SAFE-SIL

Functional Safety Module | Safe coupling relay up to SIL 3

SAFE-SIL is an all-purpose safe coupling device with three safe relay contacts for safe switching, certified by TÜV Rheinland. The SAFE-SIL couples safe signals of pulsed PLC outputs to the field for galvanic isolation and power adjustment or it can be used as contact extension for a basic device. No feedback circuit necessary. It is designed according to EN ISO 13849-1, EN 62061 and EN 61508.

FEATURES

- 3 non-delayed safety contacts
- 1 non-delayed auxiliary contact
- Coupling of safe signals for galvanic isolation and power adjustment
- LED indicator for status
- Self-monitoring
- Automatic start
- Up to PL e/SILCL 3/category 4 (EN ISO 13849-1/EN 62061/EN 61508)

ORDER DETAILS

Brand	SALZ Automation
Product Name	SAFE-SIL
Revision	00
Function	Safe coupling relay with 3 N/O and 1 N/C, up to SIL 3
Product SKU/Order No.	SA-SAFE-SL-01-00 (1 pc) | SA-SAFE-SL-50-00 (50 pcs)

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

Table of Content

1 Function

The safety relay SAFE-SIL is designed for safe isolation of safety circuits according to EN 60204-1, stop category 0 and can be used in safety-related applications up to safety category 4, PL e (EN ISO 13849-1) SILCL 3 (EN 62061 / EN 61508). The internal logical system closes the safety contacts when the control line is switched on.

If the control line is switched off, the forced guided safety contacts are opened and safely switch the application off. It is ensured that a single fault does not lead to a loss of the safety function and that every fault is detected by cyclical self-monitoring no later than when the system is switched off and switched on again.

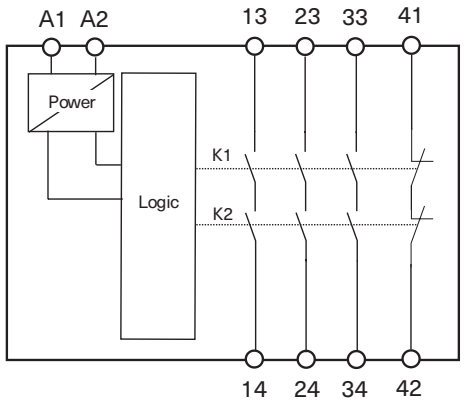

Fig. 1: Block diagram SAFE-SIL

2 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.

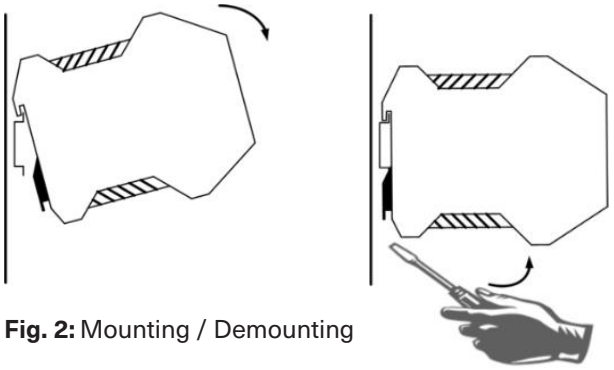

Fig. 2: Mounting / Demounting

3 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.
- 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 “Rev.”) 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.

4 Electrical Connection

- Observe the instructions in the section Techical Data.
- External fusing of the safety contacts must be provided.
- Max. line resistance at nominal voltage is 50 Ω.
- 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: Control Voltage
A2: Control Voltage
13/14: Safety Relay Contact
23/24: Safety Relay Contact
33/34: Safety Relay Contact
41/42: Auxiliary Contact

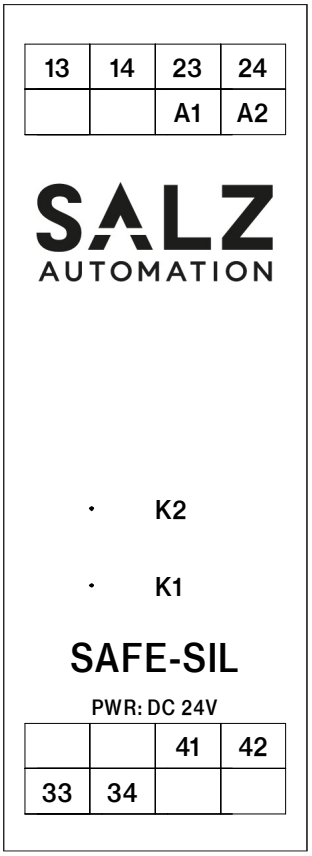

Fig. 3: Terminals

5 Operation Instructions

5.1 Applications

The device must be wired as shown in Fig. 4 to Fig. 7.

