OPERATING INSTRUCTIONS

TR110 Lock

Safety locking device

TR110-xxxxxBx

SICK
Sensor Intelligence.

Described product

TR110 Lock

Manufacturer

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Original document

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Contents

1 About this document

1.1 Scope

Product

This document applies to the following products:

- TR110 Lock safety locking device with type code TR110-xxxxxBx
- “Operating instructions” type label entry: 8028544

Document identification

Document part number:

- This document: 8028546
- Available language versions of this document: 8028544

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

1.2 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 14 "Technical data", page 44
Installers	"Mounting", page 22
Electricians	"Electrical installation", page 28
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Project planning", page 14 "Commissioning", page 34 "Technical data", page 44
Operators	"Troubleshooting", page 41
Maintenance personnel	"Troubleshooting", page 41

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:

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

The safety locking device must be configured and operated correctly by qualified safety personnel according to the machine requirements.

2.2 Intended use

The safety locking device is a locking unit with a safety locking function and is suitable for the following applications:

- Temporarily preventing access to a hazardous area (protection of people)
- Monitoring of movable physical guards (protection of people)
- Locking for process protection

In conjunction with a movable physical guard and the machine controller, the safety locking device prevents the movable physical guard from being opened. The locking function remains active for as long as the hazardous machine function is performed or until the production step has finished.

The product may be used in safety functions.

The product is only suitable for use in industrial environments.

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.

2.3 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 Scope of delivery

- Safety switches
- Extension of the escape release (only for variants with escape release)
- Safety note
- Mounting instructions
- Operating instructions for download: www.sick.com

3.2 Structure and function

Structure

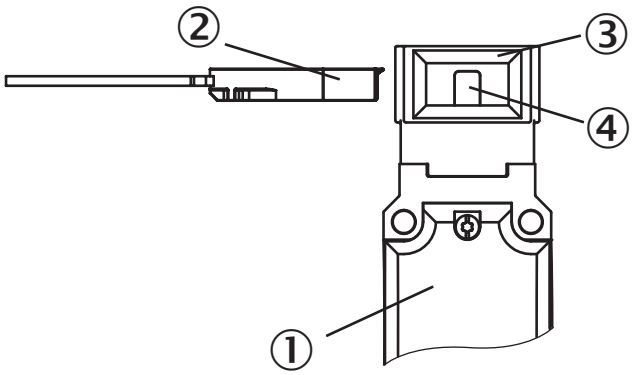


Figure 1: Structure of the TR110 Lock safety locking device

① Safety switches
② Coded actuator
③ Actuating head
④ Locking pin

The safety locking device is an interlocking device with a locking function. The safety locking device consists of a safety switch and a coded actuator. The actuator has a high coding level (uniquely coded).

Function

When the protective device is closed, the actuator is inserted into the actuating head of the safety switch. In doing so, the locking pin is pressed downward by the actuator. If the actuator reaches the end position, the locking pin moves into the provided hole of the actuator.

Further functioning depends on whether the safety locking device is based on the power to release or the power to lock principle.

- In the power to release principle, the inserted actuator is immediately blocked and the locking device is locked (to unlock the locking device, the locking solenoid must be energized).
- In the power to lock principle, the locking solenoid must be energized in order to lock the locking device. If the locking solenoid is not energized, the actuator is only held in position by retaining force (spring force). The actuator can be pulled out again by overpowering the retaining force.

Complementary information

- The code of the actuator is read out and evaluated using transponder technology. If the code is valid, the door application diagnostic output (Out AUX DOOR) switches to the ON state.
- If the locking device is locked, the safe output signal switching devices (OSSD) are switched to the ON state. In addition, the locking function application diagnostic output (Out AUX LOCK) switches to the ON state.
- If the locking device is locked, the actuator cannot be removed from the actuating head.
- The locking device can only be locked when the protective device is closed (prevention of incorrect closing).

3.3 Product characteristics

3.3.1 Product variants

Overview

The safety locking device is delivered with or without pushbuttons. You will find an overview of important distinguishing features of the variants in the following.

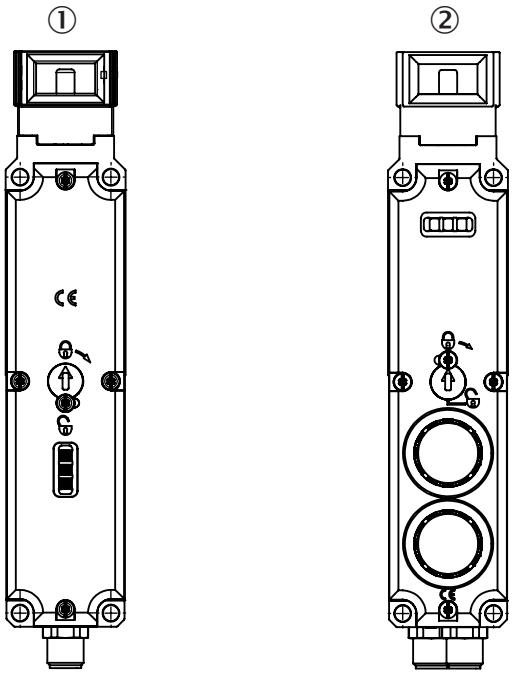


Figure 2: Device variants

① TR110 Lock

② TR110 Lock with pushbuttons

TR110 Lock

The TR110 Lock safety locking device differs between the following variants:

- Power to lock principle
- Power to release principle
- Power to release principle with escape release

The variants also each have the following connection types:

- For stand-alone connection, e.g. to a safety controller or a safety relay.
- For connection to Flexi Loop
- For OSSD cascading with T-connectors or in the control cabinet

TR110 Lock with pushbuttons

The TR110 Lock safety locking device with pushbuttons features two pushbuttons:

- The pushbuttons contain single-channel normally open contacts which can be used to trigger control signals.
- LEDs are located in the pushbuttons which can be controlled, e.g. to signal operational statuses.
- The pushbuttons can be assigned colors using cover caps.

The TR110 Lock safety locking device with pushbuttons differs between the following variants:

- Power to lock principle
- Power to release principle
- Power to release principle with escape release

Further topics

- "Ordering information", page 61

3.3.2 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.

3.3.3 Application diagnostic outputs

Important information

NOTE
In the case of safety locking devices cascaded with T-connectors, the locking function application diagnostic output (Out AUX LOCK) cannot be evaluated.

Different application diagnostic outputs

Depending on the device connection, the variants feature various application diagnostic outputs.

- Door application diagnostic output (Out AUX DOOR)
- Locking device application diagnostic output (Out AUX LOCK)
- Diagnostic application diagnostic output (Out AUX DIA)

3.3.4 Status indicators

The safety locking device indicates status information using multiple LEDs.

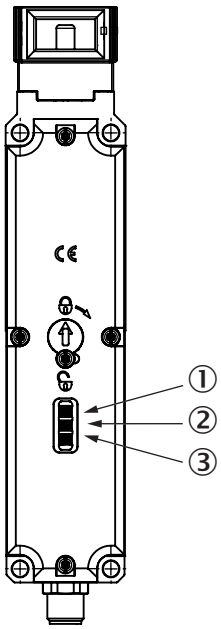


Figure 3: Status LEDs

① STATE
② LOCK
③ DIA

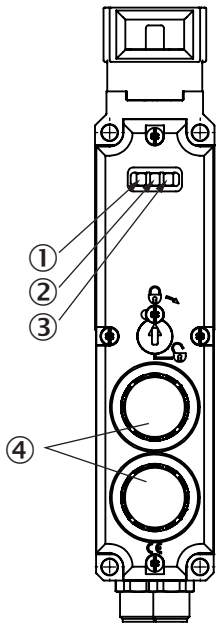


Figure 4: Status LEDs

① STATE
② LOCK
③ DIAG
④ LEDs in the pushbuttons

Table 2: Status LEDs

Item	Name	Color
①	STATE	Green
②	LOCK	Yellow
③	DIA	Red

The variants with 2 pushbuttons feature two LEDs in the pushbuttons. The LEDs of the pushbuttons are controlled using two inputs.

3.4 Manual unlocking

In some situations, it necessary to unlock the locking device manually (e.g. if faults are present). When unlocking, the safe output signal switching devices (OSSD) switch to the OFF status. A stop command must be generated as a result.

After manual unlocking, a function check-out must be performed (see "Testing", page 36).

3.4.1 Mechanical unlocking mechanism

Using the mechanical unlocking mechanism, the safety locking device can be unlocked regardless of the status.

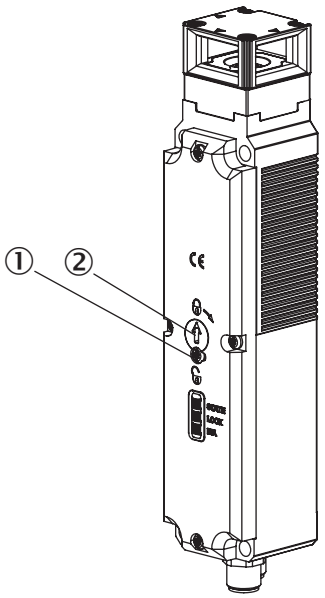


Figure 5: Mechanical unlocking mechanism

① Retaining screw

② Mechanical unlocking mechanism

3.4.2 Emergency release

The emergency release can be retrofitted as an accessory. The emergency release can be used to actuate the mechanical unlocking mechanism without tools.

NOTICE

- The emergency release must be able to be actuated manually outside of the protected area without tools.
- The emergency release must have a label stating that it may only be actuated in an emergency.

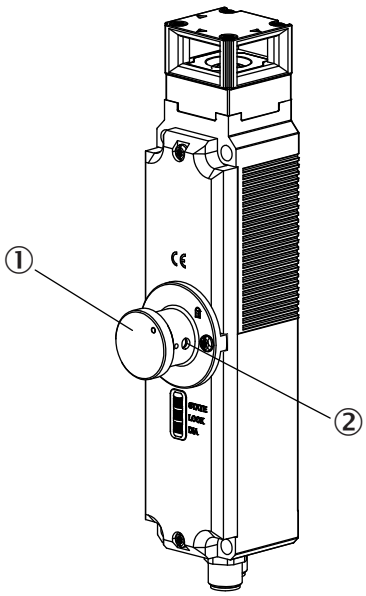


Figure 6: Emergency release

① Emergency release

② Stop bolt

3.4.3 Escape release

The escape release makes it possible to open a closed protective device without tools from within the hazardous area.

NOTICE

- The escape release must be able to be actuated manually from inside the protected area without tools.
- Mount the escape release so that actuation can only take place from inside of protected area (hazardous area).

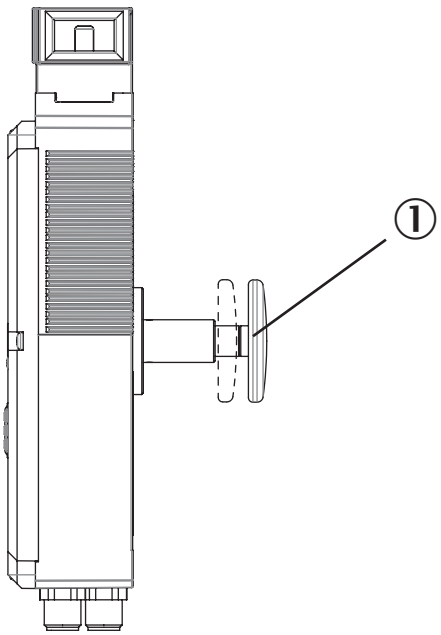


Figure 7: Escape release

① Red button of the escape release

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 Design

4.3.1 Selection of the actuator

NOTICE
Selecting unsuitable actuators or improper mounting can damage the device.

- ► Select the right actuator (see table 26).
- ► Pay attention to the door radius and mounting options (see "Actuator dimensional drawings", page 54).
- ► Pay attention to the door hinge.

4.3.2 Actuating direction

Actuating direction

The safety locking device can be actuated from three horizontal directions (from the left, from the front and from the right). If the safety locking device is to be actuated from behind, an actuating head has to be used.

The safety locking device is not suited for an approach from a vertical angle.

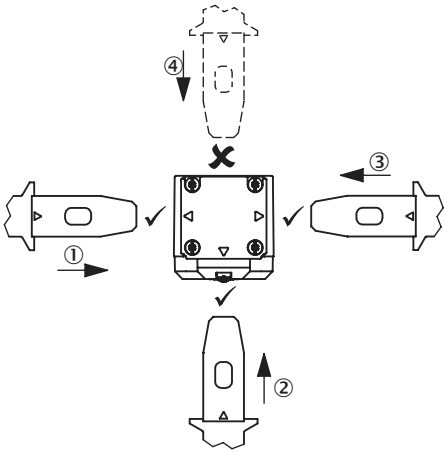


Figure 8: Directions of approach

① Left
② Front
③ Right
④ Rear (only possible with switched actuating head)

Further topics

- "Changing the actuation direction", page 22

4.3.3 Escape release

In order to mount the variant with the escape release, corresponding holes must be made in the mounting surface.

The shaft of the escape release can be extended by 30 mm or 50 mm using with spacers

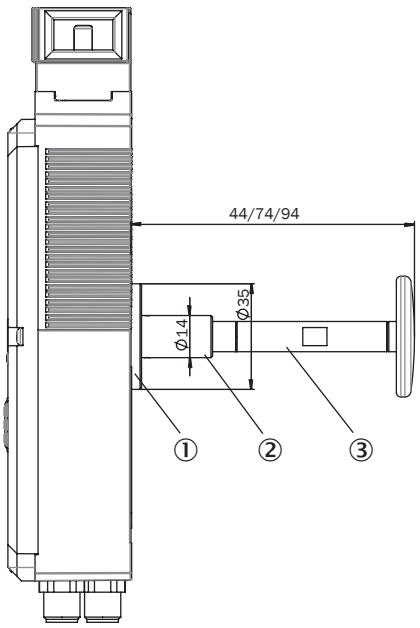


Figure 9: Escape release shaft

① Escape release flange
② Escape release shaft
③ Extension spacer

4.4 Integration in the electrical control system

- Switch-on commands that put the machine in a dangerous state may only be activated when the protective device is closed and the locking device is locked.
- The locking device may only be unlocked when the dangerous state has ended. Depending on the safety concept, the signal is analyzed, for example, by a safety relay or a safety controller.
- Closing or locking the protective device must not trigger the automated starting of a hazardous machine function. This must occur by means of a separate start command.
- The safety locking device must not be bypassed by electrical means, e.g. by bridging the contacts. You may need to take measures to prevent this.
- 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).
- The overall concept of the control system in which the safety locking device is integrated must be validated in accordance with ISO 13849-2.

4.4.1 Locking function

Overview

The activation of the locking solenoids of the safety locking device changes depending on the locking principle.

Prerequisites

- A shared voltage supply is used for the control system and for the locking solenoids of the safety locking device.
- A clocked voltage supply is not used.
- When connecting the locking solenoids to the output of a controller, this output must supply sufficient current.

Power to release principle

- Locking the locking device: Close the protective device, no voltage on the magnet
- Unlocking the locking device: Apply voltage to magnet

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

WARNING

The locking device locks even when voltage is not present

People could get trapped!

► If people are in the hazardous area, do not close the protective device even if voltage is not present.
Or:
► Use the variant with an escape release.

Power to lock principle

- Locking the locking device: Apply voltage to magnet
- Unlocking the locking device: Disconnect voltage from magnet

If voltage is disconnected at the magnet, the locking device is unlocked and the protective device can be opened immediately.

