SCHMERSAL

EN Operating instructions. . . . . .pages 1 to 6
Original

Content

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 Schmersal catalogues or in the online catalogue on the Internet: www.schmersal.net.

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.

x.000 / Januar 2017 / v.A. - 101196352-EN / F / 2016-12-21 / AE-Nr. 6907

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 14119 and ISO 13850 must be observed.

ISO 13856-1:
1. Range of application (compendium)
This part of ISO 13856 is applicable to pressure-sensitive mats and pressure-sensitive floors, regardless of the type of energy used (e.g. electrical, hydraulic, pneumatic or mechanical), designed to detect
• persons weighing more than 35 kg, and
• persons (e.g. children) weighing more than 20 kg.
It is not applicable to detect persons weighing less than 20 kg.

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:

SRB301HC/T-①

No.	Option	Description
①	24V	24 VAC/DC
	24V-(V.2)	24 VDC
	230V	48 … 240 VAC

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 Destination and use

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 for safety functions on sliding, hinged and removable safety guards as well as emergency stop control devices and safety mats (SMS from Schmersal).

The safety function is defined as the opening of the enabling circuits 13-14, 23-24 and 33-34 when the inputs S13-S14 and/or S23-S24 are opened. The safety-relevant current paths with the outputs contacts 13-14, 23-24 and 33-34 meet the following requirements under observation of a PFH value assessment (also refer to chapter 2.5 "Safety classification"):

– Control category 4 – PL e to ISO 13849-1
– SIL 3 to IEC 61508-2
– corresponds to SILCL 3 to IEC 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 DIN rail to EN 60715
Terminal designations:	IEC 60947-1
Material of the housings:	Plastic, glass-fibre reinforced thermoplastic, ventilated
Material of the contacts:	AgSnO, self-cleaning, positive drive
Weight:	24 V-version: 320 g, 230 V-version: 340 g
Start conditions:	Automatic or start button
Feedback circuit (Y/N):	yes
Pull-in delay:	typ. 200 ms, max. 400 ms
Drop-out delay:	typ. 20 ms, max. 25 ms
Drop-out delay (V.2):	typ. 70 ms, max. 130 ms
Drop-out delay on "supply failure":	typ. 100 ms
Bridging in case of voltage drops:	typ. 90 ms
Mechanical data:	
Connection type:	Screw connection
Cable section:	min. 0.25 mm² / max. 2.5 mm²
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 vibrations to EN 60068-2-6:	10 ... 55 Hz, amplitude 0.35 mm
Ambient conditions:	
Ambient temperature:	–25 °C … +60 °C
Ambient temperature (V.2):	–25 °C … +50 °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:	
- 24V-version:	max. 1.6 W / 3.7 VA
- 230V-version:	max. 2.0 W / 5.1 VA
Rated operating voltage U_e:	
- 24V version:	24 VDC –15% / +20%, Residual ripple max. 10% 24 VAC –15% / +10%,
- 24V (V.2) version:	24 VDC –5% / +15%
- 230V version:	48 … 240 VAC
Frequency range:	50 / 60 Hz
Fuse rating for the operating voltage:	
- 24V-version:	F1: internal electronic fuse, tripping current > 500 mA; secondary side: internal electronic fuse, tripping current > 0.12 A;
- 230V-version:	primary side: safety fuse, tripping current T 1 A

Monitored inputs:	
Cross-wire detection (Y/N):	Yes
Wire breakage detection (Y/N):	Yes
Earth leakage detection (Y/N):	Yes
Number of NO contacts:	0
Number of NC contacts:	2
Cable length:	1,500 m mit 1.5 mm² 2,500 m mit 2.5 mm²
Conduction resistance:	max. 40 Ω
Outputs:	
Number of safety contacts:	3
Number of auxiliary contacts:	1
Number of signalling outputs:	0
Switching capacity of the safety contacts:	13-14; 23-24; 33-34: max. 250 V, 8 A ohmic (inductive in case of appropriate protective wiring); min. 10 V / 10 mA
Switching capacity of the safety contacts (V.2):	13-14; 23-24; 33-34: max. 250 V, 2 A ohmic (inductive in case of appropriate protective wiring); min. 10 V / 10 mA
Switching capacity of the auxiliary contacts:	41-42: 24 VDC / 2 A
Fuse rating of the safety contacts:	external (I_k = 1000 A) to IEC 60947-5-1 Safety fuse 10 A quick blow, 8 A fast blow
- (V.2):	Safety fuse 2,5 A quick blow, 2 A fast blow
Fuse rating for the auxiliary contacts:	external (Ik = 1000 A) to IEC 60947-5-1 Safety fuse 2.5 A quick blow, 2 A slow blow
Current and voltage at the control circuits:	
- S13-S14:	24 VDC, start impulse: 80 mA / 120 ms; continuous current: 20 mA
- S23-S24:	24 VDC / 20 mA
- X1-X2:	24 VDC, start impulse: 80 mA / 120 ms
Utilisation category to IEC 60947-5-1:	AC-15: 230 V / 6 A DC-13: 24 V / 6 A
Dimensions (H/W/D):	100 mm x 45 mm x 121 mm
The data specified in this manual are applicable when the component is operated with rated operating voltage U_e ±0%.	

