OPERATING INSTRUCTIONS

deTem4 Core

Multiple light beam safety device

MB-M4C-3/400

SICK
Sensor Intelligence.

Described product

deTem4 Core

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

Original document

This document is an original document of SICK AG.

CE

Contents

1 Ordering information

1.1 Ordering information

Table 1: Ordering information for MB-M4C-3/400 with short scanning range

Number of beams	Part number	Type	Package contents
3	1112125	MB-M4C-3/400	• Sender (1113775) • Receiver (1113776) • FlexFix bracket (2066614)

2 About this document

2.1 Function of this document

These operating instructions contain the information needed during the life cycle of the multiple light beam safety device.

Operating instructions of the multiple light beam safety device must be made available to all people who work with the device.

Please read these operating instructions carefully and make sure that you understand the content fully before working with the multiple light beam safety device.

2.2 Scope

These operating instructions only apply to the deTem4 Core multiple light beam safety devices with the following type label entries in the “Operating Instructions” field:

- 8025911

This document is included with the following SICK part numbers (this document in all available language versions):

8025911

2.3 Target groups of these operating instructions

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

Table 2: Target groups and selected chapters of these operating instructions

Target group	Chapters of these operating instructions
Project developers (planners, developers, designers)	"Project planning", page 14 "Technical data", page 50
Installers	"Mounting", page 27
Electricians	"Electrical installation", page 34
Safety experts (such as CE authorized representatives, compliance officers, people who test and approve the application)	"Project planning", page 14 "Commissioning", page 37 "Technical data", page 50 "Checklist for initial commissioning and commissioning", page 56
Operators	"Operation", page 43 "Troubleshooting", page 46
Maintenance personnel	"Maintenance", page 44 "Troubleshooting", page 46

2.4 Additional information

www.sick.com

The following information is available on the Internet:

- This document in other languages
- 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

2.5 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes and other notes

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

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

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

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

NOTE
Indicates useful tips and recommendations.

Instructions to action

▶ The arrow denotes instructions to action.

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

✓ The check mark denotes the result of an instruction.

LED symbols

These symbols indicate the status of an LED:

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

Sender and receiver

These symbols indicate the sender and receiver of the device:

The symbol indicates the sender.
The symbol indicates the receiver.

3 Safety information

3.1 General safety notes

DANGER
If the safety component is integrated incorrectly, the dangerous state may be ended to late.

- ▶ Plan the integration of the safety component in accordance with the machine requirements, see "Project planning", page 14.

3.2 Intended use

The deTem4 Core multiple light beam safety device is an electro-sensitive protective device (ESPE) and is suitable for the following applications:

- Single-sided access protection
- Multi-sided access protection

The deTem4 Core multiple light beam safety device must only be used within the limits of the prescribed and specified technical data and operating conditions at all times.

Any instance of improper use, incorrect modification, or manipulation of the deTem4 Core multiple light beam safety device shall void any warranty provided by SICK AG; furthermore, SICK AG shall not accept any responsibility or liability for any resulting damage and consequential damage.

3.3 Improper use

The multiple light beam safety device works as an indirect protective measure and cannot provide protection from pieces thrown from application nor from emitted radiation. Transparent objects are not detected.

Among others, the deTem4 Core multiple light beam safety device is **not** suitable for the following applications:

- Outdoors
- Underwater
- In explosion-hazardous areas
- At altitudes over 3,000 m above sea level
- In environments with increased levels of ionizing radiation

3.4 Requirements for the qualification of personnel

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

Project planning

For project planning, a person is considered competent when he/she has expertise and experience in the selection and use of protective devices on machines and is familiar with the relevant technical rules and national work safety regulations.

Mechanical mounting, electrical installation, and commissioning

For the task, a person is considered qualified when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine to be able to assess whether it is in an operationally safe state.

Operation and maintenance

For operation and maintenance, a person is considered competent when he/she has the expertise and experience in the relevant field and is sufficiently familiar with the application of the protective device on the machine and has been instructed by the machine operator in its operation.

4 Product description

4.1 Setup and function

Overview

The deTem4 Core multiple light beam safety device is an electro-sensitive protective device (ESPE) consisting of a sender and receiver.

Parallel infrared light beams between the sender and receiver protect the hazardous area. When one or more light beams are completely interrupted, the multiple light beam safety device reports the interruption in the light path to the secure output signal switching devices (OSSDs) by a signal change. The machine or its control must safely analyze the signals (for example using a safe control or safety relays) and stop the dangerous state.

Sender and receiver automatically synchronize themselves optically. An electrical connection between both components is not required.

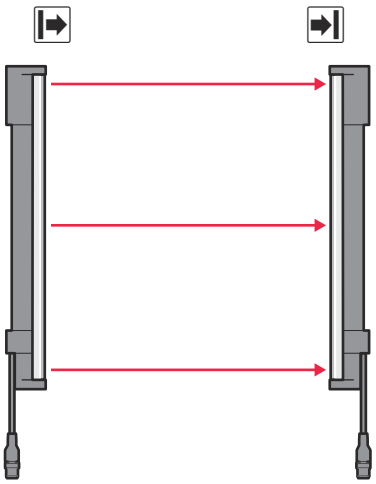


Figure 1: Sender and receiver

Beam separation and number of beams

The beam separation is the distance between two adjacent light beams, measured from the center of one beam to the center of the next.

The beam separation and number of beams depend on the device variant.

Scanning range

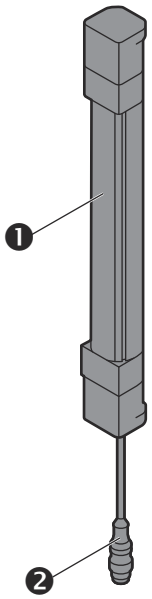
The scanning range is the maximum dimension of the light path between sender and receiver.

Further topics

- "Data sheet", page 50

4.2 Product characteristics

4.2.1 Device overview



❶ Sender or receiver
❷ System connection

4.2.2 Status indicators

Overview

The sender and receiver LEDs indicate the operational status of the multiple light beam safety device.

Sender indicators

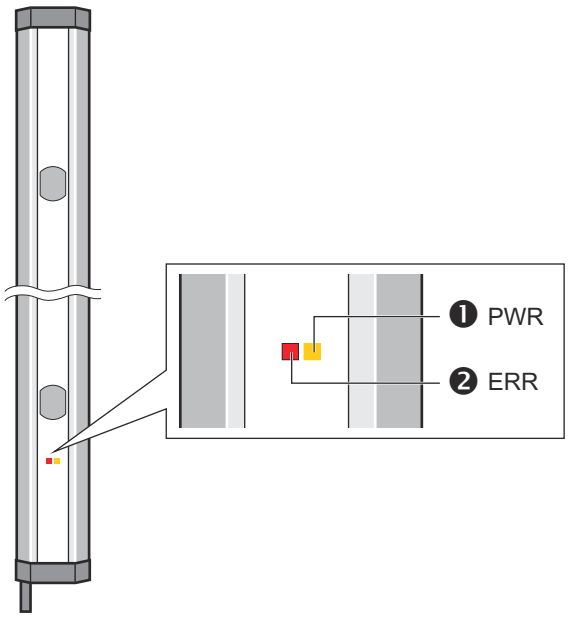


Figure 2: Sender indicators

Two light emitting diodes on the sender indicate the operational status:

Position	LED color	Display	Labeling
❶	Yellow	Status indicator	PWR
❷	Red	Fault indicator	ERR

Receiver indicators

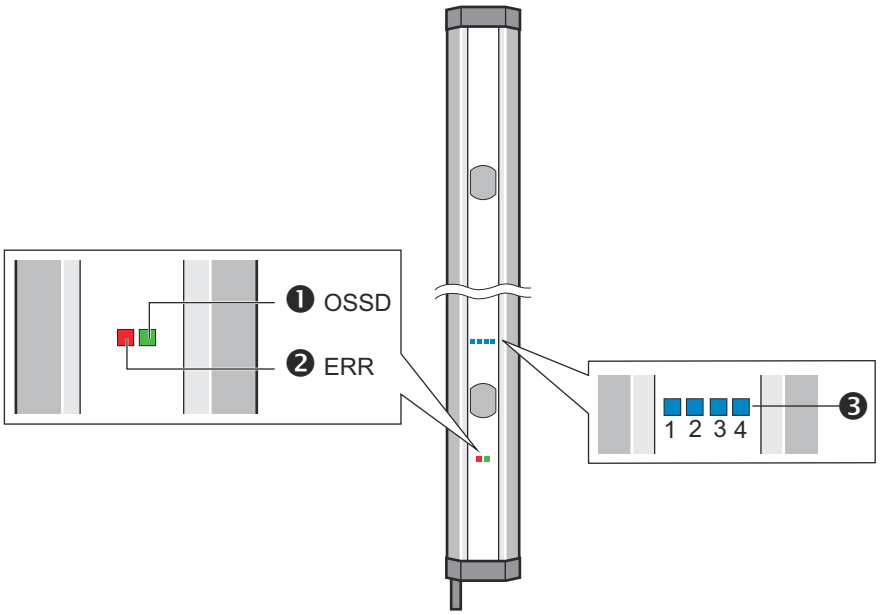


Figure 3: Receiver indicators

Six light emitting diodes on the receiver indicate the operational status:

Position	LED color	Display	Labeling
❶	Red/green	OSSD status	OSSD
❷	Red	Fault indicator	ERR
❸	Blue	Alignment quality	1, 2, 3, 4

The blue alignment quality light emitting diodes in combination with the red flashing ERR LED also denote faults.

