OPERATING INSTRUCTIONS

TR10 Lock

Safety locking device

SICK
Sensor Intelligence.

Described product

TR10 Lock

Manufacturer

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Germany

Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Function of this document

These operating instructions contain the information needed during the life cycle of the safety locking device.

These operating instructions must be made available to all people who work with the safety locking device.

1.2 Scope

Product

This document applies to the following products:

- Product code: TR10 Lock
- “Operating instructions” type label entry: 8019930

Document identification

Document part number:

- This document: 8019972
- Available language versions of this document: 8019930

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

1.3 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

1.4 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes 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
Indicates useful tips and recommendations.

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

Product integration

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

When used in conjunction with a movable physical guard and the machine controller, the safety locking device prevents the protective device from being opened while a dangerous machine function is being executed.

The safety locking device may only be used on the machine on which it was configured, mounted, installed, and commissioned by qualified safety personnel in accordance with these operating instructions.

Incorrect use, improper modification of or tampering with the safety locking device will invalidate any warranty from SICK AG; in addition, any responsibility and liability of SICK AG for damage and secondary damage caused by this is excluded.

NOTE
The safety locking device is also suitable for process protection.

2.3 Improper use

Among others, the safety locking device is **not** suitable for the following applications:

- Radioactivity (exception: natural radioactivity)
- Vacuum or high pressure
- High UV load
- In the vicinity of low-frequency RFID devices

- In the vicinity of magnetic fields
- Ferromagnetic background

Among others, the safety locking device is only suitable for the following applications with restrictions:

- In the vicinity of flying metal particles (see "Mounting near metal particles", page 15).

2.4 Requirements for the qualification of personnel

The safety locking device must be planned in, installed, connected, commissioned, and serviced only by qualified safety personnel.

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.

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 Setup and function

The safety locking device is an interlocking device with a lock consisting of a non-contact safety switch and a coded actuator. Depending on the product variant, the actuator either has a low (universally coded) or high (unique coded) coding level.

If the protective device is closed, the actuator is led to the safety switch. If the actuation field is reached, the actuator code is read out and evaluated by RFID. If the code is valid, the application diagnostic output switches to the OFF state. When a locking command is active, the locking pin in extended. Not until the locking pin is detected in the correct position in the actuator by the integrated proximity sensor is the locking successful and the safe output signal switching device (OSSD) are switched in the ON state.

The safety locking device can only be locked when the protective device is closed.

The locking pin is actuated by a bistable magnetic solenoid. As a result, the safety locking device has a low power consumption and does not give off any heat. The safety locking device function is nevertheless implemented according to the power to release or power to lock principle via the electronics.

3.2 Product characteristics

3.2.1 Product variants

The safety locking device is delivered in different variants. An overview of important distinguishing features between the variants is provided below.

- Designed according to “power to release” or “power to lock” principle
- Versions for universally coded or unique coded actuators
- Cable with M12 plug connector (0.2 m) or flying leads (3 or 10 m)

Complete overview of all variants: see "Ordering information for TR10 Lock", page 39

Variant according to “power to release” principle

- Activate lock: no voltage at lock input
- Deactivate lock: voltage at lock input

If voltage is interrupted, the locking device remains locked and the protective device cannot be opened immediately.

Variant according to “power to lock” principle

- Activate lock: voltage at lock input
- Deactivate lock: no voltage at lock input

When the voltage is interrupted, the lock is deactivated and the protective device can be opened immediately.

DANGER

Hazard due to lack of effectiveness of the protective device

If the voltage drops, the safety locking device deactivates regardless of whether the dangerous state of the machine has ended

▶ Assess the accident risk. The device must be configured correctly in order to be used for protection of personnel.

Variant for universally coded actuators

All universally coded actuators are accepted. No teach-in is required.

Variant for unique coded actuators

A unique coded actuator must be taught in during commissioning. Up to 8 actuators can be taught in one after another. Only the most recently taught-in actuator is valid.

When teaching in an actuator, the safety locking device can be permanently coded (optional). If the safety locking device is permanently coded, no further actuators can be taught in. This cannot be undone.

3.2.2 OSSD

Output signal switching device: signal output for the protective device, which is used for stopping the dangerous movement.

An OSSD is a safety switching output. The functionality of each OSSD is tested periodically. OSSDs are always connected in pairs and must undergo dual-channel analysis for safety reasons. An OSSD pair is formed from 2 OSSDs that are connected and analyzed together.

3.3 Manual deactivation

In some situations, it may be necessary to deactivate the lock manually (e.g., in the event of faults). A functional test must be carried out after the lock has been deactivated.

Mechanical unlocking mechanism

In the event of functional faults, the safety locking device can be deactivated with the mechanical unlocking mechanism regardless of the state of the electromagnet. The mechanical unlocking mechanism is not suitable for emergency release or escape release.

When the mechanical unlocking mechanism is actuated, the lock is deactivated and the OSSDs switch off. This must generate a stop command.

Actuating the mechanical unlocking mechanism

- ▶ Guide a screwdriver with a max. diameter of 2.5 mm through the actuator and push the guard locking pin into the safety locking device.
- ✓ The lock is deactivated. The safety locking device switches to the fault state (DIAG light emitting diodes flash red).

After using the mechanical unlocking mechanism, disconnect the voltage supply from the safety locking device and then reconnect. The safety locking device restarts.

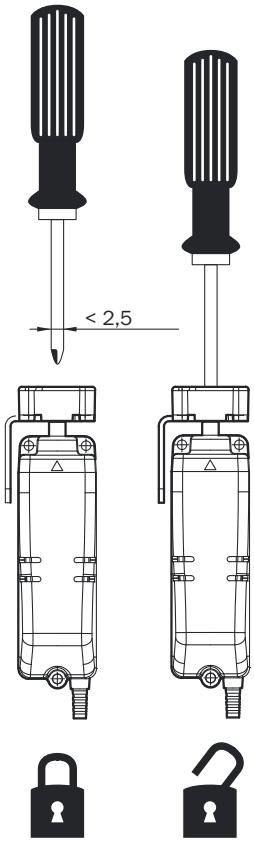


Figure 1: Mechanical unlocking mechanism

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.

Observe EN ISO 14119 for using interlocking devices associated with physical guards.

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 not be repaired. Defective products must be replaced.

Restrict access to replacement actuators, so they cannot be used for bypassing.

4.3 Assembly

DANGER

Bypassing the protective device

Hazard due to lack of effectiveness of the protective device

- Prevent any incentives to tamper with the safety locking device; for example, with the following measures:
  - Variant for universally coded actuators only:
  - Cover the safety switch and the actuator with additional equipment or protect them against access.

Actuation direction

The safety locking device can be actuated from all 4 horizontal directions.

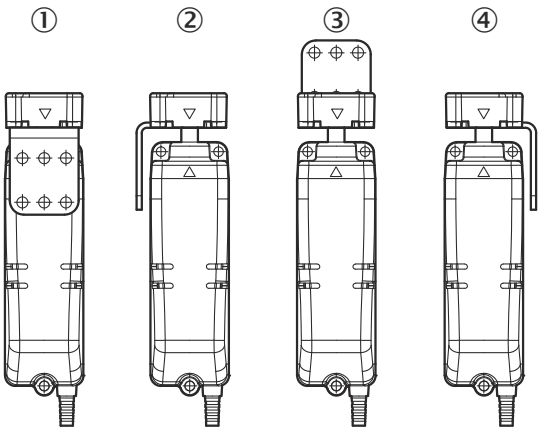


Figure 2: Possible actuation directions

① From front
② From left
③ From rear
④ From right

The safety locking device is **not** suitable for vertical actuation. The lock does **not** prevent the actuator being moved upward out of the response range.

