

# SAFE-ESTOP

Functional Safety Module | E-Stop monitoring up to SIL 3



SAFE-ESTOP is an all-purpose emergency stop device with three safe relay contacts for safe monitoring of one or two channel sensors, certified by TÜV Rheinland. Further applications for the SAFE-ESTOP 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 IEC 61508.

## FEATURES

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

## ORDER DETAILS

Brand SALZ Automation  
 Product Name SAFE-ESTOP  
 Function E-stop monitoring module with 3 N/O, 1 N/C up to SIL 3  
 Product SKU/Order No. SA-SAFE-ES-01-00 | SA-SAFE-ES-50-00



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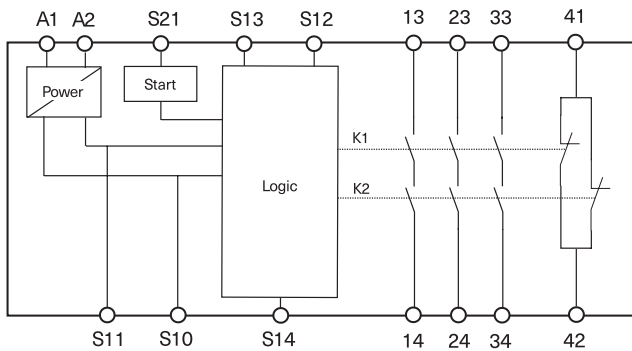
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DATASHEET

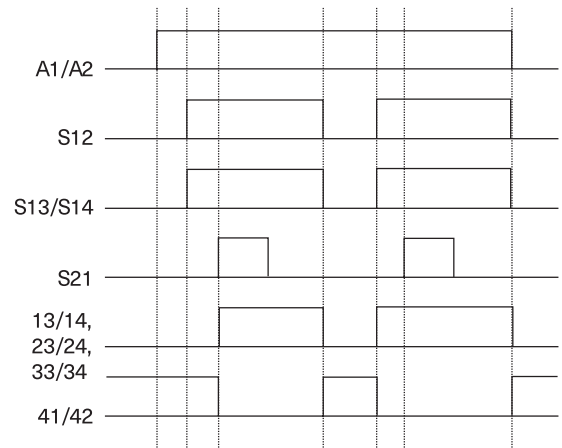
SAFE-ESTOP

# 1 Function

The safety relay SAFE-ESTOP is designed for monitoring 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) SIL 3 (EN IEC 62061, EN IEC 61508).



**Fig. 1:** Block diagram SAFE-DELAY

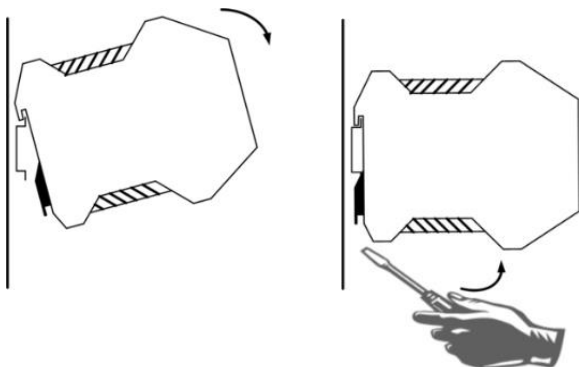


**Fig. 2:** State diagram SAFE-DELAY with manual start

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



**Fig. 3:** Mounting / Demounting

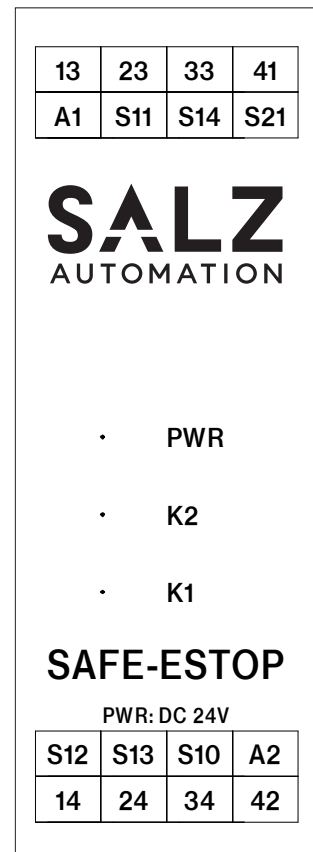
# 3 Safety Precautions

- 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

- 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 Technical 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

