OPERATING INSTRUCTIONS

ReLy LOOP1

Safety relay

SICK
Sensor Intelligence.



Described product

ReLy LOOP1

Manufacturer

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Original document

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1 About this document

1.1 Purpose of this document

These operating instructions contain the information required during the life cycle of the safety relay.

These operating instructions must be made available to everyone who works with the safety relay.

1.2 Scope

Product

This document applies to the following products:

- Product code: ReLy LOOP1
- “Operating instructions” type label entry: 8024301

Document identification

Document part number:

- This document: 8024311
- Available language versions of this document: 8024301

You can find the current version of all documents at www.sick.com.

1.3 Target groups of these operating instructions

Some sections of these operating instructions are intended for certain target groups. However, the entire operating instructions are relevant for intended use of the product.

Table 1: Target groups and selected sections of these operating instructions

Target group	Sections of these operating instructions
Project developers (planners, developers, designers)	"Project planning", page 11 "Configuration", page 22 "Technical data", page 29
Installers	"Mounting", page 17
Electricians	"Electrical installation", page 20
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Project planning", page 11 "Configuration", page 22 "Commissioning", page 25 "Technical data", page 29
Operators	"Troubleshooting", page 26
Maintenance personnel	"Troubleshooting", page 26

1.4 Additional information

www.sick.com

The following information is available on the Internet:

- Data sheets and application examples
- CAD data and dimensional drawings
- Certificates (e.g. EU declaration of conformity)
- Guide for Safe Machinery Six steps to a safe machine

1.5 Symbols and document conventions

The following symbols and conventions are used in this document:

Warnings and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Instructions to action

► The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.

✓ The check mark denotes the result of an instruction.

LED symbols

These symbols indicate the status of an LED:

○ The LED is off.
☼ The LED is flashing.
● The LED is illuminated continuously.

2 Safety information

2.1 General safety notes

Integrating the product

DANGER
The product can not offer the expected protection if it is integrated incorrectly.

- ► Plan the integration of the product in accordance with the machine requirements (project planning).
- ► Implement the integration of the product in accordance with the project planning.

Mounting and electrical installation

DANGER
Death or severe injury due to electrical voltage and/or an unexpected startup of the machine

- ► Make sure that the machine is (and remains) disconnected from the voltage supply during mounting and electrical installation.
- ► Make sure that the dangerous state of the machine is and remains switched off.

Repairs and modifications

DANGER
Improper work on the product

A modified product may not offer the expected protection if it is integrated incorrectly.

- ► Apart from the procedures described in this document, do not repair, open, manipulate or otherwise modify the product.

2.2 Intended use

The safety relay is an evaluation unit device for switching safety-related circuits on and off for the following sensor types:

- Flexi Loop safe series connection

The safety relay complies with class A, group 1 as per EN 55011. Group 1 encompasses all ISM devices in which intentionally generated and/or used conductor-bound RF energy that is required for the inner function of the device itself occurs.

The product may be used in safety functions.

The product is only suitable for use in industrial environments.

The product must only be used within the limits of the prescribed and specified technical specifications and operating conditions at all times.

Incorrect use, improper modification or manipulation of the product will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

Applications according to the National Electrical Code/Canadian Electrical Code

If the product is being used in accordance with the National Electrical Code/Canadian Electrical Code, the following conditions must also be met:

- To protect the device's 24-volt voltage supply, use a fuse with a maximum voltage of 4 A and a minimum of 30 V DC in accordance with UL 248.

NOTE
The safety functions have not be tested and evaluated by UL.

2.3 Inappropriate use

The safety relay is **not** suitable for the following applications (this list is not exhaustive):

- At altitudes of over 4,000 m above sea level
- In explosion-hazardous areas

2.4 Requirements for the qualification of personnel

The product must be configured, installed, connected, commissioned, and serviced by qualified safety personnel only.

Project planning

You need safety expertise to implement safety functions and select suitable products for that purpose. You need expert knowledge of the applicable standards and regulations.

Mounting, electrical installation and commissioning

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Configuration

You need suitable expertise and experience. You must be able to assess if the machine is operating safely.

Operation and maintenance

You need suitable expertise and experience. You must be instructed in machine operation by the machine operator. For maintenance, you must be able to assess if the machine is operating safely.

3 Product description

3.1 Device overview

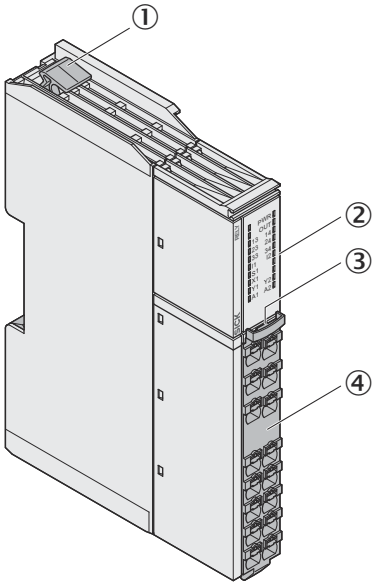


Figure 1: Device overview

① Device unlocking
② LEDs
③ Front connector unlocking
④ Front connector

3.2 Structure and function

The safety relay ReLy LOOP1 is an electrical switching device with inputs and outputs.

The safe Flexi Loop series connection is connected to the safety inputs of the safety relay.

2 safety capable inputs control the internal relays, which are used to reliably switch the enabling current paths.

At the enabling current paths it is possible to connect, for example, actuators with positively guided contacts.

3.3 Product characteristics

3.3.1 Interfaces

Inputs

- 2 safety capable inputs
- Input for reset pushbutton or external device monitoring

Outputs

- 3 enabling current paths (safe)
- 2 application diagnostic outputs (not safe)
- 1 Test output (not safe)

3.3.2 Compatible sensor types

Table 2: Compatible sensor types

Sensor type	Examples
Flexi Loop safe series connection	Flexi Loop

3.3.3 Restart interlock

A restart interlock can be implemented with a reset pushbutton.

3.3.4 External device monitoring

Permanent external device monitoring can be implemented using external wiring.

3.3.5 Status indicators

LEDs

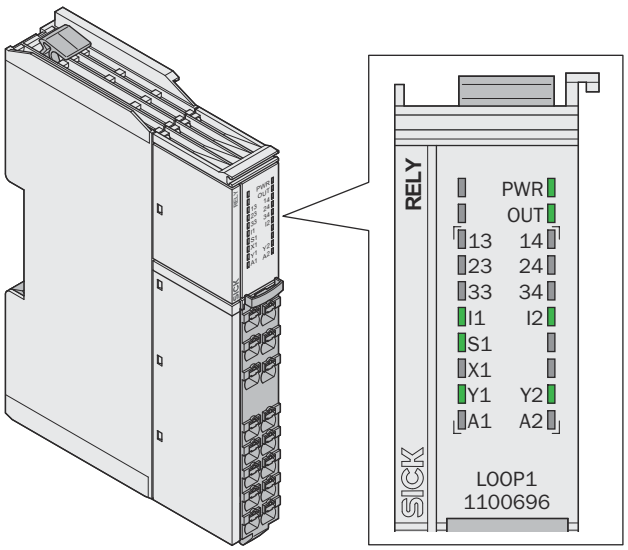


Figure 2: LEDs

The labeled positions are only partially assigned LEDs. The positions and their labels (except the top 2 lines) also indicate the assignment of the terminals on the front connector.