Further topics

- "Diagnostic LEDs", page 46

4.3 Example applications

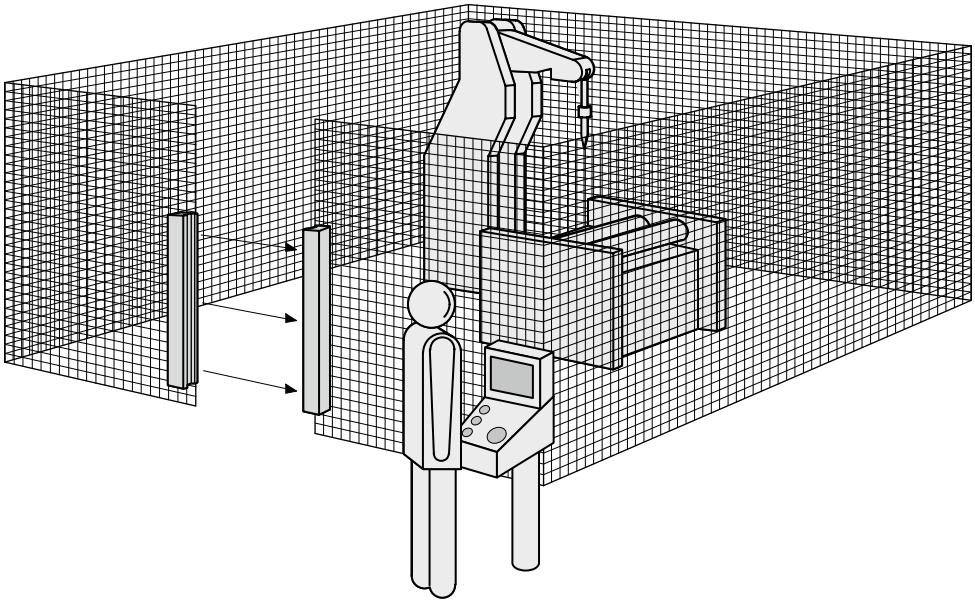


Figure 4: Single-sided access protection

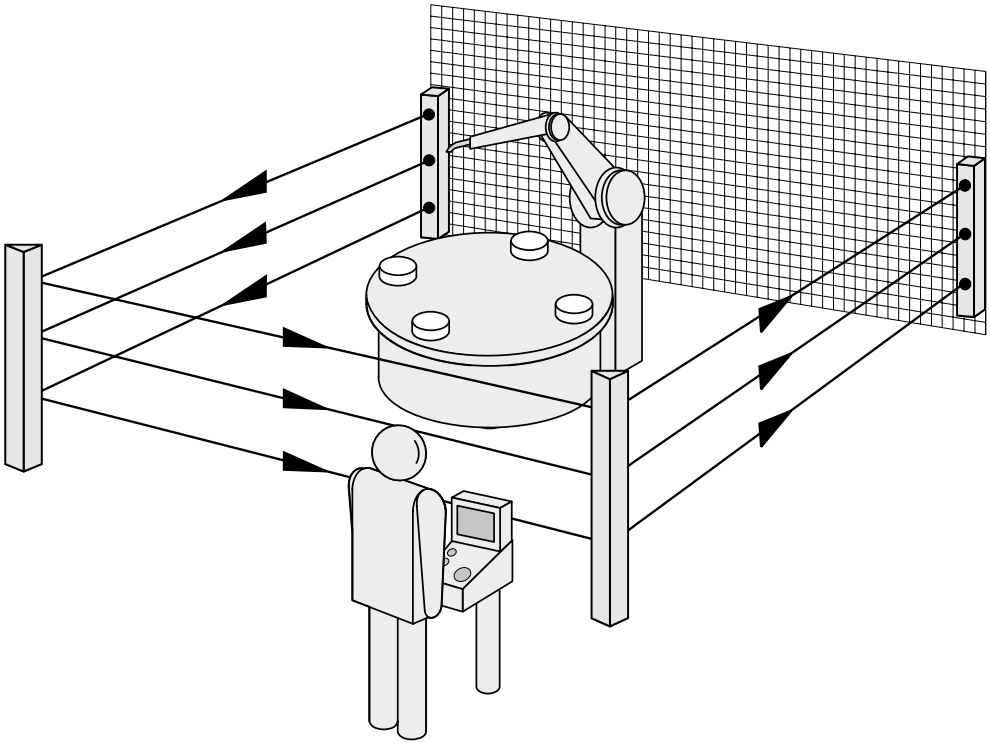


Figure 5: Multi-sided access protection

5 Project planning

5.1 Manufacturer of the machine

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.

- Use of the multiple light beam safety device requires a risk assessment. Check whether additional protective measures are required.
- Comply with the applicable national regulations derived from the application (e.g., work safety regulations, safety rules, or other relevant safety guidelines).
- Do not combine the components of the multiple light beam safety device with components from other multiple light beam safety devices.
- Apart from the procedures described in this document, the components of the multiple light beam safety device must not be opened.
- The components of the multiple light beam safety device must not be tampered with or changed.
- Improper repair of the protective device can lead to a loss of the protective function. Do not carry out any repairs on the device components.

5.2 Operating entity of the machine

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.

- Changes to the electrical integration of the multiple light beam safety device in the machine control and changes to the mechanical mounting of the multiple light beam safety device necessitate a new risk assessment. The results of this risk assessment may require the operating entity of the machine to meet a manufacturer's obligations.
- Apart from the procedures described in this document, the components of the multiple light beam safety device must not be opened.
- The components of the multiple light beam safety device must not be tampered with or changed.
- Improper repair of the protective device can lead to a loss of the protective function. Do not carry out any repairs on the device components.

5.3 Design

Overview

This chapter contains important information about the design.

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

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

- ▶ Make sure that the following design requirements are met so that the multiple light beam safety device can fulfill its protective function.
  - Sender and receiver must be arranged such that persons or parts of the body are reliably detected when they enter the hazardous area.
  - Ensure that nobody can pass under the lowest light beam, pass over the highest light beam, get between two light beams, or pass by the side of the protective device.
  - If people can stay between the protective device and the hazardous point without being detected, check if additional protective measures (e.g., restart interlock) are required.

DANGER
Hazard due to lack of effectiveness of the protective device

Certain types of light radiation can influence the protective device, e.g., light radiation from fluorescent lamps with electronic ballast installed in the path of the beam, or beams from laser pointers directed at the receiver.

- ▶ If this type of light radiation is present in the environment of the protective device, take additional measures to ensure that the protective device does not become dangerous.

Further topics

- "Mounting", page 27

5.3.1 Minimum distance from the hazardous point

A minimum distance must be maintained between the multiple light beam safety device and the hazardous point. This distance is required to prevent a person or part of the body from reaching the hazardous area before the dangerous state of the machine state has completed.

Calculating the minimum distance according to ISO 13855

The calculation of the minimum distance is based on international or national standards and statutory requirements applicable at the place of installation of the machine.

If the minimum distance is calculated according to ISO 13855, then it depends on the following points:

- Machine stopping time (time interval between triggering the sensor function and the end of the machine's dangerous state)
- Response time of the protective device
- Approach speed of personnel
- Type of approach: orthogonal (at right angles)
- Parameters specified based on the application

For the USA (scope of OSHA and ANSI), different regulations may apply, e.g.:

a) Laws: Code of Federal Regulations, Title 29 (CFR29) Part 1910.217

b) Standards: ANSI B11.19

Complementary information

Additional information is available in the ISO 13855 standard and in the Guidelines Safe Machinery.

SICK offers a stopping/run-down time measurement service in many countries.

Further topics

- "Technical data", page 50

5.3.1.1 Calculating minimum distance from the hazardous point

Important information

DANGER
Minimum distance from the hazardous point is too small

The dangerous state of the machine may not be stopped or not be stopped in a timely manner due to a minimum distance that is too small.

- ▶ Calculate the minimum distances for the machine in which the multiple light beam safety device is integrated.
- ▶ When mounting the multiple light beam safety device, observe the minimum distance.

Approach

The example shows the calculation of the minimum distance for an orthogonal (at right angles) approach to the multiple light beam safety device. Depending on the application and the ambient conditions, a different calculation may be required (e.g., at a different angle to the direction of approach or an indirect approach).

1. Calculate S using the following formula:
   $S = 1{,}600\ mm/s \times T + C$
   where:
   - S = minimum distance in millimeters (mm)
   - T = machine stopping time + response time of the protective device after interruption in the light path in seconds (s)
   - C = supplement in accordance with ISO 13855:
     - If it is not possible to reach over the protective device: C = 850 mm
     - If it is possible to reach over the protective device, the value C_{RO} must be used for C in accordance with ISO 13855, provided that this is greater than 850 mm: $C \geq 850\ mm$ and $C \geq C_{RO}$

   The reach/approach speed is already included in the formula.

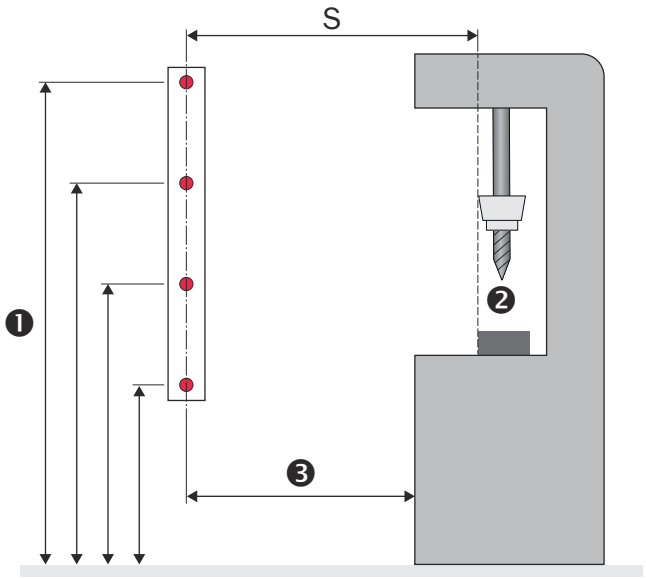


Figure 6: Minimum distance from the hazardous point

❶ Height of the light beams above ground

❷ Hazardous point

❸ Depending on the application and distance, persons must be prevented from standing behind the protective device.

Example calculation

Machine stopping time = 290 ms

Response time after interruption of the light path = 20 ms

T = 290 ms + 20 ms = 310 ms = 0.31 s

S = 1,600 mm/s × 0.31 s + 850 mm = 1,346 mm

5.3.2 Minimum distance from reflective surfaces

Overview

The light beams from the sender may be deflected by reflective surfaces and dispersive media. This can prevent an object from being detected.

Therefore, all reflective surfaces and objects (e.g., material bins, machine table, etc.) must maintain a minimum distance (a) from the light beams. This minimum distance (a) must be maintained on all sides of the light beams. This applies in horizontal, vertical and diagonal directions as well as at the end of the device. The same area must be free of dispersive media (e.g., dust, fog, or smoke).

The minimum distance (a) depends on the distance (D) between sender and receiver.

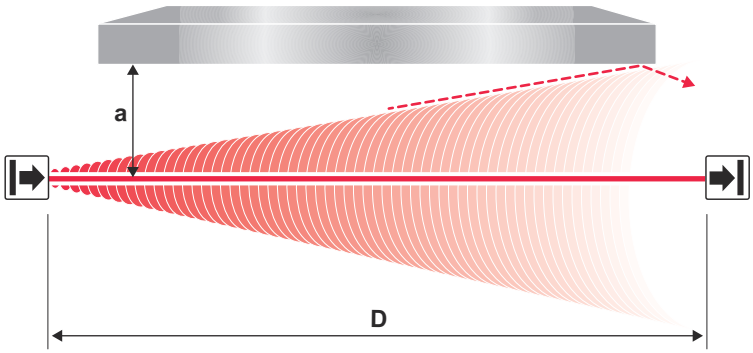


Figure 7: Minimum distance from reflective surfaces

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

Reflective surfaces and dispersive media can prevent persons or parts of the body to be protected from being properly reflected and therefore, they remain undetected.

- Make sure that all reflective surfaces and objects maintain a minimum distance from the light beams.
- Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the light beams.

