



EN Operating instructions.pages 1 to 8
Original

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1. About this document

1.1 Function

This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety-monitoring module. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.

1.2 Target group: authorised qualified personnel

All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used



Information, hint, note:

This symbol is used for identifying useful additional information.



Caution: Failure to comply with this warning notice could lead to failures or malfunctions.

Warning: Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use

The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety-monitoring module must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions

The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.



Further technical information can be found in the online catalogue on the Internet: products.schmersal.com.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.6 Warning about misuse



In case of inadequate or improper use or manipulations of the safety-monitoring module, personal hazards or damage to machinery or plant components cannot be excluded. The relevant requirements of the standards ISO 14419 and ISO 13850 must be observed.

1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden, the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

The safety-monitoring module must only be used when the enclosure is closed, i.e. with the front cover fitted.

2. Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

SRB 400①

| No. | Option | Description |
|-----|--------|---|
| ① | CS | Reset not monitored , optional automatic reset* (pull-in delay, see technical data) |
| | SNA | Reset not monitored , optional automatic reset* (pull-in delay, see technical data) |
| | CS/T | Reset monitored * |
| | CA | Reset not monitored, optional automatic reset*, switch-off level 2 with antivalent inputs |
| | CA/T | Reset monitored *, switch-off level 2 with antivalent inputs, cross-wire short detection* |
| | CA/Q | Reset not monitored , optional automatic reset*, switch-off level 2 with antivalent inputs |
| | CA/QT | Reset monitored *, switch-off level 2 with antivalent inputs, cross-wire short detection* |

* with reference to switch-off level 1



Only if the information described in this operating instructions manual are realised correctly, the safety function and therefore the compliance with the Machinery Directive is maintained.

2.2 Special versions

For special versions, which are not listed in the order code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.

2.3 Purpose

The safety-monitoring modules for integration in safety circuits are designed for fitting in control cabinets. They are used for the safe evaluation of the signals of positive break position switches or magnetic safety sensors for safety functions on sliding, hinged and removable safety guards as well as emergency stop control devices and AOPD's.

The safety function is defined as the opening of the enabling circuits 13-24 and 33-44 when the inputs S31-S32 and/or S41-S42 (S43-S44) are opened and as the opening of the enabling circuits 13-14, 13-24, 33-34 and 33-44 when the inputs S12 and/or S22 are opened. The safety-relevant current paths with the output contacts 13-14, 13-24, 33-34 and 33-44 fulfil the following requirements in consideration of a B_{10D} value (see also "Details in terms of ISO 13849-1"):

- Category 4 – PL e in accordance with ISO 13849-1
- Complies with SIL 3 in accordance with IEC 61508-2
- Complies with SILCL 3 in accordance with EN 62061

To determine the Performance Level (PL) to ISO 13849-1 of the entire safety function (e.g. sensor, logic, actuator), an assessment of all relevant components is required.



The entire concept of the control system in which the safety component is integrated, must be validated to the relevant standards.

2.4 Technical data

General data

| | |
|---|---|
| Standards: | EN 60204-1, IEC 60947-5-1, ISO 13849-1, IEC 61508 |
| Climate resistance: | EN 60068-2-78 |
| Mounting: | snaps onto standard rail to EN 60715 |
| Terminal designations: | IEC 60947-1 |
| Material of the housings: | Plastic, glass-fibre reinforced thermoplastic, ventilated |
| Material of the contacts: | AgNi, self-cleaning, positive drive |
| Weight: | 235 g |
| Start conditions: | Automatic or start button (Refer to 2.1 Ordering code) |
| Feedback circuit (Y/N): | yes |
| Pull-in delay with reset button: | Switch-off level 1: typ. 40 ms Switch-off level 2: typ. 350 ms Switch-off level 2 typ. SNA: 80 ms |
| Drop-out delay in case of emergency stop: | typ. 50 ms |

Mechanical data

| | |
|--|--|
| Connection type: | Screw connection |
| Cable section: | min. 0,25 mm ² / max. 2,5 mm ² |
| Connecting cable: | rigid or flexible |
| Tightening torque for the terminals: | 0.6 Nm |
| With removable terminals (Y/N): | yes |
| Mechanical life: | 10 million operations |
| Electrical life: | Derating curve available on request |
| Resistance to shock: | 10 g / 11 ms |
| Resistance to vibration in accordance with EN 60068-2-6: | 10 ... 55 Hz, amplitude 0.35 mm |