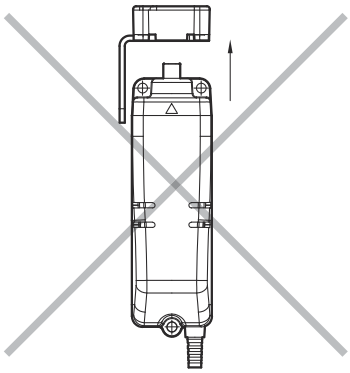


Figure 3: No vertical lock

Distance

When several safety locking devices are mounted to the machine, they must be mounted at a distance of at least 200 mm to one another.

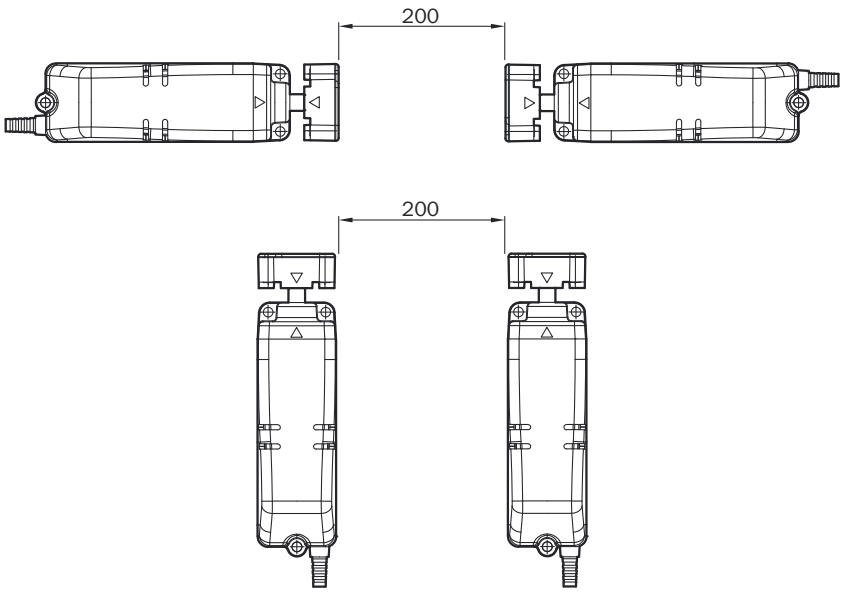


Figure 4: Min. distance for multiple safety switches

Alignment

The safety locking device can be mounted in any alignment.

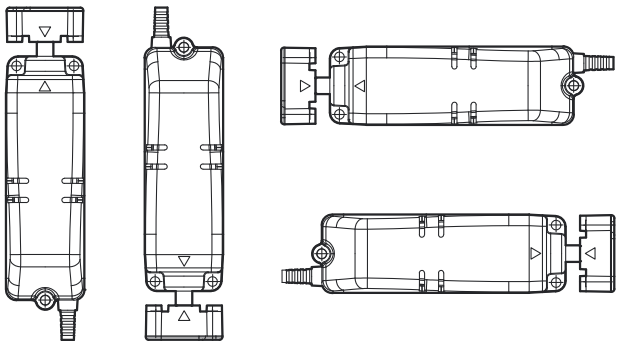


Figure 5: Possible alignment of the safety locking device

Mounting bracket for actuator

When mounting the device, the mounting bracket included with delivery must be used. If other mounting brackets are used or the supplied mounting bracket manipulated, safe functioning cannot be ensured.

Mounting of switch and actuator on the same level

If the switch and actuator are mounted on the same level, it must ensured that there is 6 mm of deviation between the mounting levels of the safety switch and the mounting bracket of the actuator.

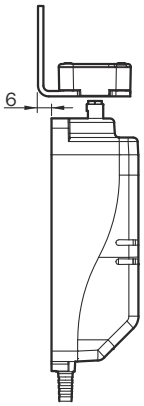


Figure 6: Deviation between mounting levels of the safety switch and the actuator

Mounting at CIP (Clean-In-Place)

The enclosure rating of the safety locking device is classified with IP69 in accordance with IEC 60529. The standard stipulates a short thorough check with 80 °C water under high pressure. The IP69 enclosure rating guarantees neither protection from liquids other than water nor durability at regular and ongoing exposure.

However, this safety locking device is designed for CIP applications, e.g. through the use of materials resistant to common alkaline cleaning agents.

For maximum service life, the safety locking device must be mounted upside down and the plug must be removed from the actuator. This ensures the best possible discharge of liquids and protects the locking pin mechanics.

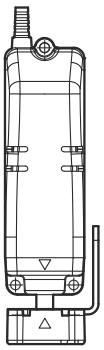


Figure 7: Ideal mounting direction for CIP applications

Mounting near metal particles

Metal particles (chips or dust) can impair the safety locking device. When metal particles collect on the locking pin, it can lead to locking pin blockage and to failure of the safety locking device in the long term. Ferromagnetic particles from permanent magnets in particular are drawn to the locking pin. Observe the following when using the safety locking device near metal particles:

- Protect the safety locking device from metal particles with constructive measures, e.g.:
  - Shielding with protective plates
  - Select the mounting site so that the safety locking device is not exposed to metal particles, e.g. at some distance to the source of metal particles or outside the room.
- If constructive measures cannot prevent the safety locking device from coming into contact with metal particles, the safety locking device must be checked and cleaned regularly before metal particles can collect on the locking pin.

4.3.1 Measures against accidental damage

You can use the following measures to avoid unintentional damage to the safety switch:

- Select the mounting location so that the safety switch is protected from impacts and mechanical pressure.
- Fit an additional stop for the door. The safety switch must not be used as a stop.

4.3.2 Measures against manipulation

The safety switch must not be defeated (contacts jumpered), rotated away, removed, or rendered ineffective in any other way. You must put measures in place, if necessary, to reduce the possibilities for circumventing the device.

4.4 Integrating into the electrical control

Switch-on commands which bring about a dangerous state of the machine must not be enabled until the protective device is closed and the lock is activated. The lock must not be deactivated until the dangerous state has ended. Depending on the safety concept, the signal is analyzed by, e.g., safety relays or a safety controller.

The connected controller and all devices responsible for safety must comply with the required performance level and the required category (for example according to ISO 13849-1).

4.4.1 Lock

The logic to generate a locking command with the control changes depending on the product variant selected.

Variant according to “power to release” principle

To lock, make sure there is no voltage at the “lock input” contact (locking command active).

To unlock, apply 24 V DC voltage at the “lock input” contact (locking command inactive).

For variants based on the power to lock principle

To lock, apply 24 V DC voltage at the “lock input” contact (locking command active).

To unlock, make sure there is no voltage at the “lock input” contact (locking command inactive).

4.4.2 OSSDs

Safety locking devices with local inputs and outputs can be directly integrated into the machine controller.

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.

▶ Make sure that the following control and electrical requirements are met so the protective function can be fulfilled.

- The output signals from an OSSD pair must not be connected to each other.
- In the machine controller, both signals from an OSSD pair must be processed separately.

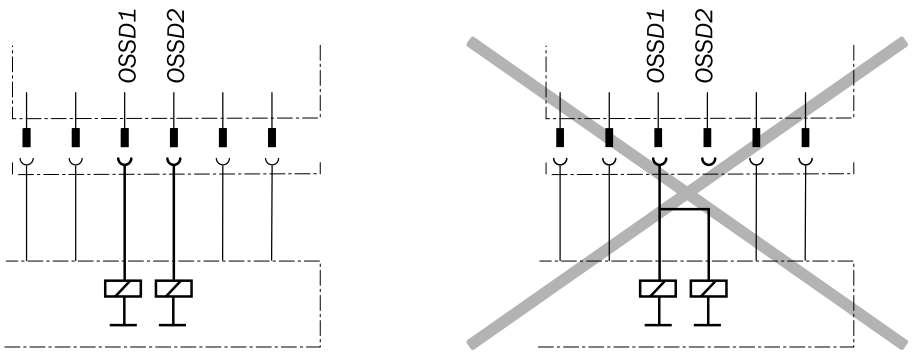


Figure 8: Dual-channel and isolated connection of OSSD 1 and OSSD 2

- The machine must switch to the safe state at any time if at least one OSSD in an OSSD pair switches to the OFF state.
- Prevent the formation of a potential difference between the load and the protective device. If you connect loads to the OSSDs (safety outputs) that also switch if controlled with negative voltage (e.g., electro-mechanical contactor without reverse polarity protection diode), you must connect the 0 V connections of these loads and those of the corresponding protective device individually and directly to the same 0 V terminal strip. In the event of a fault, this is the only way to ensure that there can be no potential difference between the 0 V connections of the loads and those of the corresponding protective device.