Determining minimum distance to reflective surfaces

The minimum distance can be determined as follows:

- Determine the distance between sender and receiver D in meters (m).
- Read the minimum distance a in millimeters (mm) in the graph or calculate using the respective formula to determine the minimum distance to reflective surfaces:

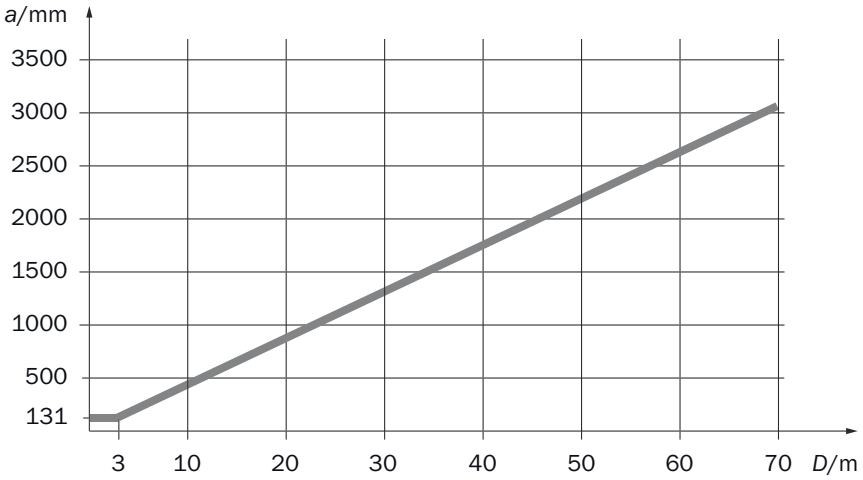


Figure 8: Graph, minimum distance from reflective surfaces

Table 3: Formula for calculating the minimum distance from reflective surfaces

Distance between sender and receiver D in m	Calculating the minimum distance from reflective surfaces a in mm
D ≤ 3 m	a = 131 mm
D > 3 m	a = tan (2.5°) × 1,000 mm/m × D = 43.66 × 1 mm/m × D

5.3.3 Protection against interference from systems in close proximity to each other

Overview

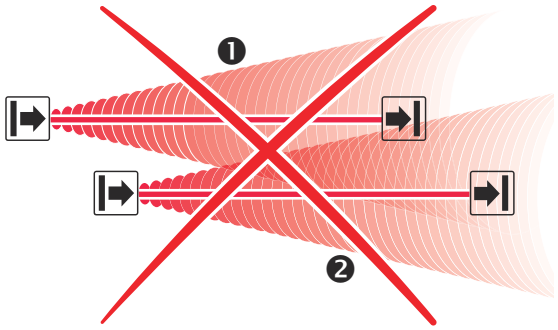


Figure 9: Preventing mutual interference from system ① and system ②

The infrared light beams of the sender of system ① can interfere with the receiver of system ②. This can disrupt the protective function of system ②. This would mean that the operator is at risk.

Avoid such installation situations or take appropriate action, e.g., install optically opaque partitions or reverse the direction of transmission of a system.

Important information

DANGER

Hazard due to lack of effectiveness of the protective device

Systems of multiple light beam safety devices in close proximity to each other can mutually interfere with each other.

- ▶ Use suitable measures to prevent interference between systems in close proximity to each other.

5.3.3.1 Using reversed direction of transmission

The direction of transmission of the system ❷ can be changed during mounting by switching the positions of the sender and receiver. With reversed direction of mounting, the receiver ❷ is not affected by the infrared light from the sender ❶.

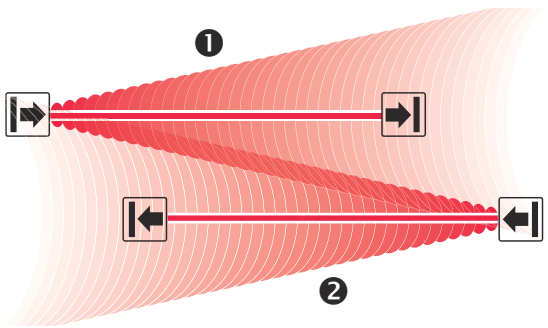


Figure 10: Trouble-free operation due to reversed direction of transmission of system ① and system ②

5.4 Integrating into the electrical control

This chapter contains important information about integration in the electrical control. Information about the individual steps for electrical installation of the device: see "Electrical installation", page 34.

Requirements for use

The output signals of the protective device must be analyzed by downstream controllers in such a way that the dangerous state of the machine is ended safely. Depending on the safety concept, the signal is analyzed by, e.g., safety relays or a safety 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 that the multiple light beam safety device can fulfill its protective function.

- It must be possible to electrically influence the control of the machine.
- The electrical control of the machine must meet the requirements of IEC 60204-1.
- Depending on the regulations which apply at the place of installation, a restart interlock may be required. Because the multiple light beam safety device does not have this function, it must be implemented in the external control if required.
- When using a safety controller, different signal levels of both OSSDs must be detected depending on the regulations which apply at the place of installation or the required reliability of the safety function. The maximum discrepancy time tolerated by the control must be selected according to the application.
- The OSSD1 and OSSD2 output signals must not be connected to each other.
- In the machine controller, the signals of both OSSDs must be processed separately.

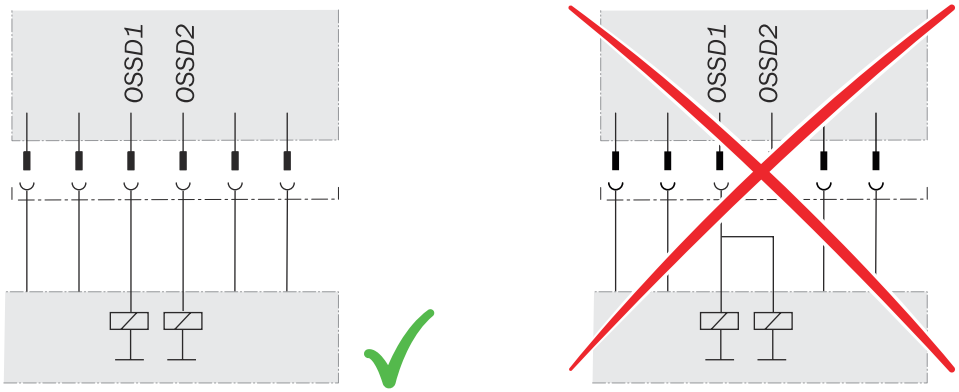


Figure 11: Dual-channel and isolated connection of OSSD1 and OSSD2

- The machine must switch to the safe state at any time if at least one of the two OSSDs 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 (output signal switching devices) 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.

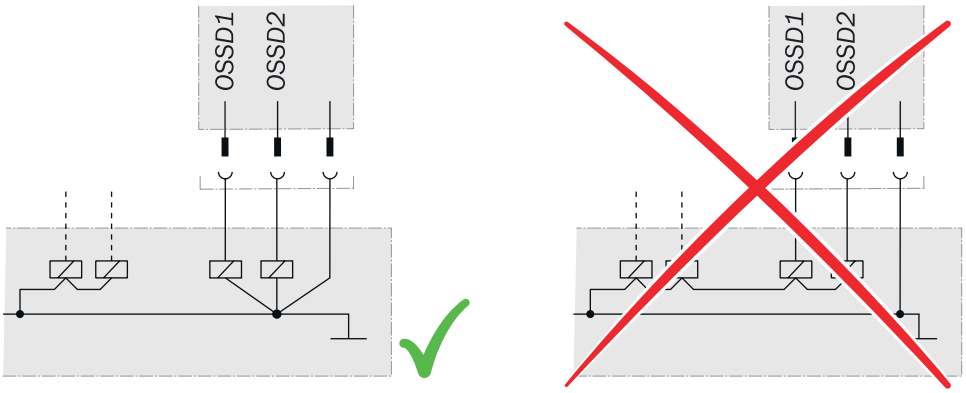


Figure 12: No potential difference between load and protective device

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).

- ▶ Because the multiple light beam safety device does not have integrated external device monitoring, this must be implemented in the external control, if required.

Requirements for the electrical control of the machine

Both outputs are short-circuit protected to 24 V DC and 0 V. When the light path is clear, the OSSDs are in the ON state. When a switch-off condition is present (e.g., interruption in the light path), the OSSDs are in the OFF state. In the event of a device fault, at least one OSSD is in the OFF state.

The multiple light beam safety device complies with the rules for electromagnetic compatibility (EMC) for the industrial sector (Radio Safety Class A). Radio interference cannot be ruled out when used in residential areas.

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 that the multiple light beam safety device can fulfill its protective function.

- The external voltage supply of the multiple light beam safety device must be capable of buffering brief power failures of 20 ms as specified in IEC 60204-1.
- The power supply unit must provide safe isolation according to IEC 61140 (SELV/PELV). Suitable power supply units are available as accessories from SICK.

5.4.1 Restart interlock

Overview

The restart interlock prevents the machine from automatically starting up, for example after a protective device has responded while the machine is operating or after changing the machine's operating mode.

Depending on the regulations which apply at the place of installation, a restart interlock may be required.

The protective device does not have an internal restart interlock. You must therefore implement a restart interlock externally via the circuitry or the control if needed, e.g. in connection with the SICK RLY3-OSSD2 / RLY3-OSSD3 safety relay.

Functionality

Before the machine can be restarted, the operator must reset the restart interlock.

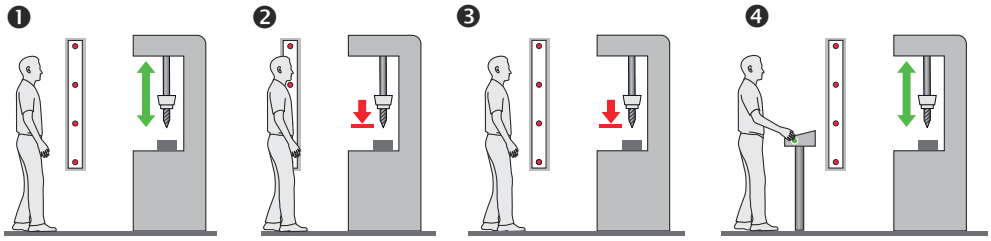


Figure 13: Schematic representation of operation with restart interlock

The dangerous state of the machine (❶) is brought to an end if the light path is interrupted (❷) and is not re-enabled (❸) until the operator presses the reset pushbutton located outside the hazardous area (❹). The machine can then be restarted.

Depending on applicable national regulations, a restart interlock must be available if it is possible to stand behind the protective device. Observe IEC 60204-1.

5.4.2 External device monitoring (EDM)

Overview

The external switching elements (external device monitoring, EDM) must be inspected in line with the regulations which apply at the place of installation or the required reliability of the safety function.

External device monitoring (EDM) monitors the status of downstream contactors.

Important information

NOTE
Because the multiple light beam safety device does not have integrated external device monitoring, this must be implemented in the external control, if required.

Prerequisites

- Positively guided contactors are used for shutting down the machine.
  If the auxiliary contacts of the positively guided contactors are connected to the external device monitoring, the external device monitoring checks whether the contactors drop off when the OSSDs are switched off.

