wieland

SLC4 and SLG4 BASE

Safety light curtains/safety light grid for securing danger zones in plant and mechanical engineering

Original operating instructions

Doc no. BA001352 (DE) / BA001353 (EN)
Last Update: 02/2024 Rev. A

INFO

Subject to change

Subject to technical changes for reasons of continued development.

1 ABOUT THIS MANUAL

1.1 Purpose

This manual is provided for users who require advanced technical information, including information relating to connection, programming, maintenance and relevant specifications. Additional documents relating to this product can be downloaded free of charge from the website listed on the back of this manual.

1.2 Scope of application

This manual describes the **SLC4** safety light curtains and the **BASE** model of the **SLG4** safety light grid. The **Standard Muting** model is described in a separate manual.

1.3 Norms and standards

These light curtains and light grids are intrinsically safe accident prevention systems designed in accordance with applicable international safety standards, in particular:

Standard	Description
EN 61496-1: 2020	Safety of machinery - Electro-sensitive protective equipment. Part 1: General requirements and tests.
EN 61496-2: 2020	Safety of machinery: Electro-sensitive protective equipment - Particular requirements for equipment that operate using active opto-electronic principle.
EN ISO 13849-1: 2015	Safety of machinery: Safety-related parts of control systems. Part 1: General principles for design.
EN 61508-1: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 1: General requirements.
EN 61508-2: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems.
EN 61508-3: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 3: Software requirements.
EN 61508-4: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 4: Definitions and abbreviations.
EN 62061:2005/A2:2015	Safety of machinery: Functional safety of electrical/electronic/programmable electronic safety-related systems.

1.4 Symbols and displays

The symbols shown below are included in this manual to provide information about important points or procedures, which must be observed when using the product:

Symbol	Meaning
	**NOTE:** The notes contain information required for proper diagnostic procedures as well as the repair and operation of the safety light curtain.
	WARNING: This term warns against actions that may result in harm or injury to the individuals carrying out the process.
	CAUTION: This term relates to actions that may result in material or equipment damage.

1.5 Abbreviations

The following abbreviations are used in this manual:

Abbreviation	Meaning
AIC	Beam coding
ESPD	Electro-sensitive protective equipment
EOA	stands for effective opening angle
M12 plug M12 socket	M12 electrical connection, consisting of plug and sockets with x ins
OSSD	Output switching elements
RX	Receiving unit
SLC	Safety light curtain
SLG	Safety light grid
TX	Transmitting unit

2 SAFETY

2.1 Safety information

NOTE: The user must have in-depth knowledge of the "safety" aspect.

The protective devices are only useful if they have been correctly installed in compliance with the guidelines set out in the regulations.

If you feel that you do not have the necessary expertise required to install the equipment, Wieland is always available to install it for you.

The fuses fitted in the protective device do not reset automatically. Therefore, if a short circuit causes these fuses to trip, both safety light curtains/safety light grids (RX and TX) must be sent to Wieland for inspection.

Malfunctions resulting in power supply failures can cause the output signal switching devices (OSSD) to open temporarily or activate the safety status on the connected safety field bus. However, this does not affect safe operation of the safety light curtain/safety light grid.

2.2 Protective device

This manual provides all the information required to select and operate the protective devices.

However, specific safety-related knowledge is required to integrate a safety light curtain or safety light grid correctly into a processing machine.

Since it is not possible to include all the necessary knowledge in this manual, Wieland technical customer service would be happy to provide additional information regarding the operation of the safety light curtains and the safety standards that enable their correct installation.

2.3 Protective device - selection

Perform an appropriate risk assessment and select a safety light curtain and safety light grid that has a minimum of three essential features:

2.3.1 Resolution

The resolution of the protective devices refers to the minimum diameter of a matt object that obscures one or more of the beams forming the protective field, thereby activating the sensitive protective devices.

The resolution is closely linked to the factor determining which part of the body must be protected.

R = 14 mm	Finger protection	
R = 30 mm	Hand protection	

As shown in the following figure, the resolution depends entirely on the geometric properties of the lenses, the diameter and the distance, and is not influenced by the environmental and operating conditions of the safety light curtain and safety light grid.

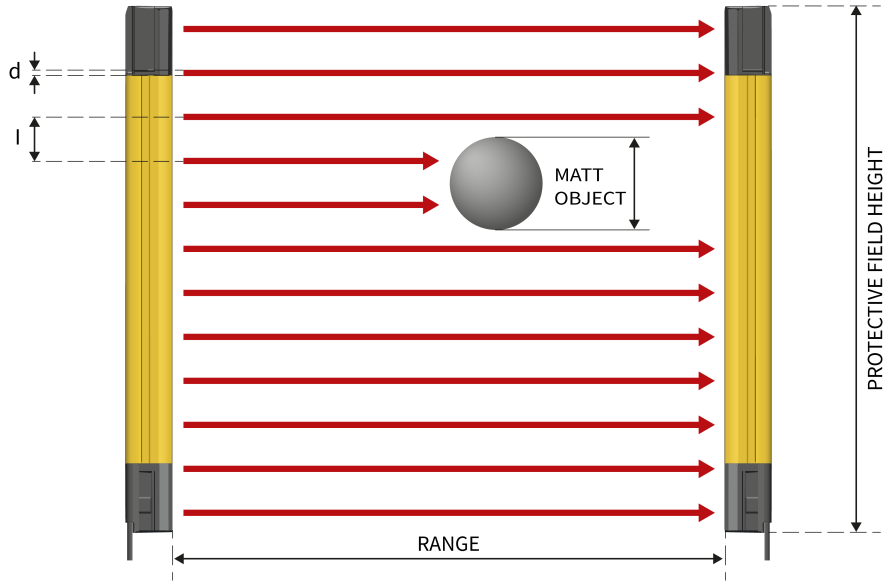


Fig. 1: Resolution

The resolution value can be calculated using the following formula:

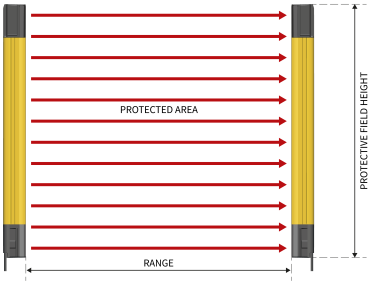
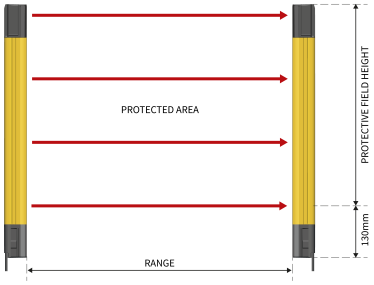
R = l + d	
l	Distance between two adjacent optics
d	Diameter of the lens

2.3.2 Protective field height

Protective field height refers to the height of the area protected by the safety light curtain or safety light grid.

The protective field height of SLC4 safety light curtains corresponds to the total length of the ESPE, There is no dead zone here.

On SLG4 safety light grids, the center of the first beam is positioned 130 mm from the bottom of the light grid. Here, the protective field height is defined as the distance between the axis of the top and bottom beams.

Safety light curtain **SLC4-B14/30**	**Safety light grid** **SLG4-B2/3/4**
	

Refer to the table below for details of the protective field height shown in the above illustrations.

Model	Protective field height
SLC4-B14/B30-0300	300
SLC4-B14/B30-0450	450
SLC4-B14/B30-0600	600
SLC4-B14/B30-0750	750

Model	Protective field height
SLC4-B14/B30-0900	900
SLC4-B14/B30-1050	1050
SLC4-B14/B30-1200	1200
SLC4-B14/B30-1350	1350
SLC4-B14/B30-1500	1500
SLC4-B14/B30-1650	1650
SLC4-B14/B30-1800	1800
SLC4-B14/B30-1950	1950
SLC4-B14/B30-2100	2100
SLG4-B2-0500	500
SLG4-B3-0800	800
SLG4-B4-0900	900
SLG4-B4-1200	1200

2.3.3 Safety distance

The protective device must be positioned at a specific safety distance (range).

This distance ensures that the operator can only enter/reach into the danger zone when the ESPE has triggered and the dangerous machine movement has stopped.

This distance depends on four different factors in compliance with Directive EN ISO 13855:

- ESPE response time (time that elapses between the effective interruption of the beams and the opening of the OSSD contacts).
- Stopping time of the machine, including the evaluation time and triggering of the safety control system (if available).
- Resolution of the ESPE
- Approach speed of the object to be detected.

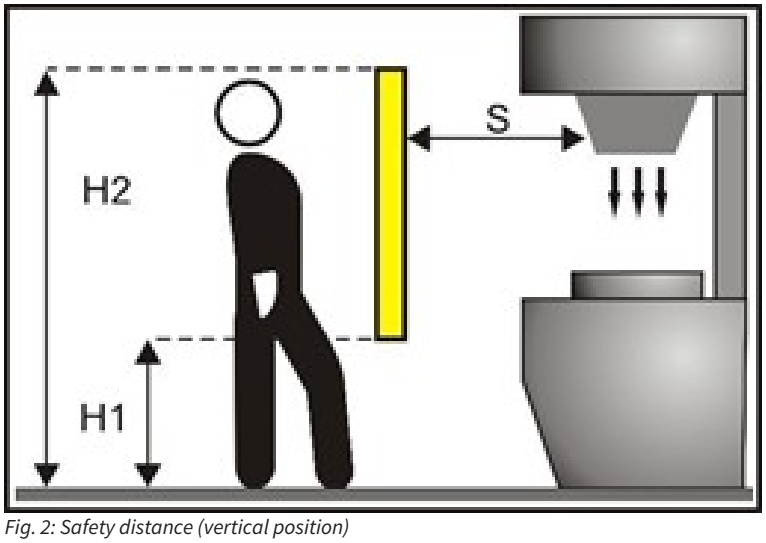


Fig. 2: Safety distance (vertical position)

The safety distance is calculated using the following formula:

S = K (t1 + t2) + C	
S	Minimum safety distance in mm
K	Approach speed of the object (body part or body) to the danger zone in mm/s
t1	ESPE response time in seconds, see chapter "*Technical data [ch. 3.4, p. 16]*"
t2	Stopping time of the machine in seconds (including safety control system)
C	Additional distance based on the possibility of the body or a body part entering the danger zone before the protective device is activated.
C	8 (R - 14) for protective devices with a resolution of ≤ 40 mm
C	850 mm for protective devices with a resolution of > 40 mm
R	Resolution of the protective device

Note

Resulting K-value:

2000 mm/s if the calculated value S is ≤ 500 mm

1600 mm/s if the calculated value S is > 500 mm

When using protective devices with a resolution of > 40 mm, the top beam must be positioned at a height of ≥ 900 mm (H2) from the machine support base, while the lower beam must be positioned at a height of ≤ 300 mm (H1).

In the event that the safety light curtain or safety light grid needs to be installed horizontally (see the illustration below), the distance between the danger zone and the optical beam furthest away from this zone must correspond to the value calculated using the following formula:

S = 1600 mm/s (t1 + t2) + 1200 - 0.4 H	
S	Minimum safety distance in mm
t1	ESPE response time in seconds, see chapter "*Technical data [ch. 3.4, p. 16]*"
t2	Stopping time of the machine in seconds (including safety control system)
H	Height of the beams above ground. In any case, this height must always be less than 1000 mm.

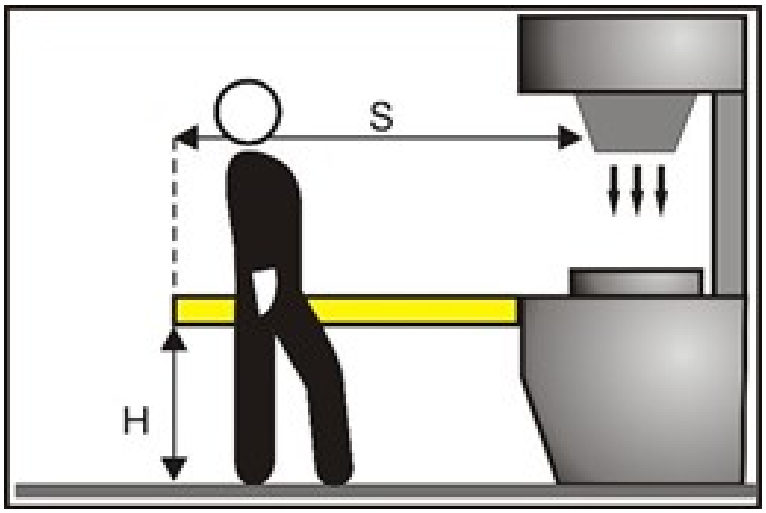


Fig. 3: Safety distance (horizontal position)

Application example

Let us assume that a light curtain has a height of 600 mm.

The following formula is used to calculate the distance between the protective device and the ESPE when aligned vertically:

S = K*T + C	
S	Minimum safety distance in mm
t1	ESPE response time
t2	Stopping time of the machine (including safety control system)
T	(t1 + t2) Total stopping time of the machine
C	8 *(R - 14) for protective devices with a resolution of ≤ 40 mm
R	Resolution of the protective devices

In any case, the value S > 500 mm results in K = 2000 mm/s. This requires a recalculation of the safety distance using the value K = 1600 mm/s.

Note:

The reference guideline here is EN ISO 13855 "Safety of machines - The positioning of protective equipment with respect to approach speeds of parts of the human body". The information provided here is non-binding and is intended as a summary. To calculate the safety distance correctly, refer to the complete Directive EN ISO 13855.

2.4 Protective device - typical application

2.4.1 Protection of the operating area - robot cell

The operator inserts the workpiece being processed and removes it again after processing. The operator must be protected from injury during processing.

Solution: An SLC4 safety light curtain with a resolution of 14 mm is ideal for applications where the protective device must be installed directly in the machine.

Advantage: The SLC4 safety light curtain has an extremely compact profile that ensures maximum installation flexibility as it is easy to integrate into the machine design due to its space-saving nature.

Fig. 4: Protection of the operating area on a robot cell

2.4.2 Protection of the operating area - press

The protective device must protect the operator of the bending press from being crushed between the upper and lower tools or the workpiece being processed when approaching the machine and therefore the danger zone.

Solution: Even if only one light axis of the safety light curtain is interrupted during the lowering phase of the press, all machine movements stop immediately.

Advantage: The safety light curtain can be used in most bending operations due to its ease of installation and compact dimensions.

SLC4 type safety light curtains not only guarantee a high degree of reliability, but also enhance system productivity by reducing the downtimes required for access, adjustment and machine maintenance.

Fig. 5: Protection of the operating area on presses

2.4.3 Access guarding of the production line

A typical application for SLC4 safety light curtains is access guarding on automated industrial production lines.

They are designed to protect the operator from dangers (e.g. crushing) on a fully automated production line.

Solution: The SLC4 safety light curtain with 30 mm resolution is ideal for these applications.

Advantage: The slimline design of the SLC4 safety light curtains together with easy installation ensures maximum ease of installation and the highest level of safety.

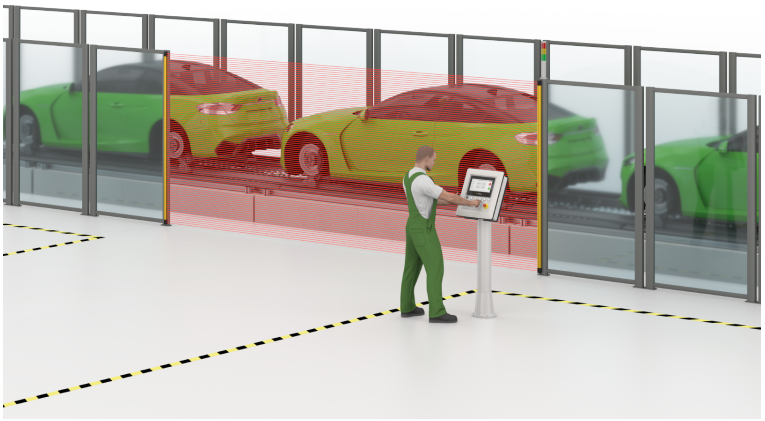


Fig. 6: Access guarding on a production line

2.4.4 Protection of the operating area - milling machine

The milling machine is used to machine complex shapes on parts made from metal and other materials. It is important that measures are implemented to prevent the tool or spindle on the machine from dragging, entangling or cutting the operators' hands or other body parts and causing injury.

Solution: In terms of safety requirements and the application type, the SLC4 safety light curtain with a resolution of 30 mm provides the perfect solution. The machine stops immediately as soon as even a single beam of the light curtain is interrupted.

Advantage: The SLC4 safety light curtain has an extremely compact profile that ensures maximum installation flexibility as it is easy to integrate into the machine design due to its space-saving nature.

Fig. 7: Example 4 - Protection of the operating area on a milling machine

3 PRODUCT DESCRIPTION

3.1 Brief overview

The safety light curtains and safety light grid are multi-beam optoelectronic protective devices designed for work areas where machines, robots and, more generally, automated systems could endanger the physical integrity of operating personnel who may come into contact with moving parts, even accidentally.

3.2 Intended use

The safety light curtains/safety light grid may only be used if they have been selected in accordance with the relevant applicable instructions as well as the standards, rules and regulations relating to occupational health and safety at work, and after they have been installed on the machine, connected, commissioned, and checked by a competent person. The devices are designed for indoor use only.

When selecting the safety light curtains/safety light grid, it must be ensured that their safety-related performance meets or exceeds the required performance level PL_r ascertained in the risk assessment.

The safety light curtains/safety light grid protect people or body parts at danger points, danger areas, or access points to machines and systems.

With the "access guarding" function, the the safety light curtains/safety light grid detect people only when they enter the danger zone but not whether there are any people within the danger zone. For this reason, a start/restart interlock or suitable walk-behind protection in the safety chain is essential in this case.

The safety light curtains/safety light grid must not be structurally modified. Changes to the safety light curtains/safety light grid mean that the protective function is no longer guaranteed. Changes to the safety light curtains/safety light grid also void all warranty claims against the manufacturer of the safety light curtains/safety light grid.

The safety light curtains/safety light grid must be inspected regularly by a competent person to ensure that they are properly integrated and fitted.

The safety light curtains/safety light grid must be replaced after a maximum of 20 years. Repairs and replacement of wear parts do not extend the service life.

Permissible maximum approach speeds (see ISO 13855):

- 1.6 m/s for access guarding
- 2.0 m/s for danger point guarding

3.3 Foreseeable misuse

Any use other than that defined under "Intended use" or that extends beyond that use is considered improper use.

