

Operating Instructions

Correct Use



SR3AD is a safety switching device specially designed for sensors with antivalent logic (normally open / normally closed combination). In case of danger, the moving parts of a machine or system can be quickly and safely shut down via three safe relay contacts.

The SR3AD is used to monitor safety gates and safety guards on machines and systems.

The SR3AD was specially designed for use in furnace systems operating in continuous mode in accordance with EN 50156-1 and EN 746-2 and was certified by TÜV-Rheinland accordingly.

- 3 redundant safety contacts
- 1 auxiliary contact
- Connection of:
 - Reed contact sensors
 - Safety door switches
 - Safety position switches
 each with NO / NC combination.
- Dual channel control
- Feedback loop for external contactors or extension modules
- Cyclical monitoring of the output contacts
- LED indicators for power and status



- Automatic or manual start
- Short-circuit monitoring and ground fault monitoring
- Up to PL e, category 4, SILCL 3
(EN ISO 13849-1 / IEC 62061 / IEC 61508)

Function

The safety relay SR3AD is designed for isolation of safety circuits according to EN 60204-1, stop-category 0 and can be used in safety-related applications up to safety cat. 4, PL e (EN ISO 13849-1) SILCL 3 (IEC 62061 / IEC 61508).

The safe inputs are activated by closing the contact between S11 and S12 and opening the contact between S13 and S14.

When the start button is pressed, the safety contacts are closed by the internal logic.

By deactivating the safe inputs, the positively driven safety contacts are opened and switch off the machine safely. It is ensured that a single fault does not lead to the loss of the safety function and that each fault is detected by cyclical

self-monitoring no later than when the machine is next switched off and switched on again.

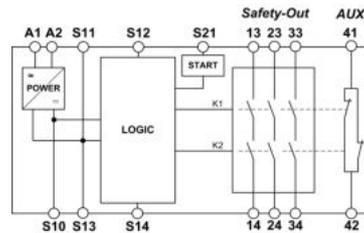


Fig. 1 Block diagram SR3AD

Installation

As per EN 60204-1, the device is intended for installation in control cabinets with a minimum degree of protection of IP54. The following should be noted:

- Mounting on 35 mm rail according to EN 60715
- Ensure sufficient heat dissipation in the control cabinet
- With the AC 115 V / 230 V version, a minimum distance of 10 mm to adjacent devices must be maintained

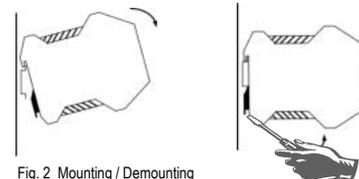


Fig. 2 Mounting / Demounting

Safety Precautions



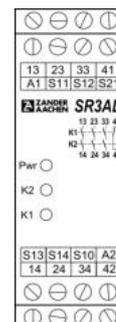
- Installation and commissioning of the device must be performed **only by authorized personnel** and who has read and understood this operating instructions.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.
- The wiring of the device must comply with the instructions in this operating instructions, otherwise there is a risk that the safety function will be lost.
- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- The contact protection and the insulation of the supply cables must be designed for the highest voltage to the

device.

- It is not allowed to open the device, tamper with the device or bypass the safety devices.
- All relevant safety regulations and standards are to be observed.
- The overall concept of the control system in which the device is incorporated must be validated by the user.
- Failure to observe the safety regulations can result in death, serious injury and serious damage.
- Note down the version of the product (see label "Ver.>") and check it prior to every commissioning of a new device. If the version has changed, the overall concept of the control system in which the device is incorporated must be validated again by the user.

Electrical Connection

- When using the 24V version, a safety transformer according to EN 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected
- Observe the instructions in the section "Tech. Data"
- A suitable protective circuit for inductive loads (e.g. free-wheeling diode) must be provided
- If the device does not function after commissioning, it must be returned to the manufacturer unopened. Opening the device will void the warranty
- The auxiliary contact 41-42 may not be used as a safety contact



- A1: Power supply
- A2: Power supply
- S10: PE connection for AC 115V/230V versions
- S11, S13: DC 24 V Control voltage
- S21: Control line start
- S12: Control line channel 1
- S14: Control line channel 2
- 13-14: Safety contact 1
- 23-24: Safety contact 2
- 33-34: Safety contact 3
- 41-42: Auxiliary contact

Fig. 3 Terminals

Operating Instructions

Applications

Depending on the application the device must be wired as shown in Fig. 1 to Fig. 8.