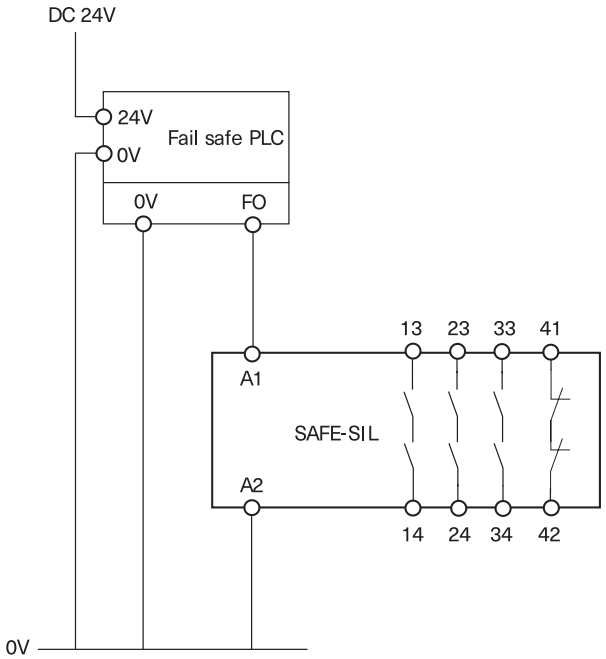

Fig. 4: SAFE-SIL as coupling relay for fail safe PLC output

Single channel control with fail safe PLC output. (Category 4, up to PL e/SILCL 3, if the safety output meets PL e/ SILCL 3 and short circuits in line between the safety output and A1 of the SAFE-SIL can be ruled out – see advice)

⚠ **CAUTION:** Safety contacts will be activated immediately by switching on the control line. Make sure that A2 is the correct reference potential to the switching voltage A1.

⚠ **ADVICE:** According to ISO 13849-2 the wiring has to be in a short-circuit-proof control cabinet with a minimum degree of protection of IP54. For example EN ISO 13849-2, table D4 - Cables within an electrical installation space in accordance with EN 60204-1.

A feedback loop for monitoring the SAFE-SIL is not necessary. However, if a feedback loop is necessary for the application, this can be achieved by wiring the feedback to the auxiliary contact 41-42.

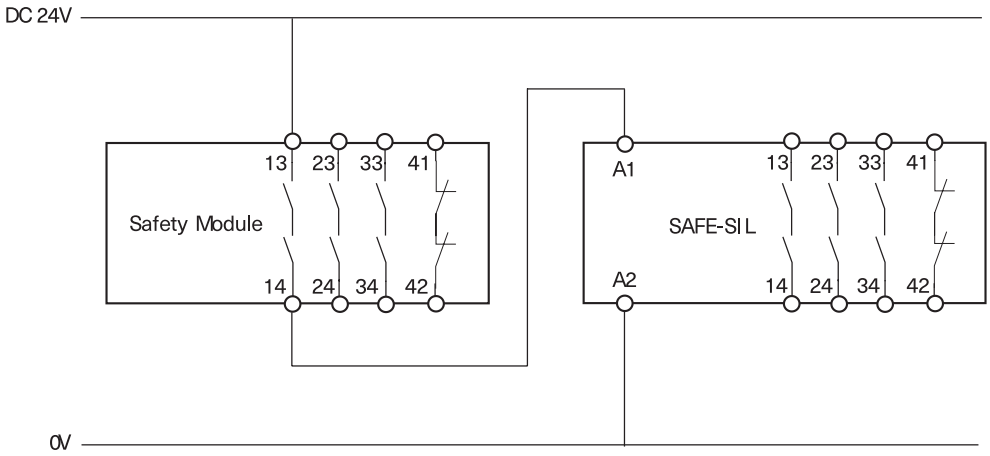

Fig. 5: SAFE-SIL as expansion module – control with safe relay contacts

Wiring as contact extension of a basic device (category 4, up to PL e/SILCL 3, if the safety output meets PL e/ SILCL 3 and short circuits in line between the safety output and A1 of the SAFE-SIL can be ruled out – see advice)

⚠ **CAUTION:** Safety contacts will be activated immediately by switching on the basic device.

⚠ **ADVICE:** According to EN ISO 13849-2 the wiring has to be in a short-circuit-proof control cabinet with a minimum degree of protection of IP54. For example, EN ISO 13849-2, table D4 – Cables within an electrical installation space in accordance with EN 60204-1.

A feedback loop for monitoring the SAFE-SIL is not necessary. However, if a feedback loop is necessary for the application, this can be achieved by wiring the feedback to the auxiliary contact 41-42 (see Fig.6 or Fig. 7).