Ambient conditions

| | |
|---|---|
| Ambient temperature: | –25 °C ... +45 °C |
| Storage and transport temperature: | –40 °C ... +85 °C |
| Protection class: | Enclosure: IP40 Terminals: IP20 Clearance: IP54 |
| Air clearances and creepage distances to IEC 60664-1: | 4 kV/2 (basic insulation) |
| EMC rating: | to EMC Directive |

Electrical data

| | |
|--|---|
| Contact resistance in new state: | max. 100 mΩ |
| Power consumption: | max. 4.4 W |
| Rated operating voltage U_e : | 24 VDC –15% / +20%, residual ripple max. 10% |
| Fuse rating for the operating voltage: | electronic fuse, Tripping current > 1 A; Reset after approx. 1 sec. |

Monitored inputs

| | |
|----------------------------------|----------------------------|
| Short-circuit recognition (Y/N): | Refer to 2.1 Ordering code |
| Wire breakage detection (Y/N): | Yes |
| Earth leakage detection (Y/N): | Yes |

| | |
|--|--|
| Number of NO contacts: | SNA, CS, CS/T: 0x CA, CA/T, CA/Q, CA/QT: 1x |
| Number of NC contacts: | SNA, CS, CS/T: 4x CA, CA/T, CA/Q, CA/QT: 3x |
| Current and voltage limitation of the control contacts: | S31-S32, S43-S44: 26 VDC / 100 mA |
| Cable length: | 1-channel without cross-wire short detection: – 1,500 m = 1.5 mm ² – 2,500 m = 2.5 mm ² 2-channel with/without cross-wire short detection |
| Conduction resistance: | max. 40 Ω |
| Outputs | |
| Number of safety contacts: | 4 |
| Number of auxiliary contacts: | 0 |
| Switching capacity of the safety contacts: | max. 230 V, 4 A ohmic (inductive in case of appropriate protective wiring); - max. residual current: Enabling circuits 13-14 / 13-24: 4 A; Enabling circuits 33-34 / 33-44: 4 A |
| Fuse rating of the safety contacts: | 4 A slow blow |
| Utilisation category to IEC 60947-5-1: | AC-15: 250 VAC / 1.5 A DC-13: 24 VDC / 2 A |
| Dimensions H x W x D: | 100 mm x 22,5 mm x 121 mm |
| The data specified in this manual are applicable when the component is operated with rated operating voltage $U_e \pm 0\%$. | |

2.5 Safety classification

| | |
|-------------------|------------------------------|
| Standards: | ISO 13849-1, IEC 61508 |
| PL: | up to e |
| Control category: | up to 4 |
| DC: | 99% (high) |
| CCF: | > 65 points |
| PFH value: | $\leq 2.00 \times 10^{-8}/h$ |
| SIL: | up to 3 |
| Mission time: | 20 years |

The PFH value of $2.00 \times 10^{-8}/h$ applies to the combinations of contact load (current through enabling contacts) and number of switching cycles ($n_{op/ly}$) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t_{cycle}) for the relay contacts. Diverging applications upon request.

| Contact load | $n_{op/ly}$ | t_{cycle} |
|--------------|-------------|-------------|
| 20 % | 525,600 | 1.0 min |
| 40 % | 210,240 | 2.5 min |
| 60 % | 75,087 | 7.0 min |
| 80 % | 30,918 | 17.0 min |
| 100 % | 12,223 | 43.0 min |

3. Mounting

3.1 General mounting instructions

Mounting: snaps onto standard DIN rails to EN 60715.

Snap the bottom of the enclosure slightly tilted forwards in the standard rail and push up until it latches in position.

3.2 Dimensions

Device dimensions (H/W/D): 100 x 22.5 x 121 mm
with plugged-in terminals: 120 x 22.5 x 121 mm

4. Electrical connection

4.1 General information for electrical connection



As far as the electrical safety is concerned, the protection against unintentional contact of the connected and therefore electrically interconnected apparatus and the insulation of the feed cables must be designed for the highest voltage, which can occur in the device.