Table 3: Safety relay indicators

Labeling	Color	Function
PWR	Green/Red	Voltage supply
OUT	Green	Enabling current paths
I1	Green	Safety input
I2	Green	Safety input
S1	Green	Reset pushbutton input, external device monitoring (EDM)
Y1	Green	Application diagnostic output (NC)
Y2	Green	Application diagnostic output (reset required)

Further topics

- "Status indicator (LED)", page 27

4 Project planning

4.1 Manufacturer of the machine

The manufacturer of the machinery must carry out a risk assessment and apply appropriate protective measures. Further protective measures may be required in addition to the product.

The product must not be tampered with or changed, except for the procedures described in this document.

The product must only be repaired by the manufacturer of the product or by someone authorized by the manufacturer. Improper repair can result in the product not providing the expected protection.

4.2 Operating entity of the machine

Changes to the electrical integration of the product in the machine controller and changes to the mechanical mounting of the product necessitate a new risk assessment. The results of this risk assessment may require the entity operating the machine to meet the obligations of a manufacturer.

After each change to the configuration, it is necessary to check whether the protective measure provides the necessary protection. The person making the change is responsible for ensuring that the protection measure provides the necessary protection.

The product must not be tampered with or changed, except for the procedures described in this document.

The product must only be repaired by the manufacturer of the product or by someone authorized by the manufacturer. Improper repair can result in the product not providing the expected protection.

4.3 Design

Installation site

The safety relay must be installed in a control cabinet with an enclosure rating of IP54 or higher.

The safety relay must be installed on a mounting rail (35 mm) in accordance with IEC 60715.

Space requirements in the control cabinet

To ensure sufficient air circulation and cooling, sufficient distance must be kept in the control cabinet above and below the safety relay.

Sufficient distance must be kept for the connected cables before the module (front side).

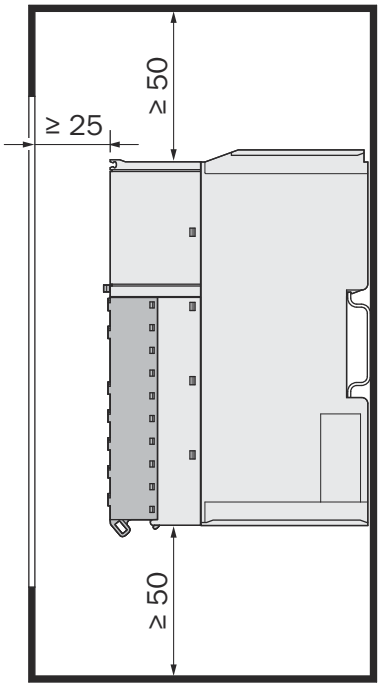


Figure 3: Distances in control cabinet

Required distance:

- Above and below the module: ≥ 50 mm
- In front of the module: ≥ 25 mm
- For spaces above and below the module of 10 mm ... 50 mm, a derating of the switching current must be taken into consideration, see "Data sheet", page 29

4.4 Electrical integration

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ► Ensure the safety relay is supplied with supply voltage in all operating statuses.
- ► Ensure that the supply voltage of the safety relay is not connected via safety sensors or safety switches in order to switch the enabling current paths.

4.4.1 Voltage supply

Prerequisites

- The power supply unit is able to jumper a brief power failure of 20 ms as specified in IEC 60204-1.
- The voltage supply and connected signals meet the requirements for SELV/PELV (EN 61140) or NEC Class 2 (UL 1310).
- The electrical voltage supply has a suitable electrical fuse.

Further topics

- "Data sheet", page 29

4.4.2 Enabling current paths

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

► Ensure the enabling current paths are supplied by the same voltage supply.

Cross-circuits

Cross-circuits between the enabling current paths or with other signals may not be detected and can put the machine in a dangerous state.

Measures:

► Lay the cables in a protected manner or separately (e.g., within the control cabinet as per IEC 60204-1).
► Take other necessary measures to achieve the required safety-related characteristic values.

4.4.3 Application diagnostic output

Application diagnostic output Y1

The signal of the Y1 application diagnostic output changes as soon as the enabling current paths switch. The application diagnostic output is not safe.

Application diagnostic output Y1 is based on the push-pull principle, meaning it can both absorb and apply current.

Table 4: Switching behavior of application diagnostic output Y1

State of enabling current paths	State of application diagnostic output Y1
Closed	LOW (NPN)
Open	HIGH (PNP)

Application diagnostic output Y2

Application diagnostic output Y2 outputs the “Reset required” signal with a frequency of 1 Hz, e.g. for the connection of a signal lamp.

Application diagnostic output Y2 is based on the push-pull principle, meaning it can both absorb and apply current.

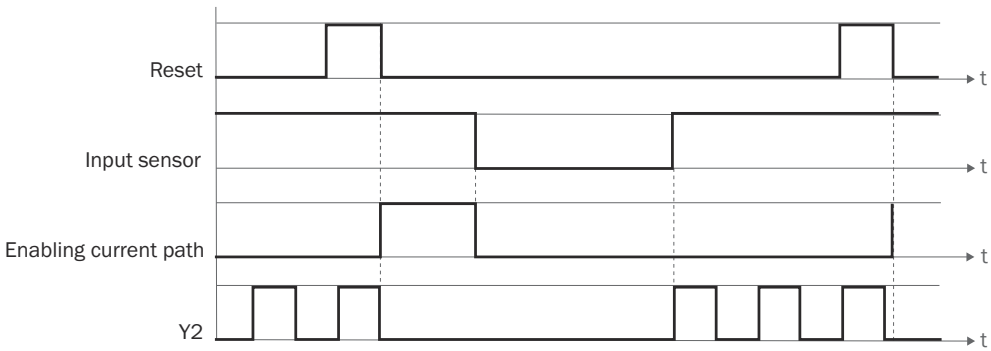


Figure 4: Sequence/timing diagram

4.4.4 Restart interlock

Important information

DANGER
Hazard due to unexpected starting of the machine
Death or severe injury

► If you connect the safety relay to an emergency stop pushbutton, you must use the restart interlock.

Restart interlock

A reset pushbutton must be connected to allow the restart interlock to be used. The reset pushbutton must be attached outside of the hazardous area. It must not be possible to access the reset pushbutton from inside the hazardous area. The entire hazardous area must be highly visible for all operators from the reset pushbutton.

