Forcibly Guided Coupling Relay SK5C

Operating Instructions

English translation

Errors and technical changes reserved

Correct use

SK5C is a coupling relay with forcibly guided contacts according to EN 61810-3, which can be used in safety-related applications according to EN ISO 13849-1 and EN 62061 / EN 61508 up to PL e or SIL 3.

The SK5C couples safe signals of e.g. pulsed PLC's to the periphery for galvanic isolation and power adjustment and can also used for contact expansion of a safety relay such as from the ZANDER SR series.

EN ISO 13849-1

IEC 62061
IEC 61511
IEC 61508



- *Forcibly guided relay contacts according to EN 61810-3*
- *5 NO / 1NC*
- *Coupling of safe signals for galvanically isolated power adjustment*
- *Contact expansion for safety relays*
- *Display of the switching status via LED*
- *Suitable for safety applications up to PL e (EN ISO 13849-1), SIL 3 (EN 62061 / EN 61508)*

Function

When the control signal is switched on at A1/A2, the forcibly guided relays are activated, whereby the NO contacts (13-14 ... 53-54) are immediately closed. Disconnecting the control signal deactivates the relays, causing the NO contacts to open immediately.

By integrating the NC contacts (61-62) as a feedback contact in the reset circuit of the controlling unit, it is ensured that a non-opening of an NO contact is detected, whereby the controlling unit takes measures for interlocked shutdown depending on the application.

ATTENTION:

The SK5C can only be used if it is controlled and monitored by a safety component that is suitable for the respective safety function. The sole use of the SK5C in safety-related applications is not permitted.

Free-wheeling diodes built into the SK5C protect the driving unit from overload. Two support terminals for A1 and A2 allow easy wiring in case of cascading several SK5C.

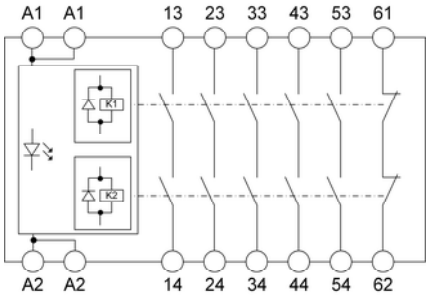


Fig. 1 Block diagram SK5C

Installation

- In accordance with EN 60204-1, the device is intended for installation in control cabinets with minimum protection class IP54. The following must be observed:
- Mounting on 35 mm mounting rail according to EN 60715
- Ensure sufficient heat dissipation in the control cabinet
- Minimum distance to adjacent devices according to cumulative current limit curve

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

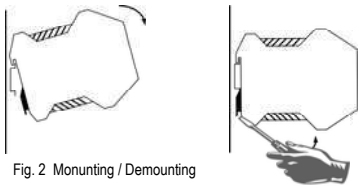


Fig. 2 Monunting / Demounting

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.
- Contact protection and insulation of the supply lines must be designed for the highest voltage applied to the device.
- 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

- Consider the information in the section "Techn. data"
- External fusing of the safety contacts must be provided
- Max. line resistance at nominal voltage is 50 Ω
- Feedback contact 61-62 must not be used as safety contact
- If the device does not function after commissioning, it must be returned to the manufacturer unopened. Opening the device will void the warranty
- Sufficient protective circuitry for inductive loads (e.g. free-wheeling diode) must be provided



Fig. 3 Terminals

A1:	*Control line - DC 24V*
A2 :	*Control line - 0V*
13-14:	*Safety contact 1*
23-24:	*Safety contact 2*
33-34:	*Safety contact 3*
43-44:	*Safety contact 4*
53-54:	*Safety contact 5*
61-62:	*Feedback contact*

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Applications

The device has to be wired as shown in Fig. 4 or Fig. 5

SK5C as coupling relay for safe PLC output

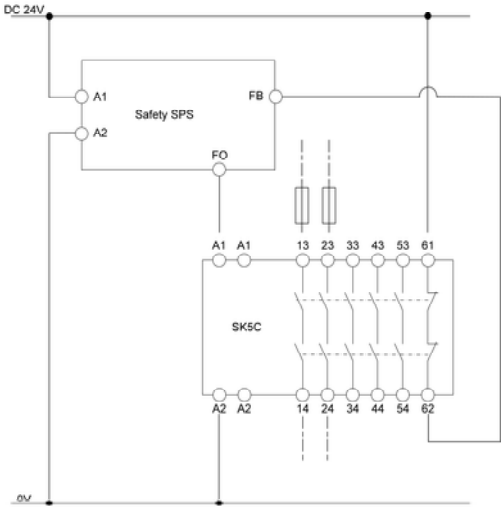


Fig. 4:
Single-channel control with safe PLC output.
(Up to PL e / SIL 3 if the safe output fulfills PL e / SIL 3, monitoring of the SK5C via the feedback contact 61 - 62 takes place and cross-circuits in the control line can be excluded - see note).