DANGER
Hazard due to lack of effectiveness of the protective device

In the event of a voltage drop, the safety locking device unlocks regardless of whether the dangerous state of the machine has ended.

► Assess the risk of accident. Use for protecting people requires correct project planning.

Activating the locking function

For single-channel activation of the locking function, the controller and the safety locking device must have the same ground.

For dual-channel activation of the locking function, clock pulses are tolerated up to a max. length of 5 ms. If possible, switch off the clocking of outputs in the control system.

NOTICE

- The locking solenoid of the TR110 Lock safety locking device is controlled externally (no control function within the device). Therefore, the TR110 Lock safety locking device does not have any characteristic safety values for controlling the locking function.
- The safety level for controlling the locking device is determined exclusively by external control (e.g. by the PFH_D of an external standstill monitor).

Types for series connection of OSSDs have a separate pin MAG 0 V DC in order to apply 0 V to the locking solenoids (see "Device connection", page 28). In the other types, the 0 V connection of the locking solenoid is connected using the 0 V connection of the safety locking device.

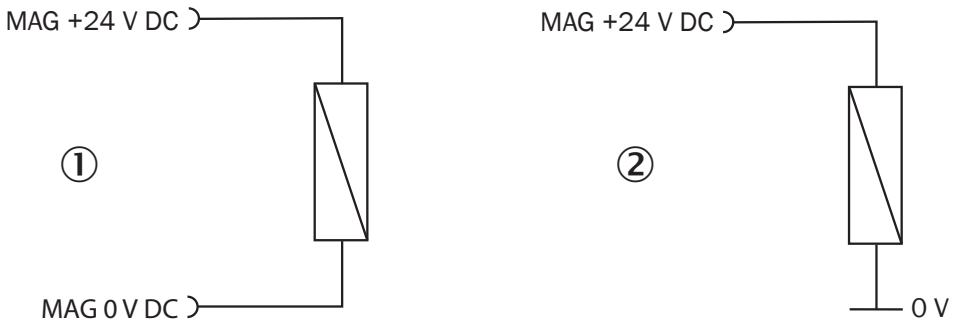


Figure 10: Connection of the locking solenoid

① In types for series connection of OSSDs

② In all other types

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.

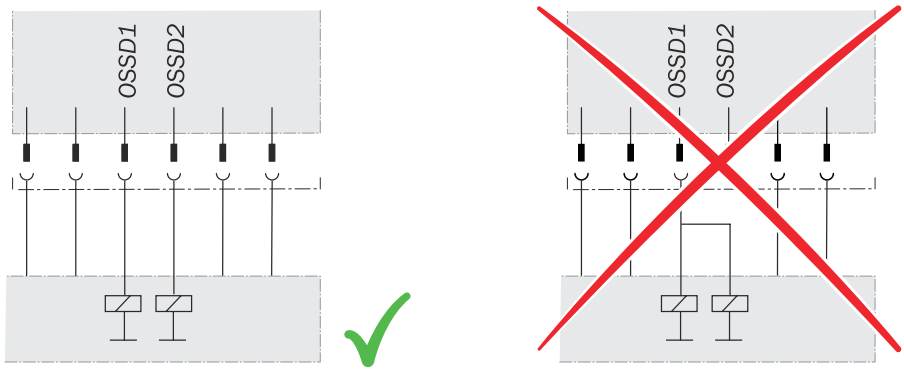


Figure 11: Dual-channel and isolated connection of OSSD 1 and OSSD 2

- 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 then 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.

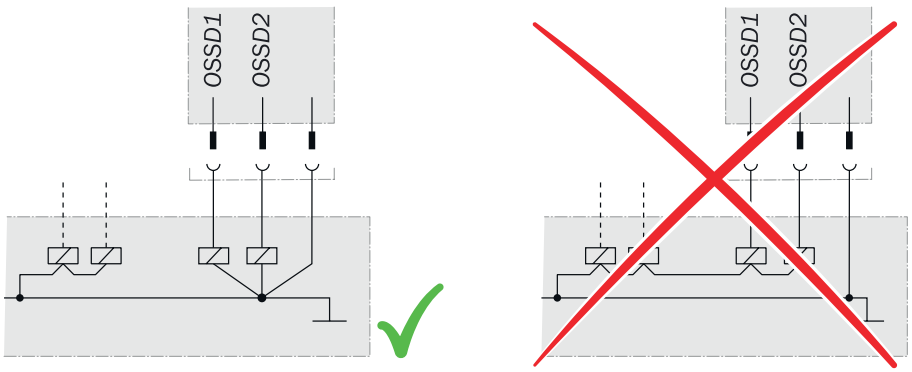


Figure 12: No potential difference between load and protective device

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).

The OSSDs are short-circuit protected to 24 V DC and 0 V. If 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.

Do not use a control system with clocking or switch off the clocking function of the control system. The device generates its own test pulses at the OSSDs. A downstream controller must tolerate these test pulses, which can have a length of up to 1 ms. The test pulses are also output when the OSSDs are switched off. Depending on the sluggishness of the downstream device (controller, relay, etc.), this can lead to short switching processes.

For inductive loads, the OSSDs must be protected with a freewheeling diode. RC suppressors must not be used:

4.4.3 Application diagnostic outputs

Door application diagnostic output (Out AUX DOOR)

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

Table 3: Switching behavior of the door application diagnostic output

Actuator	Door application diagnostic output
Actuator not in response range	OFF
Actuator in response range	ON

Locking function application diagnostic output (Out AUX LOCK)

The signal of the locking function application diagnostic output changes as soon as the locking function has been activated. This is not a safety output.

Table 4: Switching behavior of the locking function application diagnostic output

Locking function	Locking function application diagnostic output
Locking function active	ON
Locking function not active	OFF

Fault application diagnostic output (Out AUX DIA)

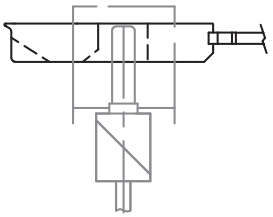
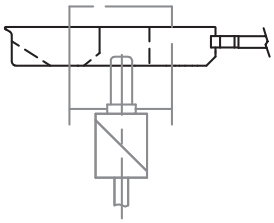
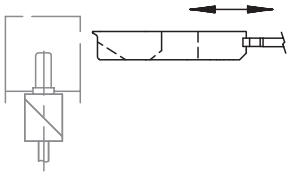
The signal of the fault application diagnostic output changes as soon as a fault occurs. This is not a safety output.

Table 5: Switching behavior of the fault application diagnostic output

Fault	Fault application diagnostic output
Fault has occurred	ON
No fault	OFF

4.4.4 Switching behavior

Table 6: Switching behavior

	 *Figure 13: Protective device closed and locked*	 *Figure 14: Protective device closed but not locked*	 *Figure 15: Protective device open*
Activating the locking function	ON	OFF	Not relevant
OSSDs	ON	OFF	OFF
Out AUX LOCK	ON	OFF	OFF
Out AUX DOOR	ON	ON	OFF

4.4.5 Safe series connection

OSSDs of several safety locking devices can be connected by safe series connection. The connected OSSDs act like the OSSDs of a single device.

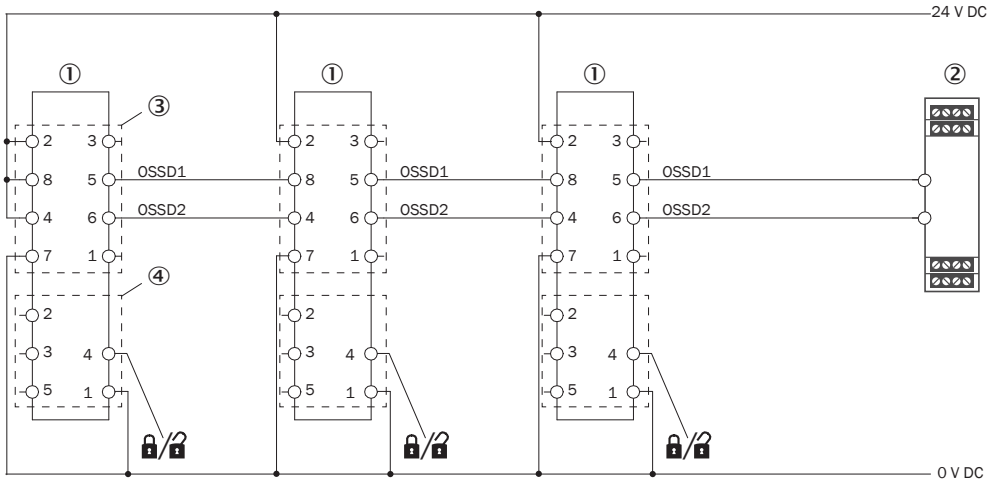


Figure 16: Safe series connection

① TR110 Lock
② Safe evaluation unit
③ Male connector, M12, 8-pin
④ Male connector, M12, 5-pin

NOTICE

- Connect the enable inputs of the OSSDs In 1 and In 2 directly to a power supply unit (+24 VDC) or to the outputs OSSD 1 and OSSD 2 of another TR110 Lock safety locking device.
- There must not be any clocked controller signals at inputs In 1 and In 2.

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

- Applied supply voltage
- Length of cables used

- conductor cross section of cables used
- Load current

The voltage drop in the safe series connection has to be checked so that the defined minimum voltage is still applied to the last safety locking device.

The number of safety locking devices in a safe series connection influences the response time of the system (see table 17, page 44).

The safe series connection can be implemented using special T-connectors and an end connector (see "Connection of a safe series connection", page 31).

4.4.6 Protection of the voltage supply

Overview

The voltage supply must be provided with fuse protection depending on the number of safety locking devices and the required current for the outputs.

Max. current consumption of a single safety locking device I_{max}:

$I_{max} = I_{TR110} + I_{OSSD1} + I_{OSSD2} + I_{OAUXL} + I_{OAUXD}$

I_{TR110} = Operating current of the TR110 Lock safety locking device

I_{OSSD1} = Load current of OSSD 1

I_{OSSD2} = Load current of OSSD 2

I_{OAUXL} = Load current of locking device application diagnostic output

I_{OAUXD} = Load current of door application diagnostic output

Max. current consumption of a safe series connection of safety locking devices $I_{Cascade}$

$I_{Cascade} = I_{OSSD1} + I_{OSSD2} + n \times (I_{TR110} + I_{OAUXL} + I_{OAUXD})$

n = Number of connected safety locking devices

Further topics

- "Data sheet", page 44

4.5 Testing plan

The safety locking device must be tested by appropriately qualified safety personnel when commissioning, after modifications, and at regular intervals.

The regular thorough checks serve to investigate the effectiveness of the safety locking device and discover defects because of modifications or external influences (such as damage or tampering).

The manufacturer and user must define the type and frequency of the thorough checks on the machine on the basis of the application conditions and the risk assessment. Determination of the thorough checks must be documented in a traceable manner.

5 Mounting

5.1 Safety

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

- ► Make sure that the dangerous state of the machine is and remains switched off.

NOTICE
If incorrectly installed or if the ambient conditions are not suitable, the safety locking device can be damaged.

- ► Arrange the safety switch and actuator so that damage due to unintentional outside influences is prevented.
- ► Do not use a safety switch and actuator as a stop.
- ► Secure the safety switch and actuator using screws of strength class 8.8 or higher.
- ► Secure the fastening materials against loosening, e.g., using a medium-strength, material-bonding screw adhesive.
- ► Note the min. door radii, see "Actuator dimensional drawings", page 54.
- ► Protect the switch head against damage and ingress of foreign bodies, e.g., chips, sand, abrasives, etc.
- ► 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.
- ► If an opening is created in the physical guard due to alignment errors, it must not impair the protective function.
- ► Checking for environmental influences before using the safety locking device, e.g., UV radiation or corrosion.

5.2 Changing the actuation direction

Overview

The safety locking device can be actuated from three directions (A, B and C). The actuation direction only needs to be changed if the safety locking device is to be actuated from behind (D).

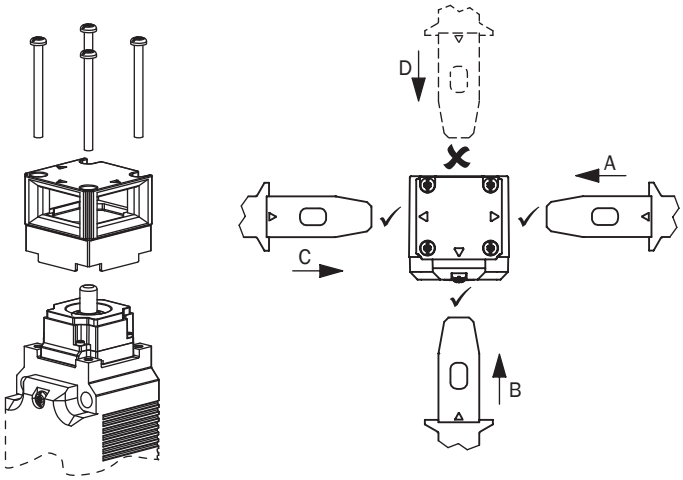


Figure 17: Changing the direction of approach

Procedure

1. Loosen the screws on the actuating head.
2. Turn the actuating head in the desired direction.
3. Tighten the screws to 1.2 Nm.

5.3 Mounting the safety switch

Important information

NOTICE
The actuator must not be used for guiding or used as a stop.

Prerequisites

- To mount on the machine, the safety switch and actuator must be put together.
- A clearance of 12 mm must be maintained around the actuating head.

Procedure

The safety locking device may be in any installation position.

► Mount the safety switch using 4 × M5 screws.
► Observe the maximum tightening torque of 1.4 Nm.

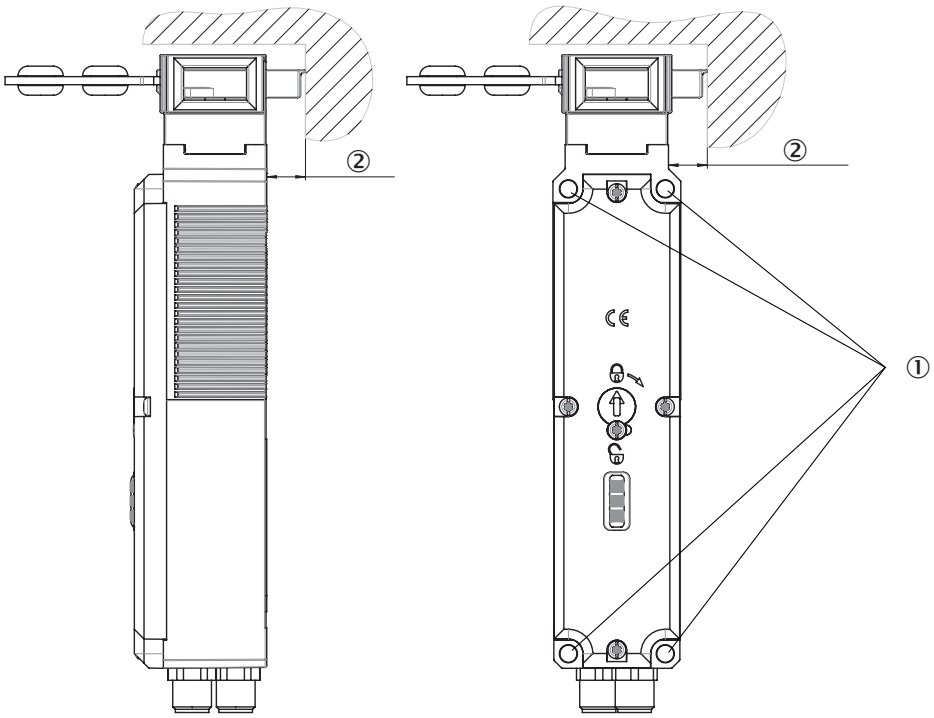


Figure 18: Mounting the safety switch

① Mounting holes
② 12 mm clearance for actuator

Complementary information

Mounting brackets are available for the actuator and safety locking device as accessories (see "Dimensional drawings of the mounting bracket", page 59).

