



EN Operating instructions.pages 1 to 10
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 Schmersal range of products is not intended for private consumers.

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: 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 EN ISO 14119 and EN 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 relay module is to be operated in an area in which access by personnel is restricted.

2. Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

SRB-E-301MC-①

No.	Option	Description
①	CC	Plug-in screw clamps: single wire (rigid) or fine wire (flexible): 0.2 ... 2.5 mm ² ; fine wire with ferrule: 0.25 ... 2.5 mm ² Plug-in cage clamps: single wire (rigid) or fine wire (flexible): 0.2 ... 1.5 mm ² ; fine wire with ferrule: 0.25 ... 1.5 mm ²

(Signal contact 41/42, normally-closed contacts parallel)

SRB-E-301MC20-①

No.	Option	Description
①	CC	Plug-in screw clamps: single wire (rigid) or fine wire (flexible): 0.2 ... 2.5 mm ² ; fine wire with ferrule: 0.25 ... 2.5 mm ² Plug-in cage clamps: single wire (rigid) or fine wire (flexible): 0.2 ... 1.5 mm ² ; fine wire with ferrule: 0.25 ... 1.5 mm ²

(Signal contact 41/42, normally-closed contacts in series)



Only if the action described in these operating instructions is carried out correctly will the safety function be safeguarded, including compliance with the Machinery Directive.

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 safety sensors for safety functions on sliding, hinged and removable safety guards as well as emergency stop control devices, safety solenoid switches and AOPD's.

The safety function is defined as deactivating outputs 13/14, 23/24, 33/34 when inputs S12 and/or S22 are opened. Taking account of a PFH value assessment, the safety-relevant current paths meet the following requirements (see also chapter 2.6 "Safety classification"):

- Control category 4 – PL e to EN ISO 13849-1
- SIL 3 to IEC 61508
- SIL CL 3 to EN 62061

To determine the Performance Level (PL) to EN 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, EN 60947-5-1, EN ISO 13849-1, EN 62061, IEC 61508
EMC rating:	to EMC Directive
Air clearances and creepage distances:	to EN 60664-1
Mounting:	standard rail in accordance with EN 60715
Terminal designations:	EN 60947-1

Electrical characteristics:

Rated operating voltage U_e :	24 VDC -15% / $+20\%$, residual ripple max. 10% 24 VAC -15% / $+10\%$
Frequency range:	50 Hz/60 Hz
Power consumption:	2.9 W, 5.0 VA
Fuse rating for the operating voltage:	internal fuse, tripping current $> 1A$

Insulation values in accordance with EN 60664-1 (Altitude max. 2,000 m):

Rated insulation voltage U_i :	
- Safety contacts:	250 V
Rated impulse withstand voltage U_{imp} :	
- Safety contacts 13-14, 23-24, 33-34:	4 kV
Overvoltage category:	III
Degree of pollution:	2

Insulation values in accordance with EN 60664-1 (Altitude max. 4,000 m):

Rated insulation voltage U_i :	
- Safety contacts:	50 V
Rated impulse withstand voltage U_{imp} :	
- Safety contacts 13-14, 23-24, 33-34:	0.8 kV
Overvoltage category:	III
Degree of pollution:	2

Pull-in delay:	< 120 ms
Drop-out delay in case of "emergency stop":	< 10 ms
Drop-out delay on "supply failure":	< 50 ms
Bridging in case of voltage drops:	typ. 40 ms

Control current circuits/inputs:

Inputs S12, S22:	24 VDC/10 mA
Inputs X2:	24 VDC/10 mA
Cable length:	1,500 m with 1.5 mm ² , 2,500 m with 2.5 mm ²

Conduction resistance:	max. 40 Ω
------------------------	------------------

Relay outputs:

Switching capacity of the safety contacts:	13-14, 23-24, 33-34: max. 250 V, 6 A ohmic, min. 10 VDC / 10 mA
- Altitude max. 2,000 m:	
- Altitude 4,000 m:	max. 50 V, 6 A ohmic, min. 10 VDC / 10 mA (Derating see 2.5)