2.5 Safety classification

Standards:	ISO 13849-1, IEC 61508, IEC 62061
PL:	up to e
Control category:	up to 4
DC:	99% (high)
CCF:	> 65 points
PFH value:	≤ 2,00 × 10^{-8}/h
SIL:	up to 3
Service life:	20 years

The PFH value of 2.00 × 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles ($n_{op/y}$) 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	$n_{op/y}$	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 DIN rail and push up until it latches in position.

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.

3.2 Dimensions

All measurements in mm.

Device dimensions (H/W/D): 100 x 45 x 121 mm
with plugged-in terminals: 120 × 45 × 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

5. Operating principle and settings

5.1 LED functions

- ON: supply voltage is on. / OFF: supply voltage missing, short-circuit between inputs S13-S14, S23-S24, internal power supply error
- IN A: ON: input S13-S14 closed / OFF: input S13-S14 open or wire breakage
- IN B: ON: input S23-S24 closed / OFF: input S23-S24 open or wire breakage
- OUT: ON: both internal relays are interconnected, when S13-S14 and S23-S24 are closed and the feedback circuit is closed / OFF: when the inputs S13-S14 or S23-S24 or the feedback circuit are/is not closed

5.2 Description of the terminals

Voltages:	A1	+24 VDC / 24 VAC / 48 … 230 VAC
	A2	0 VDC / 0 VAC
Inputs:	S13-S14	Input channel 1 (+)
	S23-S24	Input channel 2 (–)
Outputs:	13-14	First safety enabling circuit (stop 0)
	23-24	Second safety enabling circuit (STOP 0)
	33-34	Third safety enabling circuit (stop 0)
	41-42	Auxiliary NC contact as signalling contact
Feedback circuit:	X1-X2	
Start:	X1-X2	Manual start (reset button)

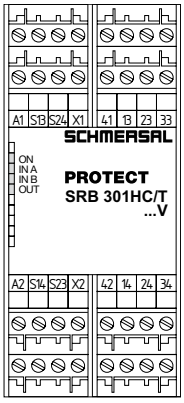

Fig. 1

5.3 Notes

Signalling outputs must not be used in safety circuits.

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 13849-1) 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 a guard door monitor; with two contacts A and B, where at least one is a positive break contact; with external reset button Ⓡ (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.
- Cross-wire shorts between the monitoring circuits are detected.

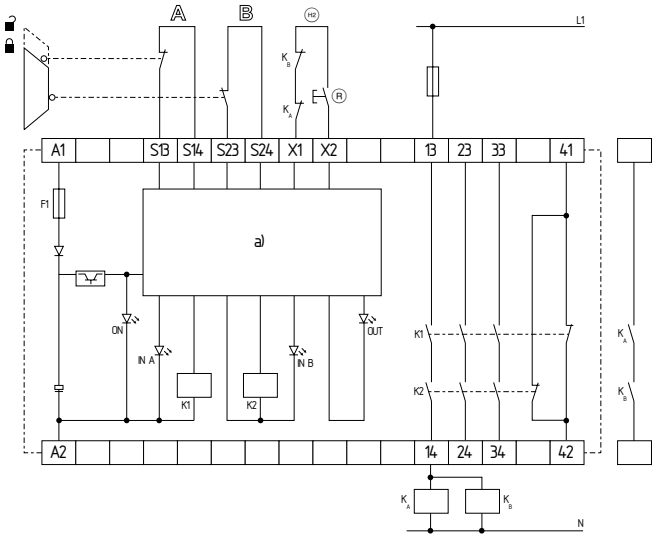

Fig. 2
a) Logic
Ⓗ2 = Feedback circuit

Two-channel control system (example shows switch mat) with external reset button Ⓡ (see fig. 2.1)
- The control system recognises wire-breakage and earth faults in the monitoring circuit.
- For the use of safety mats series SMS 4 (from Schmersal)