The safety light curtains/safety light grid are generally not suitable for use as a protective device in the following cases:

- Danger resulting from the ejection of objects or hot or hazardous liquids spraying out of the danger zone.
- Applications in explosive or highly flammable atmospheres.

3.4 Technical data

3.4.1 Safety-relevant data

Safety-relevant data			
Safety category	Type 4		Ref. EN 61496-1: 2020
	SIL 3		rif. EN 61508
	SIL CL 3		Ref. EN 62061:2005/A2: 2015
	PL e and cat. 4		Ref. EN ISO 13849-1: 2015
	PFHd = 2.62 * 10^{-8}	1/h	Ref. EN 61508
	MTTFd = 43	years	Ref. EN ISO 13849-1 2015
Duration	20	years	
DCAvg	99	%	Average diagnostic coverage
SFF	99.5	%	Fraction of a certain defect
HTF	1		Hardware defect tolerance

3.4.2 Environmental data

Environmental data			
Ambient temperature, operation	-30 to +55	°C	
Ambient temperature, storage	-30 to +60	°C	
Temperature class	T6		
Humidity	15 to 95	%	Condensate-free

3.4.3 Mechanical data

Mechanical data			
Degree of protection	IP67, IP65		EN 60529
Vibrations	10 mm / 3 g		Frequency from 5 to 150 Hz, EN 60068-2-6, class 3M7 IEC TR 60721-4-3
Shock resistance	25 g x 6 ms x 600		(EN 60068-2-27 / class 3M7 IEC TR 60721-4-3)
Housing material	Painted aluminum		yellow, RAL 1003
Sealing cap material	PBT Valox 553		Black
Cover flap material	PBT 1403g3		Blue, Pantone 072C
Front cover material	MAKROLON AR 7099		Transparent
Weight	1.4	kg/m	Single profile - unpackaged

3.4.4 Electrical data

Electrical data			
Supply	24 ± 20 %	Vdc	The external power supply must be able to withstand a 20 ms power failure as specified in the IEC 60240-1 standard.
Transmitter current consumption (TX)	Max. 3.5	W	
Receiver current consumption (RX)	Max. 5.5 (no load)	W	
Output	2	Pieces	Output signal switching devices (OSSD) on all models
Output current	Max. 250 per output Total current max. 500	mA	
Output voltage - ON min.	Less than 1	V	Operating voltage value
Output voltage - OFF max.	0.2	V	
Capacitive load at the output	1	µF	at 24 Vdc
Leakage current	< 1	mA	
Response time	from 7 to 16 ms	ms	(response time from 30 mm not coded)
	From 9 to 28	ms	(response time from 14 mm not coded)
Protective field height	from 300 to 2100	mm	(individual unit)
Safety category	Type 4		(Designation as per DIN EN 61496-1)
Protection class	Class III	Class	
Connections	M12		with 5 or 8 poles
Max. inductive load	1.5	H	(for each OSSD output)
Max. charging current Ic	250	mA	
Min. charging resistance R1	115.2	ohms	(with no capacitive load at 28.8 V)
Capacitive load: min. charging resistance	1	µF	0 ohms for R1
Cable length (for power supply)	Max. 30	m	
Pollution level	2		

3.4.5 Optical data

Optical data			
Light source, wave-length	850	nm	Infrared LED
Resolution	14 to 30	mm	SLC4
Range	From 0.2 to 10	m	for response times SLC4 14 mm
	From 0.2 to 20	m	for response times SLC4 30 mm
	From 0.5 to 15	m	SHORT ranges SLG4
	From 5 to 70	m	LONG ranges SLG4
EOA angle	< ±2.5°	°	to 3 meters
Ambient brightness	-	-	EN 61496-2-2020

3.5 Description

The device consists of a transmitter unit and a receiver unit, both of which have a robust aluminum profile, and generates an infrared beam that can detect a matt object located within the protective field of the light curtain.

The transmitter and receiver units are equipped with control and monitoring functions (no external control unit required).

The electrical connections are made using detachable connection cables (pig-tail), which are coupled to the safety light grid/safety light curtain via a customer-specific plug (same for all models) and have an M12 standard connection at the other cable end.

The first and last optics are used to optically synchronize the transmitter and receiver: No electrical connection is required between the two units and one (of the two) synchronization beams can form part of a darkened area.

The emitted and received beams are managed and controlled by microprocessors, which provide the user with information about the status of the safety light grid/safety light curtain, and possible fault conditions via a series of LEDs.

Once an object, a body part or the body of the operator interrupts the beam emitted by the transmitter unit, the receiver unit switches off the output signal switching device (OSSD) immediately, causing the machine to switch to lockout state (if properly connected to the OSSD).

SLC4 safety light curtains and SLG4 safety light grids are used in all sectors of automation where control and prevention of access to danger zones are required, They are primarily used in the manufacturing industry.

The unit consists of modular optical units, formed by of one or more pairs of transmitters and receivers.

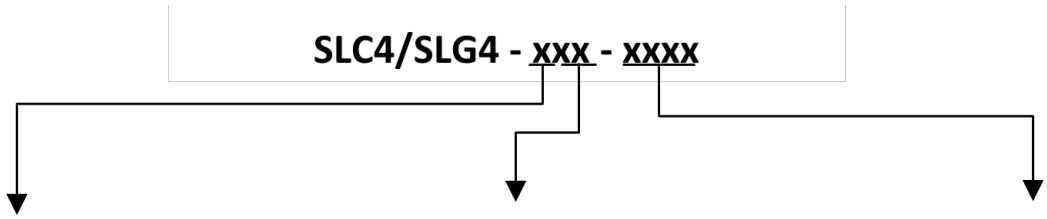
Each optical unit can consist of strips featuring multiple optical units, depending on the model.

The receiver is the primary controller of all functions. It checks and decides on safety measures when a fault occurs as well as providing a number of other general functions.

The transmitter is a device designed to perform a single task: it is constantly in operation and switches on the lighting function of its IR photocells in succession.

3.6 Model description

SLC4 safety light curtains and SLG4 safety light grids are described using the properties listed in the following illustration according to the respective model. Not all combinations are available.



Function group	Resolution or number of beams	Protective field height in mm
B = Basic	14 mm	From 300 mm to 2150 mm
	30 mm	From 300 mm to 2150 mm
SM = standard muting	2 beams	500 mm
	3 beams	800 mm
	4 beams	900 mm or 1200 mm

Example of model description

Wieland safety light curtain

SLC4-B14-0300	
SLC4	Safety light grid type 4
B	Basic
14	Resolution 14 mm
0300	Protective field height 300 mm

Note

For resolutions of 14/30 mm, the protective field height ranges from 300 mm to 2100 mm with a modularity of 150 mm.

BASIC	STANDARD MUTING
Function group	
Automatic restart	Manual/automatic restart
	Reset
	Control of the external protective device (EDM)
	Alignment function
	Muting T/muting L with two signals
	Single override
	Override dependent on muting with 2 signals
	Muting input filter and timeout setting
	Beam coding
Configuration	
-	Via DIP switches

3.7 Design

3.7.1 User interface model SLC4-B14/30-XXXX

A user interface with 16 LEDs on the receiver (RX) or transmitter (TX) helps the user to control and monitor the status of the safety light curtain during alignment, and provides information about the normal operating status as well as assistance with troubleshooting activities.

For each optical module, an RGB LED on both the RX unit and the TX unit informs the user about the status of the individual module and the function of the safety light curtain.

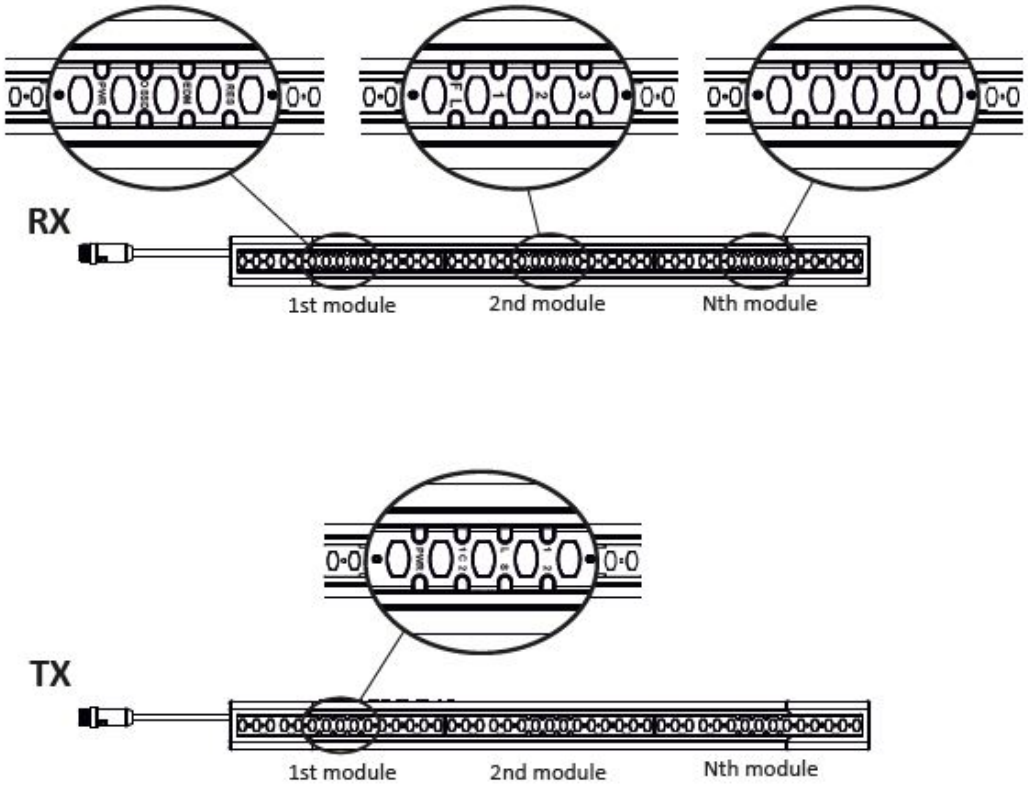
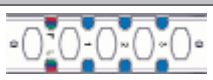
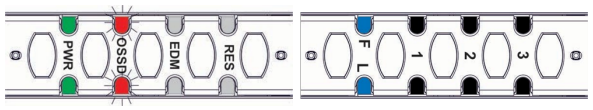
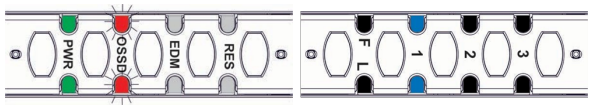
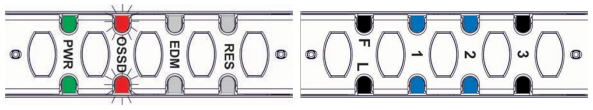
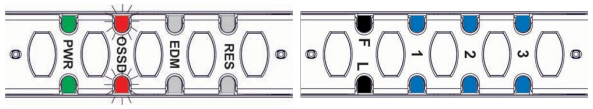
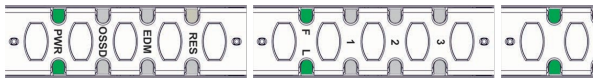
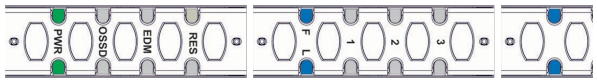
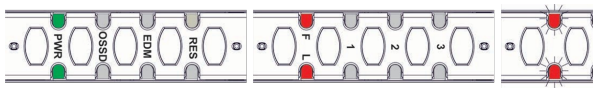
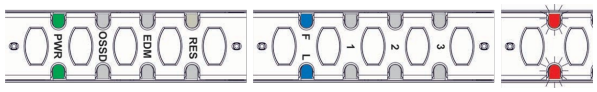
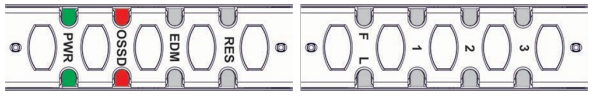
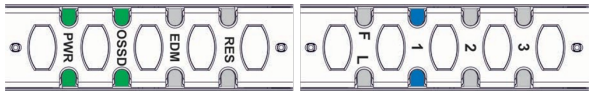
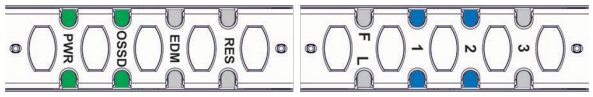
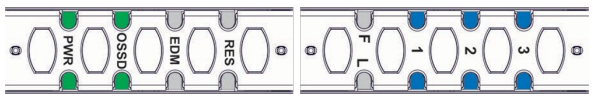
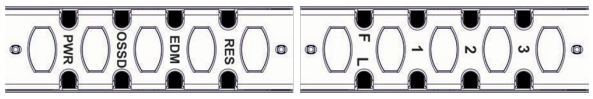
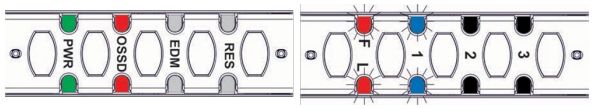
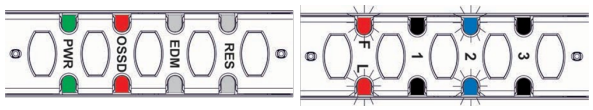


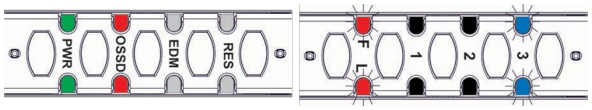
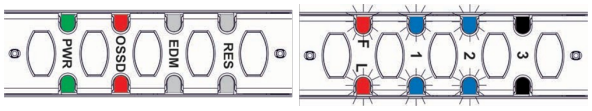
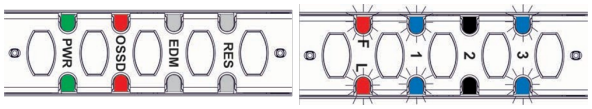
Fig. 8: RX: LED indicator on the receiver. TX: LED indicator on the transmitter.

Meaning of the LEDs			
	ON		Indifferent
	OFF		Flashing

Indicators on RX side

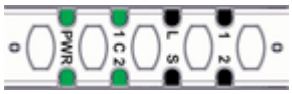
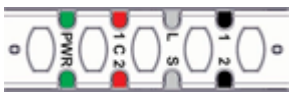
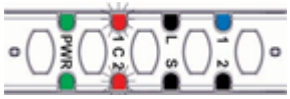
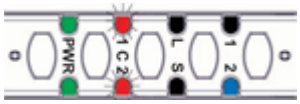
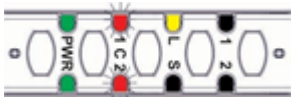
First module	Second module	Module no.
		

ESPE operating mode	Specification	LED configuration
Alignment	Not aligned	
	Level Minimum strength alignment signal	
	Level Medium strength alignment signal	
	Level Maximum alignment signal	
Status of the module signal (of second module)	Good signal on modules, no interrupted optics	
	Low signal on modules, no interrupted optics	
	One or more optics interrupted on modules with red flashing light	
	Example: Modules with different signal levels	
Normal operation OSSD OFF	No code	
Normal operation OSSD ON	Minimum signal strength	
	Good signal strength	
	Maximum signal strength	
Error (blocked)	Supply fault	
	F11 OSSD malfunction	
	F22 Microprocessor malfunctions	

ESPE operating mode	Specification	LED configuration
	F33 Optics malfunctions	
	F1122 Cascade system malfunctions	
	F1133 Input malfunction	

Indicators on TX side

Module


ESPE operating mode	Specification	LED configuration
Normal operation, emission active	No code	
Test, emission OFF	Test	
Error	F1 Microprocessor error	
	F2 Optics error	
	FL Cascade system error	

3.7.2 User interface model SLG4-B2/3/4-XXXX

A user interface with 8 LEDs helps the user to control and monitor the safety light curtain, in alignment mode, and provides information about the normal operating status as well as assistance with troubleshooting.

For each optical module, an RGB LED on both the RX unit and the TX unit informs the user about the status of the individual module and the function of the safety light grid.