Further topics

- "Device connection", page 20

4.4.5 External device monitoring (EDM)

External device monitoring (EDM)

With static external device monitoring, the safety relay tests whether the controlled actuators (contactors) have dropped out just before energizing the internal relay.

Cross-circuits

Cross-circuits within the external device monitoring (EDM) itself (e.g., before and after the contactor being monitored) or with other signals may not be detected and can put the machine in a dangerous state.

Measures:

► Lay the cables in a protected manner or separately (e.g., within the control cabinet as per IEC 60204-1).
► Take other necessary measures to achieve the required safety-related characteristic values.

Further topics

- "Device connection", page 20

4.4.6 Connection diagrams

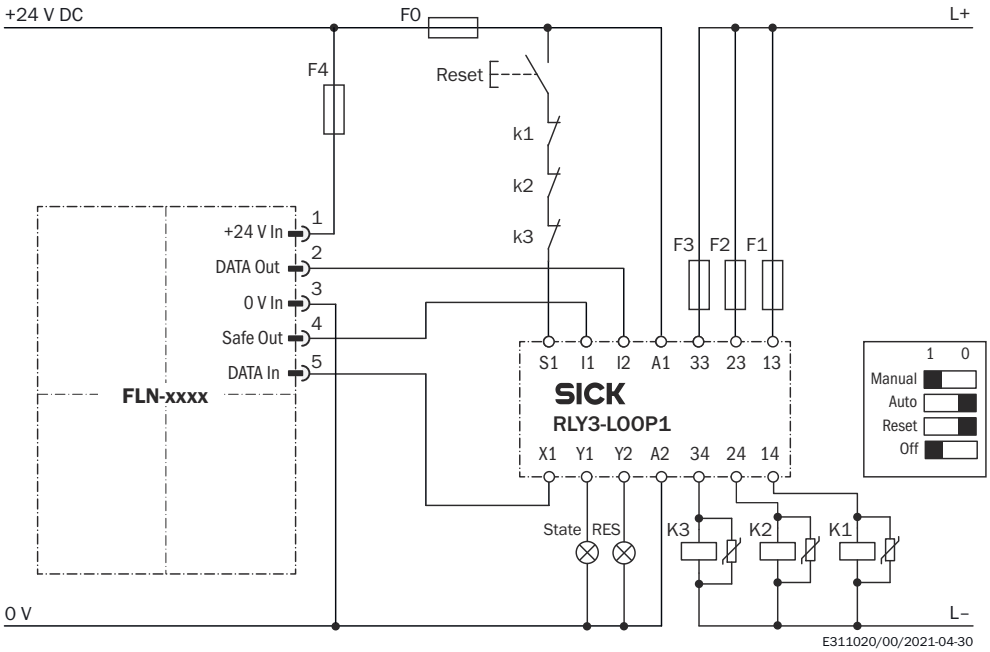


Figure 5: ReLy LOOP1 connection diagram

4.5 Testing plan

The manufacturer of the machine and the operating entity must define all required thorough checks. The definition must be based on the application conditions and the risk assessment and must be documented in a traceable manner.

The following tests must be planned:

- A thorough check must be carried out during commissioning and following modifications.
- The regular tests of the device must fulfill certain minimum requirements.

4.5.1 Planning the thorough check during commissioning and in certain situations

Overview

Before commissioning the machine and after making changes, you must check whether the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

Minimum requirements

The device and its application must be thoroughly checked in the following situations:

- Before commissioning
- After changes to the configuration or the safety function
- After changes to the mounting or the electrical installation
- After exceptional events, such as after manipulation has been detected, after modification of the machine, or after replacing components

The thorough check ensures the following:

- All relevant regulations are complied with and the device is effective in all of the machine's operating modes.
- The documentation accurately reflects the state/condition of the machine, including the protective device.

The thorough checks must be carried out by qualified safety personnel or specially qualified and authorized personnel, and must be documented in a traceable manner.

4.5.2 Planning the regular thorough check

Overview

The purpose of regular tests is to identify any defects due to changes or external influences (e.g. damage or manipulation) and to ensure that the protective measure provides the necessary protection.

Minimum requirements

The following thorough checks must be carried out at regular intervals:

- Thorough check of the housing for damage
- Thorough check of the cables for damage
- Check the device for signs of misuse or manipulation
- Thorough check of the safety function

The required interval for performing these thorough checks depends on the applicable safety capability of the overall application, see table 7, page 29.

5 Mounting

5.1 Mounting procedure

Prerequisites

- Mounting is done in accordance with EN 50274 and electrical installation in accordance with IEC 60204-1 in the control cabinet with enclosure rating IP54.
- Mounting must be done on a non-flammable base.
- Mounting is done on a 35 mm mounting rail (IEC 60715).
- The mounting rail is connected to the functional earth.
- The module is installed with a vertical orientation (on a horizontal mounting rail).
- There is at least 50 mm of space for air circulation above and below the module.
- There is at least 25 mm of space in front of the module (front side). More space may be needed depending on the connections.

Procedure

1. Attach module to mounting rail.

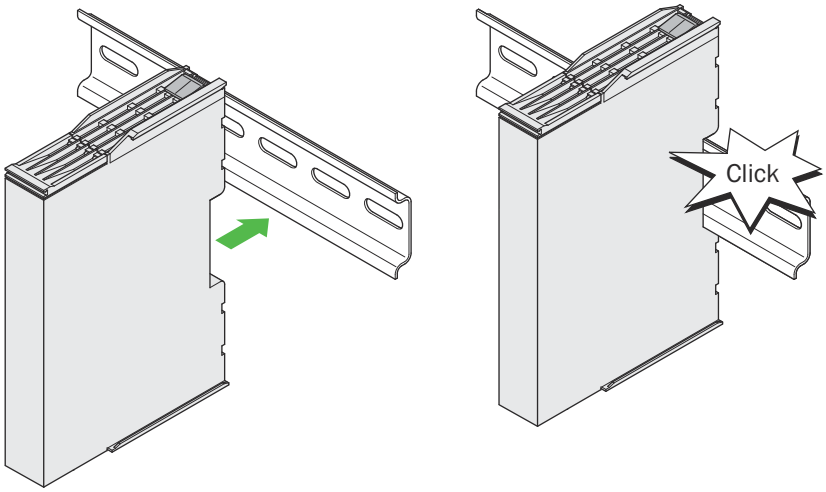


Figure 6: Mounting

✓ The module engages with an audible click.