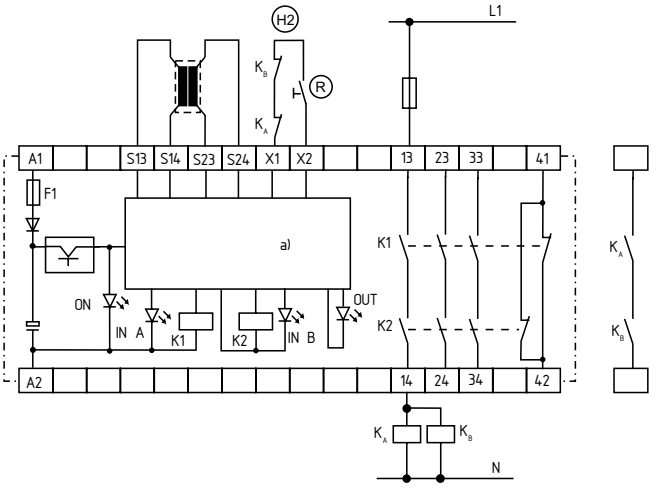

Fig. 2.1
a) Logic
Ⓗ2 = Feedback circuit

8.2 Start configuration

External reset button (see Fig. 3)
- The external reset button is integrated in the feedback circuit in series.
- The manual start or the activation of the module occurs when the button is pressed (not when it is released!).

Automatic start (see Fig. 4)
- The automatic start is programmed by connecting the feedback circuit to the terminals. If the feedback circuit is not required, establish a bridge.
- **Caution: Not admitted without additional measure due to the risk of gaining access by stepping behind!**
- When the safety-monitoring module is used with the operating mode "Automatic start", an automatic restart after a shutdown in case of emergency must be prevented by the upstream control to EN 60204-1 paragraph 9.2.5.4.2.

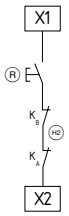

Fig. 3

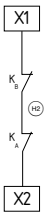

Fig. 4

8.3 Sensor configuration

Dual-channel emergency stop circuit with command devices to ISO 13850 and IEC 60947-5-5 (Fig. 5)
- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits are detected.
- Category 4 – PL e to ISO 13849-1 possible.

Dual-channel guard door monitoring circuit with interlocking device to ISO 14119 (see Fig. 6)
- With at least one positive-break position switch
- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits are detected.
- Category 4 – PL e to ISO 13849-1 possible.

Safety mat to ISO 13856-1 (see Fig. 7)
- In combination with SMS safety mat (from Schmersal)
- Without reset function
- The connection of the inputs is realised through the safety mat here.
- When the safety mat is actuated, the potentials of both inputs are connected, so that a cross-wire short is created and the device is safely shut down.
- Category 3 – PL d to ISO 13849-1 possible.

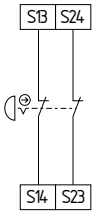

Fig. 5

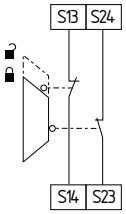

Fig. 6

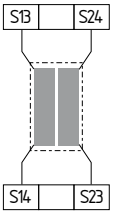

Fig. 7

8.4 Actuator configuration

Single-channel control with feedback circuit (Fig. 8)
- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- Ⓗ2 = feedback circuit:
  If the feedback circuit is not required, establish a bridge.

Dual-channel control with feedback circuit (Fig. 9)
- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- Ⓗ2 = feedback circuit:
  If the feedback circuit is not required, establish a bridge.

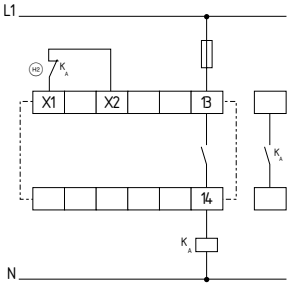

Fig. 8

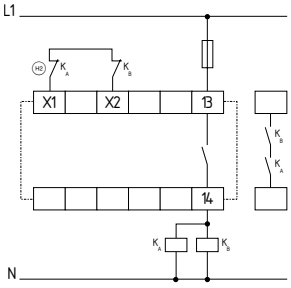

Fig. 9

9. EU Declaration of conformity

EU Declaration of conformity

SCHMERSAL

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:	SRB301HC/T-24V, SRB301HC/T-24V-(V.2), SRB301HC/T-230V
Description of the component:	Safety-monitoring module for emergency stop circuits, guard door monitoring and safety mats
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, ISO 13850:2015, ISO 13849-1:2015, ISO 13849-2:2012,
Notified body for the prototype test:	TÜV Rheinland Industrie Service GmbH Alboinstr. 56, 12103 Berlin ID n°: 0035
EC-prototype test certificate:	01/205/5158.01/17
Person authorised for the compilation of the technical documentation:	Oliver Wacker Möddinghofe 30 42279 Wuppertal
Place and date of issue:	Wuppertal, 23 December 2016

Authorised signature
Philip Schmersal
Managing Director

SRB301HC/T-D-EN

The currently valid declaration of conformity can be downloaded from the internet at www.schmersal.net.

K. A. Schmersal GmbH & Co. KG
Möddinghofe 30, D - 42279 Wuppertal
Postfach 24 02 63, D - 42232 Wuppertal

Phone: +49 - (0)2 02 - 64 74 - 0
Telefax: +49 - (0)2 02 - 64 74 - 1 00
E-Mail: info@schmersal.com
Internet: http://www.schmersal.com