5.4 Mounting straight and angled actuators

Important information

NOTICE
The actuator must not be used for guiding or used as a stop.

Prerequisites

To mount on the machine, the safety switch and actuator must be put together.

Procedure

1. Check the alignment of the actuator. The actuator must be aligned relative to the safety locking device so that the alignment mark is at the top.

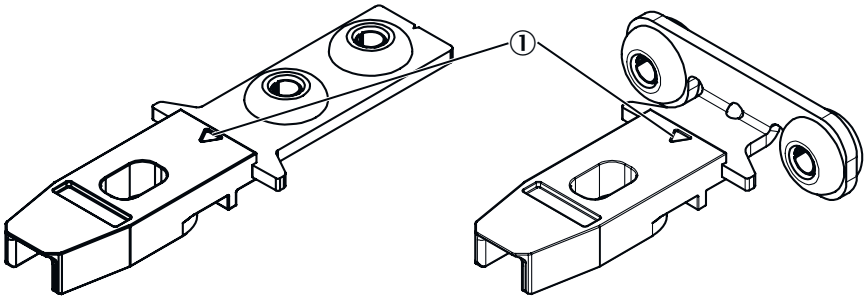


Figure 19: Position of the alignment mark on the actuators

① Alignment markings

2. Mount the actuator using 2 × M4 screws.

Complementary information

Mounting brackets are available for the actuator and safety locking device as accessories (see "Dimensional drawings of the mounting bracket", page 59).

5.5 Mounting the radius actuator

Important information

NOTICE
The actuator must not be used for guiding or used as a stop.

Prerequisites

- To mount on the machine, the safety switch and actuator must be put together.
- The actuator must be positioned perpendicularly to the guide slot before insertion.

Procedure

1. Mount the actuator using 2 × M5 screws.
2. For larger radii, the actuator can be aligned using the adjustment screw.

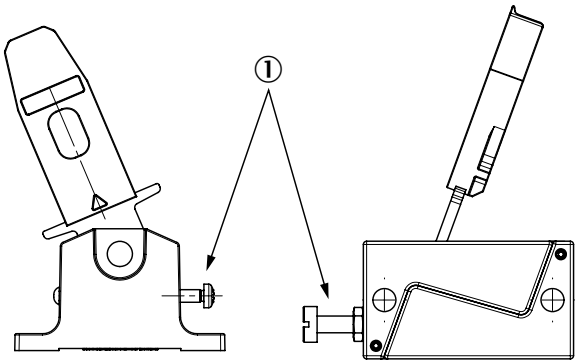


Figure 20: Adjustment screw for alignment

① Adjustment screw

Complementary information

Mounting brackets are available for the actuator and safety locking device as accessories (see "Dimensional drawings of the mounting bracket", page 59).

5.6 Mounting the escape release

Prerequisites

- Hole in the mounting surface for the escape release (see "Escape release", page 15).
- Spacers with lengths of 30 mm or 50 mm for the escape release shaft (optional).

Procedure

1. Unscrew the red button of the escape release.
2. Extend the escape release shaft if necessary.
3. Insert the escape release shaft through the hole.
4. Mount the safety switch using 4 × M5 screws.
5. Screw on the red button of the escape release.

5.7 Mounting the emergency unlocking

Procedure

1. Remove the center screws on the cover of the safety switch.
2. Remove the retaining screw of the mechanical unlocking mechanism.
3. Position the emergency release so that the blade of the emergency release can reach into the slot of the mechanical unlocking mechanism.
4. Ensure that the emergency release is blocked by the ball catch, not by the stop bolt.
5. Fasten the emergency release using the included M3 × 17 screws. Tighten the screws to 0.5 Nm.
6. Emergency release with label: The emergency release must only be actuated in an emergency.

7. Seal the emergency release. Alternatively, ensure that misuse of the unlocking function is prevented via the controller.

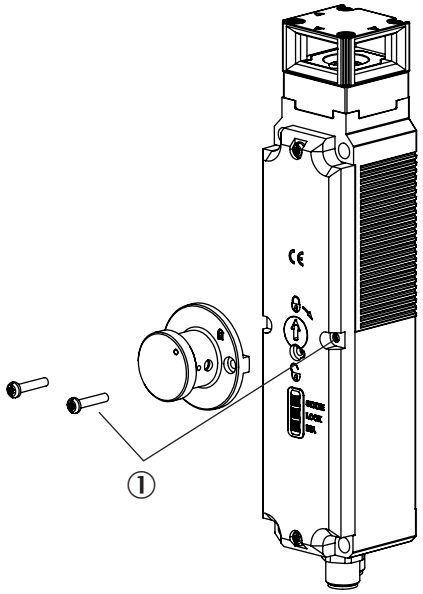


Figure 21: Mounting the emergency release

① Screws of the safety switch

5.8 Mounting the cover caps

Procedure

1. Turn the cover cap so that the point is pointing upward.
2. Insert the cover caps onto the pushbuttons.
3. Press on the cover caps until they audibly snap in.

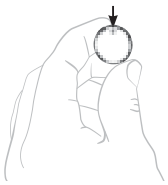


Figure 22: Cover cap mounting, step 1

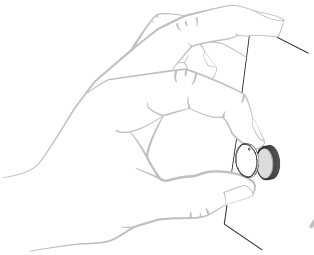


Figure 23: Cover cap mounting, step 2

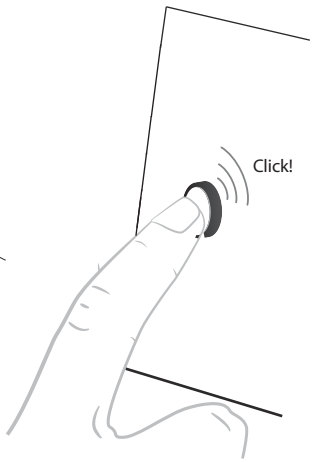


Figure 24: Cover cap mounting, step 3

5.9 Removing the cover caps

Procedure

1. Carefully guide a small slot screwdriver between the bracket and cover cap.
2. Carefully lift out the cover cap.

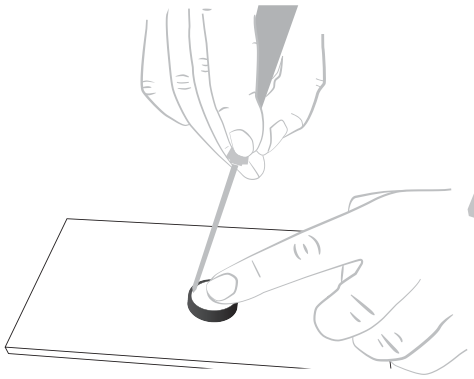


Figure 25: Cover cap removal, step 1

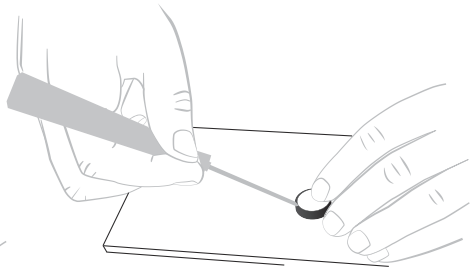


Figure 26: Cover cap removal, step 2

6 Electrical installation

6.1 Safety

DANGER
Hazard due to electrical voltage

Hazard due to unexpected starting of the machine

- ► Make sure that the machine is and remains disconnected from the power supply during electrical installation.
- ► Make sure that the dangerous state of the machine is and remains switched off during electrical installation.
- ► Make sure that the outputs of the safety locking device have no effect on the machine during electrical installation.

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.

6.2 Notes on cULus

For use according to the requirements of UL 508, the following conditions must also be met:

- A power supply marked as “for use in class 2 circuits” must be used.
- Alternative solutions must correspond to the following requirements: Electrically isolated power supply unit with fuse protection in accordance with UL248. This fuse should be rated for max. 3.3 A and be integrated in the 30 V DC voltage section.
- A connecting cable must be used that is listed under UL Category Code CYJV / 7, min. 24 AWG, min. 80 °C.

6.3 Device connection

Prerequisites

- All electrical connections must be isolated from the supply network either through safety transformers in accordance with IEC 61558-2-6 with output voltage limitation or through equivalent isolation measures (PELV).
- Power devices that represent a strong source of interference must be locally isolated from the input and output circuits for signal processing. The cable routing of the safety circuits should be separated from the cables of the power circuits by the greatest possible distance.
- In order to avoid EMC disturbances, the physical ambient and operating conditions at the installation location of the device must comply with the requirements of IEC 60204-1.

Stand-alone connection

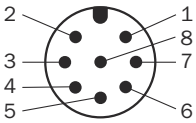


Figure 27: Device connection (male connector, M12, 8-pin, A-coded)

Table 7: Device connection pin assignment (male connector, M12, 8-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	White	Out AUX DOOR	Door application diagnostic output (not safe)
2	Brown	24 V DC	Voltage supply 24 V DC
3	Green	MAG +24 V DC	Magnet activation 24 V DC
4	Yellow	Out AUX DIA	Fault application diagnostic output (not safe)
5	Gray	OSSD 1	Output OSSD 1
6	Pink	OSSD 2	Output OSSD 2
7	Blue	0 V	Voltage supply 0 V DC
8	Red	Out AUX LOCK	Locking device application diagnostic output (not safe)

[1] Applies to the extension cables recommended as accessories.

For connection to Flexi Loop

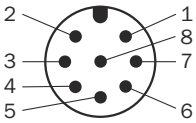


Figure 28: Device connection (male connector, M12, 8-pin, A-coded)

Table 8: Device connection pin assignment for Flexi Loop variant (M12, 8-pin)

Pin	Wire color [1]	Designation	Description
1	White	Out AUX DOOR	Door application diagnostic output (not safe)
2	Brown	24 V DC	Voltage supply 24 V DC
3	Green	MAG +24 V DC	Magnet activation 24 V DC
4	Yellow	N.C.	Not assigned
5	Gray	OSSD 1	Output OSSD 1
6	Pink	OSSD 2	Output OSSD 2
7	Blue	0 V	Voltage supply 0 V DC
8	Red	N.C.	Not assigned

[1] Applies to the extension cables recommended as accessories.

For safe series connection

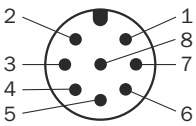


Figure 29: Device connection (male connector, M12, 8-pin, A-coded)

Table 9: Device connection pin assignment (male connector, M12, 8-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	White	Out AUX LOCK	Locking device application diagnostic output (not safe)
2	Brown	24 V DC	Voltage supply 24 V DC
3	Green	RST	Hardware reset connection [2]
4	Yellow	In 2	Enable input for OSSD 2[3]
5	Gray	OSSD 1	Output OSSD 1
6	Pink	OSSD 2	Output OSSD 2
7	Blue	0 V	Voltage supply 0 V DC
8	Red	In 1	Enable input for OSSD 1[3]

1) Applies to the extension cables recommended as accessories.
2) The switch can be reset using the RST reset input. For this, a voltage of 24 V must applied to the RST input for at least 3 s.
If the RST input is not used, it must be connected to 0 V.
3) When used as an individual safety locking device or as the first safety locking device in a safe series connection, apply 24 V DC.

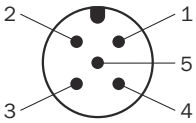


Figure 30: Device connection (male connector, M12, 5-pin, A-coded)

Table 10: Device connection pin assignment (male connector, M12, 5-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	Brown	MAG 0 V DC	Input for locking device 0 V DC
2	White	Out AUX DOOR	Door application diagnostic output (not safe)
3	Blue	Out AUX DIA	Fault application diagnostic output (not safe)
4	Black	MAG +24 V DC	Input for locking device 24 V DC
5	Gray	N.C.	Not assigned

1) Applies to the extension cables recommended as accessories.

Variant with two pushbuttons

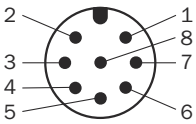


Figure 31: Device connection (male connector, M12, 8-pin, A-coded)

Table 11: Device connection pin assignment (male connector, M12, 8-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	White	Out AUX DOOR	Door application diagnostic output (not safe)
2	Brown	24 V DC	Voltage supply 24 V DC
3	Green	MAG +24 V DC	Magnet activation 24 V DC
4	Yellow	Out AUX DIA	Fault application diagnostic output (not safe)
5	Gray	OSSD 1	Output OSSD 1

Pin	Wire color [1]	Designation	Description
6	Pink	OSSD 2	Output OSSD 2
7	Blue	0 V	Voltage supply 0 V DC
8	Red	Out AUX LOCK	Locking device application diagnostic output (not safe)

[1] Applies to the extension cables recommended as accessories.

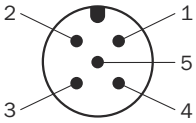


Figure 32: Device connection (male connector, M12, 5-pin, A-coded)

Table 12: Device connection pin assignment (male connector, M12, 5-pin, A-coded)

Pin	Wire color [1]	Designation	Description
1	Brown	NO 1	Pushbutton 1 output (normally open)
2	White	LED 1	LED 1 input
3	Blue	NO 2	Pushbutton 2 output (normally open)
4	Black	LED 2	LED 2 input
5	Gray	N.C.	Not connected

[1] Applies to the extension cables recommended as accessories.

6.4 Connection of a safe series connection

Overview

A maximum of 20 devices can be activated in series. The safe series connection can be implemented using special T-connectors and an end connector. The safe evaluation unit switches off the machine if a protective device is opened or a fault occurs at a safety locking device.

Prerequisites

One of the following conditions must be met:

- All safety locking devices in the safe series connection are of type TR110-xxxCA**O**x.
- All safety locking devices in the safe series connection are of type TR110-xxxCA**B**x.

Important information

NOTE

- The locking device control (MAG 0 V DC), the application diagnostic outputs door (Out AUX DOOR) and error application diagnostic outputs have to be wired separately.
- In the case of safety locking devices cascaded with T-connectors, the locking device application diagnostic output (Out AUX LOCK) cannot be evaluated.
- Mount the connecting cable so that individual T-connectors (and thus a safety locking device) cannot be easily jumpered.