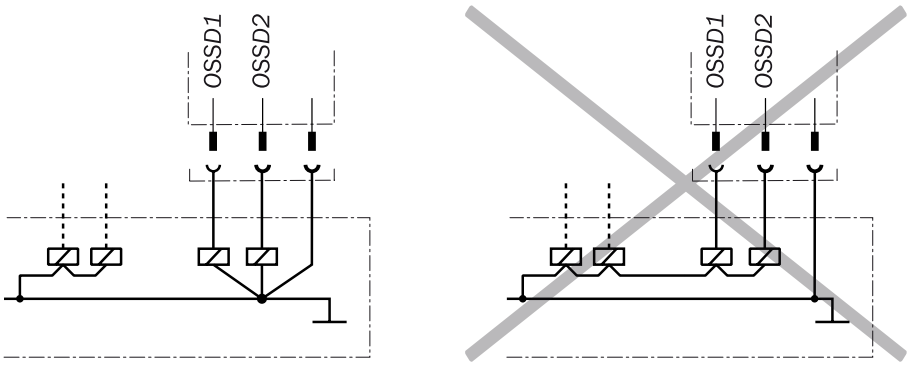


Figure 9: No potential difference between load and protective device

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.

Downstream contactors must be positively guided and monitored depending on applicable national regulations or required reliability of the safety function.

▶ Make sure that downstream contactors are monitored (external device monitoring, EDM).

Requirements for the electrical control of the machine

The OSSDs are short-circuit protected to 24 V DC and 0 V. When the safety locking device is locked, the OSSDs signal the ON state with the HIGH signal level (non-isolated). If the safety locking device is unlocked or there is a device fault, the OSSDs signal the OFF state with the LOW signal level.

4.4.3 Application diagnostic output

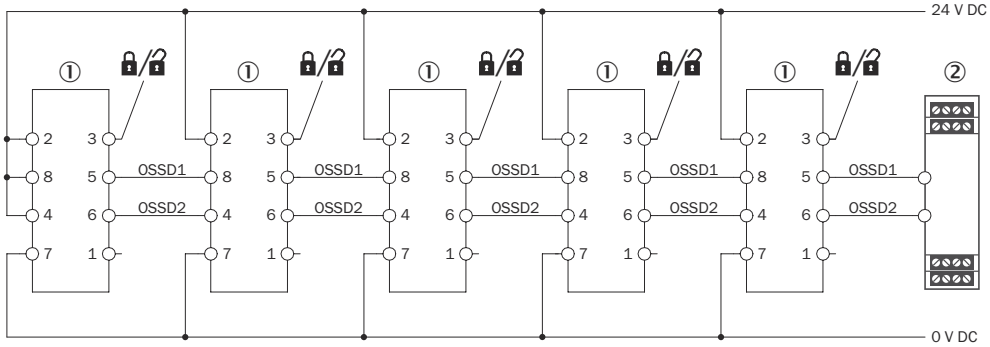
The application diagnostic output signal changes as soon as the actuator is moved into or leaves the response range of the safety switch. In other words, it does so when the moving protective device is opened and closed. This is not a safety output.

Table 1: Application diagnostic output switching behavior

Actuator	Application diagnostic output
Actuator not in response area or safety locking device in a faulty state	ON
Actuator in response area	OFF

4.4.4 Cascading

Cascading can be used to connect multiple safety locking devices. The connected devices will provide the combined safety outputs and therefore act outwardly like one device.



① TR10 Lock

② Safe evaluation unit

The maximum number of safety locking devices depends on the following factors:

- Supply voltage applied
- Length of cables used
- Cross-section of cables used
- Load current

The voltage drop in the cascade must be checked to ensure that the defined minimum voltage is still present at the last safety locking device.

The number of safety locking devices in a cascade influences the response time (see "Response time", page 36).

The cascade can be implemented using special T-connectors and an end connector (see "Connecting a cascade", page 25).

NOTE

In the case of safety switches cascaded using T-connectors, it is not possible to evaluate the application diagnostic output.

4.5 Testing plan

Overview

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.

Important information

DANGER
Insufficient checks or incorrect repair
Hazard due to lack of effectiveness of the protective device

- In the event of wear or damage, replace the entire safety locking device with actuator. Never replace individual parts or assemblies.
- Check the safety locking device following the inspection intervals specified in the national rules and regulations.

Defining the thorough check

- When defining the thorough check, please note the following:
  - Define the type and execution of the thorough check.
  - Define the frequency of the thorough check.
  - Notify the machine operators of the thorough check and instruct them accordingly.

The following thorough checks are often defined in connection with a protective device:

- Thorough check during commissioning and modifications
- Regular thorough check

Minimum requirements for the thorough check

The following checks must be done to ensure permanent and proper function:

- Proper switching function
- Manual unlock function (e.g., mechanical unlocking mechanism)
- Safe mounting of all components
- No damage, contamination, deposits or wear
- No loose plug connectors
- No signs of manipulation of the safety locking device
- No alignment error between the fixed and moving part of the physical guard that impairs the protection, e.g., gap through which operating personnel can reach.
- For variants with unique coding: The actuator used is the taught in actuator.

5 Mounting

5.1 Installation

Important information

NOTICE

- Arrange the safety switch and actuator so that damage due to unintentional outside influences is prevented.
- If any metal drilling occurs during the mounting work, protect the safety switch from metal particles.

Prerequisites

- Project planning is completed.
- Assembly is carried out according to the project planning.
- Dangerous condition of the machine is and remains switched off during mounting.
- Do not use a safety switch and actuator as a stop.
- The set-up and mounting of the safety switch and actuator must be stable enough to maintain proper operation.
- Use only reliable mounting elements that can only be removed with tools.
- The supplied mounting bracket is used for the actuator.
- If possible, use non-detachable mounting methods for actuators (such as welding, gluing, safety screws, or rivets).

Mounting the actuator

1. Mount the actuator to the mounting bracket with 2 TX10 Torx wrench screws. When doing so, note the following:
   - Max. torque: 2 Nm
   - The guard locking pin must first pass through the mounting bracket.

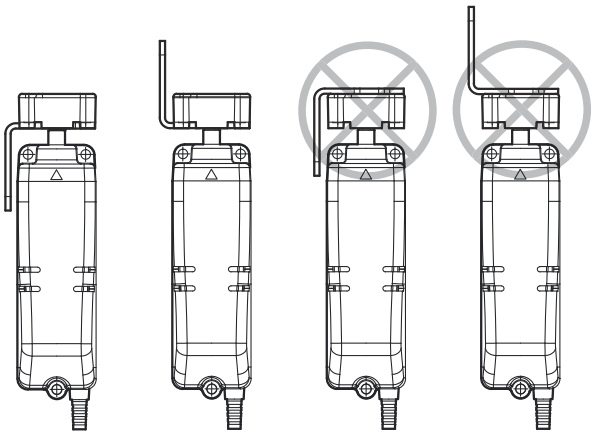


Figure 10: The guard locking pin must first pass through the mounting bracket

   - The alignment triangles on the actuator and safety switch must point to one another.

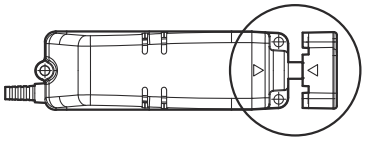


Figure 11: Correct alignment between safety switch and actuator

2. Depending on the alignment and environmental influences, dirt may accumulate in the actuator. In this case, use a screwdriver to pry the sealing plug out of the actuator. This will prevent dirt from accumulating in the actuator.

