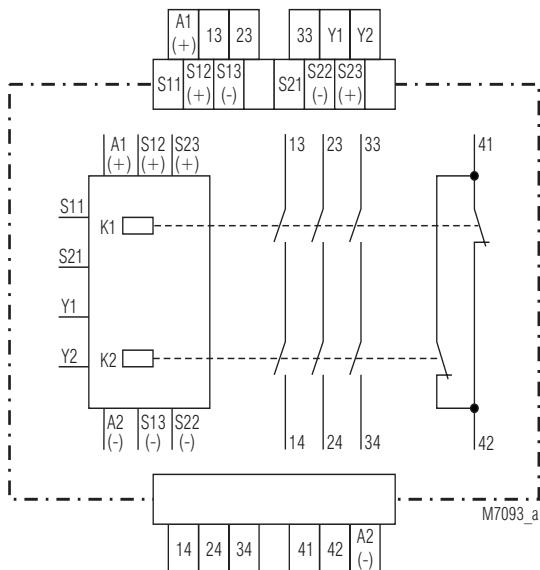


BH 5933

## Circuit Diagrams



BG 5933.22



BH 5933.48

## 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  $\leq 0.5$  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:

$$s = v \cdot t + C$$

- a) moving speed of person  $v = 1600$  mm/s
- b) stopping time of the machine  $t$  (s)
- c) Additional safety distance  $C = 250$  mm

If the risk 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:

BH 5933:

AC 24 V; DC 24 V

AC 24, 42, 48, 110, 120, 127, 230, 240 V

DC 24 V

AC 0.85 ... 1.1  $U_N$

DC 0.9 ... 1.1  $U_N$

AC approx. 4 VA

DC approx. 2.3 W

50 / 60 Hz

max. 0.5 s

1 s

2 x (1 NO, 1 NC contacts)

#### Nominal frequency:

#### Delay time for simultaneity demand:

Recovery time:

Control contacts:

#### Current via control contacts with DC 24 V:

NO contact:

NC contact:

#### Fuse protection:

#### Overvoltage protection:

typ. 50 mA

typ. 20 mA

internal with PTC

by MOV

### Output

#### Contacts:

BG 5933.22:

BH 5933.48:

2 NO, 1 NC contacts

3 NO, 1 NC contacts

The NO contacts are safety contacts.

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

typ. 40 ms

typ. 15 ms

relay, forcibly guided

AC 250 V

DC: see continuous current limit curve

$\geq 100$  mV

$\geq 1$  mA

max. 5 A

(see continuous current limit curve)

#### Operate time:

#### Release time:

#### Contact type:

#### Nominal output voltage:

#### Switching of low loads:

(contacts with 5  $\mu$  Au)

#### Thermal current $I_{th}$ :

#### Switching capacity to AC 15:

NO contacts:

NC contacts:

#### to DC 13:

NO contacts:

NC contacts:

#### Electrical contact life to AC 15 at 2 A, AC 230 V:

to DC 13 at 2 A, DC 24 V:

#### Permissible switching capacity:

#### Short circuit strength

#### max. fuse rating:

#### Line circuit breaker:

#### Mechanical life:

#### General Data

3 A / AC 230 V IEC/EN 60 947-5-1

2 A / AC 230 V IEC/EN 60 947-5-1

1 A / DC 24 V IEC/EN 60 947-5-1

1 A / DC 24 V IEC/EN 60 947-5-1

$10^5$  switching cycles IEC/EN 60 947-5-1

$> 1.5 \times 10^5$  switching cycles

max. 1 800 switching cycles / h

6 A gL IEC/EN 60 947-5-1

C 8 A

$10 \times 10^6$  switching cycles

#### Nominal 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:

#### EMC

Electrostatic discharge:

Fast transients:

Surge voltages

between

wires for power supply:

between wire and ground:

HF-wire guided:

