Emergency Stop Safety Relay SR3C

Operating Instructions

English translation

Errors and technical changes reserved

Correct Use

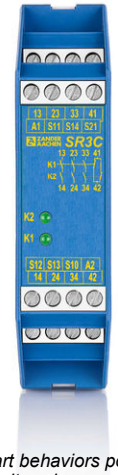
EN ISO 13849-1

EN IEC 62061
IEC 61511
IEC 61508

GL
RINA

The SR3C is a universal emergency stop safety switching device with three safe relay contactss that can quickly and safely stop the moving parts of a machine or system in case of danger.

Applications for the SR3C include single or dual-channel emergency stop circuits and guard monitoring on machines and plants according to EN ISO 13849-1, EN IEC 62061, IEC 61508 and IEC 61511.



- *3 safe, redundant relay contacts*
  1 auxiliary contact (signaling contact)
- *Connection of:*
  - *Emergency stop buttons*
  - *Safety switches*
  - *Non-contact safety switches*
  - *OSSD-Outputs*
- *Single and dual-channel operation possible*
- *Feedback loop for monitoring downstream contactors or expansion modules*
- *Cyclical monitoring of the output contacts*
- *Indication of the switching state via LED*

Product Safety
Functional
Safety
TÜVRheinland
CERTIFIED
www.tuv.com
ID 0600000000

TYPE APPROVED PRODUCT
DNV·GL
DNVGL.COM/AF

Germanischer Lloyd
Certifikat TAE00003JF

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- *2 start behaviors possible:*
  - Monitored, manual start
  - Automatic start
- *Short circuit and earth fault monitoring*
- *Up to PL e, SIL 3, category 4*

Function

The safety emergency stop relay SR3C 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 SR3C. When the safety function is requested via the emergency stop circuit (e.g. safety door open), the enable current paths of the SR3C 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.

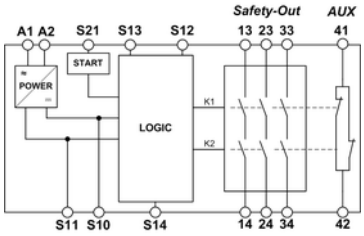


Fig. 1 Block diagram SR3C

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 TH35
- 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

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

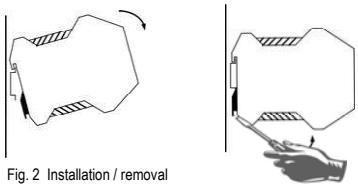


Fig. 2 Installation / removal

Safety Precautions



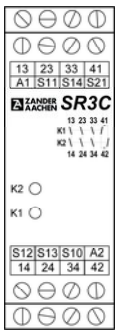
- Installation and commissioning of the device must be performed **only by authorized personnel**.
- Observe the country-specific regulations when installing the device.
- The electrical connection of the device is only allowed to be made with the device isolated.
- The wiring of the device must comply with the instructions in this user information, 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.
- 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. X”) 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.
- The year of manufacture can be found on the type label on the device. It is located at the end of the line of the voltage specification, below the ID number.

Electrical Connection

- Consider the information in the section "Techn. data"
- When the 24 V version is used, a safety transformer according to EN 61558-2-6 or a power supply unit with electrical isolation from the mains must be connected.
- External fusing of the safety contacts 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
- Use adequate protective circuit for inductive loads (e.g. free-wheeling diode)



A1:	*Power supply*
A2 :	*Power supply*
S11:	*DC 24 V 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. 3 Connections

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Ver. B
E61-137-00

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. 4 to Fig. 15.

Emergency Stop Circuit

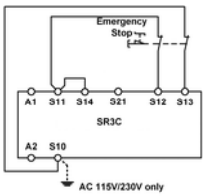


Fig. 4:
Two-channel emergency stop circuit with short circuit and earth fault monitoring.
(category 4, up to PL e)

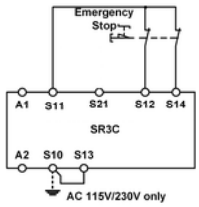


Fig. 5:
Two-channel emergency stop circuit with earth fault monitoring.
(category 3, up to PL d)

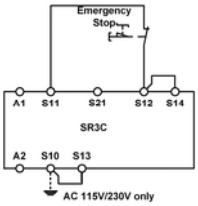


Fig. 6:
Single-channel emergency stop circuit with earth fault monitoring.
(category 1, up to PL c)

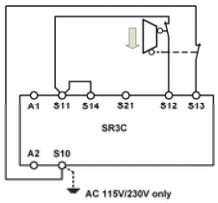


Fig. 7:
Two-channel sliding guard monitoring with short circuit and earth fault monitoring.
(category 4, up to PL e)

