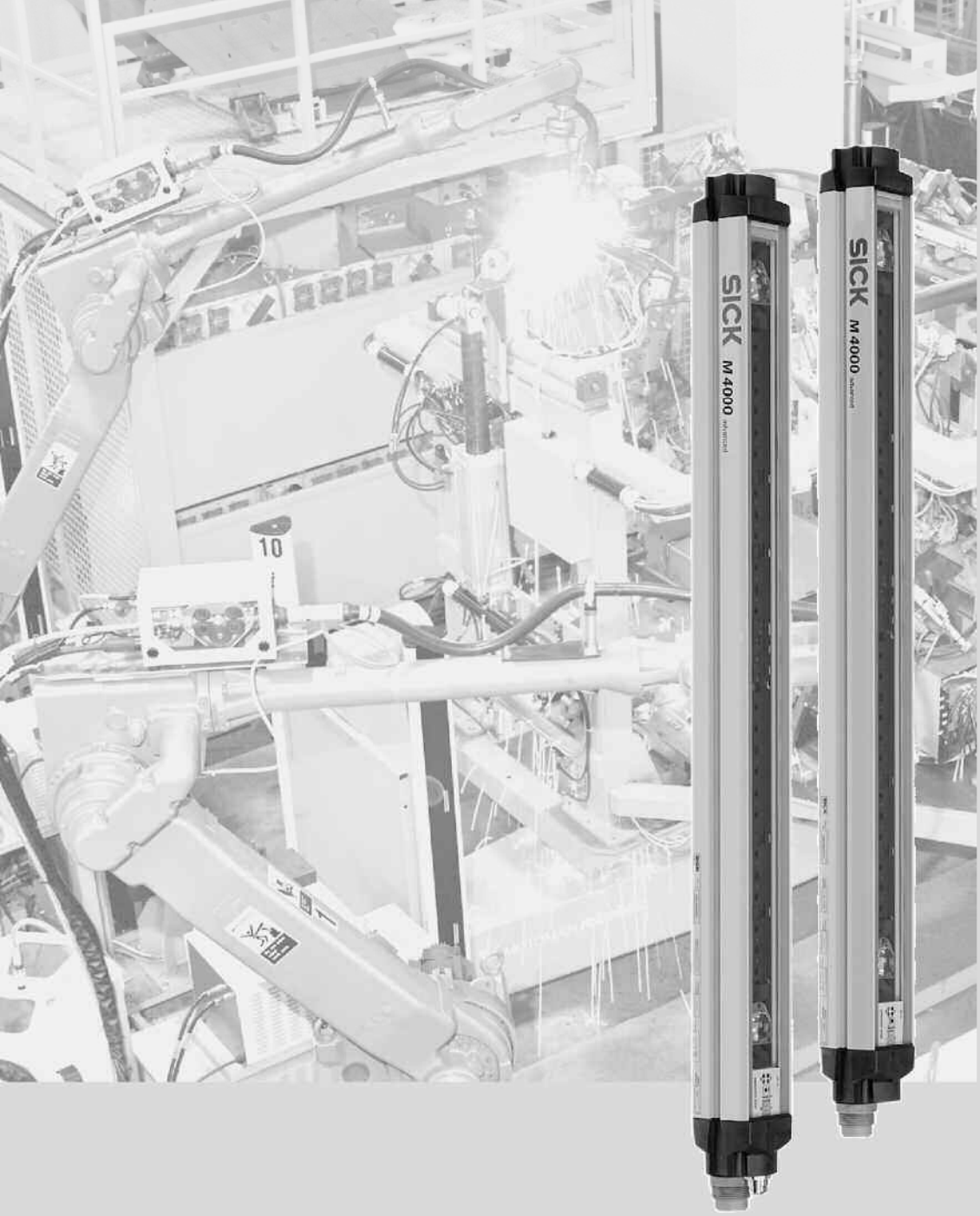


OPERATING INSTRUCTIONS

M4000 Advanced, M4000 Advanced A/P and M4000 Area 60/80 Multiple Light Beam Safety Device

SICK

QUALITY SYSTEM

certified by DQS according to DIN EN ISO 9001 Reg. No. 462-03

Contents

Contents

1 About this document

Please read this chapter carefully before working with this documentation and the M4000 multiple light beam safety device.

1.1 Function of this document

These operating instructions are designed to address *the technical personnel of the machine manufacturer* or the *machine operator* in regards to safe mounting, installation, configuration, electrical installation, commissioning, operation and maintenance of the M4000 multiple light beam safety device.

These operating instructions do *not* provide instructions for operating machines on which the multiple light beam safety device is, or will be, integrated. Information on this is to be found in the appropriate operating instructions for the machine.

1.2 Target group

These operating instructions are addressed to *planning engineers*, *machine designers* and *operators* of plants and systems which are to be protected by one or several M4000 multiple light beam safety devices. It also addresses people who integrate the M4000 multiple light beam safety device into a machine, initialise its use, or who are in charge of servicing and maintaining the device.

1.3 Depth of information

These operating instructions contain the following information on the M4000 multiple light beam safety device:

- mounting
- electrical installation
- commissioning and configuration
- care and maintenance
- fault diagnosis and troubleshooting
- part numbers
- conformity and approval

Planning and using protective devices such as the M4000 multiple light beam safety device also require specific technical skills which are not detailed in this documentation.

When operating the M4000 multiple light beam safety device, the national, local and statutory rules and regulations must be observed.

General information on accident prevention using opto-electronic protective devices can be found in the SICK brochure “Safe Machines with opto-electronic protective devices”.

Note We also refer you to the SICK homepage on the Internet at

www.sick.com

Here you will find information on:

- sample applications
- a list of frequently asked questions regarding the M4000
- these operating instructions in different languages for viewing and printing
- EC Declaration of Conformity

1.4 Scope

Note These operating instructions are applicable to the multiple light beam safety devices M4000 Advanced, M4000 Advanced A/P and M4000 Area 60/80 with the following entry on the type label in the field *Operating Instructions*: 8010794 or 8010794/PA53. This document is part of SICK part number 8010794 (operating instructions “M4000 Advanced Multiple Light Beam Safety Device” in all available languages).

For the configuration and diagnostics of these devices you require CDS (Configuration & Diagnostic Software) version 3.10 or higher. To determine the version of your software version, select the **Module-Info...** option in the **?** menu.

1.5 Abbreviations and terms

ADO Application diagnostic output = configurable signal output that indicates a specific status of the protective device

Beam separation Distance between two neighbouring beams, measured from the middle of one beam to the middle of the other.

CDS SICK Configuration & Diagnostic Software = software for the configuration and diagnostics of your M4000 multiple light beam safety device

EDM External device monitoring

EFI Enhanced function interface = safe SICK device communication

ESPE Electro-sensitive protective equipment (e.g. M4000)

Muting A temporary automatic suppression of one or more safety function/s by safety-related parts of the control system.

OSSD Output signal switching device

OWS Output weak signal = contamination signal

PLC Programmable logic controller

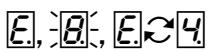
Resolution Minimum size of a test rod that is reliably detected by the protective device The resolution is measured from the outside edge of a beam to the opposite outside edge of the neighbouring beam.

SDL Safety Data Link = SICK safety interface (connection for OSSD and EFI of an ESPE)

1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.



Display indications show the status of the 7-segment display on sender or receiver:

 Constant display of the letter E

 Flashing display of the digit 8

 Alternating display of E and 4

The depiction of digits on the 7-segment display oft the M4000 can be rotated by 180° with the aid of the CDS. In this document the depiction of the 7-segment display is however always in the normal, non-rotated position.

●, ☼, ○ LED symbols describe the status of an LED:

- ● The LED is constantly illuminated.
- ☼ The LED is flashing.
- ○ The LED is off.

➢ Take action ... Instructions for taking action are shown by an arrow. Read carefully and follow the instructions for action.

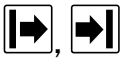
WARNING

Warning!

A warning indicates an actual or potential risk or health hazard. They are designed to help you to prevent accidents.

Read carefully and follow the warning notices!

Software notes show the location in the CDS (Configuration & Diagnostic Software) where you can make the appropriate settings and adjustments.



Sender and receiver

In drawings and diagrams, the symbol ⇨ denotes the sender and the symbol ⇨| denotes the receiver.

The term “dangerous state”

The dangerous state (standard term) of the machine is always shown in the drawings and diagrams of this document as a movement of a machine part. In practical operation, there may be a number of different dangerous states:

- machine movements
- electrical conductors
- visible or invisible radiation
- a combination of several risks and hazards

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.

➢ Please read this chapter carefully before working with the M4000 multiple light beam safety device or with the machine protected by the M4000 multiple light beam safety device.

2.1 Specialist personnel

The M4000 multiple light beam safety device must only be installed, commissioned and serviced by specialist personnel. Specialist personnel are defined as persons who

- have undergone the appropriate technical training

and

- who have been instructed by the responsible machine operator in the operation of the machine and the current valid safety guidelines

and

- who have access to these operating instructions.

2.2 Applications of the device

The M4000 system is a type 4 electro-sensitive protective equipment (ESPE) as defined by IEC/EN 61496-1 and IEC 61496-2 and is therefore allowed for use with controls in category 4 according to EN 954-1. The preconfiguration of the M4000 multiple light beam safety device is suitable for:

- hazardous area protection
- access protection

The multiple light beam safety devices must be installed such that the hazardous area can only be reached by interrupting the light path between sender and receiver. It must not be possible to start the plant/system as long as personnel are within the hazardous area.

The M4000 system is intended only for use in industrial environments. When used in residential areas it can cause interference.

Refer to page 15 for an illustration of the protection modes and an example application.


WARNING

Only use the multiple light beam safety device as an indirect protective measure!

An opto-electronic protective device provides indirect protection, e.g. by switching off the power at the source of the hazard. It cannot provide protection from parts thrown out, nor from emitted radiation. Transparent objects are not detected.

Depending on the application, mechanical protective devices may be required in addition to the M4000 system.

2.3 Correct use

The M4000 system must be used only as defined in chapter 2.2 “Applications of the device”. It must be used only by qualified personnel and only on the machine where it has been installed and initialised by qualified personnel in accordance with these operating instructions.

All warranty claims against SICK AG are forfeited in the case of any other use, or alterations being made to the system, even as part of their mounting or installation.

2.4 General safety notes and protective measures


WARNING

Safety notes

Please observe the following items in order to ensure the correct and safe use of the M4000 multiple light beam safety device.

- The national/international rules and regulations apply to the installation, commissioning, use and periodic technical inspections of the multiple light beam safety device, in particular ...
  - Machinery Directive 98/37/EC.
  - Work Equipment Directive 89/655/EEC.
  - the work safety regulations/safety rules.
  - other relevant safety regulations.

  Manufacturers and operators of the machine on which the multiple light beam safety device is used are responsible for obtaining and observing all applicable safety regulations and rules.
- The notices, in particular the test regulations (see “Test notes” on page 61) of these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device.

  The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, please always use the password hierarchy provided by SICK to ensure that only authorised persons make changes to the configuration. The SICK service team is available to provide assistance if required.
- The tests must be carried out by specialist personnel or specially qualified and authorised personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- The operating instructions must be made available to the operator of the machine where the M4000 multiple light beam safety device is fitted. The machine operator is to be instructed in the use of the device by specialist personnel and must be instructed to read the operating instructions.
- The external voltage supply of the devices must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204-1. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).

2.5 Environmental protection

The M4000 multiple light beam safety device is constructed in such a way that it adversely affects the environment as little as possible. It uses only a minimum of power and natural resources.

➢ At work, always act in an environmentally responsible manner.

2.5.1 Disposal

Unusable or irreparable devices should always be disposed as per the applicable national regulations on waste disposal (e.g. European waste code 16 02 14).

Notes

- We would be pleased to be of assistance on the disposal of this device. Contact your local SICK representative.
- Information on the individual materials in the M4000 is given in chapter 11 “Technical specifications” on page 73.

2.5.2 Separation of materials

WARNING

Only appropriately trained personnel are allowed to separate materials!

Caution is required when dismantling devices. There is a risk of injuries.

Before you send the devices for appropriate recycling, it is necessary to separate the different materials in the M4000.

➢ Separate the housing from the rest of the parts (in particular the circuit board).

➢ Send the separated parts for recycling as appropriate (see Tab. 1).

Tab. 1: Overview on disposal by components

Components	Disposal
Product	
Housing	Metal recycling (aluminium)
Circuit boards, cable, connector and electrical connecting pieces	Electronic recycling
Packaging	
Cardboard, paper	Paper/cardboard recycling
Polyethylene packaging	Plastic recycling

3 Product description

This chapter provides information on the special features and properties of the M4000 multiple light beam safety device. It describes the construction and the operating principle of the device.

➢ Please read this chapter before mounting, installing and commissioning the device.

3.1 Special features

Properties of all devices described in these operating instructions

- protective operation with either internal or external (realised on the machine) restart interlock
- external device monitoring (EDM)
- beam coding
- configurable application diagnostic output (ADO)
- status display with 7-segment display
- SDL interface

M4000 Advanced

- muting configurable (only in conjunction with external switching amplifier, e.g. UE403)
- 2, 3 or 4 beams
- scanning range up to 70 m
- integrated laser alignment aid (optional)
- end cap with integrated LED (optional)

M4000 Advanced A/P

- less wiring costs: Only one device needs to be connected electrically.
- quick and straightforward alignment in conjunction with the M4000 Passive (deflector unit)
- 2 beams, scanning range to 7.5 m (M4000 Passive with mirror deflection)
- 2 or 4 beams, scanning range to 4.5 m (M4000 Passive with fibre-optic deflection)
- muting configurable (only in conjunction with external switching amplifier, e.g. UE403)
- end cap with integrated LED (optional)

M4000 Area 60/80

- horizontal area protection
- M4000 Area 60:
  - 60 mm resolution
  - length of the monitored area 300-1800 mm
  - scanning range 19 m
  - guest support for the C4000 safety light curtain
- M4000 Area 80:
  - corresponds: 80 mm resolution
  - length of the monitored area 600-1800 mm
  - scanning range 70 m

3.2 Operating principle of the device

3.2.1 The principle of the multiple light beam safety device

The M4000 multiple light beam safety device secures the access to a hazardous area and signals the entry of objects as soon as a light beam is interrupted. The machine or plant controller that evaluates this message must then bring the dangerous movement to a halt. You can secure two sides of a hazardous area by using a deflector mirror, with two deflector mirrors you can secure three sides (see chapter 3.3.2 “Access protection on several sides with the aid of deflector mirrors” on page 17ff).

3.2.2 Device components

Fig. 1: Device components of the M4000 Advanced

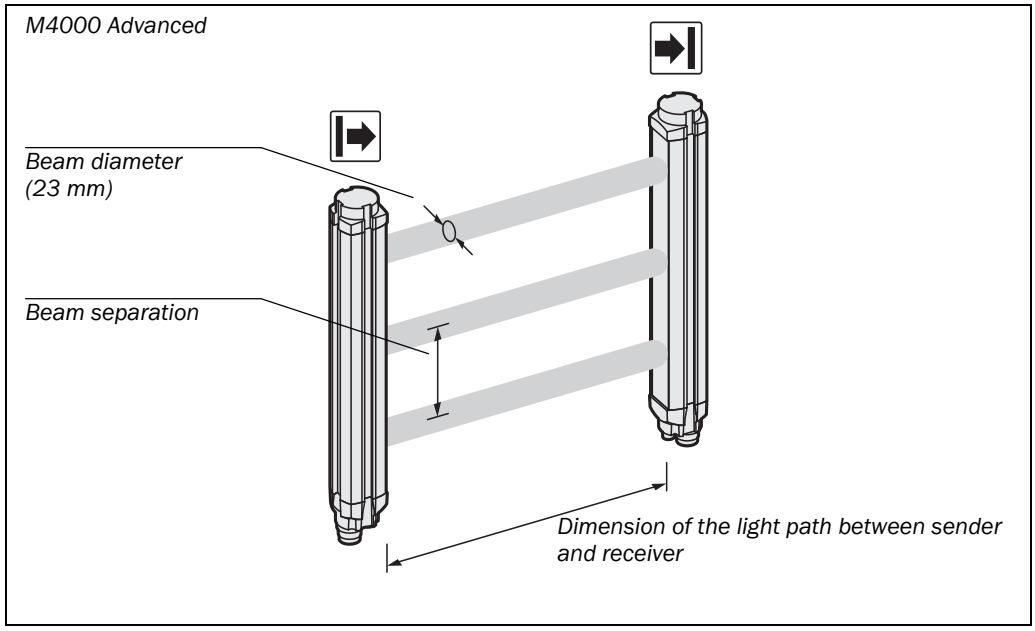


Fig. 2: Device components of the M4000 Advanced A/P

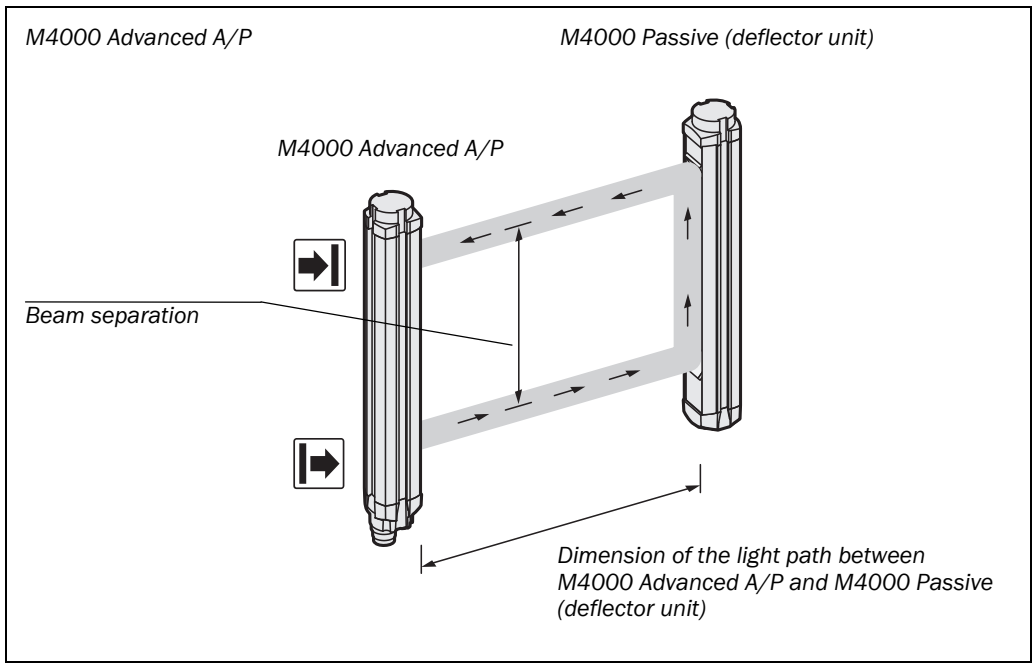
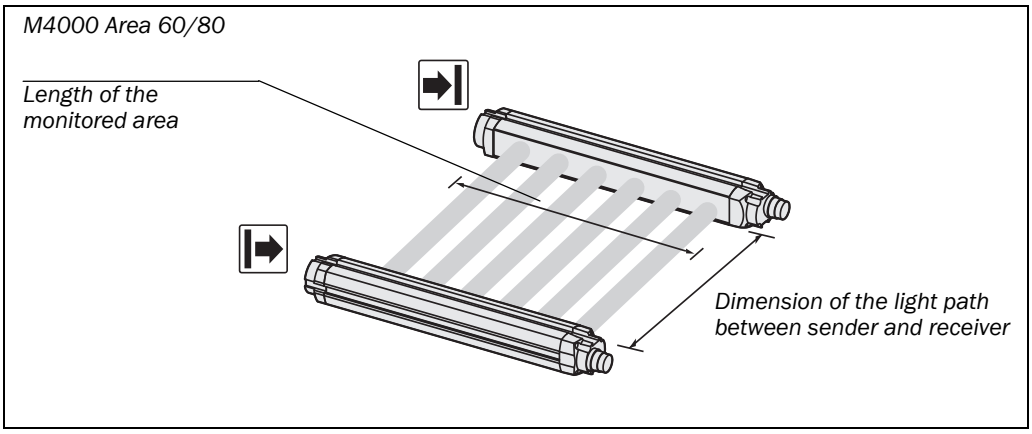


Fig. 3: Components of the M4000 Area 60/80



Principles of operation

The M4000 multiple light beam safety device consists of a sender unit and a receiver unit. A distinction should be made between active/active systems and active/passive systems:

- On the active/active system, sender unit and receiver unit are in separate housings, the *sender* and the *receiver*. The light beam is emitted from the sender and is incident to the receiver.
- On the active/passive system, sender unit and receiver unit are in a common housing (*M4000 Advanced A/P*). The light beam is emitted from the sender unit and is deflected by the deflector unit *M4000 Passive* (mirror deflection or fibre-optic deflection) by 180° back to the receiver unit (see Fig. 2). As a passive element, the deflector unit does not require any electrical connections.

For the exact number and distance of beams, please see chapter 11.3 “Dimensional drawings” on page 80ff.

The dimension of the light path between sender and receiver (or between the M4000 Advanced A/P and M4000 Passive) must not exceed the maximum permissible scanning range (see “Technical specifications” on page 73ff.).

On active/active systems, sender unit and receiver unit synchronise automatically by optical means. An electrical connection between both components is not required.

The M4000 is modular in structure. All optical and electronic components and assemblies are housed in a slim and torsionally rigid housing.

M4000 Advanced

The M4000 Advanced multiple light beam safety device is available with 2, 3 or 4 beams. Other configurations with up to 12 beams are possible on request. The maximum scanning range (dimension of the light path between sender and receiver) is 70 m.

M4000 Advanced A/P

The M4000 Advanced A/P is available with 2 or 4 beams. The maximum scanning range (dimension of the light path between the M4000 Advanced A/P and the M4000 Passive) is dependent of the number of beams as well as the utilized M4000 Passive and is 7.5 m max.

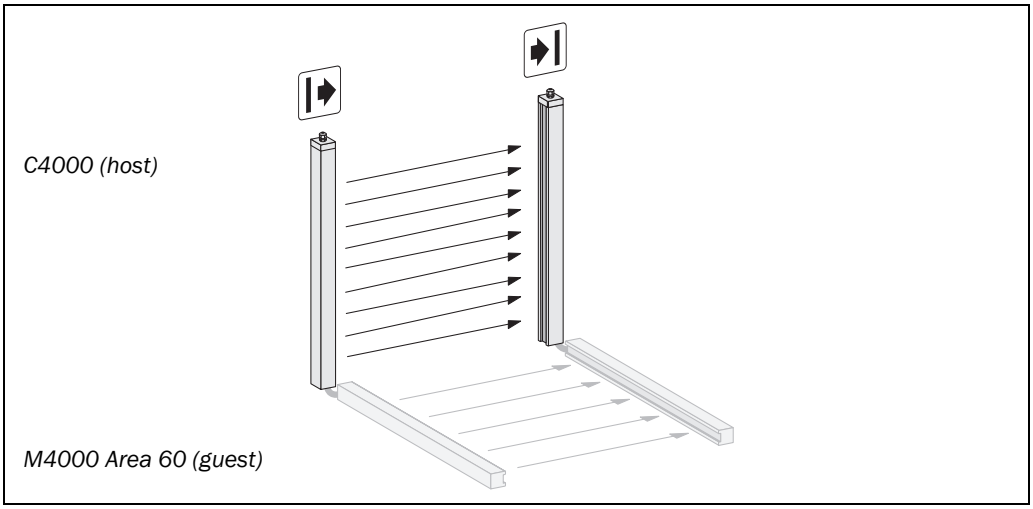
M4000 Area 60/80

The M4000 Area 60/80 multiple light beam safety device is available with a monitored area length from 300/600 mm to 1800 mm. The beam separation is 50 or 57 mm (resolution of 60 or 80 mm). The maximum scanning range is 19 m (M4000 Area 60) or 70 m (M4000 Area 80).

3.2.3 Cascading

Note Cascading can only be realised with the M4000 Area 60 multiple light beam safety device.

Fig. 4: Cascading of C4000 and M4000 Area 60



On cascading with a C4000 safety light curtain, the M4000 Area 60 can be connected in series, e.g. to realise safe point-of-operation guarding for hazardous point protection. To protect two planes, two device pairs — one safety light curtain and one multiple light beam safety device (as a terminal device) can be connected in series. The device connected to the control cabinet is the main sensor, called *Host*. The subsequent sensor is called *Guest*.

Benefits of cascading

- No additional external circuitry required.
- Resolution and monitored areas (height or length) of the individual systems can differ.

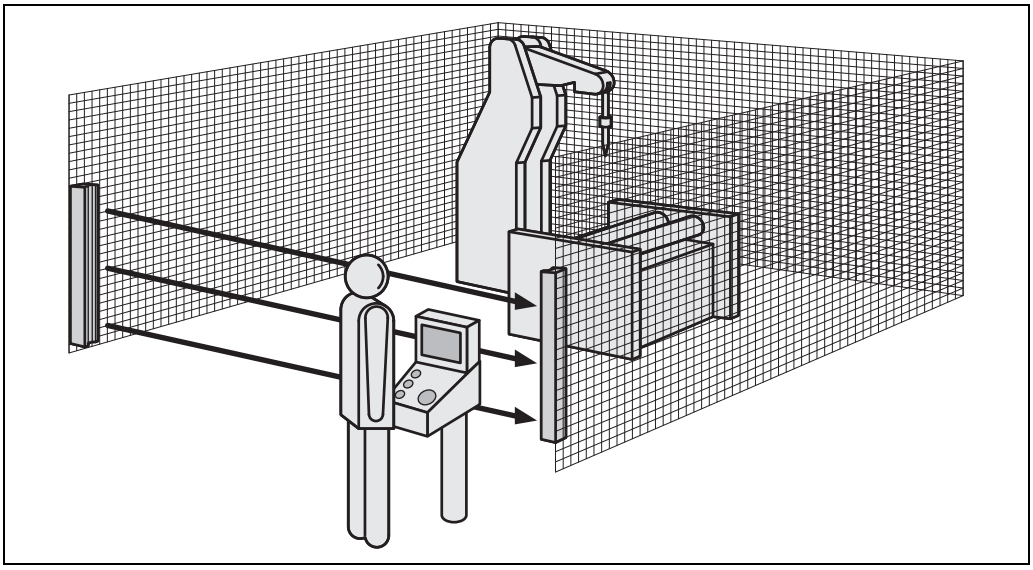
Limits of cascading

- The maximum width of the monitored area must not be exceeded by any single system!
- The maximum cable length between two cascaded systems must not exceed 3 metres.

3.3 Application examples

3.3.1 Access protection

Fig. 5: Access protection with an M4000 Advanced multiple light beam safety device



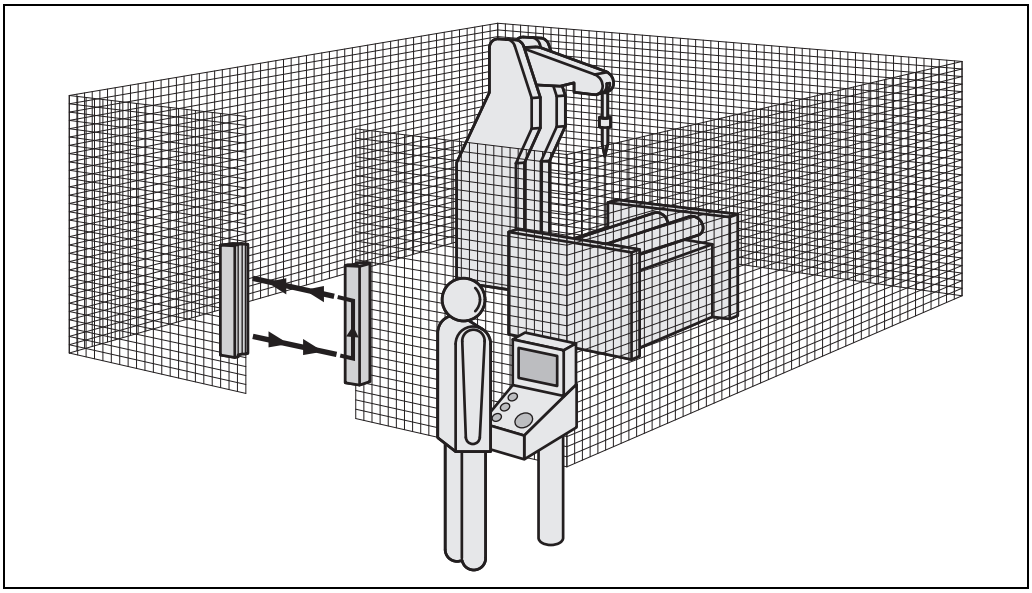


Fig. 6: Access protection with an M4000 Advanced A/P multiple light beam safety device

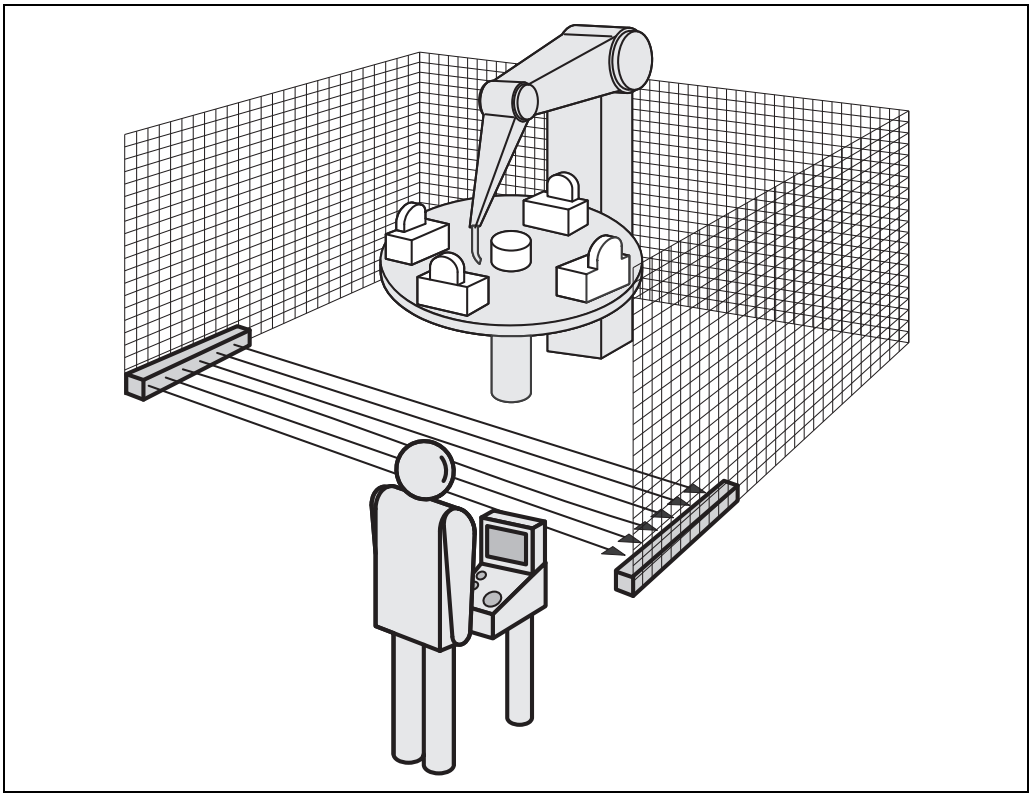


Fig. 7: Access protection with an M4000 Area 60/80 multiple light beam safety device

The M4000 multiple light beam safety device operates correctly as a protective device only if the following conditions are met:

- The control of the machine must be electrical.
- It must be possible to achieve a safe state on the machine at any time.
- Sender and receiver must be mounted in a way that objects penetrating the hazardous area are safely identified by the M4000.
- The reset button must be fitted outside the hazardous area such that it cannot be operated by a person working inside the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area.
- The statutory and local rules and regulations must be observed when installing and using the device.

