Safety technique

Emergency stop module BO 5988 safemaster

Function diagram

- According to EC Directive for machines 98/37/EG
- According to IEC/EN 60204-1
- Safety category 4 according to EN 954-1
- Output: max. 6 NO, 1 NC contacts or 1 NO contact for AC 250 V
- Optionally with release delayed NO contact to 10 min
- 1-channel or 2-channel connection
- Line fault detection at On pushbutton
- 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
- Feedback circuit X1-X2 for monitoring external contactors
- Integrated short-circuit and overvoltage protection
- Optionally with protective separation to IEC/EN 60 140, IEC/EN 60 947-1
- LED displays for channels 1 and 2 and supply
- Removable terminal strips
- Wire connection: also 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
- Width 100 mm

Block diagram

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 relay K2
LED K3: on, when supply on relay K3

only at BO 5988/4__,
BO 5988/5__: on, when delayed contacts are energised

Note

Safety category 4 according to EN 954-1 only at applications with cross fault detection.
At delayed contacts: Safety category 3 according to EN 954-1 for delays up to 30 s max. For longer delays category 1.
In applications at category 4 (DIN EN 954-1) with contact outputs the safety functions have to be tested at least once a month.

Circuit diagrams

BO 5988.61
BO 5988.47
BO 5988.48

All technical data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.
### Technical data

#### Input

| Nominal voltage U
| 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 |

#### Voltage range:

- at 10 % residual ripple: AC 0,8 ... 1,1 \( U_n \)
- at 48 % residual ripple: AC 0,9 ... 1,2 \( U_n \)

#### Nominal consumption

- 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: typ. DC 110 mA

#### DC 21 V with activated device

- Recovery time: 2 s

#### Mechanical life

- 77-78 at BO 5988.47: max. 8 A

#### Switching capacity

- to AC 15: 5 A
- to AC 230 V: 2 A
- to BO 5988.47: 3 A
- to DC 13: 4 A
- to DC 10: 10 A

#### Thermal current I

- max. 8 A

#### Electrical life

- to AC 15 at 2 A: 10^6 switching cycles
- to AC 230 V: > 240 x 10^6 switching cycles

#### Permissible operating frequency

- 600 switching cycles / h

#### Short circuit strength

- max. fuse rating: 6 A gL
- max. line circuit breaker: C 10 A

#### Mechanical life

- 30 x 10^6 switching cycles

#### General data

- Operating mode: Continuous operation
- Temperature range: - 15 ... + 50 °C
### Technical data

#### Clearance and creepage distances
- Overvoltage category / contamination level: 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: 2 kV IEC/EN 61 000-4-4

#### Surge voltages between wires and between wire and ground:
- 0.5 kV IEC/EN 61 000-4-5
- 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

#### Vibration resistance
- Amplitude 0.35 mm IEC/EN 60 664-2-6
- Frequency 10 ... 55 Hz

#### Climate resistance
- 15 / 050 / 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)
- 2 x 1.5 mm² stranded ferruled (isolated)

#### Wire fixing:
- Plus-minus terminal screws M 3.5

#### Mounting:
- DIN rail IEC/EN 60 715

#### Dimensions
- Width x height x depth: 100 x 74 x 121 mm

#### Weight
- 850 g

### Standard types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>BO 5988.61/024</td>
<td>DC 24 V + AC 230 V 50 / 60 Hz</td>
</tr>
<tr>
<td>Article number</td>
<td>0040375</td>
</tr>
<tr>
<td>Dual voltage version</td>
<td></td>
</tr>
<tr>
<td>Output: 6 NO contacts, 1 NC contact as monitoring contact</td>
<td></td>
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<tr>
<td>Width: 100 mm</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BO 5988.47/124</td>
<td>DC 24 V + AC 230 V 50 / 60 Hz 1 ... 10 s</td>
</tr>
<tr>
<td>Article number</td>
<td>0040430</td>
</tr>
<tr>
<td>Dual voltage version</td>
<td></td>
</tr>
<tr>
<td>Output: 3 NO contacts, 1 NC contact as monitoring contact, 1 release delayed NO contact</td>
<td></td>
</tr>
<tr>
<td>With adjustable time delay ( t_1 ) to 10 s</td>
<td></td>
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<tr>
<td>Width: 100 mm</td>
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### Variants

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>BO 5988.61/60</td>
<td>with CSA approval</td>
</tr>
<tr>
<td>BO 5988.61/61</td>
<td>with UL approval (Canada/USA)</td>
</tr>
</tbody>
</table>

Auxiliary supply is not nesessary during elapse of time:
- BO 5988.47 / 1 _ _: 3 NO / 1 NC contacts + \( t_1 \) adjustable
- BO 5988.47 / 2 _ _: 3 NO / 1 NC contacts + \( t_1 \) fixed

Auxiliary supply must be connected during elapse of time:
- BO 5988.47 / 4 _ _: 3 NO / 1 NC contacts + \( t_1 \) adjustable
- BO 5988.47 / 5 _ _: 3 NO / 1 NC contacts + \( t_1 \) fixed

Without time delay \( t_1 \):
- BO 5988.48 / 0 _ _: 3 NO / 1 NC contacts
- BO 5988.61 / 00: single voltage model
- BO 5988.61/24: dual voltage model

Protective seperation of control and load circuits according to IEC/EN 61 140, IEC/EN 60 947 4 kV / 2 referred to overvoltage category II with basic insulation to IEC 60 664 of 2.5 kV / 2.

### Ordering example for Variants

- BO 5988.47/124 1 ... 10 s DC 24 V + AC 230 V 50 / 60 Hz
- Nominal frequency
- Nominal voltage
- Time delay
- 00: 1 nominal voltage
- 24: 2 nominal voltages
- 0: without \( t_1 \)

- With auxiliary supply during time elapse:
  - 1: \( t_1 \) adjustable
  - 2: \( t_1 \) fixed

### Characteristics

#### 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 currents\(^2\) per safety contact = value on scale \( \Sigma I^2 \) (A\(^2\))
- B) Max. ambient temperature \( T = \) Cross point of scale \( \Sigma I^2 \) (A\(^2\)) with limit curve

#### Example 1

A) \((4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 + (4A)^2 = 96 A^2\) (Scale \( \Sigma I^2 \))
- Max. ambient temperature \( T = 43\,^\circ C\) (point 1)

#### Example 2

A) \((0.5 A)^2 + (1 A)^2 + (2 A)^2 + (1 A)^2 = 6.25 A^2\) (Scale \( \Sigma I^2 \))
- Max. ambient temperature \( T = 49\,^\circ C\) (point 2)

#### Please note:
The total current\(^2\) can still be 1.5 A\(^2\) at 50\,^\circ C, i.e. 0.5 A per safety contact
- A) \((0.5 A)^2 + (0.5 A)^2 + (0.5 A)^2 + (0.5 A)^2 + (0.5 A)^2 = 1.5 A^2\)
- B) Max. ambient temperature = 50\,^\circ C
Application examples

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.

Two-channel emergency-stop circuit with cross fault detection. Activation via On pushbutton. - - - Jumper X5 - X6:
The On pushbutton is not required.

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

Contact reinforcement by external contactors, two-channel.
The output contacts can be reinforced by external contactors with positively-driven 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).

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.

Contact reinforcement by external contactors with reduced safety level.
Two-channel monitoring of a safety gate. S1 must not close before S2.