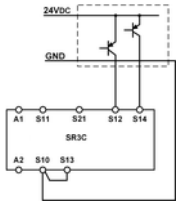


Fig. 8:
Two-channel emergency stop with pnp-outputs/OSSD-outputs ***with*** *short circuit monitoring.*
(category 4, up to PL e)

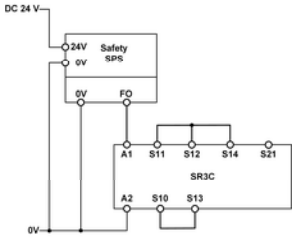


Fig. 9:
Connecting to a safety PLC
(category 4, up to PL e)
Prerequisite:
Fault exclusion for cross-circuit (e.g. according to EN ISO 13849-2; Table D4 - wiring in protected wiring space) and PLC also meets requirements for category 4, PL e.

Notice:

- In order to activate earth fault monitoring, S10 must be connected to PE (protective earth) on the AC 115/230 V devices
- For AC/DC 24 V devices, the earth connection of the power supply unit must be on the secondary side
- 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
- For the applications according Fig. 8 and 9, make sure that the reference potential of the signal generator and the SR3C is the same

Starting Behavior

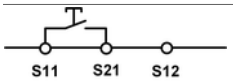


Fig. 10:
Monitored manual start.
It is monitored that the start button was opened before the emergency stop button closes. (Prerequisite: operating voltage must not be interrupted.)



Warning:
Safety contacts switch immediately when the power supply is connected.

Fig. 11:
Automatic start.
Max perm. delay during closing of the safety switches on S12 and S13:
S12 before S13: 300 ms
S13 before S12: any

Feedback Loop

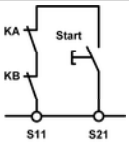


Fig. 12:
Feedback loop for monitored manual start:
The feedback loop monitors contactors or the expansion modules .

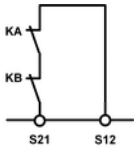


Fig. 13:
Feedback loop for automatic start:
The feedback loop monitors contactors or the expansion modules .

Power supply and Safety contacts

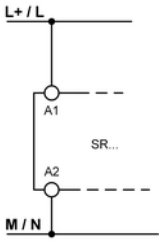


Fig. 14:
Power supply A1 and A2.
(Power supply according to techn. Data)

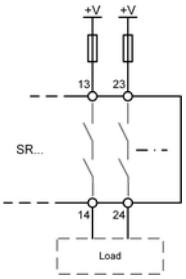


Fig. 15:
Connecting load to safety contacts.
(Figure shows example. Voltage „+V“ according to techn. Data)

Commissioning Procedure

Note: *The items listed under “Electrical connection” must be observed during commissioning.*

1. Input circuit:
Depending on the risk evaluation choose one of the wiring diagrams in „Applications“ (Fig. 4 to 9).

2. Choose start mode:
Wire the start circuit according to the examples in Fig. 10 or 11 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. 12 or 13.

4. Power supply:
Connect the power supply to A1 and A2 (Fig. 14).
Caution: Power must not yet be activated.

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5. Starting the device:

Switch on the operating voltage.

Warning:

If the “Automatic start” starting behavior is set, the safety contacts will close immediately.

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

LEDs ***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 behavior is set, close the start button to close the safety contacts.

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

Irrespective of this, the safe function of the protective device should be checked at suitable intervals, e.g. as part of the system's maintenance program. Maintenance work on the device itself is not required.

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 used for correct function and adjustment.
- Check whether the emergency stop circuit is closed.
- Check whether the start button (with manual start) is closed.
- Check the operating voltage at A1 and A2.
- Is the feedback loop closed?

Device cannot be switched on again after an emergency stop:

- Check whether the emergency stop circuit was closed again.
- Was the start button opened before closing of the emergency stop circuit (with 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 for examination.

Opening the device is impermissible and will void the warranty.