3.3.2 Access protection on several sides with the aid of deflector mirrors

You can secure two sides of a hazardous area by using one deflector mirror (see Fig. 8), with two deflector mirrors you can secure three sides (see Fig. 9).

Fig. 8: Access protection with an M4000 Advanced multiple light beam safety device and one deflector mirror

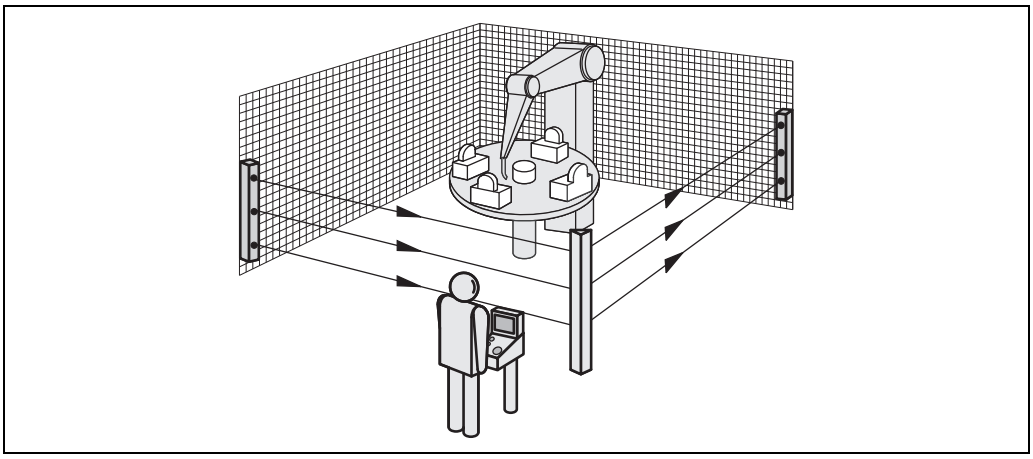


Fig. 9: Access protection with an M4000 Advanced multiple light beam safety device and two deflector mirrors

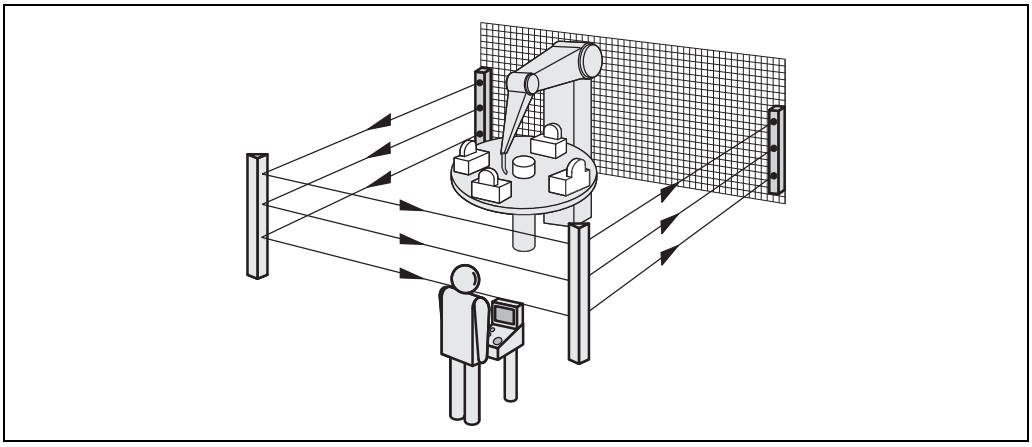
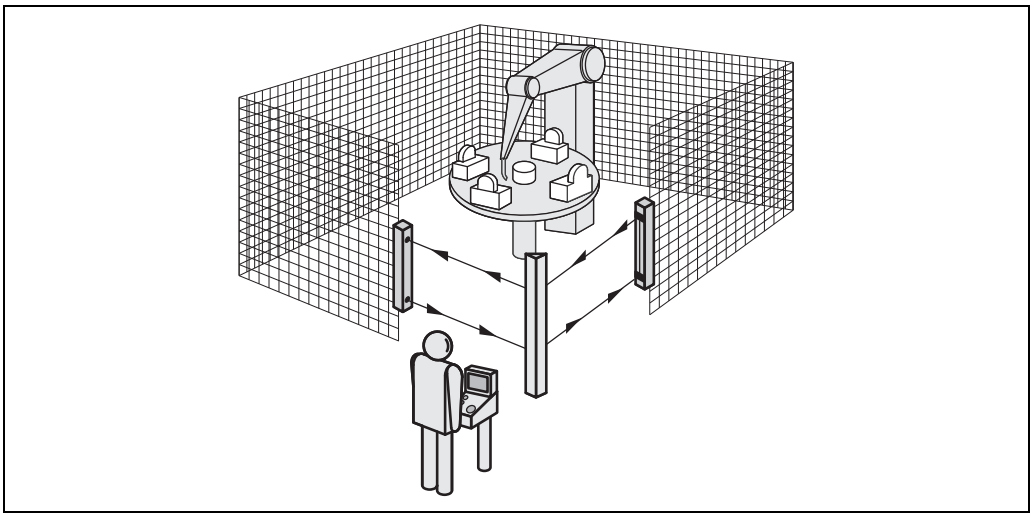


Fig. 10: Access protection with an M4000 Advanced A/P multiple light beam safety device and one deflector mirror



Notes

- The formation of droplets of heavy contamination can be detrimental to the reflection behaviour. Take the necessary organisational measures to avoid the formation of droplets on the deflector mirrors. The deflector mirrors are available as accessories (see page 88f.).
- Deflector mirrors reduce the effective scanning range. The effective scanning range depends on the number of deflector mirrors in the light path (see chapter 4.4 “Scanning range” on page 24ff).
- You can extend the M4000 Advanced A/P multiple light beam safety device with a maximum of one deflector mirror.

3.4 Controls and status indicators

The LEDs and the 7-segment display of sender and receiver signal the operating status of the M4000.

Note The depiction of numbers on the 7-segment display can be rotated by 180° with the aid of the CDS (Configuration & Diagnostic Software). If you rotate the numbers of the 7-segment display, the point in the 7-segment display goes out:

- point visible: The bottom edge of the numbers on the 7-segment display is pointing towards the configuration connection.
- point not visible: The bottom edge of the numbers on the 7-segment display is pointing towards the LED display.

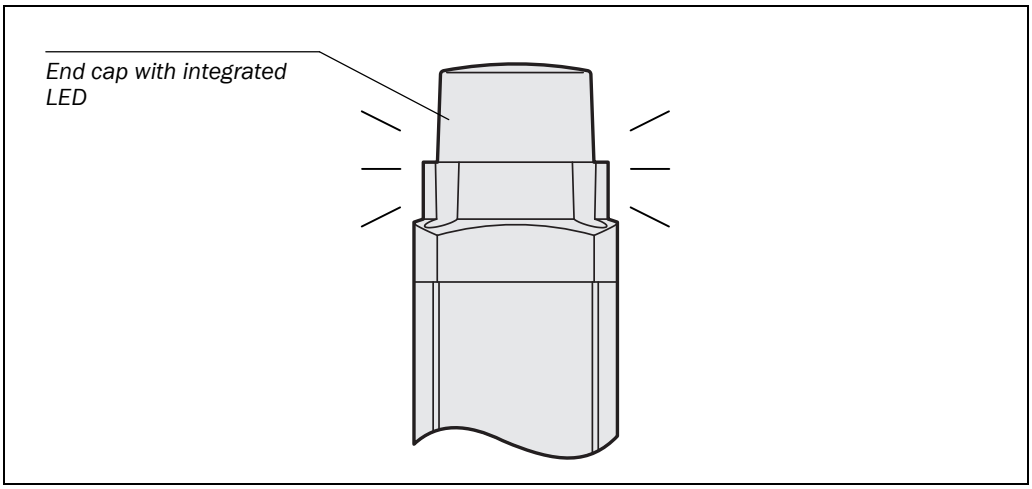
Device symbol **M4000 Advanced (sender** or **receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (sender** or **receiver)**, context menu **Open device window**, parameter node **General**.

3.4.1 End cap with integrated LED (optional, only on receiver)

Notes

- The end cap with integrated LED is available only for the receiver of the M4000 Advanced and the M4000 Advanced A/P.
- The integrated LED is not monitored. This means that a failure of the integrated LED has no effect on the function of the M4000.

Fig. 11: End cap with integrated LED

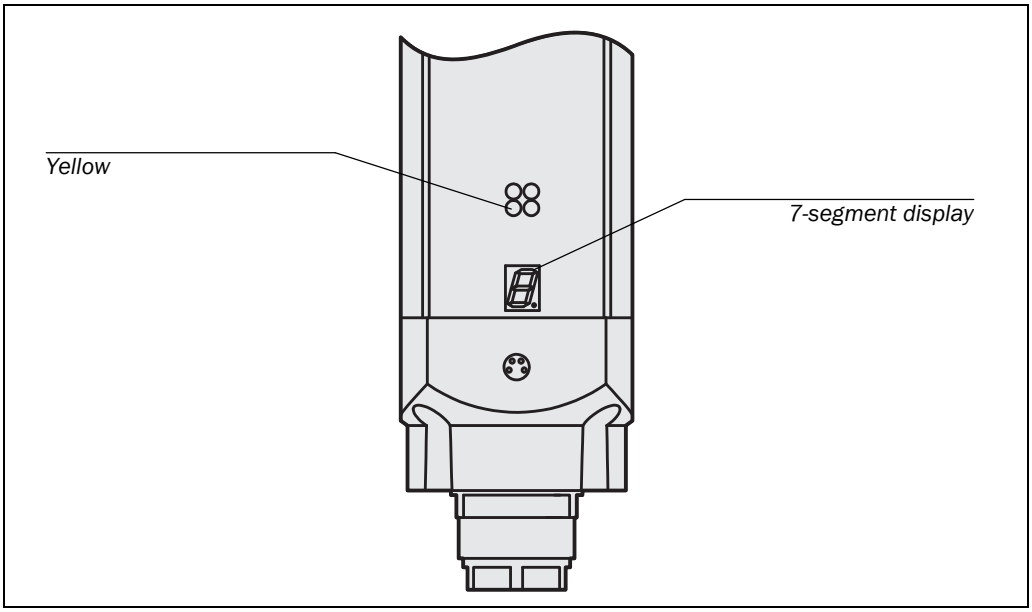


Tab. 2: Significance of the indications on the integrated LED

Indications on the integrated LED	Meaning
● **Red**	System providing signals for shutting down the machine: output signal switching devices off
● **Green**	System clear: output signal switching devices on
● **Yellow**	Muting: output signal switching devices on (only in conjunction with external switching amplifier, e.g. UE403)
☼ **Yellow**	Override required: output signal switching devices off (only in conjunction with external switching amplifier, e.g. UE403)

3.4.2 Status indicators of the sender

Fig. 12: Status indicators of the sender

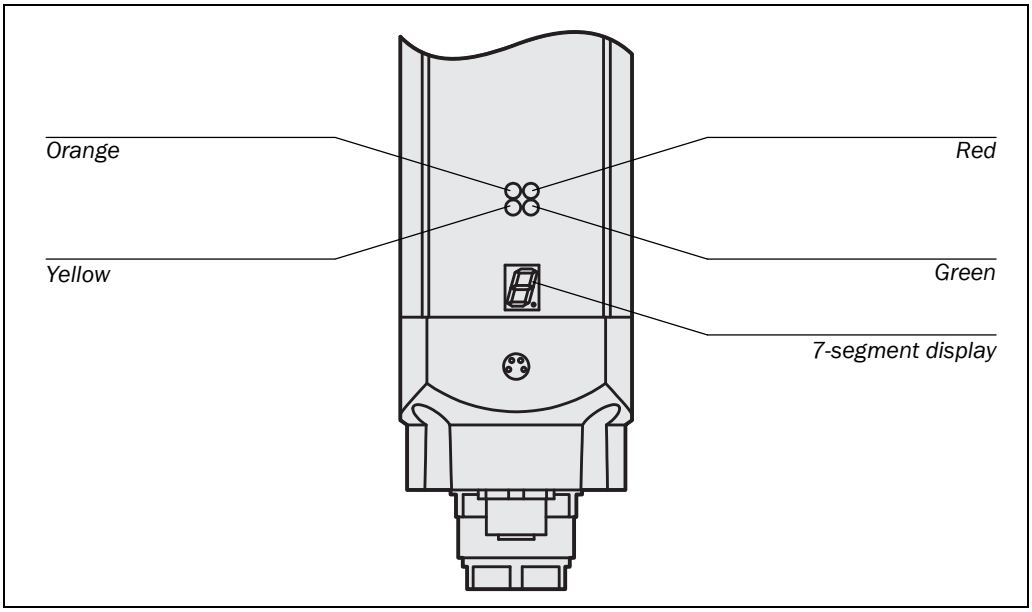


Tab. 3: Meaning of the status indicators of the sender

Display	Meaning
● **Yellow**	Supply voltage o.k.
E.	System error. Disconnect the supply voltage to the M4000 for at least 3 seconds. If the problem persists, replace the unit.
o.	The device is in the test mode.
U.	Non-coded operation (only after switching on)
-	Operation with code 1 (only after switching on)
¯	Operation with code 2 (only after switching on)
Other displays	All other displays are error messages. Please refer to chapter 10 “Fault diagnosis” on page 66.

3.4.3 Status indicators of the receiver or of the M4000 Advanced A/P

Fig. 13: Status indicators of the receiver or of the M4000 Advanced A/P



Tab. 4: Meaning of the status indicators of the receiver or the M4000 Advanced A/P

Display	Meaning
● **Orange**	Cleaning or realignment required
☀ **Yellow**	Reset required
● **Red**	System providing signals for shutting down the machine: output signal switching devices off
● **Green**	System clear: output signal switching devices on
E.	System error. Disconnect the supply voltage to the M4000 for at least 3 seconds. If the problem persists, replace the unit.
0.	Poor alignment to sender. Please refer to chapter 7.2 “Alignment of the M4000” on page 52. Note: In normal operation, the display 1. indicates the state “The light path is interrupted”.
1.	
J.	
2.	
C.	Muting (only in conjunction with external switching amplifier, e.g. UE403)
r.	Operation with reduced resolution and/or blanking (only in conjunction with external switching amplifier, e.g. UE403)
H.	Operation with large scanning range (only after switching on)
U.	Non-coded operation (only after switching on)
-	Operation with code 1 (only after switching on)
_	Operation with code 2 (only after switching on)
Other displays	All other displays are error messages. Please refer to chapter 10 “Fault diagnosis” on page 66.

4 Configurable functions

This chapter describes the functions on the M4000 multiple light beam safety device that can be set via software. Some of the functions can be combined.

WARNING

Test the protective device after any changes!

Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device (see section 7.3 on page 61).

The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, please always use the password hierarchy provided by SICK to ensure that only authorised persons make changes to the configuration. The SICK service team is available to provide assistance if required.

When starting to configure the device, you may save an application name with a maximum of 22 characters. Use this function as a “memory jog”, e.g. to describe the application of the current device configuration. Device symbol **M4000 Advanced (sender** or **receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (sender** or **receiver)**, context menu **Open device window**, parameter node **General**.

4.1 Restart interlock

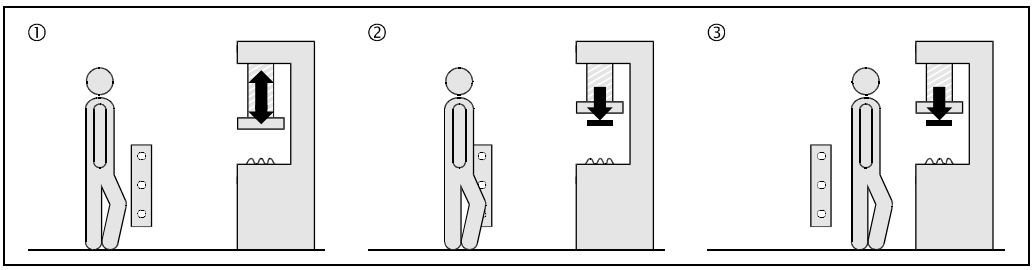


Fig. 14: Schematic illustration of the protective operation

The dangerous state of the machine ① is interrupted if the light path is broken ②, and is not re-enabled ③ until the operator presses the reset button situated outside the hazardous area.

Note Do not confuse the restart interlock with the start interlock on the machine. The start interlock prevents the machine starting after switching on. The restart interlock prevents the machine starting again after an error or an interruption in the light path.

You can prevent the machine restarting in two ways:

- with the internal restart interlock of the M4000:
  The M4000 controls the restart.
- with the restart interlock of the machine (external):
  The M4000 has no control over the restart.

The possible combinations are shown in the following table:

Tab. 5: Permissible configuration of the restart interlock

Restart interlock of the M4000	Restart interlock of the machine	Permissible application
Deactivated	Deactivated	Only when it is not possible to stand behind the multiple light beam safety device. Observe EN 60 204-1!
Deactivated	Activated	All
Activated	Deactivated	Only when it is not possible to stand behind the multiple light beam safety device. Observe EN 60 204-1!
Activated	Activated	All. The restart interlock of the M4000 handles the *Reset* function (see “Reset” further below).


WARNING

Always configure the application with restart interlock!

Ensure that there is always a restart interlock. The M4000 is unable to verify if the restart interlock of the machine is operable. If you deactivate both the internal and the external restart interlock, the users and operators of the machine will be at acute risk of injury.

The electrical connection of the reset button is described in chapter 6.5 “Reset button” on page 48.


Device symbol **M4000 Advanced (receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (receiver)**, context menu **Open device window**, parameter node **General**.

Recommendation You can indicate the status “Reset required” using a signal lamp. The M4000 has a dedicated output for this purpose. The electrical connection of the signal lamp is described in chapter “Connection of a *Reset required signal lamp*” on page 49.

Reset

If you want to activate the restart interlock on the M4000 (internal) and also a restart interlock on the machine (external), then each restart interlock has its own button.

When actuating the reset button (for the internal restart interlock) ...

- the M4000 activates the output signal switching devices.
- the multiple light beam safety device changes to green.

Only the external restart interlock prevents the machine from restarting. After pressing the reset button for the M4000, the operator must also press the restart button for the machine. If the reset button and the restart button are not pressed in the specified sequence, the dangerous state remains disrupted.

Recommendation The reset button prevents the accidental and inadvertent operation of the external restart button. The operator must first acknowledge the safe state with the reset button.

4.2 Beam coding

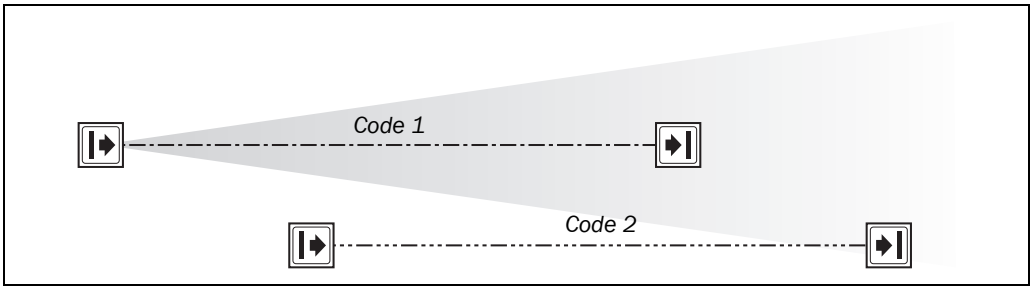
If several multiple light beam safety devices operate in close proximity to each other, the sender beams of one system may interfere with the receiver of another system. With code 1 or 2 activated, the receiver can distinguish the beams designated for it from other beams. The following settings are available: non-coded, code 1 and code 2.

WARNING

Use different beam codings if the systems are mounted in close proximity!

Systems mounted in close proximity to each other must be operated with different beam codings (code 1 or code 2). If this precaution is neglected, the system may be impaired in its protective function by the beams from the neighbouring system and so change to the unsafe state. This would mean that the operator is at risk.

Fig. 15: Schematic illustration of the beam coding



Notes

- Beam coding increases the availability of the protected machine. Beam coding also enhances the resistance to optical interference such as weld sparks or similar.
- Within a system you must configure the beam coding for every device (sender **and** receiver) separately.
- In a cascaded system the host and guest always have the same beam coding. There is no mutual interference.
- After switching on, the 7-segment display of sender and receiver will briefly display the coding.

Device symbol **M4000 Advanced (sender** or **receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (sender** or **receiver)**, context menu **Open device window**, parameter node **General**.

4.3 Application diagnostic output (ADO)

The M4000 has an application diagnostic output (ADO) that can be configured. With the aid of the application diagnostic output, the multiple light beam safety device can signal specific states. You can use this output for a relay or a PLC.

WARNING

You must not use the application diagnostic output for safety-relevant functions!

You are only allowed to use the application diagnostic output for signalling. You must never use the application diagnostic output for controlling the application or with safety-relevant functions.

The connection can signal one of the following states:

Tab. 6: Possible configuration for the application diagnostic output

Assignment	Possible uses
Contamination (OWS)	Eases diagnostics in case of contaminated front screen
OSSD status	Signals the status of the output signal switching devices when the multiple light beam safety device switches to red or green
Reset required	Signals the status “Reset required”
Muting status	Signals the status “Muting” (only M4000 Advanced and M4000 Advanced A/P in conjunction with external switching amplifier, e.g. UE403)
Override status	Signals the status “Override” (only M4000 Advanced and M4000 Advanced A/P in conjunction with external switching amplifier, e.g. UE403)

The electrical connection of a PLC to the application diagnostic output is described in chapter 6.6 “Application diagnostic output (ADO)” on page 49.

Notes

- When you connect the application diagnostic output as an alarm signal for contamination (OWS) or for the OSSD status, then during the configuration you can choose how the application diagnostic output is to signal the alarm.
  - HIGH active: If there is contamination or if the OSSDs are switched on, 24 V are present. Otherwise the output is high resistance.
  - LOW active: If there is contamination or if the OSSDs are switched on, the output is high resistance. Otherwise 24 V are present.
- If you use the application diagnostic output as an alarm signal for “Reset required”, it has a frequency of 1 Hz.
- If you connect the application diagnostic output as an alarm signal for muting or override status, then the application diagnostic output will always signal the alarm with an active HIGH. With muting or override 24 V are present. Otherwise the output is high resistance.

Device symbol **M4000 Advanced (receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (receiver)**, context menu **Open device window**, parameter node **General**.

4.4 Scanning range

WARNING

Configure the scanning range to suit the dimension of the light path between sender and receiver!

You must adjust the scanning range of every system to the dimension of the light path between sender and receiver.

- If the scanning range is set too low, the multiple light beam safety device may not switch to green.
- If the scanning range is set too large, the multiple light beam safety device may malfunction due to reflections. This would mean that the operator is at risk.

Notes

- Additional front screens (SICK accessories see page 95) reduce the effective scanning range.
- Deflector mirrors (see page 88f.) reduce the effective scanning range. It is dependent on the number of deflector mirrors in the light path.
- A further reduction in the scanning range is possible due to soiling, e.g. of the additional front screens or deflector mirrors used.
- The scanning ranges with deflector mirrors given apply for beam deflections between 80° and 110°.

4.4.1 Scanning range of the M4000 Advanced

You can set the M4000 Advanced multiple light beam safety device to two different scanning ranges. The effective scanning range is dependent here upon the dimension of the light path between sender and receiver and the number of deflector mirrors and additional front screens used. You will find the necessary scanning ranges and the resulting setting in Tab. 7.

The following scanning ranges are available:

- low scanning range (0.5-20 m)
- high scanning range (15-70 m)

Device symbol **M4000 Advanced (receiver)**, context menu **Open device window**, parameter node **General**.

Tab. 7: Scanning range of the M4000 Advanced as a function of the number of deflections per beam and the additional front screens

Number of deflections per beam	Number of additional front screens	M4000 Advanced with short scanning range	M4000 Advanced with long scanning range
None	Without	0.5-20.0 m	15.0-70.0 m
	1	0.5-18.4 m	14.6-64.4 m
	2	0.5-16.9 m	14.3-59.2 m
1	Without	0.5-18.0 m	14.2-63.0 m
	1	0.5-16.5 m	13.9-57.9 m
	2	0.5-15.1 m	13.5-53.2 m
2	Without	0.5-16.0 m	13.5-56.0 m
	1	0.5-14.7 m	13.2-51.5 m
	2	0.5-13.5 m	12.8-47.3 m
3	Without	0.5-14.3 m	12.8-50.0 m
	1	0.5-13.1 m	12.5-46.0 m
	2	0.5-12.0 m	12.0-42.3 m
4	Without	0.5-12.8 m	12.2-45.0 m
	1	0.5-11.7 m	11.7-41.4 m
	2	0.5-10.7 m	10.7-38.0 m

4.4.2 Scanning range of the M4000 Advanced A/P

With the M4000 Advanced A/P multiple light beam safety device you must differentiate between the **scanning range to be configured** and the **maximum effective scanning range**.

You must configure the scanning range to be configured to suit the deflector unit used (mirror deflection or fibre-optic deflection) (see Tab. 8).

Tab. 8: Scanning range of the M4000 Advanced A/P to be configured dependent of the deflector unit used

Deflector unit used	Scanning range to be configured
Mirror deflection • M4000 Passive with mirror deflection **or** • Two deflector mirrors PSK45 (see section 11.3.9 “Deflector mirror PSK45” on page 89) **or** • One mirror column (part number: 1027265, see section 12.5 “Deflector mirrors and mirror columns” on page 97)	Low scanning range
Fibre-optic deflection • M4000 Passive with fibre-optic deflection	High scanning range

Device symbol **M4000 Advanced (A/P)**, context menu **Open device window**, parameter node **General**.

The maximum effective scanning range is dependent here on the number of deflections between the M4000 Advanced A/P and the M4000 Passive and the number of additional front screens used (see Tab. 9).

Tab. 9: Maximum effective scanning range of the M4000 Advanced A/P as a function of the number of deflections and the number of additional front screens

Number of deflections[1)]	Number of additional front screens	Maximum effective scanning range	
		Mirror deflection	Fibre-optic deflection
None	**Without**	7.5 m	4.5 m
	1	6.3 m	3.8 m
	2	5.1 m	3.5 m
1	**Without**	6.0 m	Not recommended
	1	5.1 m	Not recommended
	2	4.3 m	Not recommended

4.4.3 Scanning range of the M4000 Area 60/80

The scanning range of the M4000 Area 60/80 multiple light beam safety device is dependent on the related resolution and the beam separation.

Note Additional front screens reduce the scanning range. Pay attention to the related maximum scanning range dependent of the number of additional front screens in Tab. 10 and Tab. 11.

[1)] Between M4000 Advanced A/P and M4000 Passive.

M4000 Area 60

You can set the M4000 Area 60 multiple light beam safety device to two different scanning ranges. The effective scanning range is dependent here upon the dimension of the light path between sender and receiver and the number of additional front screens used. You will find the necessary scanning ranges and the resulting setting in Tab. 10.

The following scanning ranges are available:

- low scanning range (0.5-6 m)
- high scanning range (5-19 m)

Device symbol **M4000 Area (receiver)**, context menu **Open device window**, parameter node **General**.

Tab. 10: Scanning range of the M4000 Area 60 as a function of the number of additional front screens

Number of additional front screens	M4000 Area 60 with short scanning range	M4000 Area 60 with long scanning range
Without	0.5-6.0 m	5.0-19.0 m
1	0.5-5.5 m	5.0-17.4 m
2	0.5-5.0 m	5.0-15.9 m

M4000 Area 80

You can set the M4000 Area 80 multiple light beam safety device to two different scanning ranges. The effective scanning range is dependent here upon the dimension of the light path between sender and receiver and the number of additional front screens used. You will find the necessary scanning ranges and the resulting setting in Tab. 11.

The following scanning ranges are available:

- low scanning range (0.5-20 m)
- high scanning range (15-70 m)

Device symbol **M4000 Area (receiver)**, context menu **Open device window**, parameter node **General**.

Tab. 11: Scanning range of the M4000 Area 80 as a function of the number of additional front screens

Number of additional front screens	M4000 Area 80 with short scanning range	M4000 Area 80 with long scanning range
Without	0.5-20.0 m	15.0-70.0 m
1	0.5-18.4 m	15.0-64.4 m
2	0.5-16.9 m	15.0-59.2 m

4.5 External device monitoring (EDM)

The external device monitoring (EDM) checks if the contactors actually de-energize when the protective device responds. If you activate external device monitoring, then the M4000 checks the contactors after each interruption to the light path and prior to machine restart. The EDM can so identify if one of the contacts has fused, for instance. In this case the external device monitoring places the system in the safe operational status. The OSSDs are not re-activated in this case.

Note The indicators and the operational status after the external device monitoring has triggered are dependent on the type of error present and the configuration of the internal restart interlock in the M4000 (see Tab. 12).

Tab. 12: Device status after the external device monitoring has triggered

Internal restart interlock of the M4000	**Signal on the EDM input**	**Device status after the external device monitoring has triggered**		
		Display of the 7-segment display	**Display of the diagnostics LED**	**Operational status**
Activated	Permanently 0 V	8.	● **Red**	Output signal switching devices off
	Permanently 24 V		● **Red** ☀ **Yellow**	Output signal switching devices off and “Reset required”
Deactivated	Permanently 0 V	8.	● **Red**	Output signal switching devices off
	Permanently 24 V	☀8.☀	● **Red**	Lock-out

The electrical connection for the external device monitoring is described in chapter 6.4 “External device monitoring (EDM)” on page 48.

Device symbol **M4000 Advanced (receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (receiver)**, context menu **Open device window**, parameter node **General**.

4.6 Sender test

Note The function Sender test is not available with the M4000 Advanced A/P.