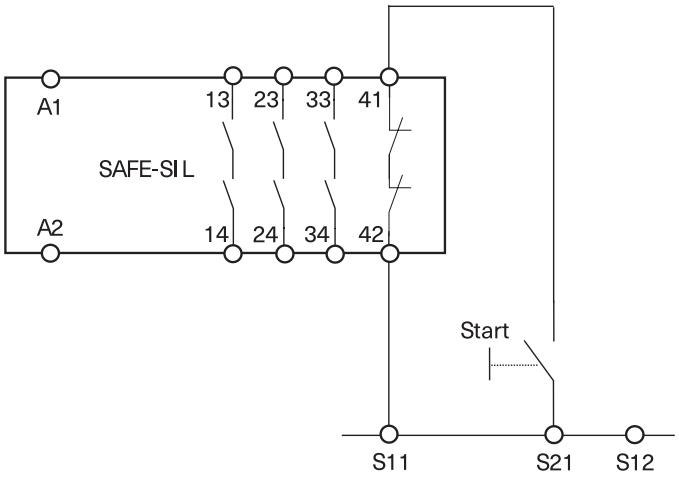

Fig. 6: SAFE-SIL as expansion module – feedback loop using a manual, monitored start

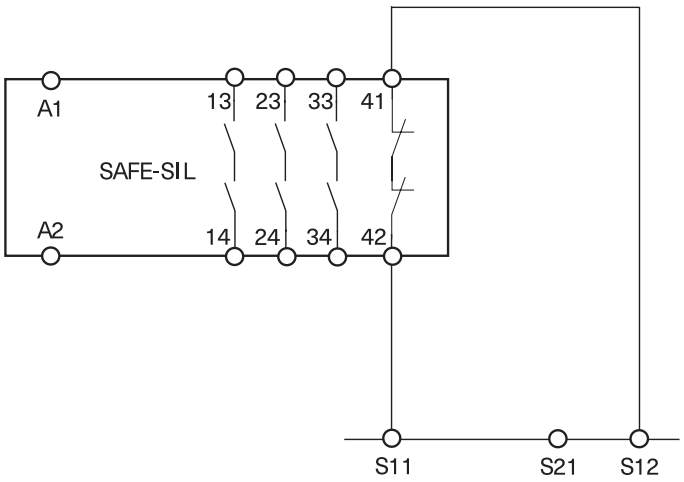

Fig. 7: SAFE-SIL as expansion module – feedback loop, automatic start

5.2 Commissioning Procedure

⚠ **ADVICE:** Follow the guidelines in “Electrical Connection” during the start-up.

1. **Feedback loop**
   If a feedback loop is necessary for the application, it has to be wired as shown in Fig.6 or Fig.7.

2. **Control line**
   Connect the control line to the contact A1 and 0V to A2. (Fig. 4).

   ⚠ **CAUTION:** Power does not have to be activated yet.

3. **Starting the device**
   Switch on the device via A1. The LEDs K1 and K2 are lit.

   ⚠ **WARNING:** The safety contacts will close immediately by turning on the control line.

4. **Triggering safety function**
   Turning off the SAFE-SIL via A1. The LEDs K1 and K2 turn off.

5. **Reactivation**
   Turning on the SAFE-SIL via A1. The LEDs K1 and K2 are lit.

5.3 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

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. No maintenance is required for the device itself.

5.4 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 contacts (13-14; 23-24; 33-34) opened by activation of the safety function.
- Close the safety circuit and start the device again. Check if the safety contacts (13-14; 23-24; 33-34) closed again. If the device doesn‘t switch on again, the proof-test failed.

⚠ **ATTENTION: Loss of functional safety!**

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

5.5 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.
- Is the feedback loop closed?
- Check the operating voltage at A1 and A2 and 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.**

5.6 Safety Characteristics according to EN ISO 13849-1

Load per contact AC-15 / DC-13	≤ 1A / ≤ 1A	≤ 2A / ≤ 2A	≤ 5A / ≤ 4A
Use duration T_{10d} [years]	20	20	20
Category	4	4	4
Performance Level PL	e	e	e
PFH_d [1/h]	1.2×10^{-8}	1.2×10^{-8}	1.2×10^{-8}
nop [Cycles per year] AC 15 / DC 13	≤ 50,000 / ≤ 350,000	≤ 35,000 / ≤ 100,000	≤ 8,760 / ≤ 8,760

5.7 Safety Characteristics according to EN 62061 / EN 61508 – High Demand

Conditions: Days of operation/year: 365; Hours/Day: 24; Switching-Cycle/Hour: 1; Maximum load AC-15 / DC-13

Load per contact	Maximum load AC-15 / DC-13
Use duration T_{10d} [years]	20
Proof-Test-Interval [years]	20
SIL(CL)	3
PFH	3.31×10^{-10}