Connection of the safe series connection (M12, 5-pin)

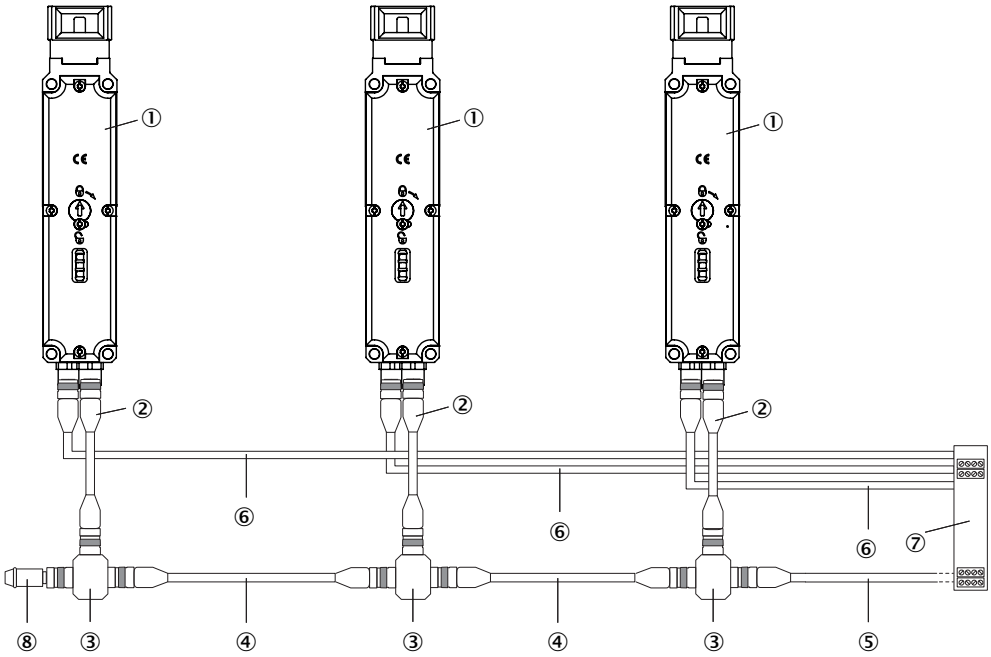


Figure 33: Safe series connection of several safety locking devices

① TR110 Lock safety locking device
② Connection cable, M12, 8-pin
③ T-connector
④ Connection cable (M12, 5-pin)
⑤ Connecting cable, M12, 5-pin, for connecting the safe series connection
⑥ Connecting cable, M12, 5-pin, for connecting the locking device controller
⑦ Safe evaluation unit
⑧ End connector

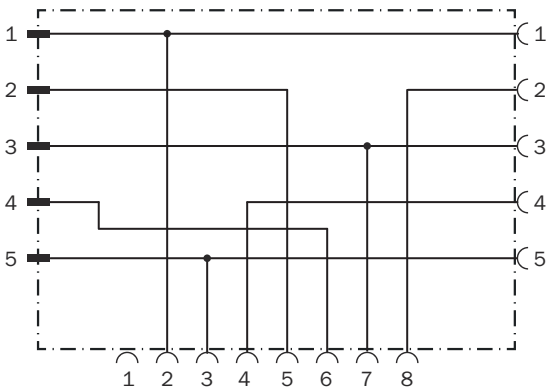


Figure 34: Internal circuitry: T-connector for safe series connection

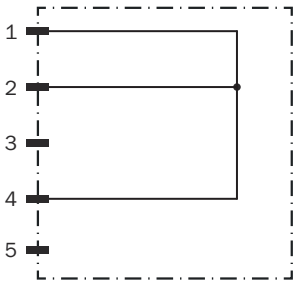


Figure 35: Internal circuitry: end connector for safe series connection

The 5-pin male connector of the last T-connector upstream of the safe evaluation unit is the interface between the safe series connection and the safe evaluation unit.

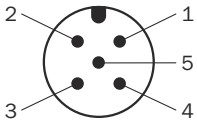


Figure 36: Connection of the T-connector (M12, 5-pin, A-coded, male connector)

Table 13: Pin connection of T-connector 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	OSSD 1	OSSD 1 output
3	Blue	0 V	Voltage supply 0 V DC
4	Black	OSSD 2	OSSD 2 output
5	Gray	RST	Hardware reset connection [2]

1) Applies to the extension cables recommended as accessories.
2) All switches of a chain can be reset simultaneously with the RST input (reset input). For this, a voltage of 24 V must applied to the RST input for at least 3 s.
If the RST input is not used, it must be connected to 0 V.

Further topics

- "Accessories", page 62

7 Commissioning

7.1 Switching on

The device initializes after it is switched on. The OSSDs are in the OFF state during this and the STATE LED flashes green at 5 Hz.

7.2 Teach-in

7.2.1 Safety

DANGER
Bypassing the protective device
The dangerous state may not be stopped in the event of non-compliance.

- ► Document teaching-in of an actuator.
- ► During regular thorough checks, make sure that the taught-in actuator is still being used.

An actuator must be taught-in during commissioning. Only the most recently taught-in actuator is valid.

During a teach-in operation, the OSSDs are in the OFF state, i.e. the system is in a safe state.

7.2.2 Teaching-in the first actuator in delivery condition

Important information

NOTE
Safety locking devices switched on in delivery condition have a teach-in readiness with no time limitation.

NOTE
The teach-in process is invalid if canceled, e.g. by interruption of the voltage supply or removal of the actuator.
Then the TR110 Lock safety locking device enters the safe error state, the DIA LED lights up red, the STATE LED flashes (see "Status indicators", page 41).

Procedure

1. Apply the supply voltage to the safety switch.
✓ The STATE LED flashes 3 times repeatedly.
2. Insert the actuator into the actuating head (close the protective device).
✓ The teach-in process starts, the STATE LED flashes at approx. 1 Hz.
The teach-in process is completed after about 30 seconds. The STATE and DIA LEDs flash in alternation.
3. Switch off the supply voltage at the safety switch for at least 3 seconds and then switch it back on.
✓ The code for the actuator that was just taught-in is enabled in the safety switch.
4. Check the effectiveness of the protective device.

7.2.3 Teaching-in the new actuator

Overview

The TR110 Lock safety locking device can be operated only with the actuator that was last taught-in.

Important information

NOTE
Safety locking devices with an actuator that has already been taught-in have a teach-in readiness of approx. 3 minutes after being switched on.

NOTE

- If the safety switch detects an actuator that has already been taught-in, then the teach-in process is canceled and the safety switch returns to normal mode.
- If the safety switch detects a blocked code of a direct predecessor actuator, then the teach-in process is canceled and the code of the previous actuator remains active. The safety switch goes into an error state (see "Status indicators", page 41).

Procedure

1. Apply the supply voltage to the safety switch.
✓ The STATE LED flashes 3 times repeatedly.
2. Insert the actuator into the actuating head within 3 minutes.
3. The teach-in process starts, the STATE LED flashes at approx. 1 Hz.
✓ The teach-in process is completed after about 30 seconds. The STATE and DIA LEDs flash in alternation.
4. Switch off the supply voltage at the safety switch for at least 3 seconds and then switch it back on.
✓ This activates the new code and deactivates the old code.
5. Check the effectiveness of the protective device.

Complementary information

When a new actuator is taught-in, the safety switch blocks the code of the last actuator. The latter cannot be taught-in again immediately when a new teach-in operation is performed. The blocked code is released again in the safety switch only after a third code has been taught-in.

7.2.4 Teaching-in the actuator in safe series connection

Important information

NOTE
It is recommended to teach in the actuators not in the safe series connection, but individually.

Prerequisites

If the actuators need to be taught-in in a safe series connection, then it has to be possible to switch from 0 V DC to 24 V DC at the RST inputs of the safety switches.

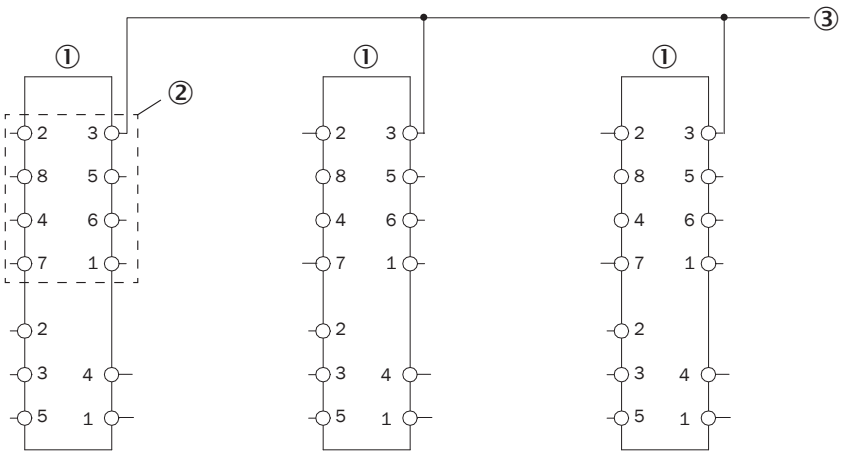


Figure 37: Connection to RST input

① TR110 Lock
② Male connector, M12, 8-pin
③ Signal for changing from 0 V DC to 24 V DC at RST

Procedure

► Apply supply voltage to the safety switches.
✓ The STATE LEDs flash 3 times repeatedly.
► Insert the actuators into the actuating heads.
► Connect the RST to +24 V DC for at least 3 s.
► The teach-in process on the safety switches of the safe series connection begins; the STATE LEDs flash at approx. 1 Hz.
✓ The teach-in process is completed after about 30 seconds. The STATE and DIA LEDs flash in alternation.
► Reconnect the RST to +24 V DC for at least 3 s.
✓ The code for the actuators that were just taught-in is enabled in the safety switches.
► Check the effectiveness of all protective devices in the safe series connection.

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.

Approach

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.

Complementary information

NOTE
With the version in accordance with the power to lock principle, an active lock command can be simulated by applying 24 V DC voltage to the “Lock input” contact.

7.4 Regular thorough check

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.

Monitoring

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

- Proper switching function
- Safe mounting of all components
- No damage, contamination, deposits or wear
- No loose plug connectors
- No manipulation by employees

8 Operation

8.1 Actuating the mechanical unlocking mechanism

Procedure

1. Ensure that actuators are not under tensile stress.
2. Loosen the retaining screw with the screwdriver.
3. Use the screwdriver to rotate the mechanical unlocking mechanism in the direction of the arrow to the following symbol:

✓ The locking device is unlocked.

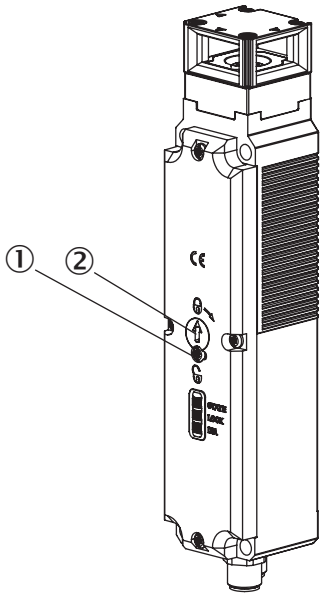


Figure 38: Actuating the mechanical unlocking mechanism

① Retaining screw
② Mechanical unlocking mechanism

8.1.1 Moving the mechanical unlocking mechanism back after use

Procedure

► Turn the auxiliary release back to the following symbol:

► Screw in the retaining screw and seal it (e.g. with locking varnish)
► Open the movable physical guard and close it again.
✓ The safety locking device operates in normal mode again.
► Carry out a functional test.

8.2 Actuating the emergency release

Procedure

1. Ensure that actuators are not under tensile stress.
2. Turn the emergency release clockwise until it latches at the following symbol:

✓ The locking device is unlocked.

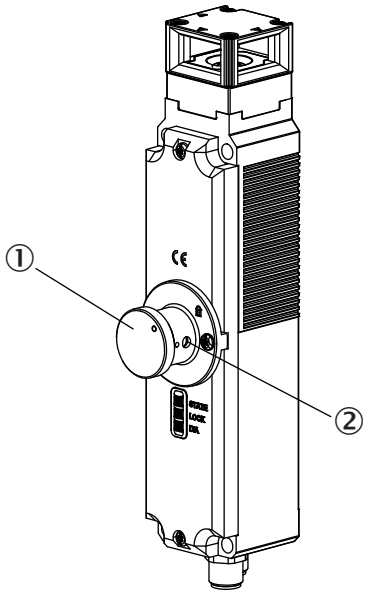


Figure 39: Actuating the emergency release

① Emergency release
② Stop bolt

8.2.1 Moving the emergency release back after use

Procedure

- ► Push the stop bolt inward, e.g. with a small screwdriver.
- ► Move the emergency release back to the following symbol:

- ► Seal the emergency release.
- ► Open the protective device and close it again.
- ✓ The safety locking device operates in normal mode again.
- ► Carry out a functional test.

8.3 Actuating the escape release

Procedure

1. Press the red button of the escape release as far as it goes.

✓ The locking device is unlocked.

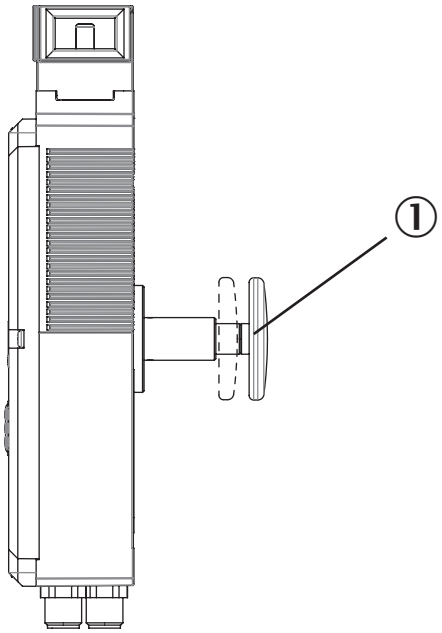


Figure 40: Fluchtentriegelung betätigen

① Red button of the escape release

8.3.1 Moving the escape release back after use

Procedure

► Pull the red button of the escape release back out.
► Open the protective device and close it again.
✓ The safety locking device operates in normal mode again.
► Carry out a functional test.

9 Troubleshooting

9.1 Security

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 error and if you cannot safely remedy the error.
- ► Secure the machine so that it cannot switch on unintentionally.

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

9.2 Status indicators

Important information

NOTE
Displays other than those described here indicate an internal device fault. In this case, please contact your responsible SICK subsidiary.

Status indicators

Table 14: Status indicators

		Outputs				LED indicators			Status
	Door	OSSDs	AUX LOCK	AUX DOOR	AUX DIA	STATE	DIA	LOCK	
Self-test	X	OFF	OFF	OFF	OFF	5 Hz 10 s	○	○	Self-test after switch-on
Normal operation	Closed	ON	ON	ON	OFF	●	○	●	Door closed and locked
	Closed	OFF	OFF	ON	OFF	1 x inverse	○	○	Door closed and not locked
	Open	OFF	OFF	OFF	OFF	1 ×	○	○	Door open
	Double click on	OFF	OFF	OFF	OFF	1 ×	○	1 ×	Door open, ready to lock
Teach-in	Open	OFF	OFF	OFF	OFF	3 ×	○	○	Teach-in readiness
	Closed	OFF	X	ON	OFF	1 Hz	○	○	Teach-in process
	X	OFF	X	X	OFF			○	Teach-in process successful

		Outputs				LED indicators			Status
	Door	OSSDs	AUX LOCK	AUX DOOR	AUX DIA	STATE	DIA	LOCK	
Error display	X	OFF	X	X	ON	1 ×	●	○	Error during teach-in (actuator removed from the response range before the teaching operation ended or defective actuator detected)
	X	OFF	OFF	OFF	ON	2 ×	●	○	Input error (e.g. missing test pulses, non-logical switching state of the predecessor in the switch chain)
	X	OFF	OFF	OFF	ON	3 ×	●	○	Read error (e.g. actuator defective)
	X	OFF	OFF	OFF	ON	4 ×	●	○	Error at output (e.g. cross-circuit, loss of switching capability)
	X	OFF	X	X	ON	5 ×	●	○	Locked actuator detected
	X	OFF	OFF	OFF	ON	○	●	X	Internal error

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

Table 15: Features

Features	
Sensor principle	Transponder
Coding	Uniquely coded
Locking force F_{max}	
With straight TR110-XAS actuator	3,900 N (EN ISO 14119)
With angled TR110-XABT actuator	1,500 N (EN ISO 14119)
With TR110-XAFx hinged actuator	2,600 N (EN ISO 14119)
Locking force F_{Zh} ($F_{Zh} = F_{max}$ /1.3)	
With straight TR110-XAS actuator	3000 N (EN ISO 14119)
With angled TR110-XABT actuator	1,100 N (EN ISO 14119)
With TR110-XAFx hinged actuator	2,000 N (EN ISO 14119)
Actuating force	10 N
Retaining force	20 N
Force against which unlocking is possible	≤ 20 N
Actuating frequency	≤ 0.5 Hz
Approaching speed of the actuator	≤ 20 m/min
Overrun	5 mm

Table 16: Safety-related parameters

Safety-related parameters	
Performance level [1]	PL e (EN ISO 13849-1)
Category [1]	4 (EN ISO 13849-1)
PFH_D [2] (mean probability of a dangerous failure per hour)	5.38×10^{-9}
T_M (mission time)	20 years (EN ISO 13849–1)
Type	Type 4 (EN ISO 14119)
Coding level	High coding level (EN ISO 14119)
Safe status when a fault occurs	At least one safety-related semiconductor output (OSSD) is in the OFF state.

