Safety Relay for Elevators SR3E

Operating Instructions

English translation

Errors and technical changes reserved

Correct Use

EN ISO 13849-1

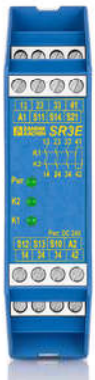
EN IEC 62061
IEC 61511
IEC 61508

EN 81-20/50

SR3E is an all-purpose emergency stop device with three safe relay contacts for safe monitoring of one or two channel sensors.

The SR3E is specially designed for the use as safety component in elevators according to EN 81-20 and EN 81-50, certified by TÜV Rheinland. Further applications for the SR3E include single or dual-channel emergency stop circuits and guard monitoring on machines and plants according to EN ISO 13849-1, EN IEC 62061 and EN 61508.

- *3 non-delayed safety contacts*
  1 non-delayed auxiliary contact
- *Connection of:*
  - *Emergency stop buttons*
  - *Mechanical Safety switches*
  - *Non-contact safety switches*
  - *Safety components with OSSD-Outputs*
- *Control: single or dual channel*
- *Feedback loop for external contactors or extension modules*
- *Cyclical monitoring of the output contacts*
- *LED indicator for power and status*



Product Safety
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LISTED

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

Function

The safety emergency stop relay SR3E is designed for the safe isolation of safety circuits in accordance with EN 60204-1 and thus performs the safety-related stop function up to PL e / SIL 3 in accordance with EN ISO 13849-1 / IEC 61508. If the emergency stop circuit (e.g. safety door or emergency stop button) is closed, the machine can be enabled via the SR3E. When the safety function is requested via the emergency stop circuit (e.g. safety door open), the enable current paths of the SR3E are opened immediately and thus safely switch off the machine. The redundant use of forcibly guided relays ensures that a single fault within the device does not lead to the loss of the safety function and that this is detected by cyclical self-monitoring the next time the safety function is requested. The SR3E can also be used as a certified safety component in elevators in accordance with EN 81-20.

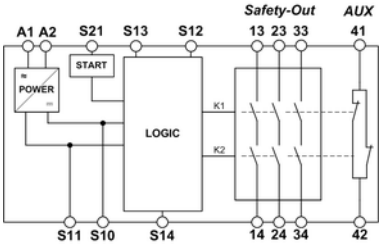


Fig. 1 Block diagram SR3E

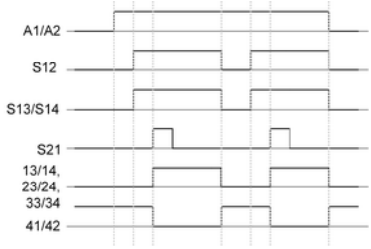


Fig. 2 State diagram for SR3E with manual start

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
- Minimum distance to adjacent devices according to the total current limit curve

Note: Spacer from ZANDER AACHEN (Art. No. 472596) for defined distances - See section Accessories.

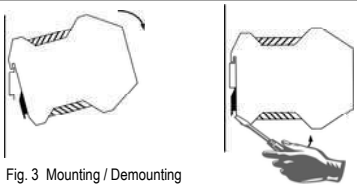


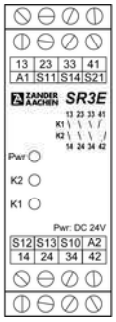
Fig. 3 Mounting / Demounting

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

- 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”
- 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
- Use adequate protective circuit for inductive loads (e.g. free-wheeling diode)



A1:	*Power supply*
A2 :	*Power supply*
S11:	*Control voltage*
S10:	*Control line*
S21:	*Start control line*
S13:	*Control line*
S14:	*Control line*
S12:	*Control line*
13-14:	*Safety contact 1*
23-24:	*Safety contact 2*
33-34:	*Safety contact 3*
41-42:	*Auxiliary contact*

Fig. 4 Terminals

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Applications

Depending on the application or the result of the risk assessment according to EN ISO 13849-1, the device must be wired as shown in Fig. 5 to Fig. 16.

Emergency Stop Circuit

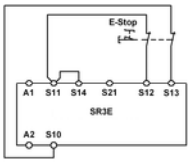

Fig. 5:
Dual channel emergency stop with short circuit and ground fault monitoring.
(category 4, up to PL e / SIL 3)

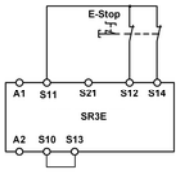

Fig. 6:
Dual channel emergency stop with ground faultt monitoring.
(category 3, up to PL d / SIL 2)
Note:
For applications according EN 81-20 a fault exclusion for short circuit between S12 and S14 is required

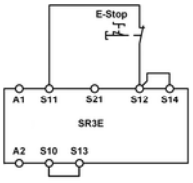

Fig. 7:
Single channel emergency stop with ground fault monitoring.
(category 1, up to PL c / SIL 1)
Note:
Not suitable for applications in elevators according to EN 81-20

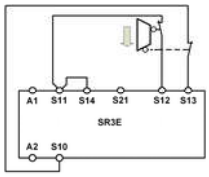

Fig. 8:
Dual channel safety guard monitoring with short circuit and ground fault monitoring.
(category 4, up to PL e / SIL 3)

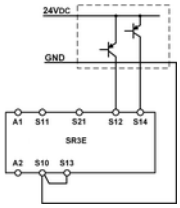

Fig. 9:
Two channel emergency stop with pnp-outputs/OSSD-outputs with its own short circuit monitoring.
(category 4, up to PL e / SIL 3)
Prerequisite:
Signal generator meet requirements for PL e / SIL 3, too.