2. Attach the end clamps on the mounting rail on the left and right of the module.

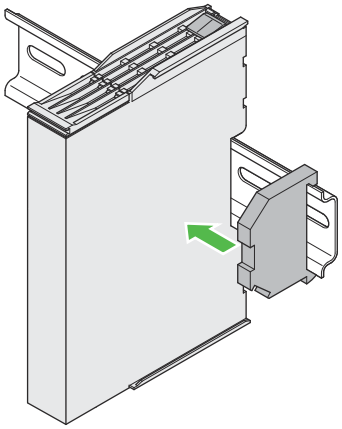


Figure 7: Mounting the end clamps

5.2 Disassembly

Prerequisites

- Electrician screwdriver (slotted screwdriver)

Procedure

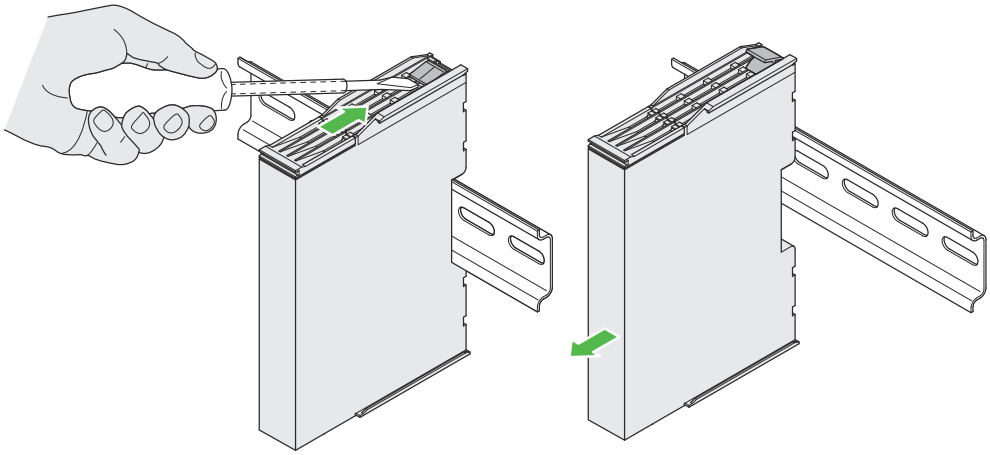


Figure 8: Disassembly

1. Press the unlocking mechanism on the upper side of the module towards the back using the electrician screwdriver.
2. Loosen module from the mounting rail.

5.3 Module exchange

Procedure

1. Disconnect module and the connected components from all voltage sources.
2. Take front connector with connected cables off the defective device: Press the unlocking mechanism of the front connector downwards and pull out the front connector.

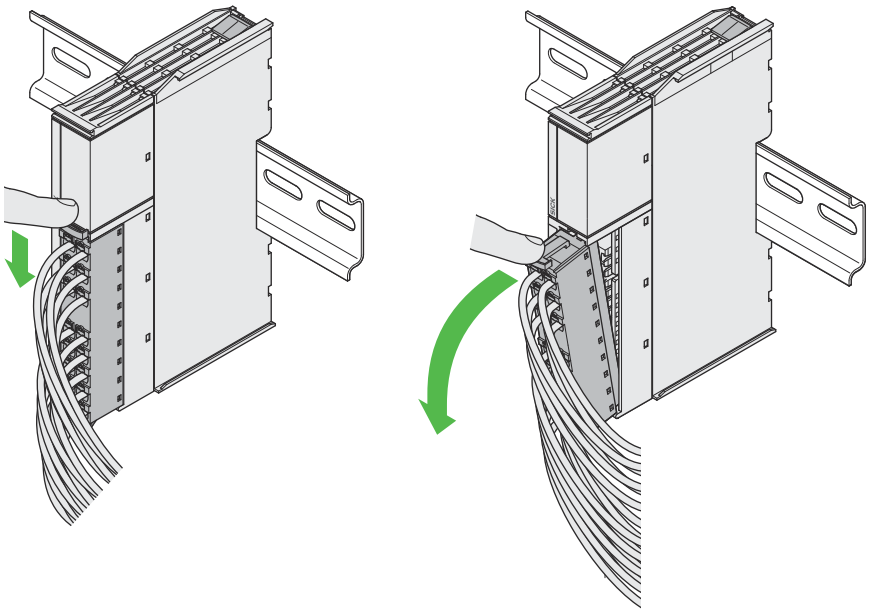


Figure 9: Removing the plug

3. Dismantle the defective module.
4. Mount new module.
5. Mount front connector with connected cables to the new module: First mount in the module with bent hook and then engage in the housing.

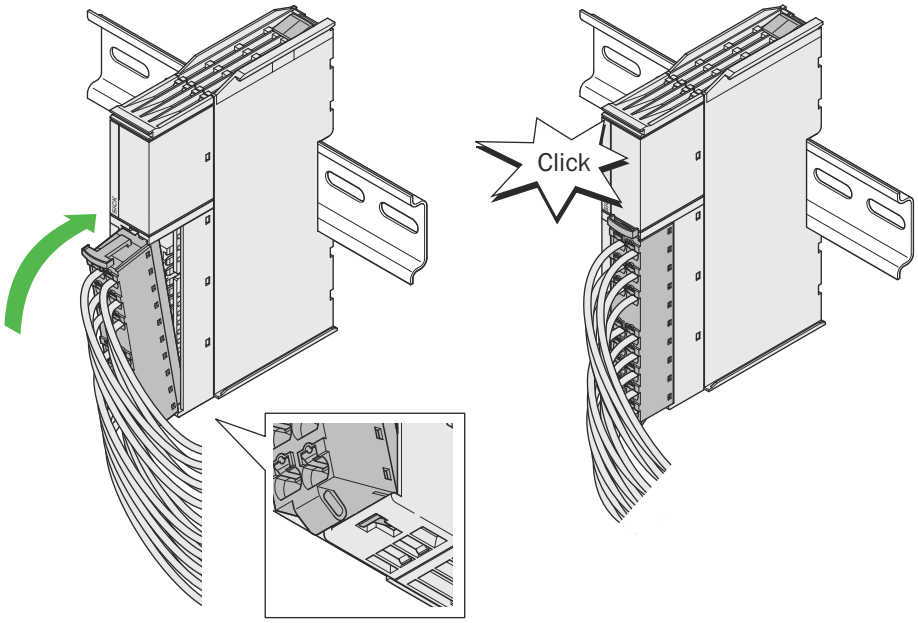


Figure 10: Mount the front connector

✓ The front connector engages with an audible click.

6 Electrical installation

6.1 Device connection

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ► Ensure the safety relay is supplied with supply voltage in all operating statuses.
- ► Ensure that the supply voltage of the safety relay is not connected via safety sensors or safety switches in order to switch the enabling current paths.

Prerequisites

- Electrical installation is carried out according to the project planning.
- Dangerous condition of the machine is and remains off during the electrical installation.
- Electrical installation is done in conformity with IEC 60204-1.
- The mounting rail is connected to the functional earth.
- The safety outputs and external device monitoring (EDM) must be wired within the control cabinet.
- When using the safety relay with voltages larger than the safety extra-low voltage: The N/C contacts of the controlled contactors must be safely isolated from the other contactor contacts.
- Enabling current paths are safely isolated from the other terminals. There is a basic insulation between the enabling current paths.
- The ground connection of all connected devices must have the same potential as A2.