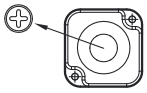


Figure 12: Remove sealing plug if necessary

3. Install mounting bracket to the movable protective device with at least 2 M5 screws. Make sure that at least 1 screw uses a drill hole near the actuator (see figure 14).

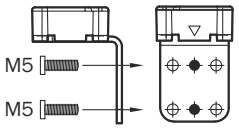


Figure 13: Fasten mounting bracket in place with at least 2 M5 screws

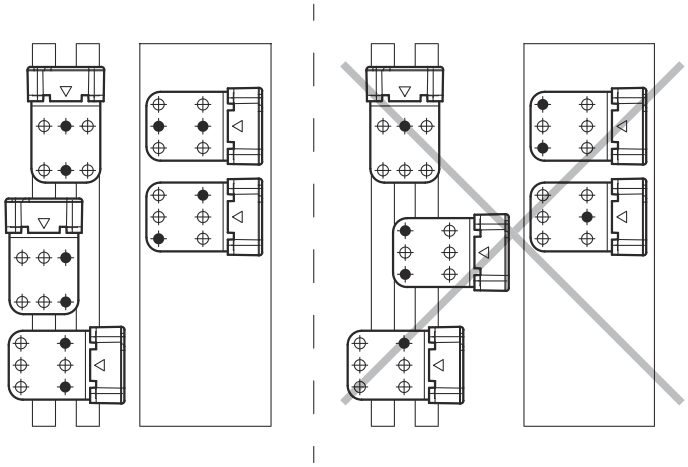


Figure 14: Correct and incorrect screw connection options for the mounting bracket

Mounting the safety switch

- ▶ Mount the safety switch with 3 M5 screws. You can ensure correct alignment of the safety switch and actuator in two ways.
  - Max. torque: 2 Nm
  - Use supplied alignment aid.

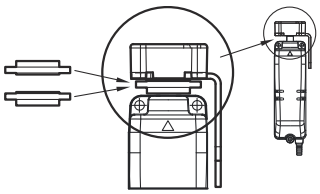


Figure 15: Alignment of safety switch and actuator, variant 1

  - Use 4 ... 9 mm for distance “H”.

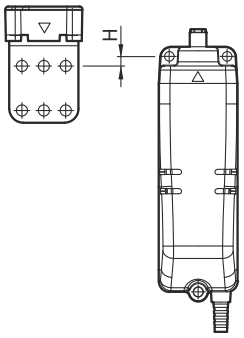
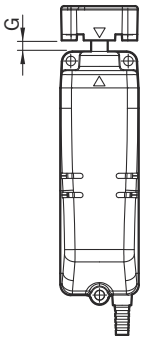


Figure 16: Alignment of safety switch and actuator, variant 2

- Use 1 ... 5 mm for distance “G”.



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.

- ▶ After mounting, make sure that the actuator cannot be raised above the extended guard locking pin.
- ▶ After mounting, make sure that the safety switch and actuator do not collide when opening or closing.

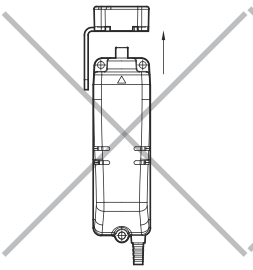


Figure 17: No raising above guard locking pin

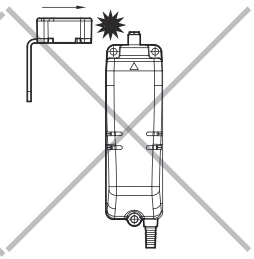


Figure 18: No collisions between safety switch and actuator

6 Electrical installation

6.1 Notes on cULus

The following conditions must also be fulfilled in order to use and apply the equipment in accordance with UL 508 requirements:

- The voltage supply must conform to Class 2 according to UL 508.
- Connections In 1 and In 2 must conform to Class 2 according to UL 508.
- The required fuse protection for each device is 1 A. In a safe series connection, a suitable device fuse protection must be calculated.

6.2 Device connection (M12, 8-pin)

Important information

DANGER
Incorrect connection of the safety locking device
Loss of safety function

- ▶ In the case of insulating material/connection strands, observe the necessary temperature resistance and mechanical load capability.
- ▶ Only use safe contacts for safety functions.

Prerequisites

- Mounting is completed.
- Electrical installation is carried out according to the project planning.
- Dangerous condition of the machine is and remains off during the electrical installation.
- Outputs of the device have no effect on the machine during electrical installation.
- With insulation material or connection slots, pay attention to the temperature resistance and mechanical load capability. For safety functions, use only safe contacts.

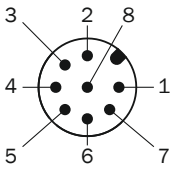


Figure 19: Device connection (male connector, M12, 8-pin, A-coded)

Device connection (M12, 8-pin)

Table 2: Pin assignment for device connection (male connector, M12, 8-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	White	Out AUX	Application diagnostic output (not secure)
2	Brown	+24 V DC	Voltage supply 24 V DC
3	Green	Lock	Lock input
4	Yellow	In 2	OSSD 2 input [2]
5	Gray	Output signal switching device (OSSD) 1	Output OSSD 1
6	Pink	Output signal switching device (OSSD) 2	Output OSSD 2

Pin	Wire color [1]	Designation	Description
7	Blue	0 V	0 V DC voltage supply
8	Red	In 1	OSSD input 1 [2]

1) Applies to the extension cables recommended as accessories.
2) When used as an individual safety locking device or as the first safety locking device in a cascade: Apply 24 V DC (see "Connecting a cascade", page 25).

- ▶ Make sure that the plug connector is tight.

6.3 Device connection (flying lead)

Prerequisites

DANGER
Incorrect connection of the safety locking device
Loss of safety function

- ▶ In the case of insulating material/connection strands, observe the necessary temperature resistance and mechanical load capability.
- ▶ Only use safe contacts for safety functions.

Prerequisites

- Mounting is completed.
- Electrical installation is carried out according to the project planning.
- Dangerous condition of the machine is and remains off during the electrical installation.
- Outputs of the device have no effect on the machine during electrical installation.

Device connection (flying leads)

Table 3: Cable assignment for device connection

Wire color	Designation	Description
White	Out AUX	Application diagnostic output (not secure)
Brown	+24 V DC	Voltage supply 24 V DC
Green	Lock	Lock input
Yellow	In 2	OSSD 2 input [1]
Gray	Output signal switching device (OSSD) 1	Output OSSD 1
Pink	Output signal switching device (OSSD) 2	Output OSSD 2
Blue	0 V	Voltage supply 0 V DC
Red	In 1	OSSD 1 input [1]

1) When used as an individual safety locking device or as the first safety locking device in a cascade: Apply 24 V DC.

6.4 Connecting a cascade

Prerequisites

DANGER
Incorrect connection of the safety locking device
Loss of safety function

- ▶ In the case of insulating material/connection strands, observe the necessary temperature resistance and mechanical load capability.
- ▶ Only use safe contacts for safety functions.

Prerequisites

- Mounting is completed.
- Electrical installation is carried out according to the project planning.
- Dangerous condition of the machine is and remains off during the electrical installation.
- Outputs of the device have no effect on the machine during electrical installation.

Setting up a cascade

The cascade can be created using special T-connectors and an end connector (see "Accessories", page 40).