Fuse rating of the safety contacts:	external ($I_k = 1000$ A) to EN 60947-5-1
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Safety fuse 10 A quick blow, 6 A slow blow

Utilisation category to EN 60947-5-1:	DC-13: 24 V / 4 A AC-15: 230 V / 4 A
---------------------------------------	---

Switching capacity of the auxiliary contacts:	41-42: 24 VDC / 1 A
---	---------------------

Fuse rating for the auxiliary contact:	safety fuse 1.5 A quick blow, 1 A slow blow
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Electrical life:	refer to 2.5
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Mechanical life:	10 million operations
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Safety contact values:	resistance max. 100 m Ω , AgNi, self-cleaning, positive action
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Max. switching cycles / minute:	20
---------------------------------	----

Inductive consumers:	Provision should be made for a suitable protection circuit.
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Mechanical data:

Connection type:	refer to 2.1
Cable section:	refer to 2.1
Connecting cable:	rigid or flexible
Tightening torque for the terminals:	0.5 Nm
Material of enclosure:	glass-fibre reinforced thermoplastic, ventilated
Weight:	175 g

Ambient conditions:

Ambient temperature:	$-25^\circ\text{C} \dots +65^\circ\text{C}$ (non condensing)
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Storage and transport temperature:	$-40^\circ\text{C} \dots +85^\circ\text{C}$ (non condensing)
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Protection class:	Enclosure: IP40 Terminals: IP20 Clearance: IP54
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Resistance to shock:	30 g / 11 ms
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Resistance to vibrations to IEC 60068-2-6:	10 ... 55 Hz, amplitude 0.35 mm
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The data specified in this manual apply for operation of equipment with rated operating voltage $U_e \pm 0\%$.

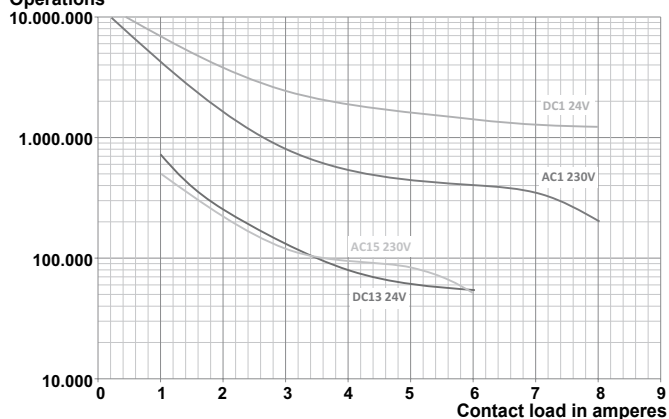
2.5 Derating / electrical lifespan of safety contacts

No derating with individual installation of modules.

Derating on request if several modules are installed one after the other without spacing and with maximum output load and ambient temperatures.

Electrical life of the safety contacts

Operations



2.6 Safety classification

2.6.1 Classification of relay output

Standards:	EN ISO 13849-1, IEC 61508, EN 62061
PL:	e
Control Category:	4
DC:	high
CCF:	> 65 points
PFH ₀ :	$\leq 6.0 \times 10^{-9}$ / h
PFH _{avg} :	$\leq 4.0 \times 10^{-4}$
SIL:	suitable for SIL 3 applications
Mission time:	20 years

The PFH value of 6.0×10^{-9} /h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n_{oply}) 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_{oply}	t_{cycle}
20 %	880,000	0.6 min
40 %	330,000	1.6 min
60 %	110,000	5.0 min
80 %	44,000	12.0 min
100 %	17,600	30.0 min

3. Mounting

3.1 General mounting instructions

Mounting: snaps onto standard rails to EN 60715.

Hook bottom of enclosure in standard rail and push down until it engages in position.

3.2 Dimensions

Device dimensions (H/W/D): 98 x 22.5 x 115 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.