Safety Circuit

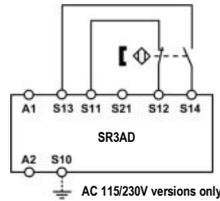


Fig. 1:
Two-channel safety door monitoring via sensor with antivalent reed contact outputs, with short circuit and ground fault monitoring.
(Category 4, up to PL e / SIL 3)

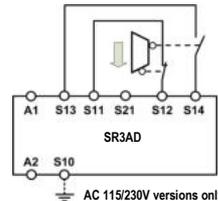


Fig. 2:
Dual channel safety guard monitoring with short circuit and ground fault monitoring.
(Category 4, up to PL e / SIL 3)

Note:

S10 must be connected to PE (protective earth) for the AC 115V/230V devices so that the ground fault monitoring becomes active. For AC/DC 24V devices, PE must only be connected to the power supply according to EN60204-1.

The start circuit must be wired corresponding to the application according to Fig. 3 or Fig. 4.

Start Behaviour

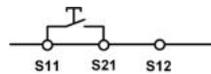
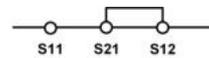


Fig. 3:
Monitored manual start.
It is monitored that the start button has been opened before the safety switch is closed.
Prerequisite:
Power supply may not be interrupted.



Warning:
Safety contacts will be activated immediately at power-on.

Fig. 4:
Automatic start.
Maximum allowable delay when closing the safety switch at S12 and opening at S14:
S12 before S14: 300ms
S14 before S12: no limit

Feedback Loop

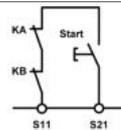


Fig. 5:
Feedback loop for monitored manual start.
The feedback loop monitors contactors or expansion modules.

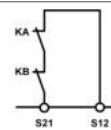


Fig. 6:
Feedback loop for automatic start.
The feedback loop monitors contactors or expansion modules.

Power Supply and Safety Contacts

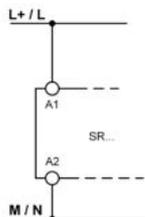


Fig. 7:
Connection of the power supply at the terminals A1 and A2.

(Power supply corresponding to "Technical Data")

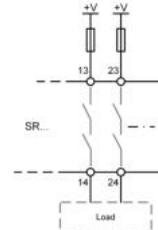


Fig. 8:
Connection of loads to be switched to the safety contacts.

(Sample contact configuration. Maybe different depending on device type.
Switching voltages "+V". according to technical data)

Commissioning Procedure

Advice: Follow the guidelines in "Electrical Connection" during the start-up.

1. Safety circuit:

Connect the safety inputs according to one of the wiring diagrams in "Applications" (Fig. 1 or Fig. 2).

2. Choose start mode:

Connect the start input according to Fig. 3 or Fig. 4 to set the start behaviour.

Warning:

If "Automatic start" is set, bear in mind that the safety contacts will switch immediately after the power supply is connected. If "Monitored manual start" is set, the start button must be opened after wiring.

3. Feedback loop:

If external contactors or extension modules are used, connect them according to Fig. 5 or Fig. 6.

4. Power supply:

Connect the power supply to A1 and A2 (Fig. 7).

Caution:

Carry out the wiring only in de-energized state.

5. Starting the device:

Switch on the operating voltage.

Warning:

If the "Automatic start" starting behaviour is set, the safety contacts will close immediately.

If the "Monitored manual start" starting behaviour is set, close the start button to close the safety contacts.

LEDs **Pwr**, **K1** and **K2** are lit.

6. Triggering safety function:

Deactivate the safety inputs by actuating the connected safety switch. The safety contacts will open immediately. The LEDs **K1** and **K2** go out.

7. Reactivation:

Activate the safety inputs. If "Automatic start" is selected, the safety contacts will close immediately.

If the start behaviour "Monitored manual start" is set, close the start button to activate the safety contacts.



Operating Instructions

Check and Maintenance

The following checks are regularly required to ensure proper and continuous functioning:

- Check the switching function.
- Check for signs of manipulation and safety function bypassing.
- Check if the device is mounted and connected securely.
- Check for soiling.

Check if the safety device is working properly, in particular:

- Every time after initial commissioning.
- Every time after replacing a component.
- After every fault in the safety circuit.