Techn. Data

Corresponds to the standards	EN 60204-1; DIN EN ISO 13849-1; EN IEC 62061; IEC 61508 Parts 1-2 and 4-7; IEC 61511-1		
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 230 V** approx. 6.9 VA	**AC 24 V** approx. 4.5 VA	**DC 24 V** approx. 2.3 W
Control voltage at S11	DC 24 V		
Control current S11...S14	approx. 60 mA		
Safety contacts	3 NO contacts		
Auxiliary contacts	1 NC contact		
Max. switching voltage	AC 250 V		
Safety contact breaking capacity (13-14, 23-24, 33-34) (6 switching cycles/ min)	AC: 250 V, 2000 VA, 8 A for ohmic load 250 V, 3 A for AC-15 DC: 40 V, 320 W, 8A for ohmic load 24 V, 3 A, for DC-13 Max. total current through all 3 contacts: 15 A (13-14, 23-24, 33-34) *)		
Auxiliary contact breaking capacity (41-12)	AC: 250 V, 500 VA, 2 A for ohmic load DC: 40 V, 80 W, 2 A for ohmic load		
Minimum contact load	5 V, 10 mA		
Contact fuses	10 A gG		
Max. line cross section	0.14 - 2.5 mm^2		
Tightening moment (Min. / Max.)	0.5 Nm / 0.6 Nm		
Typ. switch-on delay / switch-off delay for NO contacts requested via safety circuit	< 30 ms / < 20 ms		
Max. length of control line	1000m with 0.75 mm^2		
Contact material	$AgSnO_2$		
Contact service life	mech. approx. 1 x 10^7		
Test voltage	2.5 kV (control voltage/contacts)		
Rated impulse withstand voltage, leakage path/air gap	4 kV (EN 60664-1)		
Rated insulation voltage	250 V		
Degree of protection	IP20		
Temperature range	-15 °C to +40 °C *)		
Max. altitude	≤ 2000 m (above sea level)		
Degree of contamination	2 (EN 60664-1)		
Overvoltage category	3 (EN 60664-1)		
Weight	approx. 230 g		
Mounting	DIN rail according to EN 60715 TH35		

*) If several SR3C 24V devices are closely spaced under load, the max. total current at the ambient temperature of T=20 °C: 9 A; at T=30 °C: 3 A; at T=40 °C =1 A.
If these currents are exceeded, a spacing of 5 mm between the devices must be observed.

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Disclaimer and warranty

If the above mentioned conditions for appropriate use are not complied with or if the safety instructions are not followed or if any maintenance operations are not carried out as required, this shall lead to an exclusion of liability and loss of warranty.

ATTENTION!

We would like to point out that it is the full responsibility of the operator to ensure a plant availability. Using the SR3C, a safety emergency stop relay according to

- EN ISO 13849-1
- EN IEC 62061
- IEC 61508
- IEC 61511-1

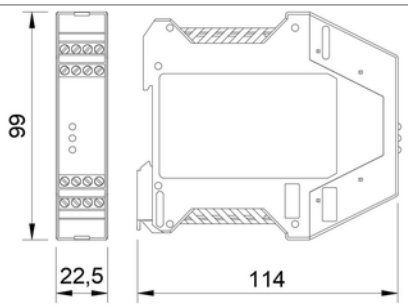
is used, which will be brought into the safe state when the safety function is requested.

This means that the connected load is switched off as soon as a request from connected sensor elements or diagnostic measures detects a dangerous state, e.g. caused by a component fault.

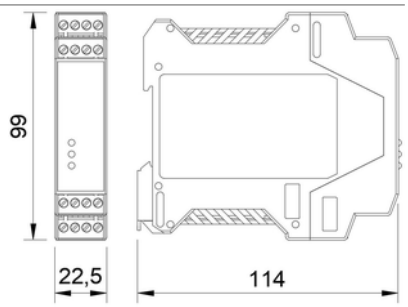
Since process-related applications in particular have high demands on availability, limited availability can also have significant consquences. It is therefore recommended to stock a second unit to avoid long downtimes in such a case. These are recommendations of the manufacturer, the evaluation of the importance of the plant availability is the sole responsibility of the operator.

Dimension Drawing

Fixed Terminals



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. 472170	SR3C, AC 230 V (50-60 Hz),	fixed screw terminals
Order no. 472171	SR3C, AC 115 V (50-60 Hz),	fixed screw terminals
Order no. 472173	SR3C, AC/DC 24 V,	fixed screw terminals
Order no. 474170	SR3C, AC 230 V (50-60 Hz),	incl. plug-in screw terminals
Order no. 474171	SR3C, AC 115 V (50-60 Hz),	incl. plug-in screw terminals
Order no. 474173	SR3C, AC/DC 24 V,	incl. plug-in screw terminals
Order no. 475170	SR3C, AC 230 V (50-60 Hz),	incl. push-in twin spring connector
Order no. 475171	SR3C, AC 115 V (50-60 Hz),	incl. push-in twin spring connector
Order no. 475173	SR3C, AC/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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Safety Charcteristics

Safety characteristics according to EN ISO 13849-1

Load - DC-13	**≤ 0.1 A**	**≤ 1A**	**≤ 2 A**
Max. duration of use [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]	≤ 500,000	≤ 350,000	≤ 100,000