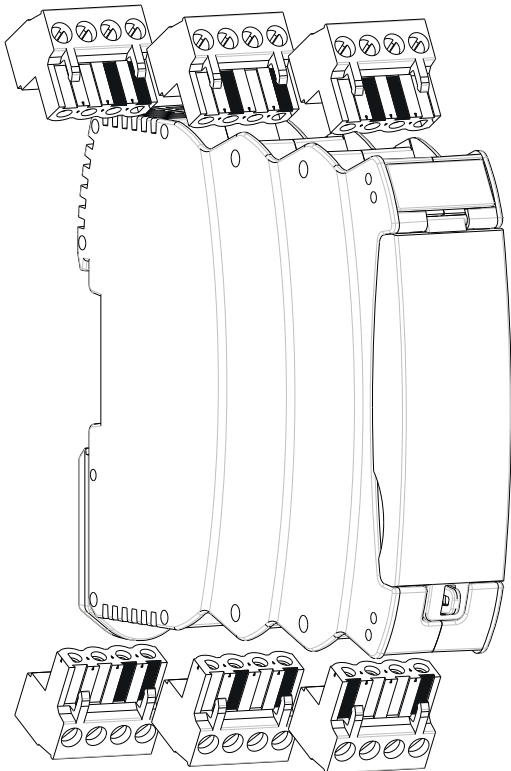
To avoid EMC disturbances, the physical ambient and operational conditions at the place where the product is installed, must meet the provisions laid down in the paragraph "Electromagnetic Compatibility (EMC)" of EN 60204-1.

Settle length x of the conductor: 7 mm



Wiring examples: see chapter 7

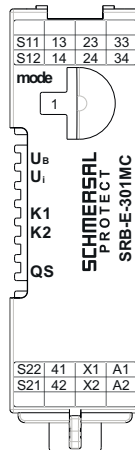
4.2 Coding of connecting terminals

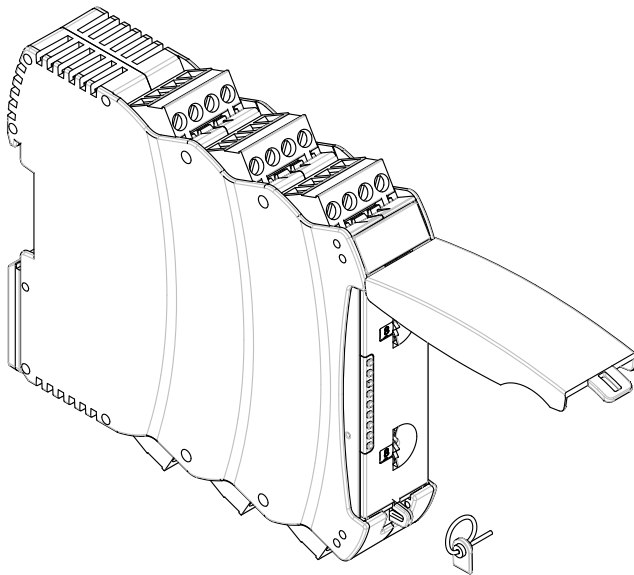


5. Operating principle and settings

5.1 Description of the terminals and LED indications

Clip	Function	LED	Function
A1	Operating voltage + 24 VDC	U _B	Operating voltage OK
	24 VAC	U _i	Internal fuse OK
A2	Operating voltage 0 V		
	24 VAC		
		QS	Cross-wire monitoring active
X1	Output start circuit / feedback circuit		
X2	Input start circuit / feedback circuit		
S11	Output channel 1		+24 VDC
S21	Output channel 2		+24 VDC without QS 0 V with QS
S12	Input channel 1	K1	Status K1
S22	Input channel 2	K2	Status K2
41/42	Signalling contact (NC)		
13/14, 23/24, 33/34	Safety outputs		





Adjustment of application using rotary “mode” switch

- Open front transparent cover (see fig.).
- Opening is carried out by lifting side with lock.
- Select desired application using rotary mode switch by turning up or down (see 5.3).
- After performing setting, close front cover again.
- Front cover can be secured with a lead seal to protect it from being opened unintentionally



Only touch the components after electrical discharge!