The electrical connection may only be carried out by authorised personnel in a de-energised condition.

Wiring examples: see appendix



To avoid EMC disturbances, the physical ambient and operational conditions at the place where the product is installed, must meet the provisions laid down in the paragraph "Electromagnetic Compatibility (EMC)" of EN 60204-1.

5. Operating principle and settings

5.1 LED functions

- K1: Status channel A
- K2: Status channel B
- K3: Status channel C
- K4: Status channel D
- U_B : Status operating voltage (LED is on, when the operating voltage on the terminals A1-A2 is ON)
- U_i : Status internal operating voltage (LED is on, when the operating voltage on the terminals A1-A2 is ON and the fuse has not been triggered)

5.2 Description of the terminals

| | | | |
|-----------|----------|--|--|
| Voltages: | A1 | +24 VDC | |
| | A2 | 0 VDC | |
| Inputs: | S12 | Switch-off level 1, input channel 1 | |
| | S22 | Switch-off level 1, input channel 2 | |
| | S31-S32 | Switch-off level 2, input channel 1 | |
| | S41-S42 | Switch-off level 2, input channel 2 (SRB 400CS, SRB 400CS/T, SRB 400SNA) | |
| | S43-S44 | Switch-off level 2, input channel 2 (SRB 400CA, SRB 400CA/T, SRB 400CA/Q, SRB 400CA/QT) | |
| | Outputs: | 13-14 | First safety enabling circuit, switch-off level 1 |
| | | 13-24 | Second safety enabling circuit, switch-off level 2 |
| | | 33-34 | Third safety enabling circuit, switch-off level 1 |
| | | 33-44 | Fourth safety enabling circuit, switch-off level 2 |
| Start: | X1 | Feedback circuit, manual start (reset button), automatic start, switch-off level 1 | |
| | X2 | Feedback circuit, manual start (reset button), automatic start, switch-off level 2 | |



Signalling outputs must not be used in safety circuits.

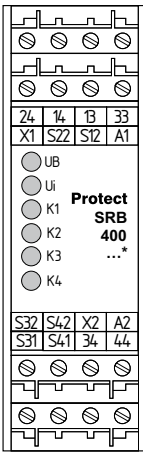


Fig. 1



Due to the operating principle of the electronic fuse, the customer must check that no hazard is caused by an unexpected restart in circuits without reset button (automatic reset).

6. Set-up and maintenance

6.1 Functional testing

The safety function of the safety-monitoring module must be tested. The following conditions must be previously checked and met:

1. Correct fixing
2. Check the integrity of the cable entry and connections
3. Check the safety-monitoring module's enclosure for damage.
4. Check the electrical function of the connected sensors and their influence on the safety-monitoring module and the downstream actuators

6.2 Maintenance

A regular visual inspection and functional test, including the following steps, is recommended:

1. Check the correct fixing of the safety-monitoring module
2. Check the cable for damages
3. Check electrical function



If a manual functional check is necessary to detect a possible accumulation of faults, then this must take place during the intervals noted as follows:

- at least every month for PL e with category 3 or category 4 (according to ISO 13849-1) or SIL 3 with HFT (hardware fault tolerance) = 1 (according to IEC 62061);
- at least every 12 months for PL d with category 3 (according to ISO 13489-1) or SIL 2 with HFT (hardware fault tolerance) = 1 (according to IEC 62061).

Damaged or defective components must be replaced.

7. Disassembly and disposal

7.1 Disassembly

The safety-monitoring module must be disassembled in a de-energised condition only.

Push up the bottom of the enclosure and hang out slightly tilted forwards.