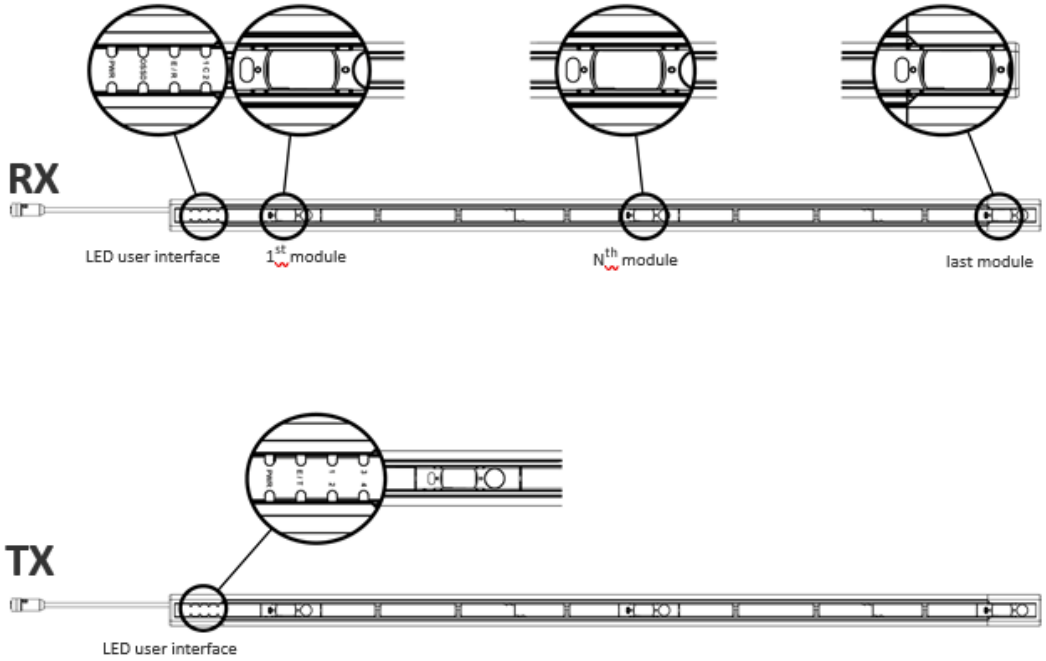
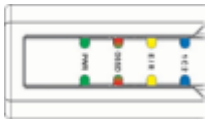
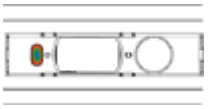
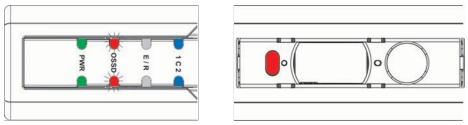
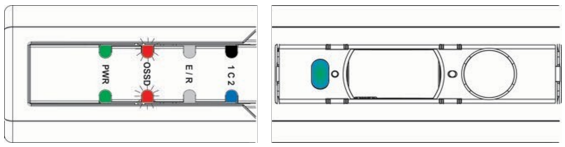
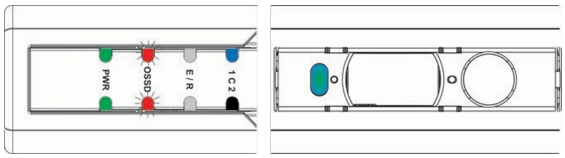
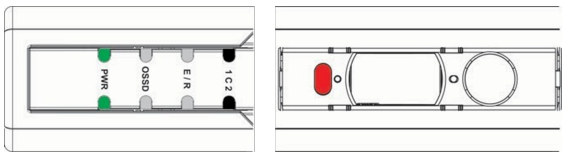
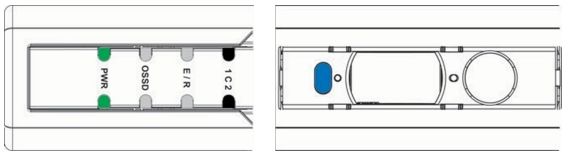
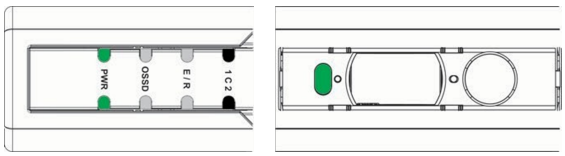
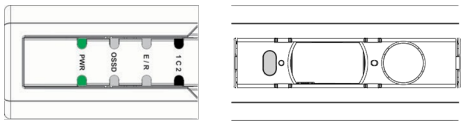
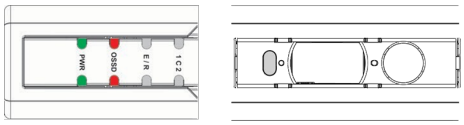
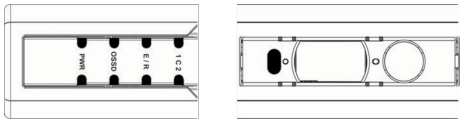
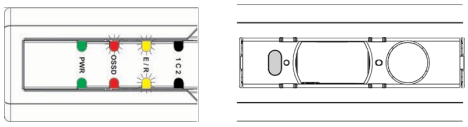
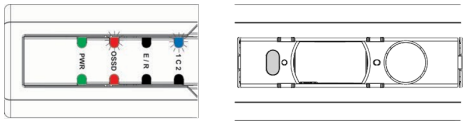
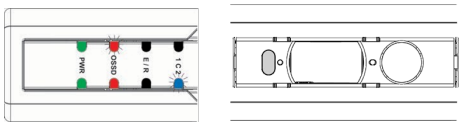


Fig. 9: RX: LED indicator on the receiver. TX: LED indicator on the transmitter.

Meaning of the LEDs			
	ON		Indifferent
	OFF		Flashing

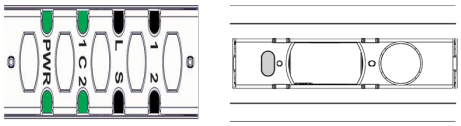
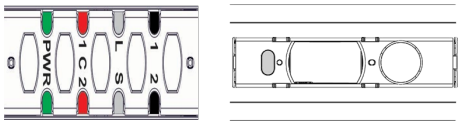
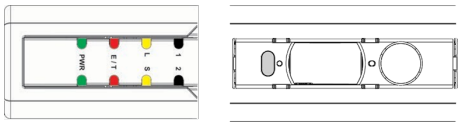
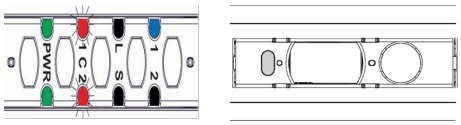
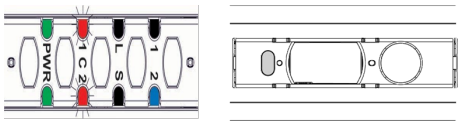
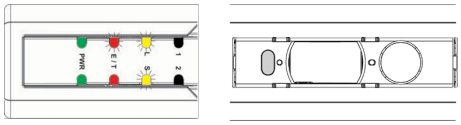
Indicators on RX side

User interface with LEDs	Module no.
	

ESPE operating mode	Specification	LED configuration	Module
Alignment	Not aligned		
	Not aligned Only the first synchronization beam is aligned		First module
	Not aligned Only the last synchronization beam is aligned		Last module
Alignment / Single optic in normal operating mode	No signal level on optic N^{th}		Module N^{th}
	Low signal strength on optic N^{th}		Module N^{th}
	Good signal level on optic N^{th}		Module N^{th}
Normal operating mode	No code		
Normal operation OSD OFF	One or more beams interrupted		
Error (blocked)	Supply fault		
	FER OSSD malfunction		
	F1 Microprocessor malfunctions		
	F2 Optics malfunctions		

Indicators on TX side

Module


ESPE operating mode	Specification	LED configuration
Normal operation, emission active	No code	
Emission OFF	Test	
	Request range change	
Error	F1 Microprocessor error	
	F2 Optics error	
	FLS Range setting error	

3.8 Function

3.8.1 General - function

This chapter describes all functions of the SLG4 safety light grids/SLC4 safety light curtains.

The main function of the safety light grids/safety light curtains is reliable detection. When an object equal in size or larger than the resolution of the safety light grid/safety light curtain is positioned at any point within the protective field, the safety light grid/safety light curtain detects it and the status of the corresponding output signal switching devices (OSSD) switches to OFF.

SLG4 safety light grids/SLC4 safety light curtains execute this detection function according to the requirements of the IEC EN 61496-2 standard.

3.8.2 RESTART MODE

When the beam detects a matt object, the output signal switching devices OSSD are switched (or the safety contacts are opened, safety conditions).

Resetting to normal operation of the ESPE (closure of the safety contacts OSSD = condition of normal operation) can be implemented in the following operating mode:

Automatic restart (all models)

When a matt object is detected, the status of the ESPE switches to OFF. Once the object has been removed from the protection area, the status of the ESPE switches back to ON.

The response time is the time from when the object is introduced into the protective field until the OSSD reaches OFF status.

The reset time is the time in which the OSSD switches to ON status after the object has been removed.

NOTE: These times are length-dependent and will be discussed here later, see chapter *Response time [ch. 8.2, p. 49]*.

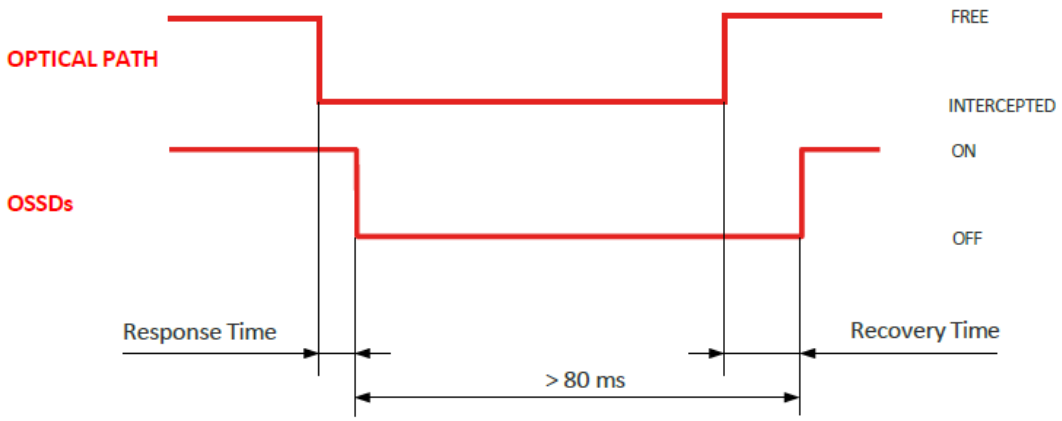


Fig. 10: Automatic restart (all models)

3.8.3 TEST

The TEST function is activated and holds the TEST HIGH signal (pin 2 on the TX unit) for at least 0.5 seconds as shown in the diagram below.

The TEST blocks the transmission phase and the RX side then detects all the beams as interrupted and the OSSD drops within the response time. As shown in the time switching diagram below, the OSSD switches to the OFF state (INTERRUPTED STATE) after 0.5 seconds (plus one cycle time) and the response time of the safety light curtain/safety light grid.

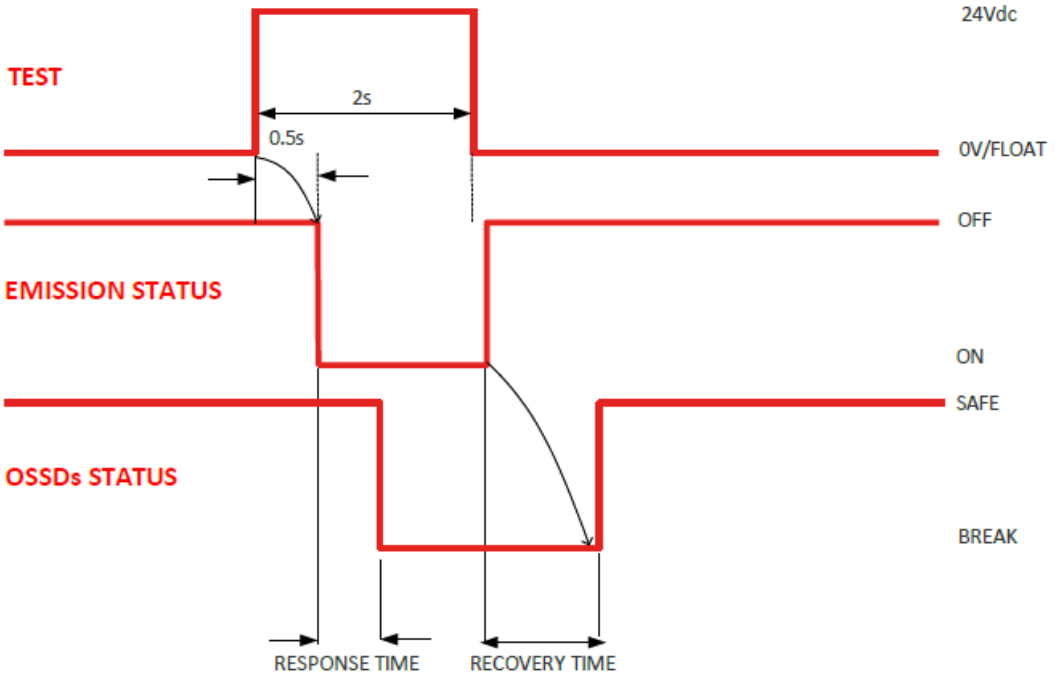


Fig. 11: OSSD time switch for the test on the TX

NOTE: On SLG4 models, the TEST output can be used to set the emission range. See the following section for further information.

CAUTION: During operation, leave the TEST input connected to 24 Vdc for more than 2 seconds and less than 5 seconds to change the range setting from LONG to SHORT or vice versa. The emission range setting is retained even after a supply cycle. See the following section for further information.

3.8.4 Selecting the emission range

The emission range can only be selected on SLG4 models.

For SLG4 safety light grids, the TEST input (pin 2 on the transmitter unit) can be used to set the emission range.

SHORT range was selected as the default setting. The range can be changed from SHORT to LONG as follows:

During operation, keep the input of connected pin 2 at 24 V for more than 2 seconds and less than 5 seconds to change the range setting from LONG to SHORT or vice versa. The emission range setting is retained even after a supply cycle.

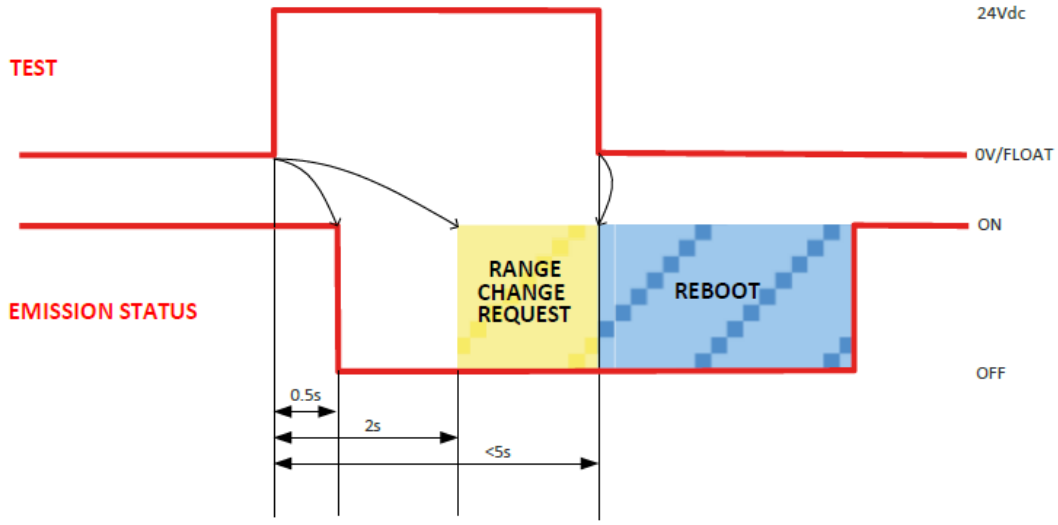


Fig. 12: Time switch for alternating request of the emission range

The emission is blocked 0.5 seconds after the rising edge at the TEST input. 2 seconds

after the rising edge on the TEST input, the range change request is activated and both LEDs (S and L) on the user interface light up.

Range change request:

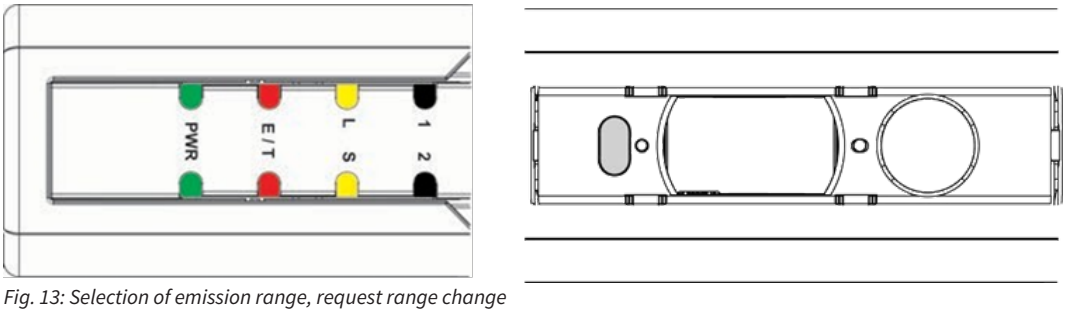


Fig. 13: Selection of emission range, request range change

If a falling edge is detected within 5 seconds of the rising edge, the transmitter unit restarts with the new range.

If a falling edge is not detected within 5 seconds of the rising edge, a range setting error will cause the transmitter unit to be blocked without changing the set range.

CAUTION: If SLG4 2/3/4-beam systems are used at a working distance of less than 5 m, the short range must be selected, otherwise safe operation cannot be guaranteed.

4 INSTALLATION

4.1 General - Installation

The transmitting (TX) and receiving units (RX) must be mounted with the surfaces of the optical lenses facing one another. The plugs must be attached on the same side and the distance must be within the working range of the model used, see chapter "*Safety-relevant data [ch. 3.4.1, p. 16]*".

The two protective devices must be aligned and positioned in parallel as accurately as possible.

Fine alignment can then begin as described in the "Alignment procedures" chapter.

The kit with mounting brackets provided for installation of the units should be used as described and shown in the illustrations below.

4.2 Procedure - Installation

To install the mounting brackets, insert the metal insert of the threaded bolts into the designated side mount on the sealing cap of the safety light curtain/safety light grid (1). Then guide the metal insert along the grooved profile of the safety light grid/safety light curtain (2). Secure the bracket to the profile by tightening the M5 (3 - 4) hexagon nuts. You can slide the mounting bracket along the specially fitted guide and then secure it again by tightening the hexagon nuts mentioned above.

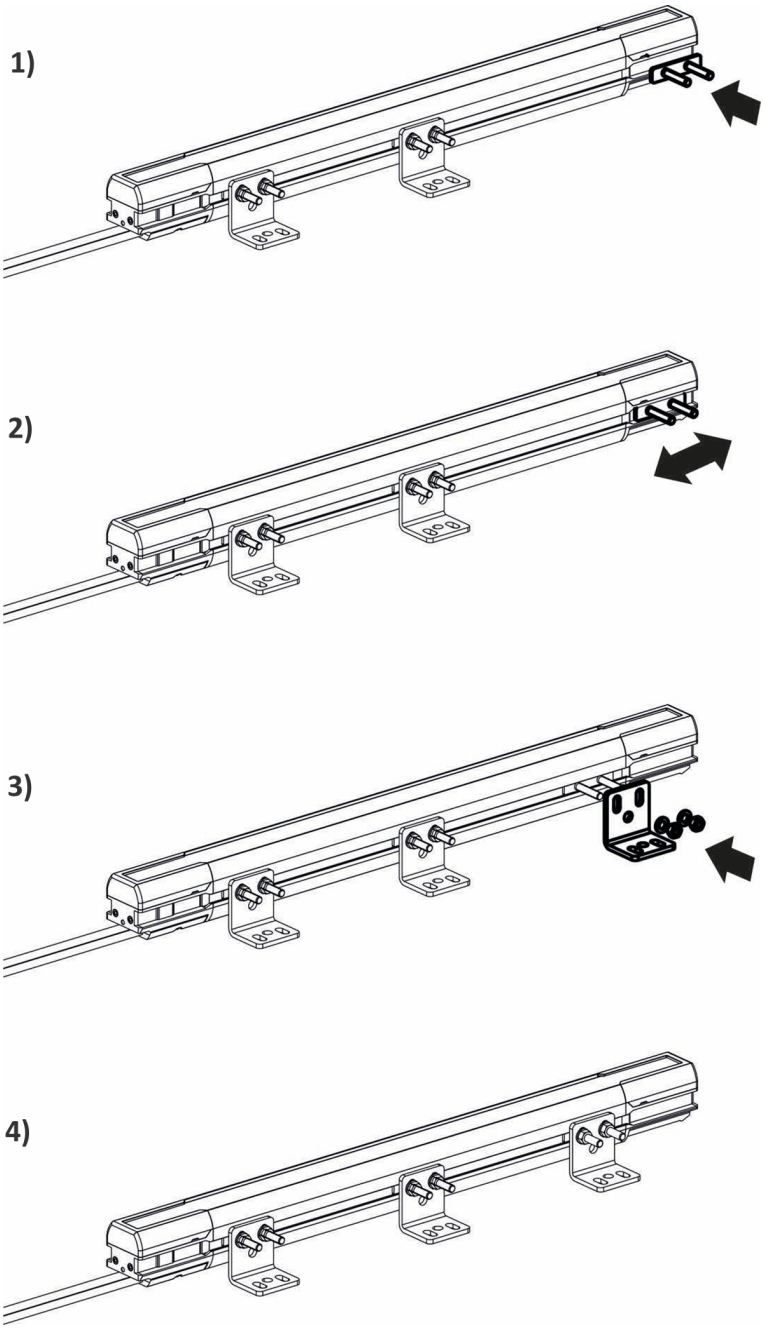


Fig. 14: Fitting the L-shaped mounting bracket

In applications that generate particularly intense vibrations, we recommend using vibration dampers in conjunction with the mounting brackets to dampen the vibrations.

