



**EN** Operating instructions. . . . .pages 1 to 6  
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 for 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](https://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 damages to machinery or plant components cannot be excluded.

### 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:

#### AES 233 ①

No.	Option	Description
①	5	without start-up test
	6	with start-up test

#### AES 253 ①

No.	Option	Description
①	5	without start-up test
	6	with start-up test



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 for safety functions or magnetic safety sensors on sliding, hinged and removable safety guards as well as emergency stop control devices.

### Design

The safety-monitoring modules have a dual-channel structure. They contain two safety relays with monitored positively driven contacts. The NO contacts of the relays, which are wired in series, build the enabling contacts.



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

Standards:	EN 60204-1, EN 60947-5-1, EN 60947-5-3, EN ISO 13849-1, IEC 61508
Start conditions:	Automatic or start button
Feedback circuit available:	yes
Start-up test:	AES ...5: no, AES ...6: yes
Pull-in delay for automatic start:	adjustable 0.1 / 1.0 s
Drop-out delay in case of "emergency stop":	≤ 30 ms
Rated operating voltage $U_e$ :	24 ... 230 VAC/DC
Rated operating current $I_e$ :	0.3 A
Rated insulation voltage $U_i$ :	250 V
Rated impulse withstand voltage $U_{imp}$ :	4 kV
Thermal test current $I_{the}$ :	6 A
Internal electronic fuse:	no
Power consumption:	5 W
<b>Monitored inputs:</b>	
Cross-wire short detection:	yes
Wire breakage detection:	yes
Earth connection detection:	no
Number of NC contacts:	convertible 1NC → 2NC
Number of NO contacts:	convertible 1NO → 0NO
<b>Outputs:</b>	
Stop category 0:	AES 2335/6: 3, AES 2535/6: 4
Stop category 1:	0
Number of safety contacts:	AES 2335/6: 3, AES 2535/6: 4
Number of auxiliary contacts:	AES 2335/6: 0, AES 2535/6: 1
Number of signalling outputs:	2 transistor outputs 24 VDC, Y1 + Y2 = max. 100 mA, p-type, short-circuit proof
Max. switching capacity of the safety contacts:	6 A
Utilisation category to EN 60947-5-1:	AC-15: 230 V / 3 A, DC-13: 24 V / 2 A
Max. fuse rating:	6 A gG D-fuse
Mechanical life:	20 million operations
LED display:	ISD
<b>Ambient conditions:</b>	
Operating temperature:	0 °C ... +55 °C
Storage and transport temperature:	-25 °C ... +70 °C
Degree of protection:	Enclosure: IP40 Terminals: IP20 Clearance: IP54
Degree of pollution:	2
Mounting:	snaps onto standard rail to EN 60715
Connection type:	Screw connection
Min. cable section:	0.2 mm <sup>2</sup>
Max. cable section:	2.5 mm <sup>2</sup> , solid strand or multi-strand lead (including conductor ferrules)
Tightening torque:	0.6 Nm
Max. cable length:	1000 m of 0.75 mm <sup>2</sup> conductor
Weight:	AES 2335 / 2336: 290 g, AES 2535 / 2536: 300 g
<b>2.5 Safety classification</b>	
Standards:	EN ISO 13849-1, IEC 61508
PL:	up to d
Category:	up to 3
SIL:	up to 2
$B_{10D}$ (light load):	20,000,000 switching cycles
$B_{10D}$ (nominal load):	400,000 switching cycles
Mission time:	20 years
$MTTF_D = \frac{B_{10D}}{0,1 \times n_{op}} \quad n_{op} = \frac{d_{op} \times h_{op} \times 3600 \text{ s/h}}{t_{cycle}}$	
$n_{op}$	= 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)

### 3. Mounting

#### 3.1 General mounting instructions

Mounting: snaps onto standard rails to EN 60715.

#### 3.2 Dimensions

Device dimensions (H/W/D): 100 x 45 x 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.

Settle length  $x$  of the conductor: 8 mm



Wiring examples: see appendix



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.