1) Applies to monitoring the door position (interlocking monitoring) and locking monitoring.
2) The locking solenoid is externally controlled and so does not contribute to the probability of failure. The safety level of the locking device controller is determined exclusively by the external controller.

Table 17: Electrical data

Electrical data	
Classification based on cULus	Class 2
Protection class	III (IEC 61140)
Utilization category	DC-13: 24 V, 150 mA (IEC 60947-5-2)
Supply voltage U_V	
Safety switches Locking solenoid[1]	20.4 V DC ... 28.8 V DC 20.4 V DC ... 28.8 V DC
Current consumption	

Electrical data	
Safety switches Locking solenoid Pushbutton (LED)	40 mA 400 mA 10 mA
Power consumption of locking solenoid	6 W
External device protection[2)]	
Safety switches Locking solenoid	0.25 A ... 2 A 0.5 A ... 8 A
Switch-on time of locking solenoid	100%
Contamination rating	3 (EN 60947-1)
Power-up time	7 s
Response time	≤ 260 ms (+5 ms for each additional safety locking device in a safe series connection)
Release time	150 ms
Discrepancy time	≤ 10 ms (EN IEC 60947-5-3)
Risk time [3)]	260 ms
Rated insulation voltage Ui	50 V DC (IEC 60947-1)
Rated impulse withstand voltage U_{imp}	500 V (IEC 60947-5-1)
Rated short-circuit current	100 A
Locking principle	
TR110-SRxxxx TR110-SLxxxx	Closed-circuit current principle Open-circuit current principle

1) The locking solenoid of the TR110 Lock safety locking device is externally controlled and supplied with power.
2) Medium time-lag triggering characteristics.
3) The risk time is the time needed to detect internal and external faults. External errors affect the OSSDs (short-circuit to an OSSD and cross-circuit between the two OSSDs). At least one of the two OSSDs is safely switched off during the risk time.

Table 18: Interfaces

Interfaces	
System connection	
TR110-SxxSAxx TR110-SxxFLxx	Male connector, M12, 8-pin, A-coded
TR110-SxxCAxx TR110-Sxx2Bxx	Male connector, M12, 8-pin, A coded, and male connector, M12, 5-pin, A coded

Table 19: Outputs

Output data	
Type of output	
Safety outputs	2 semiconductor outputs (OSSDs), p-switching, short-circuit protected
Application diagnostic outputs	p-switching, short-circuit protected
Output current (OSSDs)	
ON state	1 mA ... 150 mA
OFF state	≤ 250 µA
Output voltage (OSSDs)	
ON state OFF state	U_V -1.5 V DC ... U_V 0 V DC ... 1 V DC
Test pulse duration (OSSDs)	
All except for TR110-SRUCAxx TR110-SRUCAxx	300 µs 1 ms
Test pulse interval (OSSDs)	
All except for TR110-SRUCAxx TR110-SRUCAxx	≤ 100 ms ≤ 140 ms
Application diagnostic outputs	
Output current	1 mA ... 50 mA
Output voltage	0.8 × U_V ... U_V
N/O contacts of the pushbuttons (only TR110-SXXXBXX)	
Output current Output voltage	1 ... 50 mA U_V

Table 20: Mechanical data

Mechanical data	
Dimensions (W x H x D)	See "Safety switch dimensional drawings", page 48
Material	
Safety switch housing Actuating head Plug connector	Fiberglass-reinforced thermoplastic Zinc die cast Nickel-plated brass
Weight	0.42 kg
Mechanical service life	1 × 10^6 switching operations

Table 21: Ambient data

Ambient data	
Enclosure rating	IP 67 (IEC 60529) IP 69 (IEC 60529) IP 69K (IEC 20653)
Enclosure rating of the variants with operating buttons	IP 65 (IEC 60529)
Ambient operating temperature	–20 °C ... +55 °C
Vibration resistance	EN IEC 60947-5-3
EMC	EN IEC 60947-5-3

11.2 Connecting cables

Requirements for the connecting cables

Table 22: Requirements for the connecting cables

Parameter	Value
Min. wire cross-section	0.25 mm^2
R max.	60 Ohm/km
C max.	120 nF/km
L max.	0.65 mH/km

Recommended cable type = LIYY 8 x 0.25 mm^2 or 5 x 0.34 mm^2

Maximum cable lengths

Table 23: Maximum cable lengths

Max. number of safety locking devices	Possible output current per OSSD (mA)	Max. length of cable from the last safety locking device to the controller (m)
5	10	150
	25	100
	50	80
	100	50
	150	25
6	10	120
	25	90
	50	70
	100	50
	150	25
10	10	70
	25	60
	50	50
	100	40
	150	25

11.3 Safety switch dimensional drawings

TR110-SRUCAx0 and TR110-SLUCAx0 safety switches

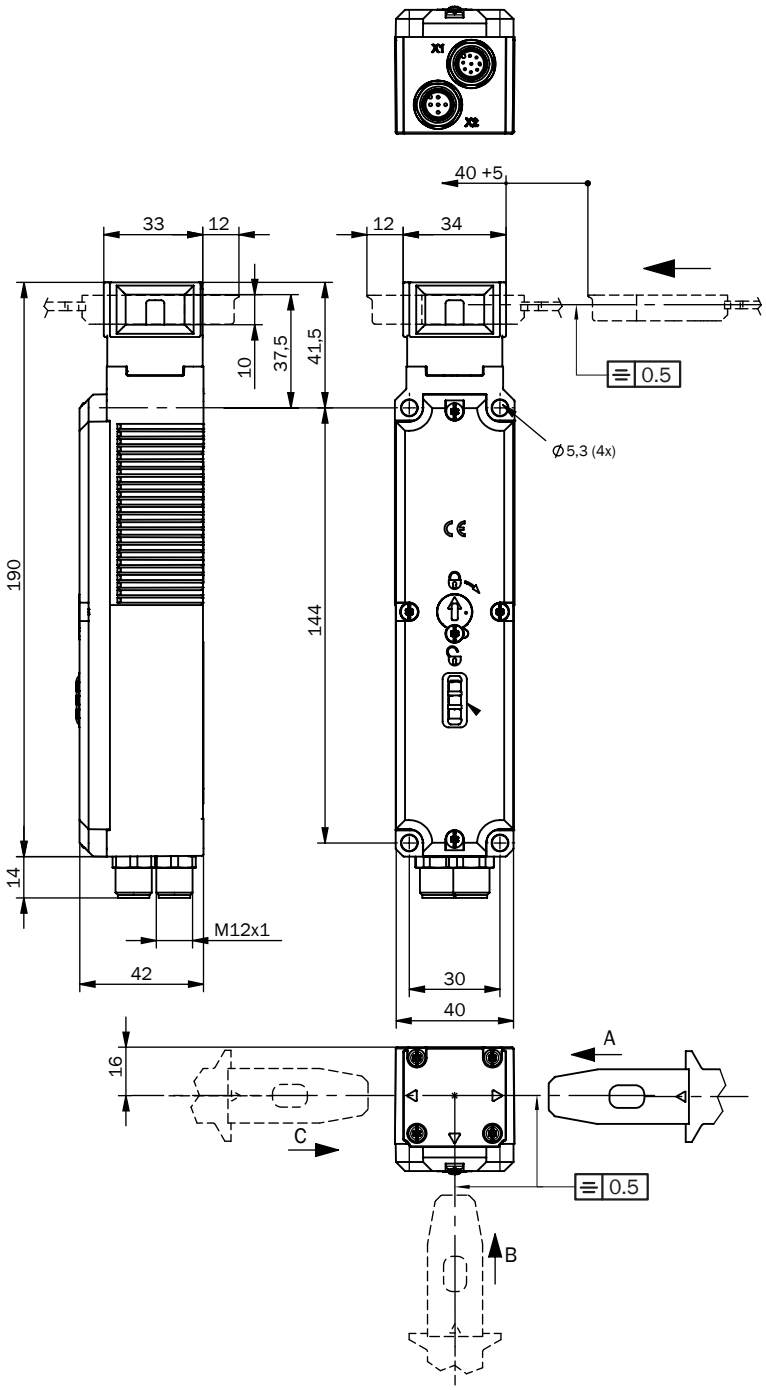


Figure 41: Dimensional drawing for TR110-SRUCAx0 and TR110-SLUCAx0 safety switches (mm)

TR110-SRUSAx1 and TR110-SRUFLx1 safety switches

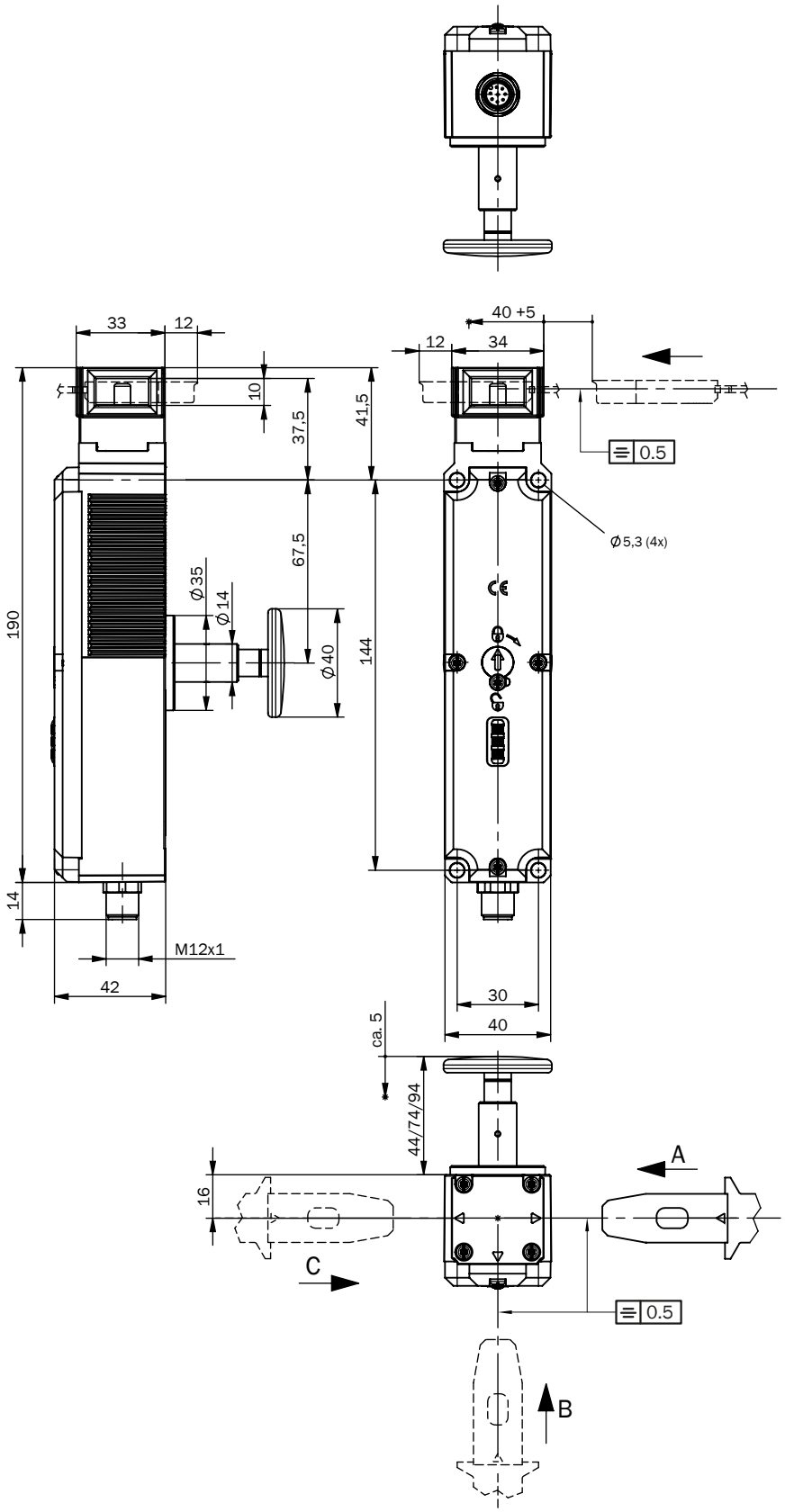


Figure 42: Dimensional drawing for TR110-SRUSAx1 and TR110-SRUFL01x0 safety switches (mm)