The M4000 sender has a test input on pin 3 for checking the sender and the related receiver. During the test, the sender no longer emits light beams.

- During the test the sender indicates .
- The test is successful, if the M4000 receiver switches to red, i.e. the output signal switching devices (OSSDs) are deactivated.

Note M4000 sender and receiver are self-testing. You only need to configure the function of the sender test if this is necessary for an older existing application.

To be able to perform a sender test, ...

- the option **Enable sender test** must be active.
- a means of controlling the test input must be available.

Device symbol **M4000 Advanced (sender)** or **M4000 Area (sender)**, context menu **Open device window**, parameter node **General**.

The electrical connection at the test input is described in chapter 6.7 “Test input (sender test)” on page 50.

The pin assignment of the system connection is described in chapter 6.1 “System connection M26 × 11 + FE” on page 44.

5 Mounting

This chapter describes the preparation and completion of the installation of the M4000 multiple light beam safety device. The mounting requires two steps:

- determining the necessary safety distance
- mounting with swivel mount or side bracket, rigid or pivoting mounting bracket

The following steps are necessary after mounting and installation:

- completing the electrical connections (chapter 6)
- aligning sender and receiver (chapter 7.2)
- testing the installation (chapter 7.3)

5.1 Determining the safety distance

The M4000 multiple light beam safety device must be mounted with an adequate safety distance:

- to the hazardous area
- from reflective surfaces

WARNING

No protective function without sufficient safety distance!

- You must mount the multiple light beam safety device/s with the correct safety distance to the hazardous area. Otherwise the safe protection of the M4000 system is not provided.

Risk of failure to detect!

- Persons who are in the hazardous area but not in the light path between sender and receiver are not detected by the M4000 system. It is therefore to be ensured that the hazardous area is fully visible and any dangerous state can only be initiated if there are no personnel in the hazardous area.
- The M4000 system is not allowed to be used for hand and finger protection.

Note The applicable legal and official regulations apply to the use and mounting of the protective device. These regulations vary depending on the application.

5.1.1 Safety distance to the hazardous area

A safety distance must be maintained between the multiple light beam safety device and the hazardous area. This ensures that the hazardous area can only be reached when the dangerous state of the machine is completely at an end.

The safety distance as defined in EN 999 and EN 294 depends on:

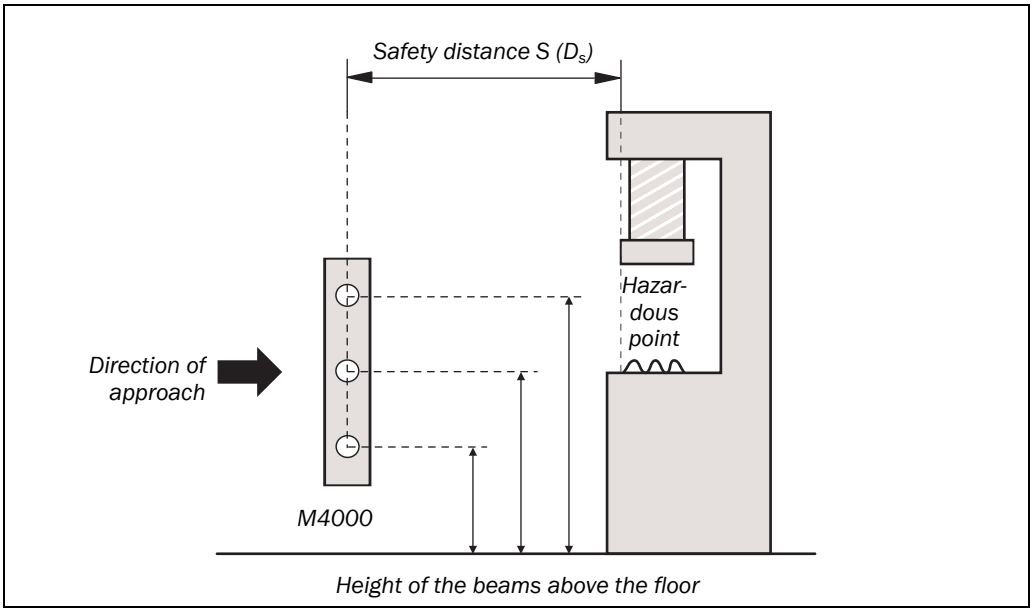
- stopping/run-down time of the machine or system
  (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the protective device (response times see chapter 11.1 “Data sheet” on page 73)
- reach or approach speed
- resolution of the multiple light beam safety device or beam separation
- other parameters that are stipulated by the standard depending on the application

Under the authority of OSHA and ANSI the safety distance as specified by ANSI B11.19-1990 E.4.2.3.3.5 and Code of Federal Regulations, Volume 29, Part 1910.217 ... (h) (9) (v) depends on:

- stopping/run-down time of the machine or system
  (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the protective device (response times see chapter 11.1 “Data sheet” on page 73)
- reach or approach speed
- other parameters that are stipulated by the standard depending on the application

Calculation of the safety distance for perpendicular approach

Fig. 16: Safety distance to the hazardous point for perpendicular approach



How to calculate the safety distance S according to EN 999 and EN 294:

Note The following calculation shows an example calculation of the safety distance. Depending on the application and the ambient conditions, a different calculation may be necessary.

➢ First, calculate S using the following formula:

S = 1600 × T + C [mm]

Where ...

T = Stopping/run-down time of the machine
+ Response time of the M4000 system after light path interruption [s]

S = Safety distance [mm]

C = Supplement [mm], depending on the number of beams (1, 2, 3 or 4), see Tab. 13

Tab. 13: Recommended height of the beams above the floor

Number of beams	1	2	3	4
Recommended height of the beams above the floor [mm]	750	400 900	300 700 1100	300 600 900 1200
C [mm]	1200	850	850	850

Example access protection with two beams:

C = 850 mm
Stopping/run-down time of the machine = 290 ms
Response time of the light path interruption = 30 ms

T = 290 ms + 30 ms = 320 ms = 0.32 s

S = 1600 × 0.32 + 850 = 1362 mm

How to calculate the safety distance D_s according to ANSI B11.19-1990 E.4.2.3.3.5 and Code of Federal Regulations, Volume 29, Part 1910.217 ... (h) (9) (v):

Note The following calculation shows an example calculation of the safety distance. Depending on the application and the ambient conditions, a different calculation may be necessary.

➢ First, calculate D_s using the following formula:

$D_s = H_s \times (T_s + T_c + T_r + T_{bm}) + D_{pf}$

Where ...

D_s = The minimum distance in inches (or millimetres) from the hazardous point to the protective device

H_s = A parameter in inches/second or millimetres/second, derived from data on approach speeds of the body or parts of the body.
Often 63 inches/second is used for H_S.

T_s = Stopping/run down time of the machine tool measured at the final control element

T_c = Stopping/run-down time of the control system

T_r = Response time of the entire protective device after light path interruption

T_{bm} = Additional response time allowed for brake monitor to compensate for wear

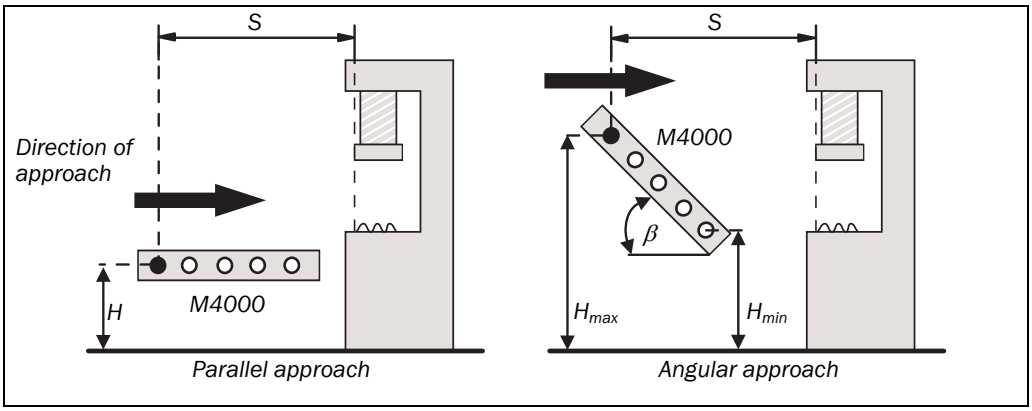
Note Any additional response times must be accounted for in this calculation.

D_{pf} = An additional distance added to the overall safety distance required. This value is based on a possible intrusion toward the hazardous point prior to actuation of the electro-sensitive protective equipment (ESPE). For applications that can be reached over, the value D_{pf} = 1.2 m. For beam arrangements that permit reaching in with the arms or the detectable object size is greater than 63 mm, the value D_{pf} = 0.9 m.

The applicable legal and official regulations apply to the use and mounting of the protective device. These regulations vary depending on the application.

Calculation of the safety distance S for non-perpendicular approach

Fig. 17: Safety distance to the hazardous point for non-perpendicular approach



Tab. 14: Equations for calculating the safety distance S

Approach	Calculation	Conditions
Parallel	S = 1600 × T + (1200 – 0.4 × H) [mm]	• 1200 – 0.4 × H > 850 mm • 15 × (d – 50) ≤ H ≤ 1000 mm
Angular	• β > 30° calculation as for perpendicular approach • β < 30° calculation as for parallel approach S is applied to the beam that is the farthest away from the hazardous point.	• $d \leq H_{min}/15 + 50$ • $H_{max} \leq 1000$ mm

Where ...

S = Safety distance [mm]

H = Height of the beams above the floor [mm]

For approach at an angle:

H_{max} = Height of the uppermost beam [mm]

H_{min} = Height of the bottom beam [mm]

d = Resolution of the multiple light beam safety device [mm]

β = Angle between detection plane and the direction of entry

T = Time

5.1.2 Minimum distance to reflective surfaces

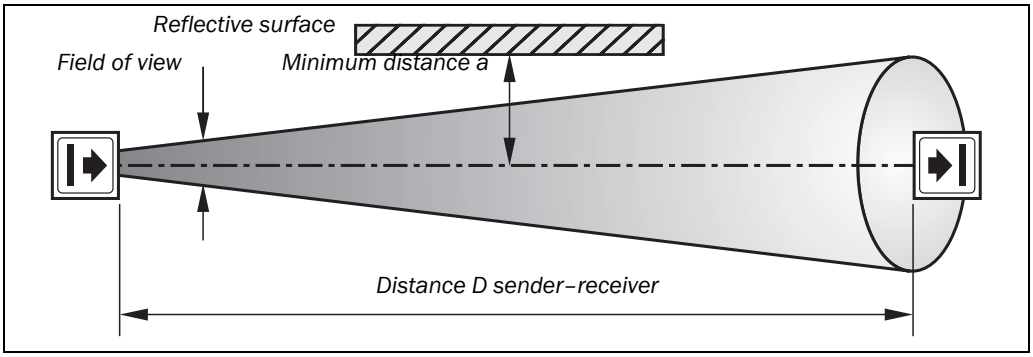
WARNING

Maintain the minimum distance from reflective surfaces!

The light beams from the sender may be deflected by reflective surfaces. This can result in failure to identify an object. This would mean that the operator is at risk.

All reflective surfaces and objects (e.g. material bins) must be a minimum distance *a* from the light path between sender and receiver. The minimum distance *a* depends on the distance *D* between sender and receiver.

Fig. 18: Minimum distance to reflective surfaces

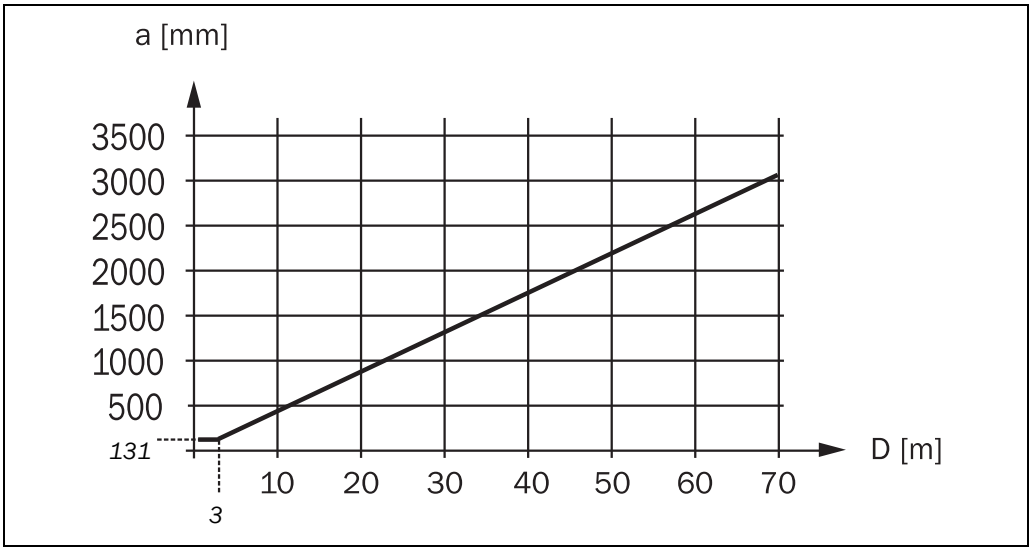


Note The field of view of the sender and receiver optics is identical.

How to determine the minimum distance from reflective surfaces:

- Determine the distance *D* [m] sender–receiver.
- Read the minimum distance *a* [mm] in the diagram or calculate it using the related formula in Tab. 15.

Fig. 19: Graph, minimum distance from reflective surfaces



Tab. 15: Formula for the calculation of the minimum distance to reflective surfaces

Distance *D* [m] sender–receiver	**Calculation of the minimum distance *a* from reflective surfaces**
D ≤ 3 m	a [mm] = 131
D > 3 m	a [mm] = tan(2.5°) × 1000 × D [m] = 43.66 × D [m]

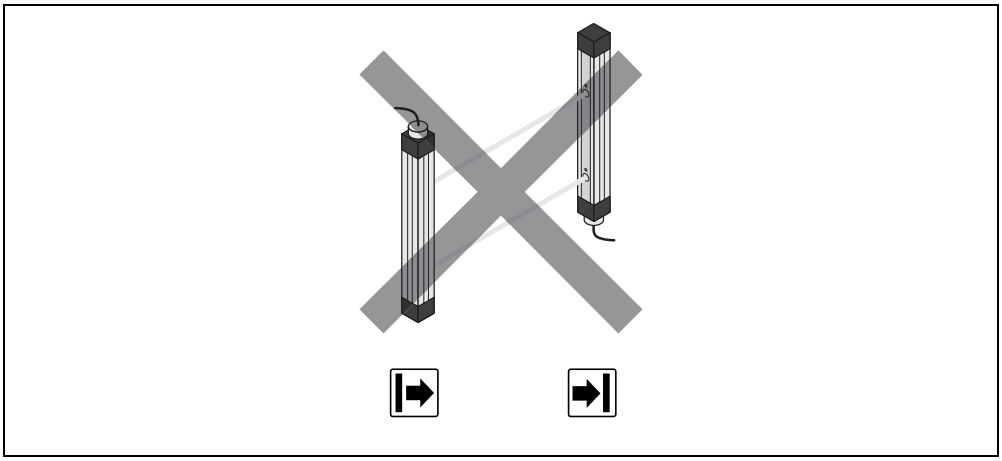
5.2 Steps for mounting the device

WARNING

Special features to note during mounting:

- Always mount the sender and receiver parallel to one another.
- During mounting, ensure that sender and receiver are aligned correctly. The optical lens systems of sender and receiver must be located in exact opposition to each other; the status indicators must be mounted at the same height. The system plugs of both devices must point in the same direction.

Fig. 20: Sender and receiver must not be rotated 180° with respect to each other



- Observe the safety distance of the system during mounting. On this subject read chapter 5.1 “Determining the safety distance” on page 30.
- Mount the multiple light beam safety device such that the risk of failure to detect is excluded. Ensure that the protective device cannot be bypassed by crawling underneath, reaching over, climbing between 2 beams, jumping over or moving the multiple light beam safety device.

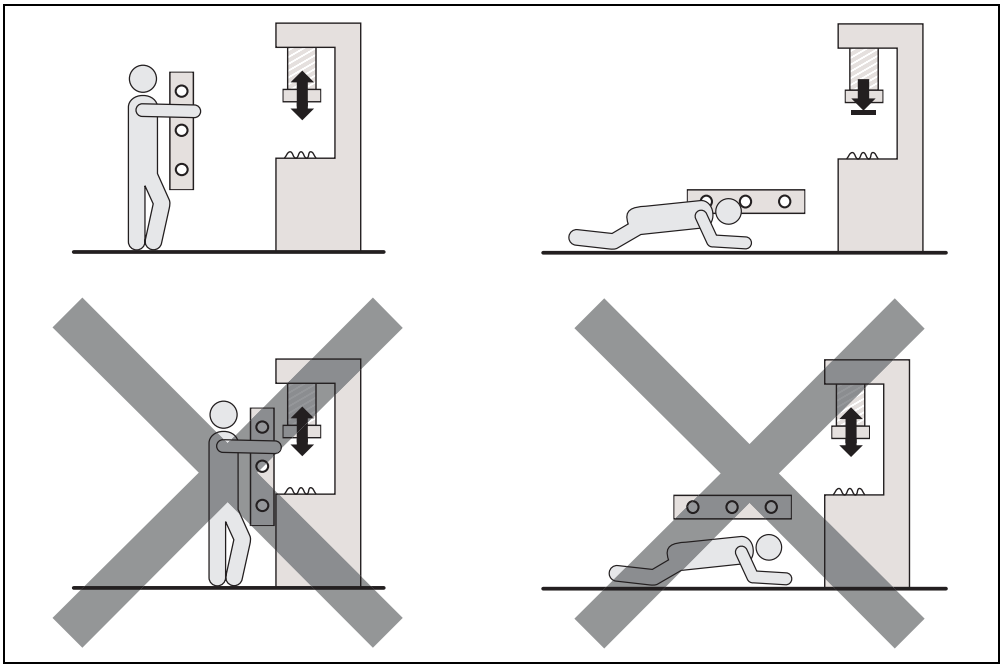


Fig. 21: The correct installation (above) must eliminate the errors (below) of reaching through and crawling beneath

- Once the system is mounted, one or several of the enclosed self-adhesive information labels must be affixed:
  - Use only information labels in the language which the users and operators of the machine understand.
  - Affix the information labels such that they are easily visible by the users and operators during operation. After attaching additional objects and equipment, the information labels must not be concealed from view.
  - Affix the information label “Important Notices” to the system in close proximity to sender and receiver.
- When mounting a M4000 with integrated laser alignment aid, ensure that the laser warning labels on the device remain visible. If the laser warning labels are covered, e.g. on installation of the M4000 in a device column (accessory), you must apply the laser warning labels supplied with the receiver in the appropriate place on the cover.

Sender and receiver can be mounted in four different ways:

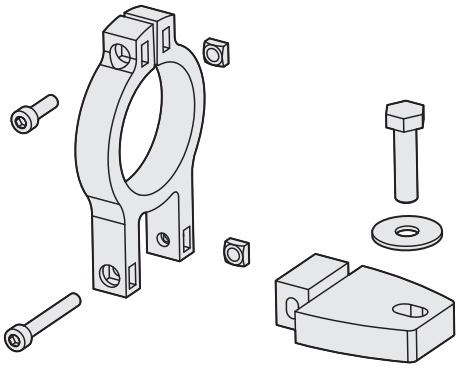
- mounting with swivel mount bracket
- mounting with side bracket
- mounting with rigid mounting bracket
- mounting with pivoting mounting bracket

5.2.1 Mounting with swivel mount bracket

The swivel mount bracket is made of high-strength black plastic. The bracket is designed such that sender and receiver can still be accurately aligned even after the bracket has been mounted.

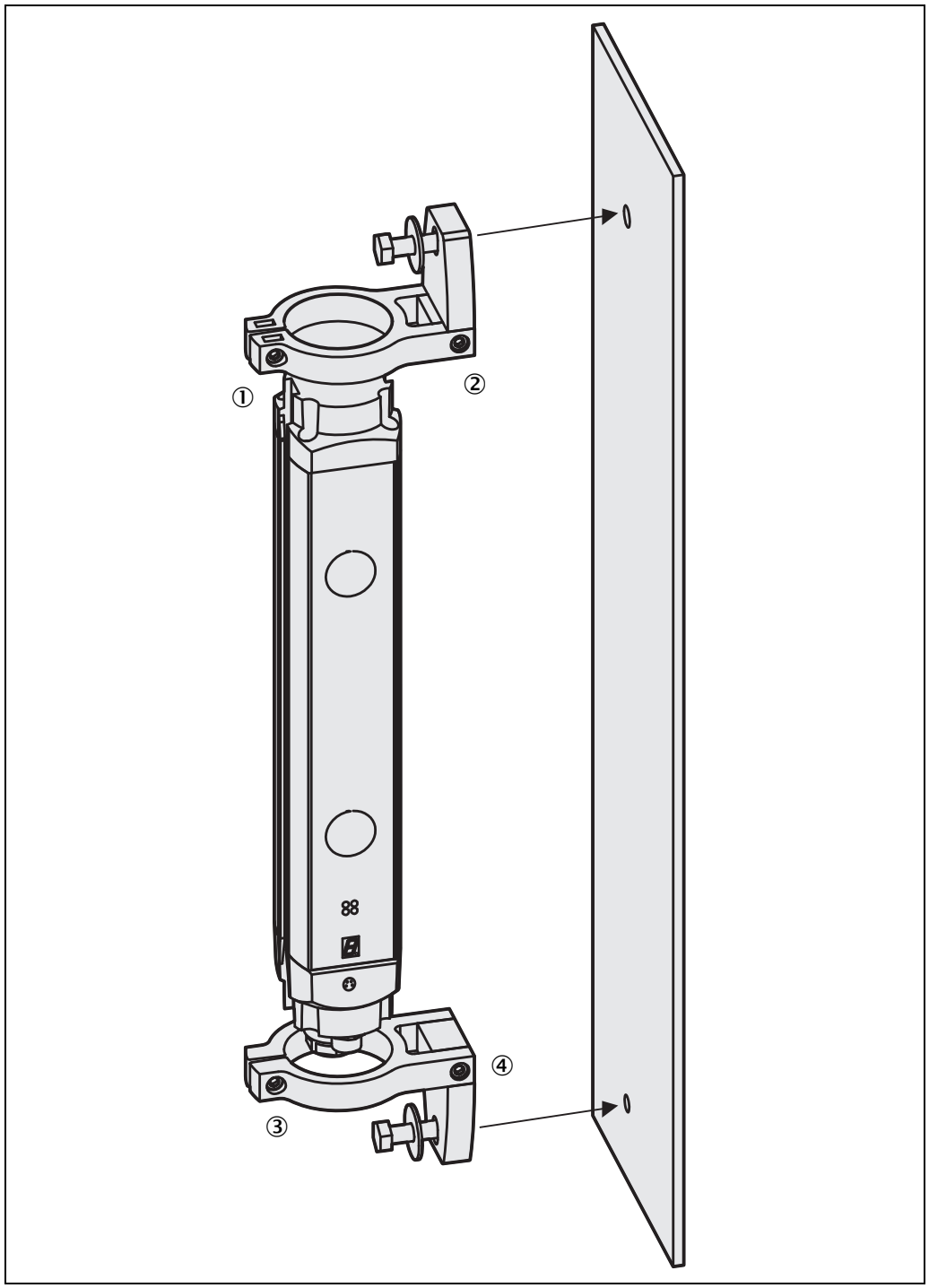
Note Attach the screws of the swivel mount bracket with a torque of between 2.5 and 3 Nm. Higher torques can damage the bracket; lower torques provide inadequate protection against vibration.

Fig. 22: Composition of the swivel mount bracket



Part No. 2030510

Fig. 23: Mounting the M4000 with swivel mount bracket



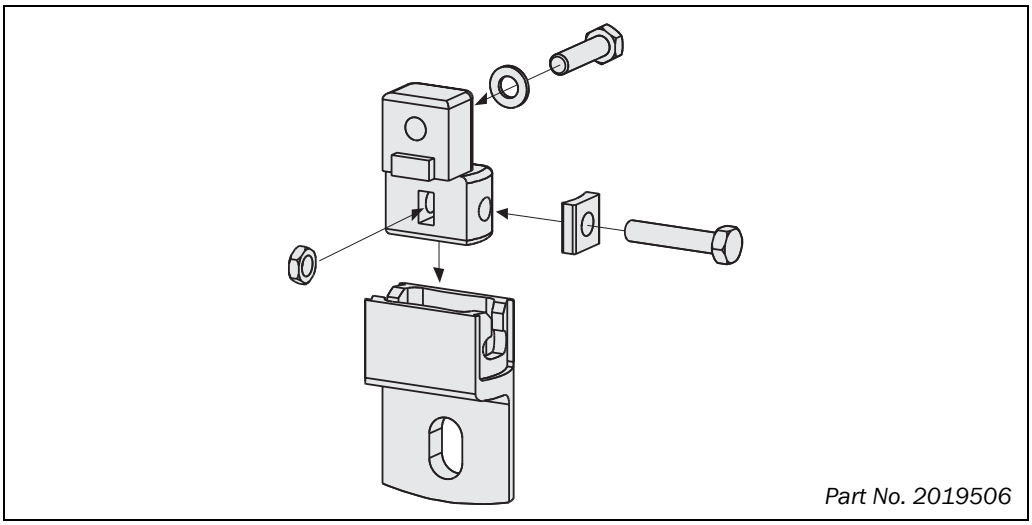
Notes

- Mount the bolts marked with ① to ④ on the operator side of the system to ensure that they remain accessible after mounting. The multiple light beam safety device can then also be adjusted later.
- The mounting screw is not included in the delivery.

5.2.2 Mounting with side bracket

The side bracket is made of die cast zinc ZP 0400. It is enamelled in black. The side bracket will be covered by the device after mounting. It provides adjustment so that the vertical alignment of sender and receiver can be corrected by ±2.5° after mounting.

Fig. 24: Composition of the side bracket

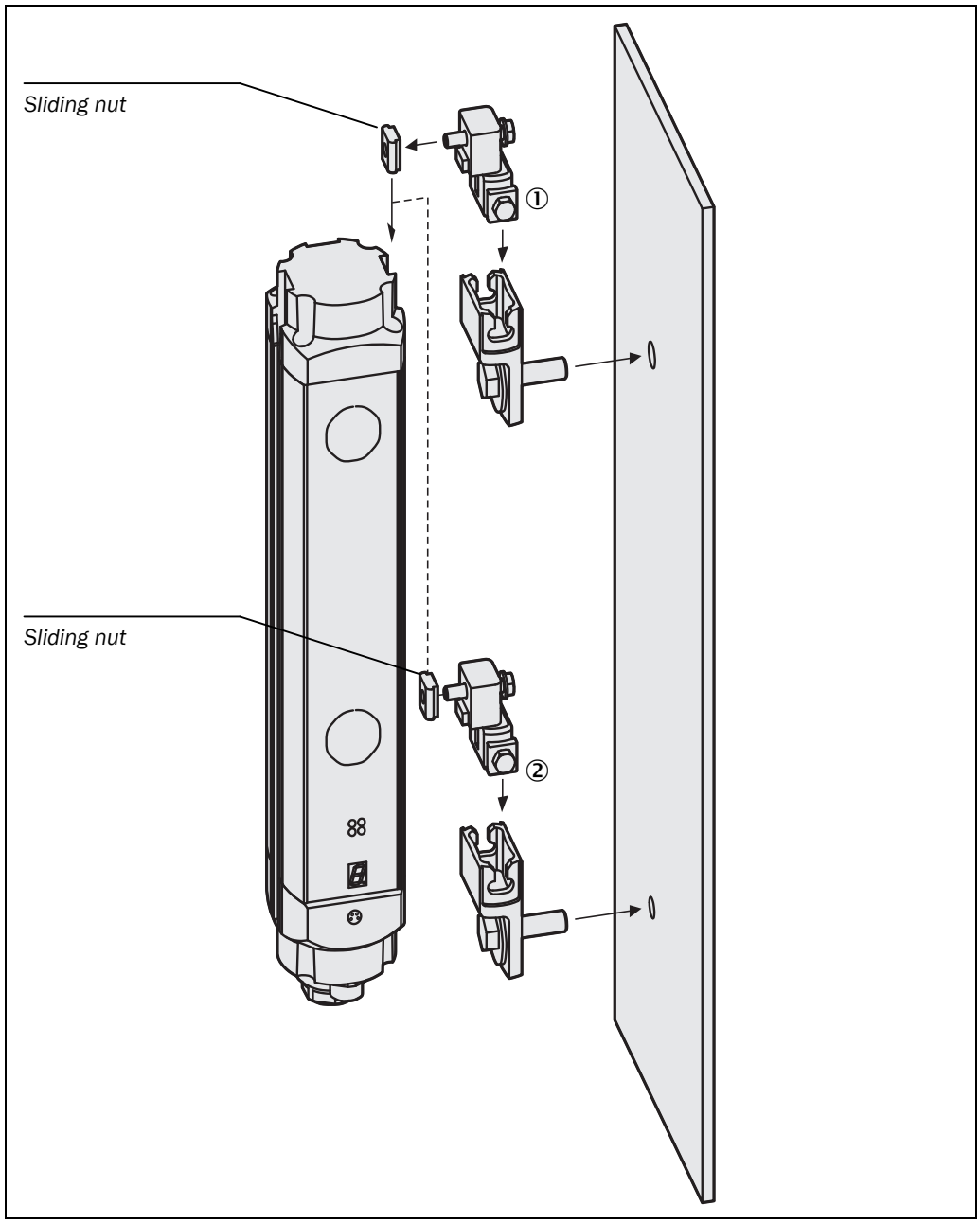


Part No. 2019506

Notes

- Attach the bolts of the side bracket with a torque of between 5 and 6 Nm. Higher torques can damage the bracket; lower torques provide inadequate protection against vibration.

Fig. 25: Mounting the M4000 with side bracket



Notes

- When mounting the side bracket ensure that the bolts marked ① and ② remain accessible, allowing you later to adjust and lock the multiple light beam safety device in position.
- When mounting the bracket, note the distance and the position of the sliding nuts as described in chapter 11.3 “Dimensional drawings” on page 80f.
- The mounting screw is not included in the delivery.

5.2.3 Mounting with rigid mounting bracket

The rigid mounting bracket is a black, powder-coated bracket without adjustment. It is only suitable for mounting surfaces on which it is not necessary to compensate for large mechanical tolerances. The alignment of the sender and receiver can be corrected after mounting using only the slots.