5.4.3 Connection diagrams

Connection diagram for RLY3-OSSD2 with restart interlock and external device monitoring

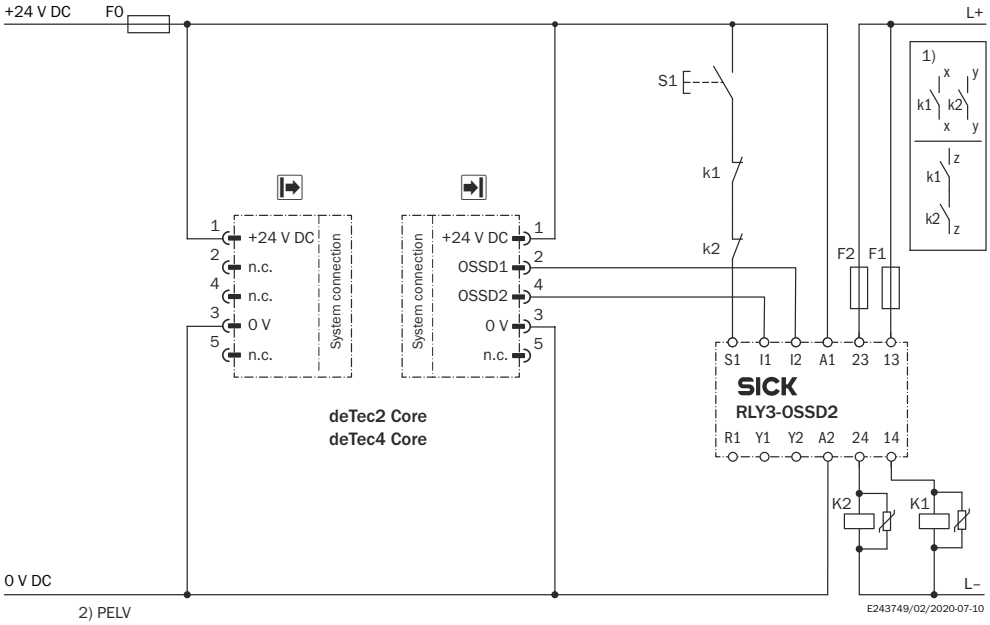


Figure 14: Connection diagram for RLY3-OSSD2 with restart interlock and external device monitoring

1) Output circuits: These contacts must be incorporated into the control such that the dangerous state is brought to an end if the output circuit is open. For categories 4 and 3, they must be incorporated on dual-channels (x, y paths). Type 2 devices are suitable for use up to PL c. Single-channel incorporation into the control (z path) is only possible with a single-channel control and taking the risk analysis into account.

2) SELV/PELV safety extra-low voltage.

Task

- Connection of a multiple light beam safety device deTem4 Core to a RLY3-OSSD2 safety relay. Operating mode: With restart interlock and external device monitoring.

Mode of operation

- When the light path is clear, the OSSD1 and OSSD2 outputs carry voltage. The system can be switched on when K1 and K2 are in a fault-free de-energized position. The RLY3-OSSD2 is switched on by pressing S1 (pushbutton is pressed and released). The outputs (contacts 13-14 and 23-24) switch the K1 and K2 contactors on. When the light path is interrupted, the OSSD1 and OSSD2 outputs switch the RLY3-OSSD2 off. Contactors K1 and K2 are switched off.

Fault analysis

- Cross-circuits and short-circuits of the OSSDs are recognized and lead to the locking status (lock-out). A malfunction with one of the K1 or K2 contactors is detected. The switch-off function is retained. In the event of manipulation (e.g., jamming) of the S1 pushbutton, the RLY3-OSSD2 will not re-enable the output current circuits.

5.5 Testing plan

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

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

The following checks are often defined in connection with a protective device:
- Check during commissioning and modifications
- Regular check

Check during commissioning and modifications

The test is intended to ensure that the hazardous area is monitored by the protective device and that unprotected access to the hazardous area is prevented.

The following points are often helpful for the definition of the check:
- Does the check have to be completed by quality safety personnel?
- Can the thorough check be completed by personnel specially qualified and authorized to do so?
- Does the check have to be documented in a traceable manner?
- Can the check be carried out according to a check list (see "Checklist for initial commissioning and commissioning", page 56)?
- Do the machine operators know the function of the protective device?
- Have the machine operators been trained to work on the machine?
- Have the machine operators been notified about modifications on the machine?
- Does the hazardous area to be secured have to be checked with a test rod, see "Test rod check", page 24?

▶ Define all guidelines for the check.

Regular check

The test is intended to ensure that the hazardous area is monitored by the protective device and that unprotected access to the hazardous area is prevented.

The following points are often helpful for the definition of the check:
- Which check must be carried out and how is it carried out?
  - Test rod check, page 24
  - Visual check of the machine and the protective device, page 26
- How often does the check have to be carried out?
- Do the machine operators have to be notified of the check and do they need to be instructed accordingly?

▶ Define all guidelines for the check.

5.5.1 Test rod check

Overview

The light beam is covered with an opaque test rod (minimum diameter of 30 mm). When the light beam is covered, the OSSD LED on the receiver must light up red. The check is carried out for each light beam and at multiple positions between the sender and the receiver.

Important information

DANGER
Hazard due to unexpected starting of the machine

- ▶ Make sure that the dangerous state of the machine is and remains switched off during the check.
- ▶ Make sure that the outputs of the multiple light beam safety device do not affect the machine during the check.

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.

Do not operate the machine if the OSSD LED lights up green during the test!

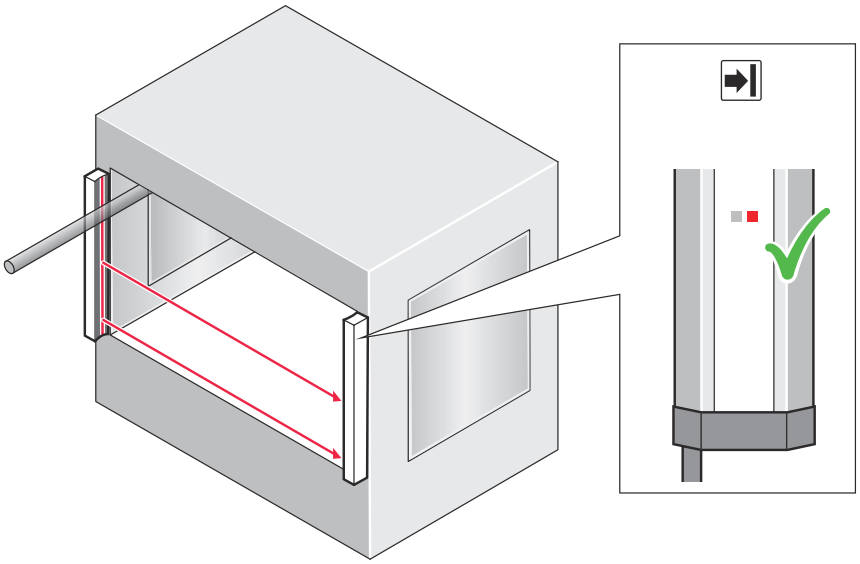
- ▶ If the OSSD LED lights up green during the test, even if only briefly, work must stop at the machine.
- ▶ In this case, the mounting and electrical installation of the multiple light beam safety device must be checked by appropriately qualified safety personnel.

Prerequisites

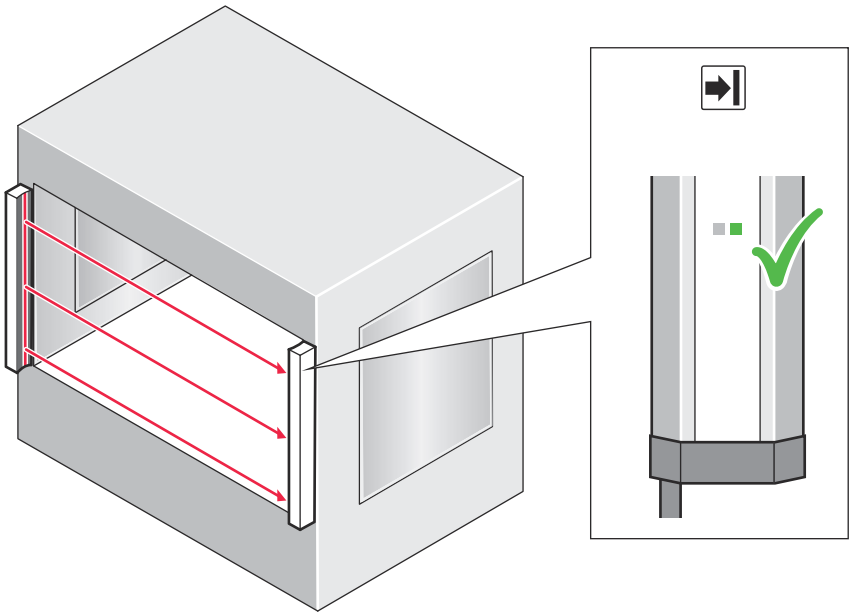
- The OSSD LED lights up green.

Approach

1. Cover a light beam completely.



✓ The OSSD LED on the receiver lights up red.
2. Enable the light beam.



✓ The OSSD LED on the receiver lights up green.

3. Carry out the check for each light beam.
4. Carry out the check at the following positions:
   - Immediately in front of the sender
   - In the middle, between the sender and the receiver (or between the deflector mirrors)
   - Immediately in front of the receiver
   - Directly before and after each deflector mirror (if installed)

5.5.2 Visual check of the machine and the protective device

The following points are often helpful for the definition of the check:

- Has the machine been retrofitted?
- Have machine parts been removed?
- Have modifications been made to the surroundings of the machine?
- Have the protective device or its parts been dismantled?
- Is it possible to enter the hazardous area without being detected?
- Is the protective device damaged?
- Is the protective device severely contaminated?
- Is the front screen contaminated, scratched or destroyed?
- Are there any damaged cables or open cable ends?

If one of the points applies, the machine should be shut down immediately. In this case, the machine and the protective device must be checked by appropriately qualified safety personnel.

6 Mounting

6.1 Safety

Important information

DANGER
Dangerous state of the machine

- Make sure that the dangerous state of the machine is (and remains) switched off during mounting, electrical installation, and commissioning.
- Make sure that the outputs of the multiple light beam safety device do not affect the machine during mounting, electrical installation, and commissioning.

DANGER
Hazard due to lack of effectiveness of the protective device

If unsuitable brackets are used or if subjected to excessive vibrations, the device may become detached or damaged.

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

- Only use SICK-approved brackets for mounting.
- Take appropriate measures for vibration damping if vibration and shock specifications exceed the values and test conditions specified in the data sheet.

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.

- Do not do repair work on device components.
- Do not make changes to or manipulate device components.
- Apart from the procedures described in this document, the device components must not be opened.

NOTE
Mount the device in the following order.

Prerequisites

- The multiple light beam safety device has been designed correctly.

Further topics

- "Design", page 14
- "Technical data", page 50

6.2 Unpacking

Approach

1. Check the components for completeness and the integrity of all parts.
2. Please contact your respective SICK subsidiary should you have any complaints.

Further topics

- "Ordering information", page 5

6.3 Mounting

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

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

- ▶ Take into consideration the minimum distances calculated for the machine.
- ▶ Mount multiple light beam safety devices such that nobody can pass under the lowest light beam, pass over the highest light beam, get between two light beams, or pass by the side of the protective device.

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.