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 Operating principle after the operating voltage is switched on Without start-up test AES 2335 / AES 2535

1. The functionality of the safety-monitoring module is tested.
2. If the safety guard is closed or the emergency stop button released, the enabling paths of the safety-monitoring module will close. The LED is green.
3. The cable and the connected safety switch are only tested when the safety guard is opened or the emergency stop button when actuated

#### With start-up test AES 2336 / AES 2536

1. The functionality of the safety-monitoring module is tested.
2. The safety guard or the emergency stop button must be actuated, in order to check the cables and the connected safety switch (start-up test).
3. If the safety guard is closed or the emergency stop button released, the enabling paths of the safety-monitoring module will close. The LED is green.

If the safety guard is opened or the emergency-stop button is actuated, the enabling paths of the safety-monitoring module will open. The machine is stopped and the LED flashes yellow. In the AES 2535 and AES 2536 versions, the NC contact 51/52 is simultaneously closed. This contact however must not be integrated in the safety circuit.

#### Inputs S14/S22

Connect a safety switch with one NC and one NO contact or two safety switches with one contact each or an emergency-stop button at input S14/S22.

#### Feedback circuit X1/X2

Connect the feedback circuit of the external contactor with positive action contacts and/or a start button to the inputs X1 and X2 or bridge the inputs X1 and X2.

#### Safety switch with two NC contacts X3/X4

For safety switches with two NC contacts, a bridge must be established between X3 and X4. In this configuration, the short-circuit detection becomes inoperative.

#### Conversion of the output function X5/X6

By using a bridge between X5 and X6, the output function of the additional outputs can be modified. This control can also be realised when e.g. a PLC is running (24 VDC at terminal X6).

#### Enable delay time X7/X8

By bridging the connections X7/X8, the enable delay time (i.e. time during which after the first closing of the guard, bouncing of the switch contacts or of the entire guard is possible without error message) can be extended from 0.1 s to 1 s. The enable delay time simultaneously is the minimum time, expiring between the guard being closed and the relays being activated.

#### Outputs

Enabling paths 13-14,  
23-24, 33-34, (43-44): NO contacts for safety function

**Additional contact (51-52):** NC contact for signalling purposes

#### Additional outputs Y1/Y2:

without bridge (X5/X6):	Y1: indication "release"
	Y2: indication "no release"
with bridge (X5/X6):	Y1: indication "guard open"
	Y2: indication "fault"

The additional outputs Y1 and Y2 must not be integrated in the safety circuit; they may only be used for signalling purposes.

### 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 fitting of the safety-monitoring module
2. Fitting and integrity of the power cable

#### 6.2 Maintenance

In the case of correct installation and adequate use, the safety-monitoring module features maintenance-free functionality. A regular visual inspection and functional test, including the following steps, is recommended:

- Check the correct fixing of the safety monitoring module
- Check the cable for damage.



The device has to be integrated into the periodic check-ups according to the Ordinance on Industrial Safety and Health, however at least 1x/year.

**Damaged or defective components must be replaced.**

### 7. Disassembly and disposal

#### 7.1 Disassembly

The safety monitoring module must be disassembled in the 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.