Fig. 26: Rigid mounting bracket

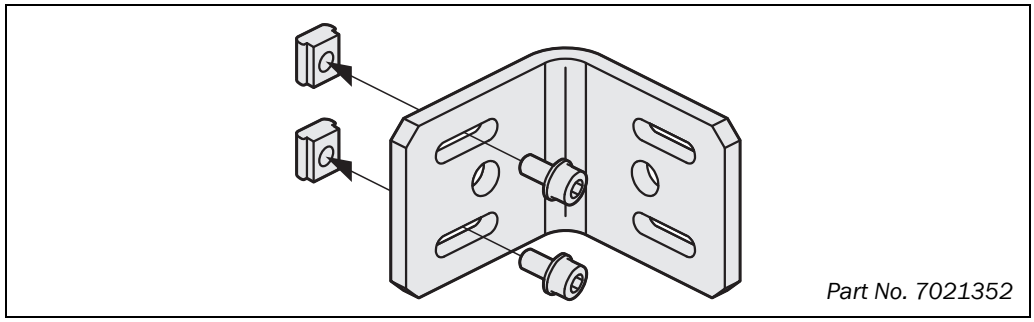
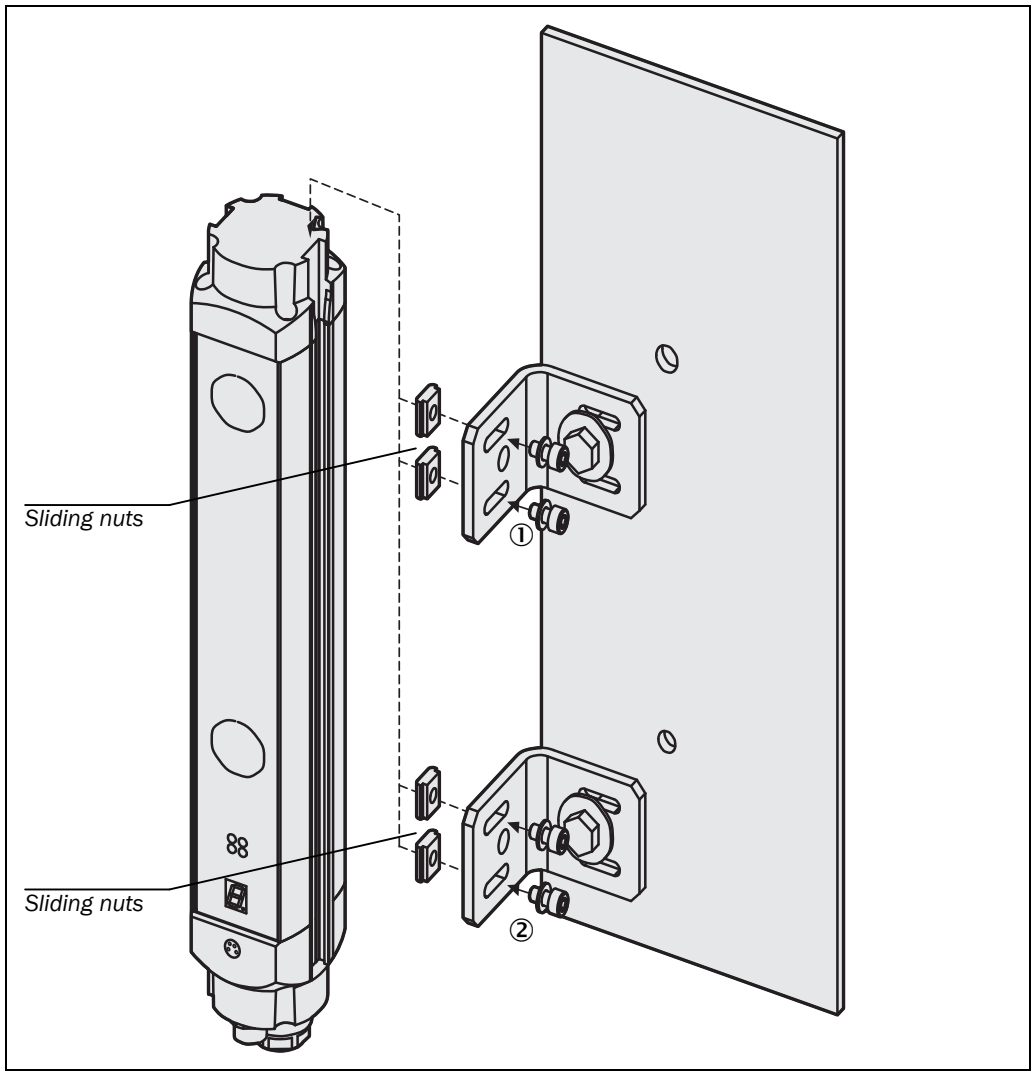


Fig. 27: Mounting the M4000 with rigid mounting bracket



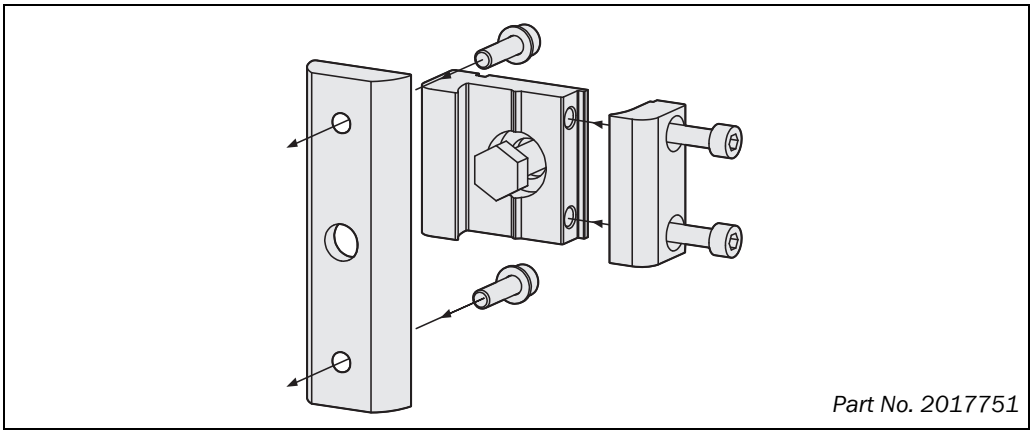
Notes

- When mounting the rigid mounting bracket ensure that the four bolts marked ① and ② remain accessible, allowing you later to adjust and lock the multiple light beam safety device in position.
- When mounting the bracket, note the distance and the position of the sliding nuts as described in chapter 11.3 “Dimensional drawings” on page 80f.
- The mounting screw is not included in the delivery.

5.2.4 Mounting with pivoting mounting bracket

The pivoting mounting bracket is made of black anodised aluminium. It will be covered by the device after mounting. The pivoting mounting bracket provides adjustment for correcting the horizontal alignment of sender and receiver by ±2.0° after mounting.

Fig. 28: Assembly of the pivoting mounting bracket



Part No. 2017751

Note ➢ Tighten the bolts on the pivoting mounting bracket to a torque of between 5 and 6 Nm. Higher torques can damage the bracket; lower torques provide inadequate protection against vibration.

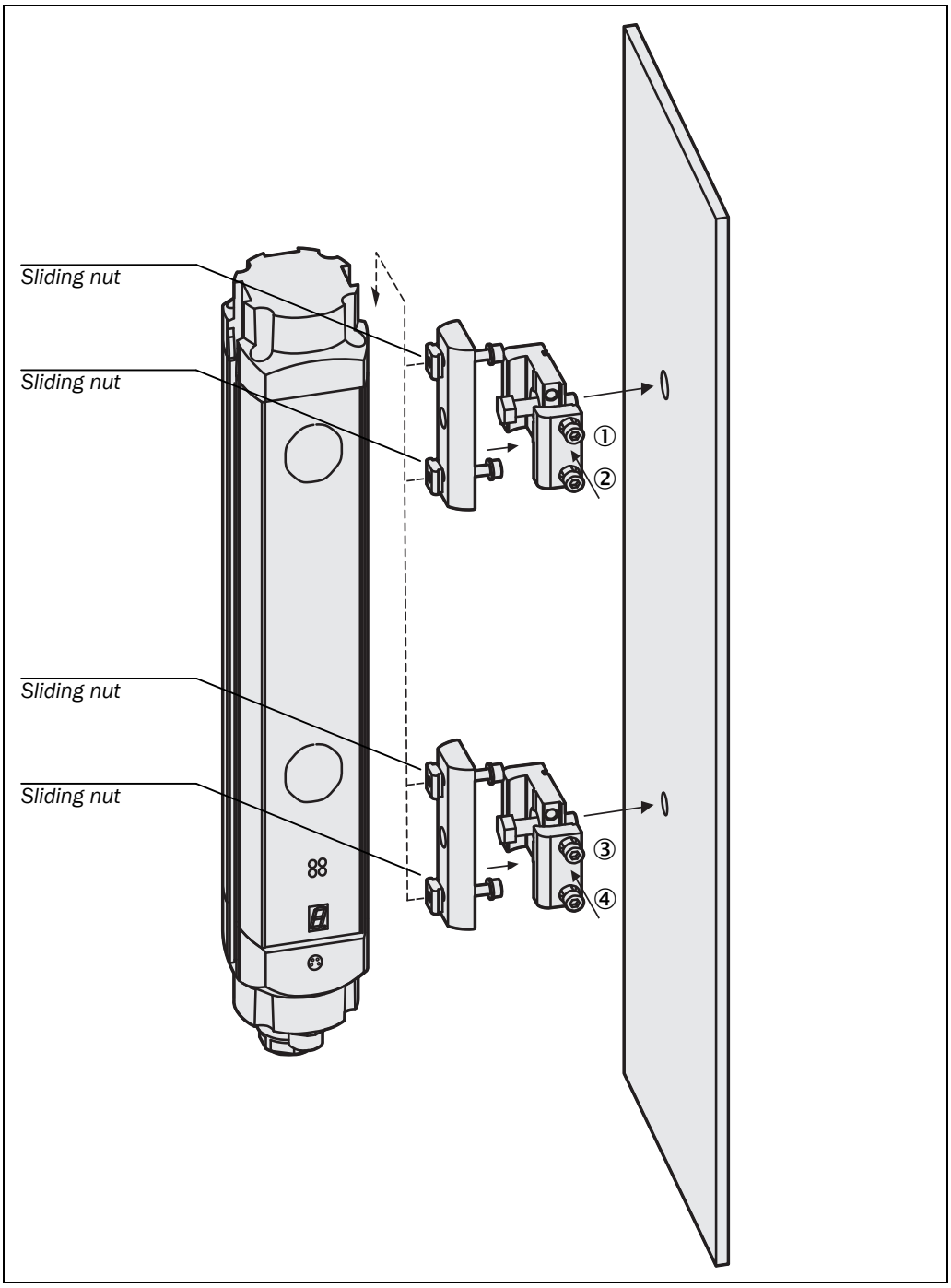


Fig. 29: Mounting the M4000 with pivoting mounting bracket

Notes

- When mounting the pivoting mounting bracket ensure that the bolts marked ①, ②, ③ and ④ remain accessible, allowing you later to adjust and lock the multiple light beam safety device in position.
- When mounting the bracket, note the distance and the position of the sliding nuts as described in chapter 11.3 “Dimensional drawings” on page 80f.
- The mounting screw is not included in the delivery.

6 Electrical installation

WARNING

Switch the power supply off!

The machine/system could inadvertently start up while you are connecting the devices.

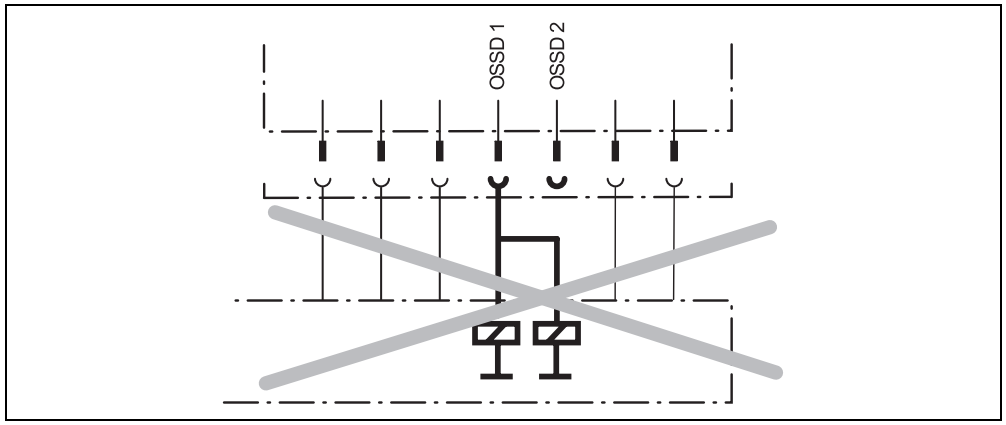
➢ Ensure that the entire machine/system is disconnected during the electrical installation.

Connect OSSD1 and OSSD2 separately!

You are not allowed to connect OSSD1 and OSSD2 together, otherwise signal safety will not be ensured.

➢ Connect OSSD1 and OSSD2 separately to the machine controller.

➢ Ensure that the machine controller processes the two signals separately.



Never connect more than one switching element to each OSSD!

➢ You are only allowed to connect one switching element (e.g. relay or contactor) to each output signal switching device (OSSD). If the application requires several switching elements per OSSD, then you must use a suitable form of contact duplication.

Notes

- The two outputs are protected against short-circuits to 24 V DC and 0 V. When the light path is clear, the signal level on the outputs is HIGH DC (at potential), when the light beams are interrupted or there is a device fault the outputs are LOW DC.
- The M4000 multiple light beam safety device meets the interference suppression requirements (EMC) for industrial use (interference suppression class A). When used in residential areas it can cause interference.
- To ensure full electromagnetic compatibility (EMC), functional earth (FE) must be connected.
- The external voltage supply of the devices must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204-1. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).
- The plug alignment (direction of turn) in the housing may vary from device to device. You can identify the correct pin assignment by the position of the pins in relation to each other as shown in the drawings.

Connections of the M4000

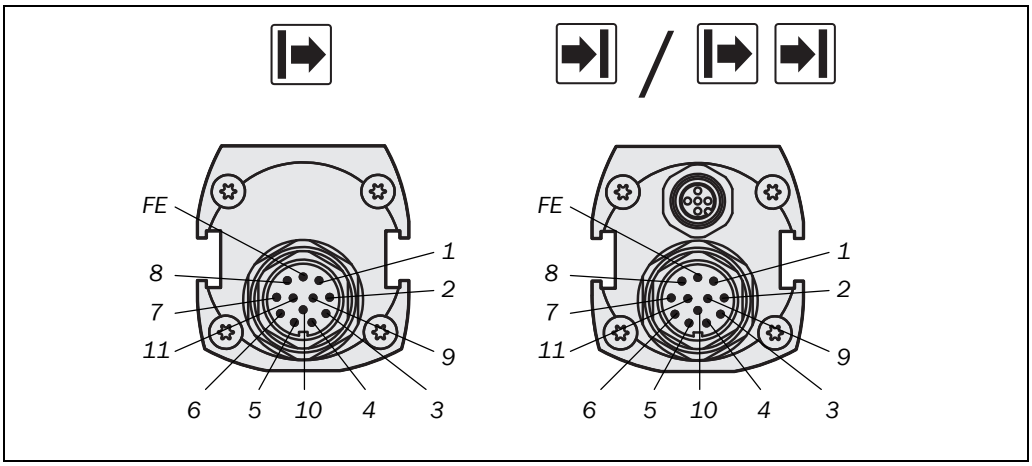
Tab. 16: Connections of the M4000

Connections	M4000 Advanced	M4000 Advanced A/P	M4000 Area 60/80
System connection	■ (see page 44)	■ (see page 44)	■ (see page 45)
Extension connection	■ (see page 46)	■ (see page 46)	–
Configuration connection	■ (see page 47)	■ (see page 47)	■ (see page 47)

6.1 System connection M26 × 11 + FE

6.1.1 M4000 Advanced or M4000 Advanced A/P

Fig. 30: Pin assignment system connection M4000 Advanced or M4000 Advanced A/P M26 × 11 + FE



Tab. 17: Pin assignment system connection M4000 Advanced or M4000 Advanced A/P M26 × 11 + FE

Pin	Wire colour	Sender	Receiver or M4000 Advanced A/P
1	Brown	Input 24 V DC (voltage supply)	Input 24 V DC (voltage supply)
2	Blue	0 V DC (voltage supply)	0 V DC (voltage supply)
3	Grey	Test input: 0 V: external test active 24 V: external test inactive	OSSD1 (output signal switching device 1)
4	Pink	Reserved	OSSD2 (output signal switching device 2)
5	Red	Reserved	Reset/restart
6	Yellow	Reserved	External device monitoring (EDM)
7	White	Reserved	Application diagnostic output (ADO)
8	Red/blue	Reserved	Reset required
9	Black	Device communication (EFI_A)	Device communication (EFI_A)

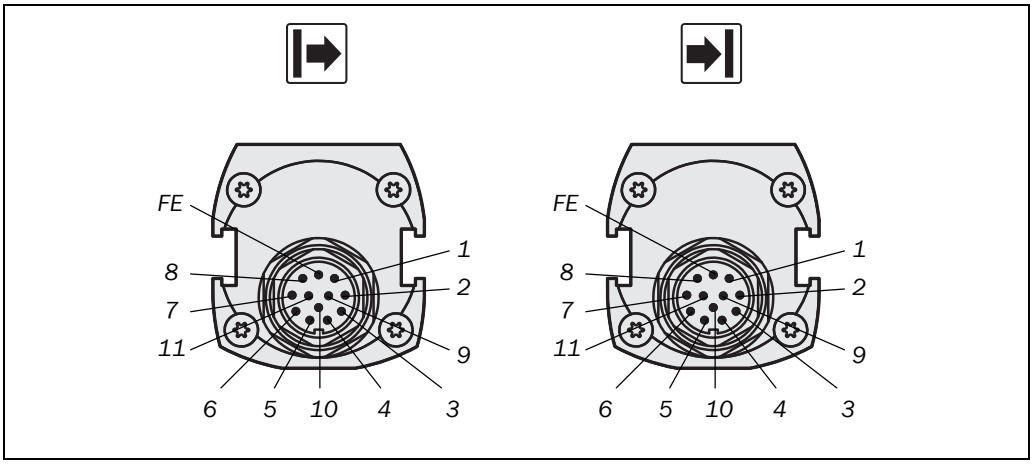
Pin	Wire colour	Sender	Receiver or M4000 Advanced A/P
10	Purple	Device communication (EFI_B)	Device communication (EFI_B)
11	Grey/pink	Reserved	Belt stop/C1 (only in conjunction with external switching amplifier, e.g. UE403)
FE	Green	Functional earth	Functional earth

Notes

- For the connection of pin 9 and 10 only use cable with twisted cores, e.g. the SICK connection cables available as accessories (see section 12.7 “Accessories” on page 98).
- If you do not use either a SICK switching amplifier or a SICK bus node on the system connections pin 9 and pin 10 (EFI device communication), to improve the EMC behaviour we recommend — especially when using the combination M4000 Advanced or M4000 Advanced A/P with the UE403 switching amplifier at the extension connection — the termination of the connections pin 9 and 10 (EFI device communication) on the system connection in the control cabinet using a resistor of 182 Ω (SICK part number 2027227).

6.1.2 M4000 Area 60/80

Fig. 31: Pin assignment system connection M4000 Area 60/80 M26 × 11 + FE



Tab. 18: Pin assignment system connection M4000 Area 60/80 M26 × 11 + FE

Pin	Wire colour	Sender	Receiver
1	Brown	Input 24 V DC (voltage supply)	Input 24 V DC (voltage supply)
2	Blue	0 V DC (voltage supply)	0 V DC (voltage supply)
3	Grey	Test input: 0 V: external test active 24 V: external test inactive	OSSD1 (output signal switching device 1)
4	Pink	Reserved	OSSD2 (output signal switching device 2)
5	Red	Reserved	Reset/restart
6	Yellow	Reserved	External device monitoring (EDM)
7	White	Reserved	Application diagnostic output (ADO)
8	Red/blue	Reserved	Reset required

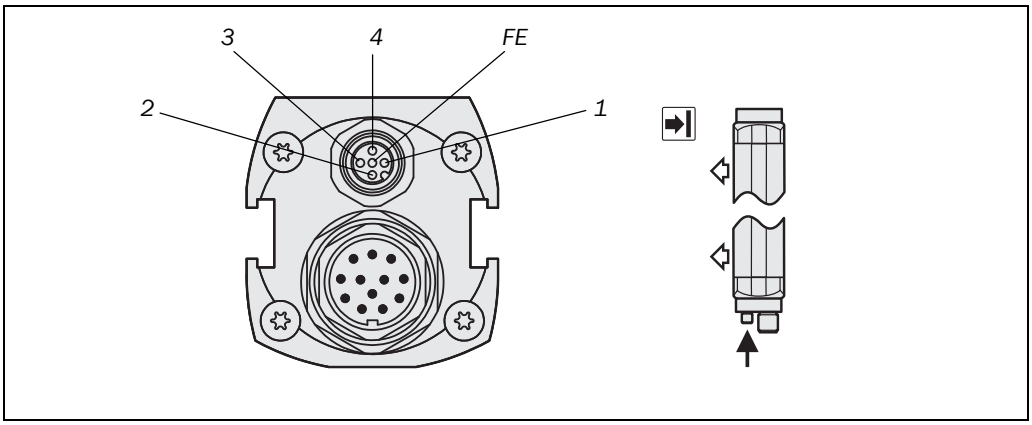
Pin	Wire colour	Sender	Receiver
9	Black	Device communication (EFI_A)	Device communication (EFI_A)
10	Purple	Device communication (EFI_B)	Device communication (EFI_B)
11	Grey/pink	Input host/guest SEL[2)]	Input host/guest SEL[2)]
FE	Green	Functional earth	Functional earth

Notes

- For the connection of pin 9 and 10 only use cable with twisted cores, e.g. the SICK connection cables available as accessories (see section 12.7 “Accessories” on page 98).
- If you do not use either a SICK switching amplifier or a SICK bus node on the system connection pin 9 and 10 (EFI device communication), to improve the EMC behaviour we recommend, especially on cascaded systems, the termination of the connections pin 9 and 10 (EFI device communication) on the system connection in the control cabinet using a resistor of 182 Ω (SICK part number 2027227).

6.2 Extension connection M12 × 4 + FE for UE403

Fig. 32: Pin assignment extension connection M12 × 4 + FE



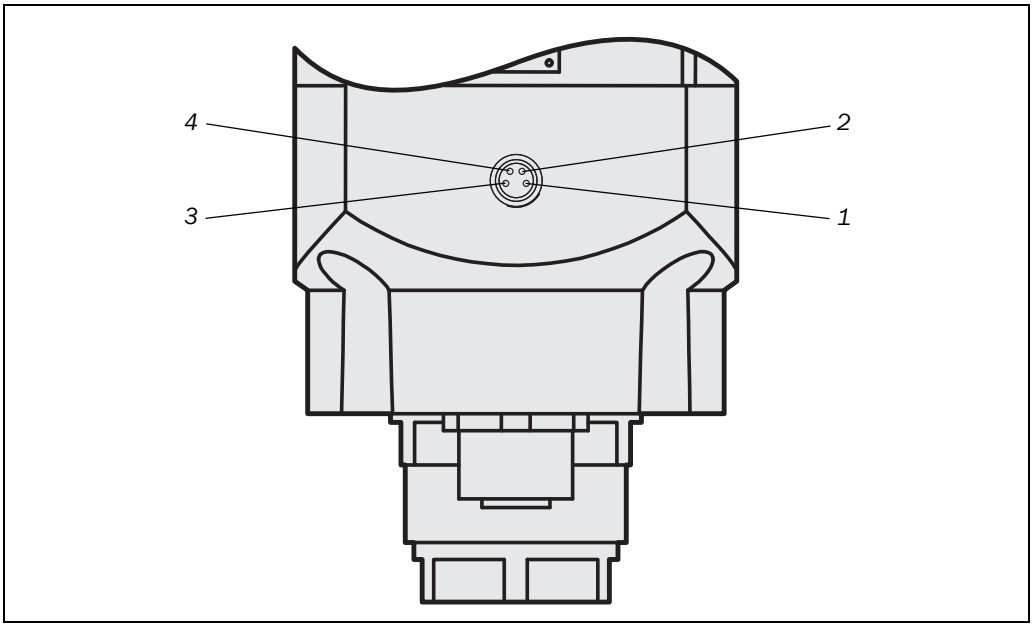
Tab. 19: Pin assignment extension connection M12 × 4 + FE

Pin	M4000 Advanced (receiver) or M4000 Advanced A/P
1	24 V DC output (voltage supply UE403)
2	Device communication (EFI_A)
3	0 V DC (voltage supply UE403)
4	Device communication (EFI_B)
FE	Functional earth

[2)] Applies only to the M4000 Area 60; on the M4000 Area 80 pin 11 is reserved.

6.3 Configuration connection M8 × 4 (serial interface)

Fig. 33: Pin assignment configuration connection M8 × 4



Tab. 20: Pin assignment configuration connection M8 × 4

Pin	M4000	PC-side RS-232-D-Sub
1	Not assigned	
2	RxD	Pin 3
3	0 V DC (voltage supply)	Pin 5
4	TxD	Pin 2

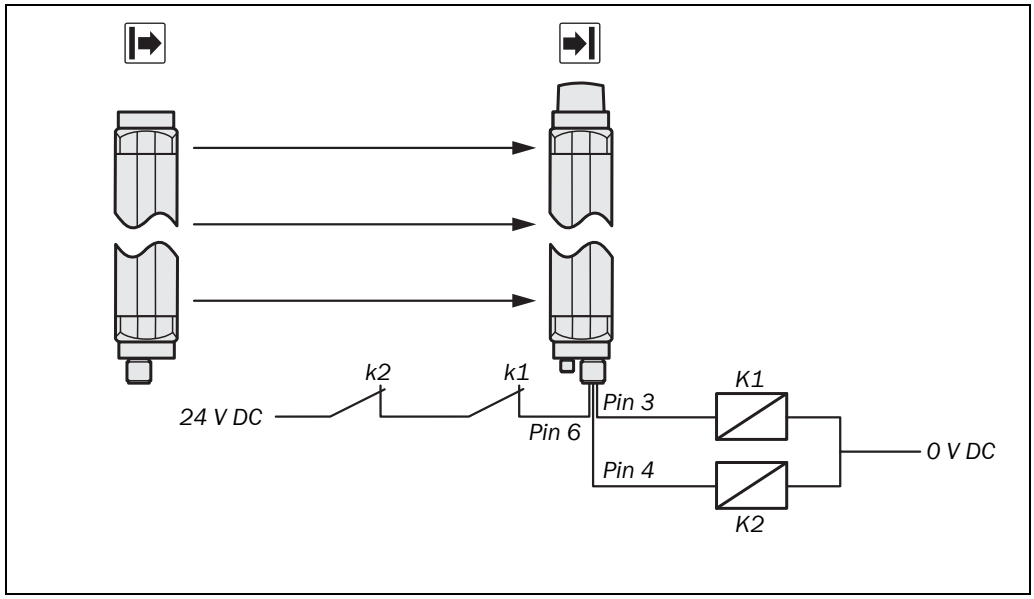
Note The pin assignment of sender, receiver and M4000 Advanced A/P is identical.

- After configuration always remove the connecting cable from the configuration connection!
- After the configuration of the device has been completed, locate the attached protection cap to cover the configuration connection.

6.4 External device monitoring (EDM)

The external device monitoring (EDM) checks if the contactors actually de-energize when the protective device responds. If, after an attempted reset, the EDM does not detect a response from the switched devices within 300 ms, the EDM will deactivate the output signal switching devices again.

Fig. 34: Connecting the contact elements to the EDM



You must implement the external device monitoring electrically by the positively guided closing action of both N/C contacts (k1, k2) when the contact elements (K1, K2) reach their de-energized position after the protective device has responded. 24 V is then applied at the input of the EDM. If 24 V is not present after the response of the protective device, then one of the contact elements is faulty and the external device monitoring prevents the machine starting up again.

Notes

- If you connect the contact elements to be monitored to the EDM input, then you must activate the option EDM in the CDS (Configuration & Diagnostic Software). If not, the device will show the error L.↻2..
- If you later deselect the EDM option, pin 6 of the system plug must not remain connected to 24 V.

6.5 Reset button

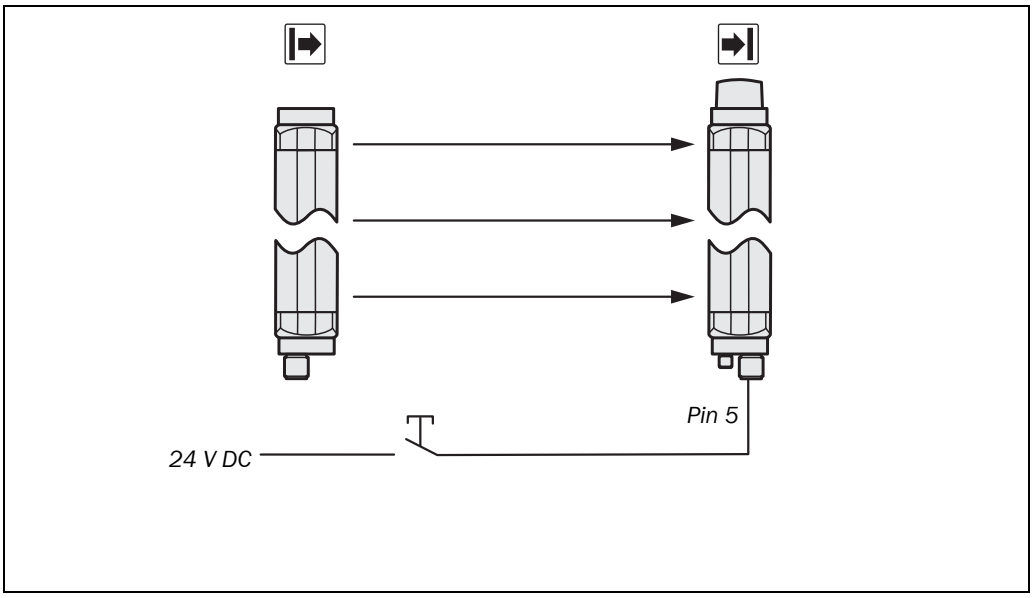
In the protective operation mode with internal restart interlock (see page 21) the operator must first press the reset button before restarting.

WARNING

Select the correct installation site for the reset button!

Install the reset button outside the hazardous area such that it cannot be operated from inside the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area.

Fig. 35: Connection of the reset button



WARNING

Device configuration after replacement!

If you replace a multiple light beam safety device with activated *Reset* function with a replacement device, you must activate the *Reset* function again via the CDS. It is not enough to only make the electrical connections.

