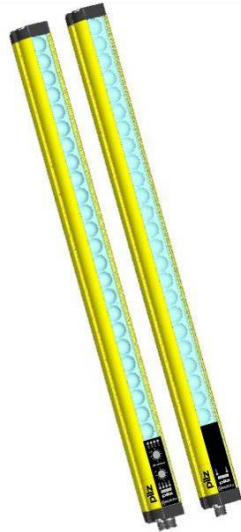




PSEN opSB-4

Safety light curtains with infrared beams



OPERATING MANUAL

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1. GENERAL INFORMATION



1.1. General description of the safety light curtain

Safety light curtains from the PSEN opSB-4 series are optoelectronic safety devices. They secure work areas in which operating personnel can come into contact with moving parts of machinery, robots and automated systems in general, which present a risk of physical injury. The safety light curtains are designed as safe Type 4 systems for accident prevention in accordance with applicable international standards, in particular:

EN 61496-1: 2004 Safety of machinery: Electrosensitive protective equipment. Part 1: General requirements and tests.

prEN 61496-2: 1997 Safety of machinery - Electrosensitive protective equipment. Part 2: Particular requirements for equipment using active optoelectronic protective devices.

The device, which consists of an emitter (TX) and a receiver (RX) housed in robust aluminium profiles, secures the protected field by generating an infrared protected field, defined by the height and width of that protected field.

The safety light curtains PSEN opSB-4 are designed exclusively for use on SafetyBUS p.

Both the control and evaluation logic are located inside the two units; the electrical connection is made via M12 connectors, which are positioned underneath the profiles. The emitter (TX) and receiver (RX) are synchronised optically. This means the two units do not have to be connected directly to each other.

The infrared beams are controlled and monitored via a microprocessor, which uses LEDs to provide the user with information about the operating status and error status of the safety light curtain and SafetyBUS p (see Chapter 8, "Diagnostics").



Before installing the PSEN opSB-4 safety light curtain you should read and take note of the information contained in the “SafetyBUS p System Description” and “SafetyBUS p Installation Manual”.

Two yellow LEDs simplify the alignment of the two units during installation (see Ch. 5 “Alignment”).

As soon as an object, a limb or the operator’s body interrupts the beams sent by the emitter (TX), the receiver (RX) sends a message to SafetyBUS p, the external outputs (OSSD) are immediately opened and the machine is stopped.

NB: *This manual uses the following abbreviations as defined in the applicable standards:*

AOPD *Active optoelectronic protection device*

ESPE *Electrosensitive protective equipment*

MPCE *Machine primary control element*

OSSD *Output signal switching device (switching output)*

TX *Transmitting device*

RX *Receiving device*

Some sections or paragraphs in this manual contain information of particular importance to those using or setting up the device. These sections are highlighted using the following symbols:



Detailed notes and descriptions of specific features on the PSEN opSB-4 safety light curtains, designed to explain their operation more clearly.

Specific installation guidelines.



This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

This manual contains all the information required for the selection and operation of the PSEN opSB-4 safety light curtains.

Specialised knowledge of safety issues is required to integrate a safety light curtain correctly on power-driven machinery.

As this manual is unable to provide such information in full, please contact the technical service department at Pilz for any information about the operation of the PSEN opSB-4 safety light curtains and the safety regulations relating to correct installation (see Ch. 9 “Regular checks and maintenance”).

1.2. How to select a safety light curtain

Three characteristic features should be taken into account when selecting a safety light curtain:

- Resolution, depending on the part of the body requiring protection.

R = 14mm

Finger
protection



R = 30mm

Hand protection



R > 40mm

Body protection



The resolution (R) of a device is understood to be the minimum size an opaque object must be in order to obscure at least one of the beams that form the sensing area.

As shown in Fig. 1, the resolution depends exclusively on the geometrical properties of the lenses, the diameter and the centre distance; it is independent of the ambient and operating conditions of the safety light curtain.

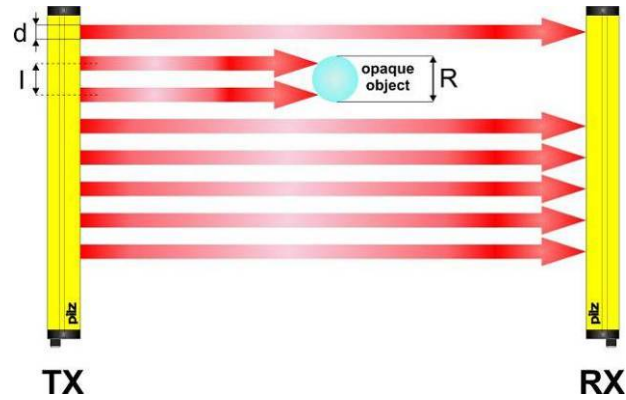
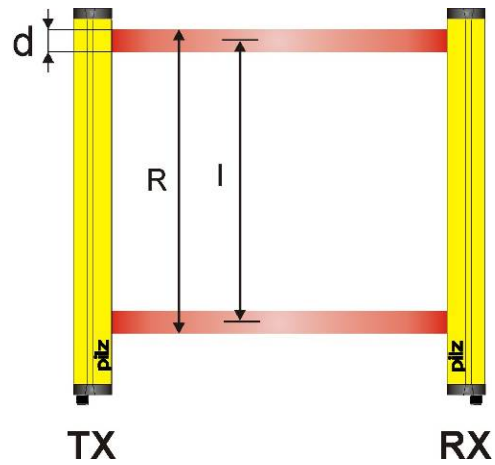


Fig. 1

The resolution can be calculated using the following formula:

$$R = I + d$$

Fig. 2, for example, shows the optical axis (I) and the resolution (R) of the safety light curtain designed for body protection.



English

Fig. 2

The following overview shows the sizes available on standard light curtains suitable for body protection.