7.2 Disposal

The safety-monitoring module must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

8. Appendix

8.1 Wiring examples

Dual-channel control, shown for an emergency stop circuit; with two contacts A and B and a guard door monitor with two contacts C and D, where at least one is a positive break contact; with external reset button (R) (related on the switch-off level 1) (see Fig. 2)

- Relay outputs: Suitable for 2-channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- The control system recognises wire-breakage and earth faults in the monitoring circuit.
- (H₀) = Feedback circuit

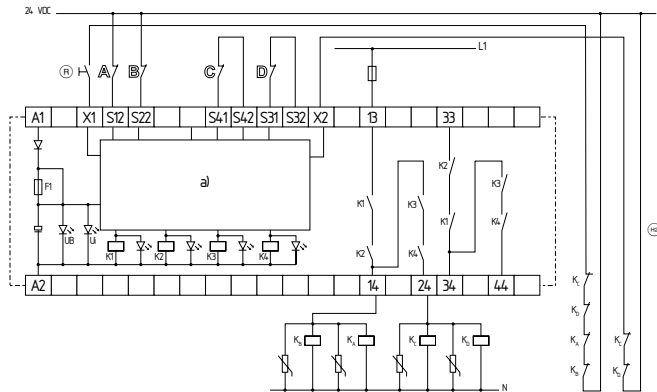


Fig. 2: SRB 400CS, 400CS/T, SRB 400SNA

a) Logic

Dual-channel control, shown for an emergency stop circuit; with two contacts A and B and a guard door monitor with two contacts C and D, where at least one is a positive break contact; with external reset button (R) (related on the switch-off level 1) (see Fig. 3)

- Relay outputs: Suitable for 2-channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- The control system of the emergency stop circuit detects wire breakage and earth faults (cross-wire shorts in the SRB 400CA/QT and SRB 400CA/Q versions). The control system of the door monitoring circuits detects wire breakage, earth faults and cross-wire shorts.
- (H₀) = Feedback circuit



Channel B of SRB 400CA/Q and SRB 400CA/QT: 0 V – S22 (see Fig. 4)

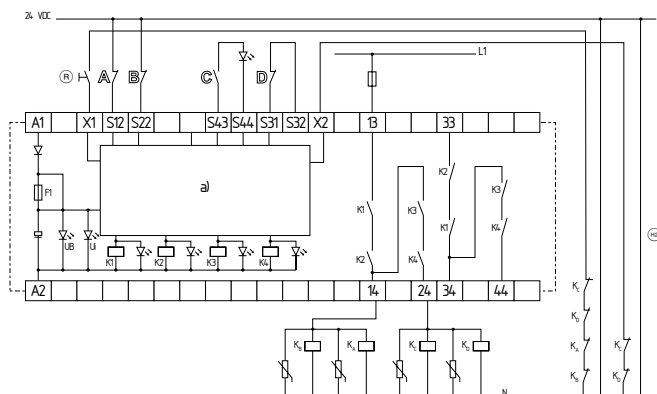


Fig. 3: SRB 400CA, 400CA/T, SRB 400CA/Q, SRB 400CA/QT

a) Logic

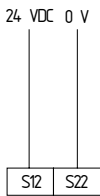


Fig. 4: SRB 400CA/Q and SRB 400CA/QT

8.2 Start configuration

External reset button (Fig. 5)

- The external reset button is wired to the terminals X1 (for switch-off level 1) and X2 (for switch-off level 2).
- The manual start or the activation of the module occurs when the button is pressed (not when it is released!).
- The external reset button is integrated in the feedback circuit in series.

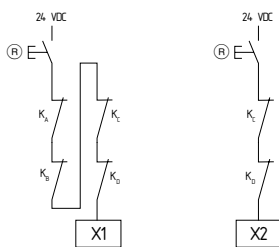


Fig. 5: SRB 400CA, SRB 400CS and SRB 400CA/Q, SRB 400SNA
left = switch-off level 1
right = switch-off level 2

External reset button (Fig. 6)

- The reset button for **switch-off level 1** is wired to terminal X1. Activation is by reset (after release) of the reset button (= detection of the trailing edge). Faults in the reset button, e.g. welded contacts or manipulations which could lead to an inadvertent restart, are detected in this configuration and will result in an inhibition of the operation.
 - The reset button for **switch-off level 2** is wired to terminal X2. The manual start or the activation of the module occurs when the button is pressed (not when it is released!).
 - The external reset button is integrated in the feedback circuit in series.
- * Automatic start at switch-off level 2: the reset button \textcircled{R} must be replaced with a bridge.