5.2 Adjustable applications

Rotary knob position	Reset button / feedback circuit	Cross-wire monitoring active	Input / Sensor configuration
1, 5, 9, 13	Yes	Yes	NC / NC
2, 6, 10, 14	Yes	No	NC / NC

5.3 Changing setting or application

Description / procedure	Rotary (mode) switch	System response	LED indications		
			U _B	U _I	QS
Factory setting	Position 1	Ready for application 1	-	-	-
Switch operating voltage on	Position 1	Ready for application 1	Lights up	Lights up	Lights up
Change SRB-E application					
Switch off operating voltage	Select desired application (2)		-	-	-
Switch operating voltage on		Ready for application 2	Lights up	Lights up	

6. Diagnostic

6.1 LED indicators / malfunctions

LED	Function	Display type
U _B	Ready for operation	Continuously lit
	No operating voltage at A1 and A2	Not lit
U _i	Operationally ready and internal fuse OK	Continuously lit
	No operating voltage at A1 and A2 Internal fuse triggered	Not lit
K1	Relay channel 1 active	Continuously lit
	Input S12 open, relay K1 deactivated	Not lit
	Manual start signal, feedback circuit missing	
	Invalid rotary switch setting	
K2	Relay channel 2 active	Continuously lit
	Input S22 open, relay K2 deactivated	Not lit
	Manual start signal, feedback circuit missing	
	Invalid rotary switch setting	

7. Wiring examples

7.1 Possible applications

All applications for 1 or 2-channel safe evaluation for protective equipment as follows:

- Safety door monitoring to EN ISO 14119
- Position switches with positive break to EN 60947-5-1
- Safety sensors to EN 60947-5-3
- Emergency stop command devices to EN ISO 13850 and EN 60947-5-5
- Magnetic safety sensors to EN 60947-5-3
- Safety light curtain and photoelectric barriers according to EN 61496



The connection of magnetic safety switches to the SRB-E-... 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 36-02Z(G), BNS 36-02/01Z(G)
- BNS 260-02Z(G), BNS 260-02/01Z(G)



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 LED's for instance.

7.2 Application example

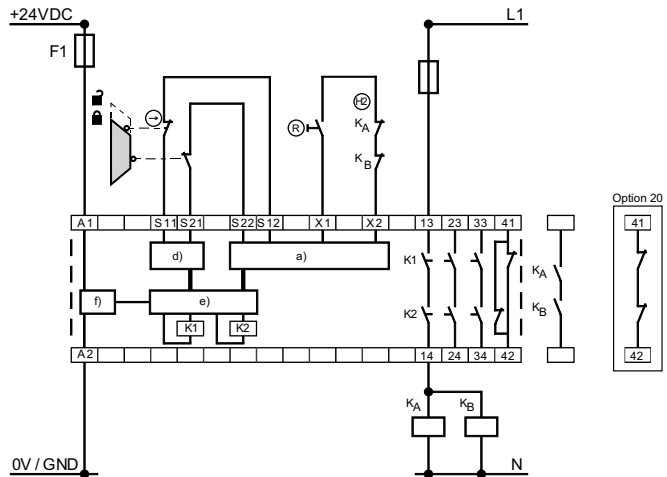
Dual-channel control, shown for a guard door monitor with two position switches where one has a positive break contact; with external reset button (R)

- 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
- H2 = Feedback circuit



Signalling outputs must not be used in safety circuits.

Wiring example



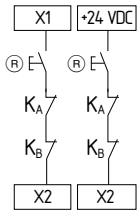
Key

- a) Safety inputs
- d) Outputs
- e) Processing
- f) Power

7.3 Start configuration

7.3.1 External reset button

- 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!).



7.3.2 Feedback circuit / Automatic start

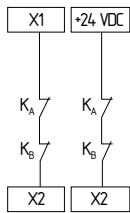
- The automatic start is programmed by connecting the feedback circuit to the terminals X1-X2. If the feedback circuit is not required, establish a bridge.



