

STR1

Safety switch

SICK
Sensor Intelligence.



Described product

STR1

Manufacturer

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Original document

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1 About this document

1.1 Information on the operating instructions

Read these operating instructions carefully before starting any work in order to familiarize yourself with the product and its functions.

The operating instructions are an integral part of the product and should remain accessible to the personnel at all times. When handing this product over to a third party, include these operating instructions.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the product is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Scope

Product

This document applies to the following products:

- Product code: STR1

Document identification

Document part number:

- This document: 8018754
- Available language versions of this document: 8018074

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

1.3 Target group

This document is intended for persons who project plan, install, commission, operate and maintain the product.

1.4 Further information

You can find the product page with further information via the SICK Product ID: pid.sick.com/{P/N}/{S/N} (see "Product identification via the SICK product ID", page 9).

The following information is available depending on the product:

- This document in all available language versions
- Data sheets
- Other publications
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Software
- Accessories

1.5 Symbols and document conventions

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 is numbered.
- 2. Follow the order in which the numbered instructions are given.
- ✓ The tick denotes the results of an action.

2 Safety information

2.1 General safety notes

Integrating the product



DANGER

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

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

Mounting and electrical installation



DANGER

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

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

Repairs and modifications



DANGER

Improper work on the product

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

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

2.2 Intended use

The safety switch is a transponder safety switch that is switched in a non-contact manner by means of actuators, and is suitable for the following applications:

- Movable physical guards
- Safe position monitoring

The product may be used in safety functions.

The safety switch must only be used within the limits of the prescribed and specified technical data and operating conditions at all times.

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

The safety switch is **not** suitable for certain ambient conditions, including:

- Radioactivity (with the exception of natural radioactivity)
- Vacuum or high pressure
- High UV exposure
- In the vicinity of low-frequency RFIDs
- In the vicinity of magnetic fields

The following can impair the function of the safety switch:

- Metal subsurfaces or metal in the immediate vicinity (see "Design", page 12)
- Flying metal chips

2.3 Qualification of personnel

Any work on the product may only be carried out by personnel qualified and authorized to do so.

Qualified personnel are able to perform tasks assigned to them and can independently recognize and avoid any potential hazards. This requires, for example:

- technical training
- experience
- knowledge of the applicable regulations and standards

3 Product description

3.1 Scope of delivery

- Sensor
- Actuator
- Protective cap for secure sensor mounting
- Protective caps for secure actuator mounting (included in scope of delivery from production date 2227)
- No protective caps in “mini” design
- Safety note
- Operating instructions for download: www.sick.com

3.2 Product identification

3.2.1 Product identification via the SICK product ID

SICK product ID

The SICK product ID uniquely identifies the product. It also serves as the address of the web page with information on the product.

The SICK product ID comprises the host name `pid.sick.com`, the part number (P/N), and the serial number (S/N), each separated by a forward slash.

For many products, the SICK product ID is displayed as text and QR code on the type label and/or on the packaging.



Figure 1: SICK product ID

3.3 Product characteristics

3.3.1 Setup and function

The safety switch consists of two components:

- **Sensor**
The sensor is mounted on the fixed part of the protective device.
- **Actuator (transponder)**
The actuator is mounted on the moving part of the protective device.

When the guard is closed, the actuator is moved towards the sensor. The sensor detects the code of the actuator when it reaches the switch-on distance. If the sensor detects a valid actuator, the sensor sets the OSSD 1 and OSSD 2 safety outputs (semiconductor outlets) to HIGH.

When the protective device is opened, the actuator is moved out of the sensor's response range. The sensor sets the OSSD 1 and OSSD 2 safety outputs to Low.

3.3.2 Product variants

Overview

The safety switch is delivered in different variants. You will find an overview of important distinguishing features of the variants in the following.

Coding

The safety switch is available with the following codings:

- **Universally coded**
All actuators are accepted. No teach-in is required.
- **Uniquely coded**
An actuator must be taught in during commissioning. Up to 8 actuators may be taught in one after the other. Only the most recently taught-in actuator is valid. Previously taught-in actuators can no longer be used.
- **Permanently coded**
An actuator must be taught in during commissioning. Teach-in only needs to be performed once. It is not possible to teach in any further actuators.

Design of the actuator

The actuator is available in the following designs:

- Standard
- Compact
- Flat
- Mini

Safe series connection

The safety switch is available with the following options for safe series connection:

- Safe series connection via T-connectors
- Safe series connection via Flexi Loop
- Safe series connection in the control cabinet

Connection type

The safety switch is available with the following connections:

- Open cable ends, 5-wire
- Open cable ends, 7-wire
- M8 male connector, 8-pin
- M12 male connector, 5-pin
- M12 male connector, 8-pin

Length of cable

Some variants are available with different lengths of cable:

- 0.2 m
- 0.3 m
- 0.5 m
- 3 m
- 10 m

Complementary information

You can find a complete overview of variants on the SICK homepage: www.sick.com/STR1

3.3.3 Active sensor surfaces

The sensor has 3 active sensor surfaces:

- Front: black surface
- 2 x sides: yellow surface with long black edge

3.3.4 Fault detection

Any faults that occur, including internal device faults, are detected at the latest with the next request (as soon as a safety output switches to HIGH). The safety switch then switches to safe state. If a fault is detected, the safety circuit is switched off and the STATE and DIAG LEDs show the error (see table 17).

3.3.5 Safe series connection

Overview

Several safety switches can be connected in series in a safe series connection. The type of safe series connection depends on the safety switch variant selected.

The following options are available:

- Safe series connection with Flexi Loop (with diagnostics)
In a series connection with Flexi Loop, the safety switches are connected to Flexi Loop nodes. Each Flexi Loop node evaluates a safety switch and sends the information to the evaluation unit for safety sensors from SICK.
- Safe series connection with T-connector (without diagnostics)
In a series connection with T-connectors, several safety switches are connected via T-connectors and connected to the safe evaluation unit. The connected devices act like a single device.
- Safe series connection in control cabinet (with diagnostics)
In a series connection in the control cabinet, the safety switches are led to the control cabinet individually. The OSSDs of the safety switches are connected in series there and evaluated by the evaluation unit. The Aux outputs can be individually connected to the programmable logic controller (PLC).

Further topics

- ["Safe series connection", page 16](#)
- ["Safe series connection with T-connector \(without diagnostics\)", page 18](#)
- ["Safe series connection in control cabinet \(with diagnostics\)", page 20](#)

3.3.6 State indicators

The STATE light emitting diode (red/green) and the DIAG light emitting diode (yellow) signal the operational state of the safety switch.

Complete overview of the light emitting diode states and their meanings: see ["Diagnostic LEDs", page 31](#).

3.3.7 Protective functions

The safety switch has the following internal protective functions:

- Short-circuit protection at all outputs
- Cross-circuit monitoring at OSSDs
- Overload protection on OSSDs
- Supply voltage reverse polarity protection

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 safety switch.

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

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

If several devices are connected in series (safe series connection) and the simplified process according to EN ISO 13849 is used to determine the performance level (PL), the PL may be reduced.

4.2 Operator of the machine

Changes to the electrical integration of the device in the machine controller and changes to the mechanical mounting of the device 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.

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

The device must not be repaired. Improper repair can result in the device not providing correct protection.

Restrict access to replacement actuators so they are not used to circumvent the device.

4.3 Design



DANGER

Bypassing the protective device

Hazard due to lack of effectiveness of the protective device

- ▶ Prevent incentives to manipulate the safety switch by taking at least one of the following measures:
 - Only for universally coded variants: Cover the sensor and the actuator with additional equipment or protect them against access.
 - If possible use permanent mounting methods for actuators (e.g., glue, safety screws, or rivets).
-

Mounting location

- ▶ When the protective device is closed, the sensor and actuator must be located opposite each other at assured switch-on distance S_{ao} or closer (see "[Sensing ranges](#)", page 41).
- ▶ Select a mounting location that allows the sensor and actuator to be accessed for maintenance work and protects them against damage.
- ▶ If possible, mount the sensor and actuator on non-ferrous subsurfaces and at a distance from metallic parts in order to avoid affecting the sensing range. If this is not possible, the effect on the safe switch on distance S_{ao} and the safe switch off distance S_{ar} must be checked.

- ▶ Make sure that there is no possibility of hazards arising when the protective device is opened, even if the actuator has not yet reached the safe switch off distance S_{ar} .
- ▶ If the actuator approaches the sensor in parallel, maintain the minimum distances (see "Sensing ranges", page 41).
- ▶ If necessary, attach an additional stop for the moving protective device.

Distance

If multiple safety switches are mounted on the machine, they must be mounted with a minimum distance in relation to one another; see "Mounting", page 22.

Alignment

Sensors and actuators can be aligned differently to one another, see "Mounting", page 22, see "Sensing ranges", page 41. The actuators can point to the front or be rotated by 90° to the front sensor surface or a side sensor surface.