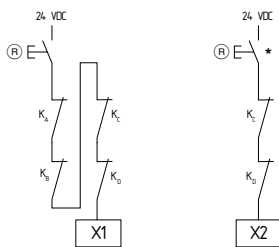


Fig. 6: SRB 400CA/T, SRB 400CS/T and SRB 400CA/QT
left = switch-off level 1
right = switch-off level 2

Automatic start (see Fig. 7)

- The automatic start is programmed by connecting the feedback circuit to the terminals X1 (referring to the switch-off level 1) and X2 (referring to the switch-off level 2). Feedback circuits are not required to be replaced by a bridge.



Not admitted without additional measure due to the risk of gaining access by stepping behind!



Within the meaning of EN 60204-1 paragraph 9.2.5.4.2, the operating mode "automatic start" is only restrictedly admissible. In particular, any inadvertent restart of the machine must be prevented by other suitable measures.

- * An external reset button for a manual start can be installed in switch-off level 2.

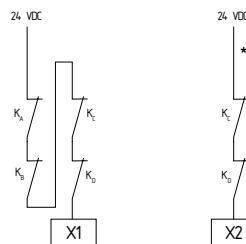


Fig. 7: SRB 400CA, SRB 400CS and SRB 400CA/Q, SRB 400SNA
left = switch-off level 1
right = switch-off level 2

8.3 Sensor configuration

8.3.1 Sensor configuration

Two enabling paths with different ranking shut-down behaviours switch-off level 1

Single-channel emergency stop circuit with command devices to ISO 13850 and IEC 60947-5-5 (Fig. 8)

- Wire breakage and earth leakage in the control circuits are detected.

Dual-channel emergency stop circuit with command devices to ISO 13850 and IEC 60947-5-5 (Fig. 9)

- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits are not detected.

Dual-channel emergency stop circuit with command devices to ISO 13850 and IEC 60947-5-5 (Fig. 10)

- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits are detected.

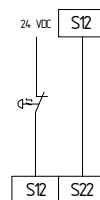


Fig. 8
SRB 400CA,
SRB 400CS,
SRB 400CA/T,
SRB 400CS/T,
SRB 400SNA

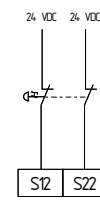


Fig. 9
SRB 400CA,
SRB 400CS,
SRB 400CA/T,
SRB 400CS/T,
SRB 400SNA

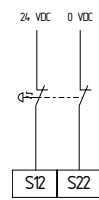


Fig. 10
SRB 400CA/Q,
SRB400CA/QT

8.3.2 Sensor configuration - partially functioning switch-off level 2

Single-channel guard door monitoring circuit with interlocking devices to ISO 14119 (Fig. 11)

- With one positive-break position switch.
- Wire breakage and earth leakage in the control circuits are detected.

Dual-channel guard door monitoring circuit with interlocking device to ISO 14119 (Fig. 12)

- With at least one positive-break position switch
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the control circuits are not detected.

Dual-channel guard door monitoring circuit with interlocking device to ISO 14119 (Fig. 13)

- With at least one positive-break position switch
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the control circuits are detected.

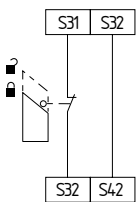


Fig. 11
SRB 400CS,
SRB 400CS/T,
SRB 400SNA

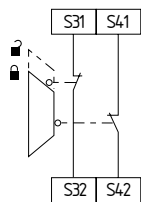


Fig. 12
SRB 400CS,
SRB 400CS/T,
SRB 400SNA

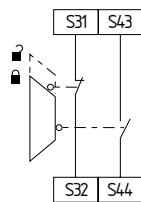


Fig. 13
SRB 400CA,
SRB 400CA/T,
SRB 400CA/Q,
SRB 400CA/QT

8.3.3 Sensor configuration - Dual-channel control of magnetic safety switches to IEC 60947-5-3 (Fig. 14)

- The control system recognises wire-breakage, earth faults and cross-wire shorts in the control circuits.

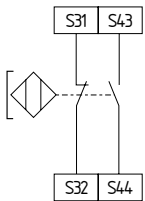


Fig. 14
SRB 400CA,
SRB 400CA/T,
SRB 400CA/Q,
SRB 400CA/QT



The connection of magnetic safety switches to the safety-monitoring modules is only admitted when the requirements of the standard IEC 60947-5-3 are observed.