- A1: 24V DC Power Supply
- A2: 0V Power Supply
- S10: Control Voltage
- S11: Control Voltage
- S12: Control Line
- S13: Control Line
- S14: Control Line
- S21: Start Input
- 13/14: Safety Relay Contact
- 23/24: Safety Relay Contact
- 33/34: Safety Relay Contact
- 41/42: Auxiliary Contact

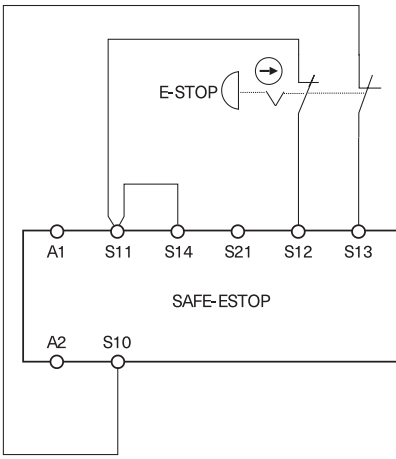


**Fig. 4:** Terminals

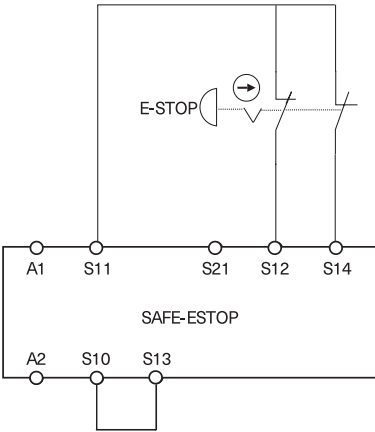
# 5 Operation Instructions

## 5.1 Applications

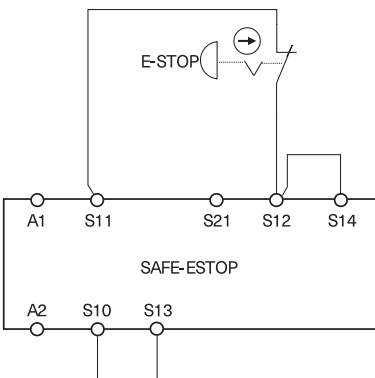
Depending on the application or the result of the risk assessment according to EN ISO 13849-1, the device must be wired as shown in Fig. 5 to Fig. 16.



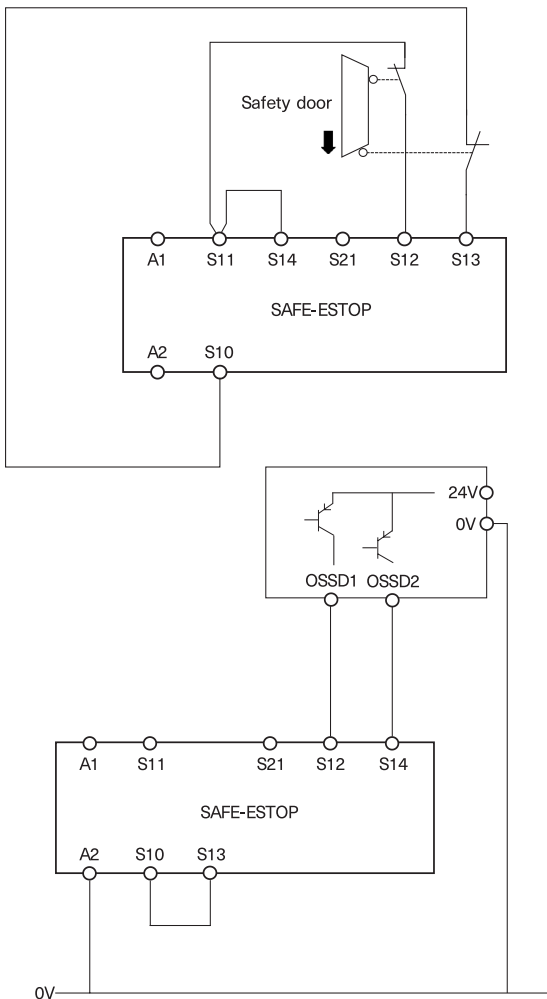
**Fig. 5:** Dual channel emergency stop with short circuit and ground fault monitoring (up to PL e/SIL 3, category 4)