Model	Optical axis (mm) (I)	No. of optics (n)	Resolution (mm) (R)	Diameter of optics (mm) (d)	Op. distance (m)
PSEN opSB-4B-2-050	500	2	515	15	25
PSEN opSB-4B-3-080	400	3	415	15	25
PSEN opSB-4B-4-090	300	4	315	15	25
PSEN opSB-4B-4-120	400	4	415	15	25

- Height of protected field: Here it is important to distinguish between the “Height of the sensing area” and the “Height of the protected area” (Fig. 3).
 - The height of the sensing area is the distance between the upper limit of the first lens and the lower limit of the last lens.
 - The height of the protected area is the effective protected area, in which an opaque object whose size is greater than or equal to the resolution of the safety light curtain will safely obscure the beam.

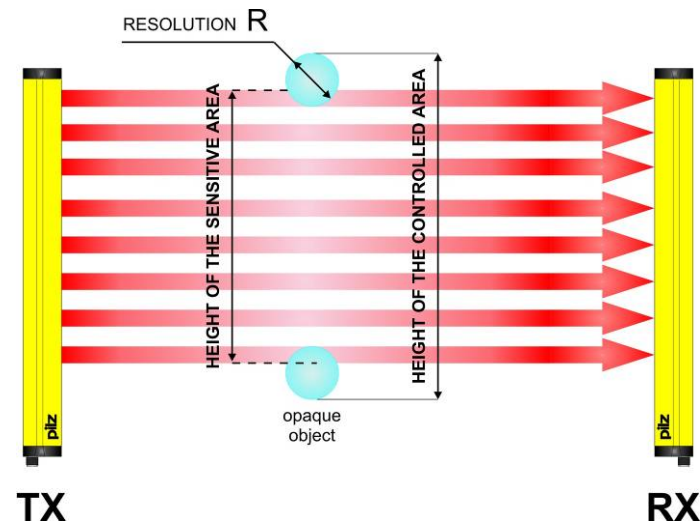


Fig. 3

- Safety distance: Great care must be taken when calculating the distance at which the safety light curtain should be positioned in relation to the hazardous machinery. (Please see Chapter 2, “*Installation*”, for details of how to calculate the safety distance.)

1.3. Typical application areas

Safety light curtains from the PSEN opSB-4 series can be used in all areas of automation where it is necessary to control and guard access to danger zones.

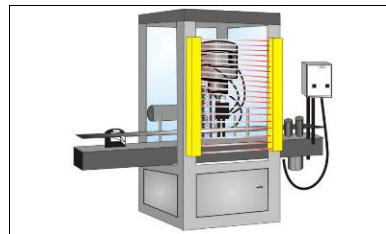
In particular they are used to stop the hazardous movement of mechanical parts on:

- Automatic machinery
- Packaging, handling and storage machinery
- Textile processing, woodworking and ceramic processing machinery
- Automatic or semi-automatic assembly lines
- Automated high-bay racking

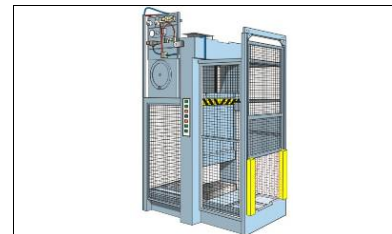


With food industry applications, please contact customer services at PILZ to check whether the safety light curtain's housing material can withstand the chemical substances that may be used in the production process.

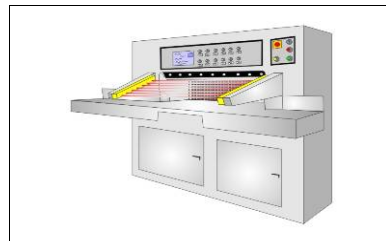
The following illustrations provide an overview of some of the main application areas:



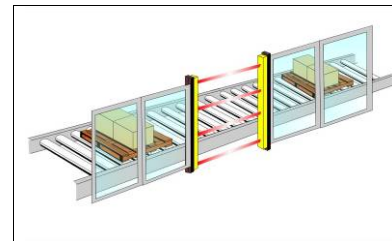
Automatic packaging machines



Presses and punching machines



Folding and cutting machines



Conveyors

1.4. Safety information



For the proper, safe use of safety light curtains in the PSEN opSB-4 series, the following guidelines must be followed:

- It must be possible to control the machine stop electrically.
- The control system must be able to stop the hazardous machine movement immediately at any stage of the operating cycle.
- The safety light curtain and its respective electrical connections must be installed by qualified personnel, in line with the guidelines stated in the relevant chapters.
- The safety light curtain must be positioned in such a way that the danger zone cannot be accessed without interrupting the beams (see Chapter 2 "*Installation*").
- Personnel working in the danger zone must be appropriately trained with regard to the operation of the safety light curtain.
- The test/reset button must be positioned outside the danger zone in such a way that operating personnel have a complete view of the danger zone during all reset, test or override operations.
- The muting lamp that displays the activated muting function must be visible from all sides of the work area.

2. INSTALLATION

2.1. Precautionary measures when selecting and installing the device



- Make sure that the category guaranteed by the safety light curtain (Type 4) matches the risk assessment for the machinery that is to be monitored, as defined in the standard EN 954-1.
- The dimensions of the smallest object to be detected must not be less than the resolution level of the device.
- The environment in which the ESPE is installed must comply with the technical details stated for the safety light curtain in Chapter 10, “*Technical details*”.
- Avoid installing the device, particularly the receiver (RX), close to intense and/or flashing light sources.
- Avoid strong electromagnetic interference as this can adversely affect the proper operation of the device.
- Smoke, mist or dust within the operating environment can reduce the range of the safety light curtain by up to 50%.
- Sudden temperature fluctuations beyond freezing point can cause condensation to form on the surface of the lenses, adversely affecting the proper operation of the safety light curtain.
- Install and replace emitter and receiver only in pairs. Emitter and receiver have the same serial number.
Guideline for repair:
Always send both emitter **and** receiver for repair.

