SCHMERSAL
Elan

EN Operating instructions..... pages 1 to 8
Translation of the original operating instructions

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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 proper functionality of the entire machinery 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 Elan catalogues or in the online catalogue on the Internet: www.schmersal.net.

The information contained in this operating instructions manual is provided without liability und 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 standard EN 1088 must be observed.

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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.

2 Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

SRB 301ST V.2

⚠ 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 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 enabling circuits 13-14, 23-24 and 33-34 when the inputs S11-S12 and/or S21-S22 are opened. B_{10d} value assessment (also refer to "Requirements to DIN EN ISO 13849-1"):
– control category 4 – PL e to DIN EN ISO 13849-1
– corresponds to SIL 3 to DIN EN 61508-2
– corresponds to SILCL 3 to DIN EN 62061
(corresponds to control category 4 to DIN EN 954-1)

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

2.4 Technical data

General data	
Standards:	IEC/EN 60204-1, EN 60947-5-1; EN ISO 13849-1, IEC/EN 61508
Climate resistance:	EN 60068-2-78
Fixing:	Snaps onto standard DIN rails to DIN EN 60715
Terminal designations:	EN 60947-1
Material of the enclosure:	glass-fibre reinforced thermoplastic, ventilated
Material of the contacts:	AgSnO, self-cleaning, positive drive
Weight:	240 g
Start conditions	automatic or start button (monitored)
Feedback circuit (Y/N):	Yes
Pull-in delay with automatic start:	typ. 100 ms
Pull-in delay with reset button:	typ. 25 ms
Drop-out delay in case of emergency stop:	typ. 25 ms
Drop-out delay on "supply failure":	typ. 100 ms
Bridging in case of voltage drops:	typ. 80 ms
Mechanical data	
Connection type:	Screw terminals
Cable section:	min. 2 mm^2 / max. 2 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 vibrations to EN 60068-2-6:	10 ... 55 Hz, amplitude 0.35 mm
Ambient conditions	
Ambient temperature:	–25°C … +60°C
Storage and transport temperature:	–40°C … +85°C
Protection class:	Enclosure: IP 40 Terminals: IP 20 Wiring compartment: IP 54
Air clearances and creepage distances to IEC/EN 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. 2.0 W / 4.9 VA
Rated operating voltage U_e:	24 VDC –15% / +20%, residual ripple max. 10% 24 VAC –15% / +10%
Frequency range:	50 Hz / 60 Hz
Max. fuse rating of the operating voltage:	Internal electronic trip, tripping current > 500 mA, Internal electronic trip, tripping current > 50 mA (S11,S21), Reset after disconnection of supply voltage
Current and voltage at:	**S11-S12, S21-S22:** 24 VDC / 10 mA **X3:** 24 VDC, startimpulse 35 mA / 20 ms
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 lengths:	– 1,500 m = 1.5 mm² – 2,500 m = 2.5 mm² 1-channel 2-channel without cross-wire short detection
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 suitable protective wiring); min. 10 V / 10 mA; AC-15: 230 VAC / 6 A; DC-13: 24 VDC / 6 A; residual current at ambient temperature up to 45°C: 24 A / 55°C: 18 A / 60°C: 12 A
Switching capacity of the auxiliary contacts:	41-42: 24 VDC / 2 A
Fuse rating of the safety contacts:	8 A slow blow
Recommended fuse for the auxiliary contacts:	2 A slow blow
Utilisation category to EN 60947-5-1:	AC-15 / DC-13: EN 60947-5-1
Dimensions (H/W/D):	100 mm x 22,5 mm x 121 mm
The data specified in this manual is applicable when the component is operated with rated operating voltage U_e ±0%.	