As the technical data are regarded, at least the following requirements must be met:
Switching capacity: min. 3 W
Switching voltage: min. 30 VDC
Switching current: min. 10 mA



For example, the following safety sensors meet the requirements:

- BNS 33-11z, BNS 33-12z-2063, BNS 33-11z-2063
- BNS 250-11z
- BNS 120-11z
- BNS 180-11z
- BNS 303-11z
- BNS 36-11z
- BNS 260-11z



Caution! When sensors with LED are wired in the control circuit (protective circuit), the following rated operating voltage must be observed and respected:

- 24 VDC with a max. tolerance of -5%/+20 %

Otherwise availability problems could occur, especially in series-wired sensors, where a voltage drop in the control circuit is triggered by LEDs for instance.

8.4 Actuator configuration

Single-channel control (see Fig. 15)

- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.

- H_B = feedback circuit:

If the feedback circuit is not required, establish a bridge.

- A = switch-off level 1, B = switch-off level 2

- * Disabling of the enabling circuits 13-14, 13-24 when switch-off level 1 is triggered, disabling of the enabling circuit 13-24 when switch-off level 2 is triggered

Dual-channel control (see Fig. 16)

- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.

- H_B = feedback circuit:

If the feedback circuit is not required, establish a bridge.

- A = switch-off level 1, B = switch-off level 2

- * Disabling of the enabling circuits 13-14, 13-24 when switch-off level 1 is triggered, disabling of the enabling circuit 13-24 when switch-off level 2 is triggered

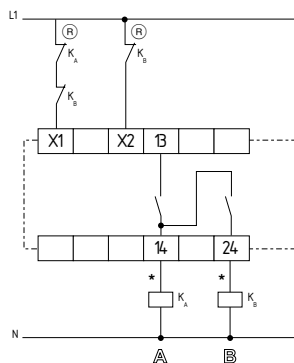


Fig. 15

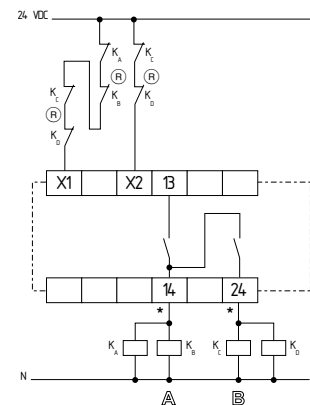


Fig. 16

8.5 Flowcharts

SRB 400CA, SRB 400CS, SRB 400CA/Q, SRB 400SNA
see Fig. 17

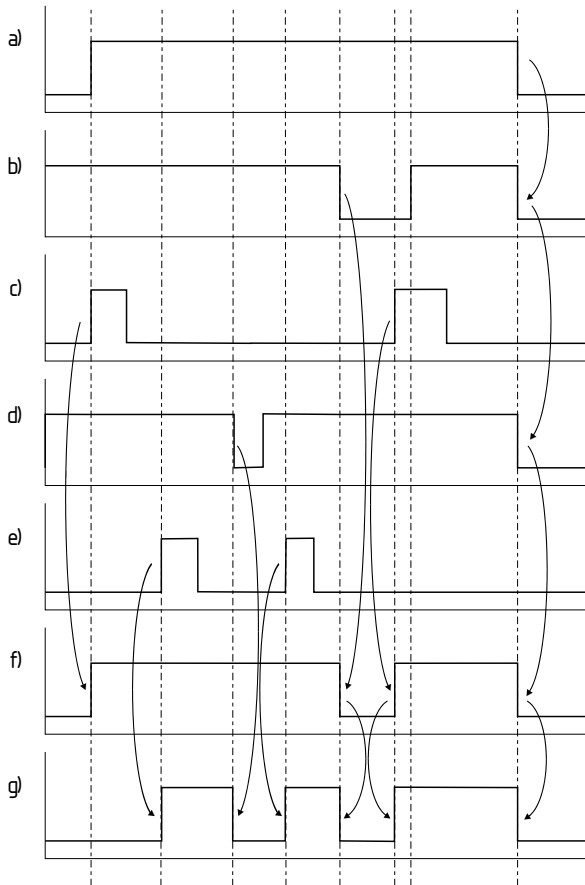


Fig. 17
a) U_B
b) Sensor level 1
c) Reset switch-off level 1
d) Sensor level 2
e) Reset switch-off level 2
f) Enabling circuit 13-14 and 33-34 switch-off level 1
g) Enabling circuit 13-24 and 33-44 switch-off level 2