TR110-SRUCAx1 safety switch

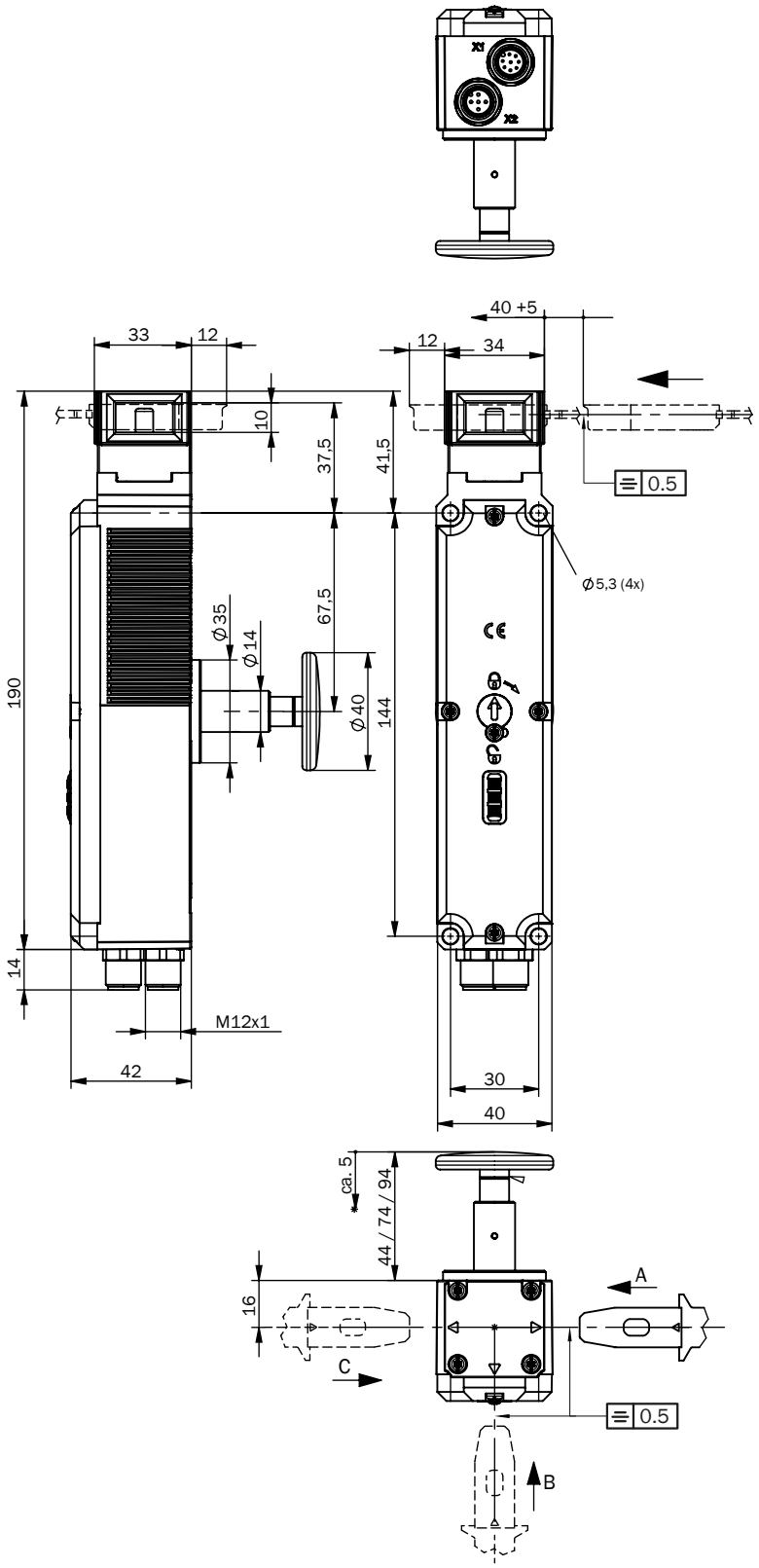


Figure 43: Dimensional drawing for TR110-SRUCAx1 safety switch (mm)

TR110-SRUFLx0, TR110-SLUFLx0, TR110-SRUSAx0 and TR110-SLUSAx0 safety switches

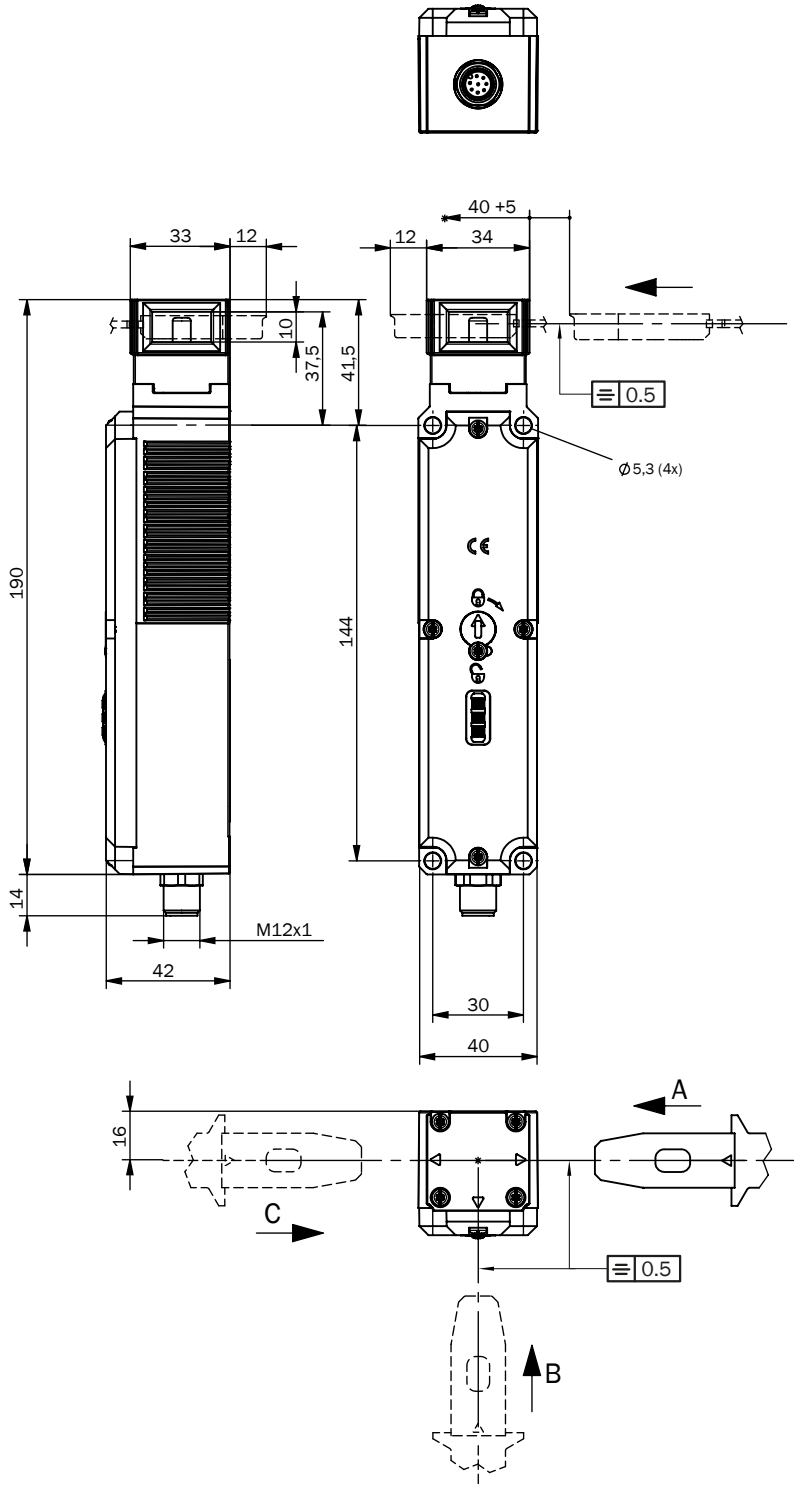


Figure 44: Dimensional drawing for TR110-SRUFLx0, TR110-SLUFLx0, TR110-SRUSAx0 and TR110-SLUSAx0 safety switches (mm)

TR110-SRU2Bx0 and TR110-SLU2Bx0 safety switches

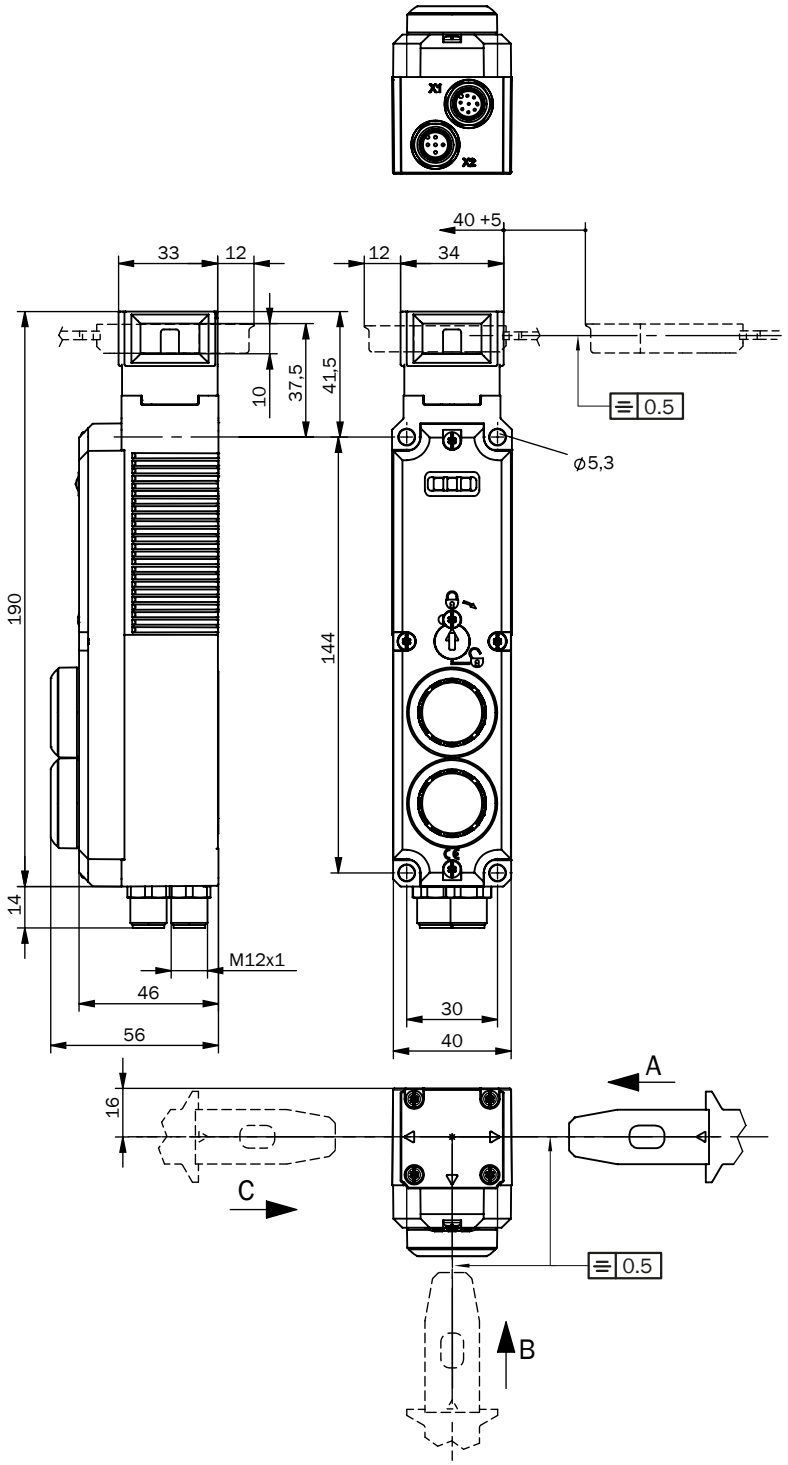


Figure 45: Dimensional drawing for TR110-SRU2Bx0 and TR110-SLU2Bx0 safety switches (mm)

TR110-SRU2Bx1 safety switch

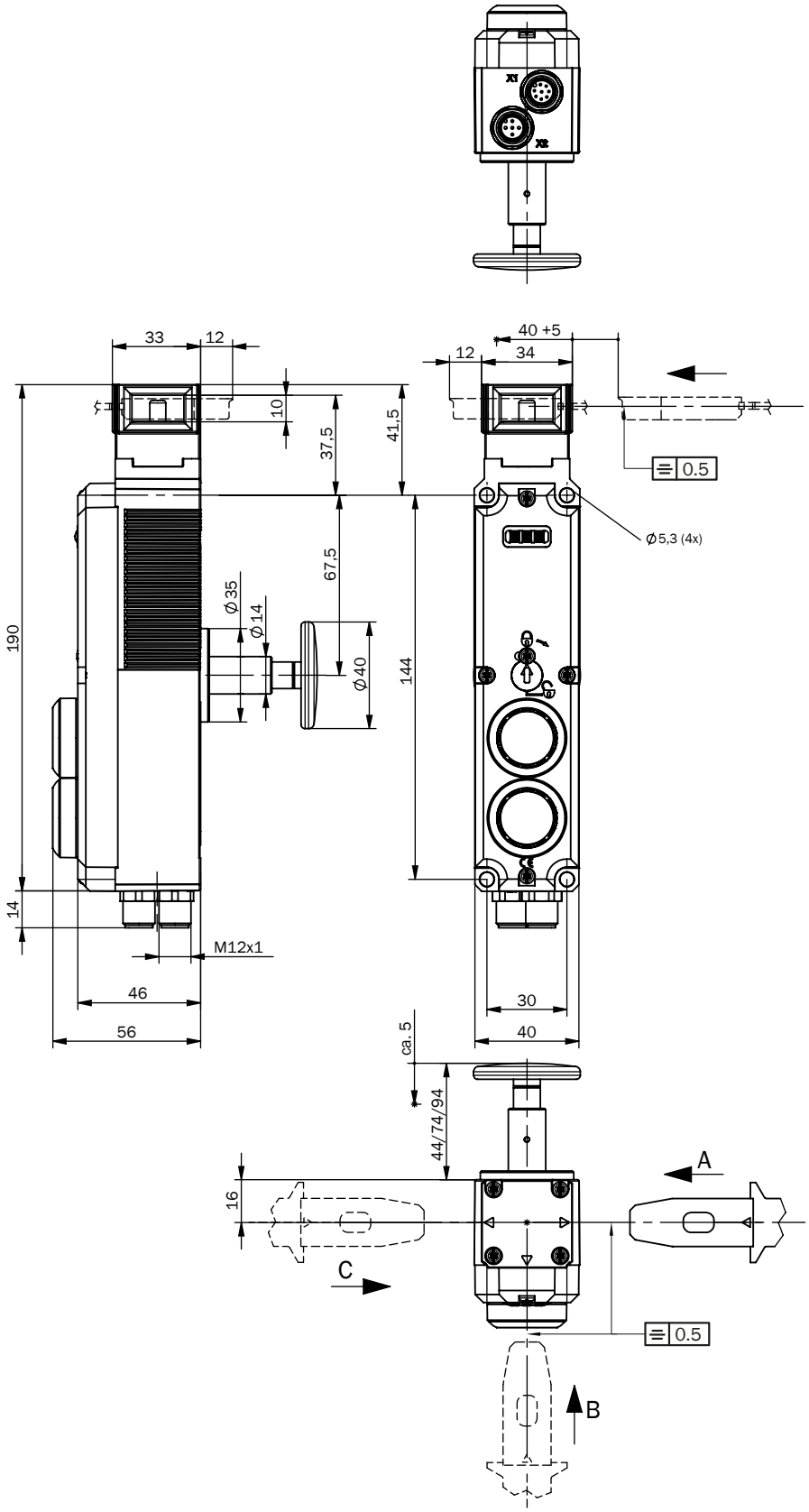


Figure 46: Dimensional drawing for TR110-SRU2Bx1 safety switch (mm)

11.4 Actuator dimensional drawings

Straight actuator – TR110-XAS

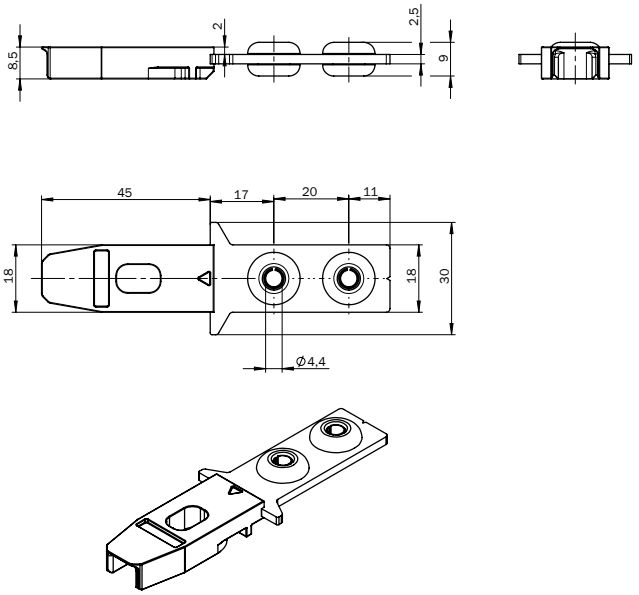


Figure 47: Dimensional drawing of TR110-XAS straight actuator (mm)