- ▶ The end with the cable connection must point in the same direction for the sender and receiver.

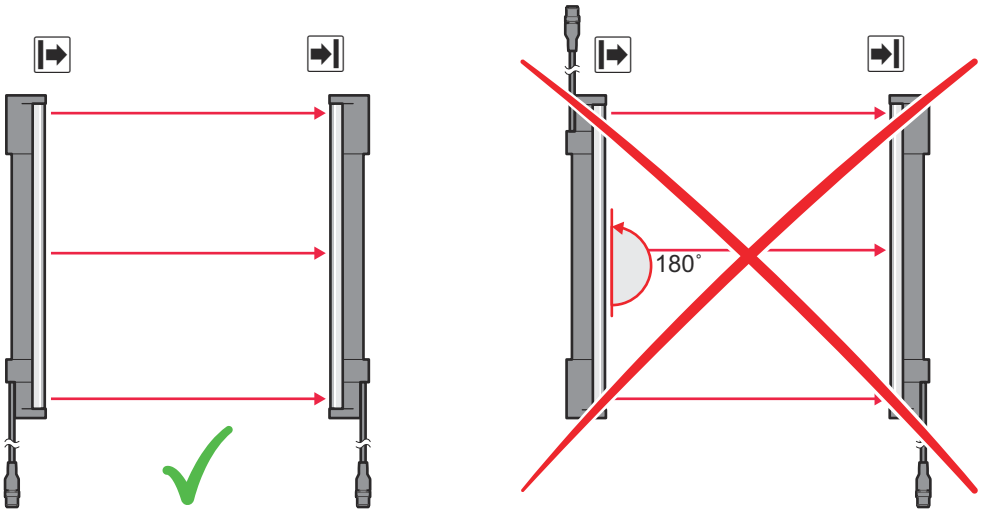
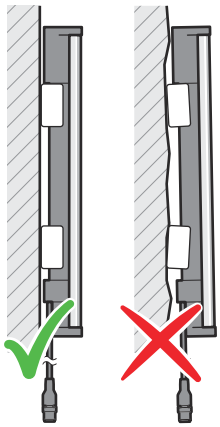


Figure 15: Sender and receiver must not be installed such that they are rotated 180 ° relative to each other

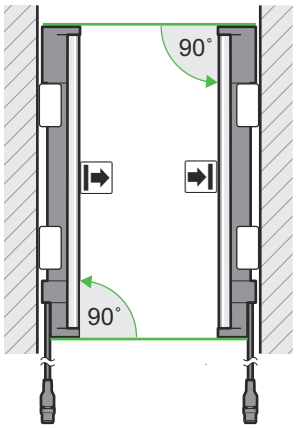
Notes on mounting

- ▶ Mount the sender and receiver on a level surface (❶).

❶

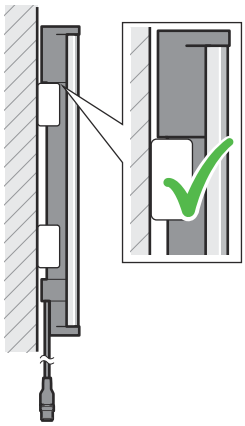


❷



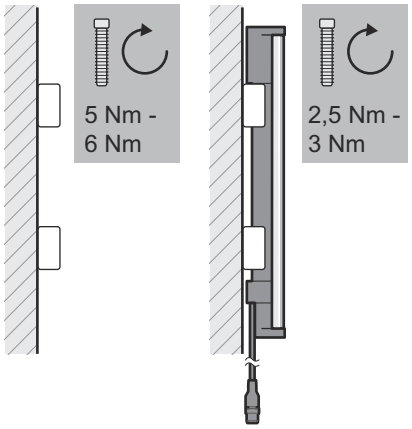
- If possible, mount the top bracket at a height such that the offset in the multiple light beam safety device housing rests on the bracket. This ensures that the multiple light beam safety device will not slip down during mounting (❸).

❸



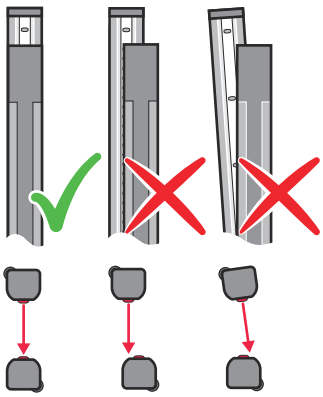
- Tightening torque for the screws used to mount the bracket: 5 Nm ... 6 Nm. Tightening torque for the screws used to secure the multiple light beam safety device in the bracket: 2.5 Nm ... 3 Nm (❹). Higher torques can damage the bracket, while lower torques are not secure enough to prevent the multiple light beam safety device from moving.

❹



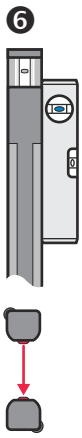
▶ Make sure that the sender and receiver are aligned correctly. The optical lens systems of the sender and the receiver must be located opposite one another (❺).

❺



▶ If necessary, use a spirit level to check that the components are parallel (❻).

❻



Further topics

- "Sender and receiver alignment", page 38
- "Minimum distance from the hazardous point", page 15
- "Minimum distance from reflective surfaces", page 17
- "Alignment with the FlexFix bracket or with the upgrade bracket", page 40

6.3.1 Mounting the FlexFix bracket

Overview

In the FlexFix bracket, the sender and receiver can be rotated ± 15° around their longitudinal axis.

2 FlexFix brackets are used to mount the sender and receiver.

As a rule, each FlexFix bracket is mounted to the flange plate with 2 screws. In exceptional cases (e.g. reduced vibration and shock requirements), a FlexFix bracket can be mounted with only one screw if this does not impair the function.

Important information

NOTICE

The housing of the multiple light beam safety device can become scratched if the screw heads protrude when the FlexFix brackets are mounted on the back.

Avoid this by taking one of the following measures:

- Use flat head screws.
- If using cylinder head screws, use two screws per bracket and no washers.

6.3.1.1 Mounting the FlexFix bracket on a machine or profile frame

Mounting method

Table 4: Lateral and rear mounting with the FlexFix bracket

Mounting method	Description
On the side	With the M5 screw through the FlexFix bracket on the machine or profile frame. A screw nut or threaded hole is required on the machine or profile frame (❶).
	With the M5 screw through the FlexFix bracket on the profile frame. 2 sliding nuts are required on the profile frame (❷).
On the back	With the M5 screw through the FlexFix bracket on the machine or profile frame. A screw nut or threaded hole is required on the machine or profile frame (❸).

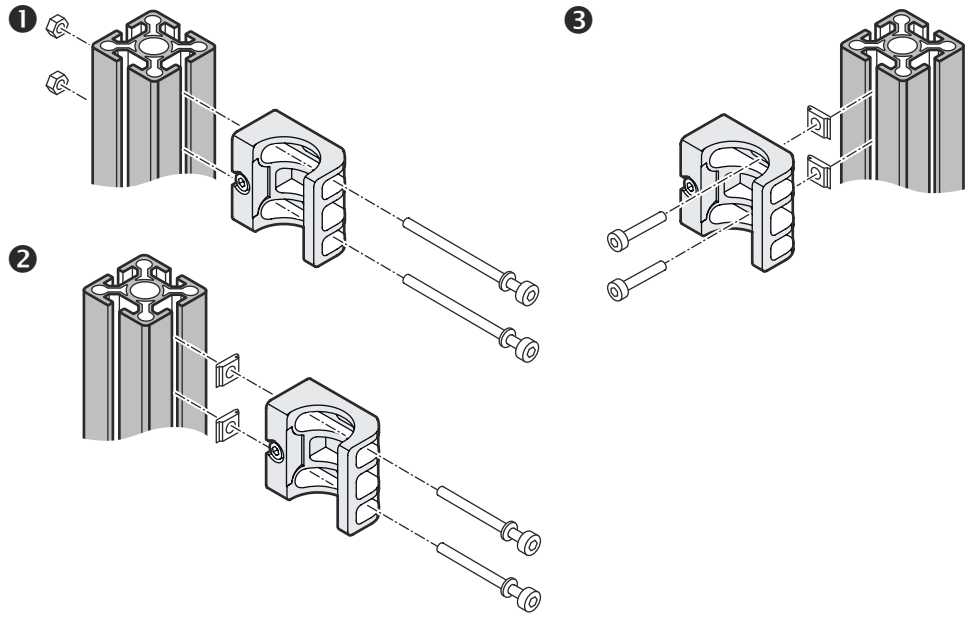


Figure 16: Mount FlexFix bracket to a profile frame

Approach

1. After assembling the FlexFix brackets, screw the sender or receiver into the FlexFix brackets from the front. (❶)
2. Align the sender and receiver. (❷)
3. Use an M5 screw to secure the position of the sender and receiver in the FlexFix bracket. (❸)

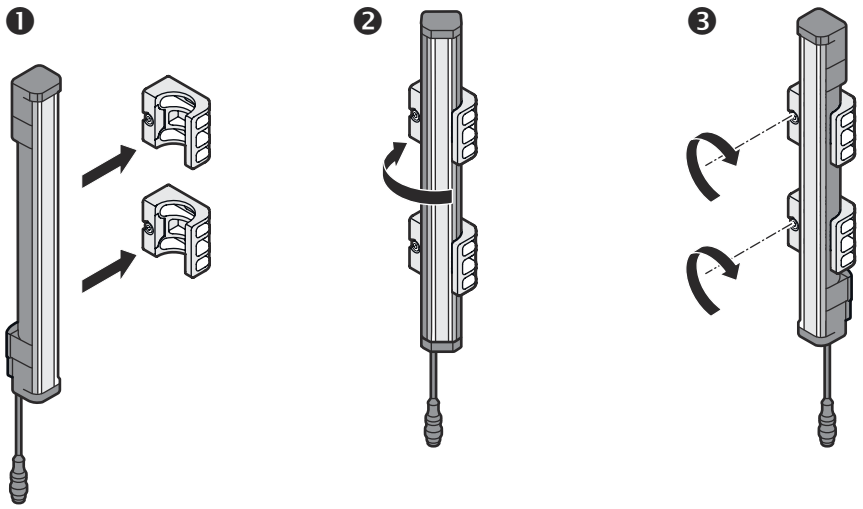


Figure 17: Inserting the multiple light beam safety device in the FlexFix brackets

NOTE
The protective device can only be screwed in when both FlexFix brackets are in alignment.

Recommendation:

1. Only hand-tighten the screws on the FlexFix brackets at first.
2. Align the two FlexFix brackets. To do this, place a straightedge or spirit level, for example, on the screw mounting surfaces of the FlexFix brackets that are not being used.
3. Tighten the screws.

Further topics

- "Sender and receiver alignment", page 38

6.3.1.2 Mounting the FlexFix bracket on the back of a device column

Overview

The FlexFix bracket can be mounted in the device column using sliding nuts.

Use washers between the FlexFix brackets and the device column if you want to mount the sender and receiver in the center of the device column.

Approach

1. After assembling the FlexFix brackets, screw the sender or receiver into the FlexFix brackets from the front.
2. Align the sender and receiver.
3. Use an M5 screw to secure the position of the sender and receiver in the FlexFix bracket.

