

# The C 4000 has arrived! The new FGS with even more possibilities.

**C 4000, the new generation of FGS Safety Light Curtains: increased performance with many new functions.**

### Achieve complete safety economically.

Protect personnel from danger and reduce accidents on machinery and plant, optimise and improve the cost-effectiveness of work processes: C 4000 provides the solution.

The C 4000, used in a vertical or horizontal position, can be employed wherever hazardous points-of-operation and danger areas require safeguarding.



## Safety that can be integrated anywhere, rapidly.

**Easy integration and fast communication reduce costs.**

### The system for all safety requirements.

Regardless of the hazardous point-of-operation or danger area involved, the C 4000 Safety Light Curtain provides a cost-effective and individual solution anywhere.

### Small dimensions, great opportunities.

This optically and electronically optimised system takes up little space. It offers small profile cross-sections with protective field heights of between 300 and 1800 mm. The system is self-monitoring and complies to EN 61496 Parts 1 + 2 (Type 4 ESPE).

### Reduced MTTR periods.

The C 4000 significantly reduces your MTTR periods from standstill to restart.

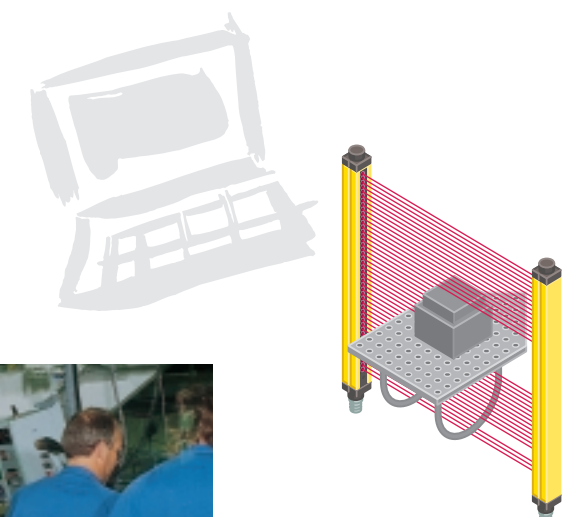
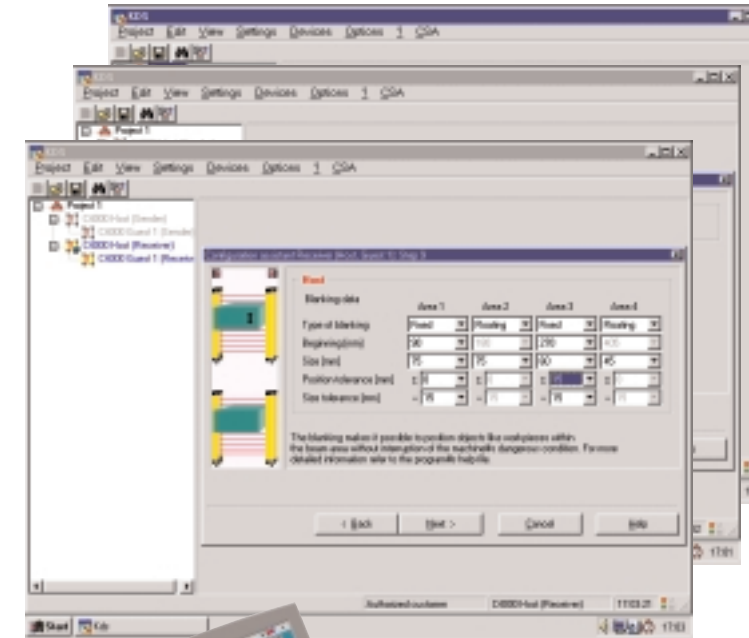
### 7-segment display.

With reliable information on all the device's operating states.

## Plan your safe future with the C 4000.

### Decentralised safety management.

Integrated functions such as EDM or blanking of defined field sections support your decentralised safety management system and keep cabling costs to a minimum.



Blanking out a defined field section to allow for material supply.

### Blanking.

Up to four fixed and floating fields can be blanked simultaneously (e.g. for material transport).

### Coded version.

The modulated light source prevents mutual interference between devices mounted in rows.

### THE C 4000 IN OVERVIEW

- Type 4 acc. to EN 61496 (self-monitoring)
- 14/20/30/40 mm resolution
- 7 ms response time (dependent on no. of beams)
- Beam coding (2 addresses programmable)
- Alignment aid and diagnosis using 7-segment display
- RS-232 interface
- Cascadable-up to 3 systems
  - cable length between sensors max. 4 m
  - parameters individually set for each sensor
- Housing dimensions: 38.5 x 47.0 mm

### Host-guest cascading.

Simple host-guest cascading with up to 3 systems.

### Online diagnosis.

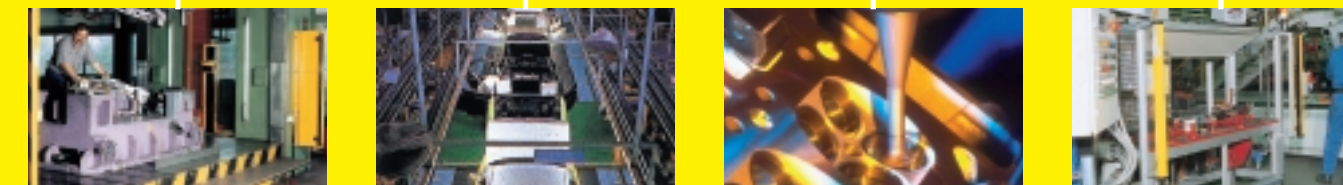
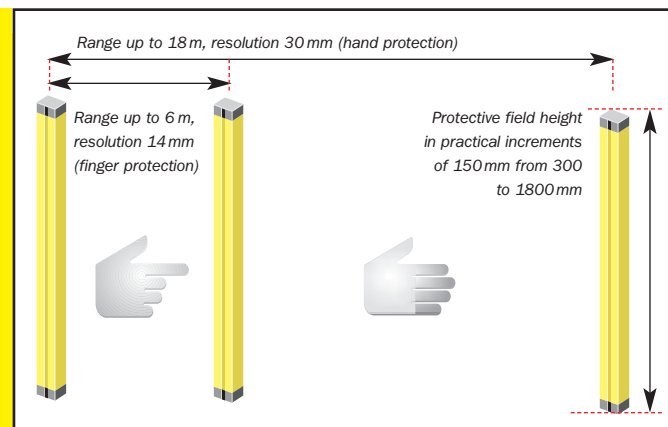
Breakdowns or error messages can rapidly and reliably be detected and evaluated on the C 4000.

### Standardised interfaces.

Via standardised interfaces OSSD and RS 232 the system allows a simple and quick integration into control systems.

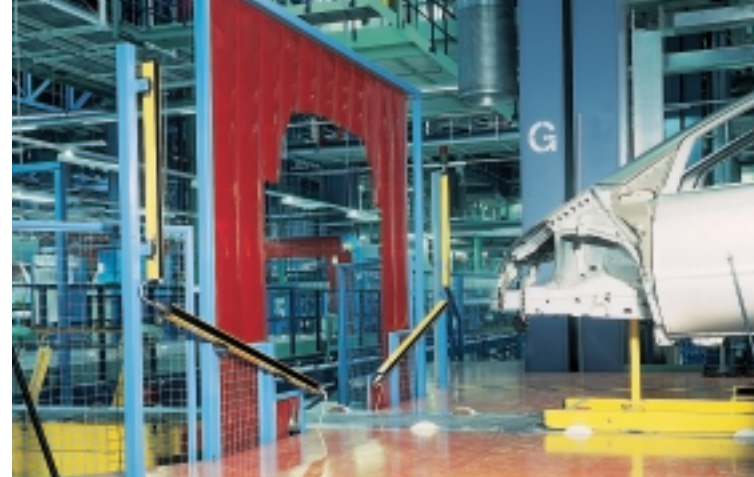
### Quick and simple programming with only a mouse-click.

Easily adaptable to your application via PC or laptop: the comprehensive user interface makes the setting of parameters child's play.





C 4000 not the end,  
but the beginning of  
your safety.



**C 4000. An overview of the advantages:**

- **Simple system integration** via standardised interfaces
- **Easy communication** with control systems
- **Diagnosis** through online assessment of device status
- **Cost-effective through reduced MTTR** i.e. substantially reduced machine standstill times
- **Decentralised safety management** through integrated EDM, blanking and reset

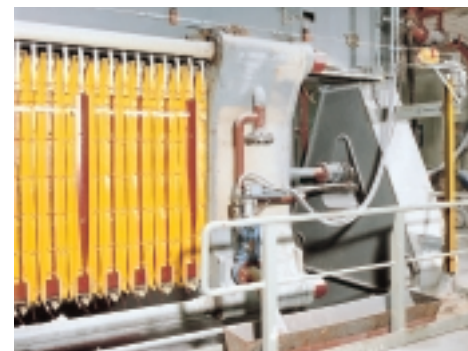
**A global player in sensor technology.**

Our subsidiaries and agencies provide us with a worldwide presence that allows us to be better placed to handle customers' requirements. SICK's consulting engineers work closely with customers and users on site to come up with solutions that are both economical and effective. The company, with production sites in Germany, Italy, Hungary, the USA, and Japan, has more

than 50 years' sensor experience. SICK is one of the world's leading sensor manufacturers with 2000 employees in more than 20 countries. SICK is involved in major projects in almost all sectors of industry – not only as a supplier of components, but also as an experienced systems partner.

More information for  
downloading at:  
[www.C4000.com](http://www.C4000.com)

- **Technical Description**
- **Connection diagrams**
- **Examples of applications**



F a x R e p l y

Interested? Copy, Fill In and Fax Back.

Company

Name

Position/  
Department

Address

Post code/  
Town

Phone/Fax

Industry/Field  
of application

Yes, I would like to know more about the new C 4000 Safety Light Curtain.

I am interested in a detailed consultation with one of your project advisors. Please arrange an appointment with me.

More information and Technical Description from: [www.C4000.com](http://www.C4000.com)

Your contacts:

**Australia**  
Phone +61 3 94 97 41 00  
0 08 33 48 02 – toll free  
Fax +61 3 94 97 11 87

**Austria**  
Phone +43 2 23 66 22 88-0  
Fax +43 2 23 66 22 88-5

**Belgium/Luxembourg**  
Phone +32 24 66 55 66  
Fax +32 24 63 35 07

**Brazil**  
Phone +55 11 55 61 26 83  
Fax +55 11 53 41 53

**China/Hong Kong**  
Phone +852 27 63 69 66  
Fax +852 27 63 63 11

**Czech Republic**  
Phone +42 02 57 91 18 50  
+42 02 57 81 05 61  
Fax +42 02 57 81 05 59

**Denmark**  
Phone +45 45 82 64 00  
Fax +45 45 82 64 01

**Finland**  
Phone +358 9 728 85 00  
Fax +358 9 72 88 50 55

**France**  
Phone +33 1 64 62 35 00  
Fax +33 1 64 62 35 77

**Germany**  
Phone +49 76 81 2 02-0  
Fax +49 76 81 2 02-38 15

**Great Britain**  
Phone +44 17 27 83 11 21  
Fax +44 17 27 85 67 67

**Italy**  
Phone +39 02 92 14 20 62  
Fax +39 02 92 14 20 67

**Japan**  
Phone +81 3 33 58-13 41  
Fax +81 3 33 58-05 86

**Netherlands**  
Phone +31 3 02 29 25 44  
Fax +31 3 02 29 39 94

**Norway**  
Phone +47 67 56 75 00  
Fax +47 67 56 66 10

**Poland**  
Phone +48 2 26 44-83 45  
Fax +48 2 26 44-83 42

**Singapore**  
Phone +65 744 37 32  
Fax +65 841 77 47

**Spain**  
Phone +34 9 34 80 31 00  
Fax +34 9 34 73 44 69

**Sweden**  
Phone +46 8 680 64 50  
Fax +46 8 710 18 75

**Switzerland**  
Phone +41 4 16 19 29 39  
Fax +41 4 16 19 29 21

**Taiwan**  
Phone +886 2 23 65 62 92  
Fax +886 2 23 68 73 97

**USA**  
Phone +1 (952) 941-6780  
Fax +1 (952) 941-9287

Branch offices and representatives in all major industrial countries.



**NEW**  
C 4000

PRODUCT INFORMATION

Optimising procedures,  
safeguarding hazardous  
points-of-operation.  
The C 4000 Safety Light Curtain.

**SICK**

SICK AG · Safety Systems · Sebastian-Kneipp-Straße 1 · D-79183 Waldkirch

8 009 219/09-00/MRH - FD - Printed in Germany - Subject to change without notice

**SICK**



**Safety Light Curtain  
C 4000**

**SICK**





## List of contents

<b>1</b>	<b>About this document</b>	<b>6</b>
1.1	Function of this document	6
1.2	Target group	6
1.3	Information depth	6
1.4	Abbreviations	7
1.5	Symbols used	7
<b>2</b>	<b>On safety</b>	<b>8</b>
2.1	Specialist personnel	8
2.2	Range of uses of the device	8
2.3	Proper use	8
2.4	General protective notes and protective measures	9
2.5	Protection of the environment	9
<b>3</b>	<b>Product description</b>	<b>10</b>
3.1	Special features	10
3.2	Mode of function of the device	10
3.2.1	Components of the device	10
3.2.2	The light curtain principle	11
3.2.3	Cascading	11
3.3	Examples of range of use	12
3.4	Configurable functions	12
3.4.1	Restart interlock	13
3.4.2	External device monitoring (EDM)	14
3.4.3	Beam coding	14
3.4.4	Scanning range	15
3.4.5	Fixed blanking	16
3.4.6	Floating blanking	17
3.4.7	Reduced resolution	19
3.5	Indicator elements	20
3.5.1	Operation status indicators of the sender	20
3.5.2	Indicator elements of the receiver	21
<b>4</b>	<b>Installation and mounting</b>	<b>22</b>
4.1	Determining the safety distance	22
4.1.1	Safety distance from the hazardous area	22
4.1.2	Minimum distance from reflecting surfaces	24
4.2	Steps for mounting the device	25
4.2.1	Mounting with swivel mount bracket	26
4.2.2	Mounting with side bracket	28
<b>5</b>	<b>Electrical installation</b>	<b>30</b>
5.1	System connection M26×11 + FE	30
5.2	Configuration connection M8×4 (serial interface)	31
5.3	Extension connection M26×11 + FE	32
5.4	External Device Monitoring (EDM)	33
5.5	Reset button/restart button	34

# List of contents

<b>6</b>	<b>Commissioning</b>	<b>35</b>
6.1	Display sequence during power-up	35
6.2	Aligning sender and receiver	35
6.3	Test notes	36
6.3.1	Tests before the first commissioning	36
6.3.2	Regular inspection of the protective device by qualified personnel	36
6.3.3	Daily function checks of the protective device	37
<b>7</b>	<b>Configuration</b>	<b>38</b>
7.1	Delivery status	38
7.2	Preparing the configuration	38
<b>8</b>	<b>Care and maintenance</b>	<b>39</b>
<b>9</b>	<b>Fault diagnosis</b>	<b>40</b>
9.1	What to do in case of faults	40
9.2	SICK Support	40
9.3	Error displays of the LEDs	40
9.4	Error displays of the 7-segment display	41
9.5	Extended diagnosis	42
<b>10</b>	<b>Technical specifications</b>	<b>43</b>
10.1	Data sheet	43
10.2	Response time	45
10.3	Table of weights	47
10.4	Dimensional drawings	48
10.4.1	Standard system (not cascable)	48
10.4.2	Cascable system	49
10.4.3	Swivel mount bracket	50
10.4.4	Side mounting	50
10.4.5	Deflector mirror	51
<b>11</b>	<b>Ordering information</b>	<b>52</b>
11.1	Delivery	52
11.2	Standard system	53
11.2.1	Standard system without function package	53
11.2.2	Standard system with function package B	54
11.3	Cascable system	55
11.3.1	Cascable system without function package	55
11.3.2	Cascable system with function package B	56
11.4	Additional front screen (welding spark guard)	56
11.5	Deflector mirror	57
11.5.1	Deflector mirror PNS 80 for protective field width 0 ... 4 m (total)	57
11.5.2	Deflector mirror PNS 120 for protective field width 4 ... 15 m (total)	57
11.6	Accessories	58
<b>12</b>	<b>Annex</b>	<b>59</b>
12.1	Declaration of conformity	59
12.2	Checklist for the manufacturer	60
12.3	List of tables	61
12.4	List of illustrations	62

## 1 About this document

Please read this chapter carefully before working with this documentation and the C 4000.

### 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, parameterisation, electrical installation, commissioning, operation and maintenance of the Safety Light Curtain C 4000.

These operating instructions do *not* provide instructions for operating machines in which the safety light curtain is, or will be, integrated. Information on these items is found in the appropriate operating instructions of the machine.

### 1.2 Target group

These operating instructions addresses *planning engineers, developers and the operators* of plants and systems which are to be secured by one or several safety light curtains C 4000. It also addresses persons who integrate the C 4000 into a machine, initialize its use, or who are in charge of servicing and maintaining the unit.

### 1.3 Information depth

These operating instructions contain information on:

- Installation and mounting
- Electrical installation
- Commissioning and parameterisation
- Care and maintenance
- Fault and error diagnosis and troubleshooting
- Part numbers
- Conformity and approval

of the safety light curtain C 4000.

Planning and using safety devices such as the C 4000 also require specific technical skills which are not conveyed in this documentation.

When operating the C 4000, the national, local and statutory rules and regulations must be observed.

General information on health and safety at work and accident prevention using opto-electronic safety devices is found in the brochure "Safe machinery with opto-electronic protection".

**Note** We also refer you to the C 4000 homepage in the Internet at

[www.c4000.com](http://www.c4000.com)

Here you will find information on:

- Sample applications
- A list of frequently asked questions on the C 4000
- These operating instructions in different languages for viewing and printing



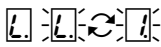
## 1.4 Abbreviations

<b>ESPE</b>	Electro-sensitive protective equipment (e.g. C 4000)
<b>CDS</b>	SICK Configuration & Diagnostic Software = software for the configuration of your safety light curtain C 4000
<b>EDM</b>	External device monitoring
<b>OSSD</b>	Output signal switching device

## 1.5 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 indicators show the status of the 7-segment display of sender or receiver:

Constant display of the letter F

Flashing display of the letter F

Alternating display of F and 2



LED symbols denote a flashing LED (upright orientation, 7-segment display, bottom)

➤ Take action ...