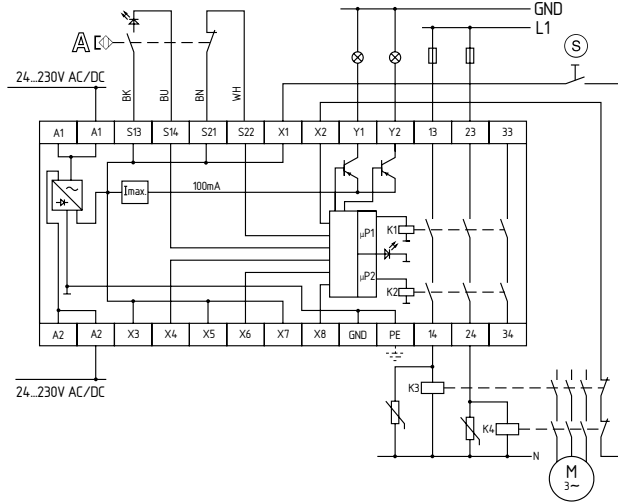
8. Appendix

8.1 Wiring examples

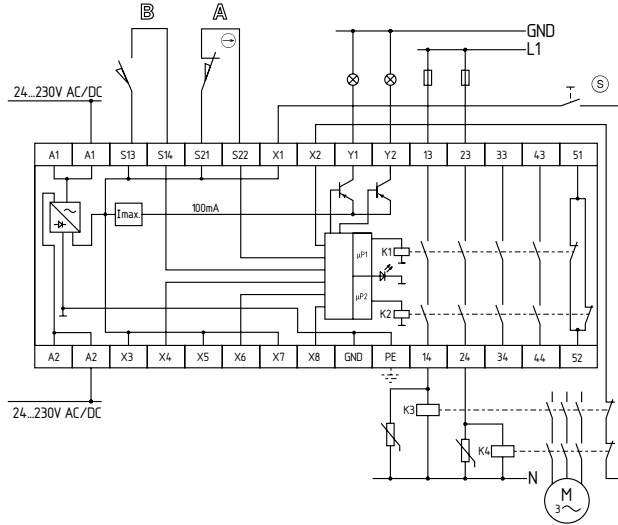
The application examples shown are suggestions. They however do not release the user from carefully checking whether the switchgear and its set-up are suitable for the individual application.

The wiring diagram is shown with guard doors closed and in a de-energised condition. Inductive loads (e.g. contactors, relays, etc.) are to be provided with suitable interference suppression circuitry. Do not connect additional loads to terminal S..

AES 2335/2336



AES 2535/2536



Key

- ⊖ Positive break
- A [⊖] Non-contact safety sensor
- A + B Safety switch
- Ⓢ Start button

8.2 Integral System Diagnostics (ISD)

The LED indication of the safety-monitoring modules shows the different switching conditions and errors. The following tables show the different switching conditions.

Tables switching condition indication

Diagnostic LED	System condition
The LED is green.	Enabling paths closed
LED flashes yellow (0.5 Hz)	Enabling paths open
LED flashes yellow (2 Hz)	Safety guard closed, however no release; possible causes: incorrect operation (only one contact actuated upon opening) or voltage drop → perform start-up test

In case of error messages, the LED lights orange intermittently. During these intermissions, the LED flashes one up to seven times with short pulses.

Table error indications

Indication (orange) LED	Error	Cause
1 impulse	Inputs S1	Defective supply voltage lead, defective switch, erroneous fitting of the switch; switch only partially actuated* for at least 5 s
4 impulses	Interference signals at the inputs (no safe evaluation assured)	Too high capacitive or inductive interference at the switch's cables or the supply voltage lead
5 impulses	One or both relays did not close within the monitoring time	Too low operating voltage $U_e$ ; Defective relay
6 impulses	Relay not disabled upon the actuation of the switch	Welded relay contact
7 impulses	Dynamic monitoring of both channels (cross-monitoring) failure	Fault in one channel; internal data transmission interrupted

\* Partial actuation: position of the switch, in which only one contact was actuated.

Deleting the error message

The error message is deleted, when the error cause is eliminated and the AES can check all functions. In case of an error of switch 1 or switch 2, actuate the switch concerned (open the safety guard and close it again). For all other errors, both switches must be actuated.

### 9. Declaration of conformity

We declare under our sole responsibility that the products mentioned comply with all relevant provisions of the directives and regulations listed below and conform to the following standards.

**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



The currently valid declaration of conformity can be downloaded from the internet at [products.schmersal.com](http://products.schmersal.com).

**K.A. Schmersal GmbH & Co. KG**  
Möddinghofe 30, 42279 Wuppertal  
Germany  
Phone: +49 202 6474-0  
Telefax: +49 202 6474-100  
E-Mail: [info@schmersal.com](mailto:info@schmersal.com)  
Internet: [www.schmersal.com](http://www.schmersal.com)