**Fig. 6:** Dual channel emergency stop with ground fault monitoring (up to PL d/SIL 2, category 3)



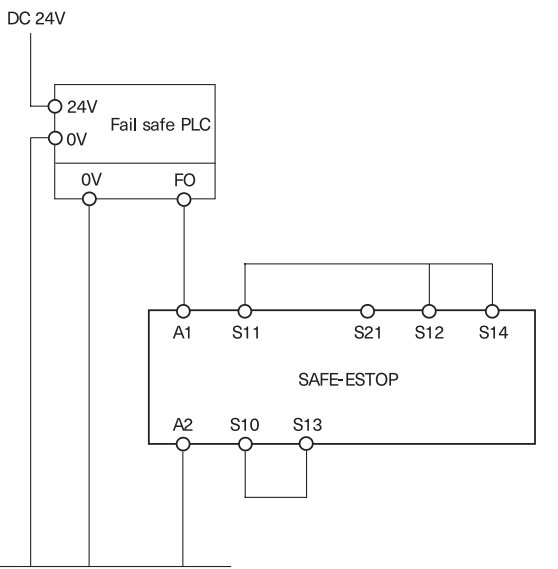
**Fig. 7:** Single channel emergency stop with ground fault monitoring (up to PL c/SIL 1, category 1)



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

**Fig. 9:** Two channel emergency stop with PNP outputs/OSSD outputs with its own short circuit monitoring (up to PL e/SIL 3, category 4)

**PREREQUISITE:** Signal generator meets requirements for PL e/SIL 3



**Fig. 10:** Connecting to a safety PLC (up to PL e/SIL 3, category 4)

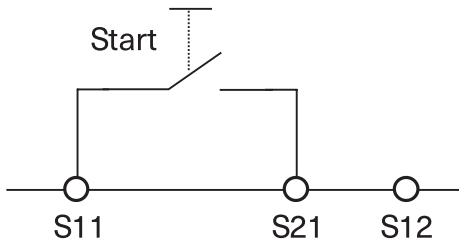
**PREREQUISITE:** Safe PLC output meets the required safety level and short circuit between PLC output and SAFE-ESTOP can be excluded (e.g. wiring inside an electrical installation space – see EN ISO 13849-2, table D4).

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

For the applications according to Fig. 5 and Fig. 6 the following is to be noted:

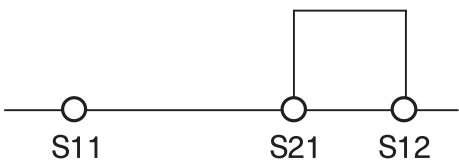
- Make sure that the ground potential of the signal generator and the SAFE-ESTOP is the same.
- It must be ensured that any switch-on pulses (light test) sent by the signal generator do not lead to a short activation of the safety relay and should therefore basically be deactivated.