Instructions for taking action are shown by an arrow. Carefully read and follow the instructions for action.



WARNING

### Warning notice!

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

Carefully read and follow the warning notices!



Software notes show the location in the CDS (Configuration & Diagnosis Software) where you can make the appropriate settings and adjustments. Go to the menu **View, Dialogue windows** of the CDS and activate the item **File cards** to view the named dialogue fields as needed. Alternatively, the Software Assistant will guide you through the appropriate setting.



### 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 current carrying parts
- 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 C 4000 or with the machine protected by the C 4000.

### 2.1 Specialist personnel

The safety light curtain C 4000 must be installed, commissioned and serviced only by specialist personnel. Specialist personnel is 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 currently valid safety guidelines
- and
- who have access to these operating instructions

### 2.2 Range of uses of the device

The safety light curtain C 4000 is an electro-sensitive protective equipment (ESPE). The physical resolution is 14, 20, 30 or 40 mm with a maximum protective field width of 19 meters (resolution 20 mm and higher). The realisable protective field height is between 300 and 1,800 mm.

The device is a *Type 4 ESPE* as defined by IEC 61496-1 and -2 and is therefore allowed for use with controls in safety category 4 in compliance with EN 954. The device is suitable for

- Hazardous point protection (finger and hand protection)
- Hazardous area protection
- Access protection

Access to the hazardous area must be allowed only through the protective field. The plant/system is not allowed to start as long as personnel are within the hazardous area. Refer to chapter 3.3 “Examples of range of use” on page 12 for an illustration of the protection modes.

Depending on the application, mechanical protection devices may be required in addition to the safety light curtain.

**Note** The safety light curtain C 4000 operates as standalone system, comprising a sender and receiver, or in combination with other cascable C 4000 systems. This means that the protective field can be adapted to suit individual safety requirements.

### 2.3 Proper use

The safety light curtain C 4000 must be used only as defined in the chapter 2.2 “Range of uses of the device”. It must be used only by qualified personnel and only on the machine where it has been installed and initialized by qualified personnel.

If the device is used for any other purposes or modified in any way – also during mounting and installation – any warranty claim against SICK AG shall become void.

## 2.4 General protective notes and protective measures



### Safety notes

Please observe the following items in order to ensure the proper and safe use of the safety light curtain C 4000.

- The national/international rules and regulations apply to the installation, use and recurring technical inspections of the safety light curtain, in particular:
  - Machine Directive 98/37 EG
  - Equipment Usage Directive 89/655 EWG
  - the work safety regulations/safety rules
  - other relevant health and safety regulations

Manufacturers and users of the machine by which the safety light curtain 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 36) of these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- The tests must be carried out by specialist personnel or specially qualified and authorized 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 user of the machine where the safety light curtain C 4000 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 device must be capable of buffering brief mains failures of 20 ms as specified in EN 60204. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).

## 2.5 Protection of the environment

The safety light curtain C 4000 has been designed to minimize environmental impact. It uses only a minimum of power and natural resources.

At work, always act in an environmentally responsible manner. For this reason please note the following information on disposal.

### Disposal

- Always dispose of unserviceable or irreparable units in compliance with local/national rules and regulations with respect to waste disposal.
- Remove the plastic panel and dispose of the aluminium housing of the light curtain as recyclable waste.
- Dispose all electronic assemblies as special or hazardous waste. The electronic assemblies are easy to dismantle.

**Note** SICK AG will not accept unserviceable or irreparable units returned to the company.

## 3 Product description

This chapter provides information on the special feature and properties of the safety light curtain C 4000. It describes the structure and the mode of function of the unit, in particular the different operating modes.

➤ Please read this chapter before mounting, installing and commissioning the unit.

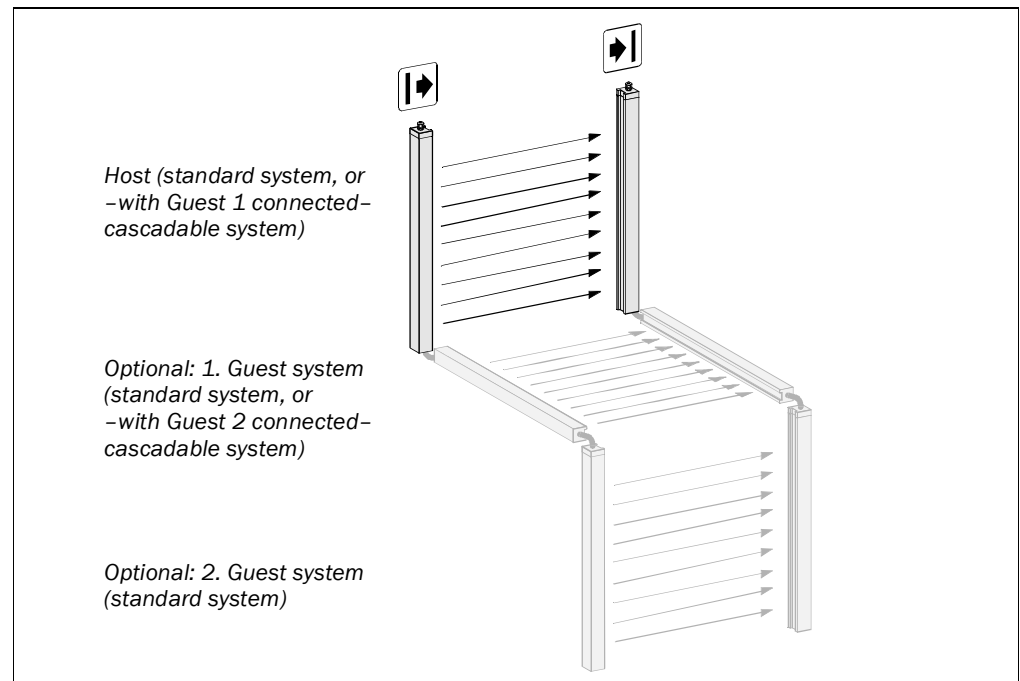
### 3.1 Special features

- Protective operation, optionally with internal or external machine-integrated restart interlock
- Connecting options for the reset button
- External device monitoring (EDM)
- Beam coding
- Status display with 7-segment display
- Optional: Function package B
  - Blanking several areas
  - Blanking with tolerance of up to 2 beams
  - Floating blanking
  - Reduced resolution
  - Monitoring the blanked area

### 3.2 Mode of function of the device

#### 3.2.1 Components of the device

Fig. 1: Components of the C 4000



Please refer to chapter 10 “Technical specifications” on page 43 for the data sheet. Please refer to pages 48 ff. for the dimensional drawings.

## 3.2.2 The light curtain principle

The safety light curtain C 4000 consists of a sender and a receiver (figure 1). Between these two units is the protective field, defined as the protective field height and the protective field width.

The construction size height determines the *height of the protective field* of the appropriate system. The upper and lower limit of the protective field is shown by markings on the profile sections.

The *width of the protective field* is derived from the length of the light path between sender and receiver and must not exceed the maximum rated width of the protective field (see "Technical specifications" on page 43).

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

The C 4000 is modular in structure. All optical and electronic components and assemblies are housed in a slim and torsionally rigid housing.

## 3.2.3 Cascading

To provide an effective point-of-operation guard, a maximum of three C 4000 can be connected in series for cascading configuration. The device connected to the control cabinet is the main sensor, called *Host*. The subsequent sensors are called *Guests* (cf. figure 1 on page 10).

### Benefits of cascading

- No additional external circuitry required
- Resolution and protective field height may differ among the individual systems

### Limits of cascading

- The maximum protective field width must be guaranteed for each individual system!
- The maximum total number of beams must be 480 beams in non-coded operation, and a maximum of 405 beams in coded operation.
- The maximum cable length between two cascaded systems must not exceed 3 meters.



## 3.3 Examples of range of use

Fig. 2 (left): Securing dangerous points with a safety light curtain C 4000

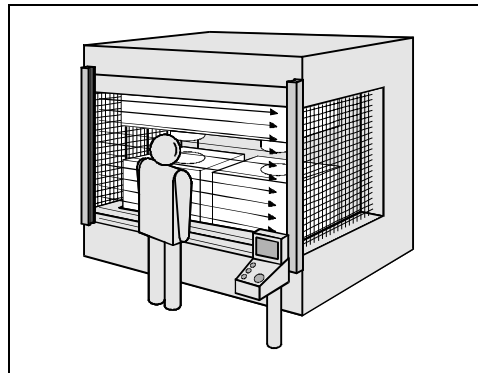


Fig. 3 (right): Securing dangerous areas with a safety light curtain C 4000

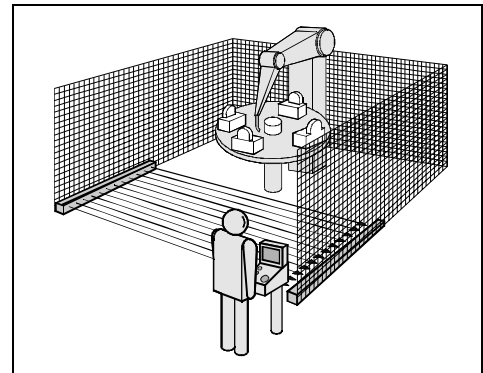
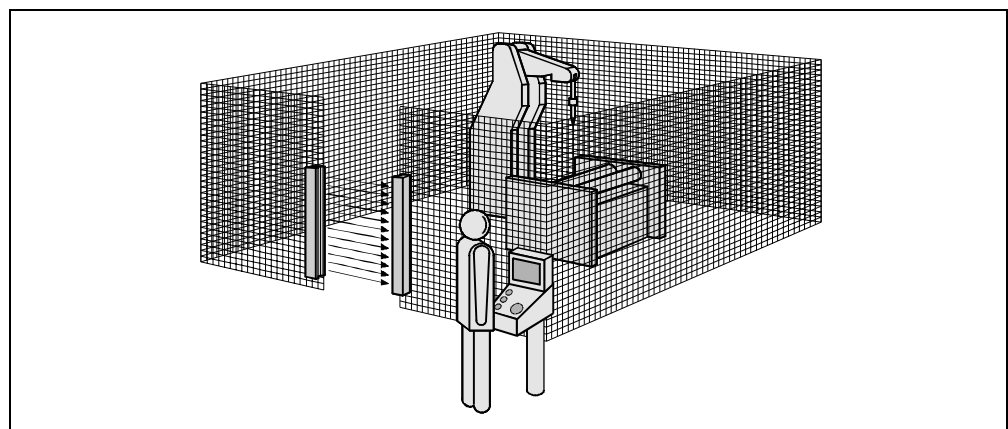


Fig. 4: Access guarding using a safety light curtain C 4000



The safety light curtain C 4000 operates as a proper protective device only if the following conditions are met:

- The control of the machine must be electrical.
- The dangerous state of the machine must be transferable at any time into a safe state.
- Sender and receiver unit must be so mounted that objects penetrating the hazardous area are safely identified by the C 4000.
- The restart button must be fitted outside the hazardous area such that it cannot be operated by a person working inside the hazardous area.
- The statutory and local rules and regulations must be observed when installing and using the device.

## 3.4 Configurable functions

This chapter describes the functions of the safety light curtain C 4000 selectable via software. Some of the functions can be combined.



### Test the protective device after any changes!

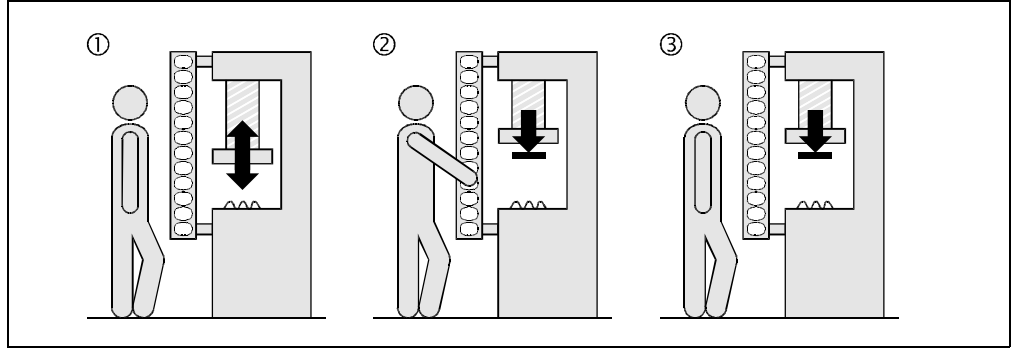
The entire protective device must be tested for proper operation after each change of the configuration (see 6.3 on page 36).



When starting to configure the device, you may save an application name with a maximum of 22 characters. Use this function as a “memory jogger”, e.g. to describe the application of the current device configuration.

3.4.1 Restart interlock

Fig. 5: Outline drawing of the protective operation



The dangerous state of the machine (①) is interrupted if the light curtain (②) is disrupted and will not be reinstated (③) until the user actuates the restart button.

The restart interlock can be implemented in two different ways:

- With the internal restart interlock of the C 4000:  
The C 4000 controls the restart.
- With the restart interlock of the machine:  
The C 4000 has no control over the restart.

The possible combinations are shown in the following table:

Tab. 1: Permissible configuration of the restart interlock

Restart interlock of the C 4000	Restart interlock of the machine	Permissible application
deactivated	deactivated	Only if the light curtain cannot be stood behind. Observe EN 60204-1!
deactivated	activated	All
activated	deactivated	Only if the light curtain cannot be stood behind. Observe EN 60204-1!
activated	activated	All. Restart interlock of the C 4000 handles the reset function (see below).



**Always configure the C 4000 with restart interlock!**

The C 4000 is unable to verify if the restart interlock of the machine is connected. If you deactivate both the C 4000 and the machine-internal restart interlock, the users and operators of the machine will be at an acute risk of injury.

The electrical connection of the restart button is described in the chapter “Reset button/restart button” on page 34.



Device symbol **C 4000 receiver**, context menu **Configuration draft**, **Edit**, file card **General**, option **Restart interlock**.

**Reset**

If you activate both the C 4000 and the machine-internal restart interlock, each restart interlock will have its own button designated to it.

When actuating the button for the internal restart interlock

- the C 4000 will reset its switch outputs
- the light curtain changes to green

The machine-internal restart interlock prevents the machine from restarting. This is why the button of the internal restart interlock only fulfills the reset function in this configuration and is called Reset Button.

After activating the reset button, the user must also press the restart button. If the reset button and the restart button are not pressed in this specified sequence, the dangerous status remains unchanged.



**Recommendation**

The reset button prevents the accidental and inadvertent operation of the restart button. The user must first acknowledge the dangerous state with the reset button.  
The electrical connection of the reset button is described in chapter “Reset button/restart button” on page 34.


### 3.4.2 External device monitoring (EDM)

The EDM function controls the contact elements (if used) activated by both of the device outputs (e.g. external contacts). The machine must be allowed to restart only if both contactors have been opened.

The C 4000 controls the contactors after every disruption of the light path and before the machine restart. The EDM can so identify if one of the contactors has fused, for instance. In this case

- the error message appears  (in the 7-segment display)
- the safety light curtain changes to red
- with the internal restart interlock activated, the safety light curtain signals by flashing yellow LED  “Reset required”

**Note**

If the system is unable to change to a safe operational state (e.g. after contactor failure), the system interlocks and shuts down completely (“Lock-out”). The 7-segment display will then show the error message .

The electrical connection of the EDM is described in chapter “System connection M26×11 + FE” on page 30.



Device symbol **C 4000 receiver**, context menu **Configuration draft, Edit**, file card **General**, option **EDM**

### 3.4.3 Beam coding

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



WARNING

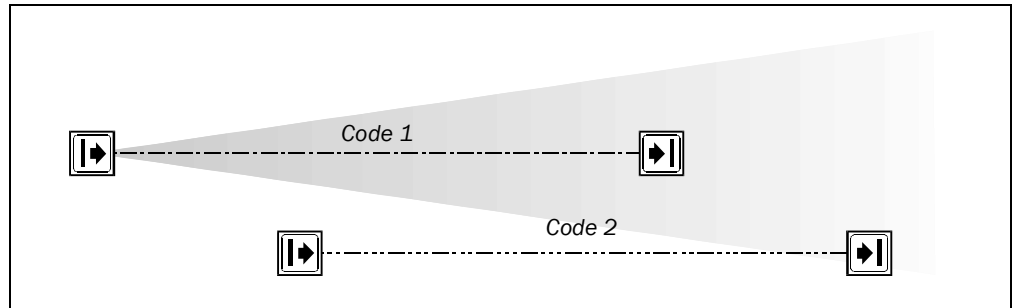
---

#### **Use different beam codings if the systems are located close to each other!**

Systems mounted in close proximity to each other must be operated with different beam codings (non-coded, 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 user/operator is at risk.

---

Fig. 6: Schematic layout 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 welding sparks and similar.
- In a cascaded system, host and guest can be operated only with the same beam coding.
- Beam coding will increase the response time of the system. This may also change the required safety distance. For details refer to chapter 4.1 “Determining the safety distance” on page 22.
- After activating the system, sender and receiver will briefly display the coding.
- If operated with beam coding, the number of beams in cascaded systems must not exceed 405 beams.



Device symbol **C 4000 receiver** or **sender**, context menu **Configuration draft, Edit**, file card **General**, option **Beam coding**.

### 3.4.4 Scanning range



**WARNING**

**Match the scanning range with the protective field width!**

The scanning range of the system (host, guest 1 and guest 2) must be adapted to the width of the protective field.

- If the scanning range is too small, the light curtain will not change to green.
- If the scanning range is too great, the light curtain may malfunction. This would mean that the user/operator is at risk.

**Note**

If you are using the additional front screen (see page 56) available as an accessory, the useful scanning range will be reduced by 8% for each additional front screen.

The available settings depend on the physical resolution of the system:

Tab. 2: Physical resolution and scanning range

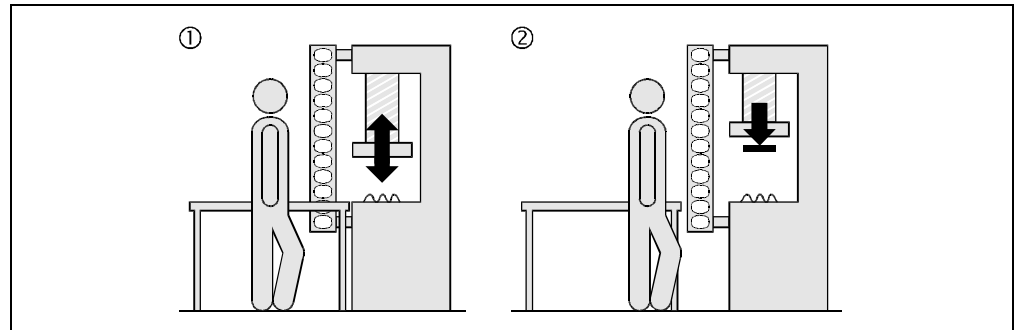
Physical resolution	Selectable scanning ranges	Scanning range with 1 additional front screen	Scanning range with 2 additional front screens
14 mm	0-2.5 m 2-6 m	0-2.3 m 1.8-5.5 m	0-2.1 m 1.7-5 m
20 mm, 30 mm, 40 mm	0-6 m 2.5-19 m	0-5.5 m 2.3-17.4 m	0-5 m 2.1-16 m



Device symbol **C 4000 receiver** or **sender**, context menu **Configuration draft, Edit**, file card **General**, option **Scanning range**.