2.2. General information on positioning the device

For effective protection it is necessary to proceed very carefully when positioning the device; in particular, the device must be installed in such a way that the danger zone cannot be accessed without interrupting the protected field.

To exclude the possibility of the machine being accessed from above or below (Fig. 4a), it is necessary to install a safety light curtain that is long enough to completely cover access to the danger zone (Fig. 4b).

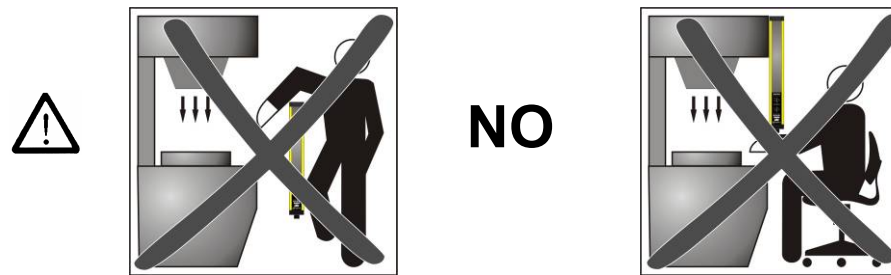


Fig. 4a

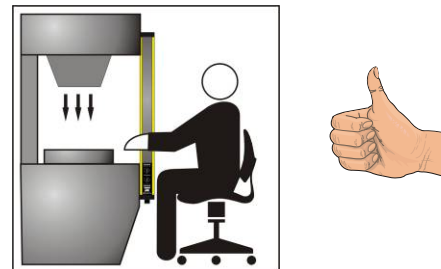


Fig. 4b

Also, under normal operating conditions, it must not be possible to start the machine until the operator is outside the danger zone. If it is impossible to install the safety light curtain in immediate proximity to the danger zone, a second safety light curtain must be installed and aligned horizontally, to exclude access from the side, as shown in Fig. 5b.

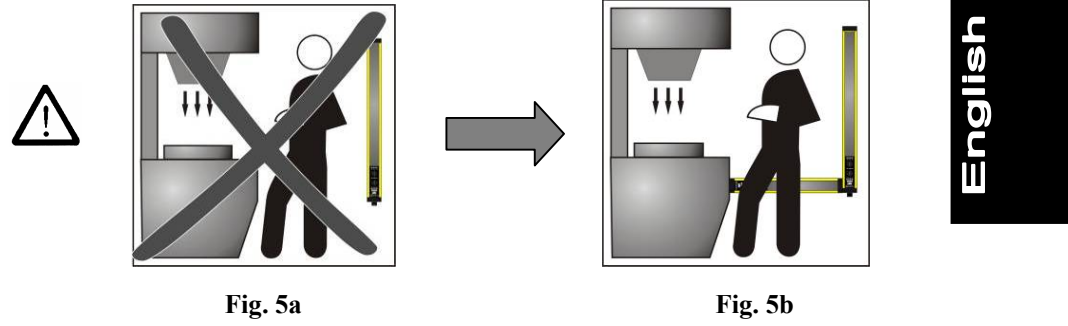



Fig. 5a

Fig. 5b

 If the installation position of the safety light curtain still enables an operator to access the danger zone without detection, an additional mechanical barrier must be installed to prevent this.

2.2.1 Minimum safety distance

The safety distance of the safety light curtain should be such that the operator cannot reach the danger zone until the movement of the hazardous machine part has come to a standstill (see Fig. 6).

According to the standards EN 999, 775 and 294, this distance depends on four factors:

- 1 ESPE reaction time (time it takes for the signal at the OSSD output to switch from High to Low once the beams have effectively been interrupted).
- 2 Machine's overrun time (time it takes for the machine to come to a standstill once the ESPE reaction time has elapsed).
- 3 Resolution of the ESPE.
- 4 Approach speed of the object requiring detection.

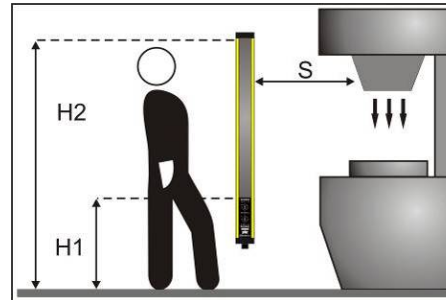


Fig. 6

The formula for calculating the safety distance is as follows:

$$S = K (t_1 + t_2 + t_3) + C$$

where:

- S** = Minimum safety distance in mm between the protected field and the danger zone
- K** = The speed at which the object requiring detection (body or parts of the body) approaches the danger zone, in mm/s
- t₁** = ESPE reaction time in seconds (Ch. 10 "Technical details").
- t₂** = Machine's overrun time in seconds
- t₃** = Max. bus reaction time (see SafetyBUS p System Description)
- d** = Resolution of the safety light curtain.

- C** = **8 (d -14)** for a safety light curtain with a resolution ≤ 40 mm
 = **850 mm** for a safety light curtain with a resolution > 40 mm

Note: The value of K is:

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

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

If it is possible to access the danger zone from above and below (Fig. 6) and the devices used have a resolution of >40 mm, the upper beam must be positioned at a height of 900 mm (H2), starting from the reference plane (e.g. base of the machine), and the lower beam must be positioned at a height of 300 mm (H1).

If the safety light curtain is to be installed horizontally (Fig. 7), the distance between the danger zone and the furthest optical beam must equal the value calculated using the following formula:

$$S = 1600 \text{ mm/s } (t_1 + t_2 + t_3) + 1200 - 0.4 H$$

where:

- S** = Minimum safety distance in mm between the protected field and the danger zone
t₁ = ESPE reaction time in seconds (Ch. 10 "Technical details").
t₂ = Machine's overrun time in seconds
t₃ = Max. bus reaction time (see "SafetyBUS p System Description")
H = Height of the beams above the floor. This height must always be less than 1000 mm.