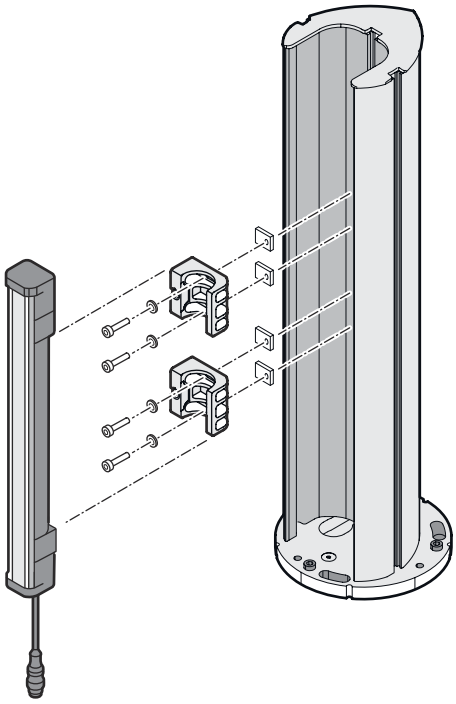


Figure 18: Mounting the FlexFix bracket on a device column (accessory)

Further topics

- "Sender and receiver alignment", page 38

7 Electrical installation

7.1 Safety

Important information

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 the 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 multiple light beam safety device do not affect the machine during electrical installation.
- ▶ Only use an appropriate voltage supply, see "Technical data", page 50.

DANGER
Hazard due to lack of effectiveness of the protective device
The dangerous state may not be stopped in the event of non-compliance.

- ▶ Always connect the two OSSDs separately. The two OSSDs must not be connected to each other.
- ▶ Connect the OSSDs such that the machine controller processes both signals separately.

DANGER
Hazard due to lack of effectiveness of the protective device
The dangerous state may not be stopped in the event of non-compliance.

- ▶ Prevent the formation of a potential difference between the load and the protective device.

Prerequisites

- The multiple light beam safety device has been safely integrated into the control system and the electrical system of the machine.
- Mounting has been completed correctly.

Example: Isolated connection of OSSD1 and OSSD2

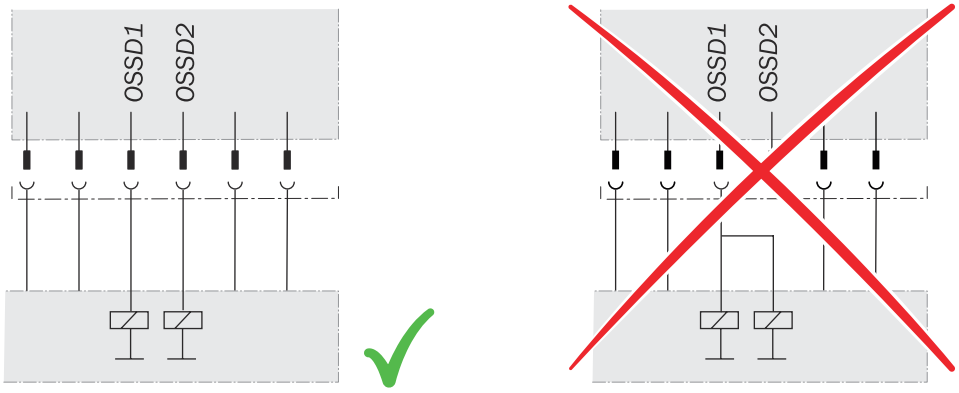


Figure 19: Dual-channel and isolated connection of OSSD1 and OSSD2

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.

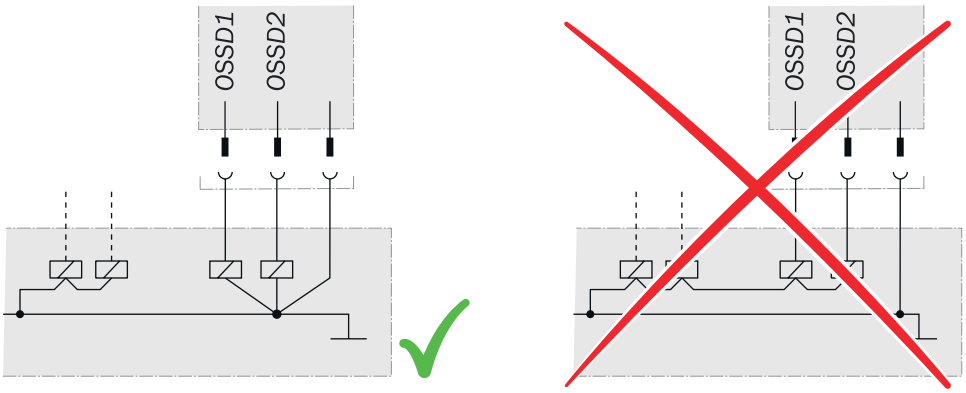


Figure 20: No potential difference between load and protective device

Further topics

- "Integrating into the electrical control", page 19

7.2 System connection (M12, 5-pin)

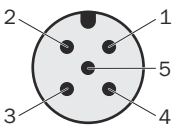


Figure 21: System connection (male connector, M12, 5-pin)

Table 5: System connection pin assignment (male connector, M12, 5-pin)

Pin	Wire color [1]	Sender	Receiver
1	Brown	+24 V DC (voltage supply input)	+24 V DC (voltage supply input)
2	White	Reserved	OSSD1 (output signal switching device 1)
3	Blue	0 V DC (voltage supply input)	0 V DC (voltage supply input)
4	Black	Reserved	OSSD2 (output signal switching device 2)
5	Gray	Not connected	Not connected

1) Applies to the connecting cables recommended as accessories.

Further topics

- "Integrating into the electrical control", page 19

8 Commissioning

8.1 Safety

Important information

DANGER
Hazard due to lack of effectiveness of the protective device
When changes are made to the machine, the effectiveness of the protective device may be affected unintentionally.

- After every change to the machine and changes to the integration or operational and secondary conditions of the multiple light beam safety device, check the protective device for effectiveness and recommission as specified in this chapter.

DANGER
Dangerous state of the machine

- Make sure that the dangerous state of the machine is (and remains) switched off during mounting, electrical installation, and commissioning.
- Make sure that the outputs of the multiple light beam safety device do not affect the machine during mounting, electrical installation, and commissioning.

WARNING
Hazard due to lack of effectiveness of the protective device

- Before commissioning the machine, make sure that the machine is first checked and released by qualified safety personnel.
- Only operate the machine with a perfectly functioning protective device.

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.

- Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - Beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- Make sure that all reflective surfaces and objects maintain a minimum distance from the light beams.
- Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the light beams.

Further topics

- "Minimum distance from reflective surfaces", page 17

8.2 Overview

Prerequisites

- Mounting has been completed correctly.
- Electrical installation has been completed correctly.

Further topics

- "Project planning", page 14
- "Mounting", page 27
- "Electrical installation", page 34

8.3 Switching on

Overview

After switching on, the sender and receiver initialize. All light emitting diodes of the sender and receiver briefly light up. After initialization, the receiver displays the alignment quality using four blue light emitting diodes. Once the safety light beam curtain is aligned (OSSD LED: green), the alignment display switches off after a certain period of time, and only the PWR LED of the sender and the OSSD LED of the receiver continue to light up.

In the event of a fault, the red fault LED flashes on the respective device. A red fault LED in combination with the blue LEDs shows the cause of the fault on the side of the receiver.

Further topics

- "Troubleshooting", page 46

8.4 Sender and receiver alignment

Overview

After mounting and electrical installation, the sender and receiver must be aligned with each other.

Important information

DANGER
Dangerous state of the machine

- ▶ Make sure that the dangerous state of the machine is (and remains) switched off during the alignment process.
- ▶ Make sure that the outputs of the multiple light beam safety device do not affect the machine during the alignment process.

Further topics

- "Alignment with the FlexFix bracket or with the upgrade bracket", page 40
- "Indication of the alignment quality", page 41
- "Diagnostic LEDs", page 46

8.4.1 Aligning the sender and receiver

Prerequisites

- Sender and receiver have been mounted at the correct height.
- The multiple light beam safety device can rotate in the bracket. If necessary, loosen the fixing screws slightly.

Approach

1. Switch on the voltage supply for the multiple light beam safety device.
2. Roughly align the sender with the receiver by rotating it.
3. Align the receiver with the sender. To do this, rotate the receiver so that as many blue alignment quality light emitting diodes as possible light up on the receiver.
4. If required, align the sender more precisely to the receiver so that as many alignment quality light emitting diodes as possible light up on the receiver.
5. If required, align the receiver more precisely to the sender so that as many alignment quality light emitting diodes as possible light up on the receiver.
6. When at least three (preferably four) alignment quality LEDs light up on the receiver, fasten the components in the brackets. Torque: 2.5 Nm ... 3 Nm.
7. Switch the voltage supply off and then on again.
8. Check the alignment quality light emitting diodes to make sure that the components are still correctly aligned with each other.

NOTE

Once three blue alignment quality light emitting diodes light up, alignment is good and availability is stable.

Please note that body parts or objects between the sender and receiver (e.g., hand, tool, AR60 optional laser alignment aid) will impair the function of the alignment quality LEDs. Remove all objects from this area to allow the alignment quality to be assessed.

Complementary information

The AR60 optional laser alignment aid can be used to facilitate alignment. To ensure that the indication of the alignment quality cannot be impaired, place the AR60 optional laser alignment aid with the adapter between the light beams of the multiple light beam safety device.

Further topics

- "Indication of the alignment quality", page 41
- "Mounting", page 27

8.4.2 Aligning the sender, receiver, and deflector mirror

Prerequisites

- Sender and receiver have been mounted at the correct height.
- The multiple light beam safety device can rotate in the bracket. If necessary, loosen the fixing screws slightly.

Approach

1. Switch on the voltage supply for the multiple light beam safety device.
2. Place the laser alignment aid near the bottom light beam on the sender.
3. Rotate the sender and adjust the height of the mirror column so that the laser beam hits the bottom mirror of the first mirror column.

- The laser beam should hit the center of the mirror horizontally.
- The laser beam should hit the mirror vertically with the same deviation from the center of the mirror that the laser of the laser alignment aid has from the bottom light beam.

4. Secure the sender in the brackets. Torque: 2.5 Nm ... 3 Nm.
   - The alignment may shift slightly when the screws are tightened. However, do not correct the setting.
5. Place the laser alignment aid near the bottom light beam on the receiver.
6. Rotate the receiver so that the laser beam hits the bottom mirror of the first mirror column.
   - The laser beam should hit the center of the mirror horizontally.
   - The laser beam should hit the mirror vertically with the same deviation from the center of the mirror that the laser of the laser alignment aid has from the bottom light beam.
7. Rotate the bottom mirror of the first mirror column so that the laser beam hits the bottom mirror of the second mirror column. If no other mirror column is available, the laser beam must hit the bottom beam of the sender.
8. Repeat the previous step for the subsequent mirror columns until the laser beam hits the sender.
9. Perform steps 5 to 8 for all beams from the bottom to the top.
   - Align each individual mirror separately.
   - When deflecting using mirrors, the angle of incidence is the same as the emergence angle. Rotating the mirror slightly results in a deflection that is twice as great.
   - Only part of the original ray beam is ever transmitted via deflector mirrors. The alignment tolerance is reduced with each additional deflection.
10. Switch the voltage supply off and then on again.
11. Check the alignment quality LEDs to make sure that the components are still correctly aligned with each other.