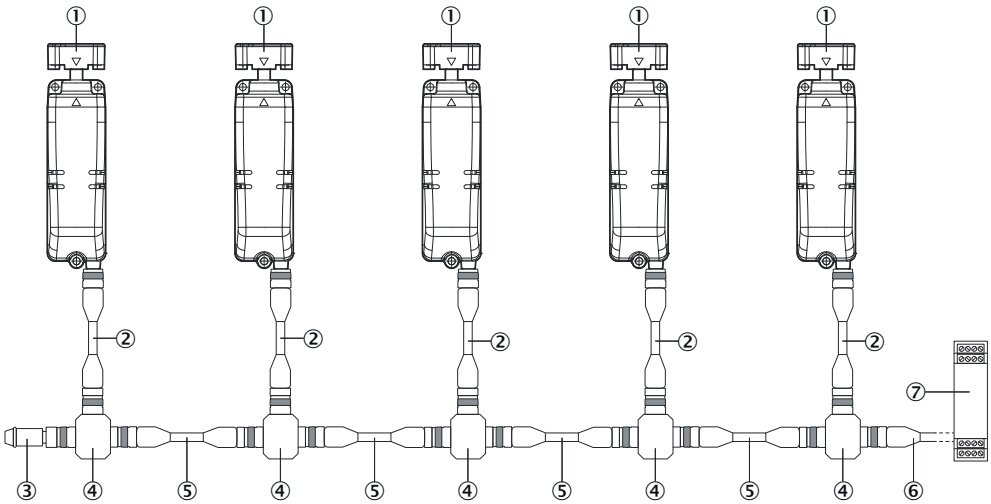


Figure 20: Cascade of multiple safety locking devices

① Safety locking device TR10 Lock
② M12 connection cable, 8-pin
③ Terminator plug
④ T-connector
⑤ M12 connection cable, 5-pin
⑥ M12 connecting cable, 5-pin
⑦ Safe evaluation unit

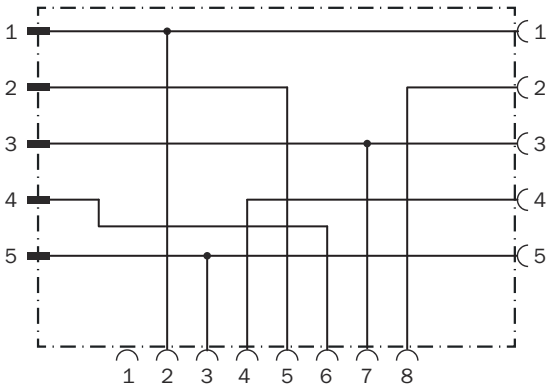


Figure 21: Internal circuitry: T-connector for cascade

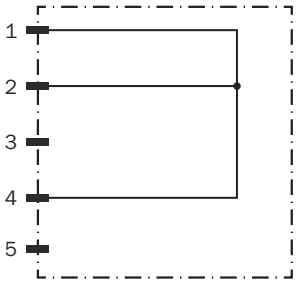


Figure 22: Internal circuitry: Terminator plug for cascade

DANGER

Bypassing the protective device

The dangerous state may not be stopped in the event of non-compliance.

If T-connectors are used for the cascade, mount connecting cables in such a way that a single T-connector (and therefore a safety locking device) cannot be jumpered easily.

NOTE

In the case of safety locking devices cascaded with T-connectors, the application diagnostic output cannot be evaluated.

Cascade connection (M12, 5-pin)

The 5-pin male connector of the last T-connector before the safe evaluation unit is the interface between the cascade and the safe evaluation unit.

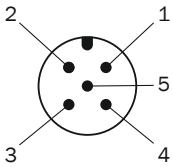


Figure 23: Cascade connection (M12, 5-pin, A-coded, male connector)

Table 4: Pin assignment for cascade connection (male connector, M12, 5-pin, A-coded)

Pin	Wire color [1)]	Designation	Description
1	Brown	+24 V DC	Voltage supply 24 V DC
2	White	Output signal switching device (OSSD) 1	Output OSSD 1
3	Blue	0 V	Voltage supply 0 V DC

Pin	Wire color [1]	Designation	Description
4	Black	Output signal switching device (OSSD) 2	Output OSSD 2
5	Gray	Lock	Lock input

1) Applies to the extension cables recommended as accessories.

7 Commissioning

7.1 Switching on

The device initializes after switch-on. During this process, the output signal switching devices are in the OFF state and the light emitting diodes flash green 6 times.

7.2 Teach-in

Variant for universally coded actuators

No teach-in is required.

Variant for uniquely coded actuators

A unique coded actuator must be taught in during commissioning. Up to 8 actuators can be taught in one after another. Only the most recently taught-in actuator is valid.

Permanent coding

Permanent coding is only possible for the variant for uniquely coded actuators.

When teaching in an actuator, the safety locking device can be permanently coded (optional). If the safety locking device is permanently coded, no further actuators can be taught in. This cannot be undone.

7.2.1 Teaching in actuators without permanent coding

1. Open physical guard.
2. Connect safety locking device to voltage supply (see "Electrical installation", page 23).

✓ The start sequence is executed. The STATUS LEDs flash 6 times.

✓ The STATUS LEDs then flash 8 times in the new status. This signal is repeated.

3. Close the physical guard and keep closed.

NOTICE

The physical guard must not be opened until the teach-in sequence is complete.

✓ If the protective device is closed and the actuator has reached the respective position, the safety locking device automatically starts the teach-in sequence. The individual teach-in sequences are displayed via the STATUS and DIAG LEDs.

Table 5: Displays of the teach-in sequences

STATUS LEDs (green)	DIAG LEDs (red)	Teach-in sequence
1 Hz	○	Actuator in response area
1 Hz, duration 15 s	1 Hz, duration 15 s	Verifying actuator
4 Hz, duration 15 s	4 Hz, duration 15 s	Programming safety locking device
Flashes once for every remaining teach-in process, is repeated for 15 s	○	Programming complete

✓ The teach-in process is complete. The locking device is now locked for when a locking command is active. Previously taught-in actuators can no longer be used and cannot be taught in again. Other actuators can be taught in in the same way.

7.2.2 Teaching in actuators with permanent coding

Important information

NOTE
The safety locking device can only be permanently coded during teach-in in a time window of 15 s. When the safety locking device is to be permanently coded, read the instructions in their entirety.

Approach

1. Open physical guard.
2. Connect safety locking device to voltage supply (see "Electrical installation", page 23).

✓ The start sequence is executed. The STATUS LEDs flash 6 times.
✓ The STATUS LEDs then flash 8 times in the new status. This signal is repeated.

3. Close physical guard.

✓ If the protective device is closed and the actuator has reached the respective position, the safety locking device automatically starts the teach-in sequence. The individual teach-in sequences are displayed via the STATUS and DIAG LEDs.

4. **Open the protective device in order to permanently code the safety locking device during the last "Programming complete" teach-in sequence.**

Table 6: Displays of the teach-in sequences

STATUS LEDs (green)	DIAG LEDs (red)	Teach-in sequence
☀ 1 Hz	○	Actuator in response area
☀ 1 Hz, duration 15 s	☀ 1 Hz, duration 15 s	Verifying actuator
☀ 4 Hz, duration 15 s	☀ 4 Hz, duration 15 s	Programming safety locking device
☀ Flashes once for every remaining teach-in process, is repeated for 15 s	○	Programming complete **Time window for permanent coding**

✓ The DIAG LEDs light up red.

5. Close the protective device. The complete process must be executed within the 15 second continuous "Programming complete" teach-in sequence. Permanent coding with the actuator is then no longer possible.

✓ The STATUS LEDs flash green (1 Hz). The teach-in process is complete. The locking device is now locked for when a locking command is active. Previously taught-in actuators can no longer be used and cannot be taught in again.

7.3 Testing

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

▶ Before carrying out the functional test, make sure that there are no people in the hazardous area.

Check that the device is functioning properly after installation and after every fault. To do this, proceed as follows:

Mechanical functional test

- Open the protective device and close it again. The components of the safety locking device must not collide with other parts. When the protective device is closed, the actuator must be in a position which enables the lock to be actuated.