Attention:
Relay contacts switches immediately when the switching voltage is applied.

Note:
For fault exclusion of cross-connections according to EN ISO 13849-2, wiring must be in a protected wiring compartment with minimum protection class IP54.
E.g. EN ISO 13849-2, Tab. D4 - Wiring within an electrical installation space according to EN 60204-1.

Monitoring of the SK5C via the feedback contact 61 - 62 is mandatory.

ATTENION:

- *The 0V - potential of the PLC and the SK5C must be the sam*
- *It must be ensured that any switch-on pulses sent by the PLC do not cause the SK5C to activate and should therefore always be deactivated.*

SK5C as expansion module for safety relays

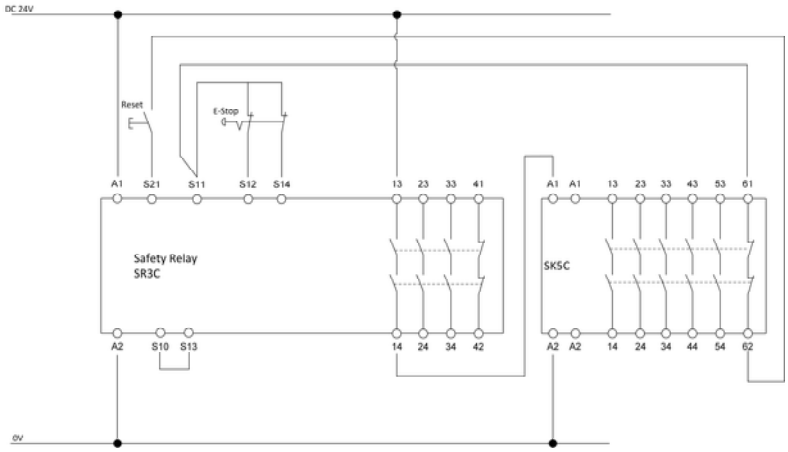


Fig. 5:
Wiring for contact expansion of a basic device (e.g. SR3C).
(Up to PL e / SIL 3 if the safety relay fulfills PL e / SIL3 and cross-connections in the control line can be excluded - see note)

Attention: Relay contacts switches immediately when the switching voltage is applied.

Note:
For fault exclusion of cross-connections according to EN ISO 13849-2, wiring must be in a protected wiring compartment with minimum protection class IP54. E.g. EN ISO 13849-2, Tab. D4 - Wiring within an electrical installation space according to EN 60204-1.

Monitoring of the SK5C via the feedback contact 61 - 62 is mandatory.

Commissioning Procedure

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

1. Wiring feedback loop:
Integrate the feedback contact into the feedback loop of the controlling unit - see figure 4 or figure 5 depending on the application.

2. Steuersignal verdrahten:
Connect the control signal to terminal A1 and A2 to the corresponding reference potential - see figure 4 or figure 5 depending on the application.

Attention:
Wiring only in the de-energized state.

3. Activate the device
Activate the SK5C via A1.

Attention:
Relay contacts switches immediately when the switching voltage is applied. The LED in the front lit.

4. Deactivate the device
Deactivate the SK5C via A1. The ELD in the front turns off.

5. Restart:
Restart the SK5C via A1.The LED in the front lit.

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Checks and maintenance

The following checks are regulary 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

Regardless of this, the safe functioning of the safety device should be checked at suitable intervals, e.g. as part of the maintenance schedule of the plant. Not maintenance ist required for the device itself.

Proof-Test



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

- Deactivate the SK5C. Check that the contacts (13-14 to 53-54) are opened by disabling and the monitoring contact 61-62 is closed
- Now reactivate the device. Check that the contacts (13-14 to 53-54) are closed again and the monitoring contact 61-62 is open.

If one of the above switching states is not present, the proof test is failed.

ATTENTION: If the proof test is not passed, it is mandatory to replace the device. Otherwise, there is a risk of loss of functional safety.