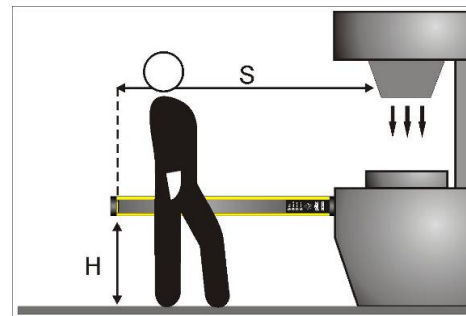


Fig. 7

2.2.2. Minimum distance from reflective surfaces

Reflective surfaces close to the light beams emitted from the safety device (whether above, below or to the side), may cause passive reflections and adversely affect detection of the object within the protected field (Fig. 8).

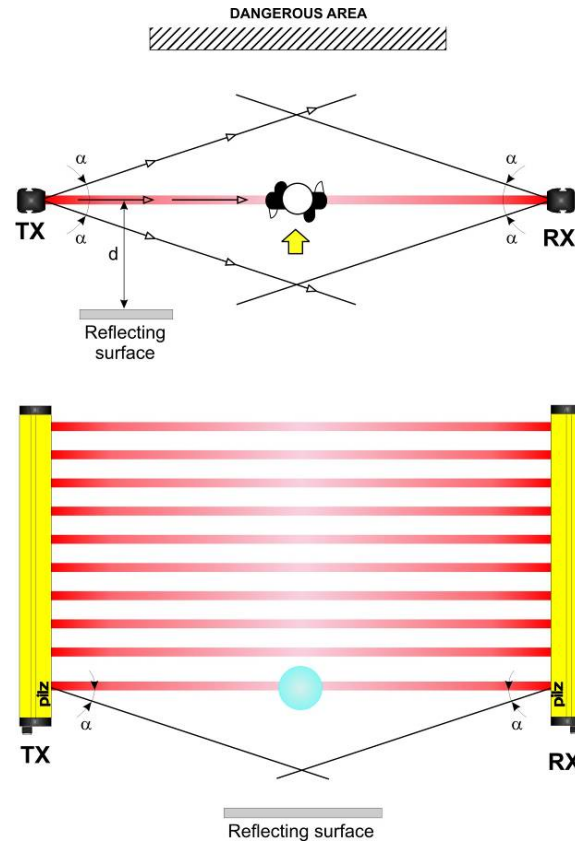


Fig. 8



Improper installation could mean that a protected field is interrupted without detection, resulting in serious injury.

So, when installing the device close to reflective surfaces (metal walls, floors, ceilings or workpieces), it is vital that the minimum distance in relation to reflective surfaces is maintained, as shown in the diagram in Fig. 9. This minimum distance depends on:

- The range between the emitter (TX) and receiver (RX)
- The maximum open angle of the light beams transmitted by the emitter (TX):
 - 5° for Type 4 ESPE ($\pm 2.5^\circ$ to light axis)

The values for the minimum distance in relation to the operating range can be taken from the illustration in Fig. 9.

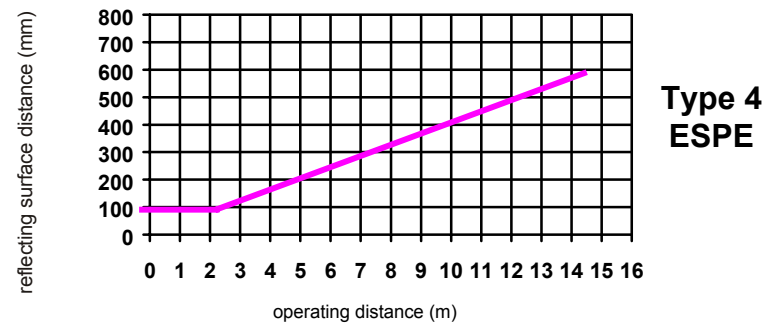


Fig. 9

English

2.2.3. Installing several adjacent safety light curtains

If it is necessary to install several safety light curtains in adjacent areas, you will need to ensure that the emitter (TX) on one device cannot interfere with the receiver (RX) on another. To prevent this, the devices will need to be installed conversely or must be separated via screening (opaque surface).

Fig. 10 gives an example of an installation that could lead to interference, plus two correct installations.

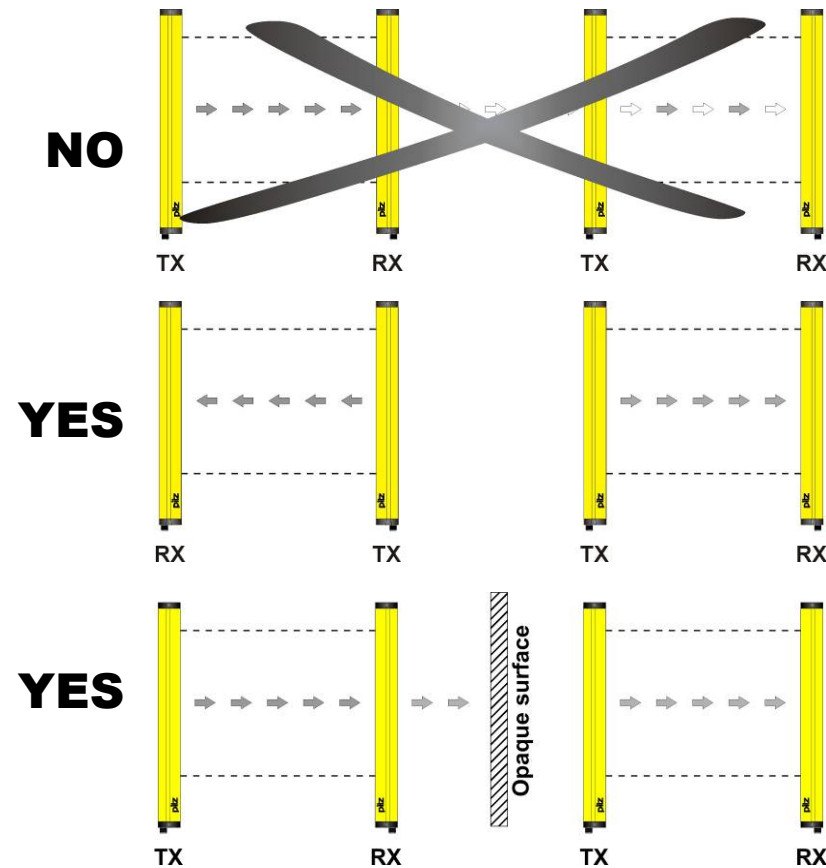


Fig. 10

2.2.4. Use of deviating mirrors

Deviating mirrors can be used to monitor danger zones where access is possible from various sides.