Pin assignment

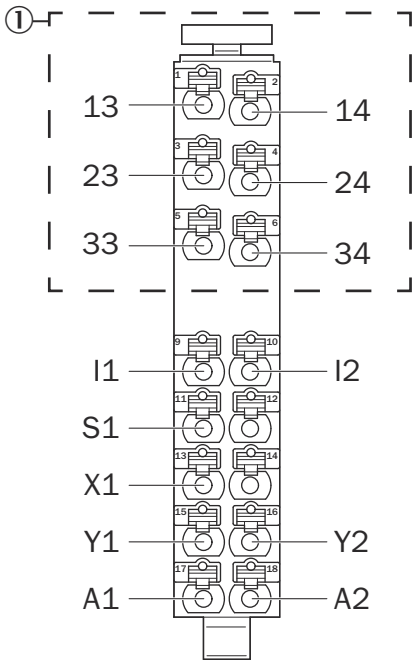


Figure 11: Terminals on front connector

① Safe isolation of the enabling current paths from the other terminals

Table 5: Pin assignment of the terminals

Terminal	Description
13, 14	Enabling current path
23, 24	Enabling current path
33, 34	Enabling current path
I1	Safety input (Flexi Loop: SAFE_OUT)
I2	Safety input (Flexi Loop: DATA_OUT)
S1[1)]	Reset pushbutton input, external device monitoring (EDM)
X1	Test output (Flexi Loop: DATA_IN)
Y1	Application diagnostic output (NC)
Y2	Application diagnostic output (reset required)
A1	24 V DC voltage supply
A2	Voltage supply 0 V DC

1)
- Use with restart interlock, with external device monitoring (EDM): Connect the N/C contacts of the actuators between voltage supply U_V, the N/O contact of the reset pushbutton and S1.
- Use with restart interlock, without external device monitoring (EDM): Connect the N/O contact of the reset pushbutton between S1 and voltage supply U_V.
- Use without restart interlock, with external device monitoring (EDM): Connect the N/C contacts of the actuators between U_V and S1.
- Use without restart interlock, without external device monitoring (EDM): Connect U_V and S1 with a wire jumper.

Complementary information

To protect and increase the service life of contact outputs, equip all connected loads with varistors or RC elements. The response times will increase depending on the suppressor used.

Further topics

- "Connection diagrams", page 15
- "Data sheet", page 29
- "Electrical integration", page 12

7 Configuration

7.1 DIP switch

The safety relay is configured via four DIP switches. The DIP switches are attached to the side of the safety relay.

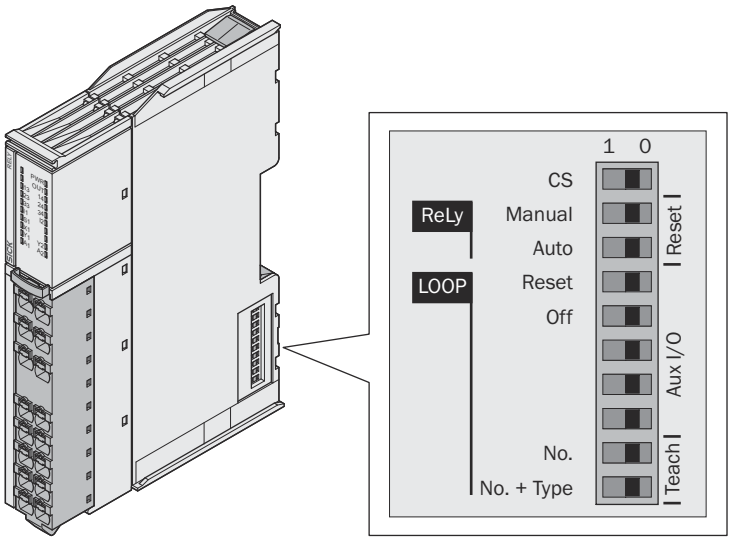


Figure 12: DIP switch

7.2 Configuring ReLy reset

Overview

The following reset options for the safety relay are available:

- Manual
  For manual reset, a pushbutton is connected between the input S1 and the supply voltage U_V. Pressing the pushbutton manually for min. 140 ms triggers a valid reset sequence at the S1 input.
- Auto
  For automatic reset, the S1 input and the supply voltage U_V are connected with a wire jumper. This automatically triggers a valid reset sequence at the S1 input. There is no restart interlock.

Important information

WARNING
Unexpected machine start-up due to automatic reset without restart interlock

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

► Take other protective measures to make sure that there is no one inside the hazardous area.

Prerequisites

- The safety relay is disconnected from the voltage supply.
- The device connection is tailored to the reset option.

Procedure

► Set the DIP switch for the desired reset option to position 1.

Complementary information

You must configure one option only otherwise the device will go into an error status.

Further topics

- "Activating configuration", page 24
- "Device connection", page 20

7.3 Configuring Flexi Loop reset

Overview

You can connect a reset signal to the AUX_IN input of the Flexi-Loop node. You can set a flashing signal at the AUX_OUT output of the Flexi Loop node.

The following options for the reset signal on the safe series connection are available:

- **Reset**: The AUX_IN input and the AUX_OUT output of the Flexi Loop node are active (Flexi Loop reset active).
- **Off**: The AUX_IN input and the AUX_OUT output of the Flexi Loop node are inactive (Flexi Loop reset inactive).

Prerequisites

- The safety relay is disconnected from the voltage supply.
- If you configure the “Reset” Flexi Loop reset option, then only the “Auto” ReLy reset option is allowed.

Procedure

► Set the DIP switch for the desired reset option to position 1.

Complementary information

You must configure one option only otherwise the device will go into an error status.

Further topics

- "Activating configuration", page 24
- "Device connection", page 20

7.4 Configuring Flexi Loop monitoring

Overview

The following options for monitoring the Flexi Loop node are available:

- Number
  The safety relay saves the number of connected Flexi Loop nodes when switched on for the first time. If the number of Flexi Loop nodes changes at a later time, the safety relay reports an error.
- Number + type
  The safety relay saves the number and the type (EMSS / OSSD) of the connected Flexi Loop nodes when switched on for the first time. If the number or the type of the Flexi Loop nodes changes at a later time, the safety relay reports an error.

Prerequisites

The safety relay is disconnected from the voltage supply.

Procedure

► Set the DIP switch for the desired monitoring option to position 1.

Complementary information

You must configure one option only otherwise the device will go into an error status.

Whenever the safety relay configuration changes, the Flexi Loop monitoring is taught-in again and the Flexi Loop series connection initialized. This results in a delay in the safety relay start when the configuration is changed.

Further topics

- "Activating configuration", page 24

7.5 Activating configuration

Prerequisites

- The Flexi Loop safe series connection is connected to the safety relay.
- The safety relay is disconnected from the voltage supply.