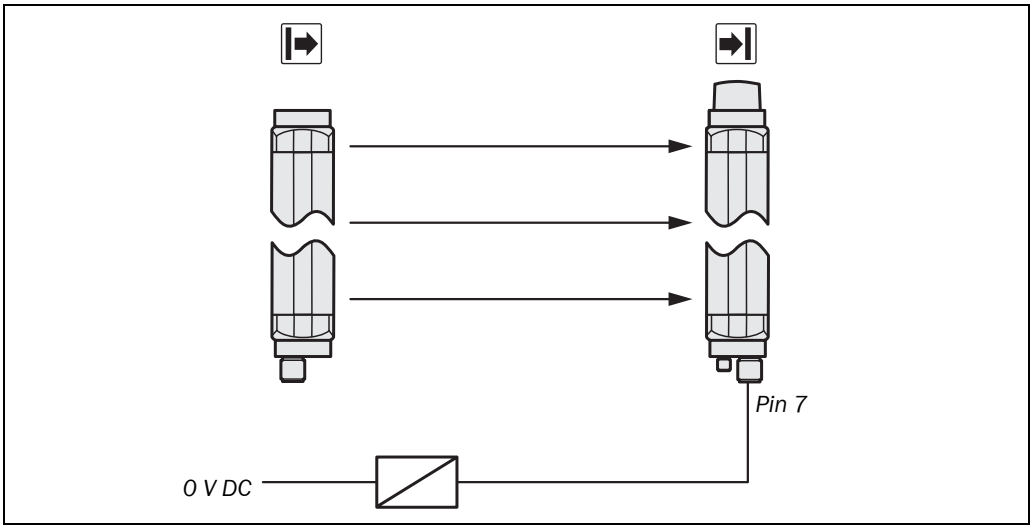
Connection of a *Reset required* signal lamp

Pin 8 of the system connection can be used as *Reset required* output (24 V). The output has a frequency of 1 Hz.

6.6 Application diagnostic output (ADO)

Pin 7 on the system plug is an application diagnostic output (ADO). You can use this output for a relay or a PLC.

Fig. 36: Connection to the application diagnostic output



Notes

- When you connect the application diagnostic output as an alarm signal for contamination (OWS) or for the OSSD status, then during the configuration you can choose how the application diagnostic output is to signal the alarm.
  - HIGH active: If there is contamination or if the OSSDs are switched on, 24 V are present. Otherwise the output is high resistance.
  - LOW active: If there is contamination or if the OSSDs are switched on, the output is high resistance. Otherwise 24 V are present.
- If you use the application diagnostic output as an alarm signal for “Reset required”, it has a frequency of 1 Hz.
- Only M4000 Advanced and M4000 Advanced A/P in conjunction with external switching amplifier, e.g. UE403:

  If you connect the application diagnostic output as an alarm signal for muting or override status, then the application diagnostic output will always signal the alarm with an active HIGH. With muting or override 24 V are present. Otherwise the output is high resistance.

If you connect the signal output, then you must configure it with the aid of the CDS prior to commissioning. Details can be found in chapter 4.3 “Application diagnostic output (ADO)” on page 23.

WARNING

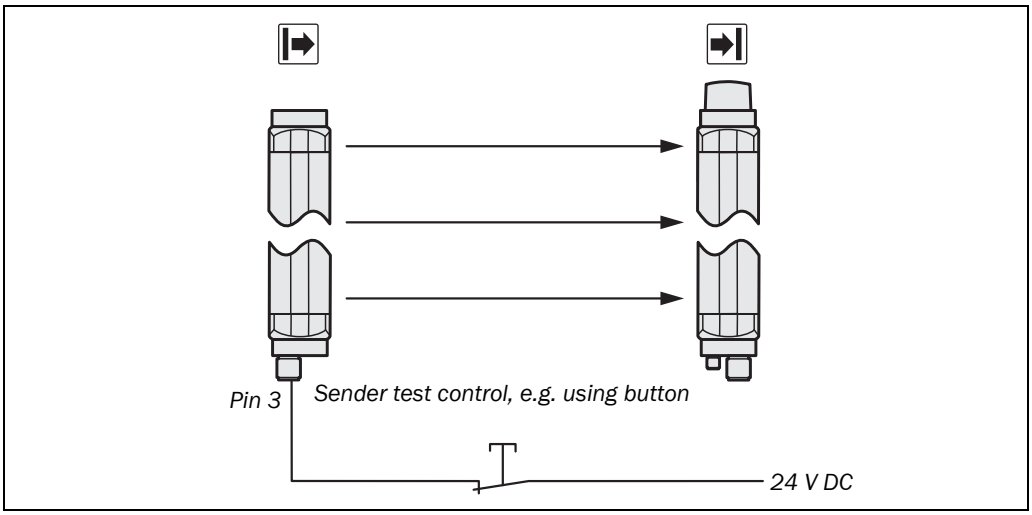
Device configuration after replacement!

If you replace a multiple light beam safety device on which the application diagnostic output (ADO) is connected and configured, then you must activate the application diagnostic output (ADO) again via the CDS. It is not enough to only make the electrical connections.

6.7 Test input (sender test)

Note The function Sender test is not available with the M4000 Advanced A/P.

Fig. 37: Connection of the sender test button



The sender test is performed when 0 V is present at the test input (pin 3) of the sender.

To be able to use the sender test button, you must also configure the **Sender test** function with the aid of the CDS: Device symbol **M4000 Advanced (sender)**, context menu **Open device window**, parameter node **General**.

6.8 Intelliface applications

Using Intelliface, the intelligent interface technology for safety systems, SICK provides you with an entire range of interface products that were specially developed for interfacing safety products and machines.

For complex applications the M4000 can be integrated into UE100 Intelliface family safety systems. In this way the functions of the multiple light beam safety device can be enhanced and corresponding applications realised.

All variants of the M4000 Advanced, M4000 Advanced A/P and M4000 Area 60/80 are equipped with EFI (safe SICK device communication). All safety-relevant signals are transmitted using this interface. A bus interface to a safe fieldbus is possible using the series UE1000 Intelliface device family.

Note You will find connection diagrams in the operating instructions for the series UE100 and UE1000.

7 Commissioning

WARNING

Commissioning requires a thorough check by qualified personnel!

Before you operate a system protected by the M4000 multiple light beam safety device for the first time, make sure that the system is first checked and released by qualified personnel. Please read the notes in chapter 2 “On safety” on page 9.

7.1 Display sequence during start-up

After the system is activated, sender and receiver go through a power-up cycle. The 7-segment display indicates the device status during the power-up cycle.

The indications have the following meaning:

Tab. 21: Displays shown during the power-up cycle

Display	Meaning
8, 0, 1, 2, 3, 4, 5, 6, 7, 9	Testing the 7-segment display. All segments are activated sequentially.
H	Ca. 0.5 s. Is displayed only at the receiver and only in operation with large scanning range.
U, - or -	Ca. 0.5 s. Non-coded operation or operation with code 1 or 2
0, 1, 1 or 2	Receiver only: Sender–receiver alignment is not optimal (see chapter 7.2.1 “Meaning of the 7-segment display during alignment” on page 52ff).
Other display	Device error. See chapter 10 “Fault diagnosis” on page 66.

7.2 Alignment of the M4000

After the multiple light beam safety device has been mounted and connected, you must align the sender and receiver precisely in relation to each other.

Alignment is performed by mechanically adjusting the M4000 components. During this process the M4000 is in the alignment mode. You can then see when the optimal alignment is achieved on the 7-segment display on the receiver.

The alignment mode is automatically activated when the multiple light beam safety device is switched on if the light beams are not yet aligned or the light path is interrupted.

Alignment aids

You can conveniently and accurately align the devices using a laser alignment aid. An alignment aid is recommended particularly when a M4000 system is used with deflector mirrors (each mirror on the mirror columns must be adjusted).

The following alignment aids are available:

- integrated laser alignment aid per beam (optional, only for M4000 Advanced)

  On this subject read the description in chapter 7.2.4 “Alignment of the M4000 Advanced with integrated laser alignment aid (optional)” on page 56.
- alignment aid AR60 + adapter for M4000 (see section 12.7 “Accessories” on page 98)

  On this topic read the description in the operating instructions for the “Alignment aid AR60”.

7.2.1 Meaning of the 7-segment display during alignment

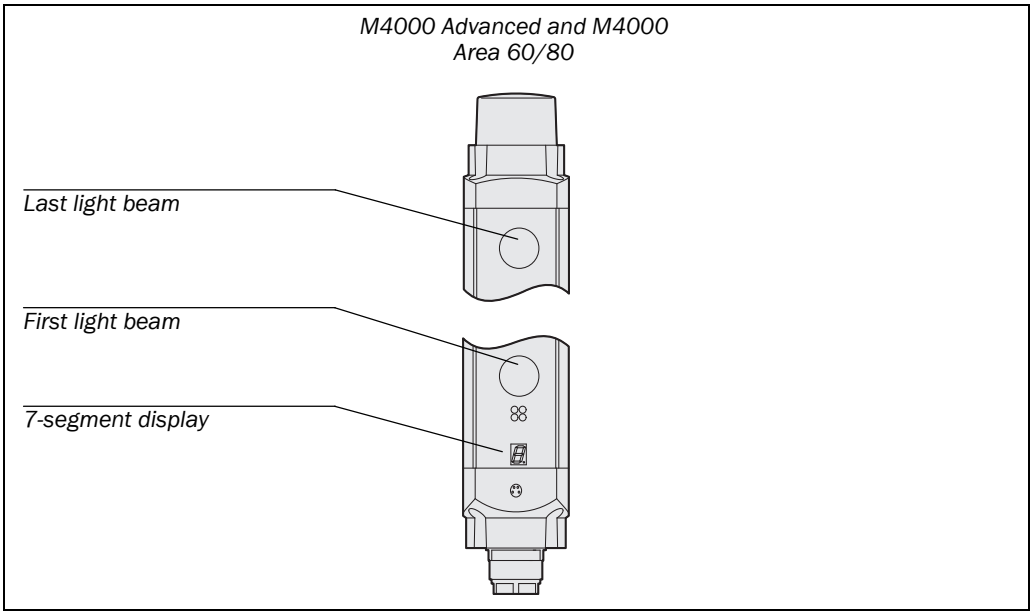
During alignment, the 7-segment display on the receiver shows you when the optimal alignment is achieved (see Tab. 22).

Notes

- The beam that is closest to the 7-segment display is termed the first light beam (see Fig. 38 and Fig. 39).
- Only the first and last light beam are evaluated during alignment.
- If the optimum alignment (= no display) persists for longer than 2 minutes without the multiple light beam safety device being interrupted, the system automatically deactivates the alignment mode.

M4000 Advanced and M4000 Area 60/80

Fig. 38: Illustration of the beam order of the M4000 Advanced and the M4000 Area 60/80

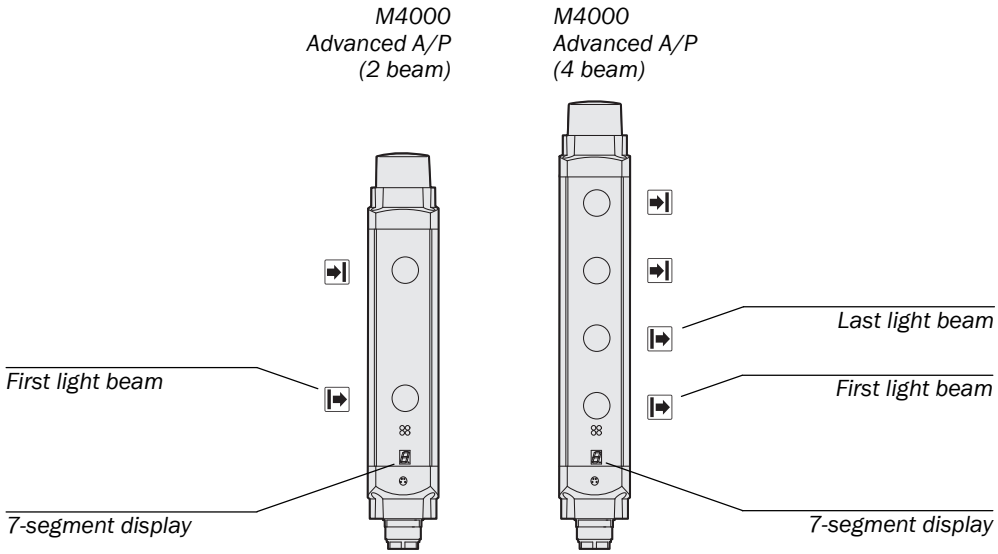


Tab. 22: Indications on the 7-segment display during alignment of the M4000 Advanced and the M4000 Area 60/80

Display	Significance during alignment
0	First and last light beam not aligned.
1	Only the first light beam is aligned.
1.	Only the last light beam is aligned.
2	All the light beams hit the receiver, but the alignment is still slightly off.
No indication and green LED illuminated on the receiver	The alignment is now true; the devices must be locked in this position.

M4000 Advanced A/P

Fig. 39: Illustration of the beam order of the M4000 Advanced A/P



Tab. 23: Indications on the 7-segment display during alignment of the M4000 Advanced A/P

Display	Meaning during alignment of the M4000 Advanced A/P	
	2 beam	**4 beam**
0.	The first light beam is not aligned.	None of the light beams is aligned.
1.	–	Only the first light beam is aligned.
J.	–	Only the last light beam is aligned.
2.	The first light beam is aligned, but the alignment is still slightly off.	All the light beams hit the receiver, but the alignment is still slightly off.
No indication and green LED illuminated.	The alignment is now true; the devices must be locked in this position.	

7.2.2 Aligning sender and receiver

WARNING

Secure the plant/system. No dangerous state possible!

Ensure that the dangerous state of the machine is (and remains) switched off! During the alignment process, the outputs of the multiple light beam safety device are not allowed to have any effect on the machine.

How to align sender and receiver in relation to each other:

- Check with a spirit level whether the devices and the deflector mirrors, if used, are mounted vertically.
- Check whether the following points are the same distance from the floor:

  M4000 Advanced or M4000 Area 60/80

  – first beam of the sender
  – first beam of the receiver
  – when using deflector mirrors: centre of the first mirror surface

  M4000 Advanced A/P

  – first beam of the M4000 Advanced A/P
  – centre of the first mirror surface for the M4000 Passive (with mirror deflection) or centre of the first beam for the M4000 Passive (with fibre-optic deflection)
- Loosen the clamping bolts which hold the multiple light beam safety device in place.
- Switch the power supply to the multiple light beam safety device on.
- Watch the alignment information on the 7-segment display of the receiver. Correct the alignment of the sender and receiver (or of the M4000 Advanced A/P and the M4000 Passive), until the 7-segment display goes off.
- Fix the multiple light beam safety device using the clamping screws.
- Switch the power supply off and then back on again and check via the 7-segment display whether the alignment is correct after tightening the clamping bolts (see Tab. 22 or Tab. 23).

7.2.3 Special aspects of alignment with deflector mirrors

If you use the M4000 multiple light beam safety device with deflector mirrors (mirror columns), then you must note the following points when aligning the mirrors:

1. On the deflection of several beams using a mirror column, each individual mirror must be adjusted separately.
2. For deflection using mirrors, the angle of incidence equals the angle of reflection. This means: A slight rotation of the mirror results in a change that is twice as large (see Fig. 40).
   If the light beam is guided to the receiver using a deflector mirror, only part of the original diverging beam is passed on.
   The alignment tolerance will become smaller with each further deflection (see Fig. 41).

Recommendation Always use an alignment aid when aligning the M4000 Advanced with deflector mirrors (see section “Alignment aids” on page 52).

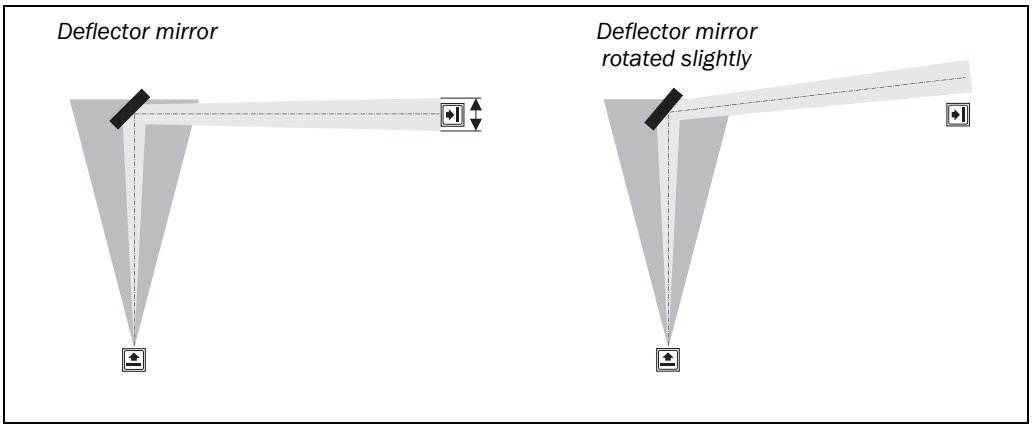


Fig. 40: Schematic illustration of the change on slight rotation of the deflector mirror

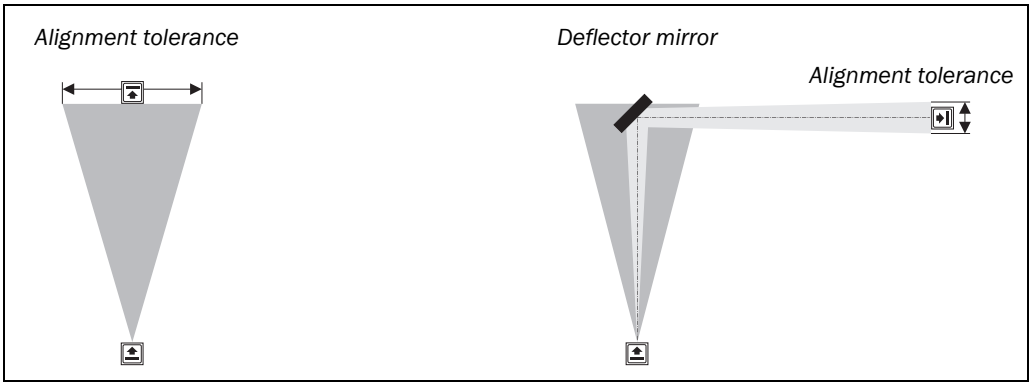


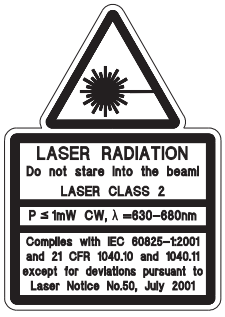
Fig. 41: Schematic illustration of the alignment tolerance without and with deflector mirror

7.2.4 Alignment of the M4000 Advanced with integrated laser alignment aid (optional)

WARNING

Never look directly into the laser beam!

If the laser beam falls on your eye, you must consciously close your eyes or turn away immediately.



The multiple light beam safety device is equipped with an integrated laser alignment aid of laser class 2. Brief action of the laser beam (up to 0.25 s) is not dangerous for the eye. Therefore, an ocular hazard can exist only if an individual overcomes their natural aversion to bright light and stares directly into the laser beam.

Do not point the laser at a person's eye at close range.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The M4000 Advanced multiple light beam safety device is available with an integrated laser alignment aid as an extra.

The laser alignment aid in conjunction with the indications on the 7-segment display enables you to precisely adjust and align the multiple light beam safety device. The aid comprises a laser per light beam (in the receiver) as well as a laser deflector mirror and a transparent display screen (in the sender).

The laser alignment aid is activated automatically when the M4000 Advanced is switched on if the light beams are not yet aligned or if the light path is interrupted.

Notes

- Always align the beams individually and in the following order: first beam, second beam ..., last beam. When aligning the second and all further beams, it may occur that the laser beams for beams already aligned (e.g. the first beam) are no longer incident to the target on the alignment template (when this is fitted again). This situation has no effect on the accuracy of the overall alignment.
- If the multiple light beam safety device is in the lock-out status when switched on (see section “The lock-out status” on page 66), the laser alignment aid is not activated.
- The laser alignment aid switches off automatically, ...
  - if the LED ● **Green** on the receiver (light path unoccupied and optimal alignment) is on without interruption for more than 2 minutes.
  - independent of the state after 60 minutes.
- In the delivery with the receiver for the M4000 Advanced with integrated laser alignment aid you will find two self-adhesive alignment templates (one template for the deflector mirror and one for the sender). Keep both alignment templates at hand. You will find further information on the alignment templates as well as a master for copying in the appendix 13.3.

WARNING

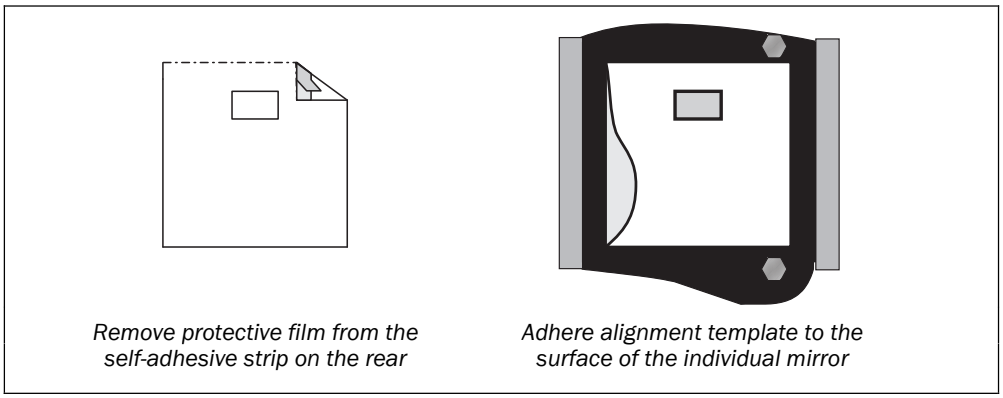
Secure the plant/system. No dangerous state possible!

Ensure that the dangerous state of the machine is (and remains) switched off! During the alignment process, the outputs of the multiple light beam safety device are not allowed to have any effect on the machine.

How to align the M4000 Advanced with the aid of the integrated alignment aid:

- ➢ Check with a spirit level whether the devices and the deflector mirrors, if used, are mounted vertically.
- ➢ Check whether the following points are the same distance from the floor:
  - first beam of the sender
  - first beam of the receiver
  - when using deflector mirrors: centre of the first mirror surface
- ➢ Loosen the clamping bolts which hold the multiple light beam safety device in place.
- ➢ Adhere the alignment template for mirrors to the individual mirror on the mirror pillar that is used to deflect the beam to be aligned. If you start the alignment with the first beam as per these instructions, this is the bottom mirror on the mirror pillar (see Fig. 43).

Fig. 42: Attaching the alignment template for mirrors



Remove protective film from the self-adhesive strip on the rear

Adhere alignment template to the surface of the individual mirror

- ➢ Activate the laser alignment aid by switching on the power supply to the multiple light beam safety device.

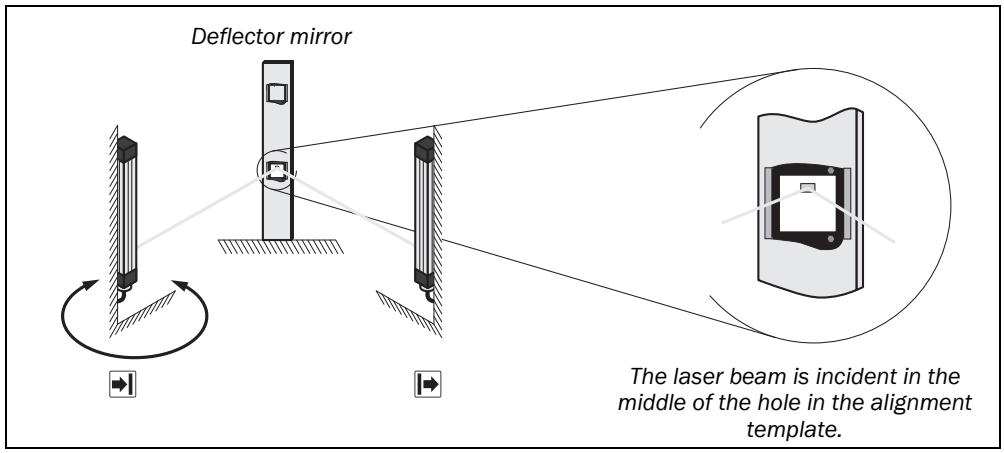
Note You can also activate and deactivate the laser alignment aid via the CDS.

➢ Rotate the receiver until the alignment beam is incident in the centre of the hole in the alignment template (see Fig. 43). If further mirror columns are used, use the alignment template for all further mirrors on the mirror columns.

Note If you do not use an alignment template, the alignment beam must be incident approx. 23.5 mm above the centre of the mirror.

➢ Remove the alignment template from the individual mirror.

Fig. 43: Alignment of the receiver to the deflector mirror using the laser alignment aid



➢ Adhere the alignment template for the sender to the beam on the sender that is closest to the 7-segment display.

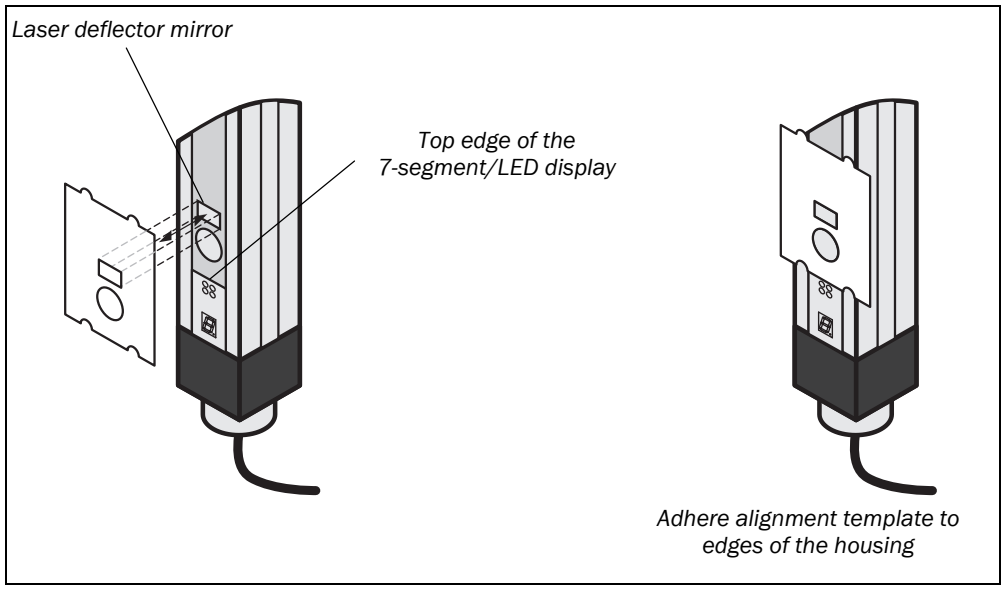
Note The alignment template for the sender is correctly positioned on the sender (see Fig. 44), when ...

– the circular opening is exactly over the beam optics

and

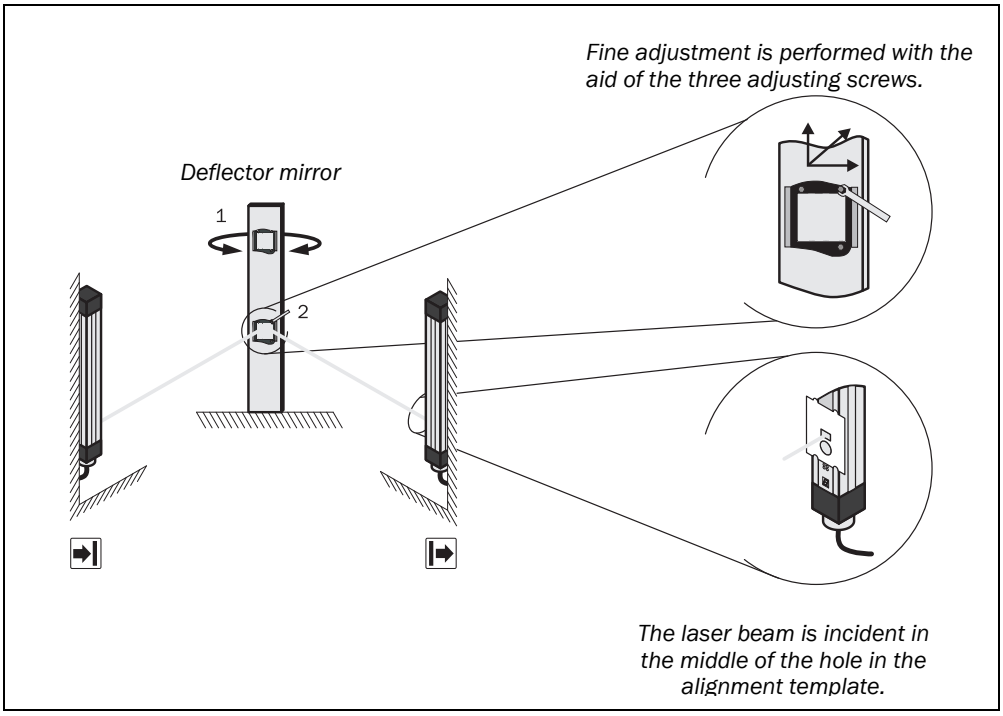
– the tabs on the template are exactly positioned on the edges of the sender housing and point upward from the 7-segment/LED display.

Fig. 44: Attach the alignment template to the sender



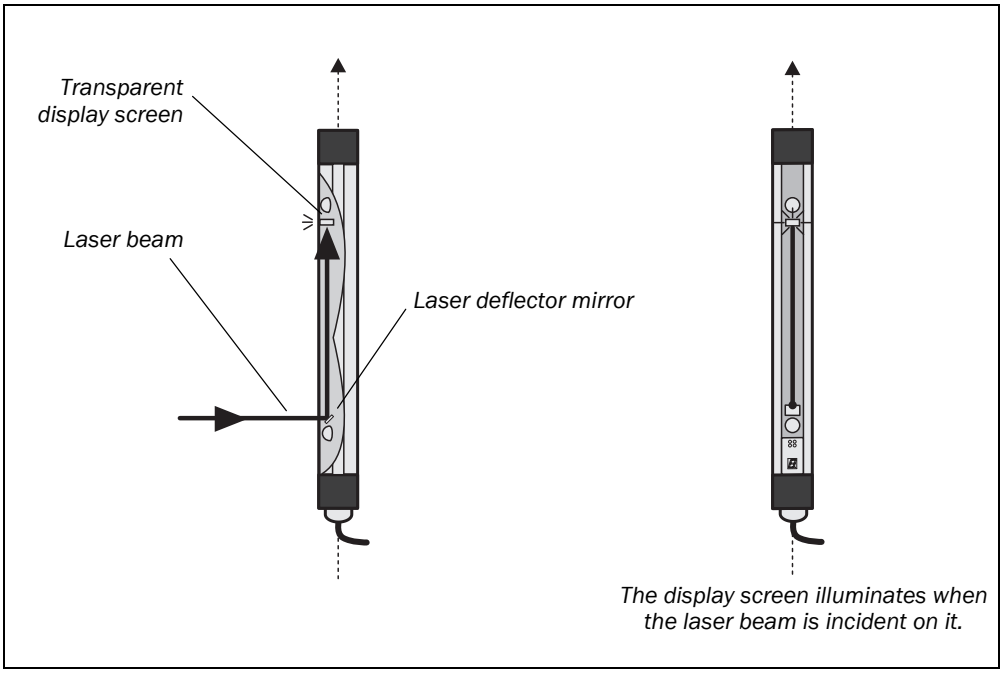
➢ Align the deflector mirror (depending on the mirror columns, you may need to remove the cover plate first). With the aid of three adjusting screws, you can finely adjust the individual mirror (see Fig. 45). The optimal alignment is achieved when the alignment beam is incident in the middle of the rectangular hole in the alignment template.