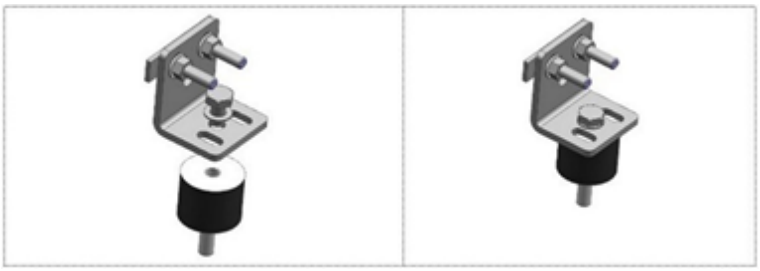


Fig. 15: Vibration-damping brackets

The recommended installation positions that depend on the length of the light curtains are shown in the following illustration with table.

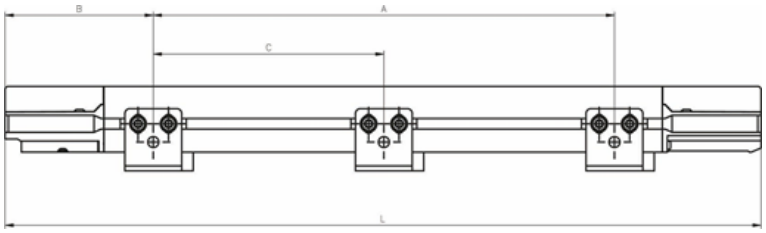


Fig. 16: Dimensions of SLC4 safety light curtains

Type designation 14 mm	Type designation 30 mm	L (mm)	A (mm)	B (mm)	C (mm)
SLC4-B14-0300	SLC4-B30-0300	309	89	110	-
SLC4-B14-0450	SLC4-B30-0450	459	239	110	-
SLC4-B14-0600	SLC4-B30-0600	609	309	150	-
SLC4-B14-0750	SLC4-B30-0750	759	409	175	-
SLC4-B14-0900	SLC4-B30-0900	909	509	200	-
SLC4-B14-1050	SLC4-B30-1050	1059	609	225	-
SLC4-B14-1200	SLC4-B30-1200	1209	909	150	454.5
SLC4-B14-1350	SLC4-B30-1350	1359	1009	175	504.5
SLC4-B14-1500	SLC4-B30-1500	1509	1109	200	554.5
SLC4-B14-1650	SLC4-B30-1650	1659	1209	225	604.5
SLC4-B14-1800	SLC4-B30-1800	1809	1309	250	654.5
SLC4-B14-1950	SLC4-B30-1950	1959	1409	275	704.5
SLC4-B14-2100	SLC4-B30-2100	2109	1509	300	754.5

Type designation 2, 3, or 4-beam systems	L (mm)	A (mm)	B (mm)	C (mm)
SLG4-B2-0500	674		150	
SLG4-B3-0800	974		200	
SLG4-B4-0900	1074		225	
SLG4-B4-1200	1374		175	

4.3 L-shaped mounting bracket installation instructions (SLX4-MO-LB)

The mounting brackets are used to install the safety light curtain/safety light grid in one of the two side grooves.

They are included in the delivery of the light curtain/light grid and can also be ordered separately (type SLX4-MO-LB, 2 pieces).

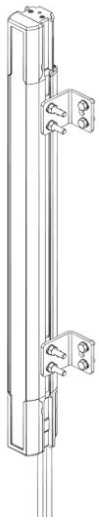


Fig. 17: Mounting bracket

The following equipment is included with each mounting bracket:

- A plate with two threaded pins
- Two washers M5 UNI 6592
- Two nuts M5 UNI 5588

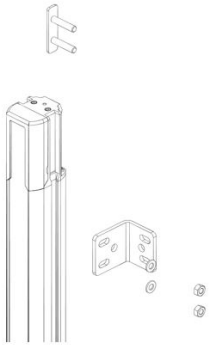
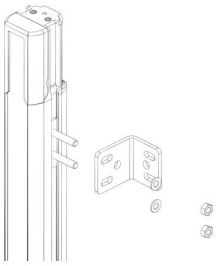


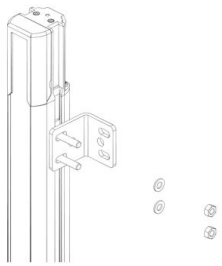
Fig. 18: Contents of delivery

✓ For heights <1200 mm, two mounting brackets on each side are sufficient; for heights =>1200 mm, three mounting brackets are required on each side.

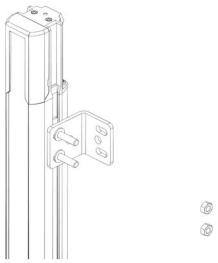
➡ Insert the plate with the threaded pins into the groove and slide vertically to the required position.



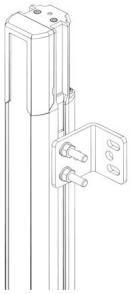
➡ Slide the mounting brackets over the threaded pins.



➡ Fit the washers.



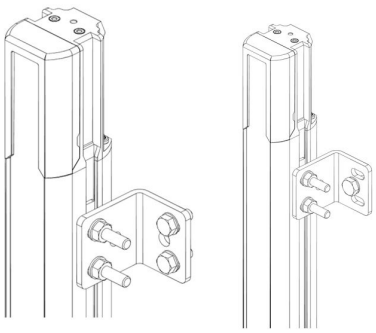
➡ After positioning the mounting bracket on the light grid/light curtain, tighten the nuts with a torque of 2.5 Nm.



The screws for mounting the brackets to the machine/system are not included.

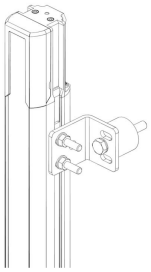
Use the following screws:

- insert two M5 UNI 5739 screws into the two external holes together with two J5 UNI 8842 washers.
- insert one M6 UNI 5739 screw into the central hole together with one J6 UNI 8842 washer.



➡ If vibrations occur between the mounting bracket and the system/machine, install vibration dampers; these can be ordered separately (SLX4-MO-AVK, 4 pieces).

➡ In this case, secure the bracket by inserting the M6 UNI 5739 screw into the central hole together with the J6 UNI 8842 washer.



4.4 Positioning the protective device

4.4.1 Incorrect/correct positioning

To ensure the necessary protection is provided, take special care when positioning the safety light curtain/safety light grid. The danger zone can only be accessed by passing through the light beams of the safety light curtain/safety light grid.

WARNING: The below illustrations show a few examples of options for accessing the top and bottom of the machine. These types of situations can be very dangerous. For this reason, the safety light curtain/safety light grid must be installed at a height that completely prevents access to the danger zone (correct positioning).

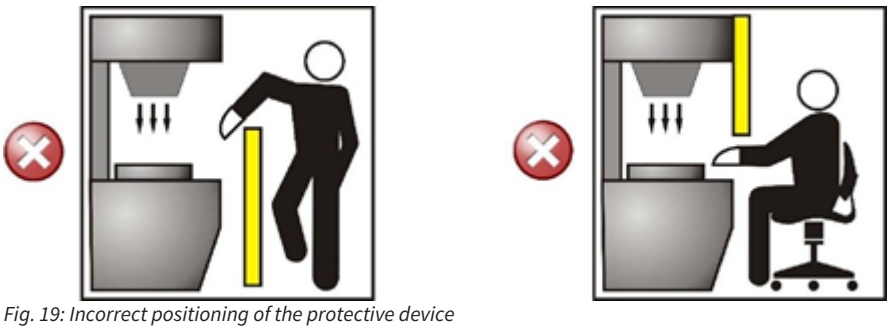


Fig. 19: Incorrect positioning of the protective device

Fig. 20: Correct positioning of the protective device

WARNING: If the operator can still access the danger zone, an additional mechanical protective device must be installed to prevent any further access.

In addition, it must not be possible to start the machine under normal operating conditions while the operator is still inside the danger zone. In cases where the safety light curtain/safety light grid cannot be installed directly in the immediate vicinity of the danger zone, an appropriate installation such as a second, horizontally aligned safety light grid must be installed to exclude the possibility of gaining access from the side. See the following illustrations.

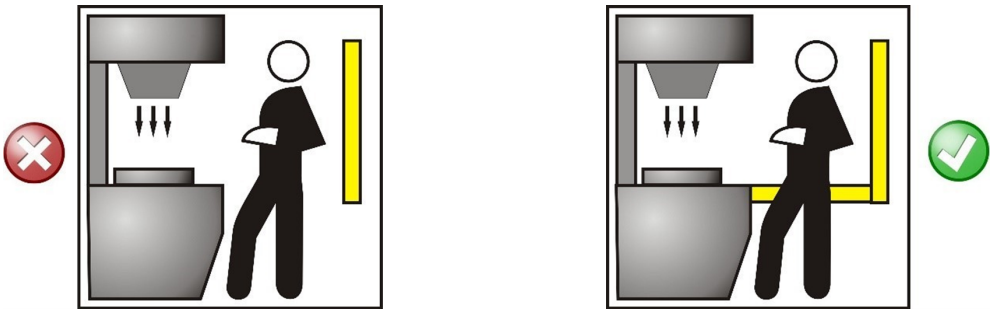


Fig. 21: Incorrect and correct positioning of the protective device

4.4.2 Minimum distance from reflective surfaces

Reflective surfaces (D_{SR}) located near the beams emitted by the protective device (above, below or to the side) can generate passive reflections. These passive reflections may prevent devices from detecting the object within the protected area. If the RX receiver unit also detects a secondary beam (reflection from the reflective, horizontally positioned surface), it is possible that the object is not detected, even if it interrupts the main beam.

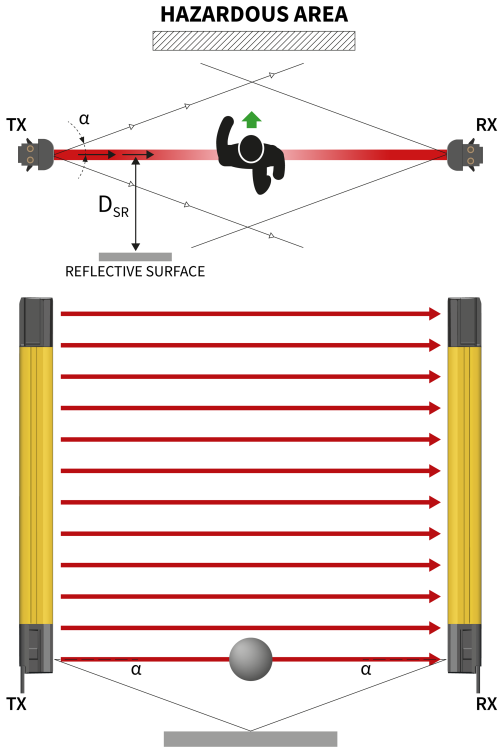


Fig. 22: Distance from reflective surfaces

When installing the safety light curtain/safety light grid, it is important that the minimum distance from reflective surfaces is maintained.

This minimum distance depends on the following factors:

- the range between transmitter (TX) and receiver (RX);
- the effective opening angle of the ESPE (EOA); especially with ESPE type 4 EOA = ± 2.5°

The graphic shows the minimum distance from the reflective surface (DSR),

depending on the range:

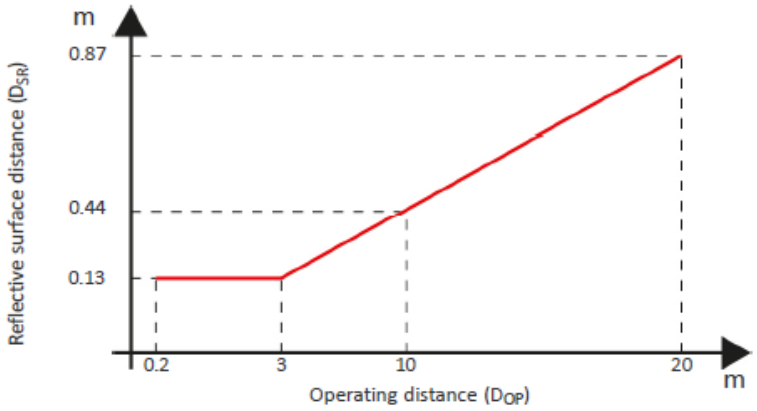


Fig. 23: minimum distance from reflective surfaces

Formula for calculating D_{SR}:	
D_{SR} (m) = 0.13	for ranges < 3 m
D_{SR} (m) = range (m) x tan (2.5°)	for ranges ≥ 3 m

4.4.3 Distance from adjacent protective devices

The following graphic shows the distance from interfering protective devices (D_{do}), depending on the range (D_{OP}) of the pair (TXA – RXA).

If multiple protective devices need to be installed in adjacent areas, it must be ensured that the transmitter unit of one protective device does not interfere with the receiver unit of another protective device.

The interfering protective device (TXB) must be installed the minimum distance D_{do} away from the axis of the TXA – RXA of the transmitter/receiver pair.

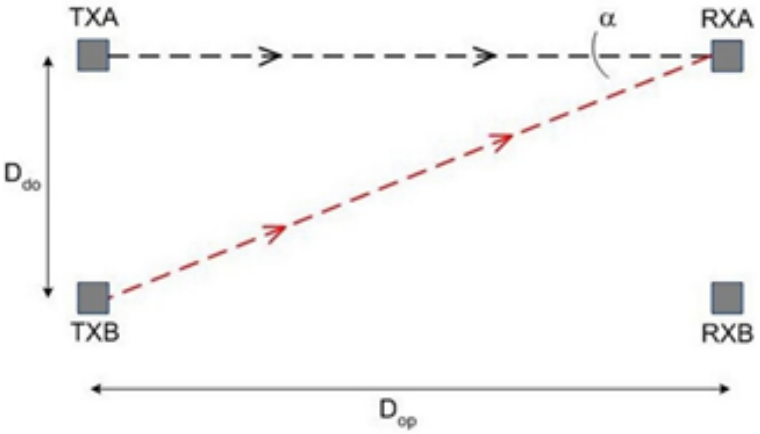


Fig. 24: Distance between adjacent protective devices

This minimum distance D_{do} depends on the following factors:

- of the range between transmitter (TXA) and receiver (RXA);
- from the effective opening angle of the ESPE (EOA).

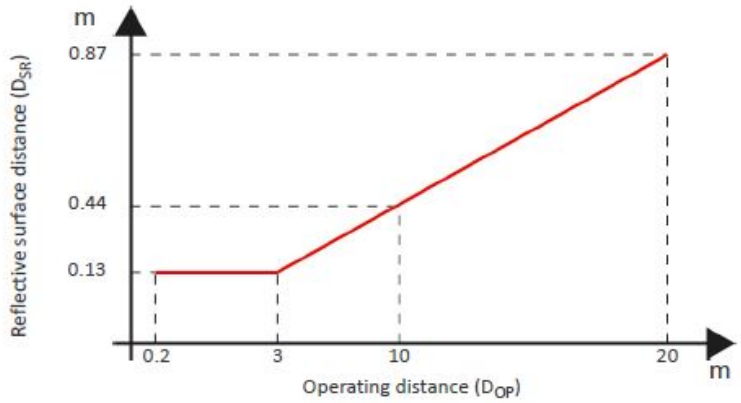


Fig. 25: ESPE type 4

Formula for calculating D_{do}:	
D_{do} (mm) = 263	for ranges < 3 m
D_{do} (m) = range (m) x tg 5°	for ranges ≥ 3 m

CAUTION: The interfering protective device (TBX) must be positioned the same distance D_{do} away as calculated above, even if it is closer to TXA than RXA.

To avoid situations where adjacent protective devices interfere with one another, proper precautions must be taken during installation. A typical situation is illustrated below, where installation areas for multiple safety light barriers are positioned next to one another and aligned with one another, as is the case in systems with linked machines, for example.

The illustration gives two examples:

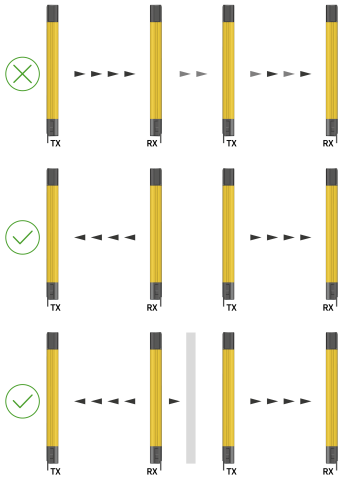


Fig. 26: Recommended positioning for adjacent protective devices

NOTE: In instances where two light curtains/light grids need to be installed next to one another, they must be positioned as shown in the above illustration.

4.4.4 Alignment of transmitter and receiver

The two units must be mounted parallel to one another, with their beams at right angles to the surfaces of the transmitter and receiver, and with their connectors pointing in the same direction.