Procedure

You must activate the configuration after configuration is complete. After activation, the safety relay will detect the configuration.

1. Set the CS switch to the corresponding position to activate the configuration:
   - If the CS switch is in position 0, set the CS switch to position 1.
   - If the CS switch is in position 1, set the CS switch to position 0.
2. Connect the safety relay to the supply voltage.

✓ If configuration is successful, the LEDs of safety relay 2 × light up one after another, from top to bottom.

Complementary information

- The initialization of the safety relay may take several seconds depending on the length of the Flexi Loop series connection.
- You only have to complete configuration once and activate the successful configuration process. If a configuration is faulty, you can fix the error without reactivating the configuration.
- If a configuration is already valid and becomes invalid at a later time (e.g., as a result of an inadvertent change to the DIP switch position), you need to correct the error and then reactivate the configuration.
- For module exchange, it can be helpful if the CS switch is at 1 at the end of configuration. The DIP switch positions are then transferable to the new module when replacing a module.

7.6 Resetting the configuration

Prerequisites

The safety relay is disconnected from the voltage supply.

Procedure

1. Set all DIP switches to position 0.
2. Connect the safety relay to the supply voltage.

✓ The PWR LED flashes red (1 Hz).

8 Commissioning

8.1 Safety

DANGER
Dangerous state of the machine

During commissioning, the machine or the protective device may not yet behave as you have planned.

► Make sure that there is no-one in the hazardous area during commissioning.

8.2 Check during commissioning and modifications

The thorough check is intended to ensure that the safety functions are fulfilling their planned purpose and whether persons are being adequately protected.

► Carry out the checks specified in the test plan of the manufacturer of the machine and the operating entity.

9 Troubleshooting

9.1 Safety

DANGER
Hazard due to lack of effectiveness of the protective device

In the case of non-compliance, it is possible that the dangerous state of the machine may not be stopped or not stopped in a timely manner.

- ► Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- ► If a machine fault cannot be definitively determined or safely rectified, immediately shut the machine down.
- ► Secure the machine so that it cannot switch on unintentionally.

NOTE
Additional information on troubleshooting is available from your SICK subsidiary.

9.2 Status indicator (LED)

Status indicator (LED)

Table 6: Fault indicators and operational statuses

LED	Status	Possible cause
PWR	○	No supply voltage
All LEDs	☼ All colors	Initialization with LED test
PWR	● Green	No fault
PWR	☼ green (1 Hz)	The Flexi Loop parameters to be monitored are read in.
PWR	☼ Red (2 Hz)	• Supply voltage too low temporarily or permanently • Internal error
PWR	☼ Red (1 Hz)	Configuration is invalid
PWR	☼ Red/green	Error Additional LEDs flash for accurate diagnosis.
OUT	○	Enabling current paths open
OUT	● Green	Enabling current paths closed
OUT	☼ green (1 Hz)	Error in enabling current path
S1	● Green	Reset pushbutton actuated, N/C contact of the actuator closed
I1	○	• Flexi Loop is not initialized yet. • The Flexi Loop series connection requested the safety function
I1	● green	Flexi Loop is initialized and closing the enabling current paths is possible.
I2	☼ green (1 Hz)	Flexi Loop safe series connection is not in operation and a recoverable external error is present. ► Check the cabling. ► Check the number and type of Flexi Loop nodes.
I2	☼ green (2 × flashing every 2 s)	Flexi Loop safe series connection is being initialized.
I2	● green	Flexi Loop is initialized.
Y1	○	Enabling current paths closed
Y1	● Green	Enabling current paths open
Y2	○	Output with LOW status
Y2	☼ Green	Reset required
Y2	● Green	Reset pushbutton actuated

Complementary information

- "Configuration", page 22

10 Decommissioning

10.1 Disposal

Procedure

► Always dispose of unusable devices in accordance with national waste disposal regulations.



Complementary information

SICK will be glad to help you dispose of these devices on request.

11 Technical data

11.1 Data sheet

Safety-related parameters

The required safety-related characteristic value depends on the application.

Table 7: Safety-related parameters

Safety integrity level (IEC 61508)	SIL 3	SIL 2	SIL 1
Safety integrity level (IEC 62061)	SIL 3	SIL 2	SIL 1
Category (ISO 13849)	4	3	3
Performance level (ISO 13849)	PL e	PL d	PL c
Hardware error tolerance	1		
Maximum test interval of the safety function	1 month	1 year	–
$MTTF_D$ (single channel) (ISO 13849-1) [1]	300 years	100 years	100 years
PFH_D (mean probability of a dangerous failure per hour) [1]			
For operating heights ≤ 2,000 m above sea level	1.5×10^{-9}	1.5×10^{-8}	1.5×10^{-7}
For operating heights 2,000... 4,000 m above sea level	7.5×10^{-9}	7.5×10^{-8}	1.5×10^{-7}
PFD_{avg} (mean probability of a dangerous failure on demand)			
For operating heights ≤ 2,000 m above sea level	7.5×10^{-5}	7.5×10^{-4}	7.5×10^{-3}
For operating heights 2,000... 4,000 m above sea level	4×10^{-4}	4×10^{-3}	7.5×10^{-3}
T_M (mission time) (ISO 13849)	20 years (ISO 13849-1)		
Safe status when a fault occurs	The normally open is open; in other words, the safety-related enabling current paths are interrupted.		
Stop category	0 (IEC 60204-1)		

1) To achieve the safety-related characteristic values, the service life curve of the safety contacts must be taken into consideration.
The maximum number of switching operations should be applied to the mission time T_M.
Mean number of switching operations per year = switching operations based on the service life curve/T_M
As long as the mean number of allowed switching operations per year and the number of allowed switching operations during the mission time T_M has not been reached, the safety-related characteristic values do not depend on the switching frequency if the service life curve is adhered to. $B10_d$ has already been taken into consideration when calculating the safety-related characteristic values.
Service life curve, see figure 14, page 35

Mechanical data

Table 8: Mechanical data

Weight	160 g
Mounting	Mounting rail (IEC 60715)
Connection type	Spring terminals
Stripping length	8 mm
Wire cross-section	
Single wire (1×)	0.14 mm² ... 1.5 mm²
Fine wire (1×)	0.14 mm² ... 1.5 mm²
Fine wire with ferrules (2 ×, same cross-section) with TWIN ferrule with plastic collar	≤ 0.5 mm²
Fine wire with ferrules with or without collar (1×)	0.25 mm² ... 1.0 mm²
For UL and CSA applications	26 AWG ... 14 AWG Use copper conductors only min. rated for 85 °C.
Vibration resistance (EN EN 60068-2-6)	1 g, 5 Hz ... 200 Hz
Shock resistance (EN 60068-2-27)	
Shock resistance, single shock	25 g, 6 ms, 3 pulses
Shock resistance, continuous shock	15 g, 11 ms, 500 pulses

Electrical data

Table 9: Operating data

Supply voltage V_S	24 V DC (16.8 V DC ... 30 V DC) (safety extra-low voltage) [1]
Rated voltage	+24 V DC
Residual ripple U_{ss}	2.4 V
Power consumption	≤ 2.5 W
Short-circuit protection	Max. 4 A Safety fuse with triggering characteristic: slow-blow UL/CSA applications: UL-listed fuse according to UL 248-14 required
Power-up delay after supply voltage is applied (if configuration was successful)	≤ 5 s [2]

1) The external voltage supply must be capable of bridging a brief power failure of 20 ms as specified in IEC 60204-1. Suitable power supply units are available as accessories from SICK.
Protect supply voltage against short-circuit.