## 5.2 Start Behavior



**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

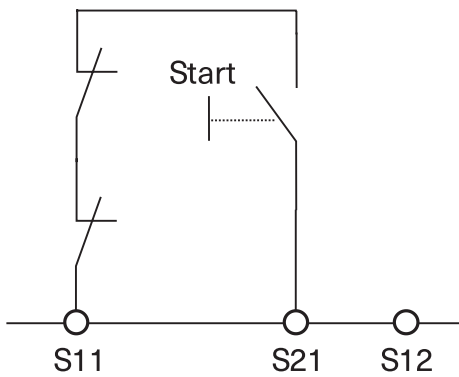


**Fig. 12:** Automatic start. Maximum allowable delay when closing the safety switches at S12 and S13/S14:

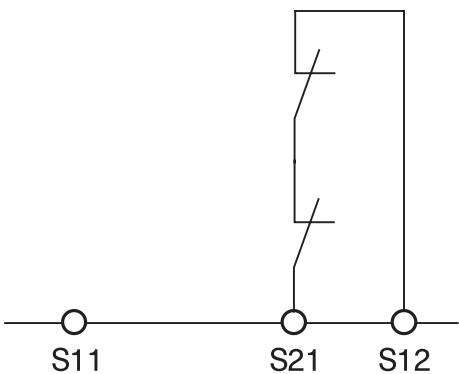
S12 before S13/S14: 200 ms  
S13/S14 before S12: no limit

**⚠ WARNING:** Safety contacts will be activated immediately at power ON.

## 5.3 Feedback Loop

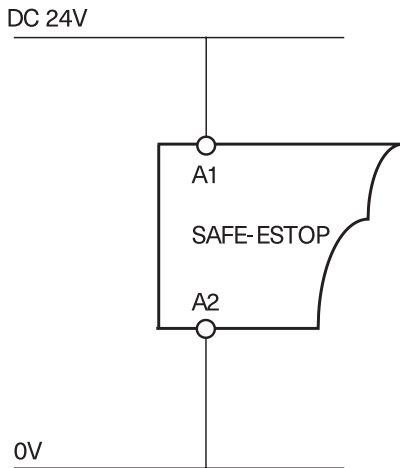


**Fig. 13:** Feedback loop for monitored manual start. The feedback loop monitors contactors or the expansion modules

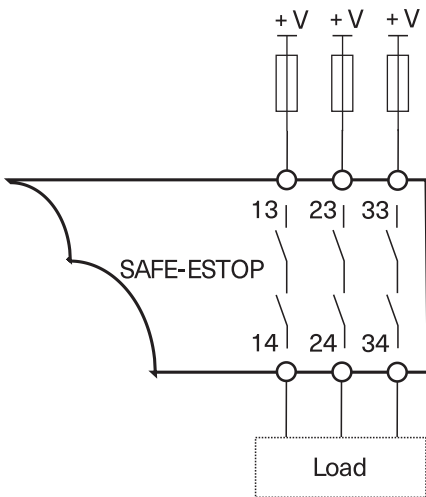


**Fig. 14:** Feedback loop for automatic start. The feedback loop monitors contactors or the expansion modules

## 5.4 Power Supply and Safety Contacts



**Fig. 15:** Power supply A1 and A2



**Fig. 16:** Connecting load to safety contacts. Voltage (+V) according to Technical Data.

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



## 5.5 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

Connect the start button with S11 and S21 for monitored manual start or connect S21 with S12 directly for automatic start (Fig. 11 or Fig. 12).

**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. 13 or Fig. 14.

### 4. Power supply

Connect the power supply to A1 and A2 (Fig. 15).