Electrical functional test

1. Switch on the supply voltage.
2. Close all protective devices and activate the locks. The machine must not start up on its own.
3. Check the lock. It must not be possible to open the protective device.
4. Start the machine function.
5. Make sure that the lock cannot be deactivated as long as the dangerous machine function is active.
6. Stop the machine function and deactivate the lock.
7. Check whether the protective device is kept locked until there is no more risk of injury (e.g., due to run-on movements).
8. Check the restart interlock. The machine function must not start while the lock is deactivated.
9. Repeat steps 3 to 8 individually for each protective device.

NOTE

In the case of the “power to lock” version, an active locking command can be simulated by applying a 24 V DC voltage at the “lock input” contact.

8 Troubleshooting

8.1 Diagnostic LEDs

8.1.1 Fault indicators during teach-in

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- Immediately put the machine out of operation if you cannot clearly identify or allocate the fault and if you cannot safely remedy the fault.
- Secure the machine so that it cannot switch on unintentionally.

Table 7: Fault indicators during teach-in

DIAG light emitting diode (red, 4 Hz)	STATUS light emitting diodes (green, 4 Hz)	Cause
Flashes three times	Flashes once	A universally coded actuator is to be taught in. This is not possible.
Flashes three times	Flashes twice	An actuator that has already been taught in is to be taught in again. This is not possible.
Flashes three times	Flashes three times	The actuator was moved outside of the scanning range (RFID signal interrupted).
Flashes three times	Flashes four times	8 actuators have been taught in. No further teach-in processes are possible.
Flashes three times	Flashes five times	The safety locking device is permanently coded. No further teach-in processes are possible.

Fault indicators are repeated until a reset is performed.

- To perform a reset, interrupt the voltage supply for at least 3 s.

8.1.2 Fault indicators in the case of cascading

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- Immediately put the machine out of operation if you cannot clearly identify or allocate the fault and if you cannot safely remedy the fault.
- Secure the machine so that it cannot switch on unintentionally.

If a fault occurs on a device in a cascade, the relevant device displays the fault and switches the output signal switching devices off (DIAG light emitting diodes flash red). All downstream devices switch their output signal switching devices off (STATUS light emitting diodes flash green).

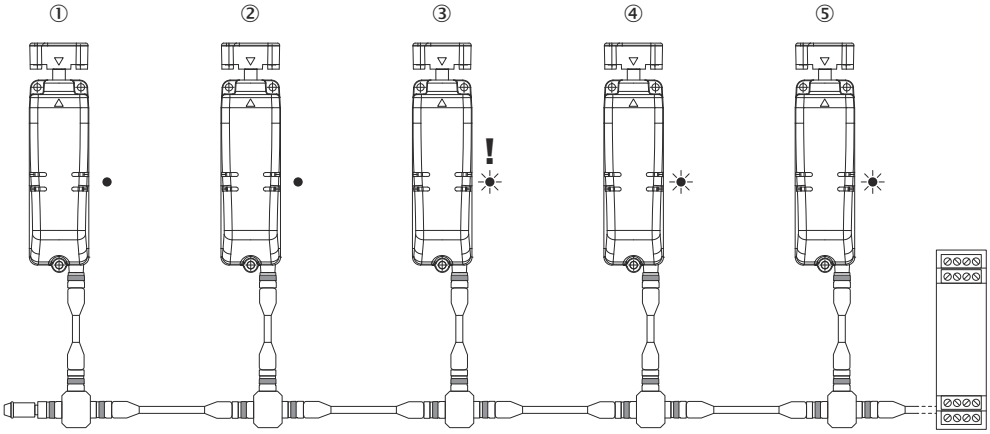


Figure 24: Fault indicators for cascaded safety locking devices. In the example: internal fault on safety locking device 3

Table 8: Light emitting diode displays in the case of cascading

	Device ①	Device ②	Device ③	Device ④	Device ⑤
STATUS light emitting diodes (green)	●	●		☀	☀
DIAG light emitting diodes (red)			☀		
Fault in device	No	No	Yes	No	No
Protective device closed and lock activated	Yes	Yes	No statement possible	Yes	Yes
State of OSSD signal at inputs	ON	ON	ON	OFF	OFF
OSSD output state	ON	ON	OFF	OFF	OFF

8.1.3 Fault indicators

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ▶ Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- ▶ Immediately put the machine out of operation if you cannot clearly identify or allocate the fault and if you cannot safely remedy the fault.
- ▶ Secure the machine so that it cannot switch on unintentionally.

Table 9: Fault indicators

STATUS light emitting diodes (green)	DIAG light emitting diodes (red)	Possible cause	OSSD state
○	○	No supply voltage	OFF
Flashes three times	Flashes three times	Start sequence with self-test	OFF
●	○	Protective device closed and lock activated	ON
○	●	Locking command inactive	OFF
4 Hz	○	Locking command active, but the actuator is not in scanning range or the actuator is invalid in the scanning range.	OFF
1 Hz	○	Protective device closed and lock activated, output signal switching device signal at inputs In 1 and In 2 invalid or not present	OFF
Flashes three times	Flashes once	Lock cannot be activated or deactivated because actuator is not aligned correctly	OFF
○	1 Hz	Fault at output signal switching devices. When fault is eliminated, perform reset by interrupting the voltage supply.	OFF
○	4 Hz	▪ Fault when activating or deactivating lock. Align actuator correctly and perform reset by interrupting the voltage supply. ▪ General fault. Perform reset by interrupting the voltage supply. If the reset does not rectify the fault, replace the device. ▪ Actuator was moved outside sensing range during locked state. Check the alignment of the door. ▪ Interference from similar device nearby (≤ 200 mm). Increase the distance and reset the device. ▪ Actuator damaged. Replace the actuator.	OFF

9 Technical data

9.1 Technical data

Table 10: Features

Features	
Min. actuation speed	2 mm/s
Insertion path for guard locking pin for safety locking function and specified locking force	5 mm ... 10 mm
Alignment tolerance for lock	±2.5 mm
Max. actuation frequency	0.2 Hz
Dwell time between interlocking and unlocking (or vice versa)	2.5 s
Locking force F_{max}	1690 N (EN ISO 14119)
Retaining force F_{Zh} ($F_{Zh} = F_{max}/1.3$)	1300 N (EN ISO 14119)

Table 11: Safety-related parameters

Safety-related parameters	
Performance level [1]	PL e (EN ISO 13849-1)
Category [1]	4 (EN ISO 13849-1)
Safety integrity level [1]	SIL 3 (EN 61508)
PFH_D (mean probability of a dangerous failure per hour)	9.1×10^{-10}
T_M (mission time)	20 years (EN ISO 13849-1)
Response time (response to locking command dropping out)	≤ 100 ms
Release time (response time to locking command)	≤ 600 ms
Risk time [1)2)]	≤ 100 ms
Type	Type 4 (EN ISO 14119)
Coding level	
Universally coded Unique coded	Low coding level (EN ISO 14119) High coding level (EN ISO 14119)
Safe state when a fault occurs	At least one safety-related semiconductor output (OSSD) is in the OFF state.

1) Applies for monitoring of the door position (interlocking monitoring) and locking monitoring
2) At least one of the two output signal switching device outputs is switched off safely within the response time.
3) The risk time is the fault detection time for internal or external faults. External faults concern the output signal switching devices (short-circuit to an OSSD or cross-circuit between the two OSSDs). At least one of the two output signal switching devices is switched off safely within the risk time.

Table 12: Interfaces

Interfaces
System connection

Interfaces	
Voltage supply Local inputs and outputs	Cable with male connector, M12, 8-pin, A-coded (common male connector for voltage supply and inputs and outputs) or Flying leads
Length of M12 connecting cable	0.2 m
Length of open wire connecting cable	3 m 10 m

Table 13: Electrical data

Electrical data	
Supply voltage U_V	24 V DC (20.4 V ... 26.4 V) (SELV)
Protection class	II (EN 61140/IEC 61140)
Locking principle	
TR10-SRxxxx TR10-SLxxxx	“Power to release” principle “Power to lock” principle
Power consumption in passive state (lock activated or deactivated)	2.5 W
Usage category	DC-13: 24 V, 200 mA (IEC 60947-5-2)
Max. output current (per output)	200 mA
Peak current (when activating, deactivating, or switching on)	400 mA, 100 ms
Rated insulation voltage Ui	70 V DC (IEC 60947-1)
Rated impulse withstand voltage U_{imp}	1,000 V (IEC 60947-5-1)
Power-up delay after applying supply voltage	8 s time delay before availability
Thermal current I_{th}	0.2 A
Contamination rating	3 (EN 60947-1)

1) At 10 mA.