5.8 Safety Characteristics according to EN 61508 – Low Demand

Conditions: Switching operation less than 1 times per year; Maximum load AC-15 / DC-13

Load per contact	Maximum load AC-15 / DC-13
Use duration T_{10d} [years]	20
Proof-Test-Interval [years]	9
SIL(CL)	3
PFH	9.94×10^{-5}

6 Technical Data

In compliance with	EN 60204-1; DIN EN ISO 13849-1; EN 62061; EN 50156-1 EN 746-2; IEC 61508 Parts 1-2 and 4-7; IEC 61511-1
Operating voltage	DC 24 V +/- 10 %
Power consumption	typ. 2 W
Safety contacts	3 N/O
Auxiliary contacts	1 N/C
Max. switching voltage	AC 250 V
Contact rating of safety contacts (13-14, 23-24, 33-34) 6 switching cycles/min	AC: 250 V, 2,000 VA, 8 A for resistive load 250 V, 5 A for AC-15
	DC: 30 V, 240 W, 8 A for resistive load 24 V, 4 A for DC-13
Max. total current through all 3 contacts	15 A (13-14, 23-24, 33-34)
Contact rating of auxiliary contact	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)
Contact rating of auxiliary contact	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) 6 A gG for applications acc. to EN 50156-1 and EN 746-2 (see EN 50156-1; chapter 10.5.5.3.4)
Max. switch-on delay	< 30 ms
Max. switch-off delay	< 60 ms
Recovery time	< 500 ms
Max. line resistance at nominal voltage	50 Ω
Wire width	0.14 to 2.5 mm2
Tightening moment (min./max.)	0.5 Nm/0.6 Nm
Contact material	$AgSnO_2$
Service life	mech. approx. 1×10^7
Rated impulse withstand voltage	2.5 kV (control voltage/contacts)
Dielectric strength (EN 60664-1)	6 kV between relays safety loops, control lines and internal logic
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	≤ 2,000 m (above sea level)
Weight approx.	150 g
Mounting DIN rail according to EN 60715	TH35

7 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 SAFE-SIL, a safety emergency stop relay according to

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

8 Dimension Drawing

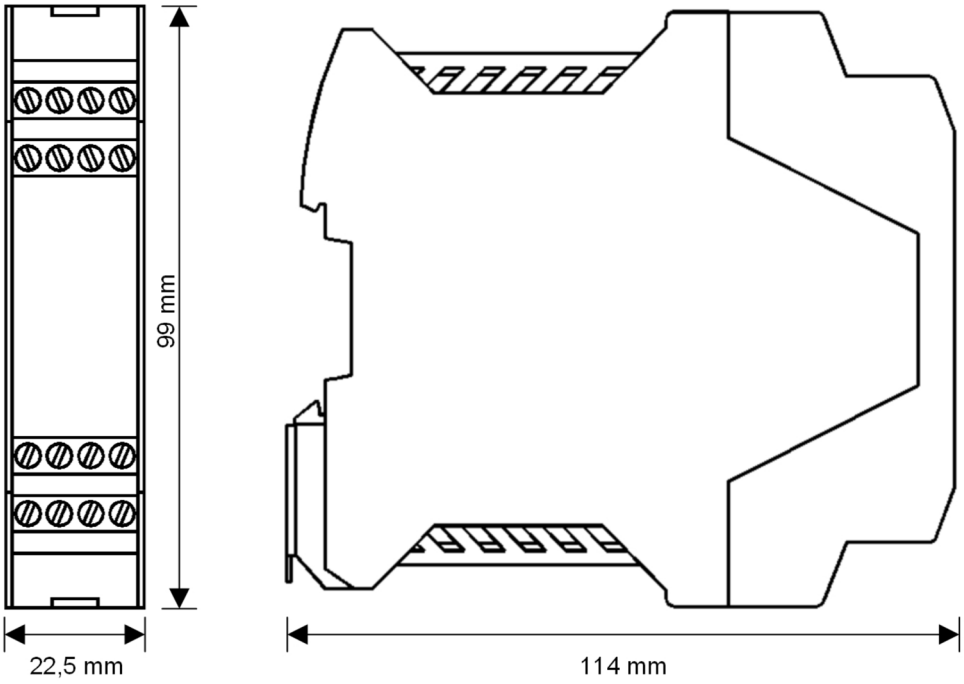

Fig. 8: Housing with Plug-In Terminal Blocks

9 Content of the EU Declaration of Conformity

The above mentioned product conforms with the most important requirements of the following directives and their modification directives:

2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2011/65/EU	RoHS Directive

Originator: Thomas Hüttemeier, Managing Director

Manufacture: SALZ Automation GmbH
Max-Planck-Str. 64
32107 Bad Salzuflen
Germany

The complete EU declaration of conformity is available on the Internet at **www.salz-automation.com**