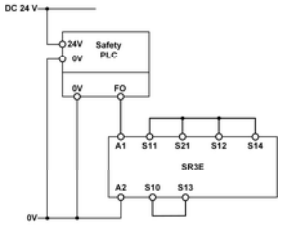

Fig. 10:
Connecting to a safety PLC
(category 4, up to PL e / SIL 3)
Prerequisite:
Safe PLC output meets the required safety level and short circuit between PLC output and SR3E can be excluded
(e.g. wiring inside an electrical installation space - see EN ISO 13849-2; Tab D4).

ATTENTION: Loss of functional safety!

For the applications according Fig. 9 and Fig. 10 the following is to be noted:

- *Make sure that the ground potential of the signal generator and the SR3E is the same*
- *It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated.*

Start Behaviour



Fig. 11:
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. 12:
Automatic start.
Maximum allowable delay when closing the safety switches at S12 and S13/S14:
S12 before S13/S14: 200ms
S13/S14 before S12: no limit

Feedback Loop

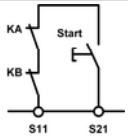

Fig. 13:
Feedback loop for monitored manual start.
The feedback loop monitors contactors or the expansion modules .

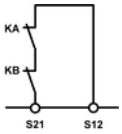

Fig. 14:
Feedback loop for automatic start.
The feedback loop monitors contactors or the expansion modules .

Power supply and Safety contacts

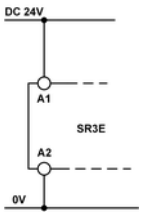

Fig. 15:
Power supply A1 and A2.

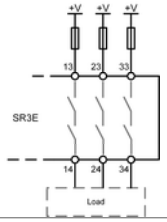

Fig. 16:
Connecting load to safety contacts. Voltage „+V“ according to techn. Data.

ATTENTION:
Inductive loads should have adequate protection circuit such as a free-wheeling diode.

Commissioning Procedure

Advice: Follow the guidelines in *„Electrical Connection“* during the start-up.

1. Input circuit:

Depending on the risk evaluation choose one of the wiring diagrams in „Applications“ (Fig. 5 to Fig. 10).

2. Choose start mode:

Wire the start circuit according to the examples in Fig. 11 or 12 to set the starting behavior.

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 your application provides for external contactors or expansion modules, connect them to the device according to the examples in Fig. 13 or 14.

4. Power supply:

Connect the power supply to A1 and A2 (Fig. 13).

Caution: Power must not yet be activated.

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:

Open the emergency stop circuit by actuating the connected safety switch. The safety contacts open immediately.

7. Reactivation:

Close the emergency stop circuit. If “Automatic start” is selected, the safety contacts will close immediately.

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

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Check and Maintenance

No maintenance is required for the device itself.

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

- Check the switch 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 and SIL 3 with HFT = 1
- Once a year for applications up to PL d with Cat. 3 and SIL 2 with HFT = 1

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 emergency stop circuit is closed.
- 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 an emergency stop:

- 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.

Safety Characteristics according to EN ISO 13849-1

Load per contact	**<= 1 A**	**<= 2A**	**<= 3A**
Use duration T_{10d} [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 per year]			
AC-15 / DC-13	≤ 55,000 / ≤ 350,000	≤ 42,500 / ≤ 100,000	≤ 42,500 / ≤ 15,000

Safety Characteristics according to EN IEC 62061 / EN 61508 - High Demand

Load per contact	**<= 1 A**	**<= 2A**	**<= 3A**
Use duration T_{10d} [years]	20	20	20
Proof-Test-Intervall [years]	20	20	20
PFH [1/h]	1.2E-10	1.2E-10	1.2E-10
SIL	3	3	3
nop [Cycles per year]			
AC-15 / DC-13	≤ 55,000 / ≤ 350,000	≤ 42,500 / ≤ 100,000	≤ 42,500 / ≤ 15,000