**CAUTION:** Power must not yet be activated.

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

## 5.6 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 European Machinery Directive 2006/42/EC + Amendment No. 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 3, SIL 3 with HFT = 1
- Once a year for applications up to PL d with Cat. 3 or SIL 2, SIL 2 with HFT = 1

## 5.7 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.

## 5.8 Safety Characteristics according to EN ISO 13849-1

Load per contact	≤ 1A	≤ 2A	≤ 3A
Use duration $T_{10d}$ [years]	20	20	20
Category	4	4	4
Performance Level PL	e	e	e
PFH <sub>d</sub> [1/h] a	$1.2 \times 10^{-9}$	$1.2 \times 10^{-9}$	$1.2 \times 10^{-9}$
nop [Cycles per year] AC 15 / DC 13	≤ 55,000 / ≤ 350,000	≤ 42,500 / ≤ 100,000	≤ 42,500 / ≤ 15,000

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

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

# 6 Technical Data

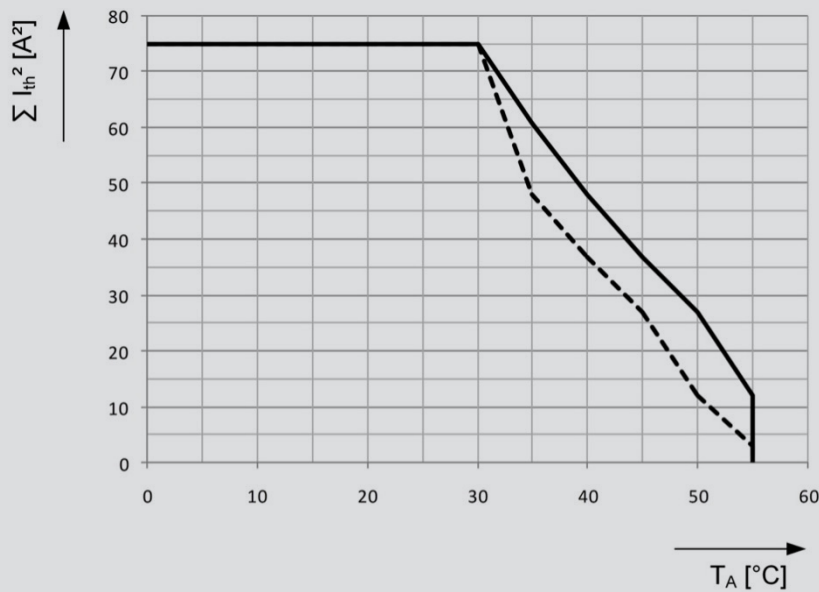
In compliance with	EN 60204-1; EN ISO 13849-1; EN IEC 62061:2021; IEC 61508 Parts 1-2 and 4-7
Operating voltage	DC 24 V +/- 10 %
Power consumption	2.6 W
Inrush current	5 A (approx. 250 µs)
Pulse suppression (A1/S12/S14) Switch-off pulse/dark test Switch-on pulse/light test	max. 3 ms (pulse width)/500 ms (pulse rate) max. 1 ms (pulse width)/500 ms (pulse rate) <b>Note:</b> 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.
Safe contact configuration	3 non-delayed safety contacts (NO)
Auxiliary contacts	1 non-delayed auxiliary contact (NC)
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, 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 <sub>th</sub>	Max. 5 A per contact (see total current limit curve)
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)
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 to 2.5 mm <sup>2</sup>
Tightening moment (min./max.)	0.5 Nm/0.6 Nm
Contact material	AgSnO <sub>2</sub>
Service life	mech. approx. 1 x 10 <sup>7</sup>
Rated impulse withstand voltage	2.5 kV (control voltage/contacts)
Dielectric strength	4 kV (DIN VDE 0110-1)
Rated insulation voltage	250 V
Degree of pollution/overvoltage category	2/3 (DIN VDE 0110-0)
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