Fig. 45: Alignment of the deflector mirror to the sender using the laser alignment aid



Note For the alignment of the sender, the laser beam is deflected within the sender onto a transparent display screen with the aid of the laser deflector mirror. As soon as correct alignment is achieved, the display screen, which can be seen from the exterior, illuminates (see Fig. 46).

Fig. 46: Principle of laser deflection in the sender



➢ Rotate the sender until the display screen illuminates.

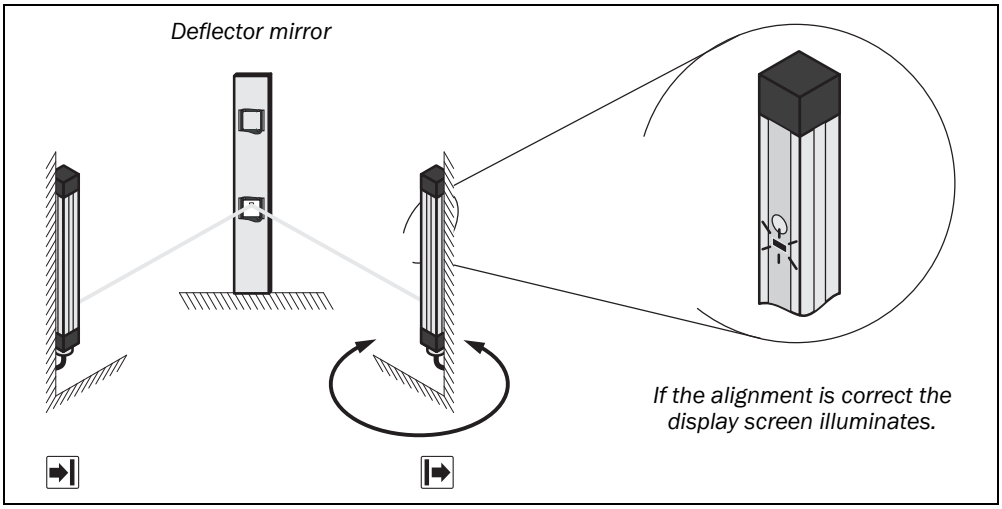


Fig. 47: Alignment of the sender using the laser alignment aid

➢ Remove the alignment template. Watch the alignment information on the 7-segment display of the receiver (see Tab. 22). The optimal alignment of the beam near the 7-segment display is achieved when a [!] appears on the 7-segment display.

Notes
- When the alignment information on the 7-segment display goes out (no indication), then all other beams are already aligned.
- The sender is only aligned once. This step is not necessary when aligning other beams.

➢ Fix the sender in place.

➢ Align the other beams using the steps described.

Note When aligning the second and all further beams, it may occur that the laser beams for beams already aligned (e.g. the first beam) are no longer incident to the target on the alignment template (when this is fitted again). This situation has no effect on the accuracy of the overall alignment.

➢ Using the clamping bolts, fix the receiver in place.

➢ Switch the power supply off and then back on again and check via the 7-segment display whether the alignment is correct after tightening the clamping bolts (see Tab. 22).

Note All alignment templates used must be removed after the alignment procedure!

7.3 Test notes

The purpose of the tests described in the following is to confirm the safety requirements specified in the national/international rules and regulations, especially the safety requirements in the Machine and Work Equipment Directives (EU Conformity).

These tests are also used to identify if the protection is affected by external light sources or other unusual ambient effects.

These tests must therefore always be performed.

7.3.1 Pre-commissioning test notes


WARNING

Ensure that you do not place anybody at risk during initial commissioning of the machine!

Always expect that the machine, plant or the protective device does not yet behave as you have planned.

- Ensure that there are no persons in the hazardous area during initial commissioning.
- Check the effectiveness of the protective device mounted to the machine, using all selectable operating modes as specified in the checklist in the annex (see 13.2 on page 101).
- Ensure that the operating personnel of the machine protected by the multiple light beam safety device are correctly instructed by specialist personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine owner.
- Annex 13.2 of this document shows a checklist for review by the manufacturer and OEM. Use this checklist as a reference before commissioning the system for the first time.

7.3.2 Regular inspection of the protective device by qualified personnel

- Check the system following the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device after the first commissioning are detected.
- If major changes have been made to the machine or the protective device, or if the multiple light beam safety device has been modified or repaired, check the plant again as per the checklist in the annex.

7.3.3 Daily functional checks of the protective device

The effectiveness of the protective device must be checked daily or prior to the start of work by a specialist or by authorised personnel, using the correct test rod.


WARNING

Do not operate the machine if the green or yellow LED is lit during the test!

If the green or yellow LED lights up during the test even for a short period, work must stop at the machine. In this case the mounting and the configuration of the multiple light beam safety device must be checked by specialised personnel (see chapter 5 and chapter 8).

Testing the light path between sender and receiver

➢ **Prior** to covering each light beam with a test rod, check whether ...
- the green LED lights up on the M4000 with de-activated internal restart interlock.
- the yellow LED lights up on the M4000 with activated internal restart interlock ("Reset required").

Note If this is not the case, ensure that this condition is reached. The test is otherwise meaningless.

Only M4000 Advanced:

➢ Completely cover each light beam with a test rod that is not transparent to light (at least 30 mm diameter) at the following positions:
- immediately in front of the sender
- in the middle between sender and receiver (or between the deflector mirrors)
- immediately in front of the receiver
- when using deflector mirrors: immediately before and after the deflector

Only M4000 Advanced A/P:

➢ Completely cover each light beam with a test rod that is not transparent to light (at least 30 mm diameter). Hold the test rod in the following positions with your arm outstretched:
- immediately in front of the M4000 Advanced A/P
- in the middle between M4000 Advanced A/P and M4000 Passive or another mirror deflection (e.g. deflector mirror PSK45)
- immediately in front of the M4000 Passive or another mirror deflection (e.g. deflector mirror PSK45)
- when using deflector mirrors between M4000 Advanced A/P and M4000 Passive: immediately before and after the deflector

Only M4000 Area 60/80:

➢ Use a test rod that is not transparent to light and that has the following diameters:
- 60 mm for the M4000 Area 60
- 80 mm for the M4000 Area 80

➢ Guide the test rod along the entire length of the area monitored:
- immediately in front of the sender
- in the middle between sender and receiver
- immediately in front of the receiver

This must produce the following result:

- On the receiver for the related multiple light beam safety device only the red LED is allowed to illuminate and **not** the green or yellow LED

  and

- as long as the light beam is interrupted, it must not be possible to initiate the dangerous state.

Further tests

- Check the protective device for damage or wear, particularly the mounting, the electrical connection and the connection cable, the housing and the front screen.
- Check whether the access to the hazardous area is only possible by interrupting the light path between sender and receiver for the M4000 system (e.g. correct mounting of mechanical protective devices).
- Check whether the protective device is effective for the set operating mode.

8 Configuration

8.1 Default delivery status

As delivered the M4000 is configured ready for protective operation. In the following table you will find all functions that can be configured as well as information on which device the functions need to be configured.

Notes

- The preconfiguration of the M4000 multiple light beam safety device depends on the type (see Ordering information on page 90ff).
- You can open the existing configuration of the M4000 at any time with the aid of the CDS.

Tab. 24: Overview of the configurable functions

Function	M4000 Advanced, M4000 Area 60/80		M4000 Advanced A/P
	Sender	Receiver	Sender and receiver unit
Beam coding	■	■	■
External device monitoring	–	■	■
Reset/restart interlock	–	■	■
Scanning range	–	■	■
Application diagnostic output (ADO)	–	■	■
Sender test	■	–	–

You will find more detailed information on the individual functions in chapter 4 “Configurable functions” on page 21ff.

8.2 Preparation of the configuration

How to prepare the configuration:

➢ Make sure that the multiple light beam safety device has been correctly mounted and that the electrical connections are correct and in place.

➢ Plan all necessary settings (beam coding, scanning range, external device monitoring, etc.) and document them.

For the configuration of the multiple light beam safety device you will need:

- CDS (Configuration & Diagnostic Software) on CD-ROM
- user manual for CDS on CD-ROM
- PC/Notebook with Windows 98/NT 4/2000 Professional/XP and a serial interface (RS-232). PC/Notebook not included
- connecting cable between PC and M4000 (SICK-Part No. 6021195)

To configure the device, please read the user manual for the CDS (Configuration & Diagnostic Software) and use the online help function of the programme.

9 Care and maintenance

The M4000 multiple light beam safety device is maintenance-free. The front screen of the M4000 multiple light beam safety device should be regularly cleaned and also if contaminated.

- Do not use aggressive detergents.
- Do not use abrasive cleaning agents.

Note Static charges cause dust particles to be attracted to the front screen. You can prevent this effect by using the antistatic plastic cleaner (SICK Part No. 5600006) and the SICK lens cloth (SICK Part No. 4003353).

How to clean the front screen:

- Use a clean and soft brush to remove dust from the front screen.
- Now wipe the front screen with a clean and damp cloth.

Note
- After cleaning, check the position of sender and receiver to ensure that the protective device cannot be bypassed (reaching over, under or standing behind).
- Verify the effectiveness of the protective device as described in chapter 7.3 “Test notes” on page 61.

10 Fault diagnosis

This chapter describes how to identify and remedy errors and malfunctions during the operation of the M4000 multiple light beam safety device.

10.1 In the event of faults or errors


WARNING

Cease operation if the cause of the malfunction has not been clearly identified!

Stop the machine if you cannot clearly identify or allocate the error and if you cannot safely remedy the malfunction.

Complete function test after rectification of fault!

After rectifying a fault, perform a complete function test as per section 7.3 “Test notes”.

The lock-out status

In case of certain faults or an erroneous configuration, the system can go into the lock-out status. The 7-segment display on the multiple light beam safety device then indicates E. or a defined error message (see Tab. 26).

- First check whether the lock-out status is still present after switching on and off the M4000 (e.g. by disconnecting the system plug and re-connecting).

To place the device back in operation:

- Rectify the cause of the fault as per Tab. 26.
- Switch the power supply for the M4000 off and on again (e.g. by unplugging the system plug and reinserting it).

Note The lock-out status has the highest priority above all other indications on the 7-segment display.

10.2 SICK support

If you cannot remedy an error with the help of the information provided in this chapter, please contact your local SICK representative.

10.3 Error displays of the LEDs

This chapter explains the meaning of the error displays of the LEDs and how to respond. You will find an description of the LEDs in chapter 3.4 “Controls and status indicators” on page 18.

Tab. 25: Error displays of the LEDs

Display		Possible cause	Remedying the error
Sender			
○ **Yellow**	LED fails to light up	No operating voltage, or voltage too low	➢ Check the voltage supply and activate, if necessary.
Receiver or **M4000 Advanced A/P**			
● **Orange**	LED illuminated	Received signal is weak	➢ Check the alignment of sender and receiver or of the M4000 Advanced A/P and the M4000 Passive. ➢ Check the front screen (dirt) and clean, if necessary.
☼● **Yellow**	LED flashing	Reset required	➢ Press the reset button.
○ **Red** and ○ **Green**	Neither the red nor the green LED lights up	No operating voltage, or voltage too low	➢ Check the voltage supply and activate, if necessary.

10.4 Error displays of the 7-segment display

This section explains the meaning of the error displays on the 7-segment display and how to respond to the messages. Please refer to chapter 3.4 “Controls and status indicators” on page 18 for a description of the 7-segment display.

Tab. 26: Error displays of the 7-segment display

Display	Possible cause	Remedying the error
0, 1, J or 2	Inadequate alignment (in alignment mode)	➢ Re-align sender and receiver (see page 52). The display goes off after 2 minutes.
1	The light path is interrupted (in normal operation)	➢ Rectify the cause of the interruption in the light path.
6	Configuration incomplete	➢ The display goes off automatically once the configuration has been successfully transferred. If the display 6 does not go off: ➢ Check the configuration of the system using the CDS (Configuration & Diagnostic Software). ➢ Re-transfer the corrected configuration to the system.
8 or 8	EDM error (see also page 28)	➢ Check the contactors and their wiring, eliminate any wiring errors, if necessary. ➢ If 8 is displayed, switch the device off and back on again.
9	Reset button fault	➢ Check the reset button for correct function. The button may be defective or stuck. ➢ Check the wiring of the reset button for any short-circuit to 24 V.
A↻3	Override time exceeded (only in conjunction with external switching amplifier, e.g. UE403)	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Ensure the muting sensors are correctly positioned and are working correctly and that the muting lamp is in correct working order.
c↻0	Invalid configuration of muting sensor B1 or B2 (only in conjunction with external switching amplifier, e.g. UE403)	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check whether muting sensor B1 or B2 is connected correctly but is not configured.
c↻1	Invalid configuration of the signals Override/C1/belt stop (only in conjunction with external switching amplifier, e.g. UE403)	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check whether the signals Override/C1/Belt stop on the external switching amplifier or C1/Belt stop on the ESPE are connected correctly, but not configured.

Display	Possible cause	Remedying the error
c.2.	Invalid configuration of the signals Reset/Override (combined), Override or Reset (only in conjunction with external switching amplifier, e.g. UE403)	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check whether the signals Reset/Override (combined) or Override on the external switching amplifier or Reset on the ESPE are connected correctly, but not configured.
E.	System error	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Replace the unit (receiver or sender).
E.4.	Error in external device (only in conjunction with external UE403 switching amplifier)	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the connection between the M4000 and the UE403. If necessary, replace defective cables. ➢ Replace the UE403 switching amplifier.
F.1.	Overcurrent at output signal switching device 1	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the contactor. Replace, if necessary. ➢ Check the wiring for short-circuit to 0 V.
F.2.	Short-circuit at output signal switching device 1	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the wiring for short-circuit to 24 V.
F.3.	Short-circuit at output signal switching device 1	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the wiring for short-circuit to 0 V.
F.4.	Overcurrent at output signal switching device 2	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the contactor. Replace, if necessary. ➢ Check the wiring for short-circuit to 0 V.
F.5.	Short-circuit at output signal switching device 2	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the wiring for short-circuit to 24 V.

Display	Possible cause	Remedying the error
F.↻6.	Short-circuit at output signal switching device 2	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the wiring for short-circuit to 0 V.
F.↻7.	Short-circuit between output signal switching device 1 and 2	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the wiring and rectify the error.
L.↻2.	Invalid configuration of the EDM	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check whether the machine-side EDM is connected but not activated in the configuration.
L.↻3.	Unknown sender detected	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the distance from reflective surfaces (see page 33) or from other multiple light beam safety devices. ➢ If necessary, re-configure the device with another beam coding (see page 22) or install non-reflective partitions.
L.↻4.	Connection problem between host and guest	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the connection between the cascaded devices. If necessary, replace defective cables.
L.↻5.	Communication in cascaded system failed	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check the configuration of the system using the CDS (Configuration & Diagnostic Software). Re-transfer the corrected configuration to the system. ➢ Check the connection between the cascaded devices. If necessary, replace defective cables.
L.↻9.	Supply voltage error	➢ Switch the device off and back on again for at least 3 seconds. If the error continues to occur: ➢ Check whether the power supply complies with the specification (see page 73). ➢ Check whether the cable lengths comply with the specification (see page 73, the cable lengths must not be exceeded).

Display	Possible cause	Remedying the error
P.	Error at external device (only in conjunction with external switching amplifier, e.g. UE403)	➢ Check the sensors/signals connected to the external device. ➢ Check whether the sensor test is configured correctly. ➢ Check the connections to the external devices. If necessary, replace defective cables.
E.1	Total muting time exceeded (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check the muting sensors. If necessary, replace them. ➢ Check whether the total muting time is correctly configured and whether the system is working correctly.
E.2	Concurrence monitoring error (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check the muting sensors. If necessary, replace them. ➢ Check whether the concurrence monitoring is correctly configured and whether the system is working correctly.
E.3	Sequence monitoring error (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check the muting sensors. If necessary, replace them. ➢ Check whether the muting sensors are activated and deactivated in the correct sequence.
E.4	Direction detection error (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check the muting sensors. If necessary, replace them. ➢ Check whether the system is working correctly, whether the transport device is functioning correctly and whether the muting sensors are correctly positioned.
E.5	Sensor gap monitoring error (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check whether the sensor gap monitoring is configured correctly and whether the gaps in the goods transported are not too large. ➢ Check the muting sensors. If necessary, replace them.

Display	Possible cause	Remedying the error
E.C6.	Error after belt stop (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check whether the belt stop input signal is working correctly. ➢ Ensure that there are no further state changes at the muting sensors and the ESPE once the belt stop signal is present. ➢ Check the muting sensors. If necessary, replace them.
E.C7.	Error of the muting lamp (only in conjunction with external switching amplifier, e.g. UE403)	If override is configured, *Override required* is displayed. ➢ Check the muting lamp. If necessary, replace them. ➢ Verify that the muting lamp is connected correctly.

10.5 Extended diagnostics

The CDS software (Configuration & Diagnostic Software) supplied with the M4000 Advanced multiple light beam safety device contains extensive diagnostic facilities. It allows you to narrow down the problem if the error is non-specific or if you experience usage downtime problems. Detailed information to be found ...

- in the online help function of the CDS (Configuration & Diagnostic Software).
- in the user manual for the CDS.

How to conduct an extended diagnostics of the M4000:

➢ Connect the PC/Notebook on which the CDS has been installed to the M4000 Advanced multiple light beam safety device.

➢ Carry out a diagnostics on the M4000 Advanced receiver.

Device symbol **M4000 Advanced (sender** or **receiver)**, **M4000 Advanced (A/P)** or **M4000 Area (sender** or **receiver)**, context menu **Diagnostics**, **Display**.

11 Technical specifications

11.1 Data sheet

M4000 Advanced, M4000 Advanced A/P and M4000 Area 60/80

Tab. 27: Data sheet M4000 Advanced, M4000 Advanced A/P and M4000 Area 60/80

	Minimum	Typical	Maximum
General system data			
Number of beams, type-dependent			
M4000 Advanced	2		12
M4000 Advanced A/P	2		4
Length of the monitored area, depending on type			
M4000 Area 60	300 mm		1800 mm
M4000 Area 80	600 mm		1800 mm
Beam separation, type-dependent			
M4000 Advanced	120 mm		600 mm
M4000 Advanced A/P		500 mm and 300 mm	
M4000 Area 60/80	50 mm		57 mm
Resolution, depending on type			
M4000 Area 60/80	60 mm		80 mm
Scanning range, configurable			
M4000 Advanced, M4000 Area 80			
Low scanning range	0.5 m		20 m
High scanning range	15 m		70 m
M4000 Area 60			
Low scanning range	0.5 m		6 m
High scanning range	5 m		19 m
Scanning range[3)]			
M4000 Advanced A/P			
With mirror deflection	0.5 m		7.5 m
With fibre-optic deflection	0.5 m		4.5 m
Beam diameter			
M4000 Advanced, M4000 Advanced A/P and M4000 Area 80		23 mm	
M4000 Area 60		13 mm	

[3)] The scanning range of the M4000 Advanced A/P device must be configured to suit the deflection used (see section 4.4.2 “Scanning range of the M4000 Advanced A/P” on page 26).

	Minimum	Typical	Maximum
Protection class (EN 50 178:1998)[4]	III		
Enclosure rating (IEC 60 529)	IP 65		
Supply voltage V_S at device[5]	19.2 V	24 V	28.8 V
Residual ripple[6]			±10 %
Synchronisation[7]	Optical, without separate synchronisation		
Type acc. to IEC 61 496	Type 4		
Power-up delay of sender and receiver before ready			10 s

Sender

Test input			
Input voltage[8] HIGH (active)	11 V	24 V	30 V
Input current HIGH	7 mA	10 mA	20 mA
Switching voltage LOW (inactive)	–30 V	0 V	5 V
Input current LOW[8]	–3.5 mA	0 mA	0.5 mA
Response time to test	Depending on the number of beams, maximum 150 ms		
Wavelength of sender[7]		950 nm	
Power consumption			
M4000 Advanced, M4000 Area 60/80			0.2 A
Weight, type-dependent	See section 11.2 “Table of weights” on page 78ff.		

Receiver or

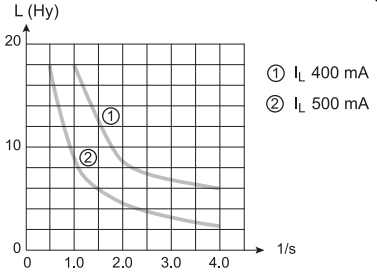
M4000 Advanced A/P

Output signal switching devices (OSSDs)	2 PNP semiconductors, short-circuit protected[9], cross-circuit monitored
Response time	
M4000 Advanced, M4000 Advanced A/P	
2 to 6 beams	10 ms
7 to 11 beams	11 ms
12 beams	12 ms
M4000 Area 60/80	
Non-coded	11 ms
Coded	17 ms

4) Safety extra-low voltage SELV/PELV.
5) The external voltage supply must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204-1. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).
6) Within the limits of V_S.
7) Only with Active/Active systems.
8) As per IEC 61 131-2.
9) Applies to the voltage range between –30 V and +30 V.

	Minimum	Typical	Maximum
Switch off time	100 ms		
Power-up delay			6.5 × response time
Switching voltage[10) 11)] HIGH (active, U_{eff})	V_s – 2.25 V	24 V	V_s
Switching voltage[10)] LOW (inactive)	0 V	0 V	3.5 V
Switching current	0 mA		500 mA
Leakage current[12)]			0.25 mA
Load capacity			2.2 µF
Switching sequence	Depending on load inductance		
Load inductance[13)]			2.2 H
Test pulse data[14)]			
Test pulse width	120 µs	150 µs	300 µs
Test pulse rate	3 ^{1}/s	5 ^{1}/s	10 ^{1}/s
Permissible cable resistance			
Between device and load[15)]			2.5 Ω
Supply lead			1 Ω
Power consumption			
M4000 Advanced			0.7 A[16)]
M4000 Advanced A/P			0.7 A[16)]
M4000 Area 60/80			0.7 A[16)]
External device monitoring (EDM) input			
Input voltage[17)] HIGH (inactive)	11 V	24 V	30 V
Input current HIGH	6 mA	10 mA	20 mA
Input voltage[17)] LOW (active)	–30 V	0 V	5 V
Input current LOW	–2.5 mA	0 mA	0.5 mA

10) As per IEC 61131-2.
11) On the device plug.
12) In the case of a fault (0-V cable open circuit) maximally the leakage current flows in the OSSD cable. The downstream controller must detect this status as LOW. A FPLC (fail-safe programmable logic controller) must be able to identify this status.
13) The maximum rated load inductance is higher with lower switching sequence.



14) 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.
15) Make sure to limit the individual cable resistance to the downstream controller to this value to ensure that a cross-circuit between the outputs is safely detected. (Also note EN 60204 Electrical Machine Equipment, Part 1: General Requirements.)
16) Without OSSDs, without ADO, without *Reset required* and without UE403.
17) As per IEC 61131-2.

	Minimum	Typical	Maximum
Contactors			
Permissible dropout time			300 ms
Permissible pick-up time			300 ms
Control switch input (reset button)			
Input voltage[17] HIGH (active)	11 V	24 V	30 V
Input current HIGH	6 mA	10 mA	20 mA
Input voltage[17] LOW (inactive)	–30 V	0 V	5 V
Input current LOW	–2.5 mA	0 mA	0.5 mA
Operation time control switch input	200 ms		
Output *Reset required*	PNP semiconductors, short-circuit protected[18]		
(24 V lamp output)			4 W/0.2 A
Switching voltage HIGH (active)	15 V	24 V	28.8 V
Switching voltage LOW (inactive)		High resistance	
Application diagnostic output (ADO)	PNP semiconductors, short-circuit protected[18]		
Switching voltage HIGH (active)	V_s – 4.2 V	24 V	V_s
Switching voltage LOW (inactive)		High resistance	
Switching current	0 mA		100 mA
Belt stop input/C1			
Input voltage[17] HIGH (inactive[19], active[20])	11 V	24 V	30 V
Input current HIGH	6 mA	10 mA	20 mA
Input voltage[17] LOW (active[19], inactive[20])	–30 V	0 V	5 V
Input current LOW	–2.5 mA	0 mA	0.5 mA
Operation time input	100 ms		
Wavelength			
M4000 Advanced A/P (sender unit)		850 nm	
Alignment laser (optional)	Laser class 2. Complies with IEC 60 825-1:2001 and 21 CFR 1040.10 and 1040.11 with the exception of the deviations as per Laser Notice No. 50, July 2001 Optical power output≤ 1 mW Wavelength 630 nm–680 nm (visible red light)		
Weight, type-dependent	See section 11.2 “Table of weights” on page 78ff.		

[18] Applies to the voltage range between –30 V and +30 V.
[19] Belt stop.
[20] C1.

	Minimum	Typical	Maximum

Operating data

Connection	Hirschmann plug M26 × 11 + FE		
Cable length[21)]			50 m
Wire cross-section	0.75 mm^2		
Ambient operating temperature	0 °C		+55 °C
Air humidity (non-dewing)	15 %		95 %
Storage temperature	–25 °C		+70 °C
Housing cross-section	52 mm × 55.5 mm		
Vibration resistance	5 g, 10-55 Hz acc. to IEC 60 068-2-6		
Shock resistance	10 g, 16 ms acc. to IEC 60 068-2-29		

Environmental data, materials

Housing	Aluminium alloy ALMGSI 0.5 (powder coated)
Front screen	Polycarbonate, scratch-resistant coating
End caps	Polyamide 6.6 CF30
Packaging	Corrugated cardboard with polyethylene inlays
Circuit boards	Glass-fibre reinforced epoxy resin with flame retarding agent TBBPA

M4000 Passive

Housing cross-section	52 mm × 55.5 mm
Weight, type-dependent	See section 11.2 “Table of weights” on page 78ff.

[21)] Depending on load, power supply and wire cross-section. The technical specifications must be observed.