## 3.4.5 Fixed blanking

Fig. 7: Schematic layout of the fixed blanking



The light curtain C 4000 is capable of fixed-blanking one or several adjacent beams, e.g. to allow continued operation in spite of an obstruction such as a table placed permanently in the light path.

The blanked area will no longer be part of the protective field. Blanked objects must therefore be permanently located inside the blanked area (①). As soon as the object is removed from the beam path, the light curtain will send a signal to disrupt the dangerous movement (②). Protection is otherwise no longer guaranteed.



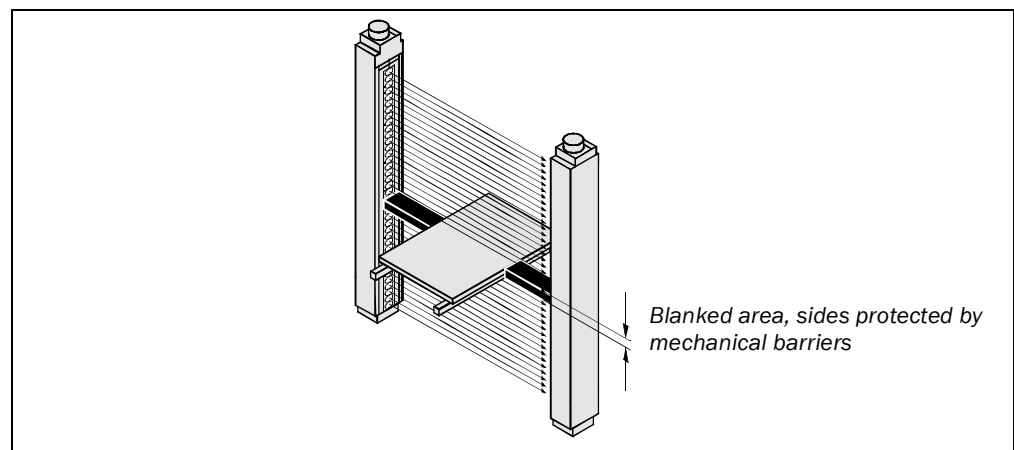
WARNING

### Completely protect the blanked area!

The object must cover the entire distance between sender and receiver.

- If necessary, protect the areas to the left and right of the object against intrusion by fitting mechanical barriers!

Fig. 8: Protecting a fixed blanking using mechanical barriers




- Also, make sure that the object can only be removed as a whole together with the barriers.
- After adapting the blanking, check the protective field with the test rod. Instructions are found in chapter 6.3.3 on page 37.



## Properties of fixed blanking

- The C 4000 is capable of blanking a total of four areas simultaneously. A minimum of one beam spacing must exist between two blanked areas.
- The first beam of the light curtain (close to the 7-segment display) must not be blanked. It is needed for the synchronisation between sender and receiver.
- For vibrating objects, you can select a position tolerance of the area of a maximum of  $\pm 2$  beams.
- In addition, you can define a size tolerance of  $-1$  beam.

## Notes

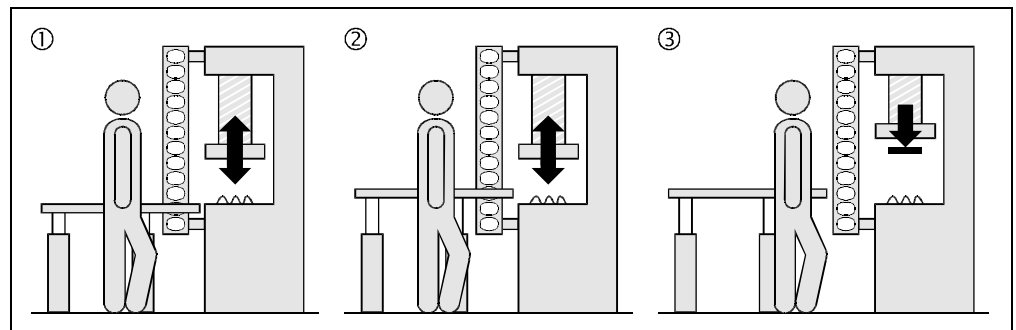
- If you configure a blanked area *without* position and *without* size tolerance, the movement of the object within the area is very limited before the light curtain changes to red.
- The maximum selectable tolerance values depend on the size of the blanked area: The actual tolerance expansion in millimetres differs. It depends on the physical resolution of the device.
- With fixed blanking, the 7-segment display indicates  as soon as sender and receiver are aligned.



Device symbol **C 4000 receiver**, context menu **Configuration draft, Edit**, file card **Blanking** of the appropriate system, **Type of blanking** = fixed. With the help of selection fields, the size of the area and the tolerance values (in millimetres) for size and position can be selected.

## 3.4.6 Floating blanking

Fig. 9: Schematic layout of the floating blanking



The light curtain C 4000 is capable of blanking an area of two or more adjacent beams (①). In contrast to fixed blanking, the blanked area is allowed to move (②) without the light curtain changing to red.

The blanked area will no longer be part of the protective field. Moving objects must therefore be permanently within the protective field (① and ②). As soon as the object is removed from the protective field, the light curtain will send a signal to disrupt the dangerous movement (③). Protection is otherwise no longer guaranteed.

## Properties of floating blanking

- The C 4000 is capable of blanking a total of four areas simultaneously.
- Fixed and floating blanking can be mixed.
- The size of the movable area must be at least equal to the effective resolution (see page 19 if you use reduced resolution).
- Areas of floating blanking must not be allowed to make contact or overlap during operation. The CDS (Configuration & Diagnostic Software) will check this automatically.

- The first beam of the light curtain (close to the 7-segment display) cannot be blanked. It is needed for the synchronisation between sender and receiver.
- Size tolerances of 1 or 2 beams may be selected for moving areas. In case of 2 beams (increased size tolerance), the effective resolution at the edges of the moving area will be reduced! For this reason the moving area must always be greater than the effective resolution at the edges of the area (see table 3).
- The size tolerance of 2 beams can be used only in devices with a physical resolution of 14 mm and 20 mm.

Tab. 3: Effective resolution in floating blanking with size tolerance

Physical resolution	Size tolerance	Effective resolution at the edges of the area with floating blanking
14 mm	1 beam	14 mm
	2 beams	22 mm
20 mm	1 beam	20 mm
	2 beams	30 mm
30 mm	1 beam	30 mm
	2 beams	Not possible
40 mm	1 beam	40 mm
	2 beams	Not possible



### Check the safety distance S!

In case of floating blanking *and* increased size tolerance (2 beams), the required safety distance S will depend on the *effective* resolution.

- If required, recalculate the safety distance and readjust it on the machine.

Example: – Physical resolution 14 mm  
 – Increased size tolerance (2 beams)  
 – Effective resolution 22 mm

Calculate the safety distance with a resolution of 22 mm.

- Mark the effective resolution on the notice label of sender and receiver.

Fig. 10: Marking the effective resolution on the device label

- Attention: In operation with „floating blanking“ and „increased size tolerance“, the safety distance in accordance with the changed resolution must be maintained.

Resolution changed to:  
(please mark)

	physical resolution	
	14 mm	20 mm
Increased size tolerance	effective resolution	
2 beams	22 mm	<input checked="" type="checkbox"/> 30 mm

4 03-4 160

**Note** With floating blanking, the 7-segment display indicates as soon as sender and receiver are aligned.

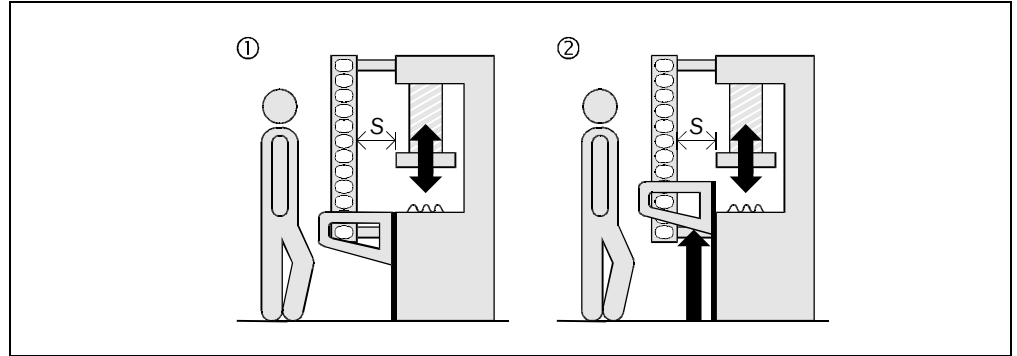


Device symbol **C 4000 receiver**, context menu **Configuration draft, Edit**, file card **Blanking** of the appropriate system **Type of blanking** = floating. With the help of the selection fields, the size of the area can be selected (in millimetres).

**3.4.7 Reduced resolution**

Under reduced resolution, the light curtain allows the disruption of 1, 2 or 3 adjacent beams. Objects which are not larger than specified in table 4 may be moved through the light curtain without the light curtain changing to red (Fig. 11, ① and ②).


Fig. 11: Schematic outline of the operation with reduced resolution (example: reduction by one beam)



Tab. 4: Effective resolution and maximum size of moving objects under reduced resolution

Physical resolution	Reduction	Effective resolution	Maximum size of movable objects
14 mm	1 beam	22 mm	10 mm
	2 beams	30 mm	18 mm
	3 beams	37 mm	25 mm
20 mm	1 beam	30 mm	14 mm
	2 beams	40 mm	24 mm
	3 beams	Not possible	—

**Notes**

- The function Reduced Resolution can be used only in devices with a physical resolution of 14 mm and 20 mm.
- The first beam of the light curtain (close to the 7-segment display) must not be interrupted. Otherwise, the safety light curtain will change to red.
- The system response time does not change under reduced resolution.
- With reduced resolution, the 7-segment display indicates  as soon as sender and receiver are aligned.



**Check the safety distance S!**

The safety distance S required under reduced resolution depends on the *effective resolution*.

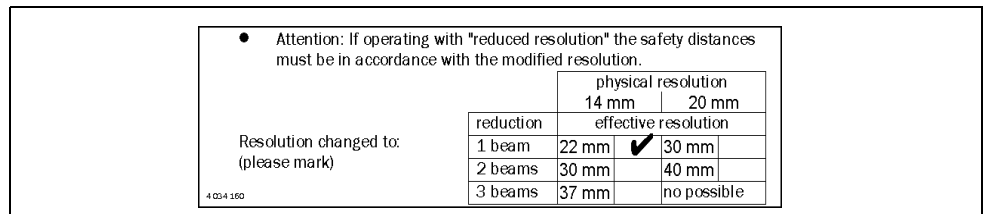
- If required, recalculate the safety distance and readjust it on the machine.

Example: – Physical resolution 14 mm  
 – Resolution reduced by 1 beam  
 – Effective resolution 22 mm

Calculate the safety distance with a resolution of 22 mm.

- Mark the effective resolution on the notice label of sender and receiver.

Fig. 12: Marking the effective resolution on the device label

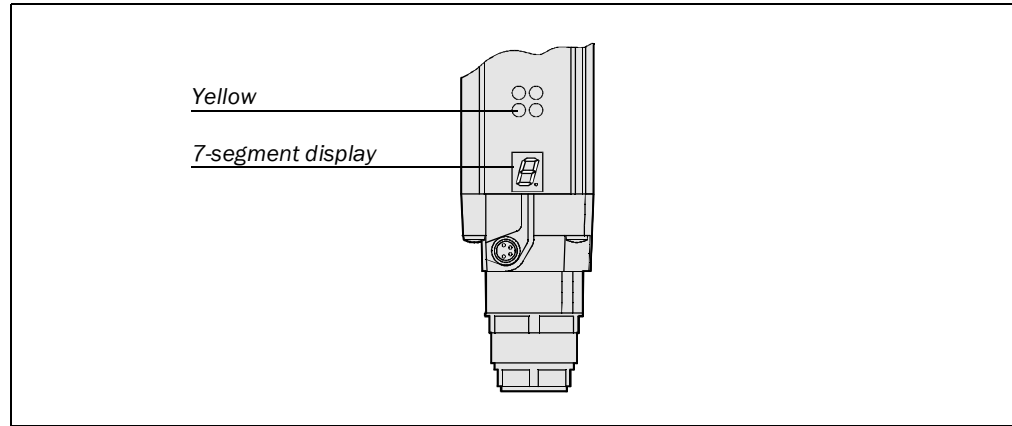


**3.5 Indicator elements**

The LEDs and the 7-segment display of sender and receiver signal the operating status of the C 4000.

**3.5.1 Operation status indicators of the sender**

Fig. 13: Indicator elements of the sender

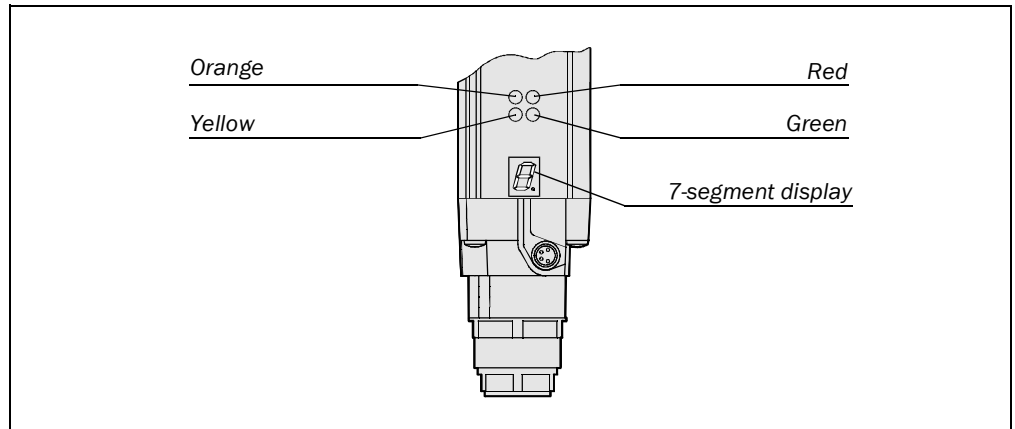


Tab. 5: Meaning of the operation indicator elements of the sender

Display	Meaning
	Yellow: Power supply OK
	System error. The device is defective. Replace the sender.
	The device is in the test mode.
	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 "Fault diagnosis" on page 40.

## 3.5.2 Indicator elements of the receiver

Fig. 14: Indicator elements of the receiver



Tab. 6: Meaning of the operation indicator elements of the receiver

Display	Meaning
	Orange: Cleaning or realignment required
	Yellow flashing: Reset required
	Red: System locks the machine
	Green: System enabled
	System error. The device is defective. Replace the receiver.
	Bad alignment to sender.
	Please refer to chapter "Commissioning" on page 35.
	Operation with wide protective field
	Operation with reduced resolution and/or blanking
	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 "Fault diagnosis" on page 40.



## 4 Installation and mounting

This chapter describes the preparation and completion of the installation of the safety light curtain C 4000. The installation and mounting requires two steps:

- Determining the necessary safety distance
- Installation with swivel mount or side brackets

The following steps are necessary after mounting and installation:

- Making the electrical connections (chapter 5)
- Aligning sender and receiver (chapter 6.2)
- Checking the installation (chapter 6.3)

### 4.1 Determining the safety distance

The light curtain must be mounted with proper safety distance

- from the point of danger
- from reflecting surfaces



---

#### **No protective function without adequate safety distance!**

The safe protective effect of the light curtain depends on the system being mounted with the correct safety distance from the point of danger.

---

#### **4.1.1 Safety distance from the hazardous area**

A safety distance must be maintained between the light curtain and the point of danger. This safety distance ensures that the point of danger can only be reached after the dangerous state of the machine has been removed.

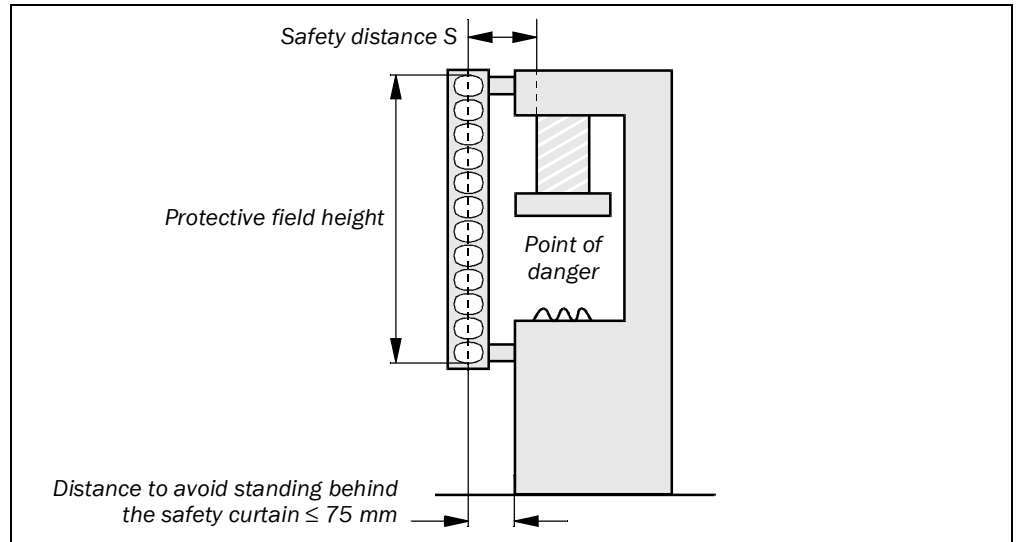
#### **The safety distance as defined in EN 999 and EN 294 depends on:**

- 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 entire protective device, e.g. C 4000 consisting of host and guest  
(response times, see chapter "Response time" on page 45)
- Reach or approach speed
- Resolution of the light curtain and/or beam distance

#### **The safety distance as specified by OSHA § 1910.217 and ANSI/RIA R 15.06 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 entire protective device, e.g. C 4000 consisting of host and guest  
(response times, see chapter "Response time" on page 45)
- Reach or approach speed

Fig. 15: Safety distance from the point of danger



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

- First, calculate S using the following formula:

$$S = 2000 \times T + 8 \times (d - 14) \text{ [mm]}$$

T = stopping/run-down time of the machine  
+ response time of the protective device [ms]

d = resolution of the light curtain [mm]

S = safety distance [mm]

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

- If the result S is  $\leq 500$  mm, then use the determined value as the safety distance.
- If the result S is  $> 500$  mm, then recalculate S as follows:  
 $S = 1600 \times T + 8 \times (d - 14) \text{ [mm]}$
- If the new value S is  $> 500$  mm, then use the newly determined value as the minimum safety distance.
- If the new value S is  $\leq 500$  mm, then use 500 mm as the safety distance.