NOTE

Once three blue alignment quality light emitting diodes light up, alignment is good and availability is stable.

Please note that body parts or objects between the sender and receiver (e.g., hand, tool, AR60 optional laser alignment aid) will impair the function of the alignment quality LEDs. Remove all objects from this area to allow the alignment quality to be assessed.

NOTE

The AR60 optional laser alignment aid can be used to facilitate alignment.

To ensure that the indication of the alignment quality is not impaired, place the AR60 optional laser alignment aid with the adapter between the light beams of the multiple light beam safety device.

8.4.3 Alignment with the FlexFix bracket or with the upgrade bracket

Prerequisites

- A FlexFix bracket or upgrade bracket has been used to mount the sender and receiver

Alignment with the FlexFix bracket or with the upgrade bracket

The FlexFix bracket and upgrade bracket offer you the following adjustment options for aligning the sender and receiver with each other:

- Shift vertically
- Rotation (± 15°)

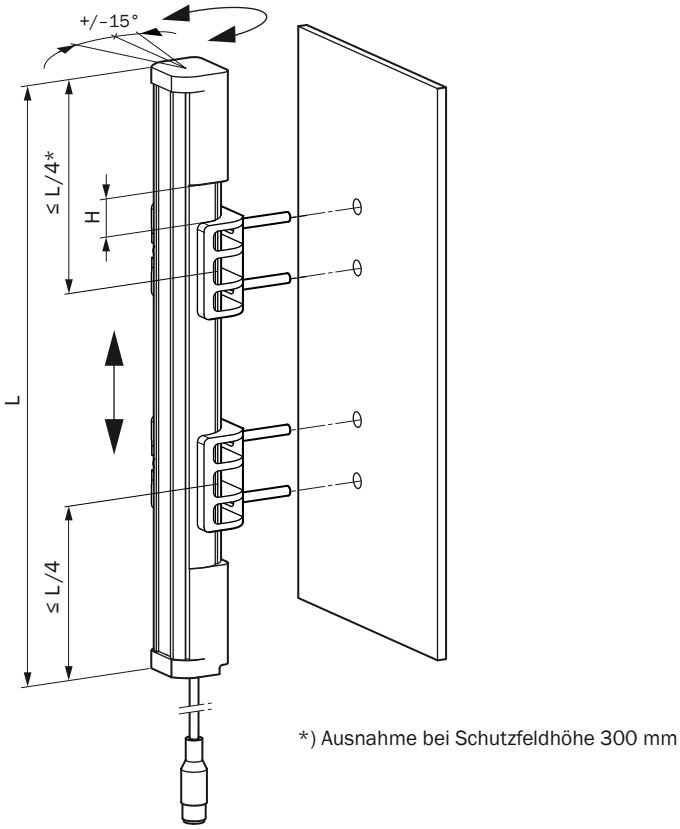


Figure 22: FlexFix bracket: Vertical adjustment / rotation

8.4.4 Indication of the alignment quality

Important information

NOTE

Once three blue alignment quality light emitting diodes light up, alignment is good and availability is stable.

Please note that body parts or objects between the sender and receiver (e.g., hand, tool, AR60 optional laser alignment aid) will impair the function of the alignment quality LEDs. Remove all objects from this area to allow the alignment quality to be assessed.

Indication of the alignment quality

Table 6: Indication of the alignment quality

LEDs					Meaning
Alignment quality light emitting diodes				OSSD	
1	2	3	4		
○	○	○	○	● Red	Alignment is insufficient or a light beam is interrupted at least partially. The receiver cannot synchronize with the sender.
● Blue	○	○	○	● Red	Alignment is insufficient or a light beam is interrupted at least partially.
● Blue	● Blue	○	○	● Red	Alignment is insufficient or a light beam is interrupted at least partially.

LEDs					Meaning
Alignment quality light emitting diodes				OSSD	
1	2	3	4		
● Blue	● Blue	○	○	● Green	Alignment is not yet sufficient for stable availability.
● Blue	● Blue	● Blue	○	● Green	Alignment is good, stable availability. [1]
● Blue	● Blue	● Blue	● Blue	● Green	Alignment is very good.

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

1) If the light path is very long, there is a possibility that all four alignment quality light emitting diodes will not light up even when alignment is excellent.

8.5 Check during commissioning and modifications

The test is intended to ensure that the hazardous area is monitored by the protective device and that unprotected access to the hazardous area is prevented.

▶ Carry out the checks according to the instructions from the manufacturer of the machine and from the operating entity.

9 Operation

9.1 Safety

Important information

DANGER
Hazard due to lack of effectiveness of the protective device
Persons and parts of the body to be protected may not be recognized in case of non-observance.

- ▶ Maintenance work, alignment work, fault diagnoses, and any changes to the integration of the protective device in the machine must only be carried out by qualified personnel.
- ▶ The effectiveness of the protective device must be checked following such work.

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.

- ▶ Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - Beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- ▶ Make sure that all reflective surfaces and objects maintain a minimum distance from the light beams.
- ▶ Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the light beams.

NOTE
This document does not provide instructions for operating the machine in which the multiple light beam safety device is integrated.

Further topics

- "Minimum distance from reflective surfaces", page 17

9.2 Regular thorough check

The test is intended to ensure that the hazardous area is monitored by the protective device and that unprotected access to the hazardous area is prevented.

- ▶ Carry out the checks according to the instructions from the manufacturer of the machine and from the operating entity.

10 Maintenance

10.1 Safety

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.

- Do not do repair work on device components.
- Do not make changes to or manipulate device components.
- Apart from the procedures described in this document, the device components must not be opened.

10.2 Regular cleaning

Overview

Depending on the ambient conditions of the multiple light beam safety device, the front screens must be cleaned regularly and in the event of contamination. Static charges can cause dust particles to be attracted to the front screen.

Important information

DANGER
Hazard due to lack of effectiveness of the protective device

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

- Regularly check the degree of contamination on all components based on the application conditions.
- Observe the information on the regular rod test check.

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.

- Make sure that the optical properties of the front screens of the sender and receiver are not changed, e.g., by:
  - Beading water, mist, frost, or ice formation. If applicable, remove films or other types of contamination, disconnect the voltage supply of the receiver and then switch it back on.
  - Scratches or damage. Replace the device whose front screen is scratched or damaged.
- Make sure that all reflective surfaces and objects maintain a minimum distance from the light beams.
- Make sure that no dispersive media (e.g., dust, fog, or smoke) are within the calculated minimum distance from the light beams.

DANGER
Hazard due to unexpected starting of the machine

- Make sure that the dangerous state of the machine is and remains switched off during the cleaning.
- Make sure that the outputs of the multiple light beam safety device do not affect the machine during cleaning.

NOTICE

- Do not use any aggressive cleaning agents.
- Do not use any abrasive cleaning agents.
- We recommend anti-static cleaning agents.
- We recommend the use of anti-static plastic cleaner (SICK part number 5600006) and the SICK lens cloth (SICK part number 4003353).

Approach

1. Remove dust from the front screen using a soft, clean brush.
2. Then wipe the front screen with a clean, damp cloth.
3. Check the position of the sender and receiver.
4. Check the effectiveness of the protective device.

Further topics

- "Test rod check", page 24
- "Minimum distance from reflective surfaces", page 17

10.3 Regular thorough check

The test is intended to ensure that the hazardous area is monitored by the protective device and that unprotected access to the hazardous area is prevented.

- Carry out the checks according to the instructions from the manufacturer of the machine and from the operating entity.

11 Troubleshooting

11.1 Safety

DANGER
Hazard due to lack of effectiveness of the protective device

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

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

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

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

- Do not do repair work on device components.
- Do not make changes to or manipulate device components.
- Apart from the procedures described in this document, the device components must not be opened.

NOTE
Additional information on troubleshooting can be found at the responsible SICK subsidiary.

11.2 Diagnostic LEDs

11.2.1 Fault indicators

Overview

In the event of a fault, the type of fault is indicated by the light emitting diode display on the sender or receiver.

Sender

Position of LEDs: see "Sender indicators", page 11

Table 7: Fault indicator on the sender

PWR-LED	ERR-LED	Possible cause	Rectification
○	○	No supply voltage or supply voltage is too low or internal fault	Check the voltage supply, see "Technical data", page 50. Switch the voltage supply off and then on again. If the fault persists, replace the sender, see "Ordering information", page 5.
○	Red	The voltage was too high when operating the sender.	Check the voltage supply, see "Technical data", page 50. Replace the sender, see "Ordering information", page 5.
Yellow	Red	Fault in the supply voltage	Check the voltage supply and the power supply unit, see "Technical data", page 50. Switch the voltage supply off and then on again. If the fault persists, replace the defective components, see "Ordering information", page 5.
Yellow	Red	The sender identified an internal fault.	Switch the voltage supply off and then on again. If the fault persists, replace the sender, see "Ordering information", page 5.

○ LED off. LED flashes. ● LED illuminates.

Receiver

Position of LEDs: see "Receiver indicators", page 12

Table 8: Fault indicator on the receiver

OSSD LED	ERR-LED	Alignment quality LEDs				Possible cause	Rectification
		1	2	3	4		
Red	Red	Blue	○	○	○	An internal fault has occurred.	Switch the voltage supply off and then on again. If the fault persists, replace the receiver, see "Ordering information", page 5.
Red	Red	○	Blue	○	○	Fault in the supply voltage	Check the voltage supply and the power supply unit, see "Technical data", page 50. Switch the voltage supply off and then on again. If the fault persists, replace the defective components, see "Ordering information", page 5.

OSSD LED	ERR-LED	Alignment quality LEDs				Possible cause	Rectification
		1	2	3	4		
● Red	✳ Red	○	○	✳ Blue	○	The receiver has recognized beams from several senders.	Check the distance to senders of the same type. Make sure that beams from another sender cannot hit the receiver, see "Protection against interference from systems in close proximity to each other", page 19. Switch the voltage supply off and then on again.
● Red	✳ Red	○	○	○	✳ Blue	A fault or unexpected status was identified on the OSSDs of the system connection (e.g., overvoltage, short-circuit to HIGH or short-circuit to LOW, cross-circuit, permissible load capacity exceeded)	Check the system wiring for a fault. Make sure that the OSSDs have been wired correctly, see "Integrating into the electrical control", page 19. Switch the voltage supply off and then on again. If the fault persists, replace the defective components, see "Ordering information", page 5.

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

12 Decommissioning

12.1 Disposal

Approach

- 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.