Safety Characteristics according to EN ISO 13849-1

Load - AC-15 / DC-13	**≤ 1 A / ≤ 1 A**	**≤ 3 A / ≤ 2 A**	**≤ 5 A / ≤ 5 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] - AC-15 / DC-13	≤ 55,000 / ≤ 350,000	≤ 42,500 / ≤ 100,000	≤ 15,000 / ≤ 15,000

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

Load - AC-15 / DC-13	**≤ 1 A / ≤ 1 A**	**≤ 3 A / ≤ 2 A**	**≤ 5 A / ≤ 5 A**
Max. duration of use [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 / year] - AC-15 / DC-13	≤ 55,000 / ≤ 350,000	≤ 42,500 / ≤ 100,000	≤ 15,000 / ≤ 15,000

Safety Characteristics according to EN 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

Techn. Data

Basic component, suitable for safety application according to the following standards	EN ISO 13849-1; EN 62061; IEC 61508 Parts 1-2 und 4-7; IEC 61511-1
Power consumption	A1/A2 = DC 24 V: ca. 2.3 W
Control voltage	DC 24 V - 15 % / + 10%
Max. leakage current at „0“	5 mA
Filtering of test pulses at nominal voltage DC 24V Switch-off pulses (Pulse width / Pulse rate)	≤ 6 ms / ≥ 200 ms
Number NO contacts	5
Number NC contacts	1
Max. switching voltage	AC 250 V
NO breaking capacity (13-14, 23-24, 33-34, 43-44, 54-54) (6 switching cycles/ min)	AC: 250 V, 2000 VA, 8 A for DC-1 250 V, 5 A for AC-15 DC: 30 V, 240 W, 8 A for DC-1 24 V, 5 A for DC-13
Max. thermal total current I_{th}	See total current limit curve
NC breaking capacity (61-62)	AC: 250 V, 500 VA, 2 A for DC-1 DC: 30 V, 60 W, 2 A for DC-1
Min. contact load	5 V, 10 mA
External fusesd for NO contacts	10 A gG
Wire width	0.14 - 2.5 mm^2
Tightening moment (Min. / Max.)	0.5 Nm / 0.6 Nm
Typ. switch-on delay / switch-off delay Of NO contacts (13-14, 23-24, 33-34, 43-44, 54-54)	< 30 ms / < 50 ms (at A1/A2 = DC 24 V)
Max. line resistance at nominal voltage	50 Ω
Contact material	$AgSnO_2$
Service life	mech. 1 x 10^7 cycles
Dielectric strength (EN 60664-1)	4 kV
Rated insulation voltage	250 V
Protection	IP20
Ambient temperature range	-15 °C bis +55 °C
Max. altitude	≤ 2000 m (above sea level)
Degree of pollution / Overvoltage category	2 / 3 (DIN VDE 0110-1)
Weight	ca. 150 g
Mounting	DIN rail according to EN 60715 TH35

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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 control line at A1.*
- *If the feedback loop is used, is it closed?*
- *Check reference potential.*

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.

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 SK5C in safety applications according to e.g.

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

the safey state „Energy Switched Off" is established if requested by the controlling device.

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 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 plant availability is the sole responsibility of the operator.

Total Current Lmit Curve

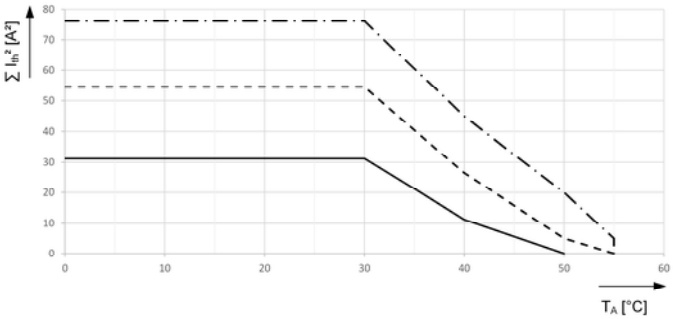


Fig. 6: Total current limit curve

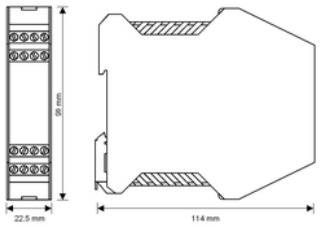
Fig. 6 shows the total current limit curve valid for the SK5C as a function of the ambient temperature as well as the distance to adjacent devices with the same power dissipation.

—— 0 mm distance to adjacent devices with the same power dissipation
– – – 5 mm distance to adjacent devices with the same power dissipation
— · – 10 mm distance to adjacent devices with the same power dissipation

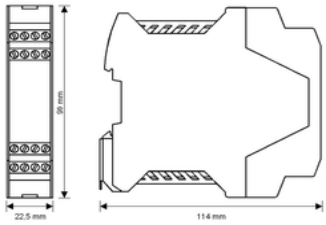
Total current: $\sum I_{th}^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2 + I_5^2$ (I_1, I_2, I_3, I_4, I_5: Current over contacts 13-14, 23-24, 33-34, 43-44, 53-54)

Dimension Drawing

Fixed terminals



Plug-In terminals



Variants

Order-No. 472342	SK5C, DC 24 V,	fixed screw terminals
Order-No. 474342	SK5C, DC 24 V,	incl. plug-in screw terminals
Order-No. 475342	SK5C, 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 Cabinetrail spacer 5mm, PU = 12 pcs	

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