According to CNB / M / 11.050, a request for the safety function is recommended at the following intervals:

- Once a month for applications up to PL e with Cat. 3 or Cat. 4 or SIL CL3, SIL 3 with HFT = 1
- Once a year for applications up to PL d with Cat. 3 or SIL CL 2, SIL 2 with HFT = 1

Proof-Test

In order to check the correct function of the device, the following steps must be carried out

- Trigger the safety function via the safety circuit. Check that the safety outputs (13-14; 23-24; 33-34) have been opened by triggering the safety function.
- Now reactivate the device by closing the safety circuit again and, if configured, trigger a start command. Check that the safety outputs (13-14; 23-24; 33-34) are closed again.

If the unit does not switch on again, the proof test has not been passed.

ATTENTION:

If the proof test is not passed, the device must be replaced. Otherwise there is a hazard of loss of functional safety.



Safety Characteristics according to EN ISO 13849-1

Load - AC-15 / DC-13	≤ 1 A / ≤ 1 A	≤ 2 A / ≤ 2 A	≤ 3 A / ≤ 3 A
Max. Use Duration [Years]	20	20	20
Category	4	4	4
PL	e	e	e
PFHd [1/h]	1.2E-08	1.2E-08	1.2E-08
nop [cycles / year] - AC-15 / DC-13	≤ 50,000 / ≤ 350,000	≤ 35,000 / ≤ 100,000	≤ 15,000 / ≤ 15,000

Assumptions: Operating days/year: 365; Operating hours/day: 24; avg. switching frequency/hour: 1.7; full load AC-15/DC-13

Safety Characteristics according to EN 61508 - High Demand

Max. Use Duration [Years]	20
Proof Test Interval [Years]	20
PFH	1.2E-10
SIL	3

Safety Characteristics according to EN 61508 - Low Demand

Assumptions: full load AC-15 / DC-13	
Max. Use Duration [Years]	20
Proof Test Interval [Years]	9
PFD _{AVG}	1.04E-04
SIL	3

Technical Data

In compliance with	EN 60204-1; EN ISO 13849-1; IEC 62061; IEC 61511-1; IEC 61508, Parts 1-2 and 4-7; EN 746-2; EN 50156-1
Operating voltage	AC 230 V, AC 115 V 50-60 Hz; AC/DC 24 V; AC: 50-60 Hz
Permissible deviation	+ / - 10 %
Power consumption	AC 115/230 V: 6.9 VA; AC 24 V: 4.5 VA; DC 24 V: 2.3 W
Control current S11-S12 / S13-S14	< 60 mA / < 15 mA
Safety contact configuration / Auxiliary contact configuration	3 NO / 1 NC
Max. switching voltage	AC 250 V
Contact rating of safety contacts (13-14, 23-24, 33-34), 6 switching cycles per minute	AC: 250 V, 2000 VA, 8 A for resistive load 250 V, 3 A for AC-15 DC: 30 V, 320 W, 8 A for resistive load 24 V, 3 A for DC-13 Max. total current 15 A (13-14, 23-24, 33-34) *)
Contact rating of auxiliary contact (41-42)	AC: 250 V, 500 VA, 2 A for AC-12 DC: 30 V, 80 W, 2 A for resistive load
Minimum contact load	5 V, 10 mA
External fuses	NO: 10 A gG or 6 A gG acc. to EN 50156-1 (Chapter 10.5.5.3.4), NC: 6 A gG
Max. switch-on delay	< 50 ms
Max. delay on safety request	Via S11-S12 or S13-S14: < 20 ms; via A1/A2: < 50 ms
Recovery time	< 500 ms
Wire width	0.14 - 2.5 mm ²
Tightening moment (Min. / Max.)	0.5 Nm / 0.6 Nm
Max. length of control lines	1000 m at 0.75 mm ²
Contact material	AgSnO ₂
Contact service life	mech. approx. 1 x 10 ⁷
Rated impulse withstand voltage	2.5 kV (control voltage / contacts)
Dielectric strength	4 kV (DIN VDE 0110-1)
Rated insulation voltage	250 V
Protection	IP20
Ambient temperature	AC/DC 24V: -15 °C to +55 °C *) AC 115V/230V: -15 °C to +55 °C (see total current limit curve)
Degree of pollution / Overvoltage category	2 / 3 (DIN VDE 0110-1)
Max. altitude	≤ 2000 m (above sea level)
Weight	approx. 230 g
Mounting	DIN rail according to EN 60715 TH35

*) If several SR3AD under load are closely connected, the max. total current at an ambient temperature of T=20 °C is 9 A; at T=30 °C is 3 A; at T=40 °C is 1 A. If these currents are exceeded, a gap of 5 mm must be maintained between the devices.