Approach direction

The actuator can approach the sensor differently:

- Direct approach
The direction of movement of the actuator is vertical to one of the 3 active sensor surfaces. No minimum distance must be maintained.
- Parallel approach
The direction of movement of the actuator is parallel to the long side of the sensor. A minimum distance must be maintained (see "Sensing ranges", page 41). Due to the principle, the response range of the sensor has side lobes. If the minimum distance is not maintained, the OSSDs switch to the ON state before the correct position is reached. SICK recommends doing without parallel approach if you cannot maintain a minimum distance.

4.3.1 Different sensing ranges

Different sensing ranges

- Assured switch-on distance S_{ao}
If the actuator approaches the sensor and reaches the assured switch-on distance, the OSSDs safely switch to the ON state.

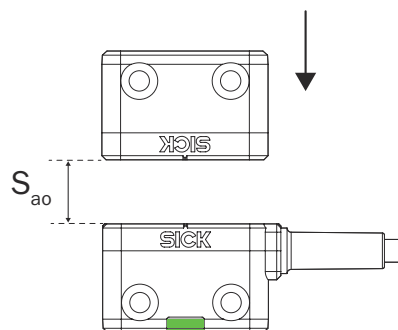


Figure 2: Assured switch-on distance S_{ao}

- Assured switch off distance S_{ar}
If the actuator is removed from the sensor and the assured switch-off distance is reached, the OSSDs safely switch to the OFF state.

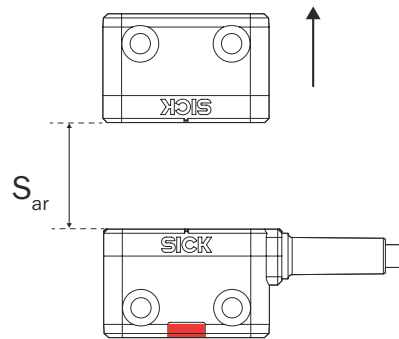


Figure 3: Assured switch off distance S_{ar}

- Typical switch-on distance
If the actuator approaches the sensor, the OSSDs typically switch to the ON state before the actuator reaches assured switch-on distance S_{ao} . The typical switch-on distance depends on the ambient conditions.

The exact values of the sensing ranges depend on different factors.

Further topics

- ["Sensing ranges", page 41](#)

4.4 Integration in the electrical control system

You need to take the following into consideration when integrating the safety switch into the electrical control system.

Requirement for use

- 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 device is integrated must be validated in accordance with ISO 13849-2.
- The inputs of a connected evaluation unit must be positive-switching (PNP) inputs because the two outputs of the safety switch supply a level of the supply voltage in the switched-ON state.

4.4.1 Course of the OSSD test over time

The device tests the OSSDs for self-diagnosis at regular intervals. To do this, the device switches each OSSD briefly 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.

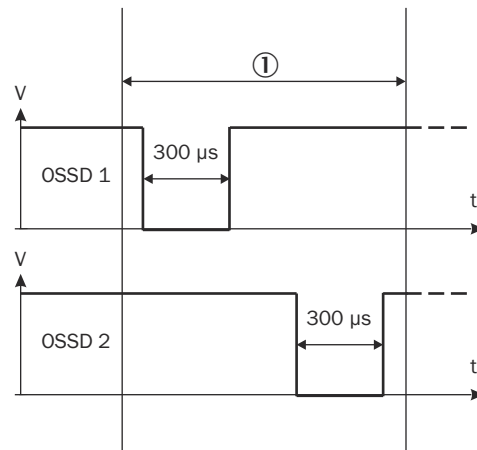


Figure 4: Course of the OSSD test over time

① Usually every 40 ms.

The interval is dynamic and can be smaller than 40 ms.

4.4.2 Application diagnostic output

The signal of the application diagnostic output (AUX) depends on various factors. This is not a safety output.

Table 1: Switching behavior of application diagnostic output

Actuator in response range	The device is in error state	Signal status a In1 and In2	OSSDs	Application diagnostic output
Yes	No	HIGH	HIGH	LOW
Yes	Yes	HIGH / LOW	LOW	HIGH
Yes	No	LOW	LOW	LOW
No	Yes/No	HIGH / LOW	LOW	HIGH

Certain variants of the safety switch have a different switching behavior.

Table 2: Switching behavior of application diagnostic output only STR1-SAXMOAC8S01

Actuator in response range	The device is in error state	Signal status a In1 and In2	OSSDs	Application diagnostic output
Yes	No	HIGH	HIGH	HIGH
Yes	Yes	HIGH / LOW	LOW	LOW
Yes	No	LOW	LOW	LOW
No	Yes/No	HIGH / LOW	LOW	LOW

Table 3: Switching behavior of application diagnostic output STR1-SAXMOAC8S02, STR1-SACMOPR5 and STR1-SACMOPR8 only

Actuator in response range	The device is in error state	Signal status a In1 and In2	OSSDs	Application diagnostic output
Yes	No	HIGH	HIGH	HIGH
Yes	Yes	HIGH / LOW	LOW	LOW
Yes	No	LOW	LOW	HIGH
No	Yes/No	HIGH / LOW	LOW	LOW

4.4.3 Safe series connection

Overview

Several safety switches can be connected in series in a safe series connection. The type of safe series connection depends on the safety switch variant selected.

The following options are available:

- **Safe series connection with Flexi Loop (with diagnostics)**
In a series connection with Flexi Loop, the safety switches are connected to Flexi Loop nodes. Each Flexi Loop node evaluates a safety switch and sends the information to the evaluation unit for safety sensors from SICK.
- **Safe series connection with T-connector (without diagnostics)**
In a series connection with T-connectors, several safety switches are connected via T-connectors and connected to the safe evaluation unit. The connected devices act like a single device.
- **Safe series connection in control cabinet (with diagnostics)**
In a series connection in the control cabinet, the safety switches are led to the control cabinet individually. The OSSDs of the safety switches are connected in series there and evaluated by the evaluation unit. The Aux outputs can be individually connected to the programmable logic controller (PLC).

Safe series connection with T-connectors or in the control cabinet

Do not use more than 30 safety switches in a series connection.

The maximum number of safety switches depends on the following factors:

- Applied supply voltage
- Length of cables used
- Wire cross-section of cables used

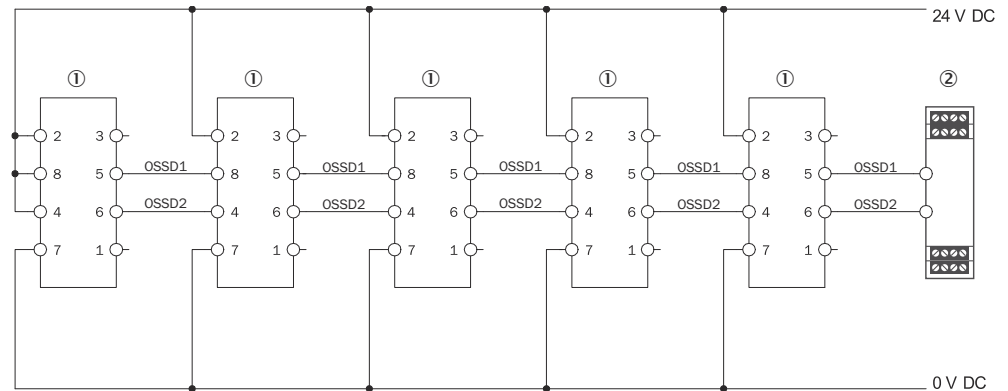


Figure 5: Switching with 5 safety switches connected in series

- ① Safety switch
- ② Safe evaluation unit

The voltage drop in the series connection must be checked so that the defined minimum voltage is still applied to the last safety switch.

For connection cables with a length of 2 m and a wire cross-section of 0.25 mm², the maximum number of safety switches in connected in series depends on the voltage as follows:

Table 4: Maximum number of safety switches in a series connection depends on the voltage

Voltage	Connection cables, uniform for the entire series connection	Input voltage at 30th safety switch	Maximum number of safety switches in series connection
24 V	Length: 2 m	17.8 V	24
26.8 V	Wire cross-section of 0.25 mm ²	19.2 V	30

Complementary information

The number of safety switches in a series connection influences the response time of the system (see "Response times in a safe series connection", page 41).

Further topics

- "Safe series connection with Flexi Loop (with diagnostics)", page 17
- "Safe series connection with T-connector (without diagnostics)", page 18
- "Safe series connection in control cabinet (with diagnostics)", page 20

4.4.3.1 Safe series connection with Flexi Loop (with diagnostics)

Prerequisites

- Safety switch with male connector, M12, 5-pin or
- Safety switch with male connector, M12, 8-pin

Construction

The safe series connection can be created using Flexi Loop nodes.