### Example:

Stopping/run-down time of the machine = 290 ms

Response time = 30 ms

Resolution of the light curtain = 14 mm

$$T = 290 \text{ ms} + 30 \text{ ms} = 320 \text{ ms} = 0.32 \text{ s}$$

$$S = 2000 \times 0.32 + 8 \times (14 - 14) = 640 \text{ mm}$$

$S > 500$  mm, therefore:

$$S = 1600 \times 0.32 + 8 \times (14 - 14) = \underline{\underline{512 \text{ mm}}}$$

## How to calculate the safety distance S according to OSHA § 1910.217 and ANSI/RIA R 15.06:

- Calculate S using the following formula:

$$S = 63 \times T \text{ [in.]} \quad (1 \text{ inch} = 25.4 \text{ mm})$$

T = stopping/run-down time of the machine  
+ response time of the protective device [s]

S = safety distance [in.]

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

### Example:

Stopping/run-down time of the machine = 290 ms

Response time = 30 ms

Resolution of the light curtain = 14 mm

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

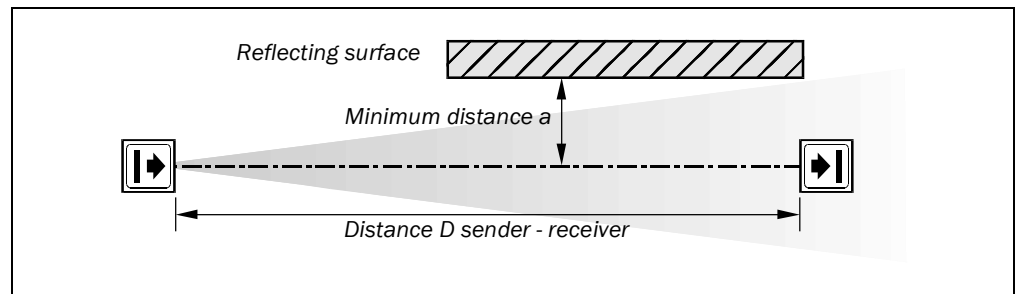
S = 63 × 0.32 = 20.16 in.

### 4.1.2 Minimum distance from reflecting surfaces

The light beams from the sender may be deflected by reflecting surfaces. This can result in failure to identify an object.

All reflecting surfaces and objects (e.g. material bins) must therefore be located at a minimum distance a from the protective field of the system. The minimum distance a depends on the distance D between sender and receiver.

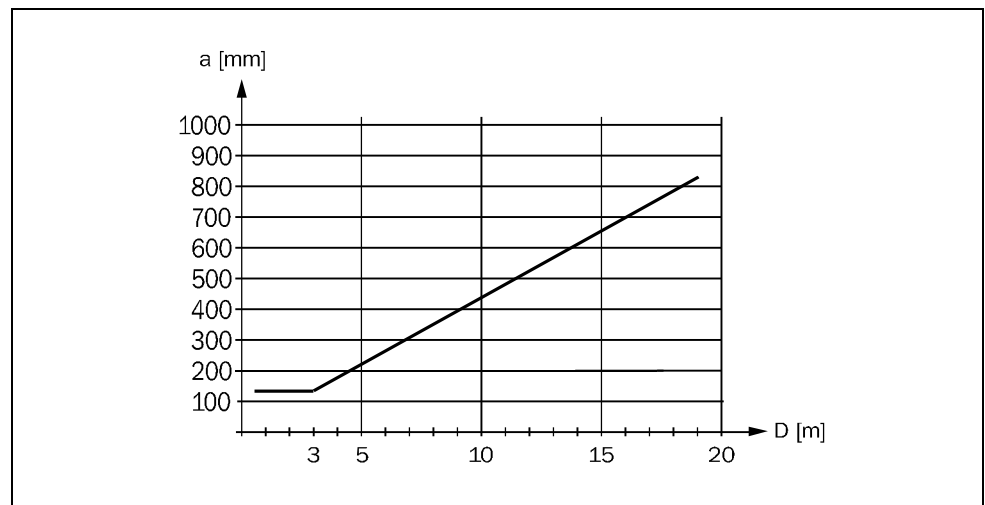
Fig. 16: Minimum distance from reflecting surfaces



### This is how you determine the minimum distance from the reflecting surfaces:

- Determine the distance D [m] sender - receiver
- Read the minimum distance a [mm] from the diagram:

Fig. 17: Diagram, minimum distance from reflecting surfaces



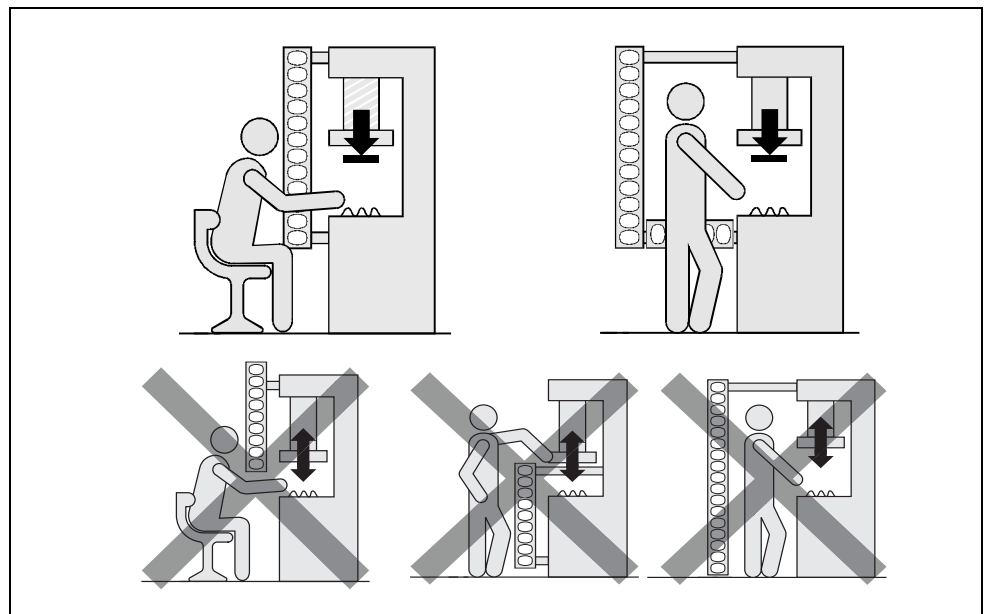
## 4.2 Steps for mounting the device



### Special features to note during mounting:

- Always mount the sender and receiver parallel to one another.
- During mounting, make sure 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 display elements must be mounted at the same height. The system plugs of both devices must point in the same direction.
- Observe the safety distance of the system during mounting. Refer to chapter “Determining the safety distance” on page 22.
- Connect a maximum of three systems into a cascaded system.
- Always connect sender-sender and receiver-receiver within a system configuration.
- Mount the safety light curtain such that the point of danger cannot be reached from below, above and behind the safety light curtain and that the light curtain cannot be shifted.

Fig. 18: The correct installation (above) must rule out the errors (below) reaching below, reaching above and reaching behind.



- Once the system is mounted, one or several of the enclosed self-adhesive safety labels must be affixed.
  - Use only labels in the language which the operators of the machine speak.
  - Affix the notice labels such that they are easily visible by the users/operators during operation. After attaching additional objects and equipment, the notice labels must not be concealed from view.
  - Affix the notice label “Important Notices” to the system immediately close to sender and receiver.
  - Operation with floating blanking: Affix the notice label for floating blanking to each sender or receiver so configured. Mark the effective resolution on the notice label.
  - For operation with reduced resolution: Affix the notice label for reduced resolution to each sender or receiver so configured. Mark the effective resolution on the notice label.

The senders and receivers can be mounted in two different ways:

- Mounting with swivel mount bracket
- Mounting with side bracket

## 4.2.1 Mounting with swivel mount bracket

The swivel mount bracket is made of black polyamide PA6. The bracket is designed such that sender and receiver can still be accurately aligned even after the bracket has been mounted.

- Note** ➤ Attach the bolts 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. 19: Composition of the swivel mount bracket

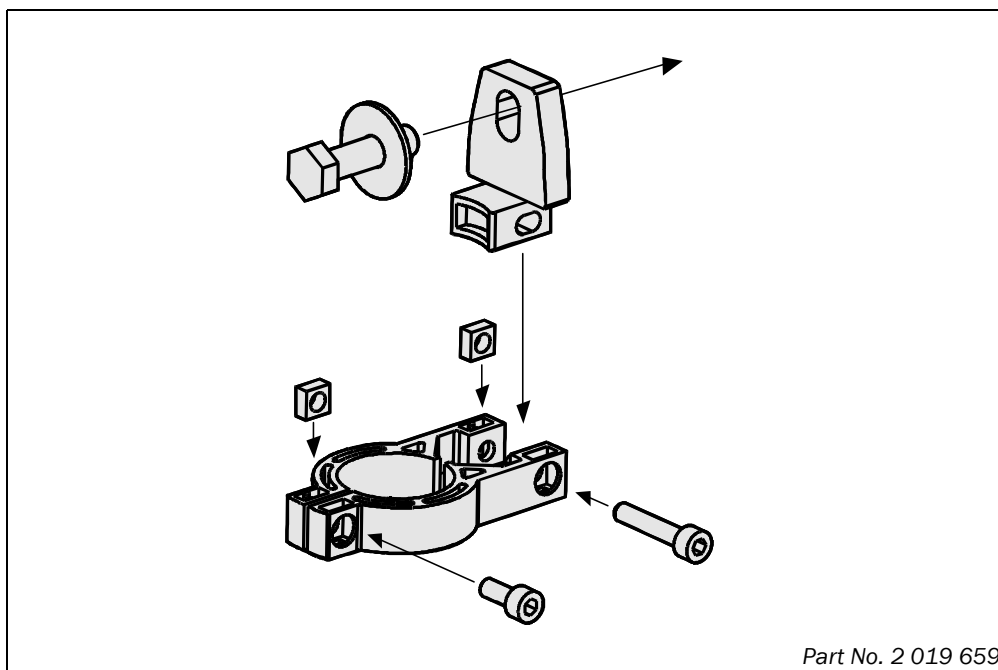
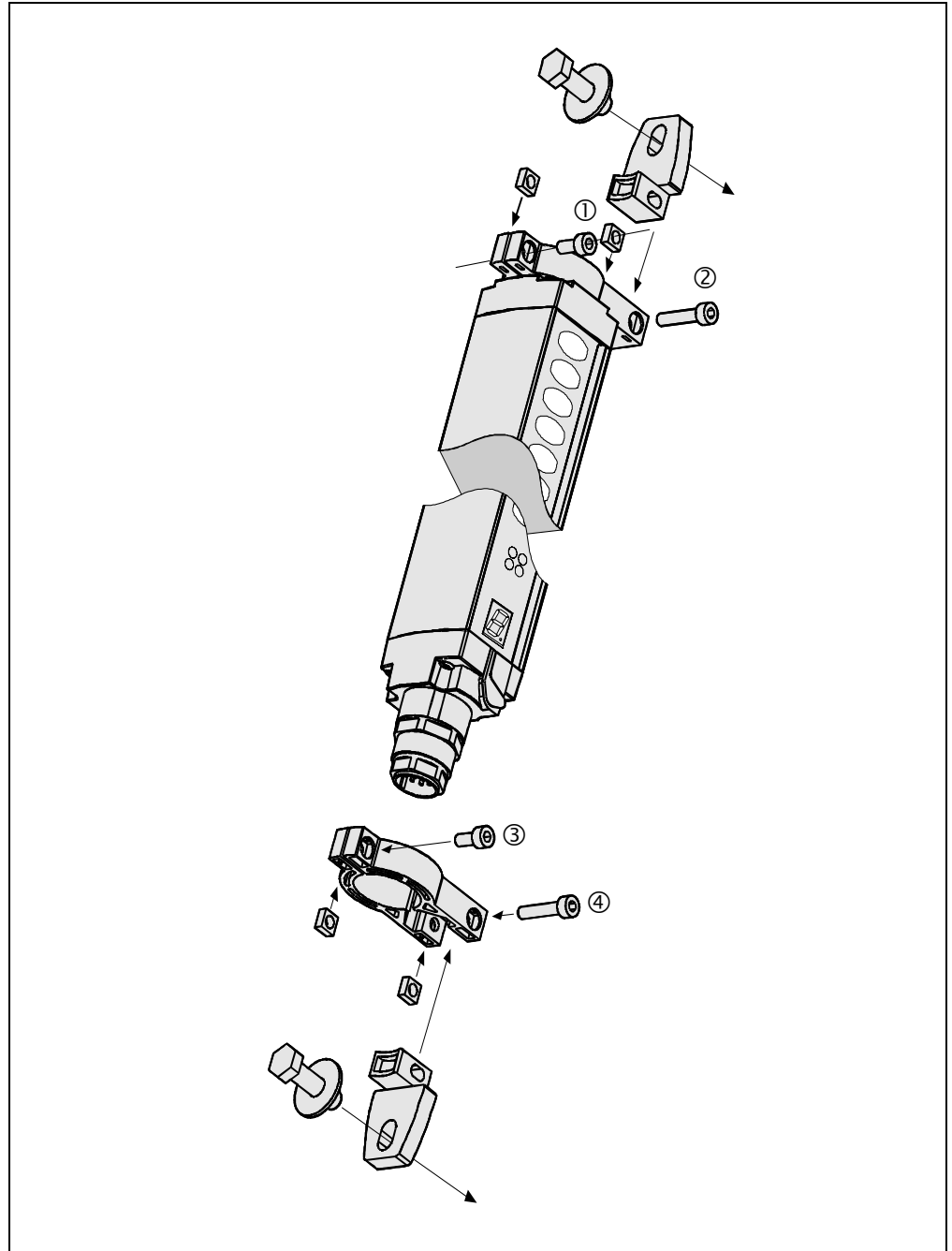


Fig. 20: Mounting sender and receiver using swivel mount brackets

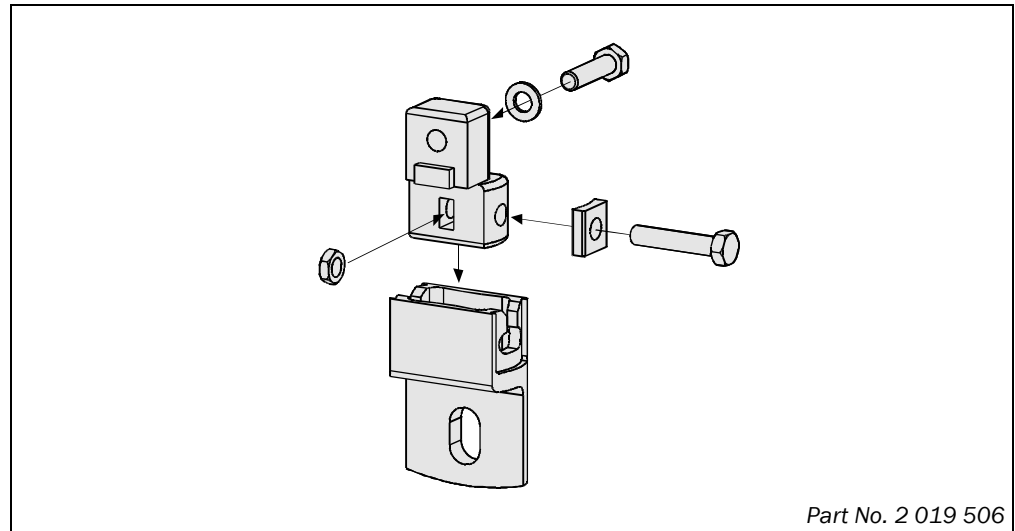


- Notes**
- Mount the bolts marked with ① and ④ on the operator side of the system to ensure that they remain accessible after mounting and to allow you to readjust the light curtain later, if necessary.
  - If you wish to use the additional front screen (see “Additional front screen (welding spark guard)” on page 56), make sure that the curved side of the device remains accessible after mounting.