2.5 Safety classification

Standards:	EN ISO 13849-1, IEC 61508, EN 60947-5-1
PL:	Stop 0: up to e
Control category:	Stop 0: up to 4
DC:	Stop 0: 99% (high)
CCF:	> 65 points
SIL:	Stop 0: up to 3
Service life:	20 years
B_{10d} value (for one channel):	Low voltages range 20%: 20,000,000 40%: 7,500,000 60%: 2,500,000 80%: 1,000,000 Maximum load 100%: 400,000

$$MTTF_d = \frac{B_{10d}}{0{,}1 \times n_{op}} \qquad n_{op} = \frac{d_{op} \times h_{op} \times 3600\ s/h}{t_{cycle}}$$

For an average annual demand rate of n_{op} = 126,720 cycles per year, Performance Level PL e can be obtained at maximum load.
n_{op} = average number of activations per year
d_{op} = average number of operating days per year
h_{op} = average number of operating hours per day
t_{cycle} = average demand rate of the safety function in s
(e.g. 4 × per hour = 1 × per 15 min. = 900 s)

(Specifications can vary depending on the application-specific parameters h_{op}, d_{op} and t_{cycle} as well as the load.)

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.

3.2 Dimensions

All measurements in mm.

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

4 Electrical connection

4.1 General information for electrical connection

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

- K1: Status channel 1
- K2: Status channel 2
- U_B: Status operating voltage (LED is on, when the operating voltage on the terminals A1-A2 is ON)
- Ui: 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/24 VAC
	A2	0 VDC/24 VAC
Inputs:	S11-S12	Input channel 1 (+)
	S12-S22	Input channel 2 (+)
	S21-S22	Input channel 2 (–) (with cross-wire short detection)
Outputs:	13-14	First safety enabling circuit
	23-24	Second safety enabling circuit
	33-34	Third safety enabling circuit
Start:	S12-X2	Feedback circuit and external reset (monitored)
	X12-X3	Feedback circuit and automatic start

5.3 Notes

Opening the front cover (see Fig. 2)

- To open the front cover, insert a slot screwdriver in the top and bottom cover notch and gently lift it.
- When the front cover is open, the electrostatic discharge requirements must be respected and observed.
- After the setting, the front cover must be fitted back in position.

Only touch the components after electrical discharge!

Setting the switch (see Fig. 3)
- The cross-wire short monitoring function (factory setting) is programmed by means of the switch underneath the front cover of the safety-monitoring module.
- The switch must only be operated in de-energised condition by means of a finger or an insulated blunt tool.
- Pos. nQS (top), not cross-wire short proof: suitable for 1-channel applications and applications with outputs connected to potential in the control circuits.
- Pos. QS (bottom), cross-wire short proof: suitable for 2-channel applications without outputs connected to potential in the control circuits.

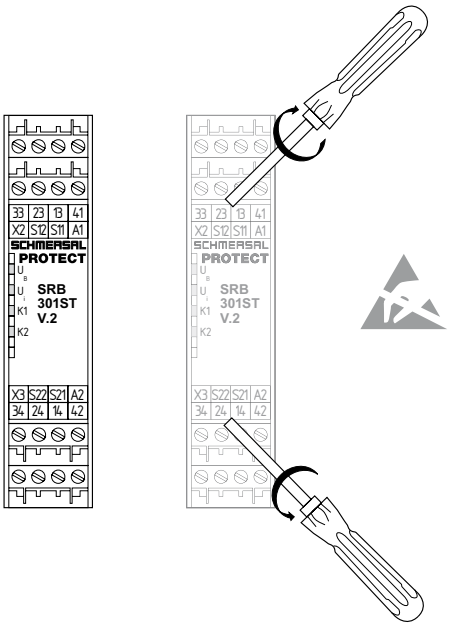


Fig. 1 Fig. 2 Fig. 3

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

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.

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 position switches where one has a positive break contact; with external reset button Ⓡ (Fig. 4)
- 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, earth faults and cross-wire shorts in the monitoring circuit.
- Ⓗ = Feedback circuit

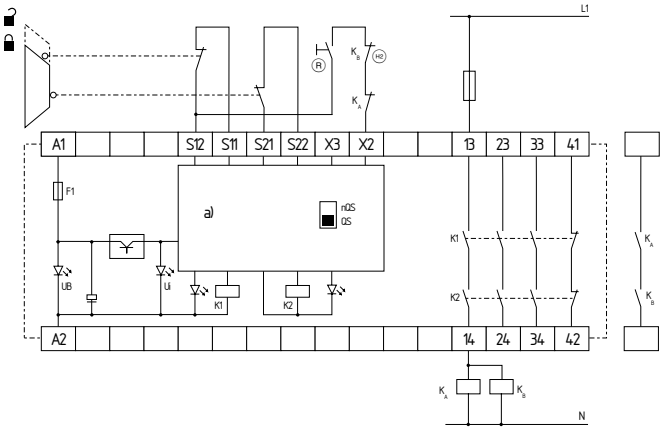


Fig. 4
a) Logic

8.2 Start configuration

External reset button (monitored start) (see Fig. 5)
- The external reset button is integrated in the feedback circuit in series.
- The safety-monitoring module is activated by the reset (after release) of the reset button (= detection of the falling 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.