13 Technical data

13.1 Data sheet

General system data

Table 9: General system data

	Minimum	Typical	Maximum
Dimension of the light path [1]			
Device with a short scanning range			
	0.5 m ... 15 m	0.5 m ... 17 m	
Number of beams	3		
Beam separation	400 mm		
Protection class [2]	III (IEC 61140)		
Enclosure rating	IP 65 (IEC 60529) IP 67 (IEC 60529)		
Supply voltage V_S [3] [4]	19.2 V DC	+24 V DC	28.8 V DC
Residual ripple [5]			± 10 %
Response time	20 ms		
Synchronization	Optical		
Type	Type 4 (IEC 61496-1)		
Safety integrity level [6]	SIL3 (IEC 61508)		
SIL claim limit [6]	SILCL3 (IEC 62061)		
Category	Category 4 (ISO 13849-1)		
Performance level [6]	PL e (ISO 13849–1)		
PFHd (mean probability of one dangerous failure per hour)	3.0×10^{-9}		
T_M (mission time)	20 years (ISO 13849-1)		
Safe status when a fault occurs	At least one OSSD is in the OFF state.		
Power-up delay of sender and receiver after supply voltage is applied			2 s
Test rod speed at which the test rod is reliably detected [7]	0 m/s ... 1.6 m/s		

1) If the light path is very long, there is a possibility that all four alignment quality light emitting diodes will not light up even when alignment is good.
2) SELV/PELV safety extra-low voltage.
3) The external voltage supply must be capable of bridging a brief power failure of 20 ms as specified in IEC 60204-1. Suitable power supply units are available as accessories from SICK.
4) A fuse rated maximum 2 A shall be installed in the isolated 24 V DC power supply circuit to the device in order to limit the available current.
5) Within the limits of U_V.
6) For more detailed information on the exact configuration of your machine, please contact your relevant SICK subsidiary.
7) Direction of movement and axis of the test rod perpendicular to the light beam.

Technical data for sender

Table 10: Technical data for sender

	Minimum	Typical	Maximum
Wavelength of sender	Near-infrared (NIR), invisible		
Effective aperture angle (EAA) [1]			2.5°

	Minimum	Typical	Maximum
Current consumption			50 mA
Power consumption			1.44 W

1) Distance between sender and receiver D ≥ 3 m.

Technical data for receiver

Table 11: Technical data for receiver

	Minimum	Typical	Maximum
Current consumption			150 mA
Power consumption			4.32 W
Output signal switching devices (OSSDs)			
Type of output	2 PNP semiconductors, short-circuit protected [1], cross-circuit monitored		
Duration of OFF state	100 ms		
Switch-on delay		3 × response time	
Output voltage for ON state (HIGH) [2]	U_V – 2.6 V		
Output voltage for OFF state (LOW) [2] [3]	0 V ... 2.0 V		
Output current for ON state (HIGH)			300 mA each
Leakage current of the OSSDs			2 mA each
Load capacity			2.2 µF
Load inductance			2.2 H
Test pulse data [4]			
Test pulse width		150 µs	300 µs
Test pulse rate	3 s^{-1}	5 s^{-1}	10 s^{-1}
Permissible cable resistance			
Between device and load [5]			2.5 Ω
Supply cable [6]			1 Ω

1) Applies to the voltage range between -30 V and +30 V.
2) According to IEC 61131-2.
3) The specified values are the switching voltage passed to the device. If higher voltages are impressed from the outside, the maximum value of 2.0 V can be exceeded.
4) When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test pulses do not result in deactivation when using the above parameters.
5) The cable resistance of the individual wires to the downstream controller must not exceed this value, to ensure that a cross-circuit between the outputs is safely detected. (Observe standard IEC 60204-1 too.)
6) The supply cable must not be used to connect other loads with the exception of the sender.

Operating data

Table 12: Operating data

System connection	Male connector, M12, 5-pin		
Length of cable [1]			50 m
E.g., wire cross-section 0.34 mm^2, copper cable			15 m
E.g., wire cross-section 0.5 mm^2, copper cable			30 m
Ambient operating temperature [2] [3]	–30 °C ... +55 °C		
Air humidity (non-condensing)	15 % ... 95 %		

Storage temperature	–30 °C ... +70 °C
Housing cross-section	31 mm × 34 mm, plus bracket, see "Dimensional drawings", page 53
Weight	Dependent on the number of beams, see "Table of weights", page 52
Vibration resistance [4]	5 g, 10 Hz ... 55 Hz (IEC 60068-2-6)
Shock resistance [5]	10 g, 16 ms (IEC 60068-2-27)

1) Maximum permissible conductor resistances must be observed.
2) The temperature difference between sender and receiver must not exceed 25 K.
3) The cable belonging to the device incl. the associated connection plug must not be flexibly mounted under -25 °C.
4) Test conditions per axis: 1 octave/minute, amplitude: 0.35 mm, 20 sweeps.
5) Test conditions per axis: 1,000 shocks.

13.2 Table of weights

Table 13: Weight of sender and receiver

Number of beams	Weight in g [1]	
	Sender	Receiver
3	800	800

1) Tolerance: ± 50 g

13.3 Dimensional drawings

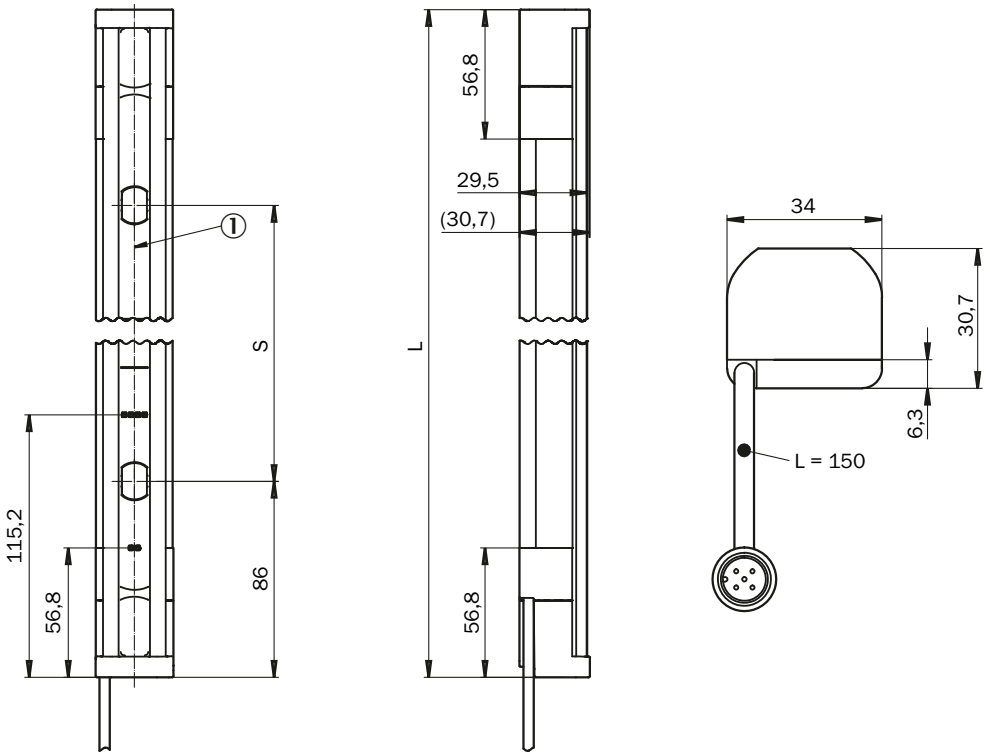


Figure 23: Dimensional drawing of sender and receiver

All dimensions in mm

① Optical axis

Table 14: Dimensions based on the number of beams, sender and receiver

Number of beams	Beam separation, dimension S in mm	Length (L)
3	400	972

14 Annex

14.1 Compliance with EU directives

EU declaration of conformity (extract)

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.

Complete EU declaration of conformity for download

You can call up the EU declaration of conformity and the current operating instructions for the protective device by entering the part number in the search field at www.sick.com (part number: see the type label entry in the “Ident. no.” field).

14.2 Note on specified standards

Standards are specified in this document. The table shows regional standards with similar or identical contents.

Table 15: Note on specified standards

Standard	Standard (regional)
	China
IEC 60068-2-6	GB/T 2423.10
IEC 60068-2-27	GB/T 2423.5
IEC 60204-1	GB/T 5226.1
IEC 60529	GB/T 4208
IEC 60825-1	GB 7247.1
IEC 61131-2	GB/T 15969.2
IEC 61140	GB/T 17045
IEC 61496-1	GB/T 19436.1
IEC 61496-2	GB/T 19436.2
IEC 61496-3	GB 19436.3
IEC 61508	GB/T 20438
IEC 62061	GB 28526
ISO 13849-1	GB/T 16855.1
ISO 13855	GB/T 19876

14.3 Checklist for initial commissioning and commissioning

Checklist for manufacturers or installers for installing electro-sensitive protective device (ESPE)

The details relating to the items listed below must be available no later than when the system is commissioned for the first time. However, these depend on the specific application (the requirements of which must be reviewed by the manufacturer or installer).

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

This checklist does not replace the initial commissioning, nor the regular inspection by qualified safety personnel.

Have the safety rules and regulations been observed in compliance with the directives and standards applicable to the machine?	Yes ☐ No ☐
Are the applied directives and standards listed in the declaration of conformity?	Yes ☐ No ☐
Does the protective device comply with the required PL/SIL claim limit and PFHd in accordance with EN ISO 13849-1/EN 62061 and the required type in accordance with EN 61496-1?	Yes ☐ No ☐
Is access to the hazardous area or hazardous point only possible through the protective field of the ESPE?	Yes ☐ No ☐
Have appropriate measures been taken to protect (mechanical protection) or monitor (protective devices) any persons or objects in the hazardous area when protecting a hazardous area or hazardous point, and have these devices been secured or locked to prevent their removal?	Yes ☐ No ☐
Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching below, above or around the ESPE?	Yes ☐ No ☐
Has the maximum shutdown and/or stopping time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?	Yes ☐ No ☐
Has the ESPE been mounted such that the required minimum distance from the nearest hazardous point has been achieved?	Yes ☐ No ☐
Are the ESPE devices properly mounted and secured against manipulation after adjustment?	Yes ☐ No ☐
Are the required protective measures against electric shock in effect (protection class)?	Yes ☐ No ☐
Is the control switch for resetting the protective devices (ESPE) or restarting the machine present and correctly installed?	Yes ☐ No ☐
Are the outputs of the ESPE (OSSDs or safety outputs via the network) integrated according to the required PL/SILCL in accordance with EN ISO 13849-1/EN 62061 and does the integration correspond to the circuit diagrams?	Yes ☐ No ☐
Has the protective function been checked in compliance with the test notes of this documentation?	Yes ☐ No ☐
Are the specified protective functions effective at every operating mode that can be set?	Yes ☐ No ☐
Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?	Yes ☐ No ☐
Is the ESPE effective over the entire period of the dangerous state?	Yes ☐ No ☐
Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device?	Yes ☐ No ☐

15 List of figures

16 List of tables

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Australia
Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Russia
Phone +7 495 283 09 90
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

SICK AG | Waldkirch | Germany | www.sick.com

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