11.2 Table of weights

11.2.1 M4000 Advanced and M4000 Advanced A/P

Tab. 28: Table of weights M4000 Advanced and M4000 Advanced A/P

Number of beams	Beam separation [mm]	Type code	Weight [g]
2	500	M40Z-0250#####[22)]	1860
		M40#-0250#####	1925
	600	M40#-0260#####	2200
3	220	M40#-0322#####	1760
	400	M40#-0340#####	2750
	450	M40#-0345#####	3025
4	220	M40#-0422#####	2370
	300	M40Z-0430#####[22)]	3040
		M40#-0430#####	3030
5	220	M40#-0522#####	2975
6		M40#-0622#####	3580
7		M40#-0722#####	4185
8		M40#-0822#####	4795

11.2.2 M4000 Passive

Tab. 29: Table of weights M4000 Passive

For number of beams	Deflector unit	Part number	Type code	Weight [g]
2	Mirror deflection	1027906	PSD01-1501	1500
	Fibre-optic deflection	1027907	PSD01-2501	1760
4	Fibre-optic deflection	1027908	PSD02-2301	2920

[22)] M4000 Advanced A/P

11.2.3 M4000 Area 60/80

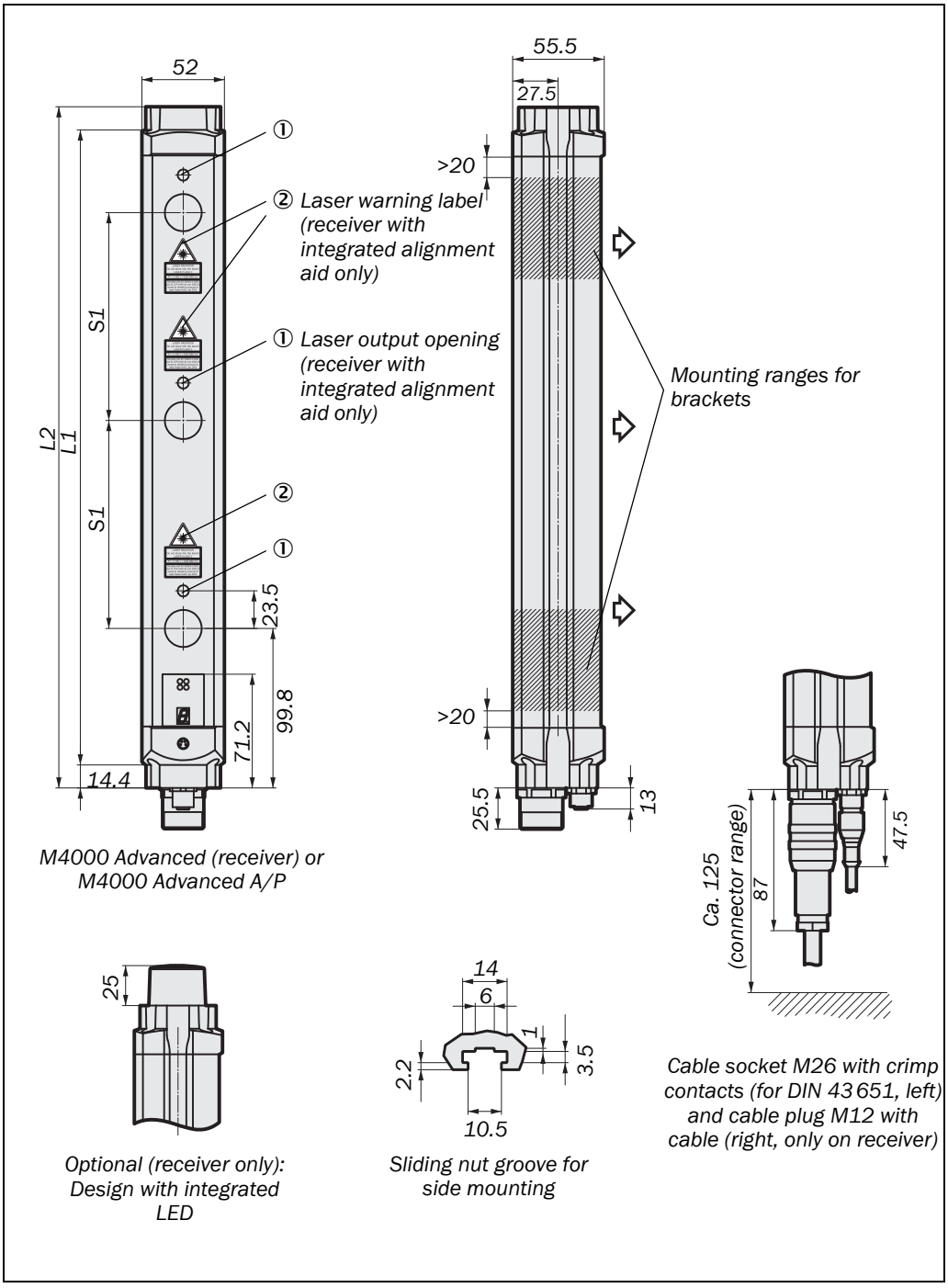
Tab. 30: Table of weights M4000 Area 60/80

Length of the monitored area [mm]	Type code	Weight [g]	
		M4000 Area 60	M4000 Area 80
300	M40#-60A######	1290	1290
450	M40#-61A######	1740	1740
600	M40#-62A######	2195	2090
750	M40#-63A######	2650	2510
900	M40#-64A######	3100	2950
1050	M40#-65A######	3555	3375
1200	M40#-66A######	4010	3795
1350	M40#-67A######	4465	4230
1500	M40#-68A######	4915	4660
1650	M40#-69A######	5370	5095
1800	M40#-70A######	5825	5515

11.3 Dimensional drawings

11.3.1 M4000 Advanced, M4000 Advanced A/P

Fig. 48: Dimensional drawing M4000 Advanced receiver (sender mirror image) or M4000 Advanced A/P (mm)



Tab. 31: Dimensions of the M4000 Advanced or the M4000 Advanced A/P dependent on the number of beams

M4000 Advanced

Number of beams	Beam separation S1 [mm]	Dimension L1 [mm]	Dimension L2 [mm]
2	500	643	672
	600	743	772
3	220	583	612
	400	943	972
	450	1043	1072
4	220	803	832
	300	1043	1072
5	220	1023	1052
6		1243	1272
7		1462	1491
8		1682	1711

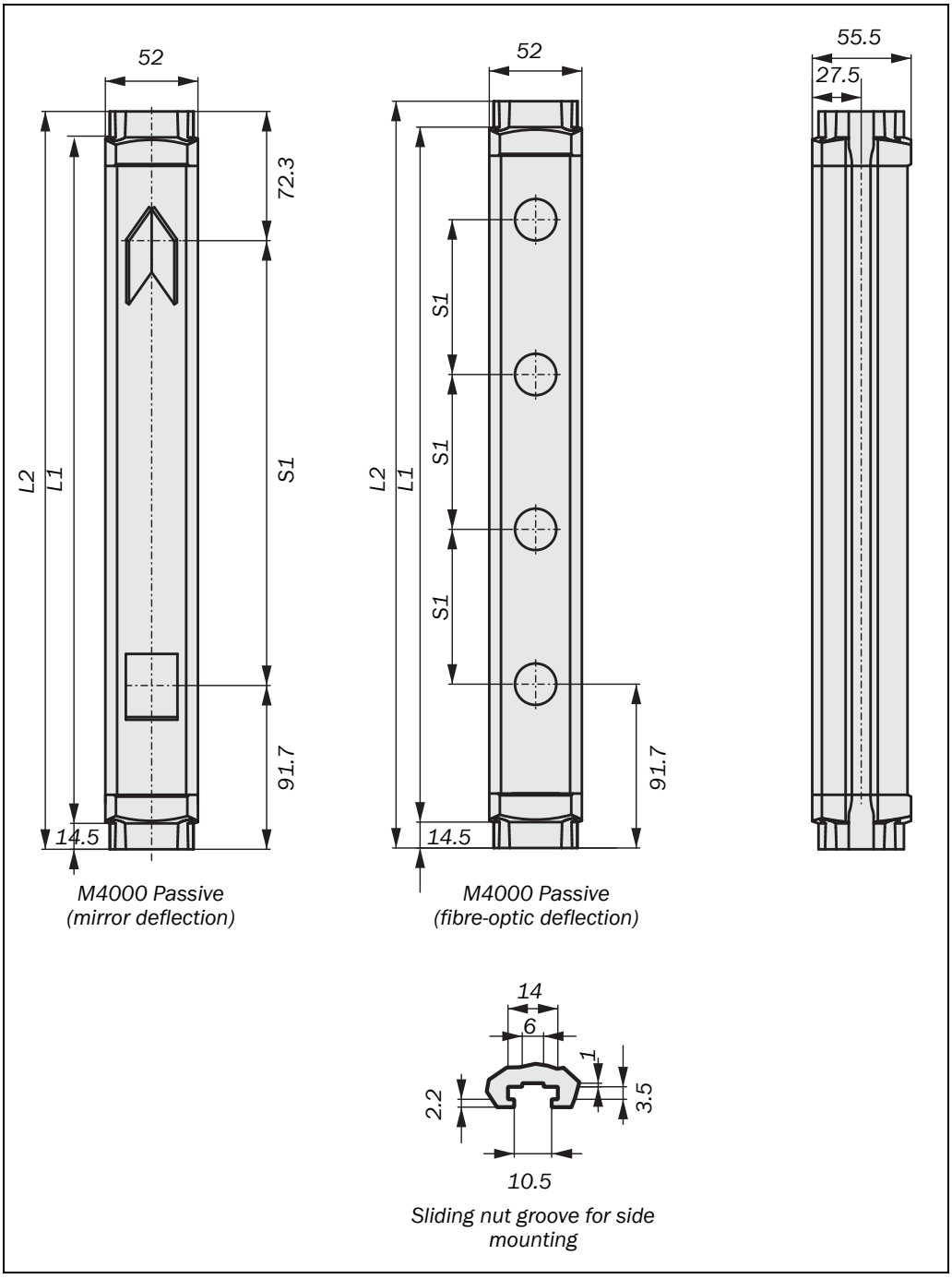
M4000 Advanced A/P

Number of beams	Beam separation S1 [mm]	Dimension L1 [mm]	Dimension L2 [mm]
2	500	643	672
4	300	1043	1072

Note If you use the M4000 Advanced (or the M4000 Advanced A/P) with optional end cap with integrated LED, the dimension L2 of the receiver increases by 25 mm.

11.3.2 M4000 Passive

Fig. 49: Dimensional drawing M4000 Passive (mm)



Tab. 32: Dimensions of the M4000 Passive dependent on the number of beams

M4000 Passive (mirror deflection)

For number of beams	Beam separation S1 [mm]	Dimension L1 [mm]	Dimension L2 [mm]
2	500	635	664

M4000 Passive (fibre-optic deflection)

For number of beams	Beam separation S1 [mm]	Dimension L1 [mm]	Dimension L2 [mm]
2	500	635	664
4	300	1035	1064

Note If you use a two-beam M4000 Advanced A/P, then instead of the M4000 Passive you can use one of the following alternatives:

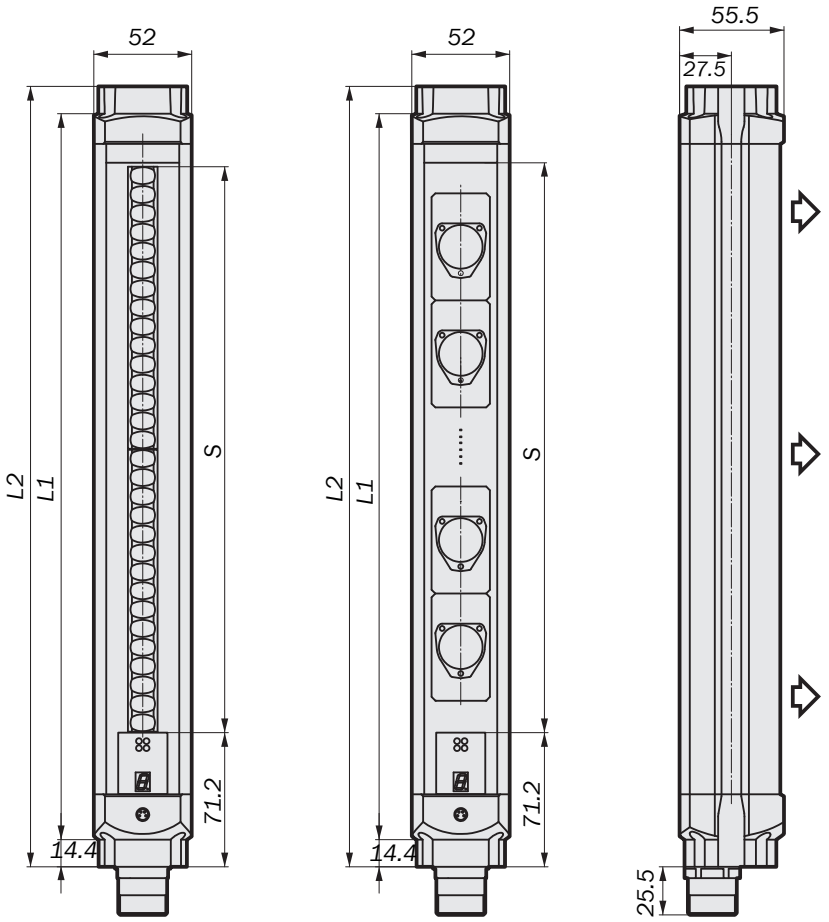
- two deflector mirrors PSK45 (see section 11.3.9 “Deflector mirror PSK45” on page 89)

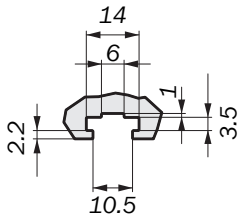
or

- one mirror column (part number: 1027265, see section 12.5 “Deflector mirrors and mirror columns” on page 97)

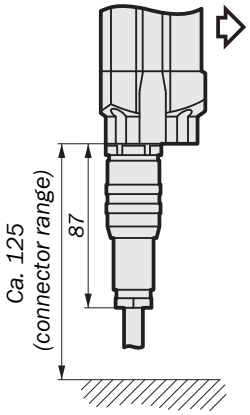
11.3.3 M4000 Area 60/80

Fig. 50: Dimensional drawing M4000 Area 60/80 receiver, sender mirror image (mm)





Sliding nut groove for side mounting



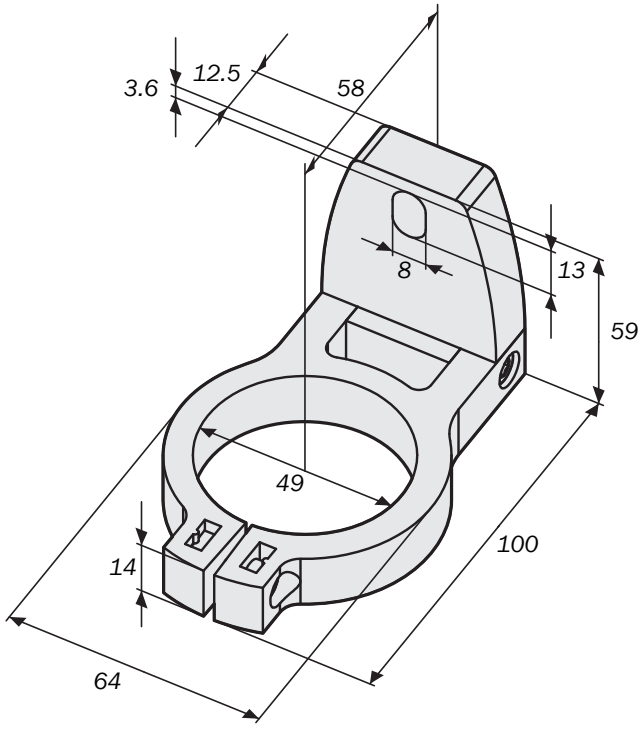
Cable socket M26 with crimp contacts (for DIN 43651)

Tab. 33: Dimensions of the M4000 Area 60/80, dependent of the length of the monitored area

Length of the monitored area S [mm]	Dimension L1 [mm]	Dimension L2 [mm]
300	387	416
450	537	566
600	687	716
750	837	866
900	987	1016
1050	1137	1166
1200	1287	1316
1350	1437	1466
1500	1587	1616
1650	1737	1766
1800	1887	1916

11.3.4 Swivel mount bracket

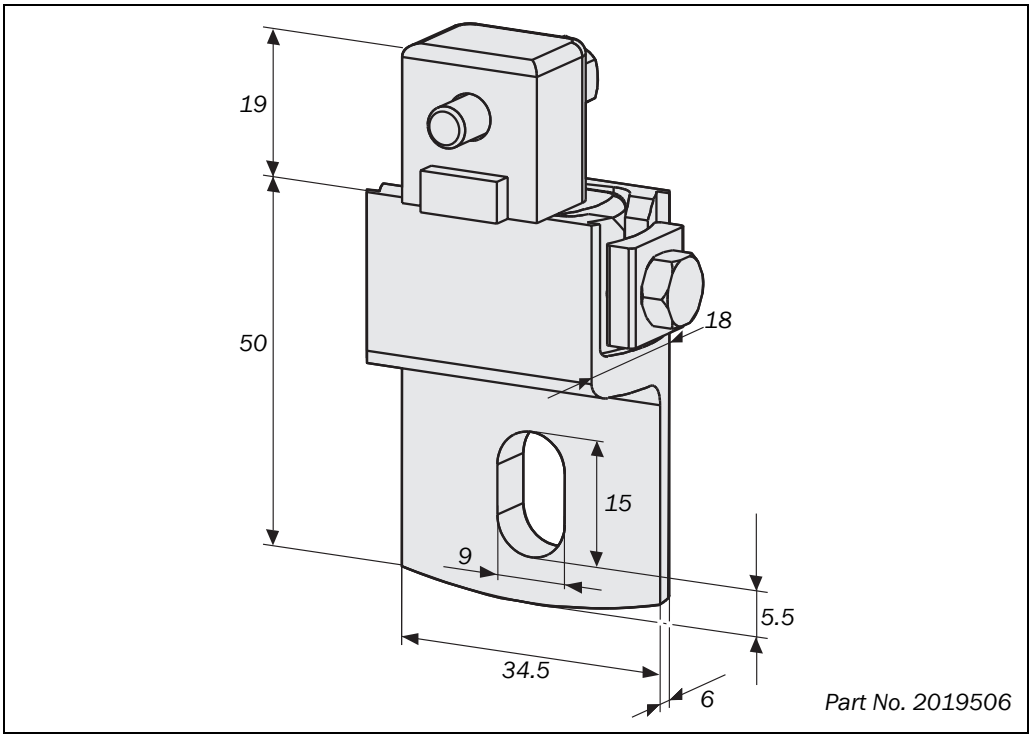
Fig. 51: Dimensional drawing swivel mount bracket (mm)



Part No. 2030510

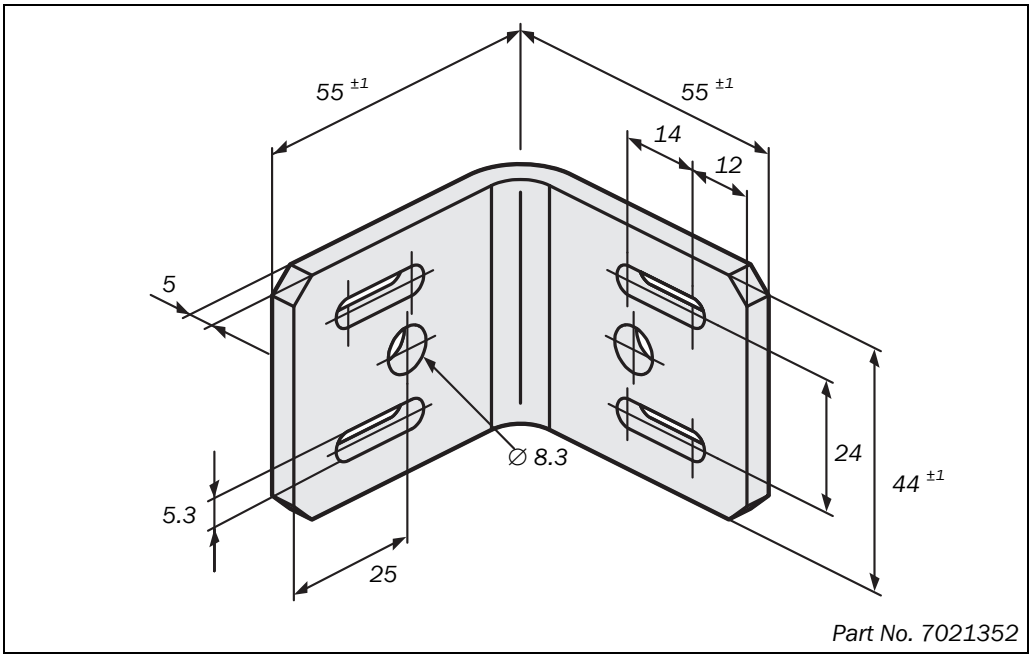
11.3.5 Side bracket

Fig. 52: Dimensional drawing side bracket (mm)



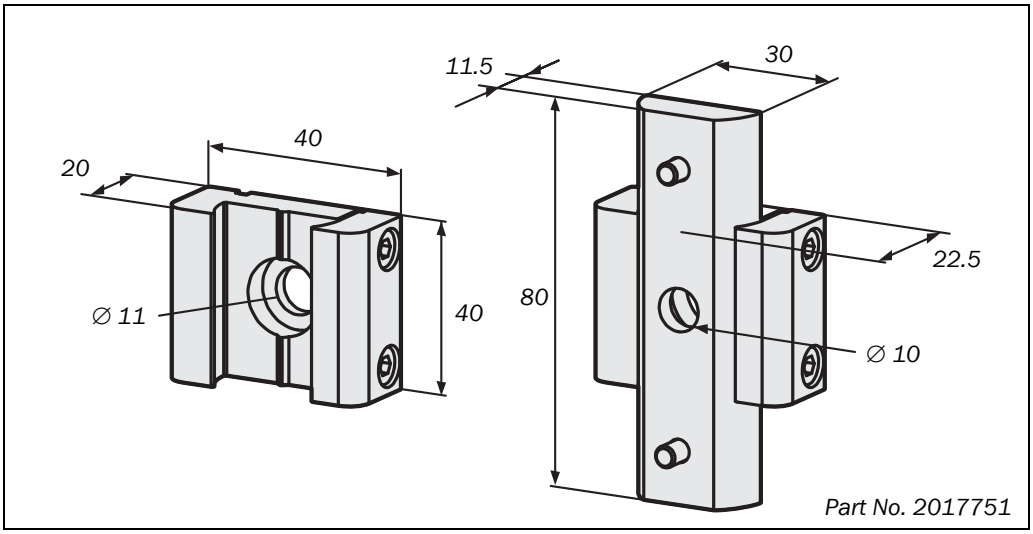
11.3.6 Rigid mounting bracket

Fig. 53: Dimensional drawing rigid mounting bracket (mm)



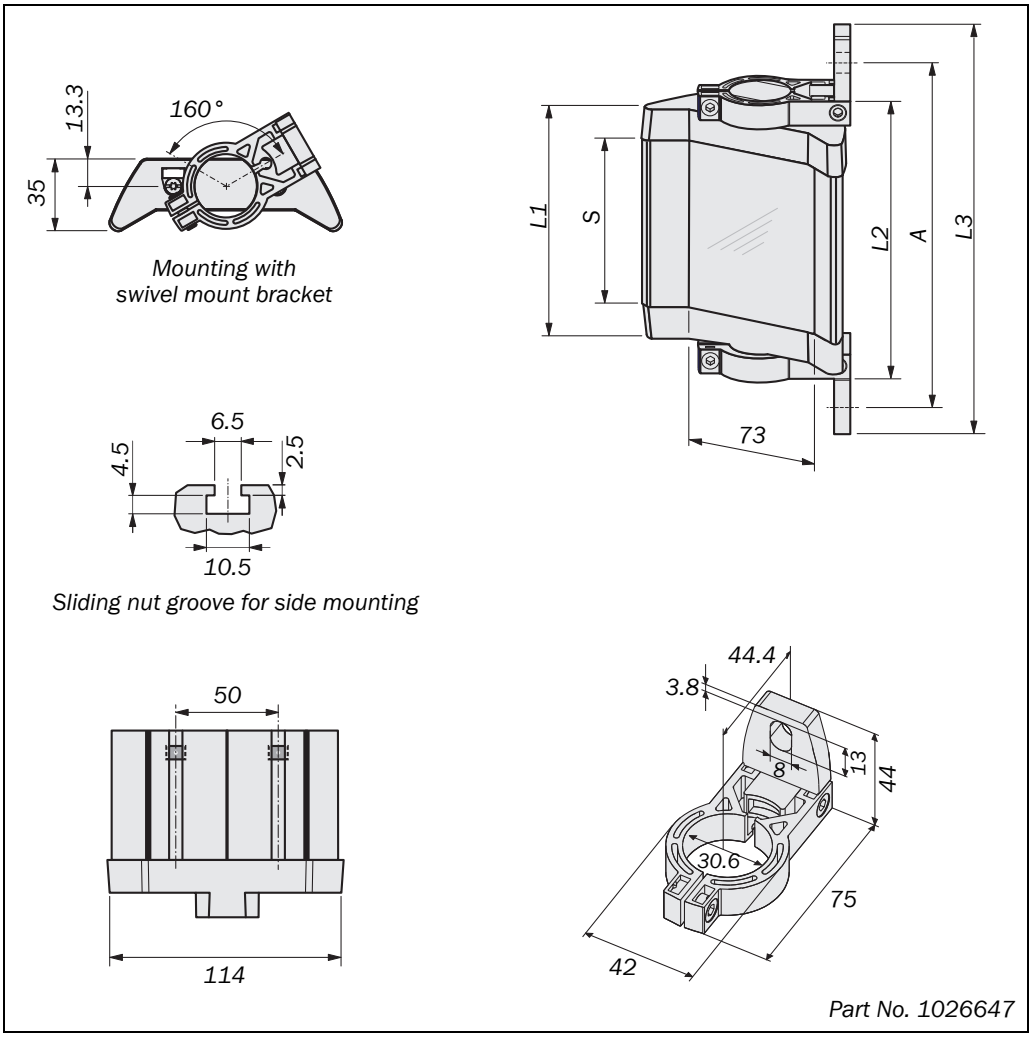
11.3.7 Pivoting mounting bracket

Fig. 54: Dimensional drawing pivoting mounting bracket (mm)



11.3.8 Deflector mirror PNS75-008

Fig. 55: Dimensional drawing deflector mirror PNS75-008 (mm)



Tab. 34: Dimensions of the deflector mirror PNS75-008

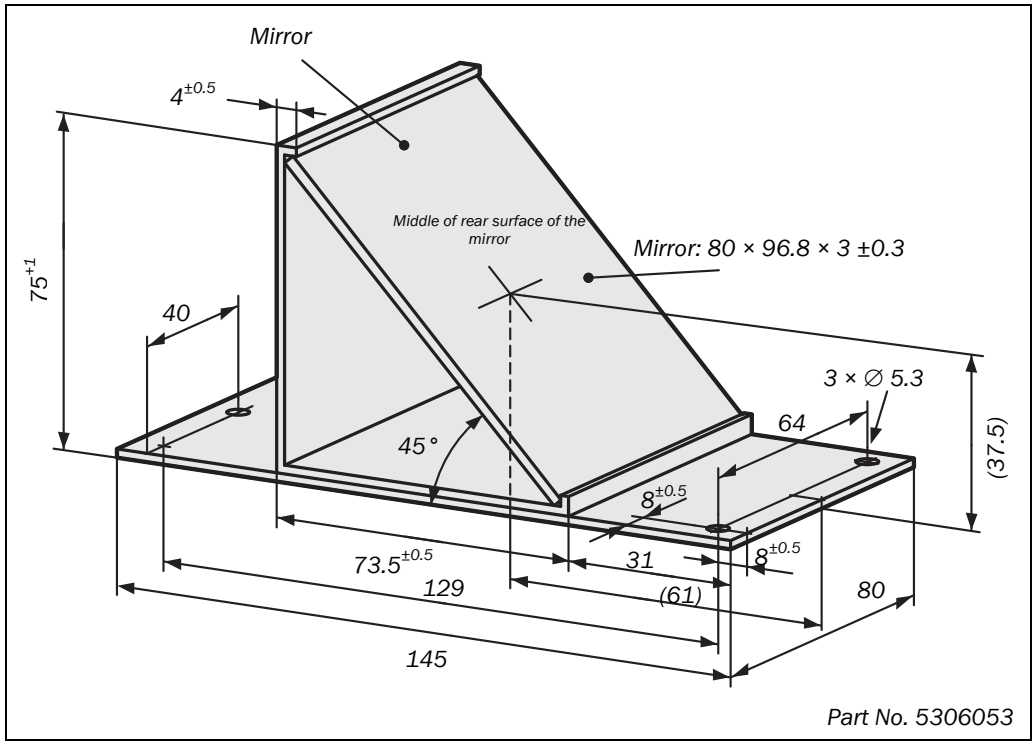
Mirror height S [mm]	Dimension L1 [mm]	Dimension L2 [mm]	Dimension L3 [mm]	Dimension A [mm]
80	112	136	200	180

Note

- When using deflector mirrors, the effective scanning range is reduced (see Tab. 7 on page 25).
- The formation of droplets of heavy contamination can be detrimental to the reflection behaviour. Take the necessary organisational measures to avoid the formation of droplets on the deflector mirrors.
- The mounting kit is included in the delivery of the deflector mirror PNS75-008.

11.3.9 Deflector mirror PSK45

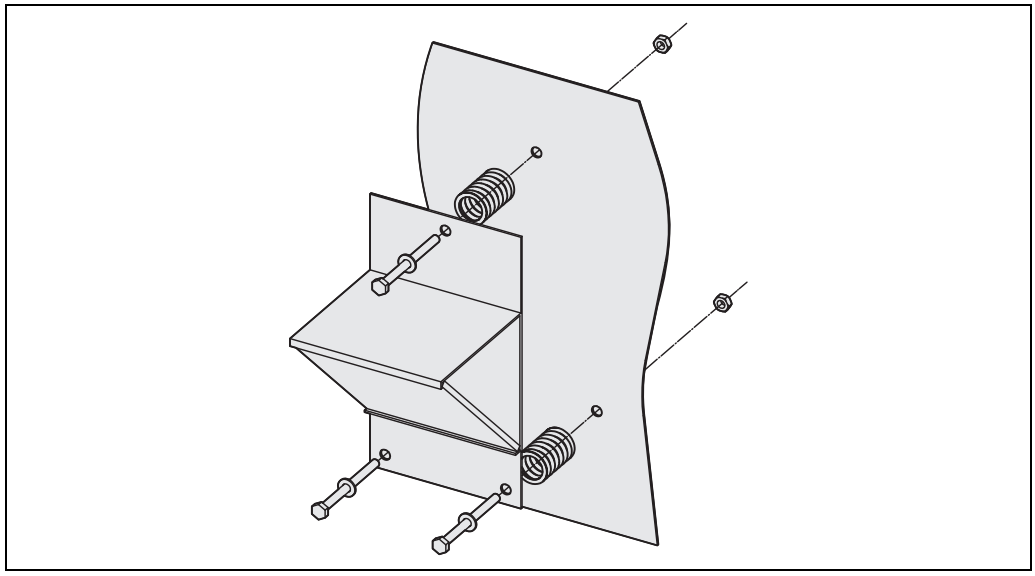
Fig. 56: Dimensional drawing deflector mirror PSK45 (mm)



Notes

- If you use a two-beam M4000 Advanced A/P, then you can use two PSK45 deflector mirrors instead of the M4000 Passive.
- The deflector mirror PSK45 is not suitable for column mounting.
- When using deflector mirrors, the effective scanning range is reduced (see Tab. 9 on page 26).
- The formation of droplets of heavy contamination can be detrimental to the reflection behaviour. Take the necessary organisational measures to avoid the formation of droplets on the deflector mirrors.

Fig. 57: Mounting of the deflector mirror PSK45



12 Ordering information

12.1 M4000 Advanced

12.1.1 Delivery

Tab. 35: Delivery M4000 Advanced

Sender	Receiver
• sender unit • 4 sliding nuts for side bracket	• receiver unit • 4 sliding nuts for side bracket • label “Important Information” • operating instructions on CD-ROM • CDS (Configuration & Diagnostic Software) on CD-ROM

12.1.2 Type code

M4000 Advanced with M26 Hirschmann plug and M12 × 5 socket[23)]

Tab. 36: Type codes M4000 Advanced with M26 plug

Number of beams	Beam separation [mm]	Type code Sender	Type code Receiver
2	500	M40S-025003AA0	M40E-025003RB0
	600	M40S-026003AA0	M40E-026003RB0
3	220	M40S-032203AA0	M40E-032203RB0
	400	M40S-034003AA0	M40E-034003RB0
	450	M40S-034503AA0	M40E-034503RB0
4	220	M40S-042203AA0	M40E-042203RB0
	300	M40S-043003AA0	M40E-043003RB0
5	220	M40S-052203AA0	M40E-052203RB0
6		M40S-062203AA0	M40E-062203RB0
7		M40S-072203AA0	M40E-072203RB0
8		M40S-082203AA0	M40E-082203RB0

[23)] Receiver only: extension connection for UE403.

M4000 Advanced with M26 Hirschmann plug, M12 × 5 socket[24] and integrated alignment aid

Tab. 37: Type codes M4000 Advanced with M26 plug and integrated alignment aid

Number of beams	Beam separation [mm]	Type code Sender	Type code Receiver
2	500	M40S-025013AA0	M40E-025013RB0
	600	M40S-026013AA0	M40E-026013RB0
3	400	M40S-034013AA0	M40E-034013RB0
	450	M40S-034513AA0	M40E-034513RB0
4	300	M40S-043013AA0	M40E-043013RB0

M4000 Advanced with M26 Hirschmann plug, M12 × 5 socket[24] and end cap with integrated LED[25]

Tab. 38: Type codes M4000 Advanced with M26 plug and end cap with integrated LED

Number of beams	Beam separation [mm]	Type code Sender	Type code Receiver
2	500	M40S-025003AA0	M40E-025023RB0
	600	M40S-026003AA0	M40E-026023RB0
3	400	M40S-034003AA0	M40E-034023RB0
	450	M40S-034503AA0	M40E-034523RB0
4	300	M40S-043003AA0	M40E-043023RB0

M4000 Advanced with M26 Hirschmann plug, M12 × 5 socket[24], integrated alignment aid and end cap with integrated LED[25]

Tab. 39: Type codes M4000 Advanced with M26 plug, integrated alignment aid and end cap with integrated LED

Number of beams	Beam separation [mm]	Type code Sender	Type code Receiver
2	500	M40S-025013AA0	M40E-025033RB0
	600	M40S-026013AA0	M40E-026033RB0
3	400	M40S-034013AA0	M40E-034033RB0
	450	M40S-034513AA0	M40E-034533RB0
4	300	M40S-043013AA0	M40E-043033RB0

12.1.3 Default delivery status

Notes

- The pre-setting for the device configuration is termed the default delivery status. You can accept or change these pre-settings (see chapter 8 “Configuration” on page 64).
- The default delivery status is only applicable for the device types listed in chapter 12.1.2 “Type code” on page 90ff.