Fig. 11 illustrates a potential solution for monitoring three different access sides using two deviating mirrors positioned at an angle of 45° to the safety light curtain.

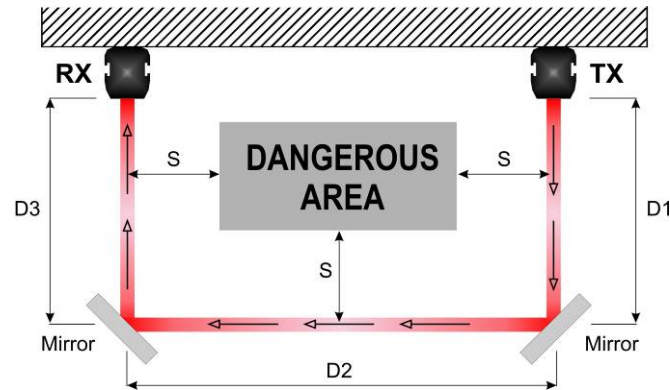


Fig. 11

Please note the following precautions to take when using deviating mirrors:

The alignment of the emitter (TX) and receiver (RX) is particularly critical when you use deviating mirrors; just a slight angular displacement of the mirror is enough to lose the alignment. This problem can be resolved by using a laser pointer, which is available as an accessory.

The minimum safety distance (S) must be maintained for each section of the safety light curtain.

Use of a deviating mirror reduces the effective operating range by about 15%. If two or more deviating mirrors are used, the range will be reduced still further (for more details please refer to the technical specifications for the specific mirror).

Never use more than three mirrors per device.

Any dust or dirt on the mirror's reflective surface will drastically reduce the operating range.

English

3. MECHANICAL ASSEMBLY

The emitter (TX) and receiver (RX) must be assembled so that the respective optical surfaces are aligned in parallel and the connectors are positioned on the same side. The distance between the emitter (TX) and receiver (RX) must be within the operating range of the model you are using (see type label or Chapter 10, “*Technical details*”).

Align the devices precisely, following the guidelines given in Chapter 5, “*Alignment*”.

Use the supplied angle bracket to attach the device, as shown in Fig. 12.



Fig. 12

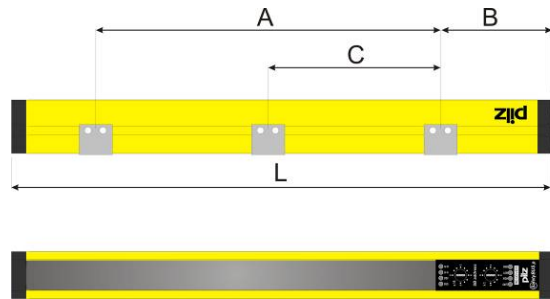
Depending on the application, both rails may either be screwed on using the fixing bolts supplied or a rigid mounting bracket, as shown in Fig. 13.



Fig. 13

Rigid mounting brackets are suitable for installations that require no large mechanical adjustments during alignment. Adjustable brackets enable the units to be inclined by $\pm 5^\circ$ and are available on request. Where applications are subject to particularly strong vibration we recommend the use of angle brackets with vibration dampers.

The drawing and table below indicate the recommended fixing points in relation to the length of the safety light curtain.



English

Fig. 14

MODEL	L (mm)	A (mm)	B (mm)	C (mm)
PSEN opSB-4F/opSB-4H*-030	393	193	100	-
PSEN opSB-4F/opSB-4H*-045	540	300	120	-
PSEN opSB-4F/opSB-4H*-060	687	387	150	-
PSEN opSB-4F/opSB-4H*-075	834	474	180	-
PSEN opSB-4F/opSB-4H*-090	981	581	200	-
PSEN opSB-4H*-105	1128	688	220	-
PSEN opSB-4H*-120	1275	875	200	438
PSEN opSB-4H*-135	1422	1022	200	510
PSEN opSB-4H*-150	1569	1121	220	565
PSEN opSB-4H*-165	1716	1216	250	608
PSEN opSB-4B-2-050	642	342	150	-
PSEN opSB-4B-3-080	942	542	200	-
PSEN opSB-4B-4-090	1042	602	220	-
PSEN opSB-4B-4-120	1342	942	200	472

* opSB-4F = Resolution 14 mm
 opSB-4H = Resolution 30 mm
 opSB-4B = Resolution, see table on page 5

4. WIRING

4.1. Electrical connections

The electrical connections of the emitter (TX) and receiver (RX) are made via M12 connectors, which are located on the bottom of both units.

The inputs and outputs are galvanically isolated from the device electronics through optocouplers.

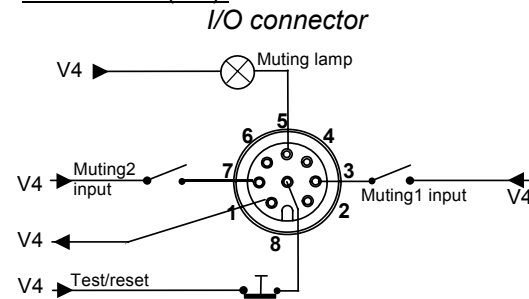


Safe electrical isolation must be ensured for the external 24 V supply. Failure to do so could result in electric shock. The supply voltage must conform to EN 60950, 03/97, section 2.3, EN 60742, 9/95 or EN 50178, 10/97.