Interference suppression

#### 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

Amplitude 0.35 mm, frequency 10 ... 55 Hz IEC/EN 60 068-2-6

15 / 055 / 04 IEC/EN 60 068-1

EN 50 005

Climate resistance: 15 / 055 / 04 IEC/EN 60 068-1

Terminal designation: EN 50 005

## Technical Data

<b>Wire connection:</b>	1 x 4 mm <sup>2</sup> solid or 1 x 2.5 mm <sup>2</sup> stranded ferruled (isolated) or 2 x 1.5 mm <sup>2</sup> stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm <sup>2</sup> stranded ferruled DIN 46 228-1/-2/-3
<b>Wire fixing:</b>	Terminal screws M3.5 Box terminals with self-lifting wire protection
<b>Mounting:</b>	DIN rail
<b>Weight</b>	IEC/EN 60 715
BG 5933:	200 g
BH 5933:	400 g
<b>Dimensions</b>	
<b>Width x height x depth</b>	22.5 x 84 x 121 mm
BG 5933:	45.0 x 84 x 121 mm

## Safety Related Data

### Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
MTTF <sub>d</sub> :	30.7	a
DC / DC <sub>avg</sub> :	99.0	%
d <sub>op</sub> :	220	d/a (days/year)
h <sub>op</sub> :	12	h/d (hours/day)
t <sub>Zyklus</sub> :	9.50E+01	s/Zyklus (BG 5933)
t <sub>Zyklus</sub> :	1.40E+02	s/Zyklus (BH 5933)

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

SIL CL:	3	IEC/EN 62061
SIL	3	IEC/EN 61508
HFT:	1	
DC / DC <sub>avg</sub> :	99.0	%
SFF	99.7	%
PFH <sub>D</sub> :	7.51E-9	h <sup>-1</sup>
T <sub>1</sub> :	20	a (year)

<sup>1</sup>) 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<sub>N</sub>:

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
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### Ambient temperature 55°C:

Pilot duty B300 4A 250Vac G.P. 4A 24Vdc
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### 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
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Technical data that is not stated in the UL-Data, can be found in the technical data section.

## Standard Type

### BG 5933.22 DC 24 V

Article number:	0049544
• Output:	2 NO contacts, 1 NC contact
• Nominal voltage U <sub>N</sub> :	DC 24 V
• Width:	22.5 mm

### BH 5933.48 AC 230 V

Article number:	0050071
• Output:	3 NO contacts, 1 NC contact
• Nominal voltage U <sub>N</sub> :	AC 230 V
• Width:	45 mm

## Ordering example

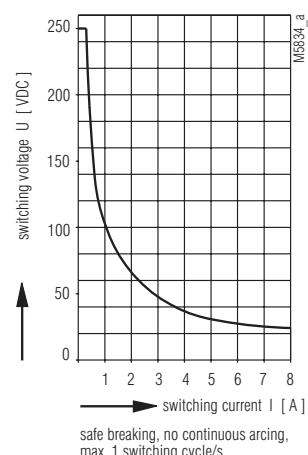
BG 5933 .22 DC 24 V

Nominal voltage  
Contacts  
Type

## Variants

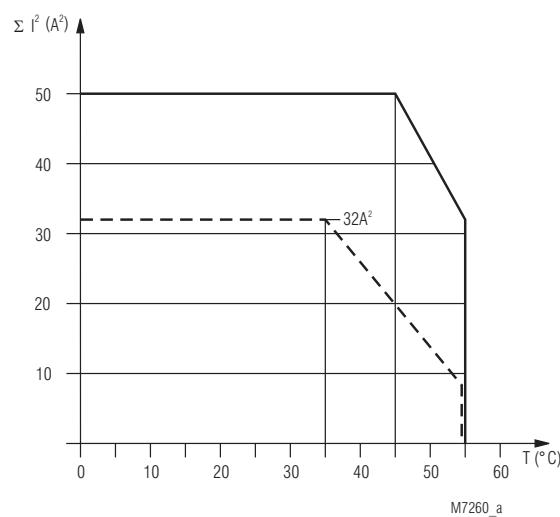
BG 5933/61, BH 5933/61: with UL-approval