Technical Data

In compliance with	EN 60204-1; EN ISO 13849-1; EN IEC 62061; IEC 61508 Parts 1-2 and 4-7; EN 81-20; EN 81-50
Operating voltage	DC 24 V +/- 10 %
Power consumption	2.6 W
Inrush current	5 A (approx. 250 µs)
Pulse suppression (A1 / S12 / S14)	
Switch-Off pulse / dark test	max. 3 ms (Pulse width) / 500 ms (Pulse rate)
Switch-On pulse / light test	max. 1 ms (Pulse width) / 500 ms (Pulse rate) Note: It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated.
Contact configuration	3 NO (Safety contacts) / 1 NC (Auxiliary contact)
Max. switching voltage	AC 250 V
Contact rating of safety contacts (13-14, 23-24, 33-34) 6 switching cycles/ min	AC: 250 V, 2000 VA, 8 A for resistive load 250 V, 3 A for AC-15 DC: 30 V, 240 W, 8 A for resistive load 24 V, 3 A for DC-13
Thermal current I_{th}	Max. 5 A per contact (see total current limit curve)
Contact rating of auxiliary contact (41-42)	AC: 250 V, 500 VA, 2 A for resistive load DC: 30 V, 60 W, 2 A for resistive load
Minimum contact load	5 V, 10 mA
External fuses	10 A gG (NO); 6 A gG (NC)
Max. switch-on delay	< 50 ms
Max. switch-off delay	Via A1: < 40 ms; Via S12 or S13/S14 < 20 ms
Recovery time	< 500 ms
Wire width	0.14 - 2.5 mm^2
Tightening moment (Min. / Max.)	0.5 Nm / 0.6 Nm
Contact material	$AgSnO_2$
Service Life	mech. approx. 1 x 10^7
Rated impulse withstand voltage	2.5 kV (control voltage / contacts)
Dielectric strength	4 kV (EN 60664-1)
Rated insulation voltage	250 V
Degree of pollution / Overvoltage category	2 / 3 (EN 60664-1)
Protection	IP20
Temperature range Ambient	-15 °C to +55 °C
Temperature range Storage	-15 °C to +85 °C
Max. altitude	≤ 2000 m (above sea level)
Weight	approx. 150g
Mounting	DIN rail according to EN 60715 TH35

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Total current limit curve

The max. permissible total current is shown in Fig. 17.

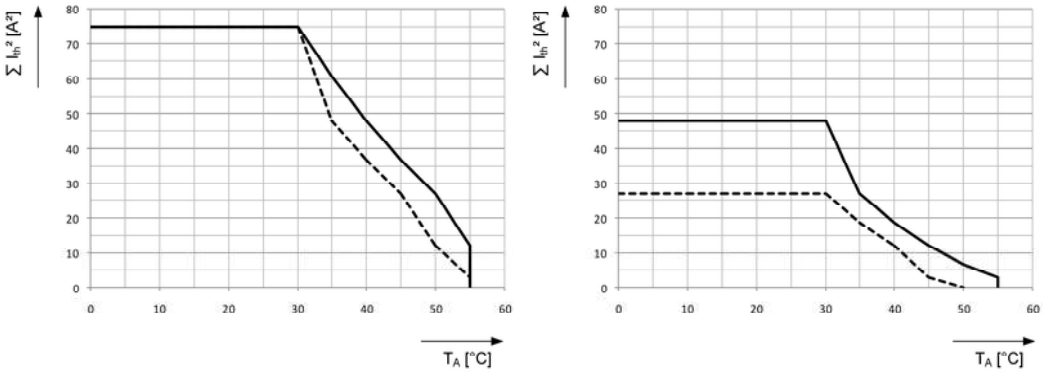


Fig. 17: Total current limit depending on the ambient temperature

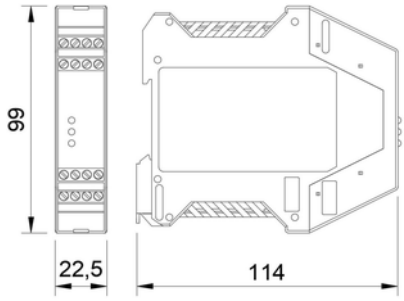
Left: SR3E with 5 mm clearance to adjacent devices, heated with same load
Right: SR3E with no clearance to adjacent devices, heated with same load

——— Nominal voltage DC 24 V
– – – Overvoltage up to DC 26,4 V

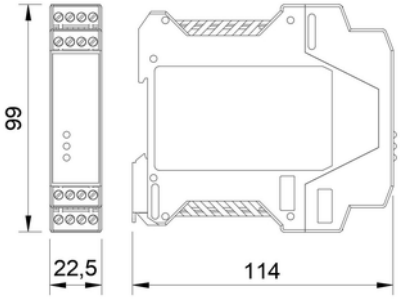
Total current: $\sum I_{th}^2 = I_1^2 + I_2^2 + I_3^2$ (I_1, I_2, I_3: Current in contact paths 13-14, 23-24, 33-34)

Dimension Drawing

Fixed Termi-



Plug-In Terminals



Note: Actual number of front LEDs may differ from the number shown in the drawing, depending on the variant.

Variants

Order No. 472292	SR3E, DC 24 V	fixed screw terminals
Order No. 474292	SR3E, DC 24 V	incl. plug-in screw terminals
Order No. 475292	SR3E, DC 24 V	incl. push-in twin spring connector

Accessories

Order No. 472592	EKLS4,	set of plug-in screw terminals
Order No. 472595	EKLZ4,	set of push-in twin spring connector
Order No. 472596	Spacer Electric Cabinet	rail spacer 5mm, PU = 12 pcs

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