## 4.2.2 Mounting with side bracket

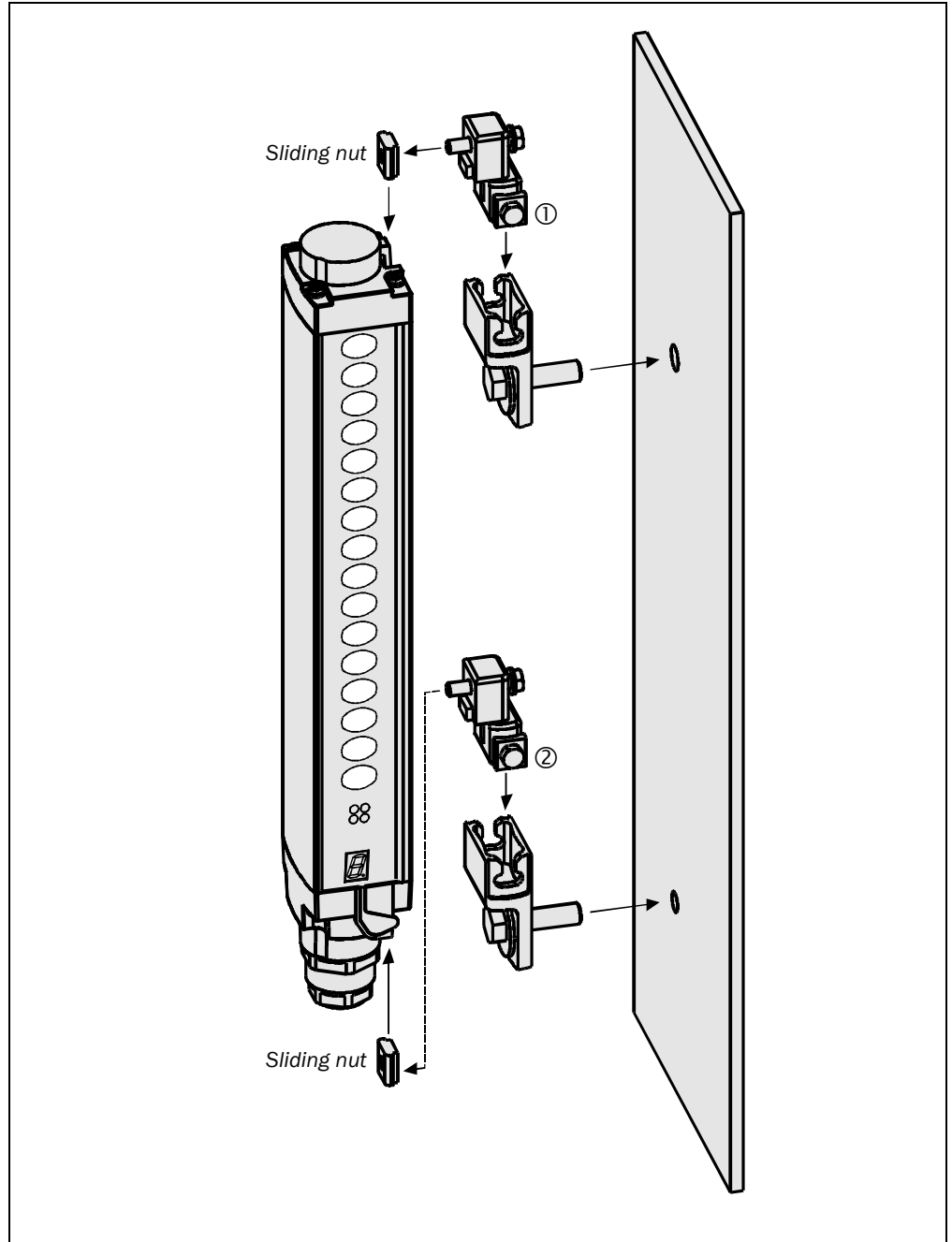
The side bracket is made of die cast zinc ZP 0400. It is enamelled in black. The side bracket is largely covered by the device. But it is only suitable for mounting surfaces lying parallel to the desired protective field because the alignment of sender and receiver can only be adjusted by a maximum of  $\pm 2.5^\circ$  after mounting.

Fig. 21: Composition of the side bracket



- 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 shifting.
  - When mounting the bracket, note the distance and the position of the sliding nuts as described in chapter 10.4 “Dimensional drawings” on page 48.

Fig. 22: Mounting the C 4000 with side bracket



- Notes**
- When mounting the side bracket make sure that the bolts marked ① and ② remain accessible, allowing you later to adjust and lock the light curtain in position.
  - If you wish to use the additional front screen (see “Additional front screen (welding spark guard)” on page 56), make sure that the curved side of the device remains accessible after mounting.



## 5 Electrical installation



### Switch the entire machine system off line!

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

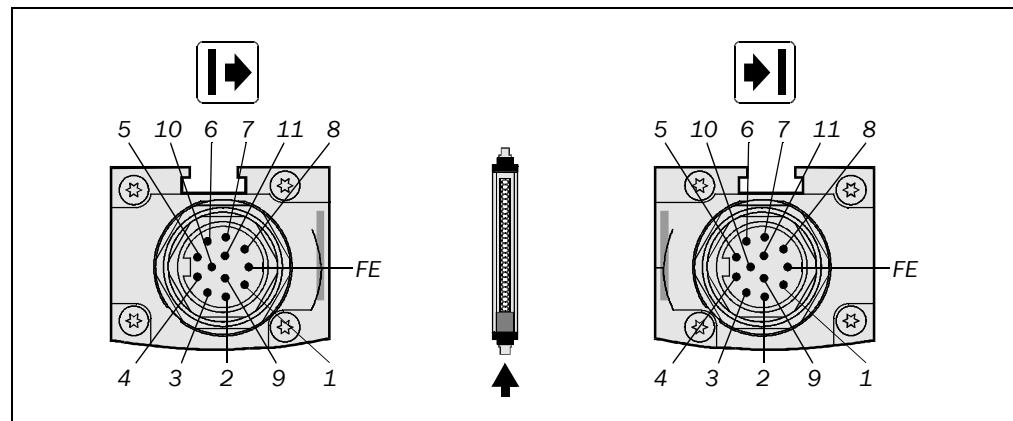
- Make sure that the entire machine/system is disconnected during the electrical installation.

### Notes

- The safety light curtain is a Class A device. It may cause radio interference in residential areas. If radio interference occurs, the person(s) affected may demand that the operator take appropriate action for suppressing interference.
- To ensure full electromagnetic compatibility (EMC), functional earthing (FE) must be connected.
- The external voltage supply of the device must be capable of buffering brief mains failures of 20 ms as specified in EN 60204. 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 unit to unit. You can identify the proper pin assignment by the position of the pins in relation to each other as shown in the drawings.
- System connections and extension connections in a cascaded system must be connected only if the system is off line. The RS 232 interface may be connected/disconnected with the system on line.

### 5.1 System connection M26×11 + FE

Fig. 23: Pin assignment system connection M26×11 + FE



Tab. 7: Pin assignment system connection M26×11 + FE

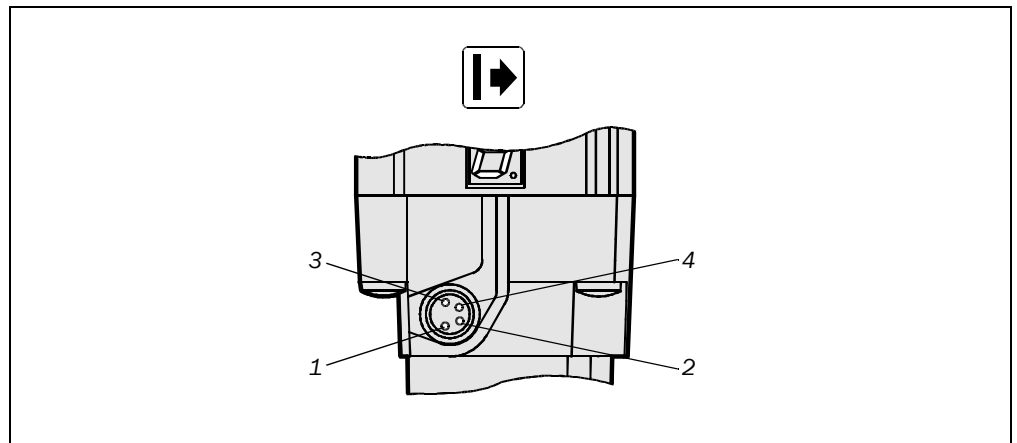
Pin	Wire colour	➡ Sender	➡ Receiver
1	brown	24 V DC input (voltage supply)	24 V DC input (voltage supply)
2	blue	0 V DC (voltage supply)	0 V DC (voltage supply)
3	grey	test input: 0 V: external test active 24 V: external test inactive	OSSD1 (switching output 1)
4	pink	reserved	OSSD2 (switching output 2)
5	red	reserved	reset/restart
6	yellow	reserved	external device monitoring (EDM)
7	white	reserved	reserved

Tab. 7: Pin assignment system connection M26×11 + FE (contd.)

Pin	Wire colour	➡ Sender	➡ Receiver
8	red/blue	reserved	reserved
9	black	device communication	device communication
10	purple	device communication	device communication
11	grey/pink	input host/guest SEL	input host/guest SEL
FE	green	functional earthing	functional earthing

## 5.2 Configuration connection M8×4 (serial interface)

Fig. 24: Pin assignment configuration connection M8×4



Tab. 8: Pin assignment configuration connection M8×4

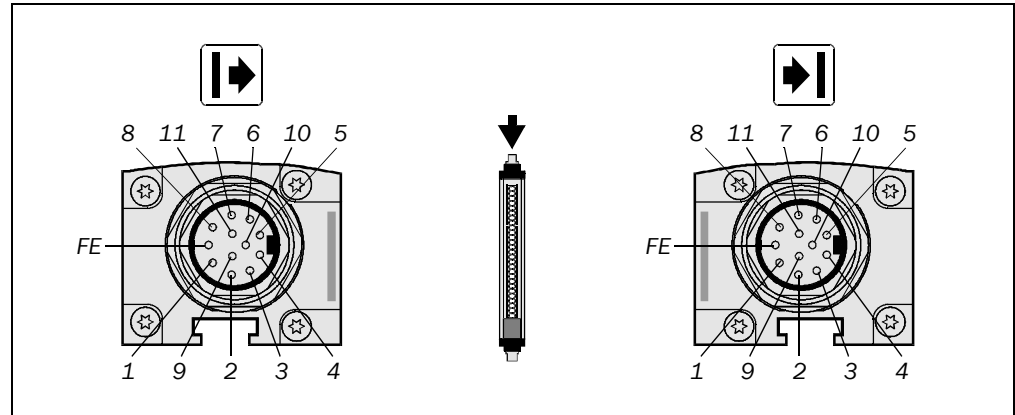
Pin	➡ Sender/➡ receiver	PC-side RS 232 SubD
1	not assigned	
2	RxD	pin 3
3	0 V DC (voltage supply)	pin 5
4	TxD	pin 2

**Notes** The pin assignment of sender and receiver is identical.

- After the configuration of the device has been completed, press the attached protection cap over the configuration connection.

## 5.3 Extension connection M26×11 + FE

Fig. 25: Pin assignment extension connection M26×11 + FE



Tab. 9: Pin assignment extension connection M26×11 + FE

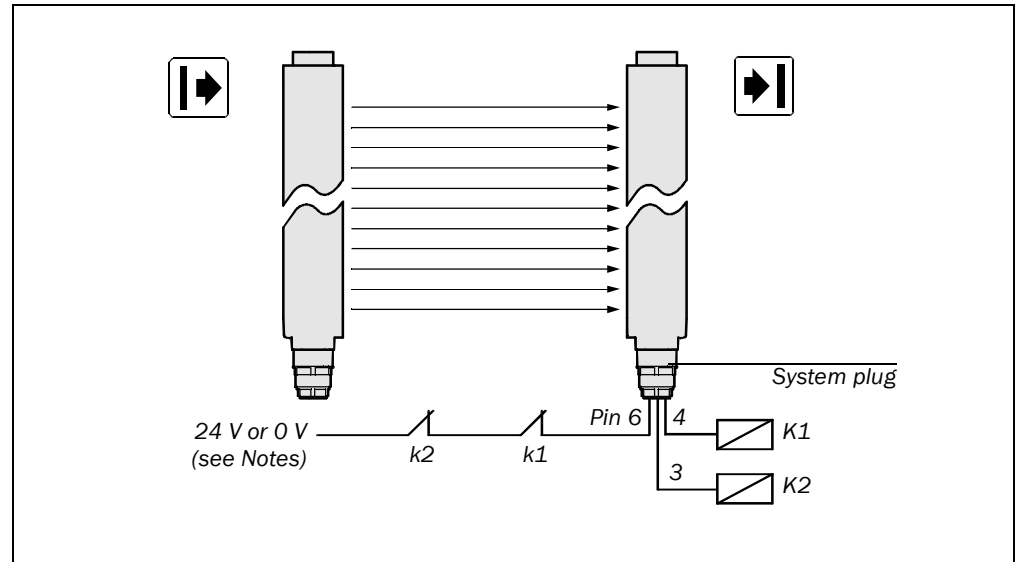
Pin	Wire colour	➡ Sender	➡ Receiver
1	brown	24 V DC output (voltage supply)	24 V DC output (voltage supply)
2	blue	0 V DC (voltage supply)	0 V DC (voltage supply)
3	grey	reserved	reserved
4	pink	reserved	reserved
5	red	reserved	reserved
6	yellow	reserved	reserved
7	white	reserved	reserved
8	red/blue	reserved	reserved
9	black	device communication	device communication
10	purple	device communication	device communication
11	grey/pink	output host/guest SEL	output host/guest SEL
FE	green	functional earthing	functional earthing

**Note** ➤ If the extension connection is no longer needed, always screw the attached protective cap over the extension connection.

## 5.4 External Device Monitoring (EDM)

The EDM checks if the contactors actually drop when the protective device responds. If, after an attempted reset, the EDM does not detect a response from the switching amplifier within 300 ms, the EDM will deactivate the OSSD switching outputs again.

Fig. 26: Connecting the contact elements to the EDM



The EDM is implemented electrically by both N/C contacts (k1, k2) having to close when the contact elements (K1, K2) reach their position of rest by the light path disruption. 24 V then apply at the input of the EDM. If no 24 V apply after a light path disruption, one of the contact elements is defective and the EDM prevents the machine restart.

### Notes



- The EDM remains active after switching the device off and back on again. It can be deactivated only with the reset function (see page 13).
- If you connect the contact elements to be monitored to the EDM input, then you must select the operating mode *EDM* in the CDS (Configuration & Diagnostic Software). If not, the device will show the error .
- If you later deselect the EDM operating mode, pin 6 of the system plug must not remain connected to 24 V. In this case, connect pin 6 to 0 V DC.

## 5.5 Reset button/restart button

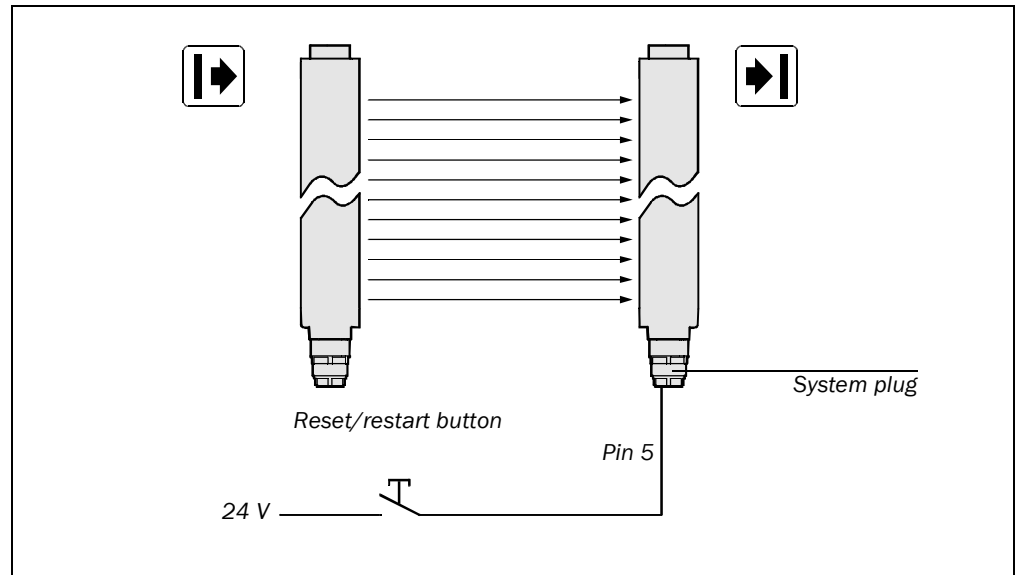
In the operating mode protective operation with internal restart interlock (see page 13) the operator must first press the reset/restart button before restarting.



### 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 be able to oversee the entire hazardous area.

Fig. 27: Connecting the reset button/restart button



### Reconfiguration after device replacement!

If you replace a safety light curtain with active reset function with a replacement unit, the reset function must again be activated via the software. It is not sufficient to make the electrical connections, because new devices are supplied ex factory with deactivated reset function.

# 6 Commissioning



**No commissioning without a thorough check-up by qualified personnel!**

Before you operate a system protected by the safety light curtain C 4000 for the first time, make sure that the system is first checked and approved by qualified personnel. Please note the notices in the chapter “On safety” on page 8.

## 6.1 Display sequence during power-up

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

The display values have the following meaning:

Tab. 10: Displays shown during the power-up cycle

Display	Meaning
	Testing the 7-segment display. All segments are activated sequentially.
	Approx. 0.5 s. Is displayed only at the receiver and only in operation with large scanning range.
	Approx. 0.5 s. System operates as host () or as guest 1 () or guest 2 () in a cascaded system.
	Approx. 0.5 s. Non-coded operation or operation with code 1 or 2.
No display or	The device is operational. Display  appears if the device is operated with reduced resolution and/or with blanking.
	Receivers only: Receiver-sender alignment incorrect (see “Aligning sender and receiver” below).
Other display	Device error. See „Fault diagnosis“ on page 40.

## 6.2 Aligning sender and receiver

After the light curtain has been mounted and connected, sender and receiver must be aligned in relation to each other. The light beams emitted by the sender must hit the receiver with pin-point accuracy.

**Note** If you wish to align a cascaded system, always align the individual systems in the following sequence: host, guest 1, guest 2.

**This is how to align sender and receiver in relation to each other:**

**Secure the plant/system. No dangerous state!**

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



- Loosen the clamping bolts which hold the light curtain in place.
- Switch on the power supply of the light curtain.
- Watch the alignment information on the 7-segment display of the receiver (see table 11). Correct the alignment, until the 7-segment display goes off.
- Using the clamping bolts, fix the light curtain 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 table 11.

The display values have the following meaning:

Tab. 11: Display values during the alignment of sender and receiver

Display	Meaning
	The receiver cannot synchronise with the sender; the alignment is highly inaccurate.
	Some light beams do not hit the receiver.
	All the light beams hit the receiver, but the alignment is still slightly off.
No display or	The alignment is now true; the devices must be locked in this position. Display  appears if the device is operated with reduced resolution and/or with blanking.

- Notes**
- If the optimum alignment (= no display) persists for longer than 2 minutes, the system automatically deactivates the alignment mode.
  - If you wish to readjust the alignment later, switch the power supply of the C 4000 off and back on again.
  - The host in a cascaded system remains on red until all guests have been accurately aligned.

## 6.3 Test notes

### 6.3.1 Tests before the first commissioning

The purpose of the tests before the first commissioning is to confirm the safety requirements specified in the national/international rules and regulations, especially in the Machine and Equipment Usage Directive (EU Conformity).

- 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 12.2 on page 60).
- Make sure that the operating personnel of the machine secured by the light curtain are properly instructed by specialist personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine operator.
- Annex 12.2 of this document shows a checklist for review by the manufacturer and OEM. Use this checklist as reference before commissioning the system for the first time.

### 6.3.2 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 are detected before commissioning.
- If substantial modifications have been made to the machine or the protective device, or if the safety light curtain has been changed or repaired, the system must be checked again as specified in the checklist in the annex.