## Characteristics



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

Limit curve for arc-free operation with resistive load



device mounted on distance with air circulation.  
max. current at 55°C over  
2 contactrows =  $4A \leq 2x4^2A^2 = 32A^2$

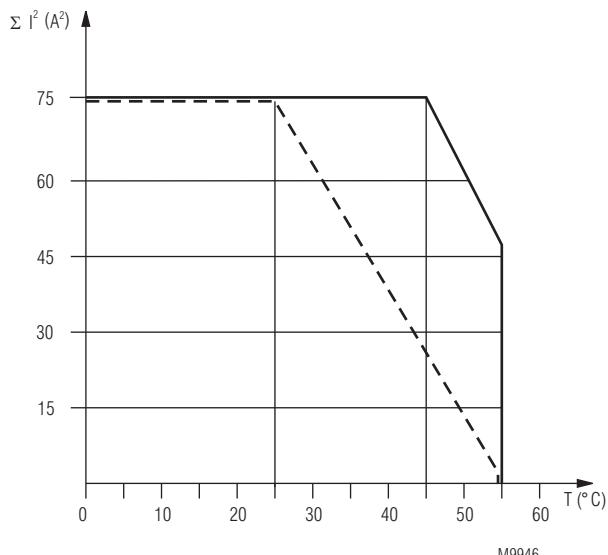
device mounted without distance heated by  
devices with same load,  
max current at 55°C over  
2 contactrows =  $2A \leq 2x2^2A^2 = 8A^2$

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

$I_1, I_2$  - current in contactrows

Continuous current limit curve BG 5933

## Characteristics



device mounted on distance with air circulation.  
max. current at 55°C over  
3 contactrows =  $4A \triangleq 3 \times 4^2 A^2 = 48 A^2$

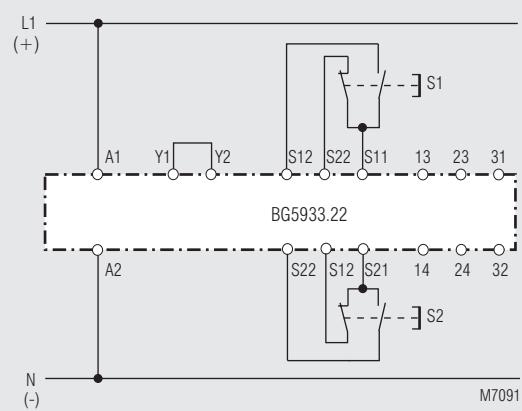
device mounted without distance heated by  
devices with same load,  
max current at 55°C over  
3 contactrows =  $1A \triangleq 3 \times 1^2 A^2 = 3 A^2$

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

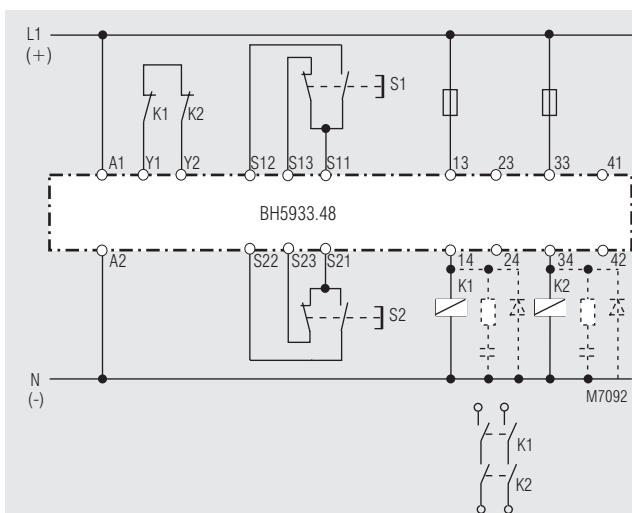
$I_1, I_2, I_3$  - current in contactrows

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