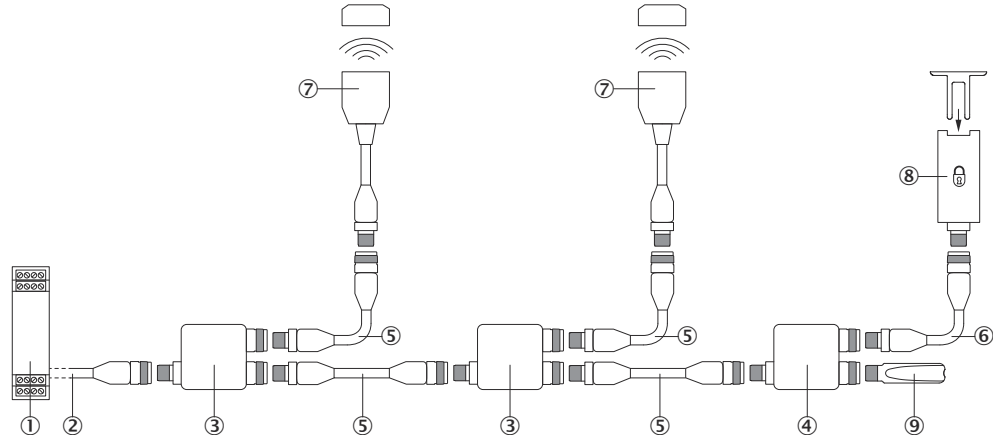


Figure 6: Safe series connection with Flexi Loop nodes

- ① Flexi Soft safety controller
- ② Connecting cable with female connector, M12, 5-pin
- ③ FLN-OSSD1000105 Flexi Loop node
- ④ FLN-EMSS1100108 Flexi Loop node
- ⑤ Connection cable with male connector, M12, 5-pin and female connector, M12, 5-pin
- ⑥ Connection cable with male connector, M12, 8-pin and female connector, M12, 8-pin
- ⑦ STR1 safety switch
- ⑧ Safety locking device
- ⑨ FLT-TERM00001 Flexi Loop terminating element

Further topics

- "Device connection (M12, 5-pin)", page 25

4.4.3.2 Safe series connection with T-connector (without diagnostics)

Important information



DANGER

Bypassing the protective device

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

If a safe series connection is created with T-connectors, the connecting cable must be mounted so that individual T-connectors (and therefore a safety switch) cannot be easily jumpered.



NOTE

If safety switches are connected in series via T-connectors, the application diagnostic output cannot be evaluated.



NOTE

If the series connection is not made using special T-connectors and end connectors, ensure that inputs In 1 and In 2 are connected to constant 24 V DC at the first safety switch of the series connection.

Prerequisites

- Safety switches with M12 plug, 8-pin and suitable pin assignment for T-piece (see [table 7, page 25](#)).

Construction

The safe series connection can be implemented using special T-connectors and an end connector.

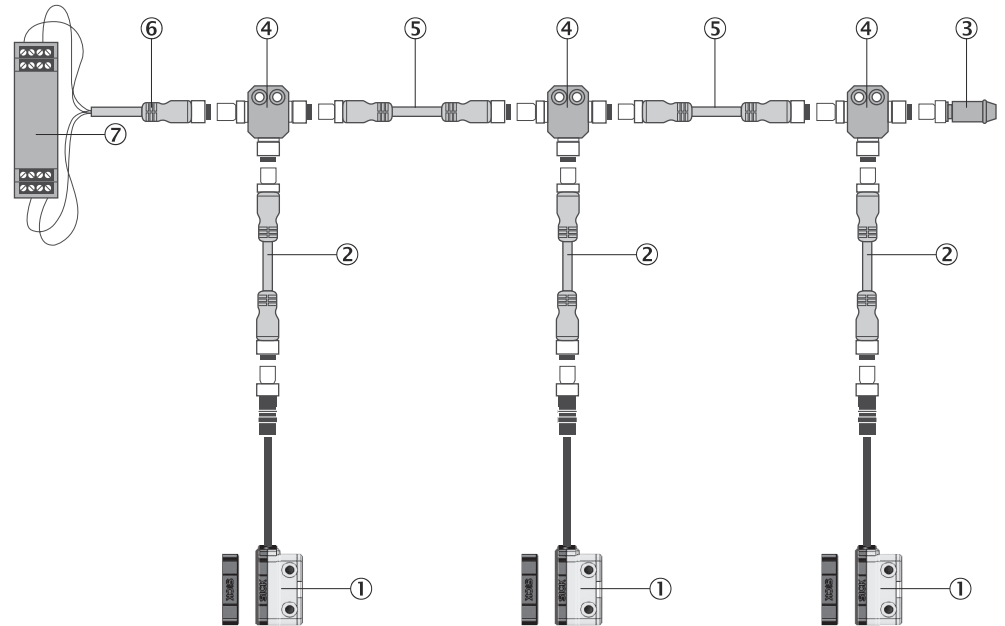


Figure 7: Safe series connection using T-connectors

- ① STR1 safety switch
- ② M12 connection cable, 8-pin
- ③ End connector
- ④ T-piece
- ⑤ M12 connection cable, 4-pin
- ⑥ M12 connecting cable, 4-pin
- ⑦ Safe evaluation unit

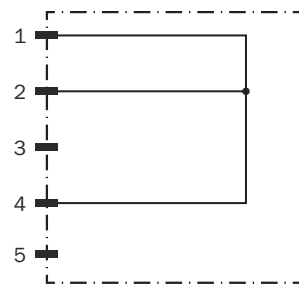


Figure 8: Internal circuitry: end connector for safe series connection

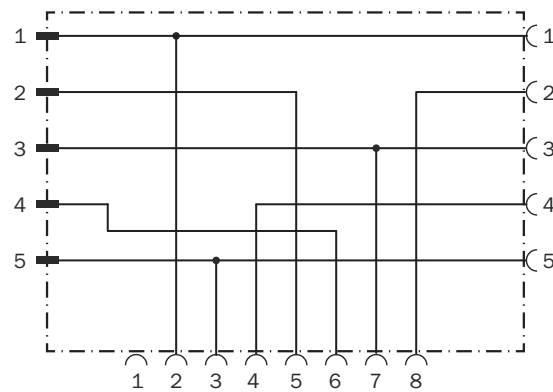


Figure 9: Internal circuitry: T-connector for safe series connection

Further topics

- "Connection of a safe series connection with T-connectors", page 28

4.4.3.3 Safe series connection in control cabinet (with diagnostics)

Prerequisites

- Safety switch with cable, 7-wire
- Safety switch with cable with male connector, M12, 8-pin

Construction

The safety switches are led individually to the control cabinet. The OSSDs of the safety switches are connected in series there and evaluated by the evaluation unit. The Aux outputs are individually connected to the programmable logic controller (PLC).

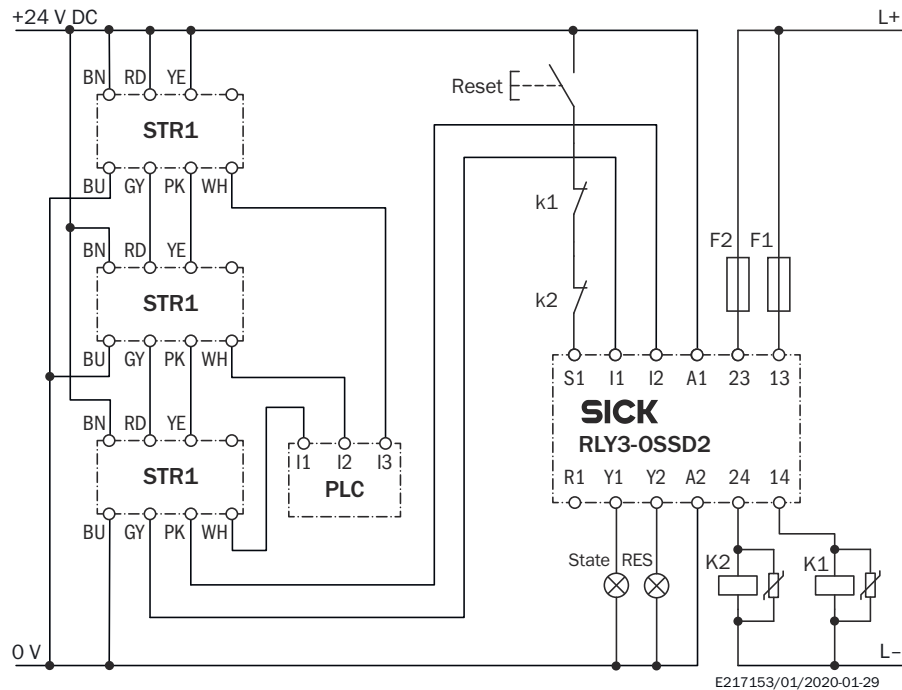


Figure 10: 3 safety switches in series connection on safety relay

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

- ▶ Replace safety switch and actuator if damaged or worn. Never replace individual parts or assemblies.
- ▶ Check the safety switch at 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 thorough checks must be carried out at least once a year:

- Proper switching function
- Thorough check of the assured sensing ranges S_{ar} and S_{ao}
- Safe mounting of all components
- No damage, contamination, deposits or wear
- No loose plug connectors
- No signs of manipulation
- For safety switches with taught-in actuators: The actuators used are taught-in actuators.

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.