### 6.3.3 Daily function checks of the protective device

The effectiveness of the protective device must be checked daily by a specialist or by authorized personnel, using the proper test rod.

**Note** Always align the test movements along the hazardous area to be protected, never along the mounting position of the light curtain.

#### How to check the effectiveness and proper function of the safety light curtain:

- Select the correct test rod depending on device resolution. If you operate the unit with reduced resolution (display  on the receiver), select the test rod using the following table:

Tab. 12: Selecting the test rod under reduced resolution

Physical resolution	Reduction	Effective resolution
14 mm	1 beam	22 mm
	2 beams	30 mm
	3 beams	37 mm
20 mm	1 beam	30 mm
	2 beams	40 mm



#### No operation while the green or yellow LED is lit during the test!

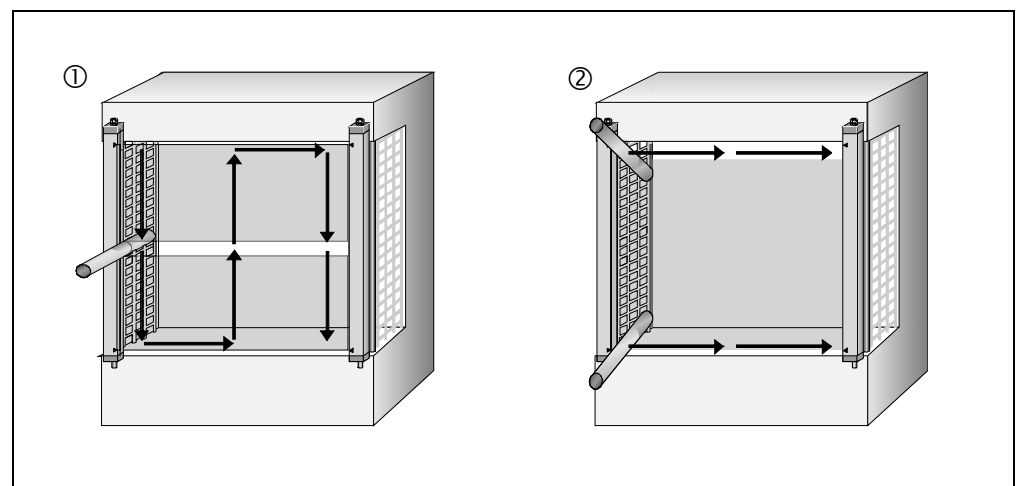
If the green or orange LED lights up *during the test* even for a short period, work must stop at the machine. In this case the installation of the safety light curtain must be checked by specialized personnel (see chapter 4).

- *Before* inserting the test rod, check that the green LED is lit if the internal restart interlock is deactivated and that the yellow LED flashes (“Reset required”) If this is not the case, make sure that this condition is reached. The test is otherwise meaningless.

- Move the test rod slowly through the protective field to be tested, as shown in ① in figure 28.
- Then move the test rod along the edges of the protective field, as shown in ② in figure 28. This procedure allows you to test if the point-of-operation guard/reaching behind protection is functioning properly (see 4.2 “Steps for mounting the device” on page 25).

**Note** In both tests, the receiver of the C 4000 must show the red LED only.

Fig. 28: Daily checks of the protective device





## 7 Configuration

### 7.1 Delivery status

When delivered, the C 4000 is configured ready for protective operation.

- Machine-side restart interlock
- No external device monitoring (EDM)
- No beam coding
- No blanking
- Small scanning range (0-2.5 m or 0-6 m)

### 7.2 Preparing the configuration

#### How to prepare the configuration:

- Make sure that the safety light curtain has been properly mounted and that the electrical connections are correct and in place.
- Plan all required settings (operating mode, beam coding, resolution, cascading, etc.)

To configure the safety light curtain, you need:

- CDS (Configuration & Diagnostic Software) on CD-ROM
- User manual for CDS on CD-ROM
- PC/Notebook with Windows 9x/NT 4/2000 and a serial interface (RS 232).  
PC not included.
- Connecting cable between PC and C 4000
- To configure the device, please read the user manual for the CDS (Configuration & Diagnostic Software) and use the online help function of the programme.

# 8 Care and maintenance

The safety light curtain C 4000 is maintenance-free. The front screen of the safety light curtain C 4000 and any additional front screen(s) (see “Additional front screen (welding spark guard)” on page 56) should be cleaned at regular intervals and when dirty.

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

**Note** Static charges cause dust particles to stick to the front screen. You can alleviate this effect by using the antistatic plastic cleaner (SICK Part No. 5 600 006) and the SICK lens cloth (Part No. 4 003 353).

### **How to clean the front screen and/or the additional front screen (optional extra):**

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

**Note** ➤ After cleaning, check the position of sender and receiver to make sure that the protective device cannot be bypassed (reaching over, under or behind).

➤ Verify the effectiveness of the protective device as described in chapter 6.3 “Test notes” on page 36.

## 9 Fault diagnosis

This chapter describes how to identify and remedy errors and malfunctions during the operation of the safety light curtain.

### 9.1 What to do in case of faults



**No 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.





### 9.2 SICK Support

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

### 9.3 Error displays of the LEDs

This chapter explains the meaning of the error displays of the LEDs and how to respond. Please refer to the description in the chapter “Indicator elements” on page 20.



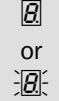










Tab. 13: Error displays of the LEDs

Display	Cause	Remedying the error
 Orange LED of receiver lights up	Weak signal	<ul style="list-style-type: none"> <li>➤ Check the alignment of sender and receiver.</li> <li>➤ Check the front screen (dirt) and clean, if necessary</li> </ul>
 Yellow LED of receiver flashes	Reset required	<ul style="list-style-type: none"> <li>➤ Press the reset button.</li> </ul>
 Yellow LED of sender fails to light up  Neither the red nor the green receiver LED lights up	No operating voltage, or voltage too low	<ul style="list-style-type: none"> <li>➤ Check the voltage supply and activate, if necessary.</li> </ul>

## 9.4 Error displays of the 7-segment display

This chapter explains the meaning of the error displays of the 7-segment display and how to respond to the messages. Please refer to chapter “Indicator elements” on page 20 for a description of the 7-segment display.

Tab. 14: Error displays of the 7-segment display

Display	Cause	Remedying the error
	Inadequate alignment	<ul style="list-style-type: none"> <li>➤ Re-align sender and receiver (see page 35).</li> </ul> The display goes off after 2 minutes.
	Configuration incomplete	<ul style="list-style-type: none"> <li>➤ The display goes off automatically once the configuration has been successfully transferred.</li> </ul> If display 6 does not go off: <ul style="list-style-type: none"> <li>➤ Check the configuration of the system using the CDS (Configuration &amp; Diagnostic Software).</li> <li>➤ Re-transfer the corrected configuration to the system.</li> </ul>
	EDM error	<ul style="list-style-type: none"> <li>➤ Check the contactors and their wiring, eliminate any wiring errors, if necessary.</li> <li>➤ If  is displayed, switch the device off and back on again.</li> </ul>
	Error in reset button/restart button	<ul style="list-style-type: none"> <li>➤ Check the reset button/restart button for proper function. The button may be defective or stuck.</li> <li>➤ Check the wiring of the reset button/restart button for any short circuit at 24 V.</li> </ul>
	System error	<ul style="list-style-type: none"> <li>➤ Replace the unit (receiver or sender).</li> </ul>
	Overcurrent at switching output 1	<ul style="list-style-type: none"> <li>➤ Check the contactor. Replace, if necessary.</li> <li>➤ Check the wiring for short-circuit at 0 V.</li> </ul>
	Short circuit at switching output 1	<ul style="list-style-type: none"> <li>➤ Check the wiring for short-circuit at 24 V.</li> </ul>
	Short circuit at switching output 1	<ul style="list-style-type: none"> <li>➤ Check the wiring for short-circuit at 0 V.</li> </ul>
	Overcurrent at switching output 2	<ul style="list-style-type: none"> <li>➤ Check the contactor. Replace, if necessary.</li> <li>➤ Check the wiring for short-circuit at 0 V.</li> </ul>
	Short circuit at switching output 2	<ul style="list-style-type: none"> <li>➤ Check the wiring for short-circuit at 24 V.</li> </ul>
	Short circuit at switching output 2	<ul style="list-style-type: none"> <li>➤ Check the wiring for short-circuit at 0 V.</li> </ul>
	Short circuit between switching output 1 and 2	<ul style="list-style-type: none"> <li>➤ Check the wiring and remedy the error.</li> </ul>

Tab. 14: Error displays of the 7-segment display (contd.)

Display	Cause	Remedying the error
	Invalid configuration of the EDM	➤ Verify that the machine-side EDM is connected properly.
	External sender detected	➤ Check the distance from reflecting surfaces (page 24) or from other light curtains. ➤ If necessary, re-configure the device with another beam coding (page 14) or mount non-reflecting partition walls.
	Connection problem between host and guest	➤ Check the connection between the cascaded devices. If necessary, replace defective cables.
	Communication in cascaded system failed	➤ Verify the configuration of the system using the CDS (Configuration & Diagnostic Software). Retransfer the corrected configuration to the system. ➤ Check the connection between the cascaded devices. If necessary, replace defective cables.
	Supply voltage too low	➤ Check the supply voltage and the power supply. If necessary, replace defective components. ➤ Switch the device off and back on again.

## 9.5 Extended diagnosis

The CDS software supplied with the device (Configuration & Diagnostic Software) includes extended diagnosis options. It allows you to narrow down the problem if the error is non-specific or if you experience availability problems. Detailed information to be found

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

# 10 Technical specifications

## 10.1 Data sheet

Tab. 15: Technical specifications C 4000

	minimum	typical	maximum
<b>General system data</b>			
Protective field height, depending on type	300 mm to 1800 mm		
Resolution, depending on type	14 mm to 40 mm		
Protective field width			
Resolution 14 mm	0 m		6 m
Resolution 20, 30 or 40 mm	0 m		19 m
Protection class (VDE 106)	III		
Enclosure rating	IP 65		
Supply voltage $U_V$ at appliance <sup>1)</sup>	19.2 V	24 V	28.8 V
Residual ripple <sup>2)</sup>			±10 %
Synchronisation	Optical, without separate synchronisation		
Safety category (EN 61496)	Type 4		
ON time after applying the supply voltage of sender and receiver			8 s
<b>Sender unit</b>			
Test input			
Input resistance (High)			10 kΩ
Sender inactive (test)	-1 V	0 V	5 V
Sender active (High)	15 V	24 V	28.8 V
Response time to test	Depending on number of beams		
Wavelength of sender	940 nm		
Power consumption			2 A (host/guest/guest)
Weight	Depending on protective field height (see page 47)		
<b>Receiver unit</b>			
Switching outputs (OSSDs)	2 PNP semiconductor, short-circuit protected <sup>3)</sup> , cross-circuit monitored		
Switching voltage HIGH active ( $U_{eff}$ ) <sup>4)</sup>	15 V	24 V	28.8 V
Switching voltage LOW	0 V	0 V	3.5 V
Switching current		500 mA	
Leakage current <sup>5)</sup>			0.25 mA
Load capacity			2.2 μF
Switching sequence	Depending on load inductance		
Load inductance <sup>6)</sup>			2.2 H
Test pulse data <sup>7)</sup>			
Test pulse width	120 μs	150 μs	300 μs
Test pulse rate	3 1/s	5 1/s	10 1/s

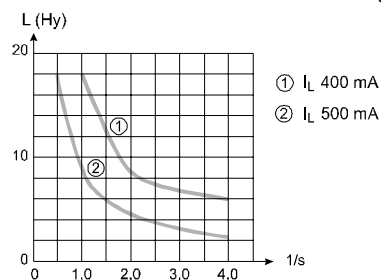
Tab. 15: Technical specifications C 4000 (contd.)

	minimum	typical	maximum
Permissible line resistance between device and load <sup>8)</sup> Supply lead			2.5 Ω 1 Ω
ON time after light beam disruption			double response time
Power consumption			3 A (host/guest/guest)
Contactors Permissible fall time Permissible response time			300 ms 300 ms
Control switch input <sup>9)</sup>	15 V	24 V	28.8 V
Weight	Depending on protective field height (see page 47)		

**Operating data**

Connection	Hirschmann plug M26×11 + FE		
Cable length	Depending on load, power supply and wire cross-section. The technical specifications must be observed.		
Wire cross-section <sup>10)</sup>		0.75 mm <sup>2</sup>	
Ambient operating temperature	0 °C		+55 °C
Air humidity (non-dewing)	15%		95%
Storage temperature	-25 °C		+70 °C
Housing cross-section	40 mm × 48 mm		
Rigidity	5 g, 10-55 Hz acc. to IEC 68-2-6		
Shock resistance	10 g, 16 ms acc. to IEC 68-2-29		

- 1) The external voltage supply must be capable of buffering brief mains failures of 20 ms as specified in EN 60204. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).
- 2) Within the limits of  $U_V$ .
- 3) Applies to the voltage range between  $U_V$  and 0 V.
- 4) In compliance with IEC 61131.
- 5) In case of malfunction (disruption of 0 V lead) the output acts like a resistor >13 kΩ after  $U_V$ . The downstream controller must detect this status as LOW. A safe SPC (Stored-Programme Controller) must be able to identify this status.
- 6) The maximum rated load inductance is higher with lower switching sequence.



- 7) 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.
- 8) Make sure to limit the individual line core resistance to the downstream controller to this value to ensure that the cross-circuit between the outputs is safely detected. (Also note EN 60204 Electrical Machine Equipment, Part 1: General Requirements.)
- 9) In compliance with IEC 61131-2.
- 10) Maximum cable length ≤ 50 m.

## 10.2 Response time

The response time depends on the following parameters:

- Number of beams
- Beam coding
- Configuration of floating blanking
- Number of cascaded systems

### How to determine the response time of the system:

- Read the response times of the individual systems (shown on type plate). Note whether the system is operated with or without beam coding.

**Note**

If you are planning the application without actually having any devices available, you may also determine the response time using the tables 17 and 18. When determining the number of beams in table 17, the physical resolution is important. The physical resolution of the light curtain does not change even if fixed or floating blanking has been selected.

- Fill out the following table to determine the total response time.

Tab. 16: Determining the total response time of a system

Line	Required detail	Response time
1	Host	ms
2	Guest 1	+ ms
3	Guest 2	+ ms
4	Only if floating blanking is used:	Longest response time from lines 1 to 3: ____ × 0,5 = + ms
		Deduct 4 ms. - ms
5	If exactly 1 guest is used, then add 8 ms.	+ ms
6	<b>Total response time: Sum of all lines (The total response time must be ≤ 108 ms!)</b>	= <b>ms</b>

- Verify that the total response time determined is ≤ 108 ms. EN 61496 does not permit response times exceeding 108 ms. If necessary, adjust the configuration.

### Example

Calculating the response time for a cascaded system with beam coding in which fields are configured with floating blanking:

Line	Required detail	Response time
1	Host: 750 mm protective field height, resolution 14 mm	16 ms
2	Guest 1: 600 mm protective field height, resolution 20 mm	+ 13 ms
3	Guest 2: –	+ 0 ms
4	Only if floating blanking is used:	Longest response time from lines 1 to 3: <u>16 ms</u> × 0.5 = + 8 ms
		Deduct 4 ms. - 4 ms
5	If exactly 1 guest is used, then add 8 ms.	+ 8 ms
6	<b>Total response time: Sum of all lines</b>	= <b>41 ms</b>



Tab. 17: Number of beams depending on the protective field height and the physical resolution

Protective field height [mm]	Number of beams for physical resolution			
	14 mm	20 mm	30 mm	40 mm
300	40	30	15	10
450	60	45	23	15
600	80	60	30	20
750	100	75	38	25
900	120	90	45	30
1050	140	105	53	35
1200	160	120	60	40
1350	180	135	68	45
1500	200	150	75	50
1650	220	165	83	55
1800	240	180	90	60

Tab. 18: Response time as factor of the number of beams

Number of beams	Without beam coding	With beam coding
10	9 ms	11 ms
15	10 ms	12 ms
20	10 ms	13 ms
23	10 ms	14 ms
25	10 ms	14 ms
30	11 ms	15 ms
35	11 ms	16 ms
38	11 ms	17 ms
40	11 ms	17 ms
45	12 ms	18 ms
50	12 ms	19 ms
53	12 ms	20 ms
55	12 ms	20 ms
60	13 ms	21 ms
68	13 ms	22 ms
75	14 ms	24 ms
80	14 ms	25 ms
83	14 ms	25 ms
90	15 ms	27 ms
100	16 ms	29 ms
105	16 ms	30 ms
120	17 ms	33 ms
135	18 ms	36 ms
140	19 ms	37 ms
150	19 ms	39 ms
160	20 ms	40 ms
165	20 ms	41 ms
180	22 ms	44 ms
200	23 ms	48 ms
220	24 ms	52 ms
240	26 ms	56 ms