Table 14: Mechanical data

Mechanical data	
Dimensions (W x H x D)	
Safety switch Actuator with mounting bracket	45 mm x 140 mm x 50 mm 40 mm x 65 mm x 51.5 mm
Material	
Housing Guard locking pin Cable Mounting bracket	Acrylonitrile butadiene styrene (ABS) Stainless steel (304) PVC Stainless steel (304)
Weight	
Safety locking device Actuator Mounting bracket	400 g 22 g 60 g
Mechanical service life	5×10^5 Switching operations

Table 15: Ambient data

Ambient data	
Enclosure rating	IP 66 (IEC 60529) IP 67 (IEC 60529) IP 69K (IEC 60529)
Ambient operating temperature	0 °C ... +55 °C
Storage temperature	–25 °C ... +75 °C
Relative humidity	5 ... 95%
Shock resistance	30 g, 11 ms (IEC 60068-2-27)
Vibration resistance	10 Hz ... 55 Hz (IEC 60068-2-27)

9.2 Response time

The response time is subject to the following parameters

- Switching safety outputs on or off
- Number of cascaded devices

Response time for switching off the safety outputs

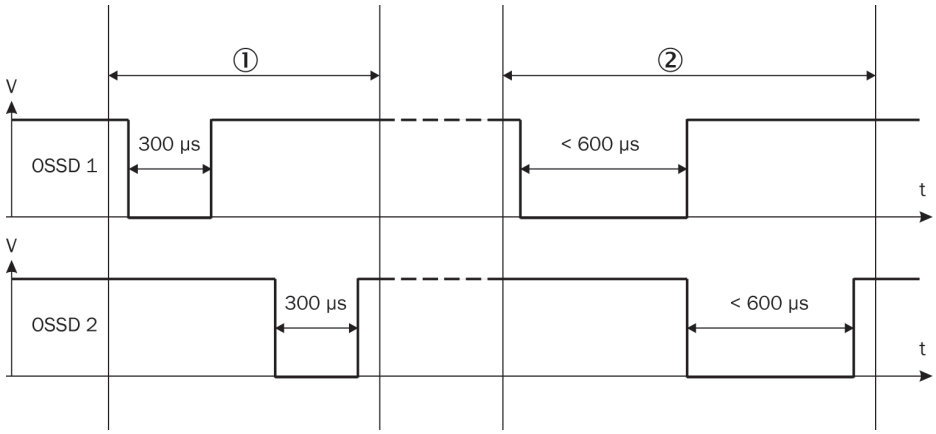
- Response time for single safety locking device: 100 ms
- Response time for cascade: 50 ms + 50 ms * number of safety locking devices in cascade

Response time for switching on the safety outputs

- Response time for single safety locking device: 600 ms
- Response time for cascade: 575 ms + 25 ms * number of safety locking devices in cascade

9.3 Course of the output signal switching device test over time

The safety locking device tests the OSSDs for self-diagnosis at regular intervals. To do this, the safety locking device switches each output signal switching device briefly (for max. 600 µs) to the OFF state and checks whether this channel is voltage-free during this time.
Make sure that the machine's control does not react to these test pulses and the machine does not switch off.



① Every 22 ms

② Every 11 s

9.4 Dimensional drawings

Safety switch

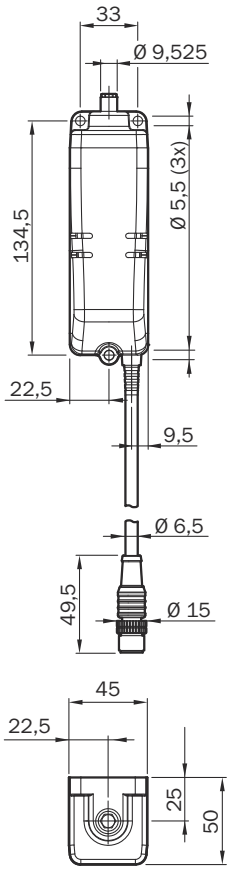


Figure 25: Dimensional drawing of safety switch with M12 male connector

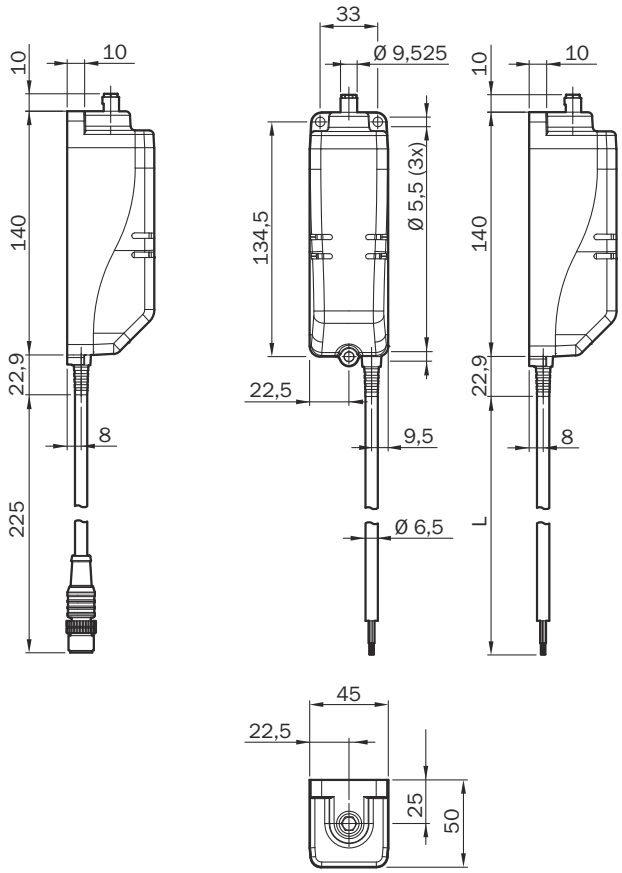


Figure 26: Dimensional drawing of safety switch with flying leads

Actuator with mounting bracket

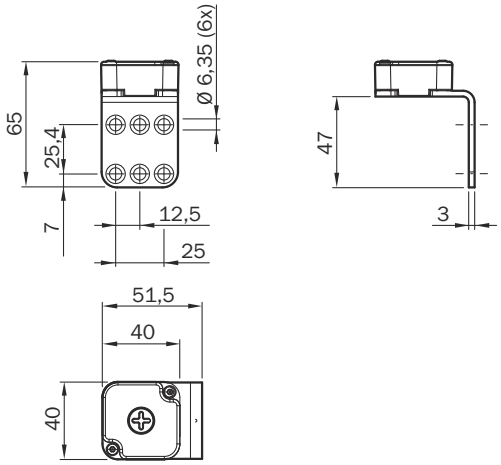


Figure 27: Dimensional drawing of actuator with mounting bracket

Mounting bracket for safety switch (accessories)