The configurations shown in the illustration should therefore be avoided:

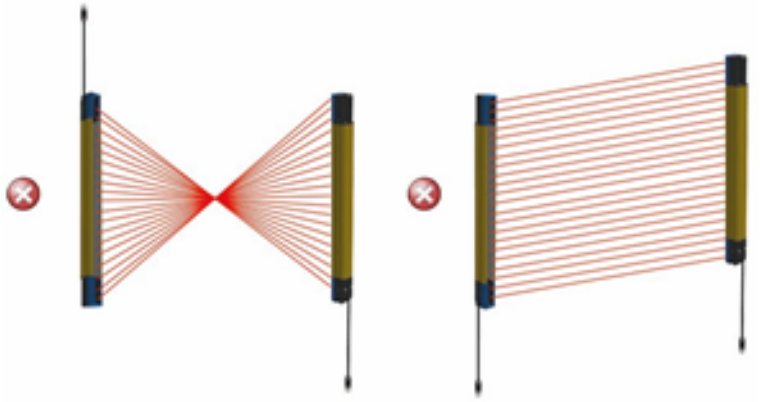


Fig. 27: Incorrect alignment of TX-RX of the safety light curtain/safety light grid

4.4.5 Use of the deflecting mirror

If a single protective device is used, danger zones with different but adjacent access sides can be monitored using appropriately positioned deflecting mirrors.

The illustration shows a potential solution where two access sides are monitored by one mirror. The deflecting mirror must be positioned at a 45° inclination to the light axes.

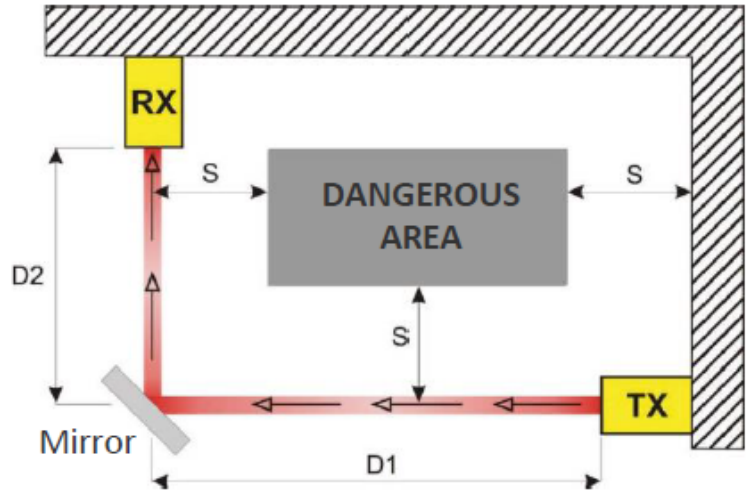


Fig. 28: Use of deflecting mirrors

Always take the following precautions before using deflecting mirrors:

- When deflecting mirrors are used, the alignment of the transmitting and receiving units is a particularly critical process. Even a slight angular offset of the mirror can result in misalignment.
- In this case, the use of the Wieland laser pointer is recommended (available as an accessory).
- The minimum safety distance (S) must be maintained on all beam sections.
- The use of only one deflecting mirror reduces the actual range by approx. 20%.

The table below contains the ranges according to the number of mirrors used.

Number of mirrors	Range (14 mm)	Range (30 mm)
0	10 m	20
1	8 m	16

- The possible presence of dust or dirt on the reflective surface of the mirror will drastically reduce the range.

4.5 Alignment - protective device

4.5.1 General - Alignment

NOTE: A black triangle is printed on the side of each receiving unit in the area around the laser marking to identify and distinguish it from the transmitting unit.

Accurate alignment of the transmitter and receiver units is essential for proper operation of the safety light curtain/safety light grid. It prevents an unstable status (the OSSDs switch from ON to OFF and vice versa) caused by dust or vibrations.

Perfect alignment is achieved when the optical axes of the first and last beams of the transmitter match the optical axes of the corresponding elements on the receiver.

The illustration shows that the first beam is located on the lower front of the light grid/light curtain next to the connections. The last beam is located at the top side. These beams also function as synchronization beams.

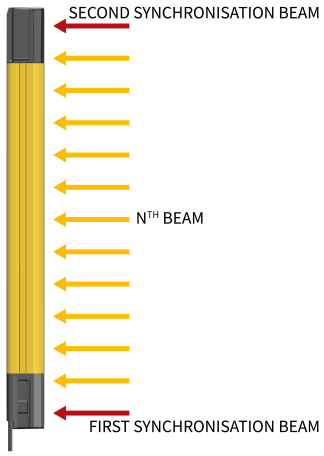
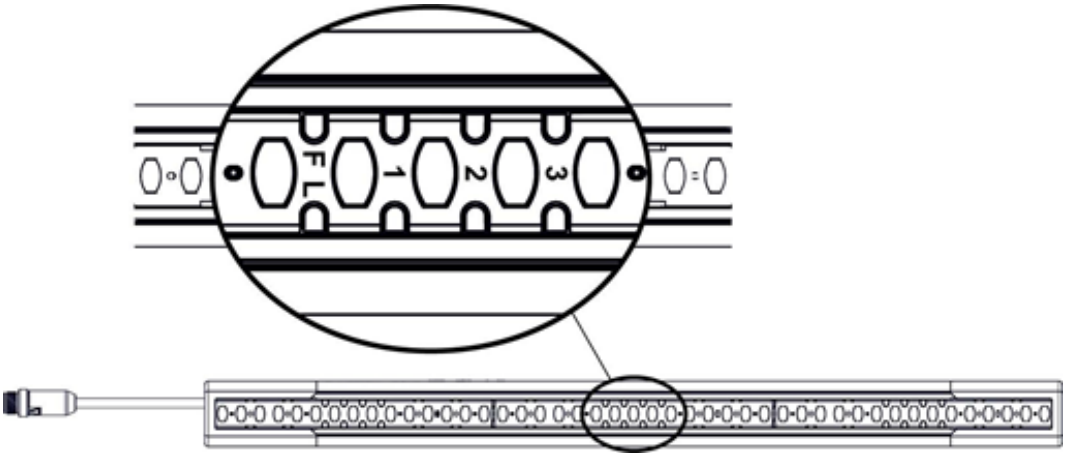


Fig. 29: Description of beams

4.5.2 User interface - Alignment

Model SLC4-XXXX-XXXX

LEDs on the user interface indicate the level.



Meaning of the LEDs			
	ON		Indifferent
	OFF		Flashing

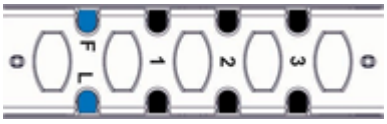
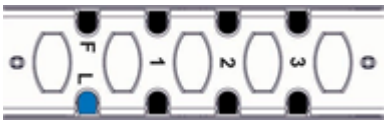
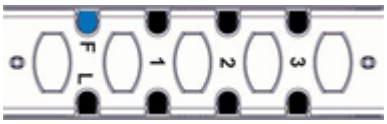
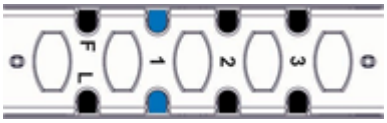
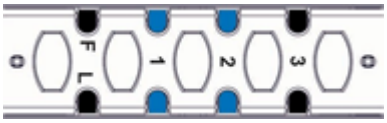
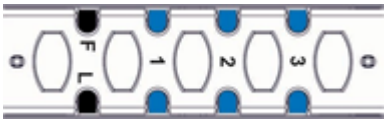
Description	LED Configuration
Not aligned	
Not aligned Only the first synchronization beam is aligned	
Not aligned Only the last synchronization beam is aligned	
Level Minimum strength of alignment signal	
Level Medium strength alignment signal	
Maximum signal strength	

Table 1: The display of the user interface is set to alignment mode

NOTE: During normal operation, the level of the signal is indicated by the same LEDs used in alignment mode, whereby the F/L LED lights up green/red, depending on the status of the optics on the second module.

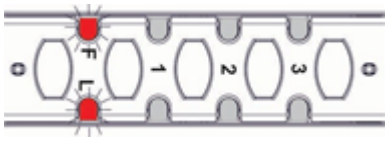
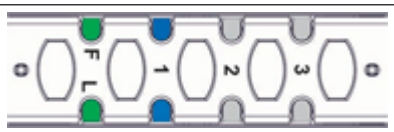
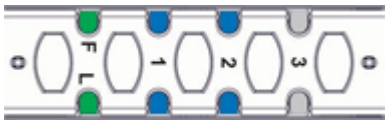
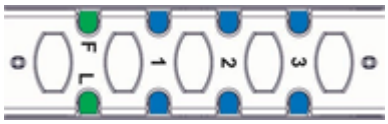
Description	LED configuration	Result of OSSD status during normal operation
One or more beams is interrupted on the second module		OFF
Minimum signal strength		ON
Medium strength signal		ON
Maximum signal strength		ON

Table 2: Alignment indicator during normal operation

NOTE: On SLC4 safety light curtains, every optical module apart from the first one (15 cm segment for a resolution of 14/30 mm) shows the status of its optics via a status LED on the RGB module, both during normal operation and in alignment mode. Modules whose beams have been interrupted flash red.

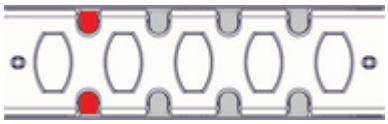
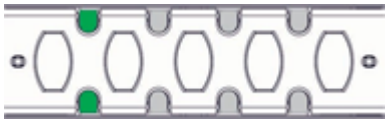
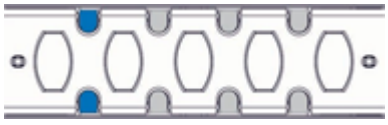
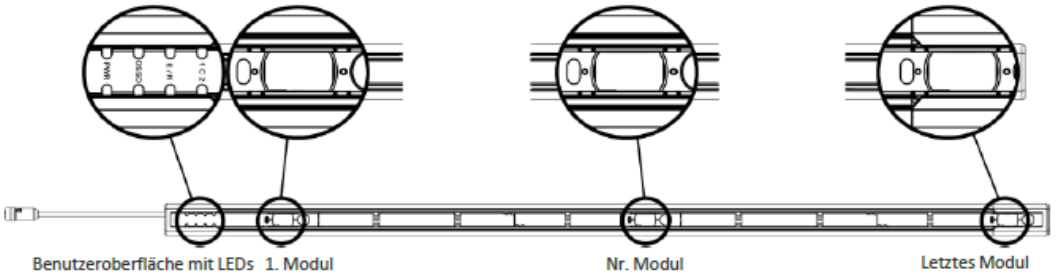
Description	LED configuration	Result of OSSD status during normal operation
At least one of the beams is interrupted on the other modules		OFF
At least one of the beams is interrupted on the module		OFF
All beams free, good signal		ON
At least one of the beams on the module has the minimum signal strength		ON

Table 3: Alignment indicator of a single module

Module SLG4-XXXX-XXXX

LEDs on the user interface indicate the level.



Meaning of the LEDs			
	ON		Indifferent
	OFF		Flashing

Description	LED configuration	
Not aligned		
Not aligned Only the first synchronization beam is aligned		First module
Not aligned Only the last synchronization beam is aligned		Last module

Table 4: The display of the user interface is set to alignment mode (SLG4 2/3/4-beam systems)

5 INSTALLATION

5.1 Packaging contents

The packaging contains the following parts:

- Receiver (RX)
- Transmitter (TX)
- Quick guide for installing the safety light curtain or safety light grid
- Four mounting brackets and matching mounting accessories
- Two additional mounting brackets for models with a height of 1200 mm or more.

5.2 Requirements - Installation

Note: Ensure that the safety level guaranteed by the protective devices corresponds to the effective danger level of the machine being monitored in accordance with the following standards:
EN ISO 13849-1 2015 or EN 62061:2005/A2: 2015.

- Always use pairs of transmitters and receivers with the same resolution and protective field height.
- The outputs (OSSD) of the electro-sensitive protective equipment (ESPE) must be used as stopping devices on the machine, not as control devices.
- The machine must have a separate START control.
- The dimensions of the smallest detected object must be defined based on the resolution of the protective device.
- The ESPE must be installed in an environment whose properties meet the specifications in the technical data, see chapter "*Safety-relevant data [ch. 3.4.1, p. 16]*".
- The ESPE must not be installed near particularly intense and/or flashing light sources, especially near the front area of the receiver unit.
- Strong electromagnetic interference could prevent the protective device from operating correctly. If necessary, contact Wieland Electric's technical customer service for advice.
- The presence of smoke, mist or dust in the working environment can significantly reduce the range of the protective device.
- Sudden and significant temperature fluctuations with extremely low peak values can result in the formation of a light layer of condensation on the front surfaces of the protective device, which will prevent it from operating correctly.

5.3 Requirements - safety

Note: In order to use the safety light curtains and safety light grids correctly and safely, observe the following information:

- It must be possible to electrically control the safety monitoring system designed for stopping the machine.
- This monitoring system must be capable of stopping dangerous machine movements within the overall stopping time T, see chapter "*Safety distance [ch. 2.3.3, p. 10]*", in every phase of the processing cycle.
- Installation of the safety light grid/safety light curtain and the electrical connections must be carried out by qualified personnel in compliance with the relevant specifications and applicable guidelines, see chapter "*Installation [ch. 4, p. 28]*, *Electrical installation [ch. 5.4, p. 43]*, *Alignment - protective device [ch. 4.5, p. 38]*, *Installation [ch. 5, p. 42]*".
- The safety light curtain/safety light grid must be installed in such a way that the danger zone cannot be accessed without interrupting the beams.

- The personnel working inside the danger zone must be adequately trained in the operation of the safety light curtain/safety light grid.
- The TEST button must be located outside the danger zone in a location where the operator can monitor the protective field area when performing test procedures.
- The RESET/RESTART button must be located outside the danger zone in a location where the operator can monitor the protective field area during all resetting/restarting procedures.

Note: Always closely observe the instructions on correct operation before switching on the safety light grid/safety light curtain.

5.4 Electrical installation

5.4.1 Connections

The below instructions relating to connections should be observed to ensure correct operation of the safety light curtain/safety light grid.

- Never bring the connection cables in the close vicinity of or in contact with cables that have high voltage ratings and/or experience current fluctuations (e.g.: power supply for motors, inverters, etc.).
- Do not connect the OSSD wires of multiple safety light curtains/safety light grids to the same multi-core cable.
  - The TEST connection must be connected to the operating voltage of the ESPE via a button with a normally closed contact.

CAUTION: The test button must be positioned so that the user can monitor the protective field during each test.

The RESET / RESTART / ALIGN button must be positioned so that the user can monitor the protective field during all resetting procedures.

- The protective device is already internally equipped with suppressors for overvoltages and overcurrents.
- The use of additional external components is not recommended.

See also

User interface model SLC4-B14/30-XXXX [▶ 20]

5.4.2 Pin assignment and configuration

All electrical connections of the transmitting and receiving units are established using one or more M12 plugs.

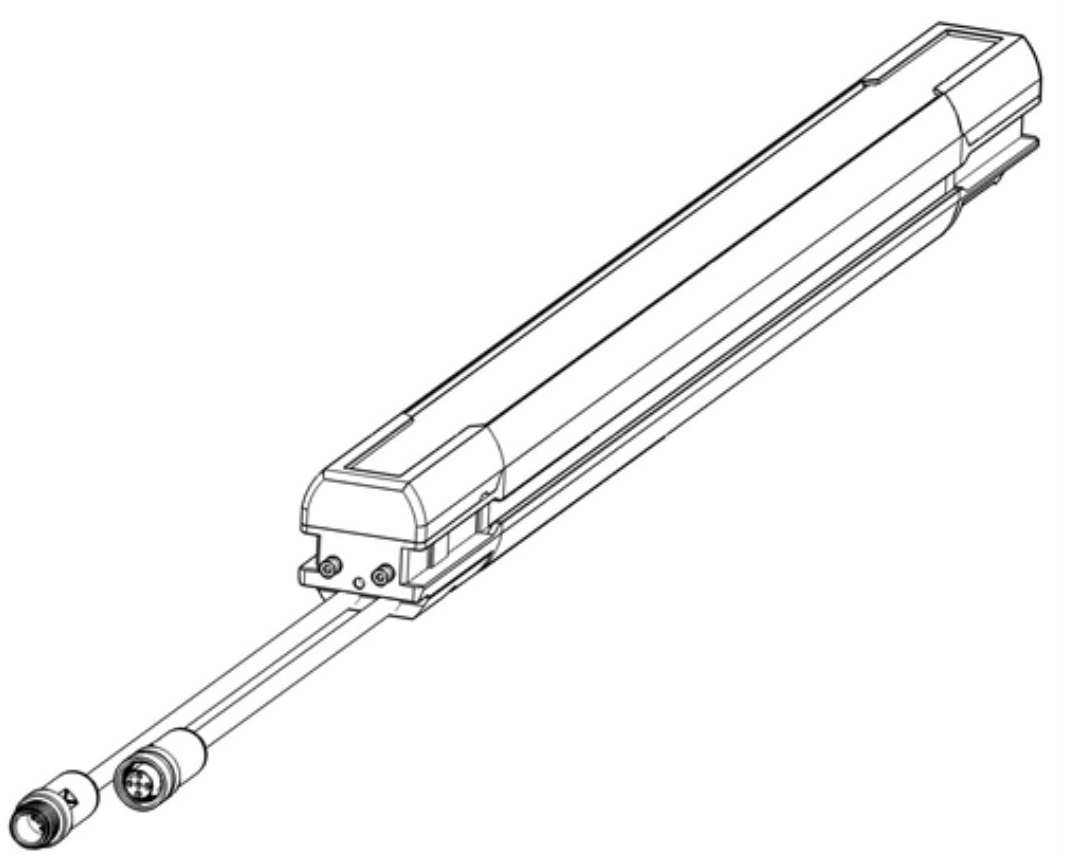
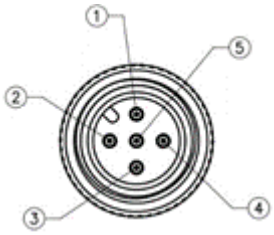
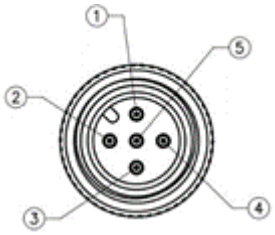


Fig. 30: Connections

Receiver	Transmitter
RX 5-pin M12 plug	TX 5-pin M12 plug
	
1 - 24 V (brown)	1 - 24 V (brown)
2 - OSSD1 (white)	2 - TEST (white)
3 - 0 V (blue)	3 - 0 V (blue)
4 - OSSD2 (black)	4 - Not connected (black)
5 - Serial communication (gray)	5 - Serial communication (gray)

5.5 Checking the installation

The checks that must be carried out after initial installation and before the machine is started are listed below. The checks must be carried out by qualified personnel, directly, or under the supervision of the machine safety officer.