**10.3 Table of weights**

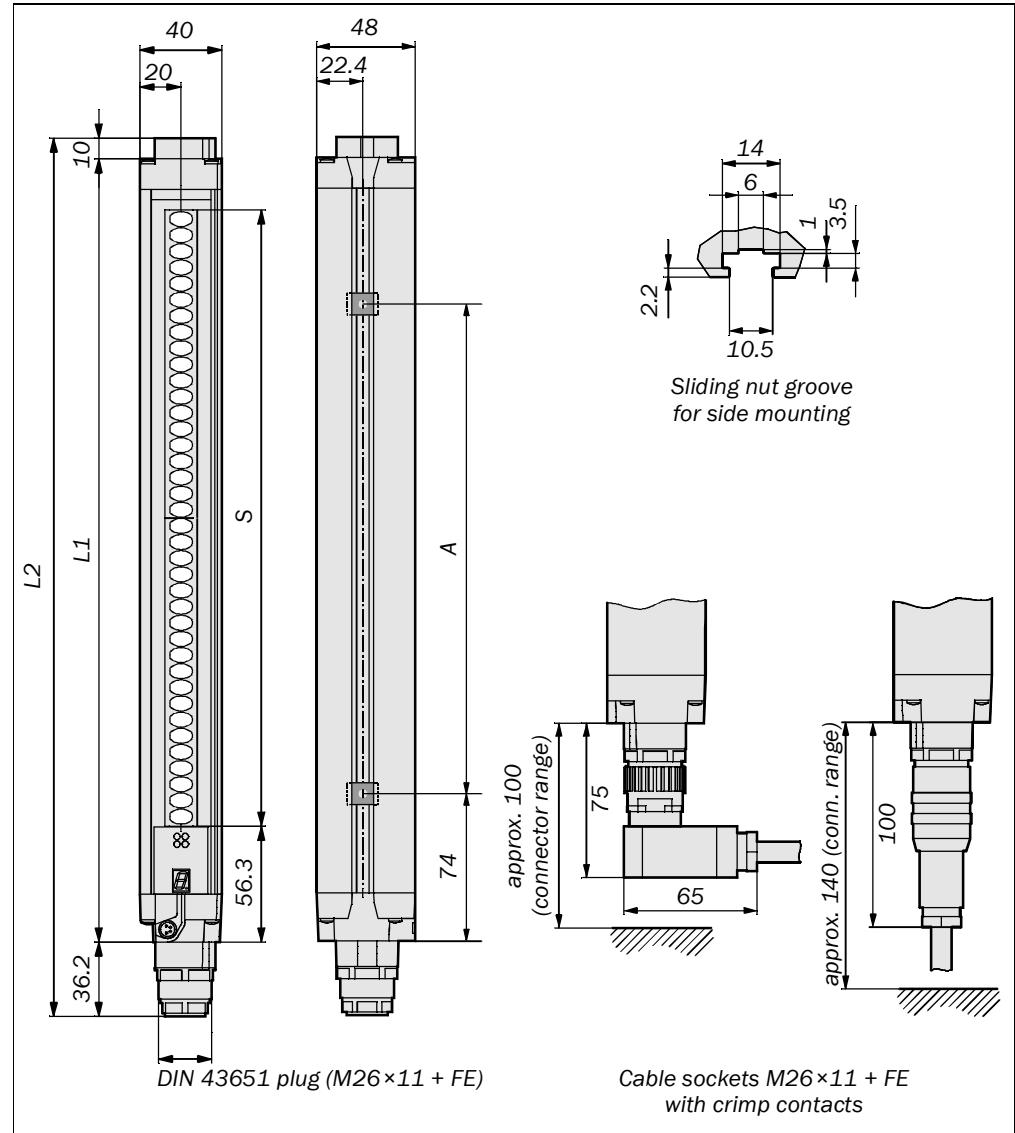
*Tab. 19: Weight of sender and receiver*

Protective field height [mm]	Weight [g]	
	Sender	Receiver
<b>300</b>	820	850
<b>450</b>	1100	1130
<b>600</b>	1390	1420
<b>750</b>	1670	1700
<b>900</b>	1960	1990
<b>1050</b>	2250	2280
<b>1200</b>	2530	2560
<b>1350</b>	2820	2850
<b>1500</b>	3110	3140
<b>1650</b>	3390	3420
<b>1800</b>	3680	3710

## 10.4 Dimensional drawings

### 10.4.1 Standard system (not cascable)

Fig. 29: Dimensional drawing C 4000 sender, standard system (not cascable). Receiver, mirror image (mm)

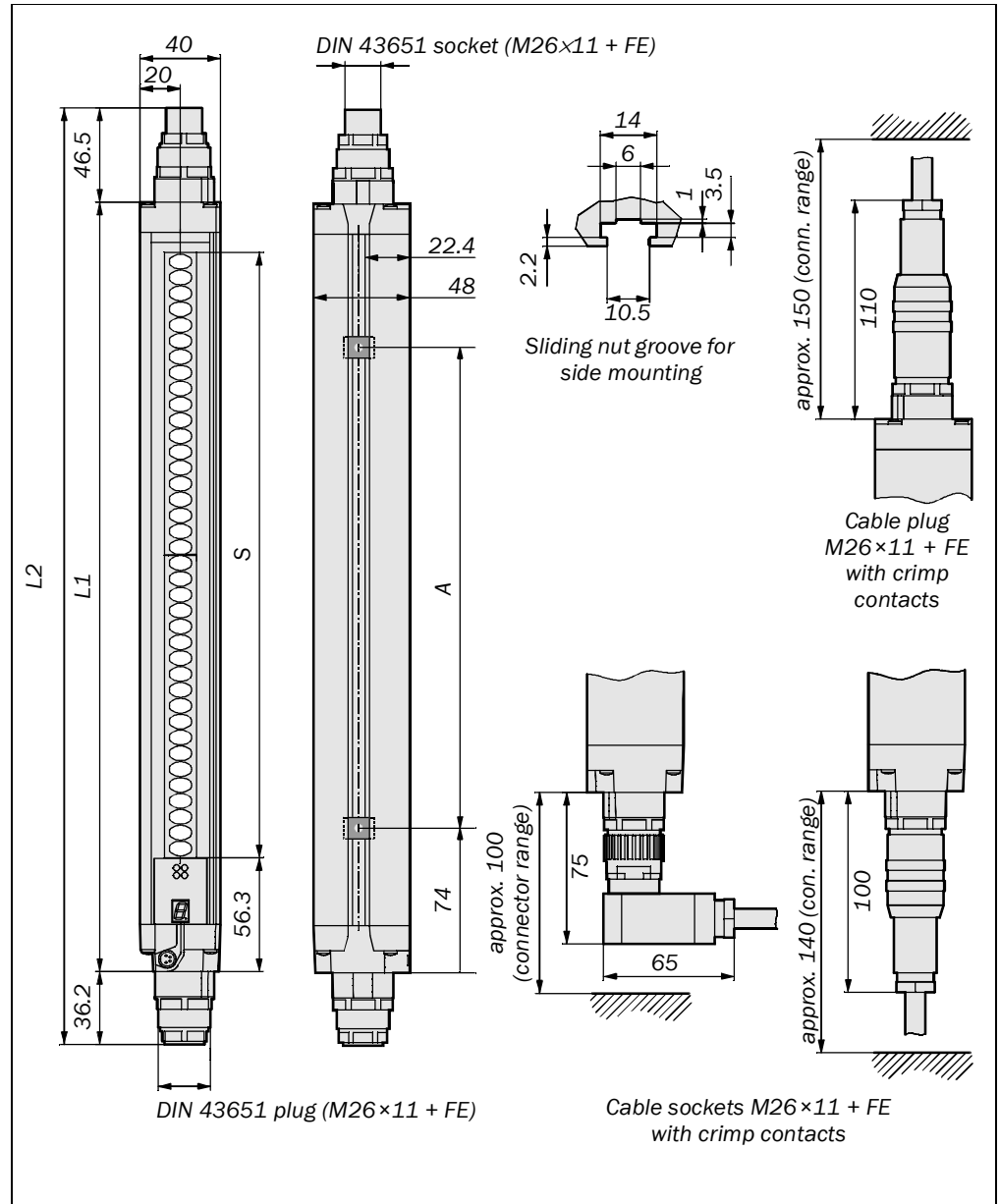


Tab. 20: Dimensions depending on protective field height, standard system (not cascable)

Protective field height S [mm]	Dimensions L1 [mm]	Dimensions L2 [mm]	Dimensions A [mm]
300	381	427	224
450	532	578	374
600	682	728	524
750	833	879	674
900	984	1030	824
1050	1134	1180	974
1200	1283	1329	1124
1350	1435	1481	1274
1500	1586	1632	1424
1650	1736	1782	1574
1800	1887	1933	1724

## 10.4.2 Cascadable system

Fig. 30: Dimensional drawing C 4000 sender, cascadable system. Receiver, mirror image (mm)

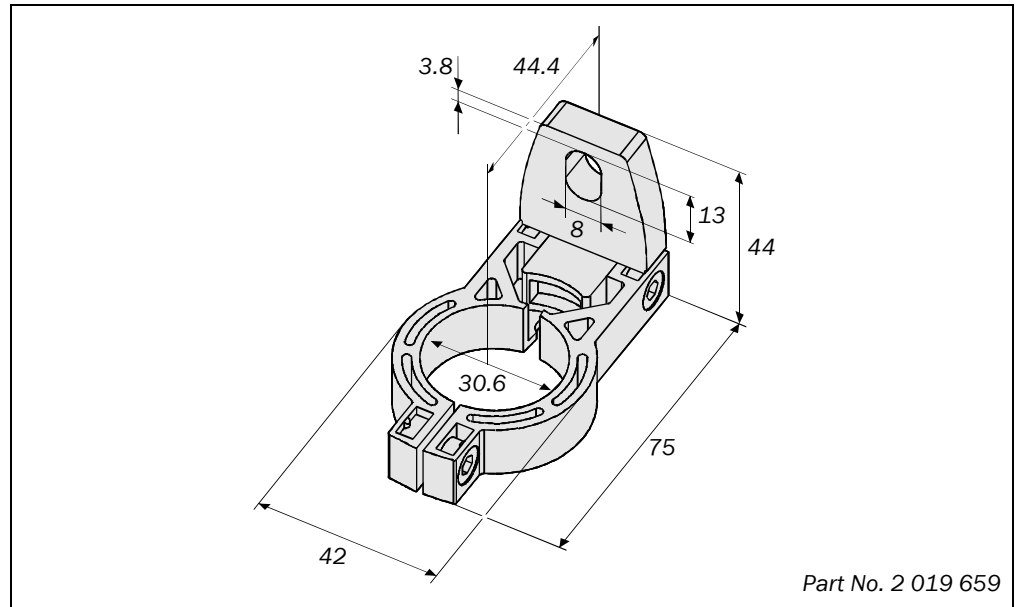


Tab. 21: Dimensions depending on protective field height, cascadable system

Protective field height S [mm]	Dimensions L1 [mm]	Dimensions L2 [mm]	Dimensions A [mm]
300	381	464	224
450	532	614	374
600	682	765	524
750	833	915	674
900	984	1066	824
1050	1134	1216	974
1200	1283	1366	1124
1350	1435	1517	1274
1500	1586	1669	1424
1650	1736	1818	1574
1800	1887	1969	1724

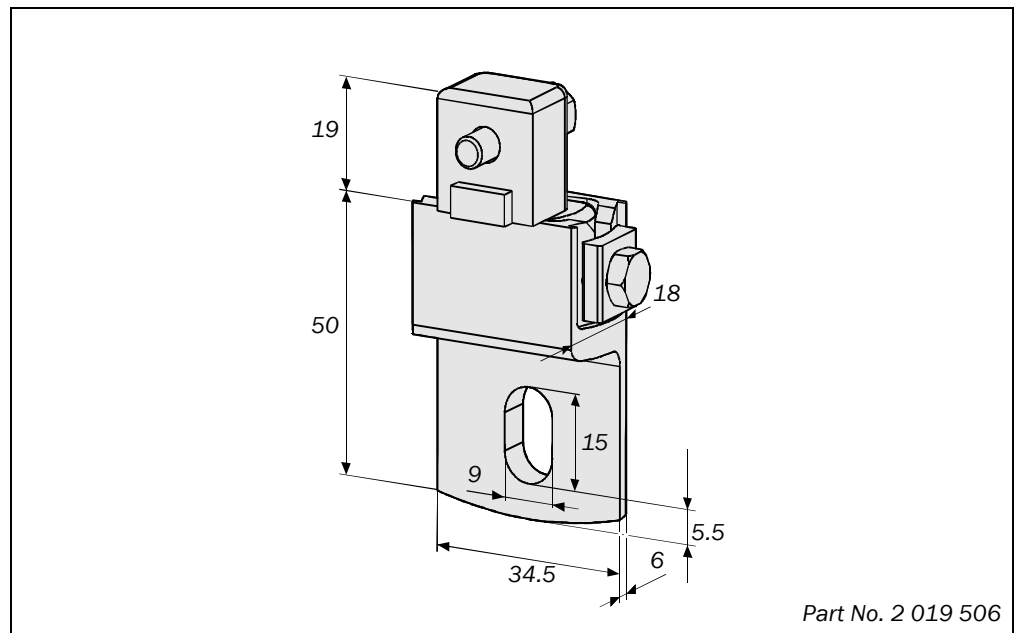
### 10.4.3 Swivel mount bracket

Fig. 31: Dimensional drawing, swivel mount bracket (mm)



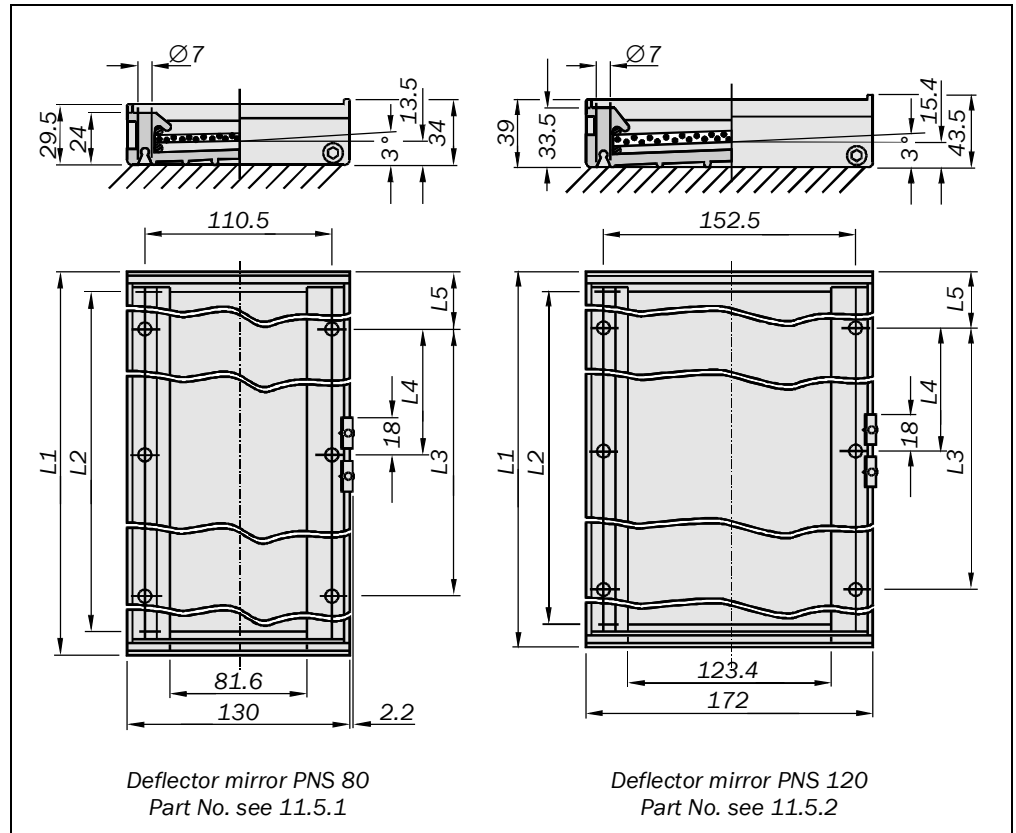
### 10.4.4 Side mounting

Fig. 32: Dimensional drawing, side mounting (mm)



## 10.4.5 Deflector mirror

Fig. 33: Dimensional drawings, deflector mirror (mm)



Tab. 22: Dimensions of the deflector mirrors depending on the protective field height

Protective field height S [mm]	Dimension L1 [mm]	Dimension L2 [mm]	Dimension L3 [mm]	Dimension L4 [mm]	Dimension L5 [mm]
300	366	340	307	—	29.5
450	523	497	307	—	108
600	666	640	528.5	—	68.75
750	816	790	639.5	—	88.25
900	966	940	750	—	108
1050	1116	1090	972	—	72
1200	1266	1240	1146	—	60
1350	1416	1390	1296	—	60
1500	1566	1540	1415.5	707.95	75.25
1650	1716	1690	1596	798	60
1800	1866	1840	1746	873	60

## 11 Ordering information

### 11.1 Delivery

#### Delivery, sender

- Sender unit
- 4 sliding nuts for side mounting

#### Delivery, receiver

- Receiver unit
- 4 sliding nuts for side mounting
- Test rod with diameter corresponding to the physical resolution of the safety light curtain
- Notice label "Important Information"
- Operating instructions on CD-ROM
- CDS (Configuration & Diagnostic Software) on CD-ROM
- Connecting cable to serial interface
- Notice label "Operation mode indicators/Error displays"

#### Function package B

Function package B is available as an option and includes:

- Function Blanking (cf. page 16 ff.)
- Function Reduced Resolution (cf. page 19)
- Additional test rods for testing the effective resolution:
  - for 14 mm systems: diameters 22, 30 and 37 mm
  - for 20 mm systems: diameters 30 and 40 mm
- Notice labels for the resolution of the device

## 11.2 Standard system

For use as single system or as last guest of a cascable system.