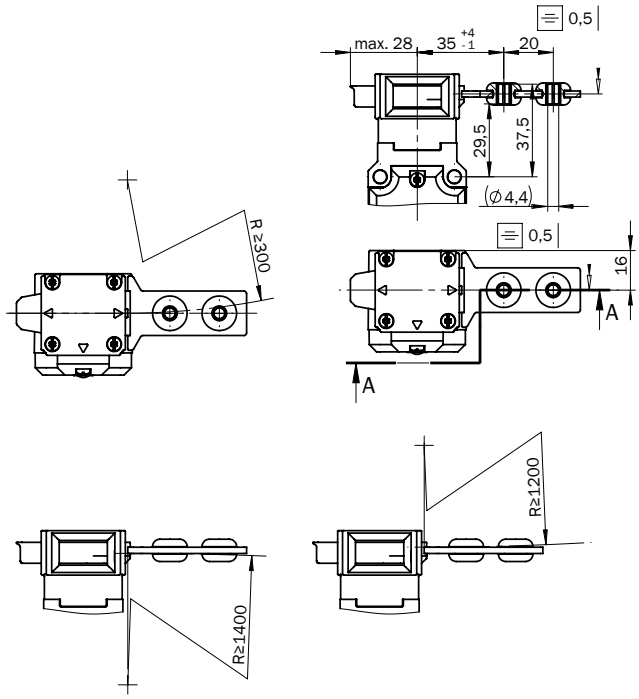


Figure 48: Min. door radii for TR110-XAS straight actuator (mm)

Angled actuator – TR110-XABT

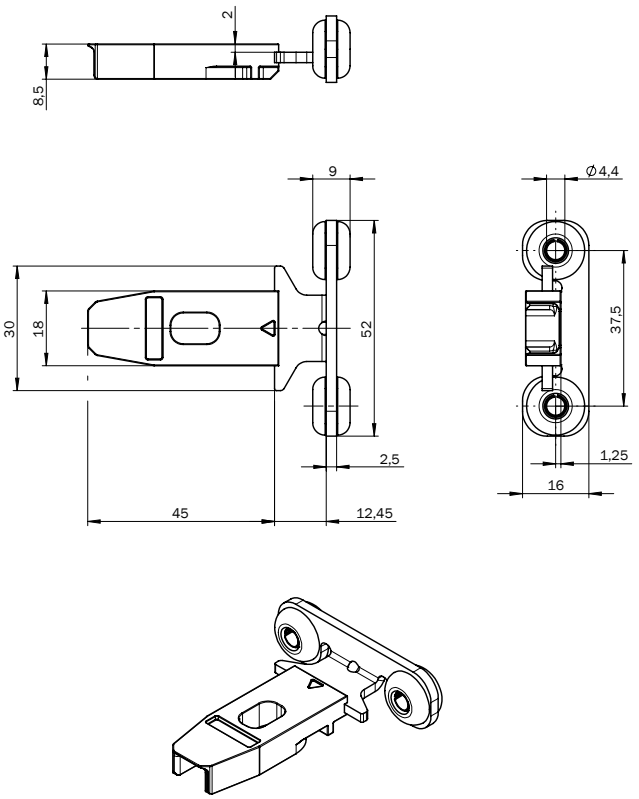


Figure 49: Dimensional drawing of TR110-XABT angled actuator (mm)

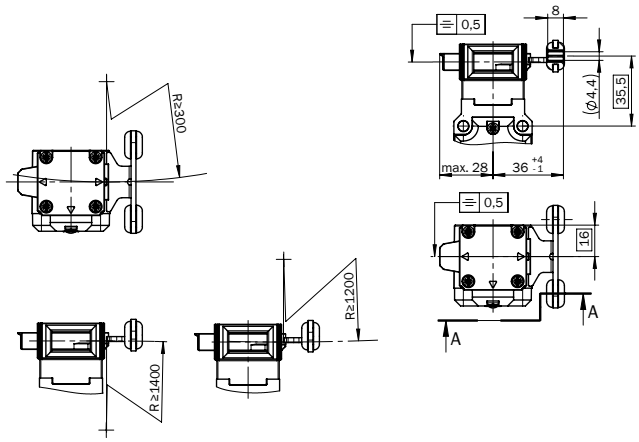


Figure 50: Min. door radii for TR110-XABT angled actuator (mm)

Hinged actuators for top-hinged doors – TR110-XAFT

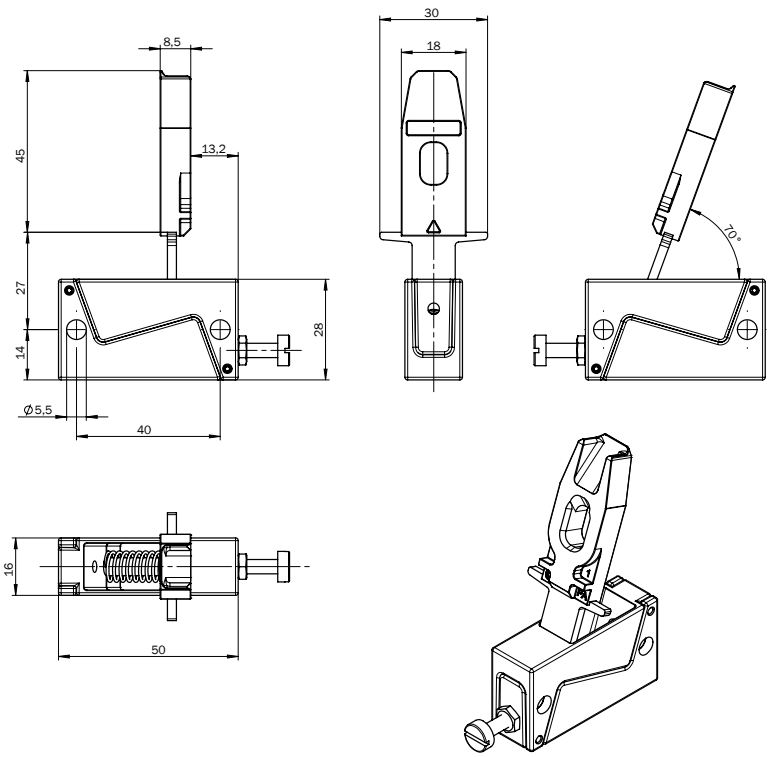


Figure 51: Dimensional drawing of TR110-XAFT hinged actuator (mm)

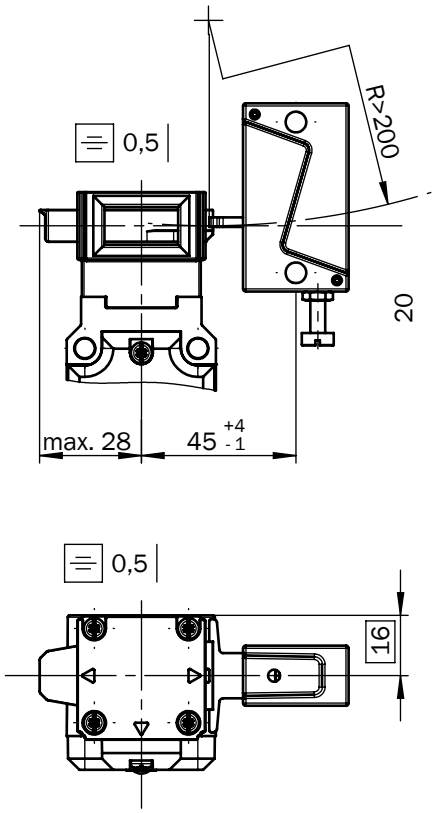


Figure 52: Min. door radii for TR110-XAFT hinged actuator (mm)

Hinged actuators for bottom-hinged doors – TR110-XAFB

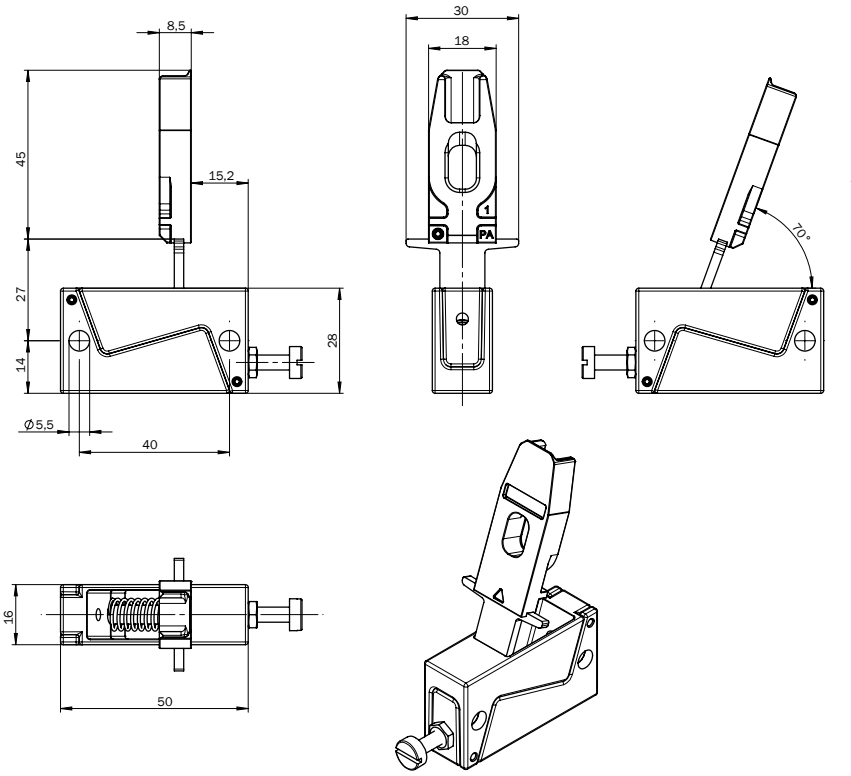


Figure 53: Dimensional drawing of TR110-XAFB hinged actuator (mm)

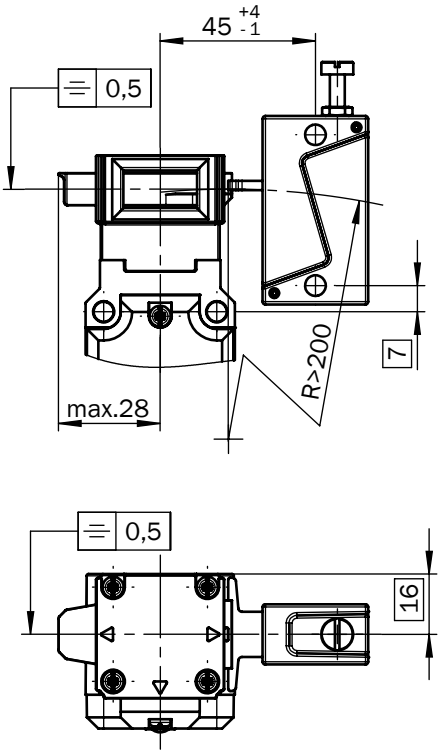


Figure 54: Min. door radii for TR110-XAFB hinged actuator (mm)

Hinged actuators for left-hinged doors – TR110-XAFL

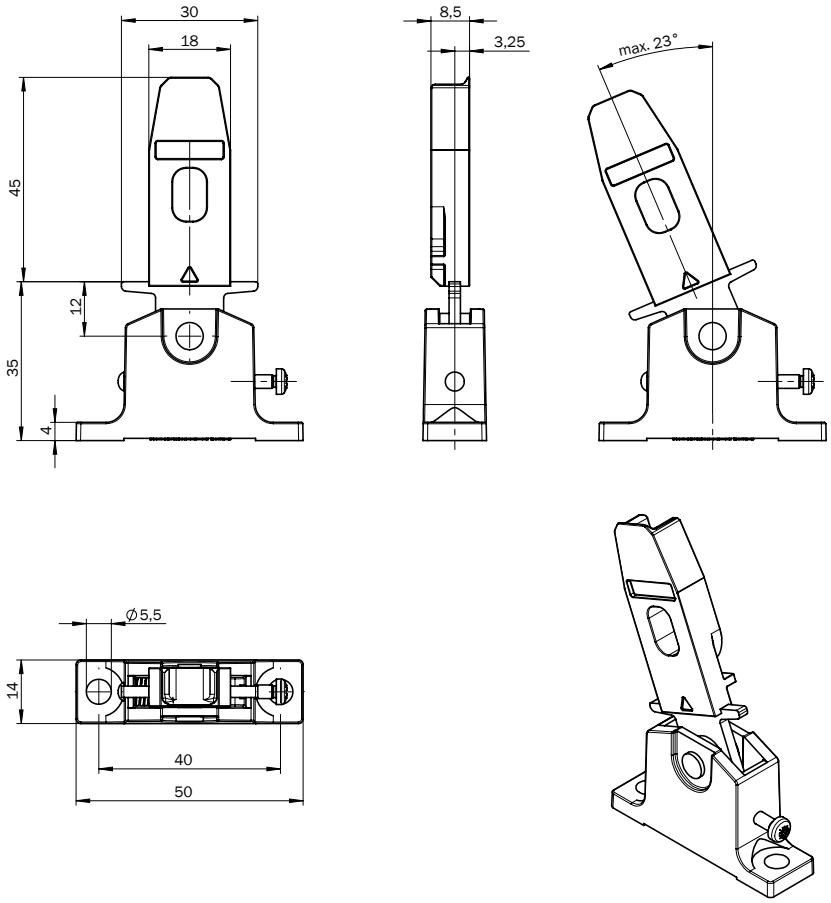


Figure 55: Dimensional drawing of TR110-XAFL hinged actuator (mm)

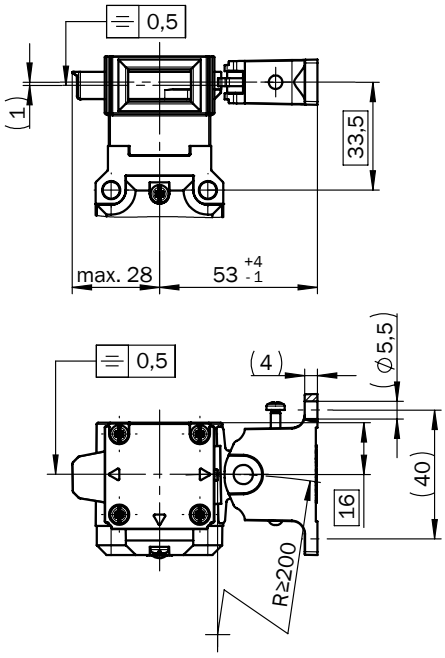


Figure 56: Min. door radius for TR110-XAFL hinged actuator (mm)