**DANGER**

Bypassing the protective device

Hazard due to lack of effectiveness of the protective device

- ▶ Prevent incentives to manipulate the safety switch by taking at least one of the following measures:
 - Universally coded variant only: Attach safety switches with a cover or with shielding, or ensure they are out of reach.
 - If possible, use non-detachable mounting methods for actuators (such as welding, gluing, non-removable screws, or rivets).

**NOTICE**

Incorrect mounting and unsuitable ambient conditions may damage the safety switch.

- ▶ Arrange the sensor and actuator in a way that prevents damage from foreseeable external influences.
- ▶ Do not use the sensor and actuator as a stop.
- ▶ The holder and mounting method for the sensor and actuator must be stable enough to ensure that correct operation can take place.
- ▶ Always use reliable mounting elements that can only be removed using tools.
- ▶ If misalignment results in an opening on the physical guard, this must not impair the protection that is provided.

5.2 Unpacking

- ▶ Check the components for completeness and the integrity of all parts, [see "Scope of delivery", page 9](#).
- ▶ Please contact your respective SICK subsidiary should you have any complaints.

5.3 Mounting

Selecting the mounting location

If the machine documentation does not specify the mounting location, select one carefully:

- ▶ When the protective device is closed, the sensor and actuator must be located opposite each other at assured switch-on distance S_{ao} or closer ([see "Sensing ranges", page 41](#)).
- ▶ Select a mounting location that allows the sensor and actuator to be accessed for maintenance work and protects them against damage.
- ▶ If possible, mount the sensor and actuator on non-ferrous subsurfaces and at a distance from metallic parts in order to avoid affecting the sensing range. If this is not possible, the effect on the safe switch on distance S_{ao} and the safe switch off distance S_{ar} must be checked.

- ▶ Make sure that there is no possibility of hazards arising when the protective device is opened, even if the actuator has not yet reached the safe switch off distance S_{ar} .
- ▶ If the actuator approaches the sensor in parallel, maintain the minimum distances (see "Sensing ranges", page 41).
- ▶ If necessary, attach an additional stop for the moving protective device.

Mounting the sensor

1. Mount the sensor on the fixed part of the protective device.
2. Take account of the tightening torque for the fixing screws: 1 Nm

Mounting the actuator

1. Align actuator using the marking nib on the sensor.

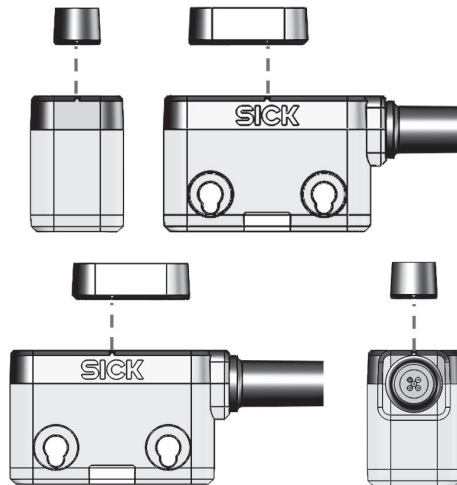


Figure 11: Aligning the actuator on the sensor

2. Screw on actuator, then observe tightening torque.

Table 5: Actuator tightening torque

Actuator	Standard	Compact	Flat	Mini
Tightening torque	1 Nm	1 Nm	1 Nm	0.7 Nm

Mounting multiple safety switches

If several STR1 devices are mounted, they must be mounted at a minimum distance to one another.

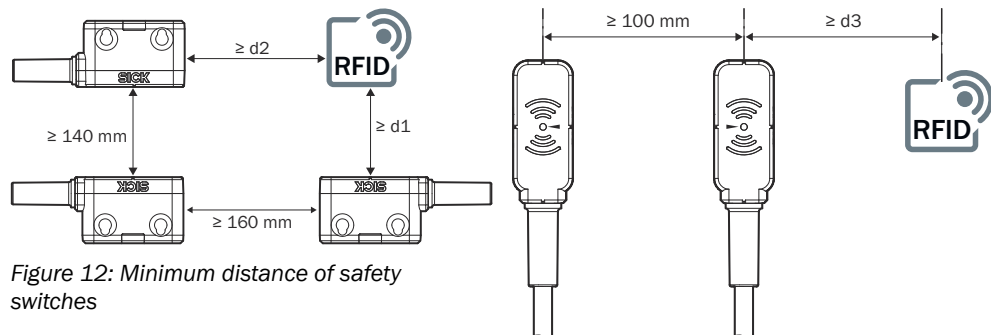


Figure 12: Minimum distance of safety switches

If STR1 is mounted in the vicinity of other RFID devices, their specified minimum distances (d_1 , d_2 , d_3) must be taken into consideration as well as the minimum distances of STR1. The largest value must be adhered to.

6 Electrical installation

6.1 Safety

Isolated connection of OSSD1 and OSSD2

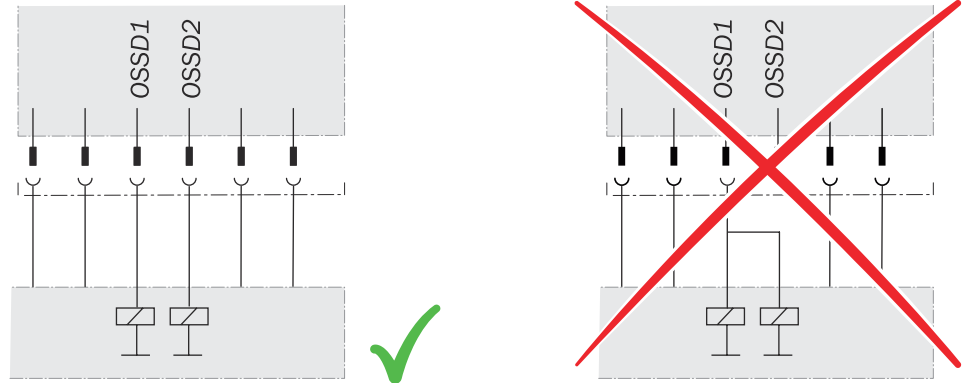


Figure 13: Dual-channel and isolated connection of OSSD1 and OSSD2

Avoiding any potential difference between load and protective device

If you connect loads to the output signal switching devices (switching 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 separately and also 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.

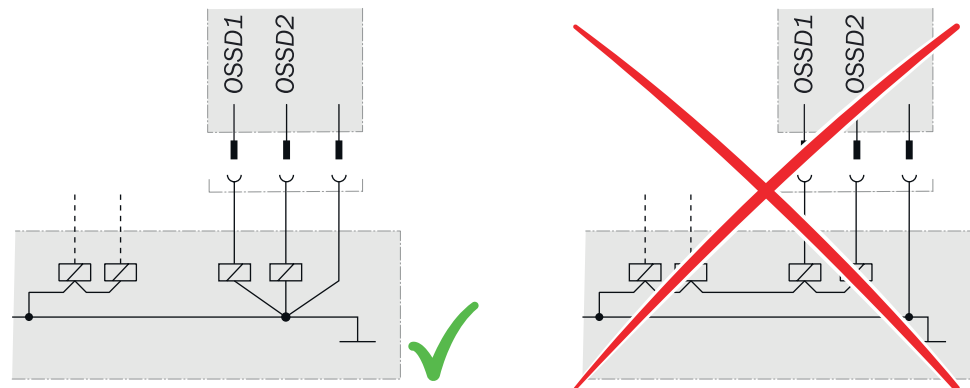


Figure 14: No potential difference between load and protective device

6.2 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.

6.3 Device connection (M12, 5-pin)

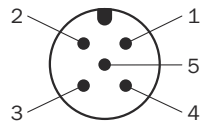


Figure 15: Device connection (male connector, M12, 5-pin, A-coded)

Table 6: Device connection pin assignment (male connector, M12, 5-pin, A-coded)

Pin	Wire color ¹⁾	Designation	Description
1	Brown	+24 V DC	24 V DC voltage supply
2	White	OSSD 1	Output OSSD 1
3	Blue	0 V	0 V DC voltage supply
4	Black	OSSD 2	Output OSSD 2
5	Gray	Aux	Application diagnostic output (not safe)

¹⁾ Applies to the connecting cables recommended as accessories.

- Ensure the plug connector is tightly connected.

6.4 Device connection (M12, 8-pin)

All variants except those specified below

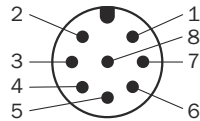


Figure 16: Device connection (male connector, M12, 8-pin, A-coded)

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

Pin	Wire color ¹⁾	Designation	Description
1	White	Aux	Application diagnostic output (not safe)
2	Brown	+24 V DC	Voltage supply 24 V DC
3	Green	n. c.	Not connected
4	Yellow	In 2	Enable input OSSD 2 Apply 24 V DC to enable. ²⁾
5	Gray	OSSD 1	OSSD 1 output ³⁾
6	Pink	OSSD 2	OSSD 2 output ³⁾
7	Blue	0 V	Voltage supply 0 V DC
8	Red	In 1	Enable input OSSD 1 Apply 24 V DC to enable. ²⁾

¹⁾ Applies to the connecting cables recommended as accessories.