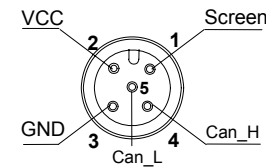


To supply the inputs and outputs, only connect the supply voltage “V4”!

RECEIVER (RX):



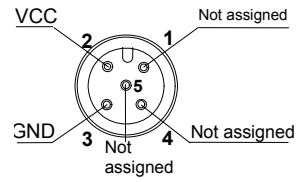
SafetyBUS p connector



- 1 = white = V4 supply voltage
- 2 = brown = Not assigned
- 3 = green = MUTING1 input
- 4 = yellow = Not assigned
- 5 = grey = Muting lamp
- 6 = pink = Not assigned
- 7 = blue = MUTING2 input
- 8 = red = Test/reset

- 1 = = Screen
- 2 = red = VCC
- 3 = white = GND
- 4 = green = Can_H
- 5 = brown = Can_L

EMITTER (TX):



- 1 = - = Not assigned
- 2 = red = VCC
- 3 = white = GND
- 4 = green = Not assigned
- 5 = brown = Not assigned

English

4.2. Connection to SafetyBUS p

To make the connection to SafetyBUS p, the safety light curtain must be linked to the SafetyBUS p main branch. To do this use the active SafetyBUS p junction “PSS SB ACTIVE JUNCTION BASIS” (see operating manual for the “PSS SB ACTIVE JUNCTION BASIS”).

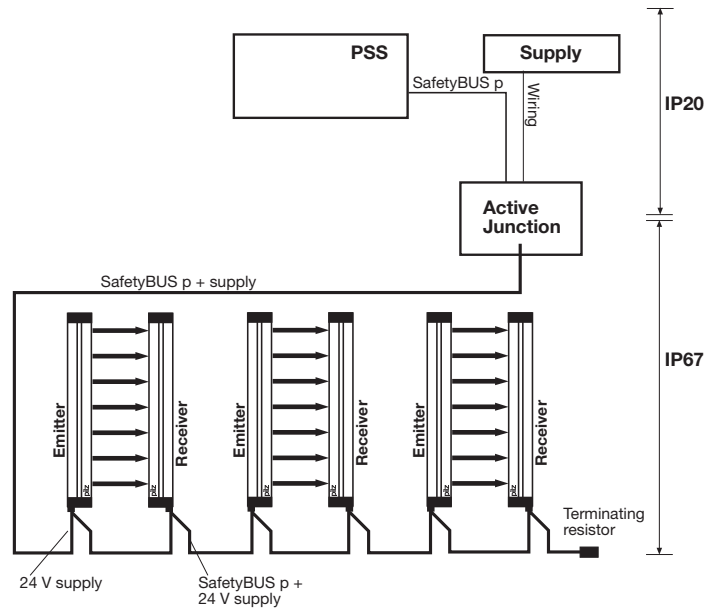


Fig. 15

4.3. Notes on wiring

To ensure the correct operation of the PSEN opSB-4 safety light curtain, please note the following:

- Only certified SafetyBUS p cable should be used for connecting the safety light curtain receiver (RX) to SafetyBUS p (see Accessories). This cable can also be used to connect the emitter (TX).
- The emitter (TX) can be supplied via the SafetyBUS p cable or it may be connected to a separate supply voltage (19.2 VDC - 28.8 VDC).
- Local inputs and outputs for local functions on the safety light curtain are connected to the 8-pin I/O connector
- Under no circumstances should the connection cables come into contact with or be laid in proximity to cables that generate strong electromagnetic interference (e.g.: motor feeds, inverters etc.); these could compromise the device's ability to function.
- If the local inputs and outputs are unused, the 8-pin I/O connector must not be connected. If this is the case, make sure to deactivate the corresponding server classes.
- If you are using the test/reset button, it must be positioned in such a way that the operator has a clear view of the protected field when reset, test or override procedures are in progress.
- If you are not using the muting function, pins 3, 5 and 7 on the receiver's (RX) I/O connector must be electrically isolated.
- For EMC reasons, cable runs on the local I/O connector must be limited to 10 m.



Earthing

The **receiver (RX)** must be connected to the functional earth. To do this use the fastening kit provided for earthing (see Fig. 16) and connect it to a cable with a cable cross section of at least 2.5 mm².

If you are connecting evaluation devices that do not have safe separation, the **emitter (TX)** must be operated in protection class 1 and must be connected to the protective earth. To do this use the fastening kit provided for earthing (see Fig. 16) and connect it to a cable with a cable cross section of at least 2.5 mm².

Assembling the fastening kit:

- Insert the slot nut (M4 x 0.7 mm tapped holes) into a groove on the safety light curtain.
- Screw the two threaded pins (M4 x 14) into the external tapped holes.
- The torque setting should be between 2.2 and 2.5 Nm. This way the cupped point on the threaded pin will pierce the coating and make contact with the metal housing.
- To prevent the threaded pin from working loose under heavy vibration, attach two self-locking M4 nuts to the threaded pins. Use a hexagonal wrench CH.7.
- Attach the earth lead to the middle tapped hole using the lock washer (M4) and screw (M4).