Hinged actuators for right-hinged doors – TR110-XAFR

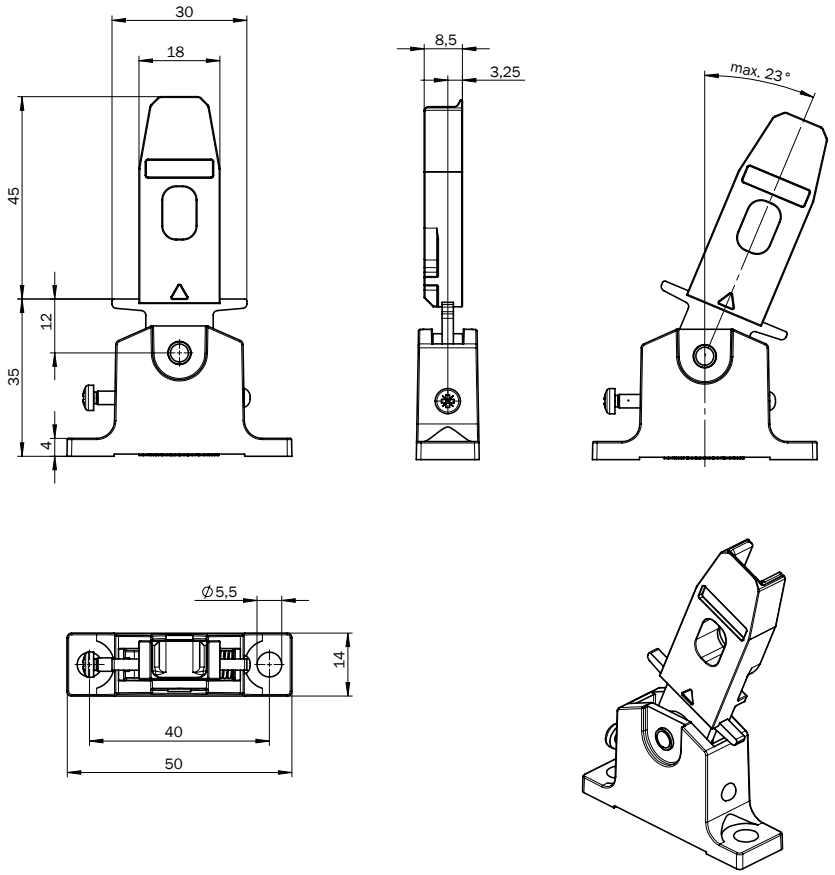


Figure 57: Dimensional drawing of TR110-XAFR hinged actuator (mm)

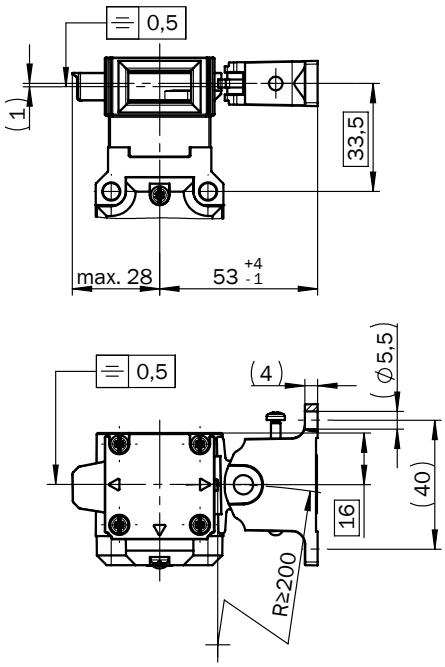


Figure 58: Min. door radius for TR110-XAFR hinged actuator (mm)

11.5 Dimensional drawings of the mounting bracket

Mounting bracket for safety locking device

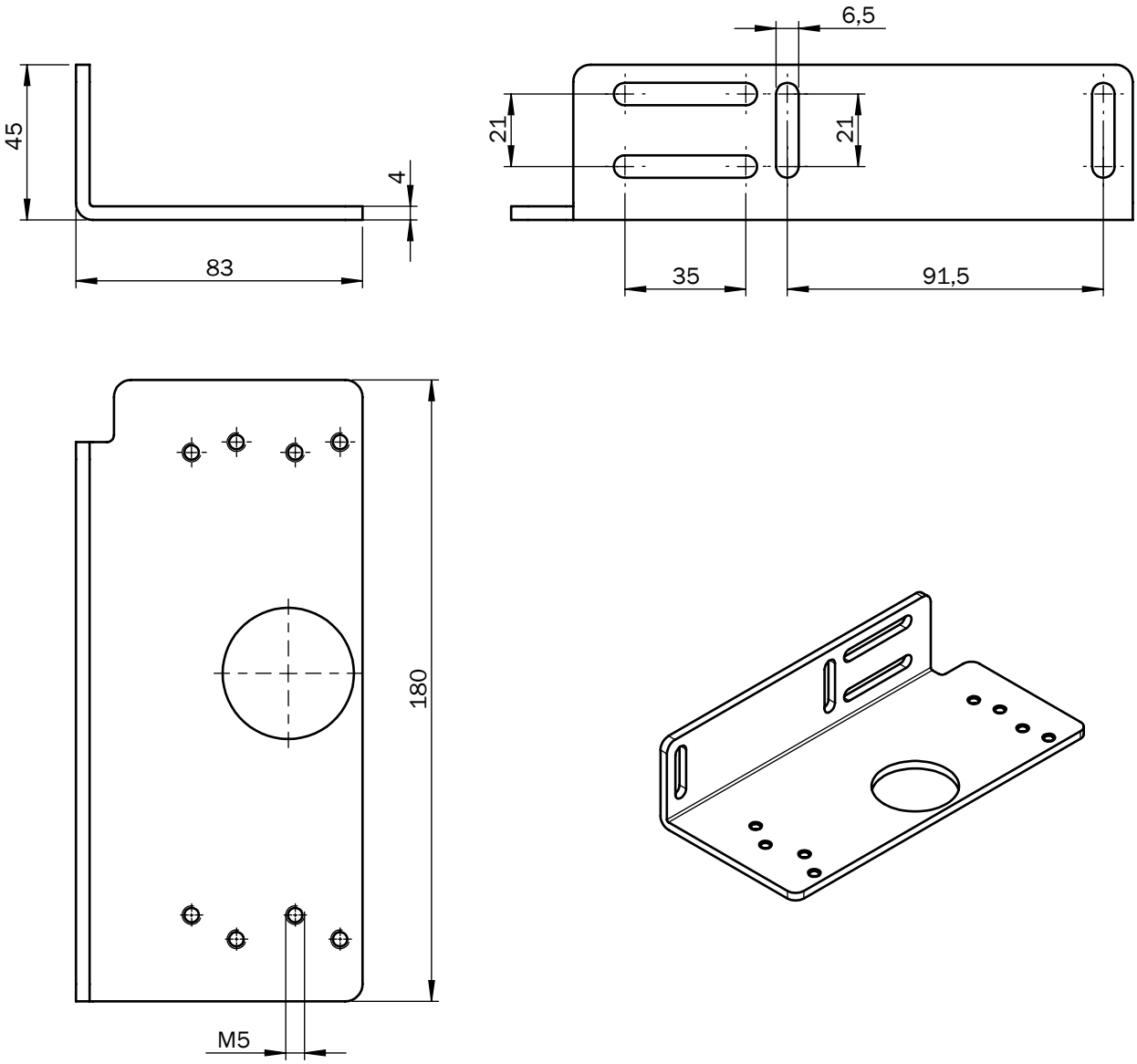


Figure 59: Mounting bracket for safety locking device

Mounting bracket for actuator

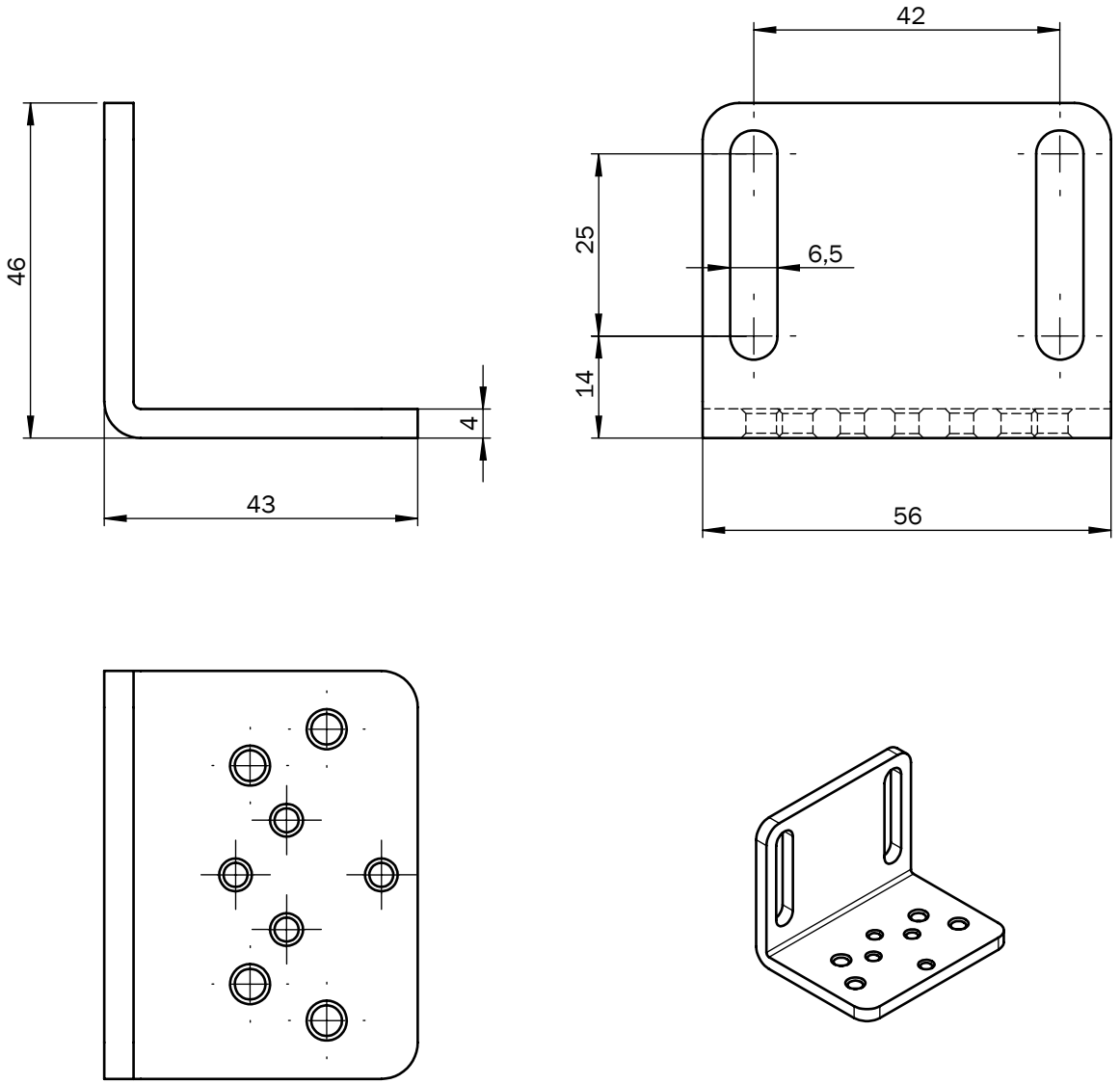


Figure 60: Mounting bracket for actuator

12 Ordering information

12.1 Ordering information

Table 24: Ordering information, TR110 Lock

Locking principle	Connection type	Type code	Part number
Power to release principle	M12 female connector (8-pin), straight	TR110-SRUSAB0	6082944
Power to release principle	M12 female connector (8-pin), straight, for connecting to a Flexi Loop	TR110-SRUFLB0	6082947
Power to release principle	M12 female connector (5-pin), straight M12 female connector (8-pin), straight OSSDs cascadable with T-connector or in the control cabinet	TR110-SRUCAB0	6082950
Power to release principlewith escape release	M12 female connector (8-pin), straight	TR110-SRUSAB1	6082946
Power to release principlewith escape release	M12 female connector (8-pin), straight, for connecting to a Flexi Loop	TR110-SRUFLB1	6082949
Power to release principlewith escape release	M12 female connector (5-pin), straight M12 female connector (8-pin), straight OSSDs cascadable with T-connector or in the control cabinet	TR110-SRUCAB1	6082952
Power to lock principle	M12 female connector (8-pin), straight	TR110-SLUSAB0	6082945
Power to lock principle	M12 female connector (8-pin), straight, for connecting to a Flexi Loop	TR110-SLUFLB0	6082948
Power to lock principle	M12 female connector (5-pin), straight M12 female connector (8-pin), straight OSSDs cascadable with T-connector or in the control cabinet	TR110-SLUCAB0	6082951

Table 25: Ordering information, TR110 Lock with pushbuttons

Locking principle	Connection type	Type code	Part number
Power to release principle	M12 female connector (5-pin), straight M12 female connector (8-pin), straight	TR110-SRU2BB0	6082953
Power to release principlewith emergency release	M12 female connector (5-pin), straight M12 female connector (8-pin), straight	TR110-SRU2BB1	6082955
Power to lock principle	M12 female connector (5-pin), straight M12 female connector (8-pin), straight	TR110-SLU2BB0	6082954

13 Accessories

13.1 Actuator

TR110 Lock actuator

Table 26: Actuator

Description	Type code	Part number
Actuator, straight	TR110-XAS	5321176
Actuator, angled	TR110-XABT	5334663
Hinged actuators for top-hinged doors	TR110-XAFT	5338336
Hinged actuators for bottom-hinged doors	TR110-XAFB	5338338
Hinged actuators for left-hinged doors	TR110-XAFL	5338331
Hinged actuators for right-hinged doors	TR110-XAFR	5338332

Complementary information

- The straight actuators and angled actuators are provided with 2 × M4 retaining screws.
- The hinged actuators are provided with 2 × M5 retaining screws.

13.2 Connectivity

M12 connecting cable, 5-pin (0.34 mm²)

Table 27: 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 28: Ordering information for connection cable, M12, 8-pin (0.25 mm²) [2]

Part	Type code	Part number
Female connector, straight, 2 m cable, flying leads	YF2A18-020UA5XLEAX	2095652

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, 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
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 29: 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	YF2A15-150UB5M2A15	2096171

M12 connection cable, 8-pin (0.25 mm²)

Table 30: Ordering information for M12 connection cable, 8-pin (0.25 mm²) [3]

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

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

Part	Type code	Part number
Female connector, straight, 10 m cable, straight male connector	YF2A18-100UA5M2A18	2096035
Female connector, straight, 15 m cable, straight male connector	YF2A18-150UA5M2A18	2104374

Distributor

Table 31: Ordering information for distributor

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

Terminator plug

Table 32: Ordering information for terminator plug

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

13.3 Additional accessories

Table 33: Additional accessories

Description	Type code	Part number
Emergency release	TR110-XER	5338333
Safety switch mounting plate, angled	TR110-XMSB	5338334
Actuator mounting plate, angled	TR110-XMAB	5338335
Cover cap set, unprinted with 5 colors: • 2 × white (transparent) • Green • Red • Blue • Yellow	TR110-XTC	5339045

14 Annex

14.1 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).

14.1.1 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
- MACHINERY DIRECTIVE 2006/42/EC
- RE DIRECTIVE 2014/53/EU

14.1.2 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
- Supply of Machinery (Safety) Regulations 2008
- Radio Equipment Regulations 2017

14.1.3 FCC and IC radio approval

- FCC ID: 2AHDR-TR110
- IC: 21147-TR110

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.

Supplier's Declaration of Conformity
47 CFR § 2.1077 Compliance information

Unique Identifier:

- TR110-SRUSAB0
- TR110-SLUSAB0
- TR110-SRUSAB1
- TR110-SRUFLB0
- TR110-SLUFLB0
- TR110-SRUFLB1
- TR110-SRUCAB0
- TR110-SLUCAB0
- TR110-SRUCAB1
- TR110-SRU2BB0
- TR110-SLU2BB0
- TR110-SRU2BB1

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