[24] Receiver only: extension connection for UE403.
[25] Receiver only.

Tab. 40: Default delivery status M4000 Advanced

Function	Configuration	
	Sender	Receiver
Beam coding	Non-coded	Non-coded
Sender test	Deactivated	–
Restart interlock	–	Internal
External device monitoring (EDM)	–	Activated
Scanning range	–	0.5-20 m
Application diagnostic output (ADO)	–	Contamination

12.2 M4000 Advanced A/P

12.2.1 Delivery

Tab. 41: Delivery M4000 Advanced A/P

M4000 Advanced A/P	M4000 Passive
• sender/receiver unit • 4 sliding nuts for side bracket • label “Important Information” • operating instructions on CD-ROM • CDS (Configuration & Diagnostic Software) on CD-ROM	• deflector unit • 4 sliding nuts for side bracket

12.2.2 Type code

M4000 Advanced A/P with M26 Hirschmann plug and M12 × 5 socket[26)]

Tab. 42: Type codes M4000 Advanced A/P with M26 plug

Number of beams	Beam separation [mm]	Type code	Part number	Type code
		M4000 Advanced A/P	M4000 Passive	
2	500	M40Z-025003RB0	1027906	PSD01-1501[27)]
		M40Z-025003TB0	1027907	PSD01-2501[28)]
4	300	M40Z-043003TB0	1027908	PSD02-2301[28)]

[26)] Receiver only: extension connection for UE403.
[27)] With mirror deflection (max. effective scanning range 7.5 m).
[28)] With fibre-optic deflection (max. effective scanning range 4.5 m).

M4000 Advanced A/P with M26 Hirschmann plug, M12 × 5 socket[29] and end cap with integrated LED[30]

Tab. 43: Type codes M4000 Advanced A/P with M26 plug and end cap with integrated LED

Number of beams	Beam separation [mm]	Type code	Part number	Type code
		⇨ ⇦ M4000 Advanced A/P	M4000 Passive	
2	500	M40Z-025023RB0	1027906	PSD01-1501[31]
		M40Z-025023TB0	1027907	PSD01-2501[32]
4	300	M40Z-043023TB0	1027908	PSD02-2301[32]

12.2.3 Default delivery status

Notes
- The pre-setting for the device configuration is termed the default delivery status. You can accept or change these pre-settings (see chapter 8 “Configuration” on page 64).
- The default delivery status is only applicable for the device types listed in chapter 12.2.2 “Type code” on page 92ff.

Tab. 44: Default delivery status M4000 Advanced A/P

Function	Configuration ⇨ ⇦ M4000 Advanced A/P
Beam coding	Non-coded
Restart interlock	Internal
External device monitoring (EDM)	Activated
Scanning range	Preconfigured depending on type
Application diagnostic output (ADO)	Contamination

12.3 M4000 Area 60/80

12.3.1 Delivery

Tab. 45: Delivery M4000 Area 60/80

⇨ Sender	⇦ Receiver
• sender unit • 4 sliding nuts for side bracket	• receiver unit • 4 sliding nuts for side bracket • label “Important Information” • operating instructions on CD-ROM • CDS (Configuration & Diagnostic Software) on CD-ROM

[29] Receiver only: extension connection for UE403.
[30] Receiver only.
[31] With mirror deflection (max. effective scanning range 7.5 m).
[32] With fibre-optic deflection (max. effective scanning range 4.5 m).

12.3.2 Type code

M4000 Area 60
with M26 Hirschmann plug

Tab. 46: Type codes M4000 Area 60 with M26 plug

Length of the monitored area [mm]	Type code	Type code
	Sender	Receiver
300	M40S-60A005AA0	M40E-60A005RA0
450	M40S-61A005AA0	M40E-61A005RA0
600	M40S-62A005AA0	M40E-62A005RA0
750	M40S-63A005AA0	M40E-63A005RA0
900	M40S-64A005AA0	M40E-64A005RA0
1050	M40S-65A005AA0	M40E-65A005RA0
1200	M40S-66A005AA0	M40E-66A005RA0
1350	M40S-67A005AA0	M40E-67A005RA0
1500	M40S-68A005AA0	M40E-68A005RA0
1650	M40S-69A005AA0	M40E-69A005RA0
1800	M40S-70A005AA0	M40E-70A005RA0

M4000 Area 80
with M26 Hirschmann plug

Tab. 47: Type codes M4000 Area 80 with M26 plug

Length of the monitored area [mm]	Type code	Type code
	Sender	Receiver
600	M40S-62A105AA0	M40E-62A105RA0
750	M40S-63A105AA0	M40E-63A105RA0
900	M40S-64A105AA0	M40E-64A105RA0
1050	M40S-65A105AA0	M40E-65A105RA0
1200	M40S-66A105AA0	M40E-66A105RA0
1350	M40S-67A105AA0	M40E-67A105RA0
1500	M40S-68A105AA0	M40E-68A105RA0
1650	M40S-69A105AA0	M40E-69A105RA0
1800	M40S-70A105AA0	M40E-70A105RA0

12.3.3 Default delivery status

Notes

- The pre-setting for the device configuration is termed the default delivery status. You can accept or change these pre-settings (see chapter 8 “Configuration” on page 64).
- The default delivery status is only applicable for the device types listed in chapter 12.3.2 “Type code” on page 94ff.

Tab. 48: Default delivery status M4000 Area 60/80

Function	Configuration	
	Sender	Receiver
Beam coding	Non-coded	Non-coded
Sender test	Deactivated	–
Restart interlock	–	Internal
External device monitoring (EDM)	–	Activated
Scanning range M4000 Area 60 M4000 Area 80	 – –	 0.5-6 m 0.5-20 m
Application diagnostic output (ADO)	–	Contamination

12.4 Additional front screen (weld spark guard)

Tab. 49: Part numbers additional front screens for M4000

Description	Part number
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0250#####	2033225
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0260#####	2033226
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0322#####	2033227
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0340#####	2033228
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0345#####, M40#-0430#####	2033229
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0422#####	2033230
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0522#####	2033231
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0622#####	2033232
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0722#####	2033233

Description	Part number
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-0822#####	2033234
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-60#######	2033235
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-61#######	2033236
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-62#######	2033237
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-63#######	2033238
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-64#######	2033239
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-65#######	2033240
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-66#######	2033241
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-67#######	2033242
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-68#######	2033243
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-69#######	2033244
Additional front screen for M4000, including sliding nuts and fixing screws, 2 pieces, suitable for: M40#-70#######	2033245

Notes

- The additional front screens are bolted directly to the mounting groove on the M4000 using the sliding nuts and fixing screws.
- Each additional front screen fits both on the sender and on the receiver.
- An additional front screen reduces the scanning range of the system by 8%. If sender and receiver each use an additional front screen, the scanning range will be reduced by 16%.

12.5 Deflector mirrors and mirror columns

Tab. 50: Part numbers deflector mirrors and mirror columns

Description	Part number
Deflector mirror PNS75-008, including mounting kit	1026647
Deflector mirror PSK45, including mounting kit, not suitable for column mounting	5306053
Mirror column, fully assembled with mirrors Suitable for M40#-0250#####, 2-beam, 500 mm beam separation	1027199
Mirror column, fully assembled with mirrors Suitable for M40#-0260#####, 2-beam, 600 mm beam separation	1027290
Mirror column, fully assembled with mirrors Suitable for M40#-0340#####, 3-beam, 400 mm beam separation	1027289
Mirror column, fully assembled with mirrors Suitable for M40#-0345#####, 3-beam, 450 mm beam separation	1027288
Mirror column, fully assembled with mirrors Suitable for M40#-0430#####, 4-beam, 300 mm beam separation	1027291
Mirror column, fully assembled with mirrors (45°) Suitable for M40Z-02500#### and M40Z-02501####, 2-beam, 500 mm beam separation	1027265
Adjusting plate Suitable for mirror and device columns	4031053

Note Mirror columns affect the scanning range of the system. On this subject see section 4.4 “Scanning range” on page 24ff.

12.6 Device columns

Tab. 51: Part numbers device columns

Description	Part number
Device column with front plate, incl. mounting kit Suitable for M40#-02500#### and M40#-02501####, 2-beam, 500 mm beam separation	2031438
Device column with front plate, incl. mounting kit Suitable for M40E-02502#### and M40E-02503####, 2-beam, 500 mm beam separation	2032467
Device column with front plate, incl. mounting kit Suitable for M40#-02600#### and M40#-02601####, 2-beam, 600 mm beam separation	2032969
Device column with front plate, incl. mounting kit Suitable for M40#-02602#### and M40#-02603####, 2-beam, 600 mm beam separation	2032970
Device column with front plate, incl. mounting kit Suitable for M40#-03400#### and M40#-03401####, 3-beam, 400 mm beam separation	2032465
Device column with front plate, incl. mounting kit Suitable for M40E-03402#### and M40E-03403####, 3-beam, 400 mm beam separation	2032468
Device column with front plate, incl. mounting kit Suitable for M40#-04300#### and M40#-04301####, 4-beam, 300 mm beam separation	2032466
Device column with front plate, incl. mounting kit Suitable for M40E-04302#### and M40E-04303####, 4-beam, 300 mm beam separation	2032469
Device column with front screen, incl. mounting kit Suitable for M4000 with max. device length (incl. connection cable) of 1200 mm	2018608
Device column with front screen, incl. mounting kit Suitable for M4000 with max. device length (incl. connecting cable) 1500 mm	2031232
Device column with front screen, incl. mounting kit Suitable for M4000 with max. device length (incl. connecting cable) 1700 mm	2018767
Adjusting plate Suitable for mirror and device columns	4031053
Mounting bracket UE403 for device column For fastening to base plate, including screw	2032035

12.7 Accessories

Tab. 52: Part numbers accessories

Part	Part number
Mounting kits	
Mounting kit 1: mounting bracket rigid, 4 pcs.	7021352
Mounting kit 2: mounting bracket pivoting, 4 pcs.	2017751

Part	Part number
Mounting kit 6: side bracket pivoting, 4 pcs.	2019506
Mounting kit 12: swivel-mount bracket, pivoting, 4 pcs	2030510
M4000 system connection	
Hirschmann cable socket M26 × 11 + FE, crimp contacts, straight	6020757
Hirschmann cable socket M26 × 11 + FE, crimp contacts, angled	6020758
Terminal with 182 Ω resistance for pin 9 and 10 on the system connection (see page 45)	2027227
Connecting cable for M4000 with Hirschmann cable socket M26 × 11 + FE:	
Socket straight, stripped, 2.5 m	2022544
Socket straight, stripped, 5 m	2022545
Socket straight, stripped, 7.5 m	2022546
Socket straight, stripped, 10 m	2022547
Socket straight, stripped, 15 m	2022548
Socket straight, stripped, 20 m	2022549
Socket straight, stripped, 30 m	2022550
M4000 extension connection	
Connection cable for M4000 Advanced with 5-pin M12 plug and UE403	
Wire cross-section 0.34 mm², 5-pin M12 plug, 5-pin M12 socket, PUR halogen-free	
Plug straight/socket straight, 0.6 m	6025930
Plug straight/socket straight, 1.0 m	6029280
Plug straight/socket straight, 1.5 m	6029281
Plug straight/socket straight, 2.0 m	6025931
Plug straight/socket straight, 5.0 m	6029282
Connection cable for PC	
For the connection between PC and M4000 or UE403	6021195
External laser alignment aid	
AR60	1015741
Adapter for M4000 housing	4040006
Accessories included in a standard delivery	
CDS (Configuration & Diagnostic Software) on CD-ROM incl. Online documentation and operating instructions in all available languages	2032314
Sliding nuts for mounting bracket/side bracket, 4 pcs	2017550
Alignment template for integrated laser alignment aid[33)]	4040263

[33)] Only with devices with integrated laser alignment aid.

13 Annex

13.1 Declaration of conformity

SICK

EC Declaration of conformity

en

Ident-No. : 9098179

The undersigned, representing the following manufacturer

SICK AG
Industrial Safety Systems
Sebastian-Kneipp-Straße 1
79183 Waldkirch
Germany

herewith declares that the product

M4000 Advanced

is in conformity with the provisions of the following EC directive(s) (including all applicable amendments), and that the standards and/or technical specifications referenced overleaf have been applied.

Waldkirch, 19.7.05

ppa. Dr. Plasberg
(Industrial Safety Systems)

i.V. Knobloch
(Industrial Safety Systems)

8006440.0499 BK I - 18868

Note You can obtain the complete EC declaration of conformity via the SICK homepage on the Internet at: www.sick.com

13.2 Manufacturer's checklist

SICK

Checklist for the manufacturer/installer for the installation of electro-sensitive protective equipment (ESPE)

Details about the points listed below must be present at least during initial commissioning — they are, however, dependent on the respective application, the specifications of which are to be controlled by the manufacturer/installer.

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

1.	Have the safety rules and regulations been observed in compliance with the directives/standards applicable to the machine?	Yes ☐	No ☐
2.	Are the applied directives and standards listed in the declaration of conformity?	Yes ☐	No ☐
3.	Does the protective device comply with the required category according to EN 954-1?	Yes ☐	No ☐
4.	Is access to the hazardous area/hazardous point only possible through the light path/the protective field of the ESPE?	Yes ☐	No ☐
5.	Have appropriate measures been taken to prevent (mechanical point-of-operation guarding) or monitor unprotected presence in the hazardous area when protecting a hazardous area/hazardous point and have these been secured against removal?	Yes ☐	No ☐
6.	Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching under, over or around the ESPE?	Yes ☐	No ☐
7.	Has the maximum stopping and/or stopping/run-down time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?	Yes ☐	No ☐
8.	Has the ESPE been mounted such that the required safety distance from the nearest hazardous point has been achieved?	Yes ☐	No ☐
9.	Are the ESPE devices correctly mounted and secured against manipulation after adjustment?	Yes ☐	No ☐
10.	Are the required protective measures against electric shock in effect (protection class)?	Yes ☐	No ☐
11.	Is the control switch for resetting the protective equipment (ESPE) or restarting the machine present and correctly installed?	Yes ☐	No ☐
12.	Are the outputs of the ESPE (OSSDs) integrated in compliance with the required category according to EN 954-1 and does the integration comply with the circuit diagrams?	Yes ☐	No ☐
13.	Has the protective function been checked in compliance with the test notes of this documentation?	Yes ☐	No ☐
14.	Are the given protective functions effective at every setting of the operating mode selector switch?	Yes ☐	No ☐
15.	Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?	Yes ☐	No ☐
16.	Is the ESPE effective over the entire period of the dangerous state?	Yes ☐	No ☐
17.	Is a dangerous state halted when the ESPE is switched on or off, the operating modes are changed over, or when switching over to another protective device?	Yes ☐	No ☐
18.	Has the information label for the daily check been attached so that it is easily visible for the operator?	Yes ☐	No ☐

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

13.3 Alignment templates

For the alignment of the M4000 Advanced with integrated laser alignment aid you need two alignment templates:

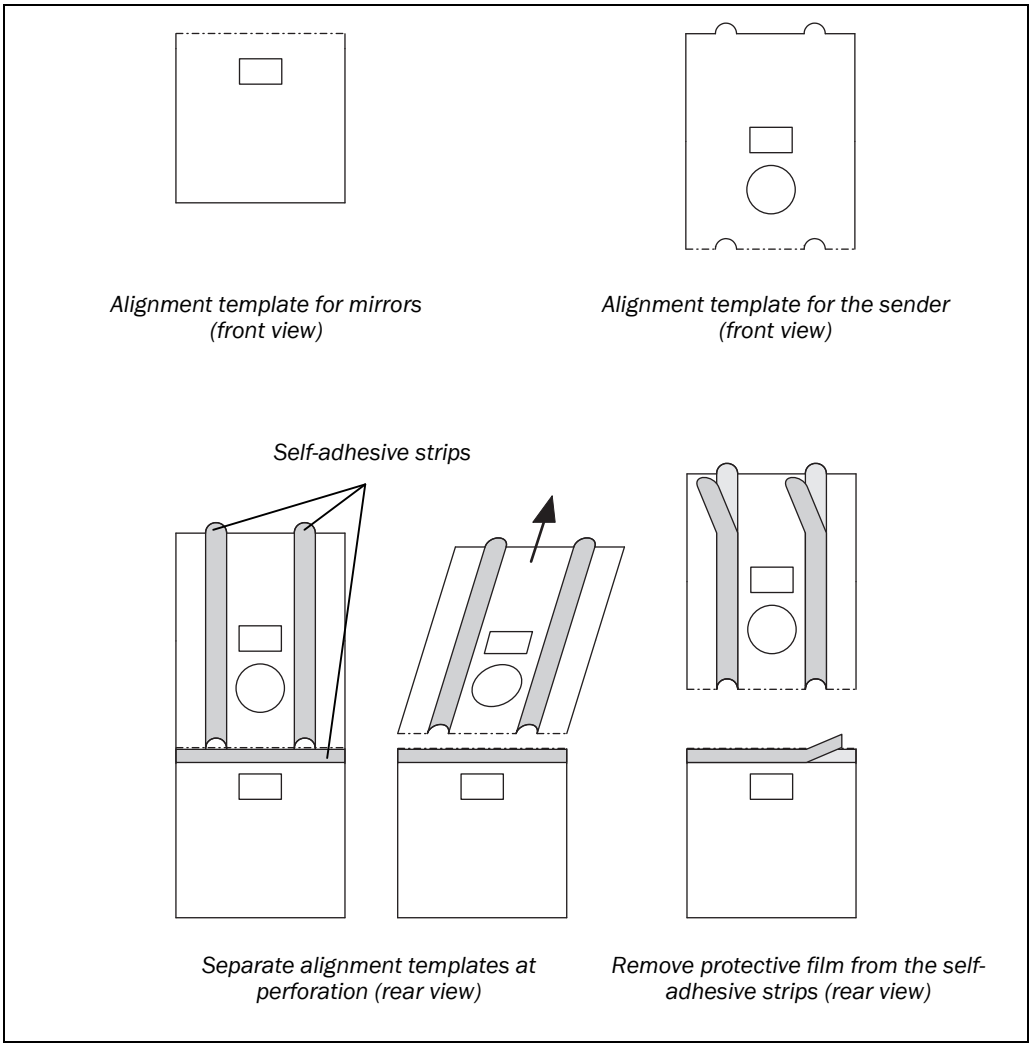
- alignment template for mirrors
- alignment template for the sender

Note The alignment templates are in the delivery of the M4000 receiver[34]. If you no longer have the alignment templates supplied, you can make new templates using the master for copying on the next page.

➢ Separate the alignment templates along the perforated line.

➢ Pull the protective film off the self-adhesive strips on the rear of the alignment templates.

Fig. 58: Illustration of the alignment templates

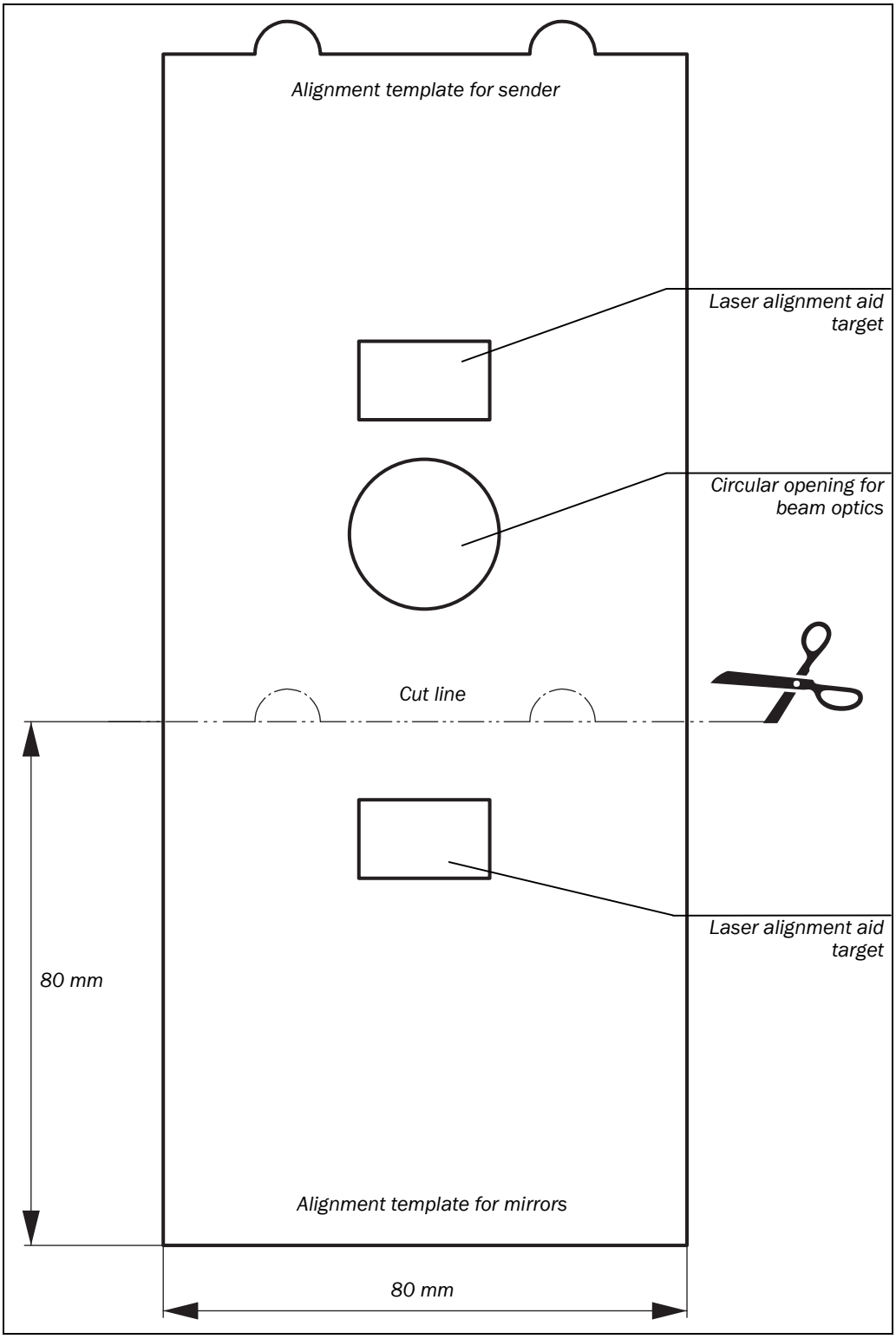


[34] Only with devices with integrated laser alignment aid.

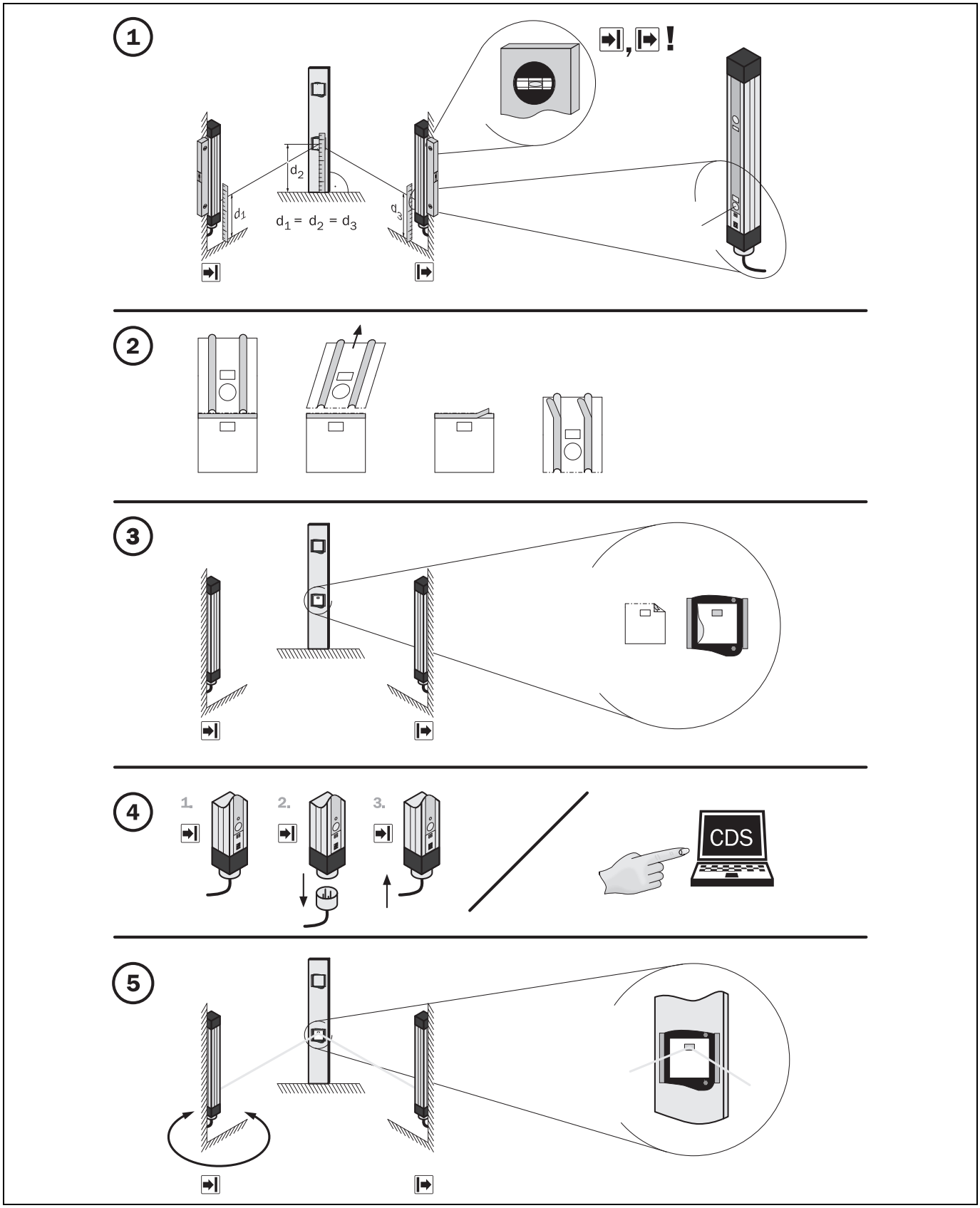
How to make the alignment templates:

- Copy this page.
- Cut the copied template along the edge and at the line marked.
- Cut out the two targets on the laser alignment aid and the circular opening for the beam optics.

Fig. 59: Alignment templates copying master



13.4 Alignment instructions



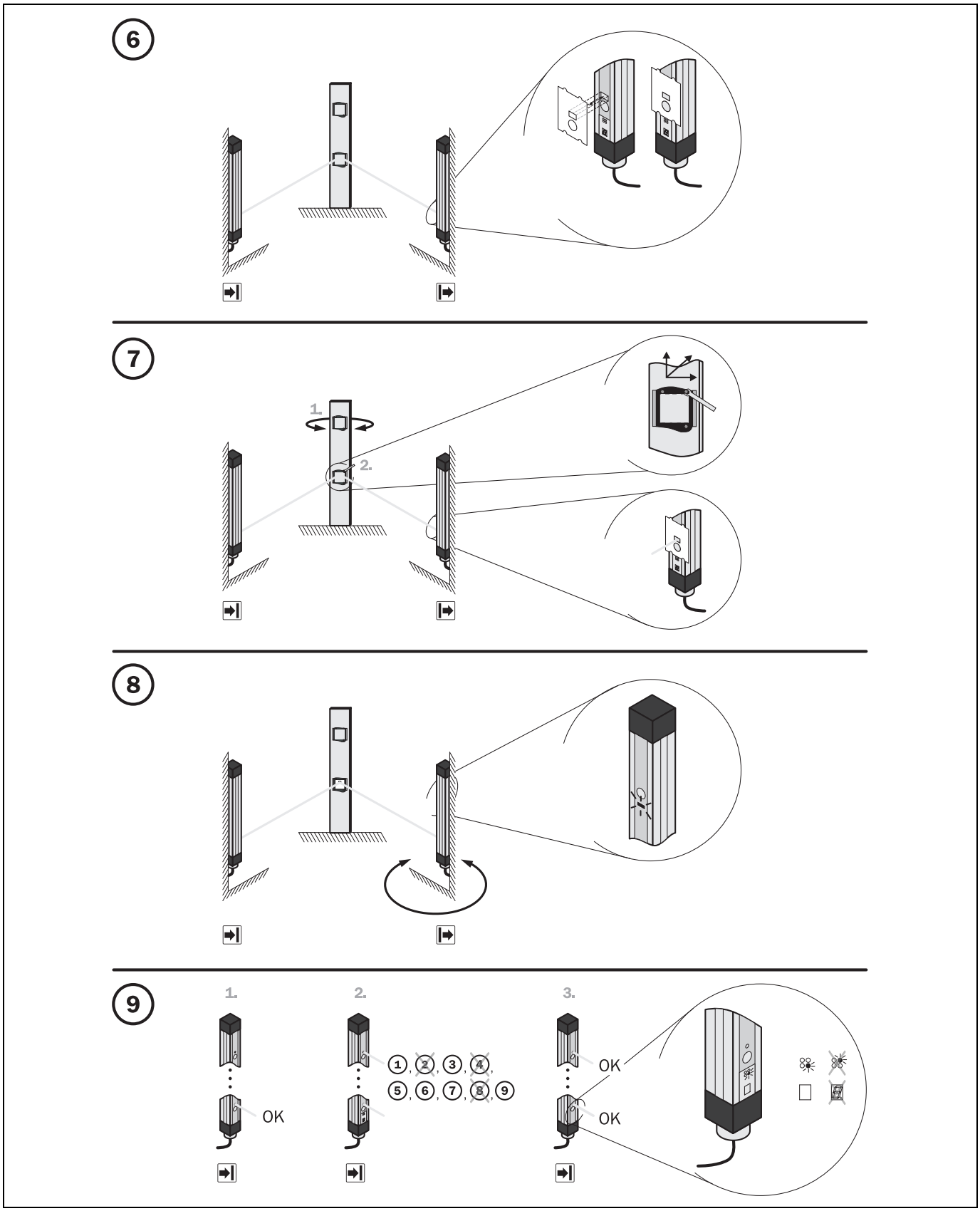


Fig. 60: Alignment instructions copying master

13.5 List of tables

13.6 List of illustrations

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