²⁾ With a safe series connection, only the enable input of the first device in the series connection needs to be enabled.

³⁾ In a safe series connection, the OSSD output of a safety switch acts as an enable output for the next safety switch.

Only for variants STR1-SAXM0AC8S01 and STR1-SAXM0AC8S02

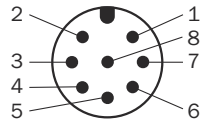


Figure 17: Device connection (male connector, M12, 8-pin, A-coded)

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

Pin	Wire color ¹⁾	Designation	Description
1	White	+24 V DC	Voltage supply 24 V DC
2	Brown	In 1	Enable input OSSD 1 Apply 24 V DC to enable. ²⁾
3	Green	0 V	Voltage supply 0 V DC
4	Yellow	OSSD 1	OSSD 1 output ³⁾
5	Gray	Aux	Application diagnostic output (not safe)
6	Pink	In 2	Enable input OSSD 2 Apply 24 V DC to enable. ²⁾
7	Blue	OSSD 2	OSSD 2 output ³⁾
8	Red	n. c.	Not connected

- 1) Applies to the connecting cables recommended as accessories.
- 2) With a safe series connection, only the enable input of the first device in the series connection needs to be enabled.
- 3) In a safe series connection, the OSSD output of a safety switch acts as an enable output for the next safety switch.

Only for STR1-SACM0PR8 variants

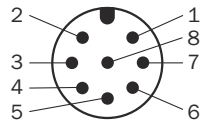


Figure 18: Device connection (plug, M12, 8-pin, A-coded)

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

Pin	Wire color ¹⁾	Designation	Description
1	White	In 2	Enable input OSSD 2 Apply 24 V DC to enable. ²⁾
2	Brown	+24 V DC	Voltage supply 24 V DC
3	Green	OSSD 1	OSSD 1 output ³⁾
4	Yellow	OSSD 2	OSSD 2 output ³⁾
5	Gray	AUX	Application diagnostic output not safe
6	Pink	In 1	Enable input OSSD 1 Apply 24 V DC to enable. ²⁾
7	Blue	0 V	Voltage supply 0 V DC
8	Red	n. c.	Not connected

- 1) Applies to the connecting cables recommended as accessories.
- 2) With a safe series connection, only the enable input of the first device in the series connection needs to be enabled.
- 3) In a safe series connection, the OSSD output of a safety switch acts as an enable output for the next safety switch.

6.5 Device connection (M8, 8-pin)

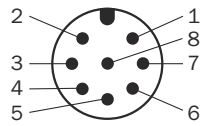


Figure 19: Device connection (male connector, M8, 8-pin, A-coded)

Table 10: Device connection pin assignment (male connector, M8, 8-pin, A-coded)

Pin	Wire color ¹⁾	Designation	Description
1	White	In 2	Enable input OSSD 2 Apply 24 V DC to enable. ²⁾
2	Brown	+24 V DC	Voltage supply 24 V DC
3	Green	OSSD 1	OSSD 1 output ³⁾
4	Yellow	OSSD 2	OSSD 2 output ³⁾
5	Gray	AUX	Application diagnostic output not safe
6	Pink	In 1	Enable input OSSD 1 Apply 24 V DC to enable. ²⁾
7	Blue	0 V	Voltage supply 0 V DC
8	Red	n. c.	Not connected

1) Applies to the connecting cables recommended as accessories.

2) With a safe series connection, only the enable input of the first device in the series connection needs to be enabled.

3) In a safe series connection, the OSSD output of a safety switch acts as an enable output for the next safety switch.

6.6 Device connection (loose cable, 5-wire)

Table 11: Device connection cable assignment

Wire color	Designation	Description
Brown	+24 V DC	24 V DC voltage supply
White	OSSD 1	Output OSSD 1
Blue	0 V	0 V DC voltage supply
Black	OSSD 2	Output OSSD 2
Gray	Aux	Application diagnostic output (not safe)

6.7 Device connection (loose cable, 7-wire)

Table 12: Device connection cable assignment

Wire color	Designation	Description
White	Aux	Application diagnostic output (not safe)
Brown	+24 V DC	Voltage supply 24 V DC
Yellow	In 2	Enable input OSSD 2 Apply 24 V DC to enable. ¹⁾
Gray	OSSD 1	OSSD 1 output ²⁾
Blue	0 V	Voltage supply 0 V DC
Pink	OSSD 2	OSSD 2 output ²⁾

Wire color	Designation	Description
Red	In 1	Enable input OSSD 1 Apply 24 V DC to enable. ¹⁾

- 1) With a safe series connection, only the enable input of the first device in the series connection needs to be enabled.
- 2) In a safe series connection, the OSSD output of a safety switch acts as an enable output for the next safety switch.

6.8 Connection of a safe series connection with T-connectors

Connecting the last T-piece

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

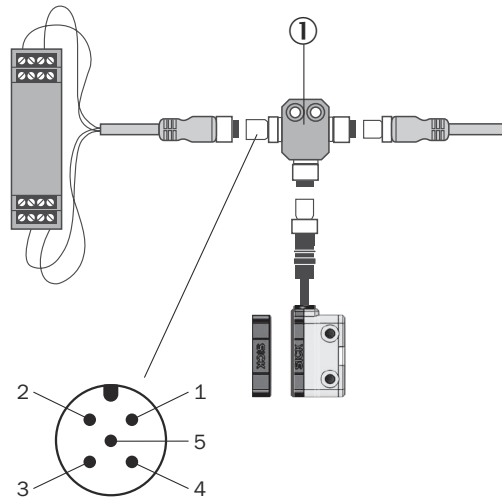


Figure 20: Connection of the T-connector (M12, 5-pin, A-coded, male connector)

- ① Last T-piece before safe evaluation unit

Table 13: Device connection of T-connector (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	Reserved	Reserved

- 1) Applies to the connecting cables recommended as accessories.

Further topics

- ["Safe series connection with T-connector \(without diagnostics\)", page 18](#)
- ["Device connection \(M12, 8-pin\)", page 25](#)

7 Commissioning

7.1 Safety



DANGER

Hazard due to lack of effectiveness of the protective device

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

1. Before commissioning the machine, have it checked and released by qualified safety personnel.
2. Make sure that the time for the safety requirement (closing the protective device again) is longer than the response time.

7.2 Switching on

The device initializes after switching on. During this process, the OSSDs are switched off and the light emitting diodes light up alternately in the color sequence green, red, and yellow. For unique coded and permanently coded safety switches only: If any actuators have already been taught in, the STATE light emitting diode will flash once after initialization for each taught-in actuator.

7.3 Teach-in



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.

Variant for universally coded actuators

No teach-in is required.

Variant for unique coded actuators

An actuator must be taught in during commissioning. Up to 8 actuators may be taught in one after the other. Only the most recently taught-in actuator is valid. Previously taught-in actuators cannot be taught in again.





Variant for permanently coded actuators

An actuator must be taught in during commissioning. It is not possible to teach in any further actuators.

Teaching in an actuator

1. Open the physical guard.
2. Connect the safety switch to the voltage supply (see "[Electrical installation](#)", page 24).
- ✓ The start sequence is performed. The LEDs light up alternately in the color sequence green, red, and yellow.
3. Close the physical guard.
- ✓ When the guard is closed and the actuator has reached the appropriate position, the safety switch will automatically start the teach-in sequence. The LEDs will display the individual steps.

Table 14: Displays for teach-in sequences

STATE light emitting diode (red/green)	DIAG light emitting diode (yellow)	Step
 green	 yellow	Actuator is being taught in
 green	 yellow	Actuator has been taught in

4. Within 5 minutes of successfully teaching in the actuator, connect and restore the voltage supply for the safety switch.
- ✓ Once the taught-in actuator is in the response range, both OSSDs switch to the ON state and the STATE light emitting diode lights up green.

7.4 Thorough check during commissioning and modification



DANGER

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

- ▶ Before the function check-out, make sure there is no danger to people.
- ▶ Immediately put the machine out of operation if you cannot clearly identify or allocate the error and if you cannot safely remedy the error.

Procedure

After installation, after every error and after modifications to the application, check that the device is functioning correctly. The following thorough checks must be carried out at least once a year:

Thorough mechanical check

- ▶ Open the movable physical guard and close it again. The components of the safety switch must not collide with other parts while doing so. When the movable physical guard is closed, the actuator must be in a position that allows the actuation.

Function check-out

- ▶ Check proper switching function.
- ▶ Check whether the protective device of the machine is effective in all operating modes in which the machine can be set.
- ▶ Thorough check of the assured sensing ranges S_{ar} and S_{ao}

The thorough check ensures the following:

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

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

8 Troubleshooting

8.1 Safety



DANGER

Hazard due to lack of effectiveness of the protective device

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

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



DANGER

Hazard due to unexpected starting of the machine

- ▶ When any work is taking place, use the protective device to secure the machine or to ensure that the machine is not switched on unintentionally.