# 7 Total Current Limit Curve

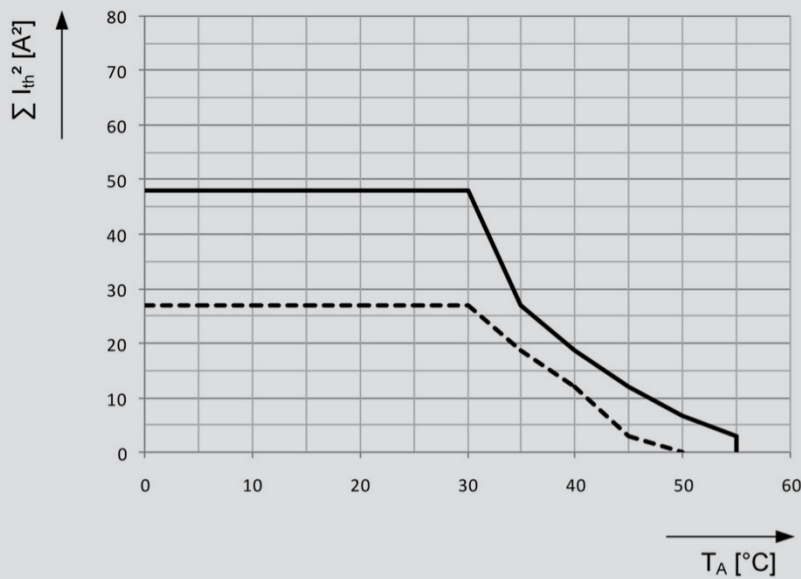
The max. permissible total current is shown in Fig. 17 and Fig. 18. Total current limit depending on the ambient temperature.

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)



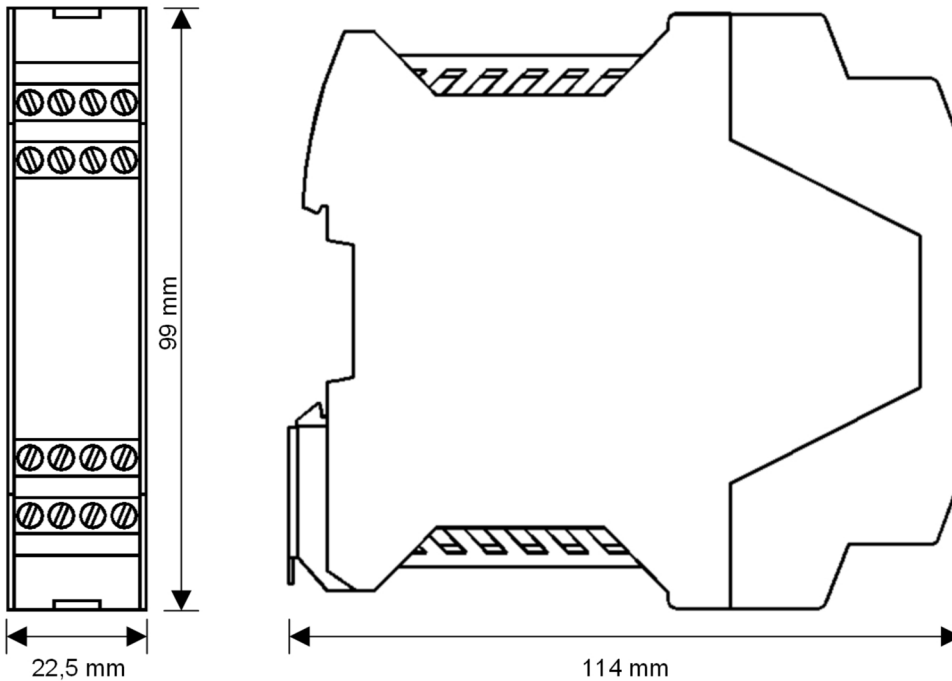
**Fig. 17:** Module with 5 mm clearance to adjacent devices, heated with same load.



**Fig. 18:** Module with no clearance to adjacent devices, heated with same load.

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

## 8 Dimension Drawing



**Fig. 19:** 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

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The complete EU declaration of conformity is available on the Internet at [www.salz-automation.com](http://www.salz-automation.com)