### 11.2.1 Standard system without function package

Tab. 23: Part numbers, standard system without function package

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	↳ 1 018 591	↳ 1 018 613	↳ 1 018 635	↳ 1 018 657
	⇨ 1 018 592	⇨ 1 018 614	⇨ 1 018 636	⇨ 1 018 658
450	↳ 1 018 347	↳ 1 018 615	↳ 1 018 637	↳ 1 018 659
	⇨ 1 018 348	⇨ 1 018 616	⇨ 1 018 638	⇨ 1 018 660
600	↳ 1 018 593	↳ 1 018 617	↳ 1 018 639	↳ 1 018 661
	⇨ 1 018 594	⇨ 1 018 618	⇨ 1 018 640	⇨ 1 018 662
750	↳ 1 018 595	↳ 1 018 619	↳ 1 018 641	↳ 1 018 663
	⇨ 1 018 596	⇨ 1 018 620	⇨ 1 018 642	⇨ 1 018 664
900	↳ 1 018 597	↳ 1 018 621	↳ 1 018 643	↳ 1 018 665
	⇨ 1 018 598	⇨ 1 018 622	⇨ 1 018 644	⇨ 1 018 666
1050	↳ 1 018 599	↳ 1 018 623	↳ 1 018 645	↳ 1 018 667
	⇨ 1 018 600	⇨ 1 018 624	⇨ 1 018 646	⇨ 1 018 668
1200	↳ 1 018 601	↳ 1 018 625	↳ 1 018 647	↳ 1 018 669
	⇨ 1 018 602	⇨ 1 018 626	⇨ 1 018 648	⇨ 1 018 670
1350	↳ 1 018 603	↳ 1 018 627	↳ 1 018 649	↳ 1 018 671
	⇨ 1 018 604	⇨ 1 018 628	⇨ 1 018 650	⇨ 1 018 672
1500	↳ 1 018 605	↳ 1 018 629	↳ 1 018 651	↳ 1 018 673
	⇨ 1 018 606	⇨ 1 018 630	⇨ 1 018 652	⇨ 1 018 674
1650	↳ 1 018 607	↳ 1 018 631	↳ 1 018 653	↳ 1 018 675
	⇨ 1 018 608	⇨ 1 018 632	⇨ 1 018 654	⇨ 1 018 676
1800	↳ 1 018 609	↳ 1 018 633	↳ 1 018 655	↳ 1 018 677
	⇨ 1 018 610	⇨ 1 018 634	⇨ 1 018 656	⇨ 1 018 678



## 11.2.2 Standard system with function package B

Tab. 24: Part numbers, standard system with function package B

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
<b>300</b>	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 018 781	➡ 1 018 792	➡ 1 018 803	➡ 1 018 815
<b>450</b>	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 018 782	➡ 1 018 793	➡ 1 018 804	➡ 1 018 816
<b>600</b>	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 018 783	➡ 1 018 794	➡ 1 018 805	➡ 1 018 817
<b>750</b>	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 018 784	➡ 1 018 795	➡ 1 018 806	➡ 1 018 818
<b>900</b>	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 018 785	➡ 1 018 796	➡ 1 018 807	➡ 1 018 819
<b>1050</b>	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 018 786	➡ 1 018 797	➡ 1 018 809	➡ 1 018 820
<b>1200</b>	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 018 787	➡ 1 018 798	➡ 1 018 810	➡ 1 018 821
<b>1350</b>	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 018 788	➡ 1 018 799	➡ 1 018 811	➡ 1 018 822
<b>1500</b>	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 018 789	➡ 1 018 800	➡ 1 018 812	➡ 1 018 823
<b>1650</b>	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 018 790	➡ 1 018 801	➡ 1 018 813	➡ 1 018 824
<b>1800</b>	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 018 791	➡ 1 018 802	➡ 1 018 814	➡ 1 018 825

## 11.3 Cascadable system

For use as single system, as host or as first or second guest of a host/guest system

### 11.3.1 Cascadable system without function package

Tab. 25: Part numbers, cascadable system without function package

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	↳ 1 018 690	↳ 1 018 710	↳ 1 018 733	↳ 1 018 755
	⇨ 1 018 691	⇨ 1 018 711	⇨ 1 018 734	⇨ 1 018 756
450	↳ 1 018 349	↳ 1 018 712	↳ 1 018 735	↳ 1 018 757
	⇨ 1 018 350	⇨ 1 018 713	⇨ 1 018 736	⇨ 1 018 758
600	↳ 1 018 692	↳ 1 018 714	↳ 1 018 737	↳ 1 018 759
	⇨ 1 018 693	⇨ 1 018 715	⇨ 1 018 738	⇨ 1 018 760
750	↳ 1 018 694	↳ 1 018 716	↳ 1 018 739	↳ 1 018 762
	⇨ 1 018 695	⇨ 1 018 717	⇨ 1 018 740	⇨ 1 018 763
900	↳ 1 018 696	↳ 1 018 718	↳ 1 018 741	↳ 1 018 765
	⇨ 1 018 697	⇨ 1 018 719	⇨ 1 018 742	⇨ 1 018 766
1050	↳ 1 018 698	↳ 1 018 720	↳ 1 018 743	↳ 1 018 767
	⇨ 1 018 699	⇨ 1 018 721	⇨ 1 018 744	⇨ 1 018 768
1200	↳ 1 018 700	↳ 1 018 722	↳ 1 018 745	↳ 1 018 769
	⇨ 1 018 701	⇨ 1 018 723	⇨ 1 018 746	⇨ 1 018 770
1350	↳ 1 018 702	↳ 1 018 724	↳ 1 018 747	↳ 1 018 771
	⇨ 1 018 703	⇨ 1 018 725	⇨ 1 018 748	⇨ 1 018 772
1500	↳ 1 018 704	↳ 1 018 726	↳ 1 018 749	↳ 1 018 773
	⇨ 1 018 705	⇨ 1 018 727	⇨ 1 018 750	⇨ 1 018 774
1650	↳ 1 018 706	↳ 1 018 728	↳ 1 018 751	↳ 1 018 775
	⇨ 1 018 707	⇨ 1 018 729	⇨ 1 018 752	⇨ 1 018 776
1800	↳ 1 018 708	↳ 1 018 730	↳ 1 018 753	↳ 1 018 777
	⇨ 1 018 709	⇨ 1 018 731	⇨ 1 018 754	⇨ 1 018 778

## 11.3.2 Cascadable system with function package B

Tab. 26: Part numbers, cascadable system with function package B

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	1 018 690	1 018 710	1 018 733	1 018 755
	1 018 827	1 018 838	1 018 849	1 018 860
450	1 018 349	1 018 712	1 018 735	1 018 757
	1 018 828	1 018 839	1 018 850	1 018 861
600	1 018 692	1 018 714	1 018 737	1 018 759
	1 018 829	1 018 840	1 018 851	1 018 862
750	1 018 694	1 018 716	1 018 739	1 018 762
	1 018 830	1 018 841	1 018 852	1 018 863
900	1 018 696	1 018 718	1 018 741	1 018 765
	1 018 831	1 018 842	1 018 853	1 018 864
1050	1 018 698	1 018 720	1 018 743	1 018 767
	1 018 832	1 018 843	1 018 854	1 018 865
1200	1 018 700	1 018 722	1 018 745	1 018 769
	1 018 833	1 018 844	1 018 855	1 018 866
1350	1 018 702	1 018 724	1 018 747	1 018 771
	1 018 834	1 018 845	1 018 856	1 018 867
1500	1 018 704	1 018 726	1 018 749	1 018 773
	1 018 835	1 018 846	1 018 857	1 018 868
1650	1 018 706	1 018 728	1 018 751	1 018 775
	1 018 836	1 018 847	1 018 858	1 018 869
1800	1 018 708	1 018 730	1 018 753	1 018 777
	1 018 837	1 018 848	1 018 859	1 018 870

## 11.4 Additional front screen (welding spark guard)

- Notes**
- One additional front screen (welding spark guard) supplied for each part number.
  - The additional front screen fits both on the sender and on the receiver.
  - The additional front screen may be used only if the curved enclosure side is accessible.
  - 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%.

Tab. 27: Part numbers, additional front screen (welding spark guard)

Protective field height [mm]	Part number
300	2 022 412
450	2 022 413
600	2 022 414
750	2 022 415
900	2 022 416
1050	2 022 417

Protective field height [mm]	Part number
1200	2 022 418
1350	2 022 419
1500	2 022 420
1650	2 022 421
1800	2 022 422

## 11.5 Deflector mirror

### 11.5.1 Deflector mirror PNS 80 for protective field width 0 ... 4 m (total)

Tab. 28: Part numbers, deflector mirror PNS 80

Protective field height [mm]	Type number	Part number
300	PNS 80-034	1 013 731
450	PNS 80-049	1 011 132
600	PNS 80-064	1 013 732
750	PNS 80-079	1 013 733
900	PNS 80-094	1 013 734
1050	PNS 80-109	1 013 735
1200	PNS 80-124	1 013 736
1350	PNS 80-139	1 013 737
1500	PNS 80-154	1 013 738
1650	PNS 80-169	1 013 739
1800	PNS 80-184	1 013 740

Dimensional drawings, see figure 33 on page 51

### 11.5.2 Deflector mirror PNS 120 for protective field width 4 ... 15 m (total)

Tab. 29: Part numbers, deflector mirror PNS 120

Protective field height [mm]	Type number	Part number
300	PNS 120-034	1 013 751
450	PNS 120-049	1 011 146
600	PNS 120-064	1 013 752
750	PNS 120-079	1 013 753
900	PNS 120-094	1 013 754
1050	PNS 120-109	1 013 755
1200	PNS 120-124	1 013 756
1350	PNS 120-139	1 013 757
1500	PNS 120-154	1 013 758
1650	PNS 120-169	1 013 759
1800	PNS 120-184	1 013 760

Dimensional drawings, see figure 33 on page 51

## 11.6 Accessories

Tab. 30: Part numbers, accessories

Part	Part number
<b>C 4000 standard</b>	
Hirschmann cable socket M26×11 + FE, crimp contacts, straight	6 020 757
Hirschmann cable socket M26×11 + FE, crimp contacts, angled	6 020 758
Connection cable for standard type and cascable devices	
Plug straight/stripped, 2.5 m	2 022 544
Plug straight/stripped, 5 m	2 022 545
Plug straight/stripped, 7.5 m	2 022 546
Plug straight/stripped, 10 m	2 022 547
Plug straight/stripped, 15 m	2 022 548
Plug straight/stripped, 20 m	2 022 549
Plug straight/stripped, 30 m	2 022 550
<b>C 4000 cascable</b>	
Connection cable between cascable devices, see "C 4000 standard"	
Connection cable between cascable devices	
Plug straight/socket straight, 0.25 m	2 022 278
Plug straight/socket angled, 0.25 m	2 022 284
Plug straight/socket straight, 0.5 m	2 021 838
Plug straight/socket angled, 0.5 m	2 022 285
Plug straight/socket straight, 1 m	2 022 279
Plug straight/socket angled, 1 m	2 022 286
Plug straight/socket straight, 1.5 m	2 022 280
Plug straight/socket angled, 1.5 m	2 022 287
Plug straight/socket straight, 2 m	2 022 281
Plug straight/socket angled, 2 m	2 022 288
Plug straight/socket straight, 2.5 m	2 022 282
Plug straight/socket angled, 2.5 m	2 022 289
Plug straight/socket straight, 3 m	2 022 283
Plug straight/socket angled, 3 m	2 022 290
<b>Mounting kit 2</b>	
Swivel mount, 4 pcs. for any protective field height	2 019 659
<b>Mounting kit 6</b>	
Swivel function (side mounting), 4 pcs. for any protective field height For higher vibration and shock exposure	2 019 506
<b>Accessories included in a standard delivery</b>	
Sliding nuts or side mounting bracket, 4 pcs.	2 017 550
CDS (Configuration & Diagnostic Software) on CD-ROM incl. online documentation	2 022 385
Connection cable between the serial interface of the PC and the configuration interface	6 021 195

# 12 Annex

## 12.1 Declaration of conformity

# SICK

### EC Declaration of Conformity

Under the terms of EC Machine Directive 98/37/EEC, Appendix VI

We hereby declare that the devices (see page 2, 3 & 4)

**of the product family C4000**

are safety components for a machine constructed as per the EC directive 98/37/EEC art. 1 para. 2. This declaration will lose its validity if any modification to a device used in the plant is made without prior consultation.

We employ a quality system certified by the DQS (German Quality Assurance Society), No. 462, as per ISO 9001 and have therefore observed the regulations in accordance with module H as well as the following EC directives and EN standards during development and production:

1. <b>EC directives</b>	EC machine directive 98/37/EEC			
	EC EMC directive 89/336/EEC as per 92/31/EEC, 93/68/EEC, 93/465/EEC			
2. <b>Harmonized standards and preliminary standards used</b>	DIN EN 954-1	Safety-related components of controllers	Ed.	97-03
	DIN EN 60204-1	Electr. equip. of mach.	Ed.	98-11
	DIN EN 61496-1	Safety of mach., active opto-electronic protective devices (AOPD)	Ed.	98-06
	IEC 61496-2	Safety of mach., active opto-electronic protective devices (AOPD)	Ed.	97-05
	DIN V VDE 0801/A1	Basic principles for computers in systems with safety functions	Ed.	94-10
3. <b>Test result</b>	EN 61496	BWS type 4		


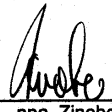
Conformance of a type sample belonging to the above-mentioned product family with the regulations from the EC machine directive has been certified by:

**Address of notified authority (Germany)** TÜV Rheinland  
Am Grauen Stein  
D-51105 Köln

**EC type sample test No** BB2011540 01 dated 2000-11-13

The CE mark was affixed to the appliance in conformance with directive 89/336/EEC.

Waldkirch/Br., 2000-11-24

 ppa. Dr. Plasberg (Head of Development Division Safety Systems)	 ppa. Zinober (Head of Production Division Safety Systems)
---	--

The declaration certifies conformance with the listed directives, but does not guarantee product characteristics. The safety instructions contained in the product documentation must be observed.

**Mat.-Nr.: 9 057 473**  
**Seite 5, engl.**  
Update no.: see page 2, 3 & 4

8 006 440 0499 BK - BK II - 16866

SICK AG  
Sebastian-Kneipp-Straße 1 · D-79183 Waldkirch  
Telefon 0 76 81-2 02-0  
Telefax 0 76 81-2 02-38 63  
www.sick.de

Aufsichtsrat: Gisela Sick (Ehrenvorsitzende)  
Dr. Horst Skoludek (Vorsitzender)  
Vorstand: Volker Reiche (Vorsitzender)  
Anne-Kathrin Deutrich  
Dieter Fischer  
Dr. Robert Bauer (Stellvertr.)

Sitz: Waldkirch i. Br.  
Handelsregister:  
Emmendingen  
HRB 355 W

## 12.2 Checklist for the manufacturer

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

The details on the items listed below must be available at the latest when the system is commissioned for the first time, depending, however, on the various applications the requirements of which must be reviewed by the manufacturer/OEM.

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 control category? Yes  No
4. Is the access to the hazardous area/the hazardous point allowed only through the protective field of the ESPE? Yes  No
5. Have appropriate measures been taken to prevent or monitor the unprotected stay in the hazardous area in the hazardous area/hazardous point protection (mechanical point-of-operation guarding) and have these been secured against removal? Yes  No
6. Are additional mechanical protective devices fitted and secured against manipulation which prevent reaching over, under or around the ESPE? Yes  No
7. Has the maximum stopping and/or post-run 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 point of danger has been achieved? Yes  No
9. Are the ESPE devices properly 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. Has the control switch for resetting the ESPE protective device and/or for restarting the machine been fitted and properly mounted and connected? Yes  No
12. Are the outputs of the ESPE (OSSD) integrated in compliance with the required control category 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 required protective functions effective in every setting of the operating mode selector switch? Yes  No
15. Are the switching elements monitored, e.g. EDMs, valves which are activated by the ESPE? Yes  No
16. Is the ESPE effective over the entire period of the dangerous state? Yes  No
17. Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device? Yes  No
18. Has the notice label "Important Information" for the daily check been attached so that it is well visible for the operator? Yes  No

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

### 12.3 List of tables

Tab. 1:	Permissible configuration of the restart interlock .....	13
Tab. 2:	Physical resolution and scanning range .....	15
Tab. 3:	Effective resolution in floating blanking with size tolerance .....	18
Tab. 4:	Effective resolution and maximum size of moving objects under reduced resolution.....	19
Tab. 5:	Meaning of the operation indicator elements of the sender .....	20
Tab. 6:	Meaning of the operation indicator elements of the receiver .....	21
Tab. 7:	Pin assignment system connection M26×11 + FE .....	30
Tab. 8:	Pin assignment configuration connection M8×4 .....	31
Tab. 9:	Pin assignment extension connection M26×11 + FE .....	32
Tab. 10:	Displays shown during the power-up cycle .....	35
Tab. 11:	Display values during the alignment of sender and receiver .....	36
Tab. 12:	Selecting the test rod under reduced resolution .....	37
Tab. 13:	Error displays of the LEDs .....	40
Tab. 14:	Error displays of the 7-segment display .....	41
Tab. 15:	Technical specifications C 4000 .....	43
Tab. 16:	Determining the total response time of a system .....	45
Tab. 17:	Number of beams depending on the protective field height and the physical resolution.....	46
Tab. 18:	Response time as factor of the number of beams .....	46
Tab. 19:	Weight of sender and receiver .....	47
Tab. 20:	Dimensions depending on protective field height, standard system (not cascable).....	48
Tab. 21:	Dimensions depending on protective field height, cascable system .....	49
Tab. 22:	Dimensions of the deflector mirrors depending on the protective field height	51
Tab. 23:	Part numbers, standard system without function package .....	53
Tab. 24:	Part numbers, standard system with function package B .....	54
Tab. 25:	Part numbers, cascable system without function package .....	55
Tab. 26:	Part numbers, cascable system with function package B .....	56
Tab. 27:	Part numbers, additional front screen (welding spark guard) .....	56
Tab. 28:	Part numbers, deflector mirror PNS 80 .....	57
Tab. 29:	Part numbers, deflector mirror PNS 120 .....	57
Tab. 30:	Part numbers, accessories .....	58



## **12.4 List of illustrations**

Fig. 1:	Components of the C 4000 .....	10
Fig. 2:	Securing dangerous points with a safety light curtain C 4000 .....	12
Fig. 3:	Securing dangerous areas with a safety light curtain C 4000 .....	12
Fig. 4:	Access guarding using a safety light curtain C 4000 .....	12
Fig. 5:	Outline drawing of the protective operation .....	13
Fig. 6:	Schematic layout of the beam coding .....	15
Fig. 7:	Schematic layout of the fixed blanking .....	16
Fig. 8:	Protecting a fixed blanking using mechanical barriers .....	16
Fig. 9:	Schematic layout of the floating blanking .....	17
Fig. 10:	Marking the effective resolution on the device label .....	18
Fig. 11:	Schematic outline of the operation with reduced resolution (example: reduction by one beam) .....	19
Fig. 12:	Marking the effective resolution on the device label .....	19
Fig. 13:	Indicator elements of the sender .....	20
Fig. 14:	Indicator elements of the receiver .....	21
Fig. 15:	Safety distance from the point of danger .....	23
Fig. 16:	Minimum distance from reflecting surfaces .....	24
Fig. 17:	Diagram, minimum distance from reflecting surfaces .....	24
Fig. 18:	The Correct installation must rule out the errors reaching below, reaching above and reaching behind .....	25
Fig. 19:	Composition of the swivel mount bracket .....	26
Fig. 20:	Mounting sender and receiver using swivel mount brackets .....	27
Fig. 21:	Composition of the side bracket .....	28
Fig. 22:	Mounting the C 4000 with side bracket .....	29
Fig. 23:	Pin assignment system connection M26×11 + FE .....	30
Fig. 24:	Pin assignment configuration connection M8×4 .....	31
Fig. 25:	Pin assignment extension connection M26×11 + FE .....	32
Fig. 26:	Connecting the contact elements to the EDM .....	33
Fig. 27:	Connecting the reset button/restart button .....	34
Fig. 28:	Daily checks of the protective device .....	37
Fig. 29:	Dimensional drawing C 4000 sender, standard system (not cascable), (mm) .....	48
Fig. 30:	Dimensional drawing C 4000 sender, cascable system (mm) .....	49
Fig. 31:	Dimensional drawing, swivel mount bracket (mm) .....	50
Fig. 32:	Dimensional drawing, side mounting (mm) .....	50
Fig. 33:	Dimensional drawings, deflector mirror (mm) .....	51