Automatic start (see Fig. 6)
- The automatic start is programmed by connecting the feedback circuit to the terminals S12-X3.If the feedback circuit is not required, establish a bridge.
- **Caution:** Not admitted without additional measures due to the risk of gaining access by stepping behind!
- When the SRB 301STV.2 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 and 10.8.3.

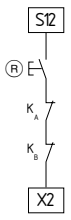




Fig. 5 Fig. 6

8.3 Sensor configuration

Single-channel emergency stop circuit with command devices to DIN EN ISO 13850 (EN 418) and EN 60947-5-5 (Fig. 7)
- Wire breakage and earth leakage in the control circuits are detected.
- Possible control categories:
  – 1 to EN 954-1
  – 2 – PL d to DIN EN ISO 13849-1

Dual-channel emergency stop circuit with command devices to DIN EN ISO 13850 (EN 418) and EN 60947-5-5 (Fig. 8)
- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits **are not detected.**
- Possible control categories:
  – 3 to EN 954-1 - 4 to EN 954-1 (with protective wiring)
  – 4 – PL e to DIN EN ISO 13849-1 (with protective wiring)

Dual-channel emergency stop circuit with command devices to DIN EN ISO 13850 (EN 418) and EN 60947-5-5 (Fig. 9)
- Wire breakage and earth leakage in the control circuits are detected.
- Cross-wire shorts between the control circuits are detected.
- Possible control categories:
  – 4 to EN 954-1
  – 4 – PL e to DIN EN ISO 13849-1

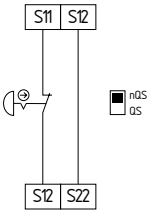


Fig. 7

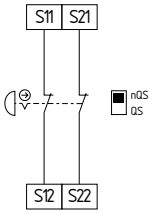


Fig. 8

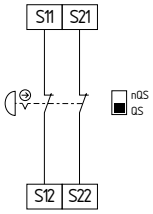


Fig. 9

Single-channel guard door monitoring circuit with interlocking devices to EN 1088 (Fig. 10)
- At least one contact with positive break required
- Wire breakage and earth leakage in the control circuits are detected.
- Possible control categories:
  – 1 to EN 954-1
  – 2 – PL d to DIN EN ISO 13849-1

Dual-channel guard door monitoring circuit with interlocking device to EN 1088 (Fig. 11)
- At least one contact with positive break required
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the guard monitoring circuits **are not detected**.
- Possible control categories:
  – 3 to EN 954-1 - 4 to EN 954-1 (with protective wiring)
  – 4 – PL e to DIN EN ISO 13849-1 (with protective wiring)

Dual-channel guard door monitoring circuit with interlocking device to EN 1088 (Fig. 12)
- At least one contact with positive break required
- Wire breakage and earth leakage in the control circuits are detected.
- Querschlüsse zwischen den Türüberwachungskreisen werden erkannt.
- Possible control categories:
  – 4 to EN 954-1
  – 4 – PL e to DIN EN ISO 13849-1

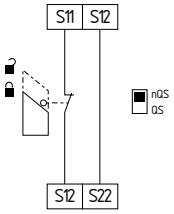


Fig. 10

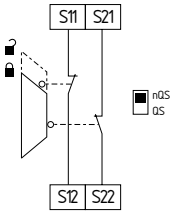


Fig. 11

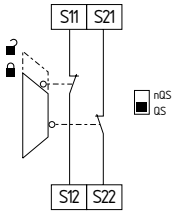


Fig. 12

Dual-channel control of a safety-related electronic (micro-processor-based) safety guard with p-type transistor outputs e.g. AOPD's to EN IEC 61496 (see Fig. 13)
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the control circuits are usually detected by the safety guards.The safety-monitoring module therefore is not equipped with a cross-wire short detection here.
- Possible control categories:
  – 3 to EN 954-1
  – If cross-wire shorts in the control circuits are detected by the safety guard:
  –4 to EN 954-1
  – 4 – PL e to DIN EN ISO 13849-1