Safety characteristics according to IEC 61508 - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13	
Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	20
PFH [1/h]	9.69E-11
SIL	3

Safety characteristics for alternate 1oo1 structure for process industry - High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13	
Device type	A
HFT	0
SIL	3
SFF [%]	99.93
λ_{SD} [FIT]	0
λ_{SU} [FIT]	121.18
λ_{DD} [FIT]	9.69
λ_{DU} [FIT]	0.10
PFH [1/h]	9.69E-11

Safety characteristics according to IEC 61508 - Low Demand

Conditions: Maximum load AC-15 / DC-13	
Max. duration of use [Years]	20
Proof-Test-Intervall [Years]	9
PFD_{AVG}	9.87E-05
SIL	3

Safety characteristics for alternate 1oo1 structure for process industry - Low Demand

Conditions: Maximum load AC-15 / DC-13	
Device type	A
HFT	0
SIL	3
SFF [%]	97.49
λ_{SD} [FIT]	0
λ_{SU} [FIT]	121.09
λ_{DD} [FIT]	0
λ_{DU} [FIT]	3.12
PFD_{avg} (e.g. for T = 1 year)	1.37E-05

Proof-Test

In order to check the proper function of the device, the following steps have to be carried out

- Demand the safety function by opening the safety circuit. Check that the relay contact (13-14; 23-24; 33-34) opened by activation of the safety function.
- Close the safety circuit and start the device again. Check that the safety contacts (13-14; 23-24; 33-34) closed again.

If the device doesn't switch on again, the proof-test failed.

ATTENTION:

If the proof-test fails, the device must be replaced. Otherwise there is a risk of loss of functional safety.

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CE
Declaration

CE Konformitätserklärung
EC Declaration of Conformity
Déclaration de conformité

Hersteller: H. ZANDER GmbH & Co. KG
Producer: Am Gut Wolf 15 • 52070 Aachen • Deutschland
Fabricant:

Produktgruppe: Sicherheits-Not-Halt-Schaltgeräte
Product Group: Safety emergency stop switching devices
Groupe de produits: Relais de sécurité d'arrêt d'urgence

Produkt Name Product Name Nom du produit	**Anbringung der CE-Kennzeichnung** Affixing of CE marking: Application du marque CE	**Zertifikats-Nr.** No of Certificate N° du certificat
SRLC	2023	01/205/5463.03/23
SR2C	2023	01/205/5463.03/23
SR3C	2023	01/205/5463.03/23
SR3D	2023	01/205/5463.03/23
SR3A	2023	01/205/5463.03/23
SR3AD	2023	01/205/5463.03/23
SK3D	2023	01/205/5463.03/23

Die Produkte stimmen mit den Vorschriften folgender Europäischer Richtlinien überein:
The products conform with the essential protection requirements of the following European directives:
Les produits sont conformes aux dispositions des directives européennes suivantes:

2006/42/EG : Maschinenrichtlinie
2006/42/EG : Machinery directive
2006/42/EG : Directive Machines

2011/65/EU: RoHS Richtlinie
2011/65/EU: RoHS directive
2011/65/EU: Directive RoHS

2014/30/EU : EMV Richtlinie
2014/30/EU : EMC directive
2014/30/EU : Directive CEM

Die Übereinstimmung der bezeichneten Produkte mit den Vorschriften der o.a. Richtlinie wird, falls anwendbar, nachgewiesen durch die vollständige Einhaltung folgender Normen:
If applicable, the conformity of the designated products is proved by full compliance with the following standards:
Le strict respect des norms suivantes confirme, s´il y a lieu, que les produits désignés sont conformes aux dispositions de la directive susmentionnée:

EN 61326-3-1:2018 **EN IEC 61000-6-2:2019** **IEC 63000:2018**

Gemäß Zertifikat der benannten Stelle:
According to the certificate of the below mentioned organisation:
Selon de organisme notifé:

EN ISO 13849-1:2015 **EN ISO 13849-1:2023** **IEC 61508 Parts 1-7:2010**

Benannte Stelle / Organisme notifé: Nr. NB 0035
TÜV Rheinland Industrie Service GmbH
51105 Köln
Zertifizierungsstelle für Maschinen

Dokumentationsbeauftragte/-r: Christiane Nittschalk
Documentation manager
Autorisé à constituer le dossier technique

Aachen, den 24.10.2023

Dr.-Ing. Marco Zander
Geschäftsleitung
General Manager
Direction

Dipl.-Ing. Alfons Austerhoff
Leiter CE-Konformitätsbewertung
Manager for EC declaration of conformity
Responsable évaluation de conformité CE

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