2) The power-up delay doubles with a new configuration.

Table 10: Inputs (I1, I2, S1)

Input voltage HIGH	24 V DC (11 V DC ... 30 V DC)
Input voltage LOW	0 V DC (–3 V DC ... 5 V DC)
Input capacitance	≤ 15 nF
Input current	4 mA ... 6 mA
Reset time	

Manual	≤ 250 ms
Automatic	≤ 250 ms
Actuation time of reset button	140 ms ... 30 s
Concurrence monitoring	≤ 3,000 ms
Length of cable (single)	≤ 100 m

Table 11: Test pulse output (X1)

Type of output	PNP semiconductor output, short-circuit protected
Output voltage	(U_V – 3 V) ... U_V
Test pulse interval	40 ms
Test pulse width	2 ms
Length of cable (single)	≤ 100 m
Conductor resistance	≤ 10 Ω

Table 12: Application diagnostic output (Y1, Y2)

Type of output	Push-pull semiconductor output, short-circuit protected
Output voltage HIGH	(U_V – 3 V) ... U_V
Output voltage LOW	0 V ... 3 V
Input current (NPN)	≤ 15 mA
Output current (PNP)	≤ 120 mA

Table 13: Enabling current path (13/14, 23/24, 33/34)

Response time (opening of enabling current paths) Flexi Loop nodes and ReLy	≤ 79 ms
Number of enabling current paths (normally open, safe)	3
Contact type	Positively guided
Contact material	Silver alloy, gold flash plated
Switching voltage	
At altitudes below 2,000 m above sea level	10 V DC ... 250 V DC 10 V AC ... 250 V AC
At altitudes 2,000 m above sea level ... 4,000 m above sea level	10 V DC ... 150 V DC 10 V AC ... 150 V AC
Switching current (Space above and below the module ≥ 50 mm)	10 mA ... 6 A see figure 13, page 34 see figure 14, page 35
Switching current (Space above and below the module 10 mm ... 50 mm)	10 mA ... 3 A see figure 13, page 34 see figure 14, page 35
Total current (Clearance below and above the module ≥ 50 mm)	≤ 12 A
Total current (space above and below the module 10 mm ... 50 mm)	≤ 6A

Utilization category	AC-15: 230 V, 5 A (IEC 60947-5-1) DC-13 (0.1 Hz): 24 V, 4 A (IEC 60947-5-1)
DC switching capacity	0.1 W ... 200 W see figure 13, page 34
AC switching capacity	0.1 VA ... 1,500 VA
Switching frequency	≤ 1 Hz
Mechanical service life	10 × 10^6 switching operations
Contact fuse with safety fuse gG or circuit breaker C	Max. 6 A
Max. short-circuit protection	≤ 400 A

Table 14: Insulation coordination – enabling current paths (13/14, 23/24, 33/34) to the 24 V circuit

Type of insulation (IEC 60947-1)	Safe electrical separation
Air and creepage distances between the insulated circuits	≥ 5.5 mm
Rated insulation voltage	
At altitudes up to 2,000 m above sea level	250 V AC
At altitudes up to 2,000 m above sea level ... 4,000 m above sea level	150 V AC with overvoltage category III 250 V AC with overvoltage category II
Rated impulse withstand voltage U_{imp}	
At altitudes up to 2,000 m above sea level	6 kV
At altitudes up to 2,000 m above sea level ... 4,000 m above sea level	4 kV

Table 15: Insulation coordination – enabling current paths (13/14, 23/24, 33/34) amongst each other

Type of insulation (IEC 60947-1)	Basic insulation
Air and creepage distances between the insulated circuits	≥ 3 mm
Rated insulation voltage	
At altitudes up to 2,000 m above sea level	250 V AC
At altitudes up to 2,000 m above sea level ... 4,000 m above sea level	150 V AC with overvoltage category III 250 V AC with overvoltage category II
Rated impulse withstand voltage U_{imp}	
At altitudes up to 2,000 m above sea level	4 kV
At altitudes up to 2,000 m above sea level ... 4,000 m above sea level	2.5 kV

Ambient data

Table 16: Ambient data

Enclosure rating (IEC 60529)	IP20 (IEC 60529) [1]
Pollution degree (IEC 61010-1)	2 (IEC 60947-1)
Ambient operating temperature	

At altitudes up to 2,000 m above sea level (UL/CSA: surrounding air temperature)	–25 °C ... +55 °C
At altitudes 2,000 m above sea level ... 3,000 m above sea level	–25 °C ... +50 °C
At altitudes 3,000 m above sea level ... 4,000 m above sea level	–25 °C ... +45 °C
Storage temperature	–25 °C ... +70 °C
Operating altitude	Max. 4,000 m above sea level
Air humidity	10% ... 95%, non-condensing for climatic conditions according to IEC 61131-2
Emitted interference	According to IEC 61000-6-4
Immunity to interference	According to IEC 61326-3-1 According to IEC 61000-6-2 According to IEC 60947-5-1

1) Prerequisite: The front plug is mounted.