Check the following:

- The ESPE must maintain safety status and the beams across the entire protective field area must be interrupted by inserting an appropriate test rod (SLX4-AC-TB14/SLX4-AC-TB30), according to the diagram in Figure 34.

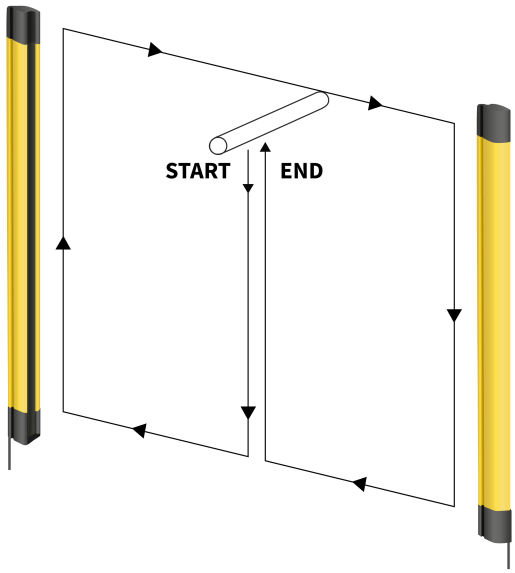


Fig. 31: Test rod path

- The ESPE must be aligned correctly: the red LED must not light up when the side of the product is pressed lightly in both directions.
- Activation of the TEST function (on the TX side) causes the output signal switching devices OSSD to open (red LED, OSSD on RX side, ON and stop controlled by the machine).
- The response time to the machine STOP, including the response time of the ESPE and the machine, must remain within the limits defined to calculate the safety distance, see chapter "*Safety distance [ch. 2.3.3, p. 10]*".
- The safety distance between the danger zones and the ESPE must match the specifications, see chapter "*Safety distance [ch. 2.3.3, p. 10]*".
- People must be prevented from accessing and standing between the ESPE and dangerous machine parts.
- It must not be possible to access the danger zones of the machine from any unprotected side.
- In order to ensure that the ESPE remains in normal operating mode for at least 10-15 minutes and maintains safety status for the same period of time after the specific sample is positioned in the protective field, it must not be disturbed by external light sources.
- All additional functions must match by being activated several times under different operating conditions.

6 MAINTENANCE

6.1 General - maintenance

SLG4 safety light grids and SLC4 safety light curtains from Wieland do not require any special maintenance work.

We do not recommend using any of the following agents to clean the plastic surfaces or painted parts of the safety light curtain/safety light grid:

- Alcohol and solvents
- Cloths made from wool or synthetic fabric
- Paper or other abrasive materials

6.2 Maintenance activities

Below is a list of recommended inspection and maintenance work,

which must be carried out regularly by qualified personnel, see chapter "*Checking the installation [ch. 5.5, p. 45]*".

Check the following points:

- ensure that the ESPE maintains SAFETY STATUS while the beams are interrupted across the entire protected field area; to do this, use the corresponding test rods (SLX4-AC-TB14 for light curtains with 14 mm resolution or SLX4-AC-TB30 for light curtains with 30 mm resolution).
- ensure that the ESPE is indicated as correctly aligned. press lightly on the light grid/light curtain from both directions, ensuring that the red LED (labeled OSSD on the RX side) does not switch on.
- ensure that the OSSD output signal switching devices are opened by activating the TEST function (on the TX side) (red LED, OSSD on RX side, ON and stop of monitored machine).
- ensure that the response time to the machine STOP, including the response time of the ESPE and the machine, remains within the limit values defined to calculate the safety distance, see chapter "*Installation [ch. 5, p. 42]*".
- ensure that the safety distance between the danger zone and the ESPE matches the specifications in the chapter "*Installation [ch. 5, p. 42]*";
- ensure that nobody can walk or stand between the ESPE and dangerous machine parts;
- ensure that the danger zones of the machine cannot be accessed from any unprotected side.
- ensure that the ESPE and external electrical connections are not damaged.

The regularity of these interventions depends on the specific application and the conditions under which the safety light curtain/safety light grid is operated.

7 DISPOSAL

7.1 Disposal

Depending on national and European guidelines, Wieland is not obliged to take responsibility for disposing of the product at the end of its service life.

Wieland recommends disposing of the devices in compliance with national waste disposal guidelines or contacting the responsible authorities/institutions.

8 APPENDIX OF MODELS AND RESPONSE TIMES

8.1 Models

Type designation	Wieland article number	Resolution	Protective field height [mm]
SLC4-B14-0300	R1.610.0300.0	14 mm Finger protection 	300
SLC4-B14-0450	R1.610.0450.0		450
SLC4-B14-0600	R1.610.0600.0		600
SLC4-B14-0750	R1.610.0750.0		750
SLC4-B14-0900	R1.610.0900.0		900
SLC4-B14-1050	R1.610.1050.0		1050
SLC4-B14-1200	R1.610.1200.0		1200
SLC4-B14-1350	R1.610.1350.0		1350
SLC4-B14-1500	R1.610.1500.0		1500
SLC4-B14-1650	R1.610.1650.0		1650
SLC4-B14-1800	R1.610.1800.0		1800
SLC4-B14-1950	R1.610.1950.0		1950
SLC4-B14-2100	R1.610.2100.0		2100
SLC4-B30-0300	R1.612.0300.0	30 mm Hand protection 	300
SLC4-B30-0450	R1.612.0450.0		450
SLC4-B30-0600	R1.612.0600.0		600
SLC4-B30-0750	R1.612.0750.0		750
SLC4-B30-0900	R1.612.0900.0		900
SLC4-B30-1050	R1.612.1050.0		1050
SLC4-B30-1200	R1.612.1200.0		1200
SLC4-B30-1350	R1.612.1350.0		1350
SLC4-B30-1500	R1.612.1500.0		1500
SLC4-B30-1650	R1.612.1650.0		1650
SLC4-B30-1800	R1.612.1800.0		1800
SLC4-B30-1950	R1.612.1950.0		1950
SLC4-B30-2100	R1.612.2100.0		2100
SLG4-B2-0500	R1.620.0500.0	Body protection 	500
SLG4-B3-0800	R1.620.0800.0		800
SLG4-B4-0900	R1.620.0900.0		900
SLG4-B4-1200	R1.620.1200.0		1200

8.2 Response time

The tables below contain the response times of all SLG4 and SLC4 models depending on the number of beams and the protective field height.

The response time depends on the protective field height, the resolution of the safety light grid/ safety light curtain and the selected beam coding (AIC).

8.2.1 Model SLC4-B14-XXXX

Type designation	Protective field height in a row	Number of beams	AIC lock response time [ms]	AIC release response time [ms]
SLC4-B14-0300	300	30	9	14
SLC4-B14-0450	450	45	10	18
SLC4-B14-0600	600	60	12	22
SLC4-B14-0750	750	75	13	26
SLC4-B14-0900	900	90	15	30
SLC4-B14-1050	1050	105	16	33
SLC4-B14-1200	1200	120	18	37
SLC4-B14-1350	1350	135	20	41
SLC4-B14-1500	1500	150	21	45
SLC4-B14-1650	1650	165	23	49
SLC4-B14-1800	1800	180	24	52
SLC4-B14-1950	1950	195	26	56
SLC4-B14-2100	2100	210	27	60

8.2.2 Model SLC4-B30-XXXX

Type designation	Protective field height in a row	Number of beams	AIC lock response time [ms]	AIC release response time [ms]
SLC4-B30-0300	300	12	7	10
SLC4-B30-0450	450	18	8	12
SLC4-B30-0600	600	24	9	13
SLC4-B30-0750	750	30	9	15
SLC4-B30-0900	900	36	10	17
SLC4-B30-1050	1050	42	11	18
SLC4-B30-1200	1200	48	12	20
SLC4-B30-1350	1350	54	12	22
SLC4-B30-1500	1500	60	13	23
SLC4-B30-1650	1650	66	14	25
SLC4-B30-1800	1800	72	14	27
SLC4-B30-1950	1950	78	15	28
SLC4-B30-2100	2100	84	16	30

8.2.3 Model SLG4 B2/3/4-XXXX

Type designation	Protective field height in a row	Number of beams	AIC lock response time [ms]	AIC release response time [ms]
SLG4-B2-0500	500	2	12	23
SLG4-B3-0800	800	3	15	27
SLG4-B4-0900	900	4	15	29
SLG4-B4-1200	1200	4	15	29

9 APPENDIX OF DIMENSIONS

9.1 Model SLC4-B14-XXXX

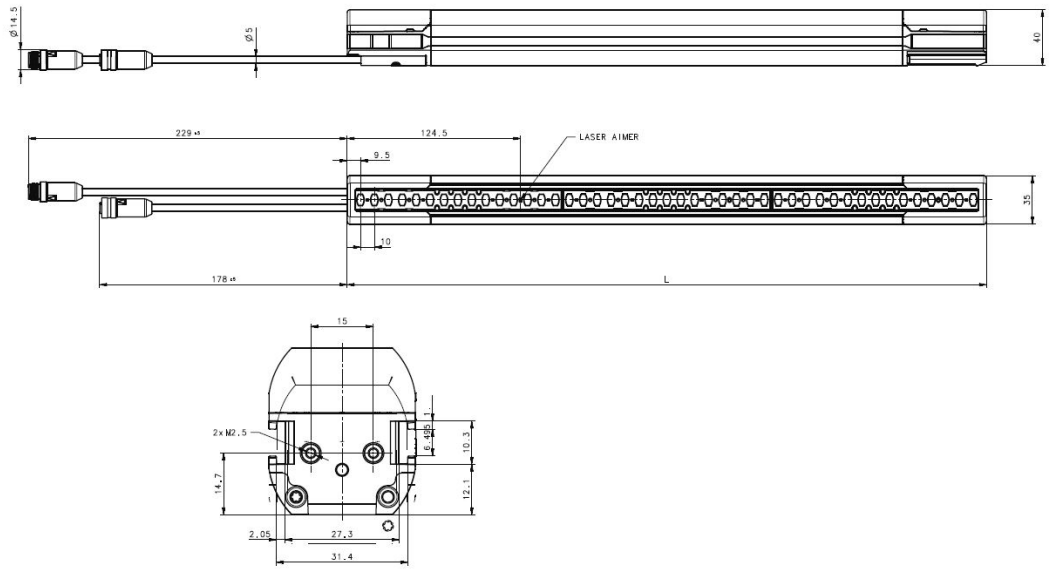


Fig. 32: Dimensions of SLC4-B14-XXXX

All dimensions are specified in mm.

Type designation	L [mm]
SLC4-B14-0300	309
SLC4-B14-0450	459
SLC4-B14-0600	609
SLC4-B14-0750	759
SLC4-B14-0900	909
SLC4-B14-1050	1059
SLC4-B14-1200	1209
SLC4-B14-1350	1359
SLC4-B14-1500	1509
SLC4-B14-1650	1659
SLC4-B14-1800	1809
SLC4-B14-1950	1959
SLC4-B14-2100	2109

9.2 Model SLC4-B30-XXXX

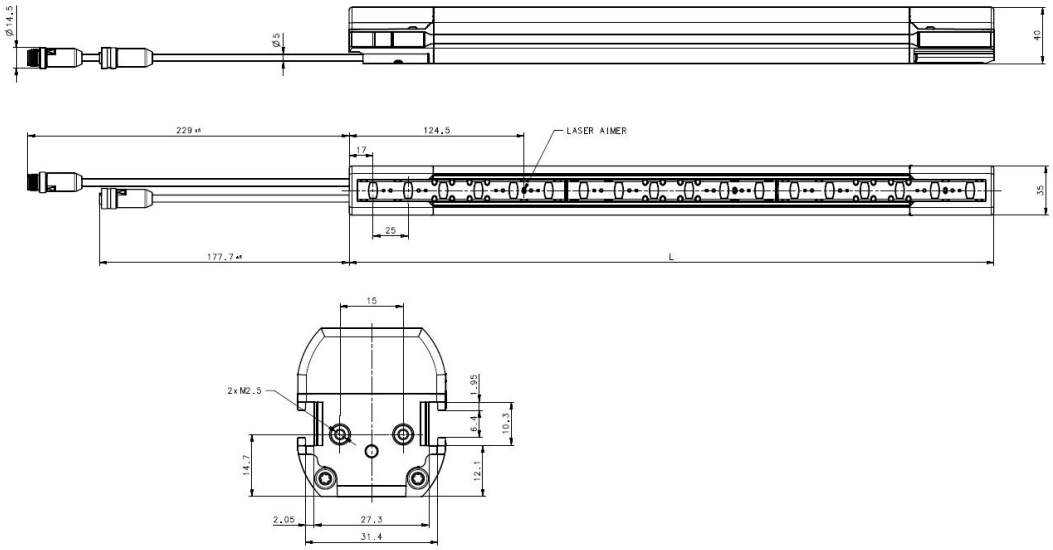


Fig. 33: Dimensions of SLC4-B30-XXXX

All dimensions are specified in mm.

Type designation	L [mm]
SLC4-B30-0300	309
SLC4-B30-0450	459
SLC4-B30-0600	609
SLC4-B30-0750	759
SLC4-B30-0900	909
SLC4-B30-1050	1059
SLC4-B30-1200	1209
SLC4-B30-1350	1359
SLC4-B30-1500	1509
SLC4-B30-1650	1659
SLC4-B30-1800	1809
SLC4-B30-1950	1959
SLC4-B30-2100	2109

9.3 Model SLG4 B2/3/4-XXXX

All dimensions are specified in mm.

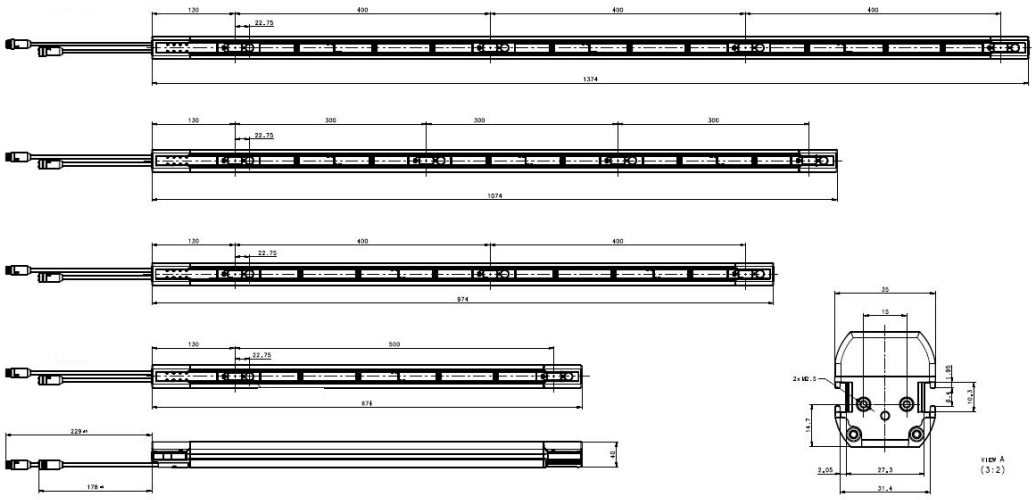


Fig. 34: Dimensions of SLG4 B2/3/4-XXXX

Type designation	L [mm]
SLG4-B2-0500	674
SLG4-B3-0800	974
SLG4-B4-0900	1074
SLG4-B4-1200	1374

10 APPENDIX OF ACCESSORIES INCLUDED IN DELIVERY

10.1 Metal L-shaped mounting bracket

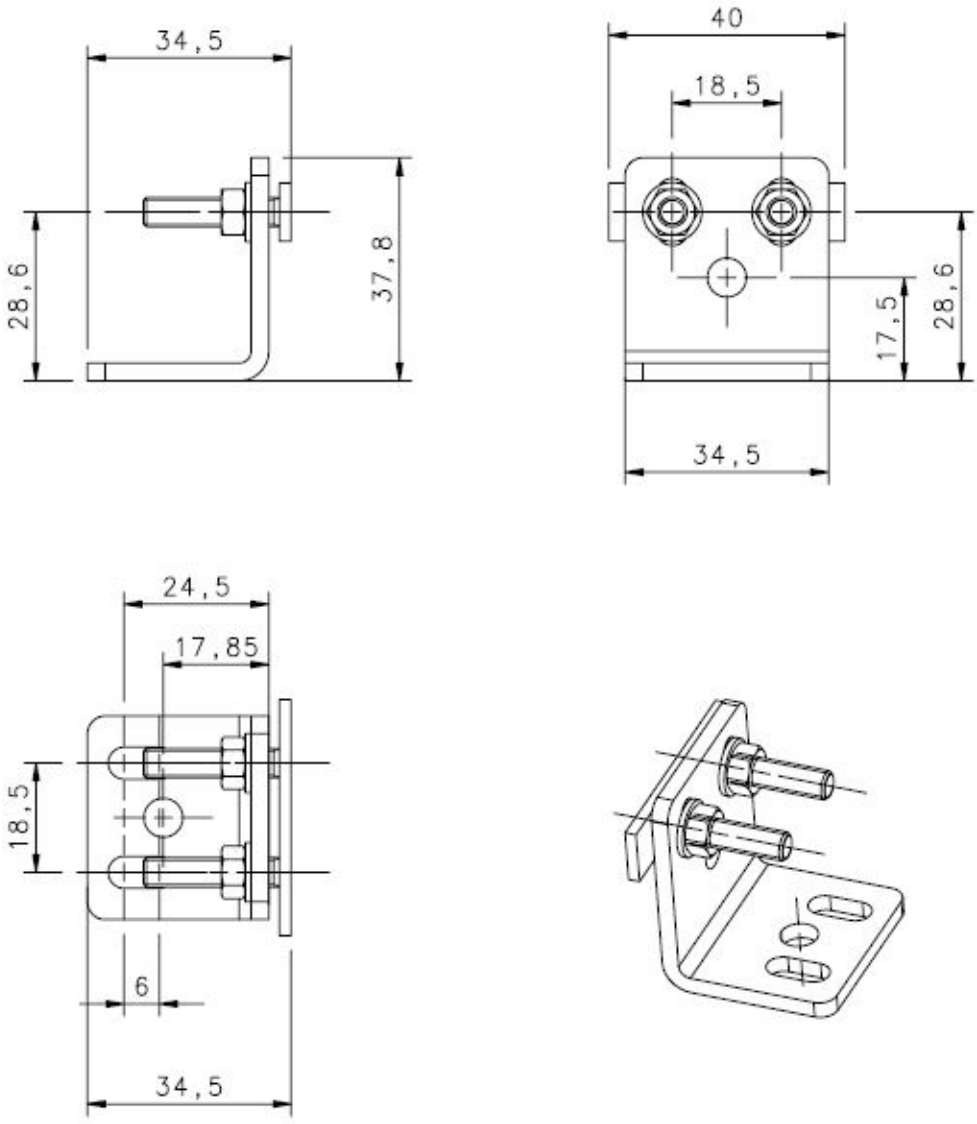


Fig. 35: Accessories included in delivery, L-shaped mounting bracket, metal

All dimensions are specified in mm.