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

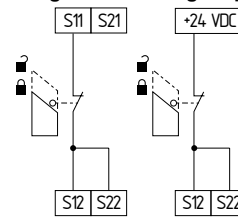


Within the meaning of EN 60204-1 paragraph 9.2.3.4.2 the operating mode "automatic start" is only restrictedly admissible. In particular, any inadvertent restart of the machine must be prevented by other suitable measures.



7.4 Sensor configuration

Single channel signal processing

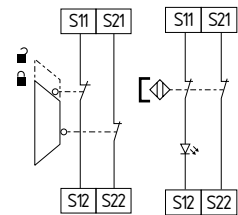


Rotary knob position	Function
2, 6, 10, 14	without cross-wire monitoring

Dual channel signal processing NC / NC

With cross-wire monitoring

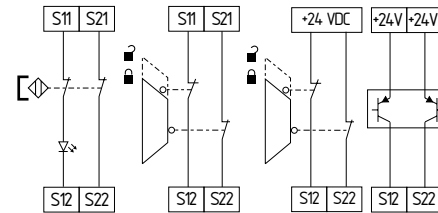
(Cat. 4 – PL e to EN ISO 13849-1 possible)



Rotary knob position	Function
1, 5, 9, 13	with cross-wire monitoring

Without cross-wire monitoring

(Cat. 4 – PL e to EN ISO 13849-1 only possible with protective wiring)



Rotary knob position	Function
2, 6, 10, 14	without cross-wire monitoring

8. Set-up and maintenance

8.1 Commissioning

The safety relay module features protection class IP54 for installation in a switch cabinet.

The safety relay module is delivered ready for operation.

Application 1 is preset in the factory.

8.2 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 sensor technology and their influence on the safety-monitoring module and the downstream actuators

The safety relay module features self-test functions.

If a fault is detected, the system adopts a safe mode and leads, if necessary, to undelayed deactivation of all safety outputs.

8.3 Behaviour in the case of faults

In the event of a fault the following procedure is recommended:

1. Identify faults according to chapter 6.1.
2. Rectify the fault if it is described in the table.

If fault could not be rectified, please contact the manufacturer.

8.4 Setting report

This report regarding the setting of the device must be completed accordingly by the customer and enclosed in the technical documentation of the machine.

The setting report must be available whenever a safety check is performed.

Company: _____

The safety-monitoring module is used in the following machine:

Machine n°	Machine type	Module n°

Configured application (mode): _____

Set on (date)	Signature of the responsible person

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

Damaged or defective components must be replaced.

9. Disassembly and disposal

9.1 Disassembly

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

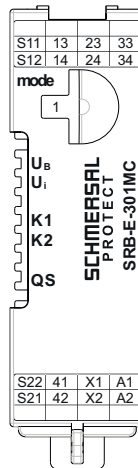
9.2 Disposal

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

10. Appendix

10.1 Wiring / circuit information

Air clearances and creepage distances of the safety contacts:



The safety contacts comply with the requirements for basic insulation.

11. EU Declaration of conformity

EU Declaration of conformity



Original
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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-E-301MC

Type: See ordering code

Description of the component: Safety-monitoring module for emergency stop circuits, guard door monitoring, magnetic safety switches and AOPDs

Relevant Directives:
Machinery Directive 2006/42/EC
EMC-Directive 2014/30/EU
RoHS-Directive 2011/65/EU

Applied standards:
DIN EN 60947-5-1:2018
DIN EN ISO 13849-1:2016
DIN EN ISO 13849-2:2013

Notified body for the prototype test:
DGUV Test
Prüf- und Zertifizierungsstelle
Elektrotechnik
Gustav-Heinemann-Ufer 130
50968 Köln
ID n°: 0340

EC-prototype test certificate: ET 20040

Person authorised for the compilation of the technical documentation: Oliver Wacker
Möddinghofe 30
42279 Wuppertal

Place and date of issue: Wuppertal, August 11, 2021

SRB-E-301MC-G-EN

Authorised signature
Philip Schmersal
Managing Director



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



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