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.

- ▶ Do not carry out any repairs on the device components.
- ▶ Do not modify or manipulate device components.
- ▶ Apart from during the procedures described in this document, the device components must not be opened.



NOTE

Additional information on troubleshooting is available from your SICK subsidiary.

8.2 Diagnostic LEDs

8.2.1 Switching on

Table 15: LED displays during initialization

STATE light emitting diode (red/green)	DIAG light emitting diode (yellow)	Duration
● green	○	500 ms
● red	○	500 ms
○	● yellow	500 ms
◐ green ¹⁾	○	

○ LED off. ◐ LED flashes. ● LED illuminates.

- ¹⁾ For unique coded and permanently coded safety switches only: If any actuators have already been taught in, the STATE light emitting diode will flash once after initialization for each taught-in actuator.

8.2.2 State display

Table 16: Status indications during normal operation

STATE light emitting diode (red/green)	DIAG light emitting diode (yellow)	Meaning
○	○	No voltage supply
● red	○	No valid actuator is in the response range. OSSD pair is in the OFF state.
● green	○	Actuator is in the response range. OSSD pair is in the ON state.
● Green	◐ Yellow	Actuator is in the response range, but is close to the assured release distance S_{ar} . ¹⁾
● red	◐ Yellow	<ul style="list-style-type: none"> Signal to the In 1 and In 2 OSSD inputs invalid or not available. No valid actuator in response range OSSD pair in OFF state Actuator is outside the response range, but is close to the assured operating distance S_{ao}.¹⁾
● Red	● Yellow	Signal to the In 1 and In 2 OSSD inputs invalid or not available. Valid actuator in response range OSSD pair in OFF state

○ LED off. ◐ LED flashes. ● LED illuminates.

1) Only applies for safety switches whose serial numbers begin with number series 2020**** or higher. The serial number is displayed on the safety switch over the data matrix code.

8.2.3 Fault displays

Table 17: Fault displays

STATE light emitting diode (red/green)	DIAG light emitting diode (yellow)	Possible cause	Corrective measure
○	○	No voltage supply	Check voltage supply. If the light emitting diodes do not light up even if a voltage supply is present, replace the safety switch.
◐ red	◐ yellow	External fault	<ul style="list-style-type: none"> Check OSSD 1 and OSSD 2 for short-circuit downstream of 0 V or 24 V DC, or between one another Check cabling for damage. There must be a dual-channel configuration. If the error occurs again, the sensor is defective. Replace sensor.

STATE light emitting diode (red/green)	DIAG light emitting diode (yellow)	Possible cause	Corrective measure
● red	○	Internal fault	<ul style="list-style-type: none"> Isolate the faulty sensor and check it separately Check wiring for cross-circuits and short-circuits. Switch the voltage supply off and on. If the fault still occurs after this, the sensor is defective. Replace sensor.

○ LED off. ● LED flashes. ● LED illuminates.

8.2.4 Fault indicators for a safe series connection with T-connectors or in the control cabinet

If an error occurs in a device in a series connection, the affected device displays the error and switches off the OSSDs (STATE LED flashes red). All downstream devices switch off their OSSDs (LED STATE flashes red, LED DIAG flashes yellow).

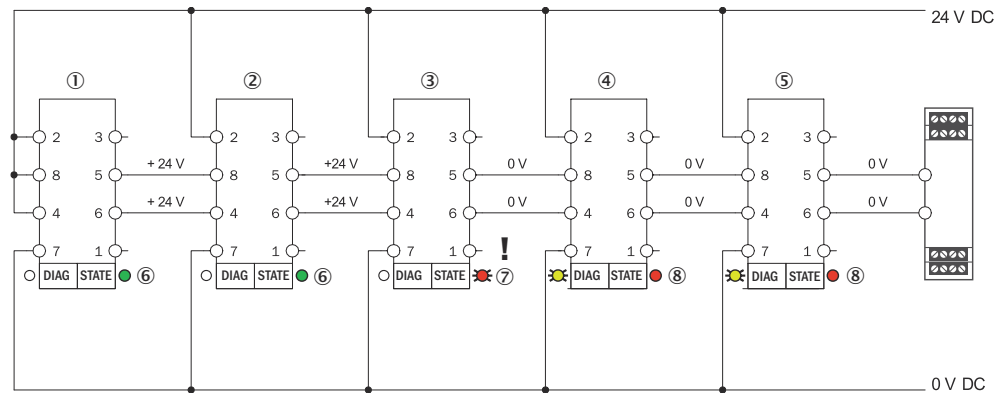


Figure 21: Fault indicators for safety switches in series connection In the example: Internal error on safety switch 3

- ① – ⑤ Safety switch
- ⑥ LED STATE lights up green
- ⑦ LED STATE flashes red
- ⑧ LED STATE flashes red, LED DIAG flashes yellow

What to do with safety switches switched in series:

- Isolate the faulty sensor and check it separately.
- Check wiring for cross-circuits and short-circuits.
- Switch the voltage supply off and on. If the fault still occurs after this, the sensor is defective. Replace sensor.

8.2.5 Fault displays during teach-in

Table 18: Fault displays during teach-in

STATE light emitting diode (red/green)	DIAG LED (yellow)	Cause
● red/green	● yellow	The maximum number of actuators has been taught in. It is not possible to carry out another teach-in process.
● red/green	● yellow	An actuator that has already been taught in needs to be taught in again. This is not possible.

STATE light emitting diode (red/green)	DIAG LED (yellow)	Cause
● red/green	○	Teach-in sequence failed. Teach in the actuator again. Possible fault: <ul style="list-style-type: none"> • Actuator removed from response range too early. • Voltage supply not isolated in a timely manner.

○ LED off. ● LED flashes. ● LED illuminates.

Fault displays are repeated until the equipment is reset.

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

9 Maintenance

9.1 Cleaning

**NOTICE**

- ▶ Do not use aggressive cleaning agents (such as isopropanol or spirit).
 - ▶ Do not use any paint wetting impairment substances.
 - ▶ We recommend anti-static cleaning agents.
-

**NOTICE**

The safety switch cables can be damaged by cleaning with high pressure or strong water jets.

- ▶ Safety switches cables must not be directly exposed to high pressure or strong water jets during cleaning.
-

9.2 Regular thorough check

The safety switch must be checked regularly. The type and frequency of thorough checks is defined by the machine manufacturer and operating entity, [see "Testing plan", page 20](#).

The regular thorough checks serve to investigate the effectiveness of the safety switch and detect any ineffectiveness due to modifications or external influences (e.g., damage or manipulation).

1. Carry out the thorough checks according to the instructions from the machine manufacturer and operating entity.

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 Technical data

Table 19: Features

Features	
Safe switch on distance S_{ao} (IEC 60947 5-3)	see "Sensing ranges", page 41
Assured switch-off distance S_{ar} (IEC 60947 5-3)	see "Sensing ranges", page 41
Max. actuation frequency	0.5 Hz
Safe series connection	≤ 30 safety switches

Table 20: Safety-related parameters

Safety-related parameters	
Performance level	PL e (EN ISO 13849-1)
Category	4 (EN ISO 13849)
Safety integrity level	SIL 3 (EN 61508)
PFH _D (mean probability of one dangerous failure per hour)	5.1 × 10 ⁻⁹ at 40 °C and sea level 14 × 10 ⁻⁹ at 40 °C and 2,000 m above sea level
T _M (mission time)	20 years (EN ISO 13849-1)
Response time (removal from response range) ¹⁾	Single device: ≤ 40 ms Safe series connection: see "Response times in a safe series connection", page 41
Release time (response time when approaching response range) ²⁾	Single device: ≤ 100 ms Safe series connection: see "Response times in a safe series connection", page 41
Risk time ³⁾⁴⁾	Single device: ≤ 100 ms Safe series connection: see "Response times in a safe series connection", page 41
Length of cable ⁵⁾	≤ 200 m
Minimum distance between 2 safety switches	Depending on alignment see "Mounting", page 22
Type	Type 4 (EN ISO 14119)
Coding level	
Universally coded	Low coding level (EN ISO 14119)
Uniquely coded	High coding level (EN ISO 14119)
Permanently coded	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) Maximum time for moving the OSSDs into the OFF state when the actuator is removed from the response area or when the OSSD input signals go into the OFF state.
- 2) Maximum time for moving the OSSDs into the ON state when the actuator is detected by the sensor and the OSSD input signals are in the ON state.
- 3) At least one of the two OSSD outputs is safely switched off during the response time.
- 4) 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.
- 5) Length of cable and wire cross-section change the voltage drop depending on the output current ($R_{max} = 14.5 \Omega$).