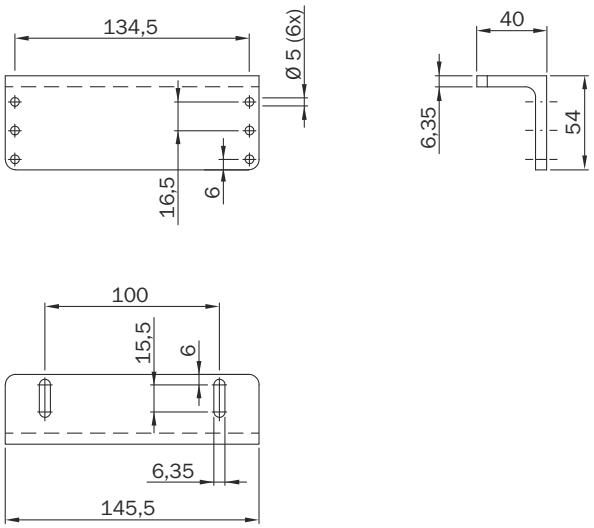


Figure 28: Dimensional drawing of mounting bracket for safety switch

10 Ordering information

10.1 Scope of delivery

- Safety switch
- Actuator
- Mounting bracket
- Fixing screws for mounting the actuator on the mounting bracket: 2 * T10 Torx wrench screws
- Alignment aid
- Safety note
- Mounting instructions
- Operating instructions for download: www.sick.com

10.2 Ordering information for TR10 Lock

Table 16: Ordering information for TR10 Lock, universally coded

Principle	Connection technology	Length	Type code	Part number
“Power to release” principle	Cable	3 m	TR10-SRM03P	6054756
Power to release	Cable	10 m	TR10-SRM10P	6054757
Power to release	M12 (8-pin)	0.2 m	TR10-SRM01C	6054758
“Power to lock” principle	Cable	3 m	TR10-SLM03P	6054759
Power to lock	Cable	10 m	TR10-SLM10P	6054760
Power to lock	M12 (8-pin)	0.2 m	TR10-SLM01C	6054761

Table 17: Ordering information for TR10 Lock, unique coded

Principle	Connection technology	Length	Type code	Part number
“Power to release” principle	Cable	3 m	TR10-SRU03P	6054762
Power to release	Cable	10 m	TR10-SRU10P	6054763
Power to release	M12 (8-pin)	0.2 m	TR10-SRU01C	6054764
“Power to lock” principle	Cable	3 m	TR10-SLU03P	6054766
Power to lock	Cable	10 m	TR10-SLU10P	6054767
Power to lock	M12 (8-pin)	0.2 m	TR10-SLU01C	6054768

11 Accessories

11.1 Actuator

Table 18: Actuator

Coding	Principle	Type code	Part number
Universally coded	“Power to release” principle	TR10-RRM000	5329548
Universally coded	“Power to lock” principle	TR10-RLM000	5329549
Unique coded	“Power to release” principle	TR10-RRU000	5329550
Uniquely coded	“Power to lock” principle	TR10-RLU000	5329551

11.2 Connectivity

M12 connecting cable, 5-pin (0.34 mm²)

Table 19: Ordering information for M12 connecting cable, 5-pin (0.34 mm²) [1]

Part	Type code	Part number
Female connector, straight, 2 m cable, flying leads	YF2A15-020UB5XLEAX	2095617
Female connector, straight, 5 m cable, flying leads	YF2A15-050UB5XLEAX	2095618
Female connector, straight, 10 m cable, flying leads	YF2A15-100UB5XLEAX	2095619
Female connector, straight, 15 m cable, flying leads	YF2A15-150UB5XLEAX	2095620
Female connector, straight, 20 m cable, flying leads	YF2A15-200UB5XLEAX	2095614
Female connector, straight, 30 m cable, flying leads	YF2A15-300UB5XLEAX	2095621
Female connector, angled, 2 m cable, flying leads	YG2A15-020UB5XLEAX	2095772
Female connector, angled, 5 m cable, flying leads	YG2A15-050UB5XLEAX	2095773
Female connector, angled, 10 m cable, flying leads	YG2A15-100UB5XLEAX	2095774

M12 connecting cable, 8-pin (0.25 mm²)

Table 20: Ordering information for M12 connecting cable, 8-pin (0.25 mm²) [2]

Part	Type code	Part number
Female connector, straight, 2.5 m cable, flying leads	YF2A18-025UA5XLEAX	2099229
Female connector, straight, 5 m cable, flying leads	YF2A18-050UA5XLEAX	2095653
Female connector, straight, 7.5 m cable, flying leads	YF2A18-075UA5XLEAX	2099230
Female connector, straight, 10 m cable, flying leads	YF2A18-100UA5XLEAX	2095654

1) Ambient operating temperature: Down to −30° C with fixed installation.
2) Ambient operating temperature: Down to -30 °C with fixed installation.

Part	Type code	Part number
Female connector, straight, 15 m cable, flying leads	YF2A18-150UA5XLEAX	2095679
Female connector, straight, 20 m cable, flying leads	YF2A18-200UA5XLEAX	2095680
Female connector, straight, 30 m cable, flying leads	YF2A18-300UA5XLEAX	2095681
Female connector, angled, 2 m cable, flying leads	YG2A18-020UA5XLEAX	2095779
Female connector, angled, 5 m cable, flying leads	YG2A18-050UA5XLEAX	2095780
Female connector, angled, 10 m cable, flying leads	YG2A18-100UA5XLEAX	2095781

M12 connection cable, 5-pin (0.34 mm²)

Table 21: Ordering information for M12 connection cable, 5-pin (0.34 mm²) [3]

Part	Type code	Part number
Female connector, straight, 0.6 m cable, male connector, straight	YF2A15-C60UB5M2A15	2096006
Female connector, straight, 1 m cable, male connector, straight	YF2A15-010UB5M2A15	2096007
Female connector, straight, 2 m cable, male connector, straight	YF2A15-020UB5M2A15	2096009
Female connector, straight, 5 m cable, male connector, straight	YF2A15-050UB5M2A15	2096010
Female connector, straight, 10 m cable, male connector, straight	YF2A15-100UB5M2A15	2096011
Female connector, straight, 15 m cable, male connector, straight	YF2A15-100UB5M2A15	2096171

M12 connection cable, 8-pin (0.25 mm²)

Table 22: Ordering information for M12 connection cable, 8-pin (0.25 mm²) [4]

Part	Type code	Part number
Female connector, straight, 0.6 m cable, straight male connector	YF2A18-C60UA5M2A18	2096031
Female connector, straight, 1 m cable, straight male connector	YF2A18-010UA5M2A18	2096032
Female connector, straight, 20 m cable, straight male connector	YF2A18-020UA5M2A18	2096033
Female connector, straight, 1 m cable, straight male connector	YF2A18-050UA5M2A18	2096034
Female connector, straight, 10 m cable, straight male connector	YF2A18-100UA5M2A18	2096035

Distributor

Table 23: Ordering information for distributor

Part	Type code	Part number
T-connector	STR1-XXA	5339609

3) Ambient operating temperature: Down to -30 °C with fixed installation.
4) Ambient operating temperature: Down to −30° C with fixed installation.

Terminator plug

Table 24: Ordering information for terminator plug

Part	Type code	Part number
End connector for series connection	MLP1-XXT	1078201

11.3 Mounting bracket

Table 25: Ordering information for mounting bracket

Part	Type code	Part number
Mounting bracket for actuator	TR10-MA0000	5329552
Mounting bracket for safety switch	TR10-MS0000	5329553

11.4 Mounting accessories

Part	Part number
M5 x 10 safety screws for actuator mounting bracket	5334497

12 Annex

12.1 Conformities and certificates

You can obtain declarations of conformity, certificates and the current documentation 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).

12.1.1 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
- RE DIRECTIVE 2014/53/EU

12.1.2 UK declaration of conformity

Excerpt

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- Electromagnetic Compatibility Regulations 2016
- Supply of Machinery (Safety) Regulations 2008
- Radio Equipment Regulations 2017

12.1.3 FCC and IC radio approval

The device fulfills the EMC requirements for use in the USA and Canada, in accordance with the following extracts from the relevant approvals:

FCC § 15.19

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

FCC §15.21 (warning statement)

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

IC

This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:

- This device may not cause interference; and
- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- l'appareil ne doit pas produire de brouillage;
- l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

8019972/1CS1/2022-07-20/en

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