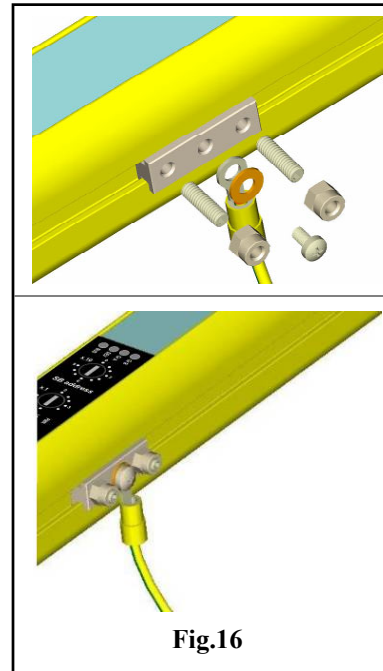


Fig.16

English

4.4. Light curtain calculation tool

The maximum number of subscribers and the maximum possible cable runs for the cable segments from the ACTIVE JUNCTION BASIS to the last connected subscriber depend on the type of subscriber and the supply voltage on the ACTIVE JUNCTION BASIS.

The Pilz light curtain calculation tool enables you to check how many subscribers can be connected and how long the cable runs can be, taking into account the subscriber type and the supply voltage.

The light curtain calculation tool is available on the Internet from the Pilz homepage at www.pilz.de.

Entry in the light curtain calculation tool

Select all subscribers under “Type”:

- Emitter (TX)
- Receiver (RX)
- Receiver + X W (3 W or 5 W; a selection must be made if a muting lamp (3 W or 5 W) is connected to the receiver's (RX) I/O connector)

Under “distance in meters”, enter the required cable runs L1 ... LX (see diagram in the light curtain calculation tool).

Under “Supply Voltage ACTIVE JUNCTION (V)”, enter the supply voltage at the ACTIVE JUNCTION BASIS.

Result

If a green “OK” field appears under “Result”, the supply voltage at the last subscriber is sufficient.

If a red “Not OK!” field appears under “Result”, the supply voltage at the last subscriber is too low and you will need to make some adjustments.

5. ALIGNMENT

The emitter (TX) and receiver (RX) must be aligned to ensure the proper function of the device.

Perfect alignment is achieved when the optical axes of the first and last beam from the emitter (TX) meet the optical axes of the corresponding elements on the receiver (RX).

Two yellow LEDs on the receiver (RX), "HIGH ALIGN" and "LOW ALIGN", simplify the alignment process.

5.1. Alignment instructions

Once the mechanical assembly and the electrical connections have been completed, the safety light curtain can be aligned as described below:

- Switch on the supply voltage at the safety light curtain's emitter (TX).
- On the emitter (TX), check the green "PWR" LED and the yellow "SAFE" LED. If they are lit, this shows that the safety light curtain is operating correctly.
- Make sure that the status of the receiver is one of the following:
 - **BREAK Status:** Green "PWR" LED is lit and "SAFE" LED lights up red. The yellow LEDs "HIGH ALIGN" and/or "LOW ALIGN" are unlit.
-> The safety light curtain is not aligned correctly.
 - **SAFE Status:** Green "PWR" LED is lit and "SAFE" LED lights up green. The yellow LEDs "HIGH ALIGN" and "LOW ALIGN" are lit.
-> The safety light curtain is aligned correctly.

Follow the steps below to align the units:

- Hold the receiver (RX) steady and align the emitter (TX) so that the yellow “LOW ALIGN” LED lights up, confirming that the first lower beam has been aligned correctly.
- Rotate the emitter (TX) until the yellow “HIGH ALIGN” LED is also lit. The “SAFE” LED switches from red (BREAK) to green (SAFE).

NOTE: Make sure that the “SAFE” LED is constantly green.

- With a few small movements, define the area in which the “SAFE” LED is constantly green; do this first with one unit and then with the other. Place both units in the centre of this area.
- Use the pins and/or mounting brackets to firmly secure both the units.
- Start the I/O-Group containing the safety light curtain.
- The safety light curtain switches to “normal” operating status.
- Make sure that the green “PWR” LED on the receiver (RX) is lit (light beams are clear, “SAFE” operating status) and that this switches to red if just a single beam is interrupted (detected object, “BREAK” operating status).
- Perform this test using a cylindrical “test rod”, the diameter of which should correspond to the resolution of the device (14 mm, 20 mm, 30 mm or 35 mm). The test rod is available as an accessory.

NOTE: If you pass the test rod from top to bottom along the length of the whole sensing area, at any distance from either unit, the “SAFE” LED must be constantly red. We recommend that you perform this test daily.

6. FUNCTIONS

This chapter describes the available functions. These functions can be performed locally via the I/O connector on the safety light curtain or externally via the PSS. Please refer to Chapter 7 “*Programming and configuration*” for details of how to configure the light curtain functions in the “Editor for light curtains from the PSEN opSB-4 series”.

6.1. Test function

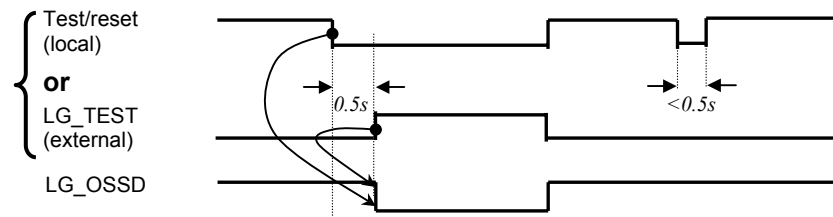
Configuration in the editor:

To activate the test function, the server class “LG_Base” must be selected (see Chapter 7 “*Programming and configuration*”).

The test function can be used to carry out a function test on the safety light curtain.

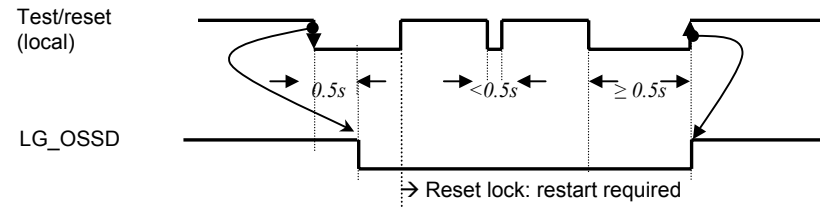
- **Local activation:** The test function is activated via the local input (test/reset) on the receiver (RX). To do this, connect a pushbutton with a N/C contact to the “Test/reset” input and “V4”. The function is activated when the test/reset button has been operated for at least 0.5 s.
- **External activation:** The test function is activated via an external command (LG_TEST) (see Chapter 7 “*Programming and configuration*”).