Table 21: Interfaces

Interfaces	
System connection	
Voltage supply Local inputs and outputs	Male connector, M12, 5-pin, A-coded (common male connector for voltage supply and outputs) Male connector, M12, 8 pin, A-coded (common male connector for voltage supply and inputs and outputs) or Male connector, M8, 8-pin, A-coded (common male connector for voltage supply and outputs) Flying leads
Length of cable	0.2 m 0.3 m 0.5 m 3 m 10 m

Table 22: Electrical data

Electrical data	
OSSD pairs	1
Rated impulse withstand voltage U_{imp}	1,500 V
Contamination rating	3 (external, according to EN 60947-1)
Power-up delay (after supply voltage applied) ¹⁾	2.5 s
Supply voltage U_V	DC 24 V (19.2 V ... 28.8 V)
Rated insulation voltage U_i	DC 32 V
Utilization category (IEC 60947-5-1)	DC-12: 24 V / 20 mA
Load capacity	400 nF (at OSSD1 and OSSD2) 2 μ F (at Out Aux)
External fuse protection (supply voltage)	0.6 A ... 2 A 1 A for UL-compliant applications
Current consumption (without load)	50 mA
Protection class	III (EN 61140 / IEC 61140)

¹⁾ Once the supply voltage has been switched on, the OSSDs and the application diagnostic output are in the OFF state during the time delay before availability. The specified time applies to one sensor; in a series connection, 0.1 s must be added per sensor. An additional 0.5 s per taught-in actuator must be added for uniquely coded and permanently coded sensors.

Table 23: Mechanical data

Mechanical data	
Dimensions (W x H x D)	
Safety switches	40 mm x 18 mm x 26 mm
Actuator dimensional drawing	see "Dimensional drawings", page 40
Housing material of the sensor	Vistal®
Housing material of the actuator	Vistal®
Cable material	PVC/PUR
Wire material	Copper
Coupling nut material	Nickel plated zinc die cast
Cable diameter	5.5 mm
Wire cross-section	0.12 mm ²
Bend radius (for fixed installation)	> 8 × cable diameter

Mechanical data	
Bend radius (for flexible use)	> 12 × cable diameter
Weight	
Safety switches	63 g ... 436 g (depending on variant)
“Standard” actuator	26 g
“Compact” actuator	13 g
“Flat” actuator	13 g
“Mini” actuator	6 g

Table 24: Inputs

Inputs	
Rated voltage	DC 24 V (19.2 V ... 28.8 V)
Switching current	
ON state	≤ 5 mA
OFF state	0 mA
Switching voltage	
ON state	21 V DC ... 24 V DC
OFF state	≤ 2 V DC

Table 25: Outputs

Outputs	
2 OSSDs (OSSD1 and OSSD2)	2 x PNP, max. 100 mA (without load), short-circuit protected and overload protected
Application diagnostic output (Aux)	50 mA max, short-circuit protected
Switching current	
ON state	≤ 100 mA
OFF state	< 500 µA
Switching voltage	
ON state	21 V DC ... 24 V DC
OFF state	0 V DC ... 2 V DC

Table 26: Ambient data

Ambient data	
Enclosure rating	IP67 (IEC 60529) IPX9K (ISO 20653) ¹⁾
Ambient operating temperature	-30 °C ... +70 °C ²⁾
Storage temperature	-30 °C ... +70 °C
Vibration resistance	1 mm / 10 Hz ... 55 Hz (IEC 60068-2-6)
Shock resistance	30 g, 11 ms (IEC 60068-2-27)
EMC	In accordance with IEC/EN 61326-3-1, IEC/EN 60947-5-2, IEC/EN 60947-5-3 and EN 300330 V2.1.1

- 1) The cables of the safety switches must not be exposed to high pressure or strong water jets during cleaning.
- 2) Only applies for safety switches whose serial numbers begin with number series 1825**** or higher. For safety switches whose serial numbers deviate from this, an ambient operating temperature of -10 °C ... +70 °C applies. The serial number is displayed on the safety switch over the data matrix code.

11.2 Dimensional drawings

Sensor

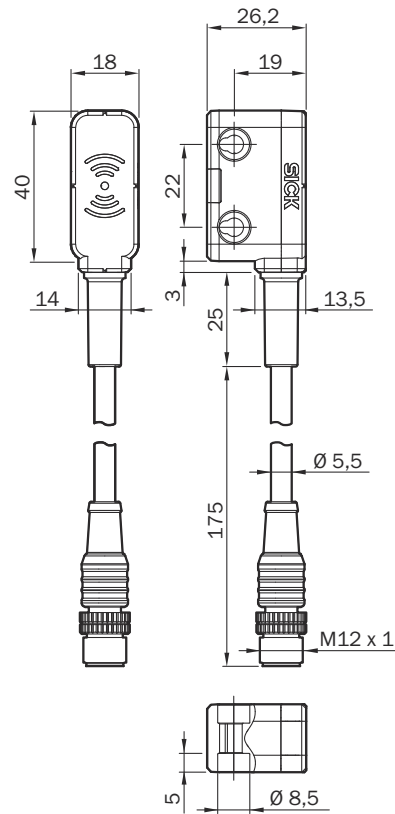


Figure 22: Dimensional drawing for STR1 sensor with M12 male connector

All dimensions in mm.

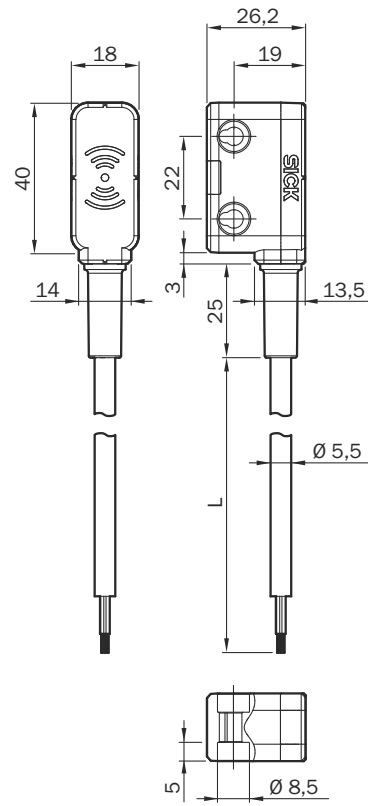


Figure 23: Dimensional drawing for STR1 sensor with flying leads

All dimensions in mm.

Actuator

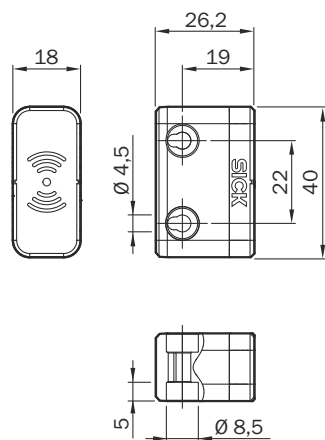


Figure 24: Dimensional drawing of "Standard" STR1 actuator

All dimensions in mm.

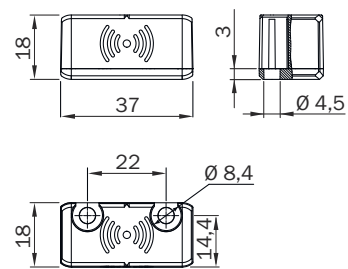


Figure 25: Dimensional drawing of "Compact" STR1 actuator

All dimensions in mm.

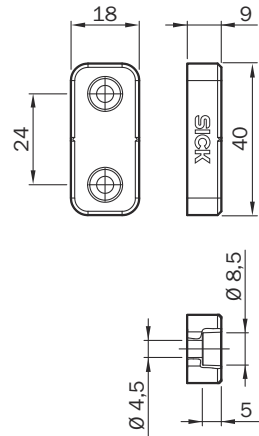


Figure 26: Dimensional drawing of "Flat" STR1 actuator

All dimensions in mm.

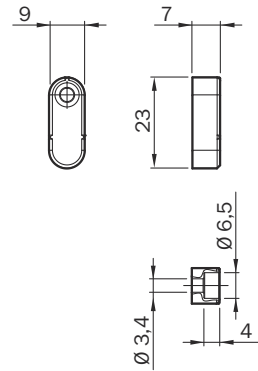


Figure 27: Dimensional drawing of "Mini" STR1 actuator

All dimensions in mm.