SRB 400CA/T, SRB 400CS/T, SRB 400CA/QT
see Fig. 18

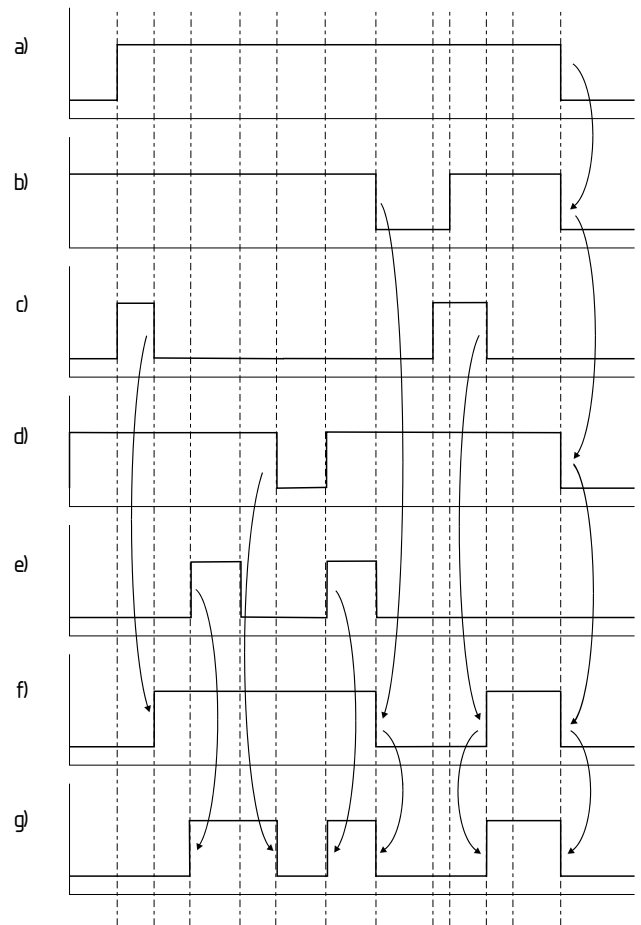

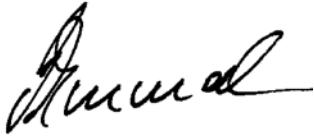


Fig. 18
a) U_B
b) Sensor level 1
c) Reset switch-off level 1
d) Sensor level 2
e) Reset switch-off level 2
f) Enabling circuit 13-14 and 33-34 switch-off level 1
g) Enabling circuit 13-24 and 33-44 switch-off level 2

9. EU Declaration of conformity

| | | |
|--|---|--|
| EU Declaration of conformity | |  |
| Original | K.A. Schmersal GmbH & Co. KG Möddinghofe 30 42279 Wuppertal Germany Internet: www.schmersal.com | |
| We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives. | | |
| Name of the component: | SRB 400C... SRB 400SNA | |
| Description of the component: | Safety-monitoring module for emergency stop circuits, guard door monitoring, magnetic safety switches and AOPD's | |
| Relevant Directives: | Machinery Directive | 2006/42/EC |
| | EMC-Directive | 2014/30/EU |
| | RoHS-Directive | 2011/65/EU |
| Applied standards: | EN 60947-5-1:2004 + AC:2005 + A1:2009, EN ISO 13849-1:2015, EN ISO 13849-2:2012, EN 61326-3-1:2008 | |
| Notified body, which approved the full quality assurance system, referred to in Appendix X, 2006/42/EC: | TÜV Rheinland Industrie Service GmbH Alboinstr. 56, 12103 Berlin Kenn-Nr.: 0035 | |
| Person authorised for the compilation of the technical documentation: | Oliver Wacker Möddinghofe 30 42279 Wuppertal | |
| Place and date of issue: | Wuppertal, January 30, 2020 | |
| SRB400C-E-EN |  | |
| | Authorised signature Philip Schmersal Managing Director | |



The currently valid declaration of conformity can be downloaded from the internet at products.schmersal.com.