Operating Instructions

What to do in Case of a Fault?

Device does not switch on:

- Check the wiring by comparing it to the wiring diagrams.
- Check the safety switch for correct function and adjustment.
- Check whether the safety inputs are activated.
- Check whether the start button (manual start) is closed.
- Check the operating voltage at A1 and A2.
- Is the feedback loop closed?

Device cannot be switched on after a safety request:

- Emergency stop circuit was closed again.
- Was the start button opened before closing of the emergency stop circuit (manual start)?
- Is the feedback loop closed?

If the fault still exists, perform the steps listed under "Commissioning Procedure". If these steps do not remedy the fault either, return the device to the manufacturer.

Opening the device is not permitted and will void the warranty.

Disclaimer and Warranty

Failure to comply with the above conditions for proper use, failure to follow the safety instructions or failure to carry out any maintenance work as required will result in a disclaimer of liability and loss of warranty.

ATTENTION

We would like to point out that ensuring the availability of the system is the sole responsibility of the operator.

The SR3AD is a safety switchgear according to

- EN ISO 13849-1
- IEC 62061
- IEC 61508
- EN 50156-1
- EN 746-2
- IEC 61511-1

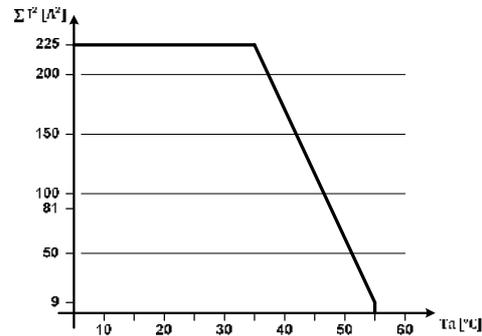
which branches to the safe state when the safety function

is required. This means that the connected load is switched off as soon as a request via connected sensors or diagnostic measures register a dangerous state, e.g. caused by a component fault. Since process applications in particular have high availability requirements, limited availability can also have considerable consequences.

It is therefore recommended to stock a second unit to avoid long downtimes in such a case.

These are recommendations of the manufacturer, the evaluation of the importance of the system availability is solely the responsibility of the operator.

Total Current Limit Curve

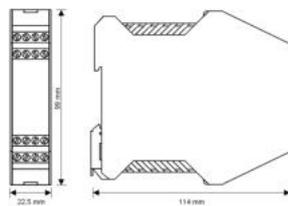


Total current limit curve depending on the ambient temperature for 115 V / 230 V variants with 10 mm gap between the devices.

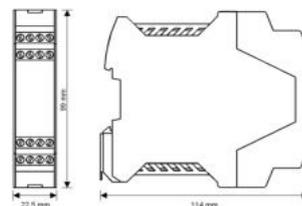
$$\text{Total current: } \Sigma I^2 = (I_1 + I_2 + I_3)^2$$

Dimension Drawing

Fixed Terminals



Plug-In Terminals



Variants

Order No. 472300	SR3AD, AC 230 V (50-60 Hz),	fixed screw terminals
Order No. 472301	SR3AD, AC 115 V (50-60 Hz),	fixed screw terminals
Order No. 472302	SR3AD, AC/DC 24 V, (AC: 50-60 Hz),	fixed screw terminals
Order No. 474300	SR3AD, AC 230 V (50-60 Hz),	incl. plug-in screw terminals
Order No. 474301	SR3AD, AC 115 V (50-60 Hz),	incl. plug-in screw terminals
Order No. 474302	SR3AD, AC/DC 24 V, (AC: 50-60 Hz),	incl. plug-in screw terminals
Order No. 475300	SR3AD, AC 230 V (50-60 Hz),	incl. push-in twin spring connector
Order No. 475301	SR3AD, AC 115 V (50-60 Hz),	incl. push-in twin spring connector
Order No. 475302	SR3AD, AC/DC 24 V, (AC: 50-60 Hz),	incl. push-in twin spring connector
Order No. 472596	Spacer for a defined minimum distance between two safety relays (see derating)	