The number of mounting brackets included depends on the length of the light grid/light curtain.

11 APPENDIX OF ACCESSORIES - ORDER SEPARATELY

11.1 Mounting accessories

11.1.1 L-shaped mounting bracket, metal

Type designation	Description	Wieland article number
SLX4-MO-LB	L-shaped mounting bracket, 4 pieces	R1.690.0041.0

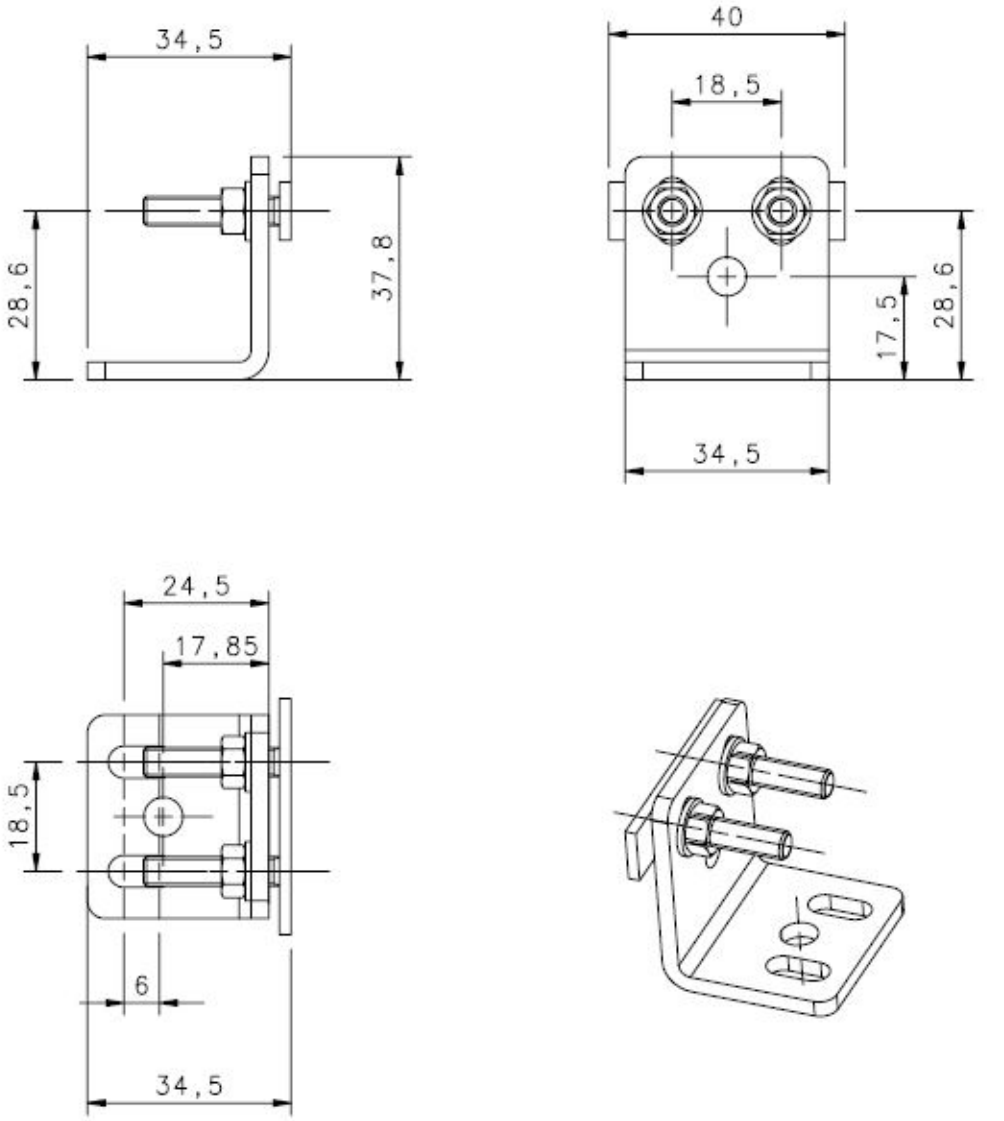


Fig. 36: Accessories - order separately, installation bracket, mounting bracket - metal, SLX4-MO-LB

All dimensions are specified in mm.

Installation of mounting bracket

The mounting bracket can be installed using adjustable, vibration-damping brackets.

Type designation	Description	Wieland article number
SLX4-MO-AVK	Vibration dampers for L-shaped mounting brackets, 4 pieces	R1.690.0040.0

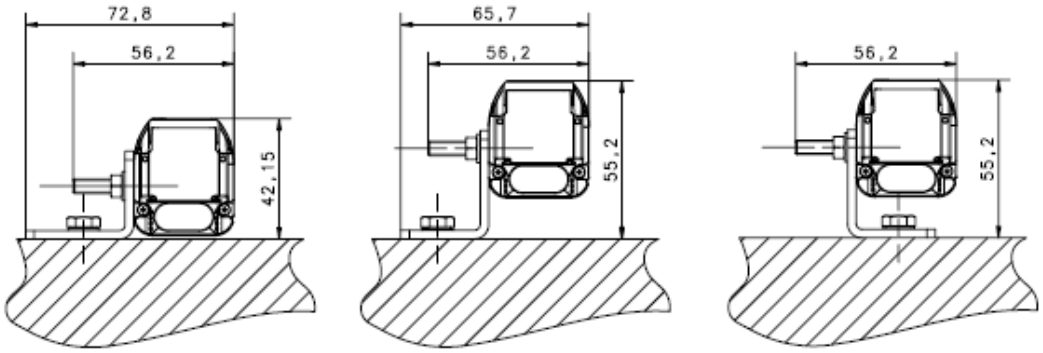


Fig. 37: Accessories - order separately, L-shaped mounting brackets

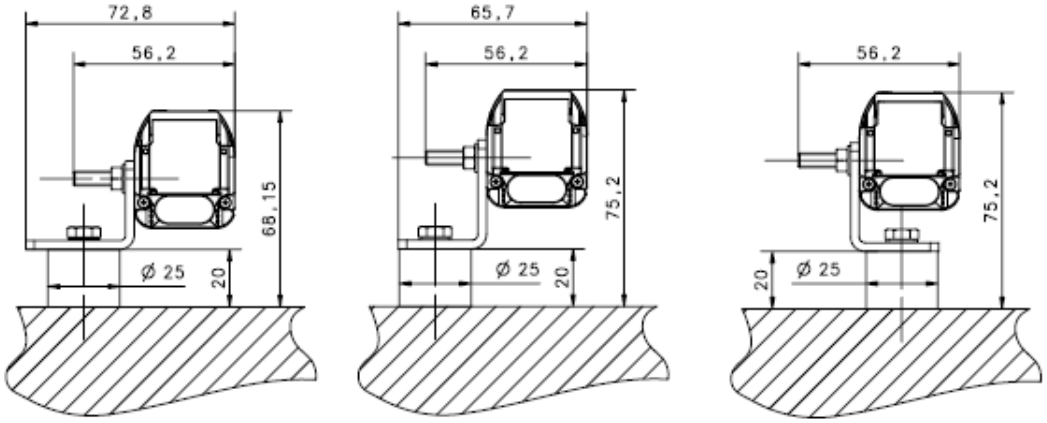


Fig. 38: Accessories - order separately, L-shaped mounting brackets in combination with vibration damper

11.1.2 Mounting brackets - rotatable

Type designation	Description	Wieland article number
SLX4-MO-RB	Rotatable mounting brackets, 4 pieces	R1.690.0005.0

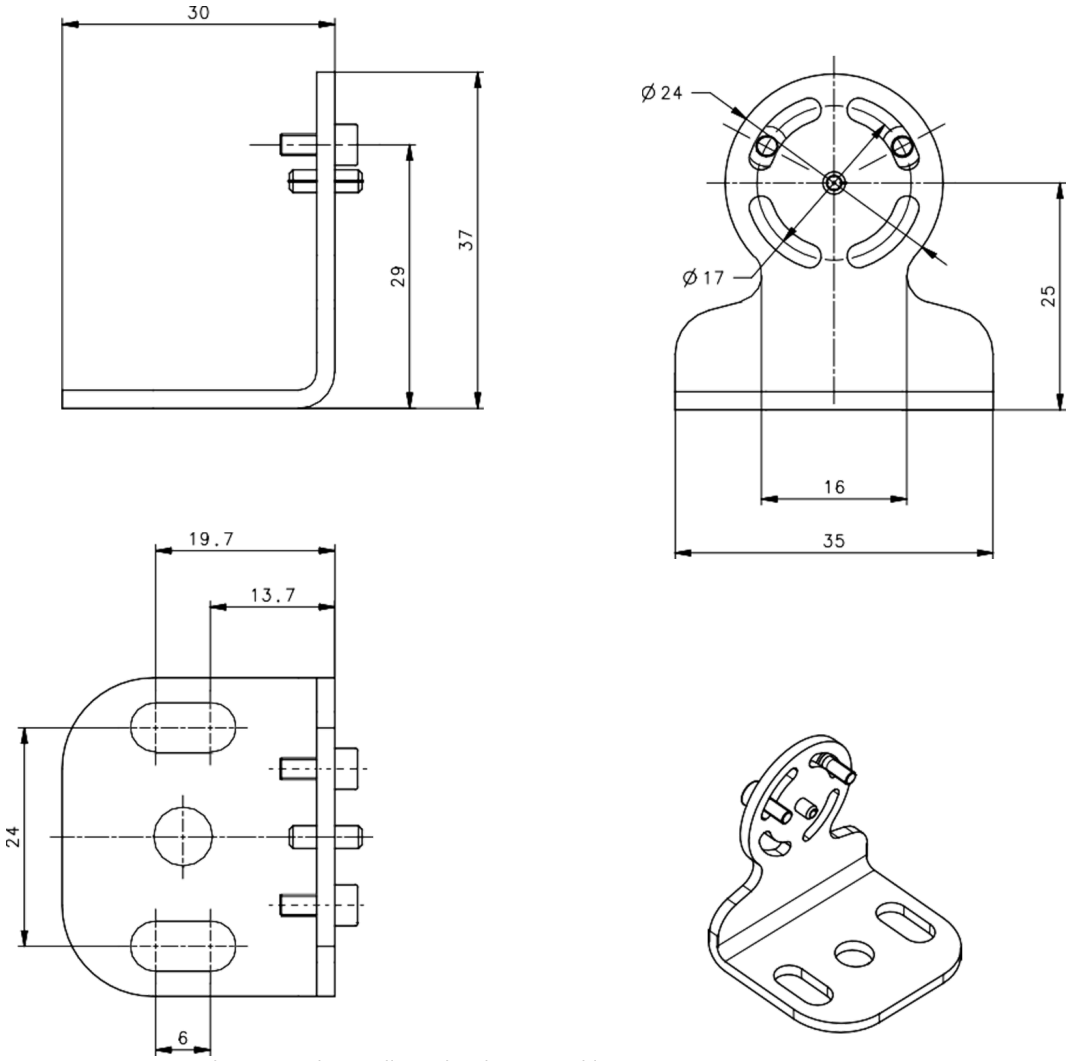


Fig. 39: Accessories - order separately, installation bracket - rotatable, SLX4-MO-RB

All dimensions are specified in mm.

11.2 Connecting cables and replacement plugs

11.2.1 Cascading cables

M12 plug/socket, 5-pin

Type designation	Description	Wieland article number
SLX4-AC-CC1	Cable for cascading, 1 m	R1.690.0002.0
SLX4-AC-CC3	Cable for cascading, 3 m	R1.690.0003.0
SLX4-AC-CC10	Cable for cascading, 10 m	R1.690.0004.0

11.2.2 Replacement plug SLX4-AC-RP-5

M12 plug, 5-pin

Type designation	Description	Wieland article number
SLX4-AC-RP-5	Replacement plug for the transmitter and receiver of the base safety light grids/safety light curtains	R1.690.0014.0

11.3 External laser alignment aid SLX4-AC-LP

Type designation	Description	Wieland article number
SLX4-AC-LP	External laser alignment aid, battery-operated	R1.690.0001.0

The SLX4-AC-LP series external laser alignment aid helps align and install the safety light curtains/ safety light grids.

To check whether the the protective device is aligned completely, the external laser alignment aid can be moved along the entire length of light barrier profile (upwards and downwards).

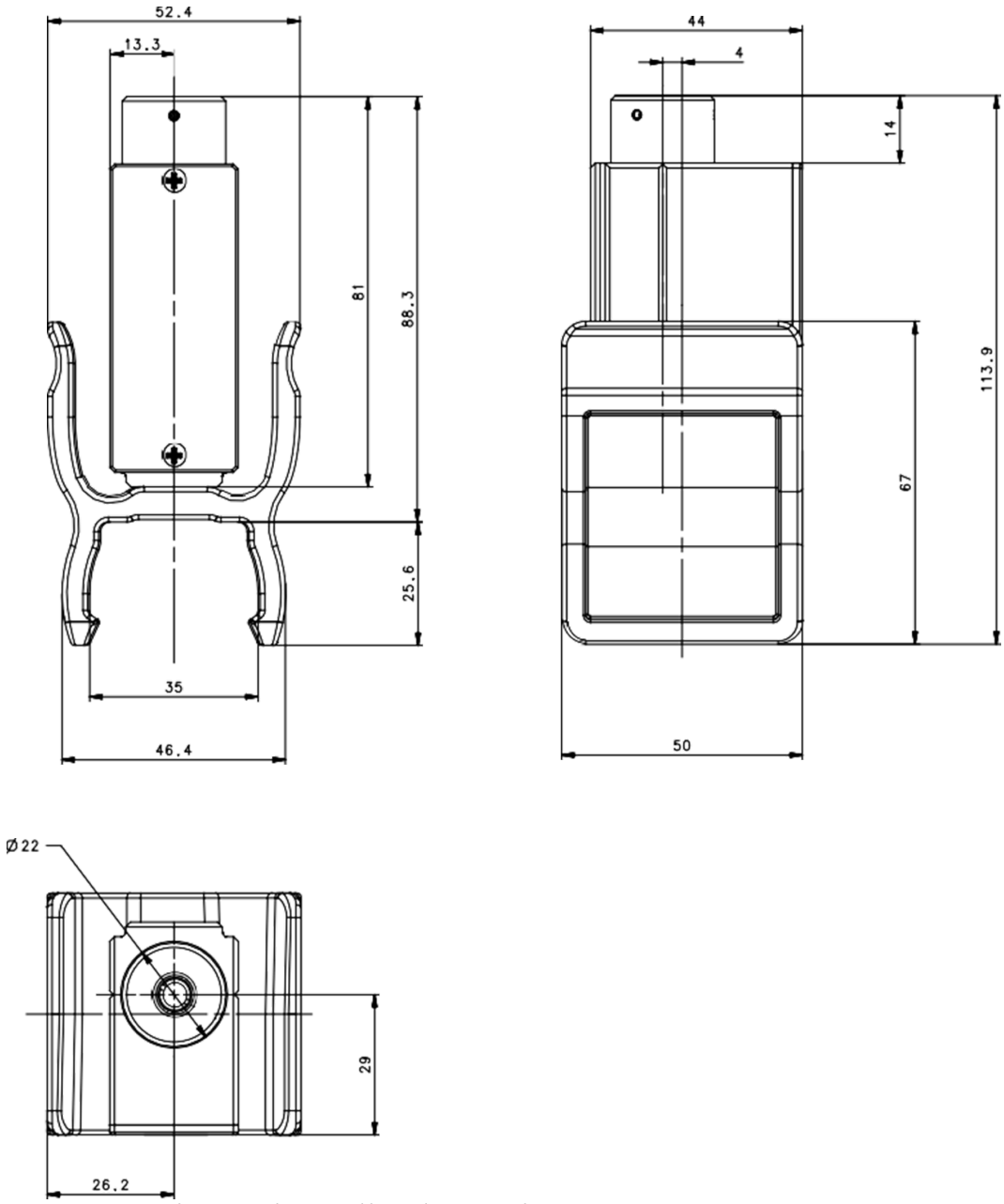


Fig. 40: Accessory order separately, external laser alignment aid SLX4-AC-LP

All dimensions are specified in mm.

11.4 Test rods for finger and hand protection

Type designation	Description	Wieland article number
SLX4-AC-TB14	Test rod for finger protection, 14 mm resolution	R1.690.0032.0
SLX4-AC-TB30	Test rod for hand protection, 30 mm resolution	R1.690.0033.0

12 APPENDIX FOR CASCADE SYSTEM

12.1 Overview

This section describes how to integrate multiple safety light curtains/safety light grids into one system. This system is called a cascade system.

Two SLC4 units can be connected in series as part of a cascade system. A cascade system is designed to connect two safety light curtains/safety light grids together to create a system that operates as a single safety light curtain/safety light grid.

The advantages of a cascade system include enhanced monitoring of the danger zones with a presence detection feature in addition to the vertical protective field as well as smaller space requirements and lower costs because only a single safety module is required.

A cascade system operates as a single long unit, where the optical scanning function is synchronized between units to prevent them from interfering with one another. A single pair of output signal switching devices (OSSD) indicates the status of all connected units.