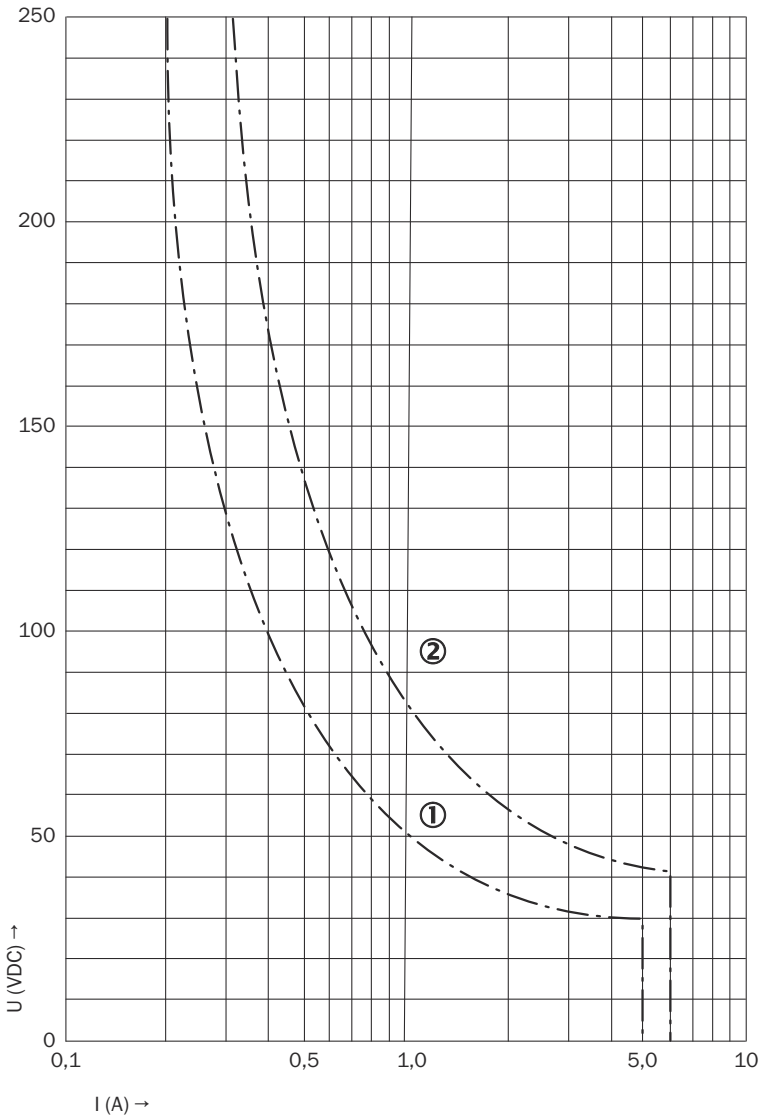


Figure 13: Breaking capacity without continuous arcing

① Inductive load L/R 40 ms

② Resistive load

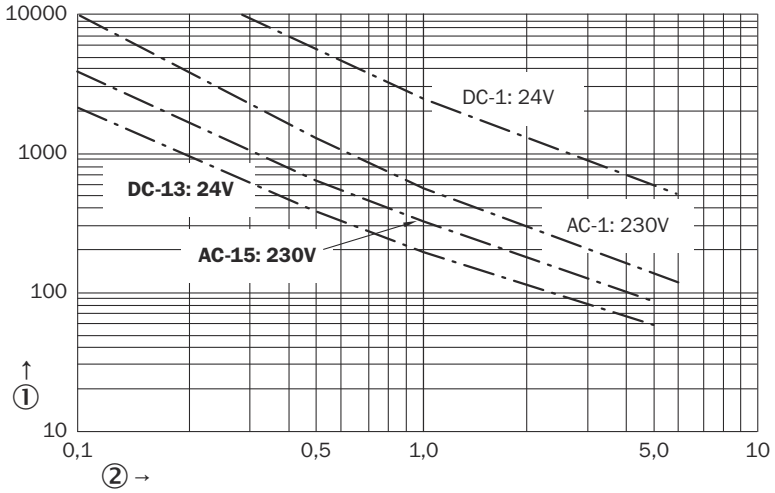


Figure 14: Electrical endurance of contacts 13/14, 23/24 and 33/34

① Switching operations × 1,000

② Switching current (A)

11.2 Dimensional drawings

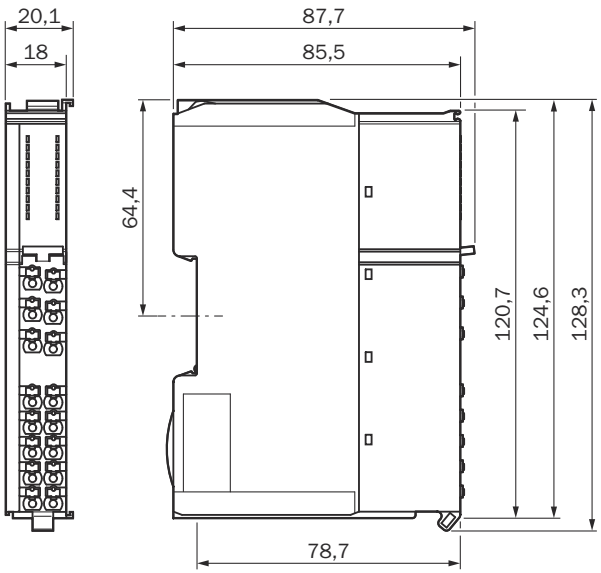


Figure 15: Dimensional drawing

11.3 Internal circuitry

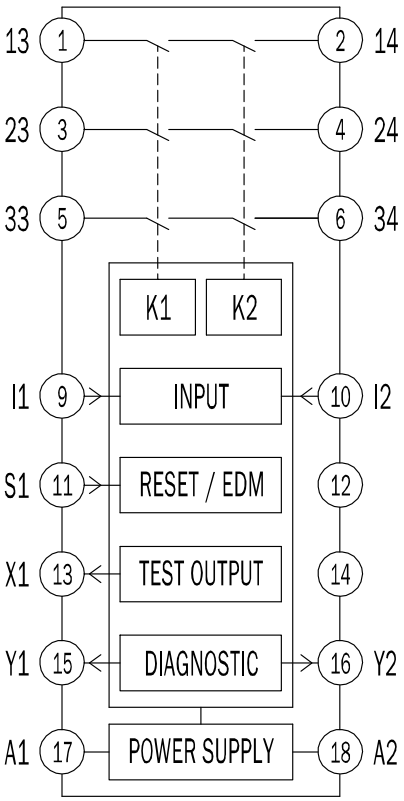


Figure 16: Internal circuitry

12 Ordering information

12.1 Ordering information for ReLy

Table 17: Ordering information

Part	Usage	Type code	Part number
ReLy OSSD1	Opto-electronic protective devices	RLY3-OSSD100	1085343
ReLy OSSD2	Opto-electronic protective devices, magnetic safety switches	RLY3-OSSD200	1085344
ReLy OSSD3	Opto-electronic protective devices, magnetic safety switches	RLY3-OSSD300	1099969
ReLy OSSD4	Opto-electronic protective devices	RLY3-OSSD400	1099971
ReLy EMSS1	Interlock safety switch	RLY3-EMSS100	1085345
ReLy EMSS3	Safety switches	RLY3-EMSS300	1099973
ReLy HAND1	Two-hand control units, type III C (IEC 13851)	RLY3-HAND100	1085346
ReLy TIME1	Safety switches, opto-electronic protective devices, magnetic safety switches	RLY3-TIME100	1100688
ReLy MULT1	Opto-electronic protective devices, safety switches, magnetic safety switches, safety pressure mats	RLY3-MULT100	1100692
ReLy LOOP1	Flexi Loop safe series connection	RLY3-LOOP100	1100696

13 Annex

13.1 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

13.1.1 EU declaration of conformity

Excerpt

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.

- ROHS DIRECTIVE 2011/65/EU
- EMC DIRECTIVE 2014/30/EU
- MACHINERY DIRECTIVE 2006/42/EC

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