2-channel control of magnetic safety switches according to EN 60947-5-3 (see Fig. 14)
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the control circuits **are not detected.**
- Possible control categories:
  – 3 to EN 954-1
  – 3 – PL e to DIN EN ISO 13849-1

2-channel control of magnetic safety switches according to EN 60947-5-3 (see Fig. 15)
- The control system recognises wire-breakage and earth faults in the control circuit.
- Cross-wire shorts between the control circuits are detected.
- Possible control categories:
  – 3 to EN 954-1
  – 3 – PL d to DIN EN ISO 13849-1

The connection of magnetic safety switches to the SRB 301ST V.2 safety-monitoring module is only admitted when the requirements of the standard EN 60947-5-3 are observed.

As the technical data are regarded, the following minimum requirements must be met:
– switching capacity: min. 240 mW
– switching voltage: min. 24 VDC
– switching current: min. 10 mA

For example, the following safety sensors meet the requirements:
– BNS 33-02z-2187, BNS 33-02zG-2187
– BNS 260-02z, BNS 260-02zG
– BNS 260-02-01z, BNS 260-02-01zG

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 %
– 24 VAC with a max. tolerance of –5 %/+10 %

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

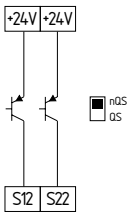


Fig. 13

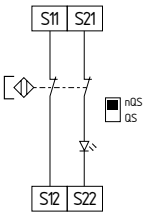


Fig. 14

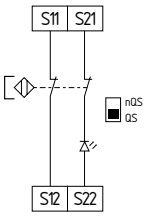


Fig. 15

8.4 Actuator configuration

Single-channel control (see Fig. 16)
- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- If the feedback circuit is not required, establish a bridge.
- H2 = Feedback circuit and external reset in series

Dual-channel control with feedback circuit (Fig. 17)
- Suitable for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- If the feedback circuit is not required, establish a bridge.
- H2 = Feedback circuit and external reset in series

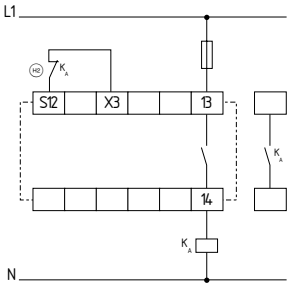


Fig. 16

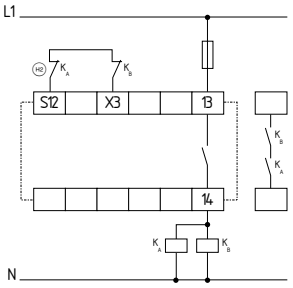


Fig. 17

8.5 EC Declaration of conformity

EC Declaration of conformity

Translation of the original declaration of conformity
valid as of December 29, 2009

Elan Schaltelemente GmbH & Co. KG
Im Ostpark 2 · 35435 Wettenberg
Germany
Internet: www.elan.de

We hereby certify that the hereafter described safety components both in its basic design and construction conforms to the applicable European Directives.

Name of the safety component:	SRB 301ST V.2
Description of the safety component:	Safety-monitoring module for emergency stop circuits, guard door monitoring, magnetic safety switches and AOPD's
Harmonised EC-Directives:	2006/42/EC EC-Machinery Directive 2004/108/EC EMC-Directive
Person authorized for the compilation of the technical documentation:	Ulrich Loss Möddinghofe 30 42279 Wuppertal
Notified body, which approved the full quality assurance system, referred to in Appendix X, 2006/42/EC:	TÜV Rheinland Industrie Service GmbH Alboinstraße 56 12103 Berlin ID n°: 0035
Place and date of issue:	Wuppertal, October 6, 2009



Authorised signature
Heinz Schmersal
Managing Director

SRB301ST V.2-B-EN

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

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