NOTE: The OSSDs are only physically connected to the master unit. Only the master unit can monitor the status of the OSSDs.

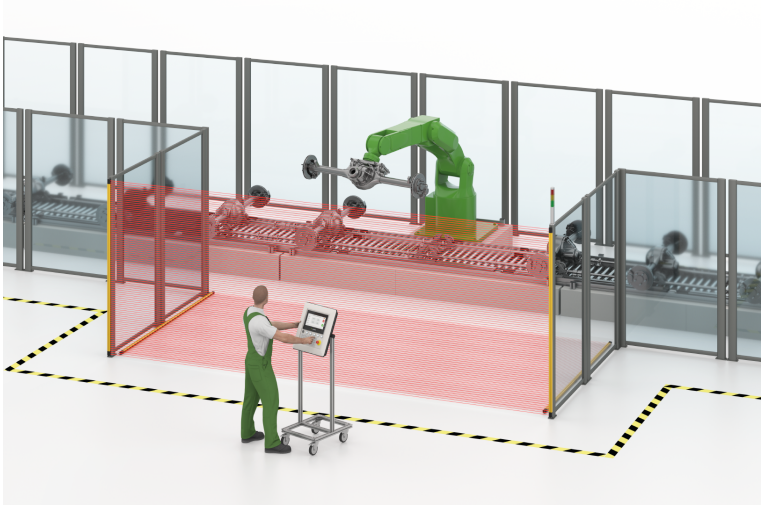


Fig. 41: Application example: cascade system, access control on a production line

Design

A cascade system consists of:

- A MASTER unit with dual connection (SLC4-SM14/30-XXXX)
- A SLAVE unit (SLC4-B14/30-XXXX)

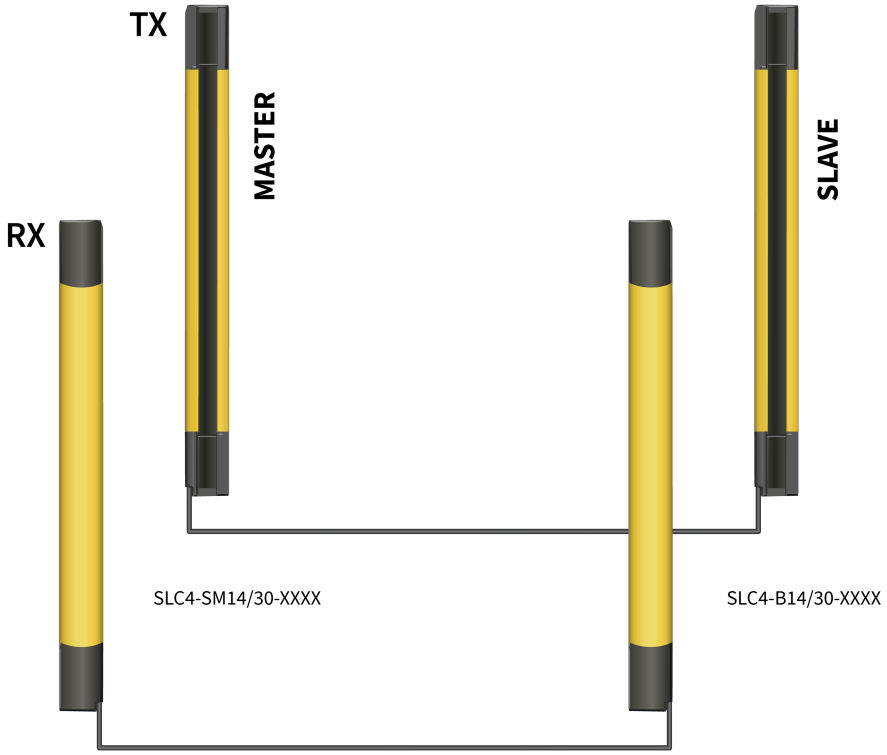


Fig. 42: Design of cascade system

12.2 Cascade system connection

Connect the SLC4 units into a cascade system as

follows:

Connect the 5-pin M12 socket on the MASTER unit to the 5-pin M12 plug on the SLAVE unit.

NOTE: If the distance between the units does not allow a direct connection, an optional M12 plug can be used, which is then connected to a cable with a maximum length of 10 meters and a 5-pin M12 socket. Available models are listed in the "Accessories" appendix, see chapter "*Appendix of accessories - order separately [ch. 11, p. 55]*"

RX connection

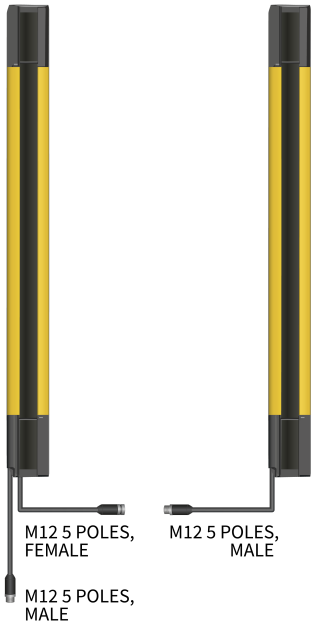


Fig. 43: Cascade system, RX connection

NOTE: For information on the pin assignment, see chapter "--- FEHLENDER LINK ---".

TX connection

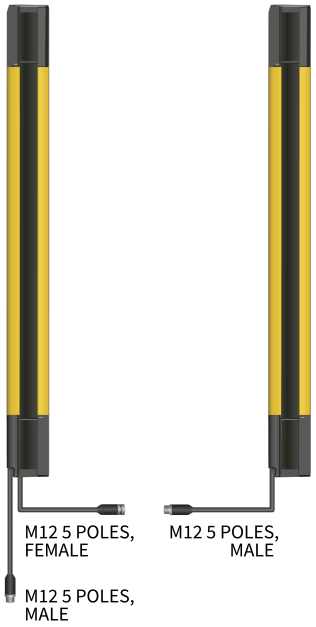


Fig. 44: Cascade system, TX connection

NOTE: For information on the pin assignment, see chapter "--- FEHLENDER LINK ---".

NOTE: A self-recognition procedure that automatically detects the topology of the cascade and ensures correct alignment of the units is executed at startup.

12.3 Protective field

When a cascade system is installed, the detection capability of each unit depends on how the cascaded units are connected to one another. Depending on the mounting brackets used in the cascade system, the detection capability at the edges can be calculated based on the specifications in the mounting bracket documentation. With both 30 mm and 14 mm resolution units, the user can always achieve a resolution of less than 40 mm.

12.4 Response behavior of the cascade system

A proprietary transmission protocol is used to transmit safety-relevant information and the corresponding status to the slave unit.

The OSSD units are only connected to (and therefore controlled by) the master unit.

The redundancy of information and a series of data integrity checks ensure that safety-critical parameters are transmitted correctly between the cascaded units. If the transmission fails due to a stuck-at error or signal degradation, both the master and slave units stop functioning and switch into lockout mode as a result of a communication error.

A maximum of one master and one slave unit can be connected in a cascade.

A cascade system can use 14 mm and 30 mm resolutions together and must have the following topology as described in the previous chapter:

Unit	Permitted models SLC4
Master	SLC4-SM14/30-XXXX
Slave	SLC4-B14/30-XXXX

The topology of the cascade system (number of units, length and resolution) is detected automatically at startup and stored in the safety light grid/safety light curtain memory for safety reasons. If the topology is modified, the muting master models must be reset to the factory configuration before the new cascade can be used.

NOTE: To reset the standard muting master models, refer to the specific product manual.

12.5 Cascade system user interface

A user interface with 16 LEDs on the receiver (RX) or transmitter (TX) helps the user to control and monitor the status of the safety light curtain/safety light grid in alignment mode, and provides information about the normal operating status as well as assistance with troubleshooting activities.

For each optical module, an RGB LED on both the RX unit and the TX unit informs the user about the status of the individual module and the function of the safety light curtain/safety light grid.

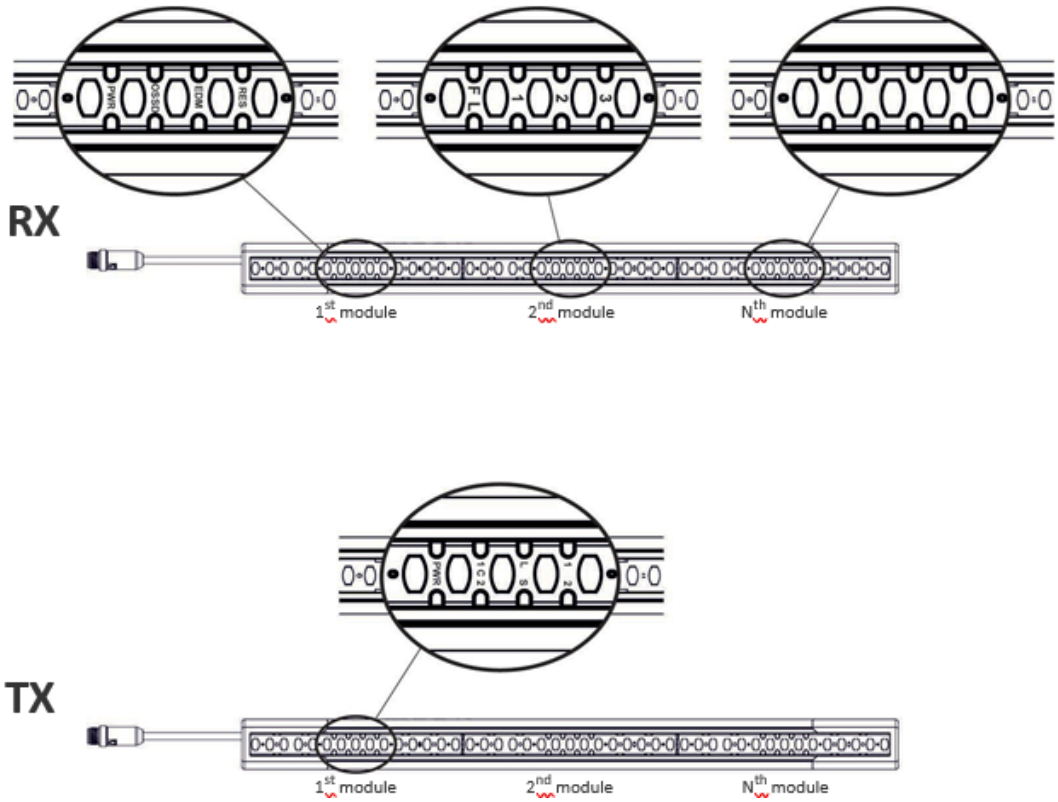
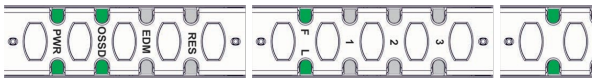
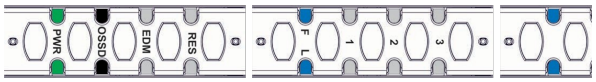
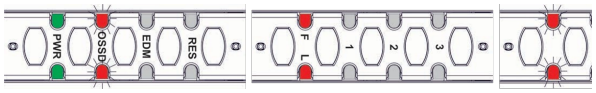
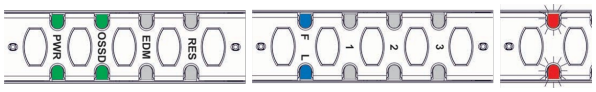
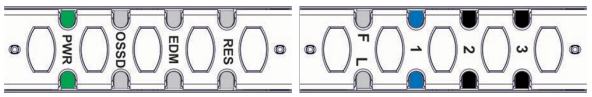
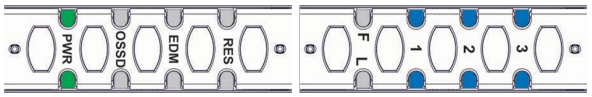
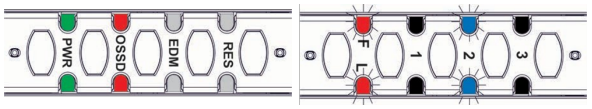
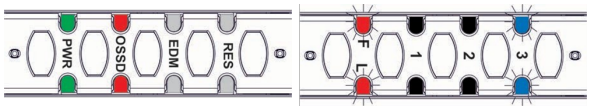
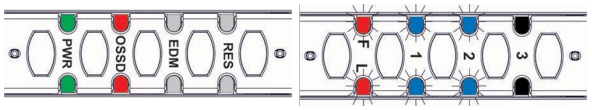


Fig. 45: User interface model SLC4-B14/30-XXXX, RX: LED indicator on the receiver. TX: LED indicator on the transmitter.

Meaning of the LEDs			
	ON		Indifferent
	OFF		Flashing

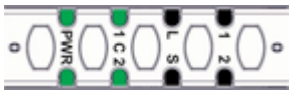
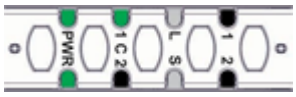
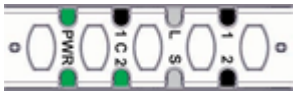
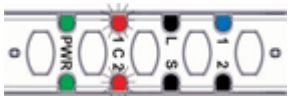
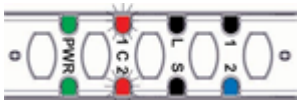
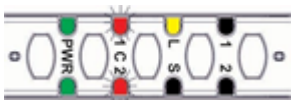
Indicators on RX side

First module	Second module	Module no.

ESPE operating mode	Description	LED configuration
Normal operating mode	Good signal on modules, no interrupted optics	
	Low signal on modules, no interrupted optics	
	One or more optics interrupted on modules with red flashing light	
	(Example) modules with different signal levels	
	Minimum signal strength	
	Maximum signal strength	
Lockout error: The slave units only output their own error code	F22 Microprocessor malfunctions	
	F33 Optics malfunctions	
	F1122 Cascade system malfunctions	

Indicators on TX side

Module


ESPE operating mode	Description	LED configuration
Normal operation: Emission active	No code	
	CODE1	
	CODE2	
Error	F1 Microprocessor error	
	F2 Optics error	
	FL Cascade system error	

12.6 Cascade system response time

Cascade operation consists of the serial optical scanning of all cascade units, i.e. the same post-processing (optical scan analysis and self-test) as when operating a single unit.

The response time can be calculated in the same way as for the individual unit, whereby T_{scan} is considered the scanning time of all cascade units (including the communication messages for synchronization of the units).

$T_{responseC} = 3 \times T_{ScanC} + 2T_{post\text{-}elabC} + T_{OSSD}$

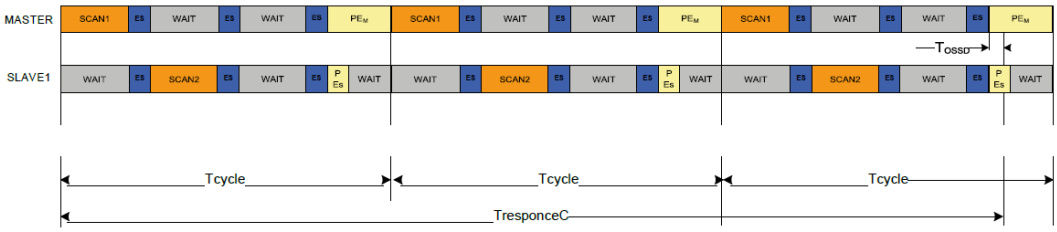


Fig. 46: Appendix for cascade system, response time

The response time of the cascade system can also be calculated using the following formulas based on

the response times of the individual units:

2 UNITS IN CASCADE: Sum of the response times of the units + 1 ms

12.7 Reset time

During cascade operation, only the master receiver unit synchronizes with the master transmitter unit via two synchronization optics and their respective unique sequences, while T_{SCAN} and $T_{Selftest}$ depend on the operation of all units.

The reset time is equal to the response time or 80 ms, whichever is greater.

13 EC DECLARATION OF CONFORMITY

See also

- EC-Declaration of Conformity [▶ 68]
- UKCA-Declaration of Conformity [▶ 69]

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QU-QP-APP-02/16e_05-287-00

CE

EC-Declaration of Conformity

Product name: Safety Light Curtain + Grid
Type designation: SLC4... + SLG4...

Applicant: Wieland Electric GmbH
Brennerstraße 10-14
96052 Bamberg

declares under its sole responsibility that the above indicated products are manufactured and tested in compliance to the attached listed directives and standards.

Directive	Standard	Edition	
2006/42/EC (MD)	EN ISO 13849-1	2015	Cat 4, PL e
	EN IEC 62061	2021	SIL 3
	EN IEC 61496-1	2020	Type 4
2014/30/EU (EMC)	EN 55032	2015 +A11:2020	
	ETSI EN 301 489-1	V2.2.3	
	ETSI EN 301 489-17	V3.2.4	
	EN 61496-1	2020	
2011/65/EU (RoHS)	EN IEC 63000	2018	
	EN IEC 61496-2	2020	
	EN 61508-1	2010	
	EN 61508-2	2010	
	EN 61508-3	2010	

has been certified by
Notified body / address

TÜV Süd Product Service GmbH
Ridlerstrasse 65
D-80339 München

Notified body number
Certification no.

0123
Z10 015813 0022 Rev. 00

Bamberg, 04.12.2023

Wieland Electric GmbH

i. V.

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Head of electronic Development

i. V.

Klaus Jungstädt
Head of Approval and Standards

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www.wieland-electric.com

eQU-RD-IPS-30/21_UK-05-054-00

UK CA

UKCA-Declaration of Conformity

Product name: Safety Light Curtain + Grid
Type designation: SLC4... + SLG4...

Applicant`s Name: Wieland Electric GmbH
Applicant's Address: Brennerstraße 10-14
96052 Bamberg
Germany

complies with the following statutory requirements and carries the UKCA marking accordingly:

Directive	Standard	Edition	
SI 2016/1597 (MD)	ISO 13849-1	2015	Cat 4, PL e
	EN IEC 62061	2021	SIL 3
	EN IEC 61496-1	2020	Type 4
SI 2016/1091 (EMC)	EN 55032	2015 + A11:2020	
	ETSI EN 301 489-1	V2.2.3	
	ETSI EN 301 489-17	V3.2.4	
	EN 61496-1	2020	
SI 2012/3032 (RoHS)	EN IEC 63000	2018	
	EN IEC 61496-2	2020	
	EN 61508-1	2010	
	EN 61508-2	2010	
	EN 61508-3	2010	

Bamberg, 05.12.2023

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