11.3 Response times in a safe series connection

Response time (removal of actuator from response range)

Response time for series connection: 40 ms × number of safety switches

Enable time (actuator approaching response range)

Release time for series connection: 100 ms × number of safety switches

Risk time (error detection time for external faults)

Risk time for series connection: 100 ms + 40 ms * (number of safety switches - 1)

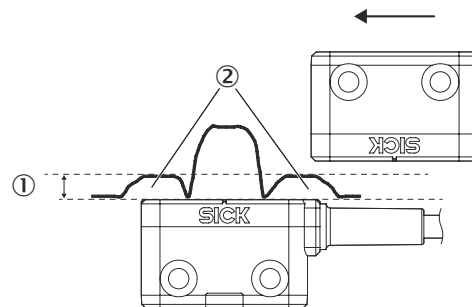
11.4 Sensing ranges

Important information



NOTE

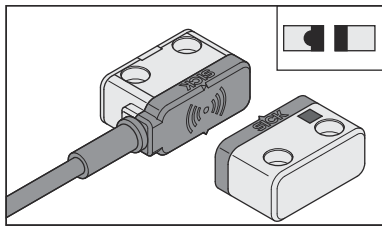
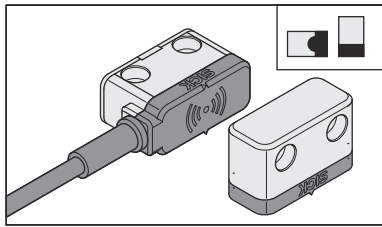
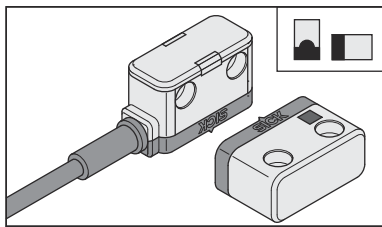
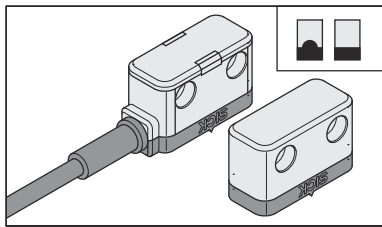
- The values specified in this chapter only apply for a deviation of 0 mm between the sensor and actuator (marking nibs on sensor and actuator).
- If the sensor approaches the actuator in parallel, a minimum distance between the sensor and actuator must be maintained due to the side lobes required due to the principle.



- ① Minimum distance with parallel approach
- ② Side lobes

Sensing ranges for “Standard” actuator

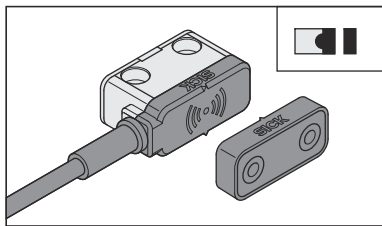
Table 27: Sensing ranges for “Standard” actuator

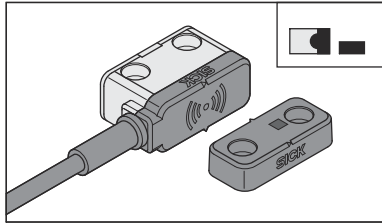
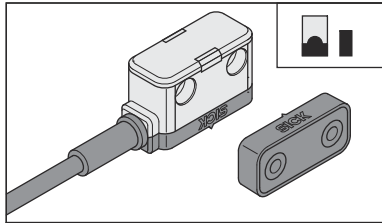
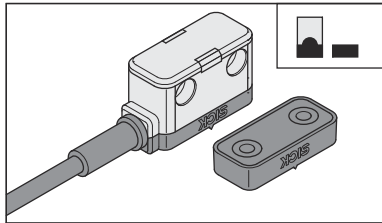
Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	≥ 10 mm	≤ 25 mm	6 mm
	≥ 10 mm	≤ 25 mm	6 mm
	≥ 3 mm ≥ 6 mm ¹⁾	≤ 15 mm	-
	≥ 3 mm ≥ 6 mm ¹⁾	≤ 15 mm	-

¹⁾ Only applies in limited temperature range of -10 °C ... $+70$ °C. Devices with serial number 1824*** or lower only support the limited temperature range. The serial number is displayed on the safety switch over the data matrix code.

Sensing ranges for “Flat” actuator

Table 28: Sensing ranges for “Flat” actuator

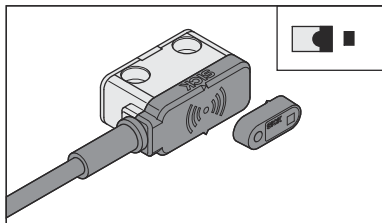
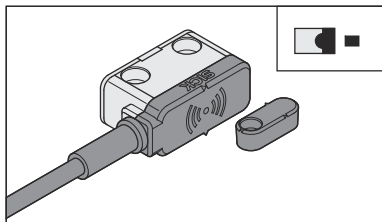
Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	≥ 10 mm ≥ 14 mm ¹⁾	≤ 28 mm	10 mm

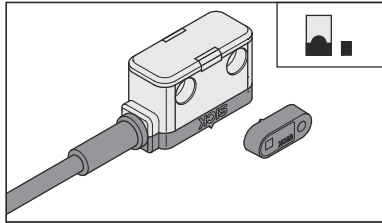
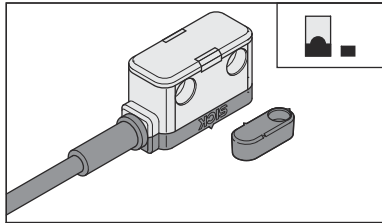
Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	$\geq 4 \text{ mm}$ $\geq 6 \text{ mm}^1$	$\leq 28 \text{ mm}$	5 mm
	$\geq 3 \text{ mm}$ $\geq 9 \text{ mm}^1$	$\leq 20 \text{ mm}$	4 mm
	Not possible		

¹⁾ Only applies in limited temperature range of $-10 \text{ }^\circ\text{C} \dots +70 \text{ }^\circ\text{C}$. Devices with serial number 1824*** or lower only support the limited temperature range. The serial number is displayed on the safety switch over the data matrix code.

Sensing ranges for “Mini” actuator

Table 29: Sensing ranges for “Mini” actuator

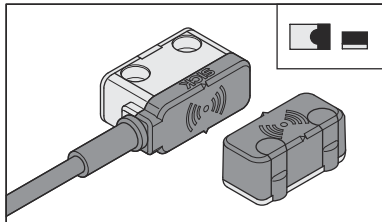
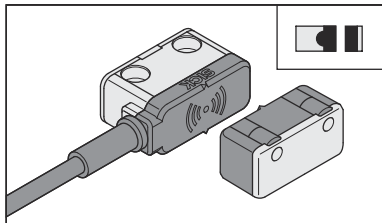
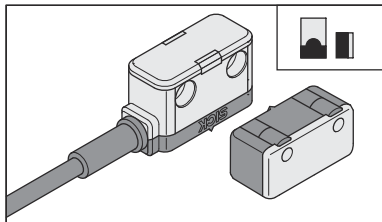
Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	$\geq 10 \text{ mm}$ $\geq 14 \text{ mm}^1$	$\leq 28 \text{ mm}$	10 mm
	$\geq 10 \text{ mm}$ $\geq 14 \text{ mm}^1$	$\leq 28 \text{ mm}$	10 mm

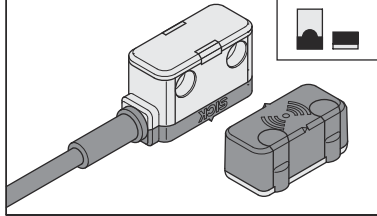
Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	$\geq 4 \text{ mm}$ $\geq 9 \text{ mm}^{1)}$	$\leq 20 \text{ mm}$	4 mm
	$\geq 4 \text{ mm}$ $\geq 9 \text{ mm}^{1)}$	$\leq 20 \text{ mm}$	4 mm

1) Only applies in limited temperature range of $-10 \text{ }^{\circ}\text{C} \dots +70 \text{ }^{\circ}\text{C}$. Devices with serial number 1824*** or lower only support the limited temperature range. The serial number is displayed on the safety switch over the data matrix code.

Sensing ranges for “Compact” actuator

Table 30: Sensing ranges for “Compact” actuator

Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	$\geq 10 \text{ mm}$	$\leq 25 \text{ mm}$	5 mm
	$\geq 10 \text{ mm}$	$\leq 25 \text{ mm}$	5 mm
	$\geq 3 \text{ mm}$	$\leq 25 \text{ mm}$	-

Alignment of sensor and actuator	Assured switch-on distance S_{ao}	Assured switch-off distance S_{ar}	Minimum distance with parallel approach
	$\geq 2 \text{ mm}$	$\leq 25 \text{ mm}$	-

12 Ordering information

12.1 Ordering information and accessories

Ordering information

Up to date code 2419 (digits 1 ... 4 of the serial number S/N):

You can order the safety switch and the spare parts of the safety switch on the SICK homepage. Please note that the part number on the sensor is not a part number that can be ordered. You can enter the printed part number on the SICK homepage and select the respective variant from the suggested products.

www.sick.com/STR1

From date code 2420 (digits 1 ... 4 of the serial number S/N):

You can find suitable spare parts and accessories using the SICK Product ID on the switch.

see "[Product identification via the SICK product ID](#)", page 9

Accessories

Suitable accessories are available at www.sick.com. All suitable accessories are listed on the Accessories tab of the product page. Accessories for your variant can also be found using the SICK Product ID (see "[Product identification via the SICK product ID](#)", page 9).

13 Annex

13.1 Conformities and certificates

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

13.1.1 EU declaration of conformity

Excerpt

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

- ROHS DIRECTIVE 2011/65/EU
- MACHINERY DIRECTIVE 2006/42/EC
- RE DIRECTIVE 2014/53/EU

13.1.2 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

13.1.3 FCC and IC radio approval

- FCC ID: 2AHDRSTR1
- IC: 21147STR1

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.

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