Timing diagram for local or external activation of the test function:
automatic start

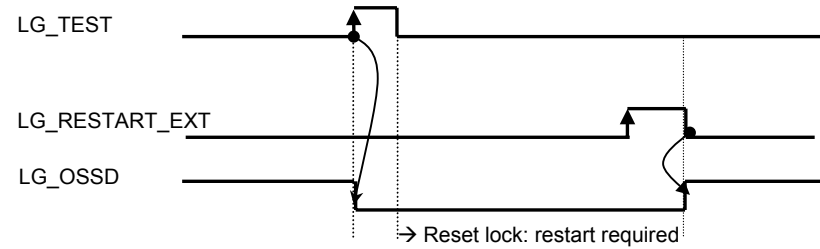


English

Timing diagram for local or external activation of the test function:
manual start (local activation)



Timing diagram for local or external activation of the test function:
manual start (external activation)



6.2. Restart

Configuration in the editor:

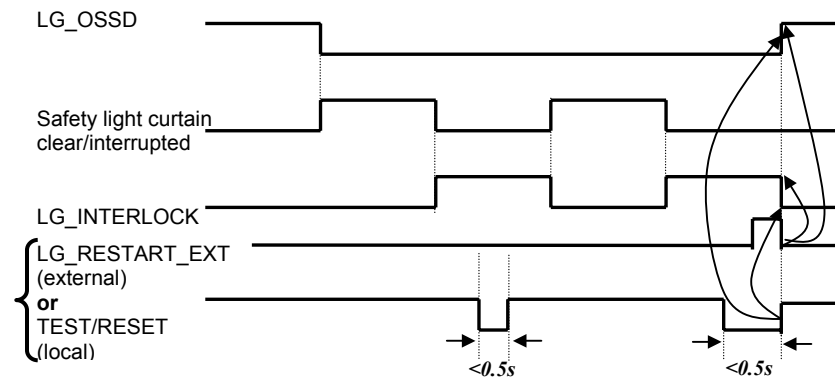
To set the restart function, activate the server class "LG_Restart" and choose "Automatic" or "Manual" from the "Settings" field (see Chapter 7 "Programming and configuration").

If the beams between the emitter (TX) and receiver (RX) are interrupted by an opaque object, the signal LG_OSSD will be reset ("BREAK" operating status).

There are two different ways to restart normal mode ("SAFE" operating status):

- **Automatic reset:** After the protected field has been interrupted, the safety light curtain returns to its normal mode as soon as the detected object has been removed from the protected field.
- **Manual reset:** After the protected field has been interrupted, the reset is blocked (LG_INTERLOCK). The safety light curtain does not return to its normal mode until the object has been removed from the protected field and either
 - the restart button (test/reset button) has been operated for at least 0.5 s (local activation)
 or
 - the function has been activated via an external command (LG_RESTART_EXT) (external activation) (see Chapter 7 "Programming and configuration").

Timing diagram for manual reset (local or external activation of restart function)



6.3. Muting function

Configuration in the editor:

To set the muting function, activate the server class “LG Muting 1+2” and select the required muting zones, muting sensor simultaneity and muting duration under “Settings” (see Chapter 7 “*Programming and configuration*”).

The muting function enables the safety light curtain to be suspended temporarily while material is transported through the protected field (Fig. 18).

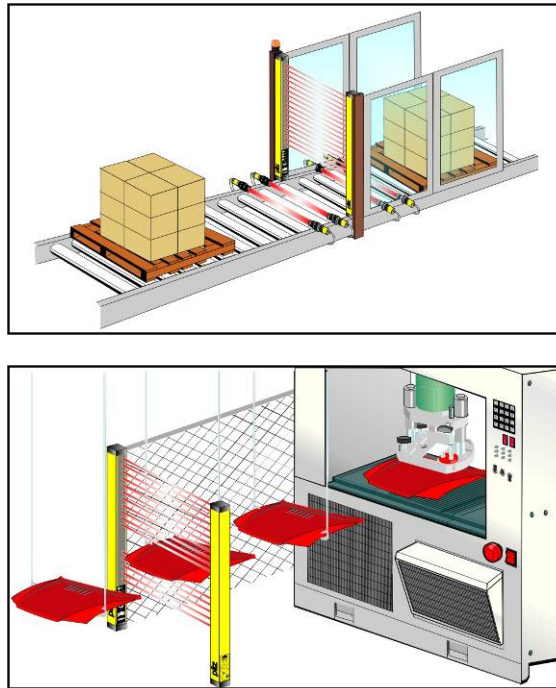


Fig. 18

For example, the muting function can be used when objects need to pass through the protected field, but operating personnel still require protection.

The muting sensors can be connected in two ways:

- **Local connection of muting sensors:** The two or four muting sensors are connected to inputs Muting1 and Muting2 on the safety light curtain.
- **External connection of muting sensors:** The muting sensors are connected to the inputs on a PSS or an I/O-Device on SafetyBUS p. The signals from the sensors are transmitted to the safety light curtain via the external commands “LG_Muting_SensorOvrd (1)” and “LG_Muting_SensorOvrd (2)”. The muting function in the safety light curtain processes the sensor signals in the same way as described under “Local connection of muting sensors” (see Chapter 7 “Programming and configuration”).

With both connection types, the internal muting function in the safety light curtain is active.

When muting is active, the bit “LB_Muting_View” is set in the PII.

When using the muting function, please note the following:

- The muting function represents a forced situation for the whole system and as such should be applied with due care.
- The muting sensors must be connected and positioned properly, so that personnel are not exposed to unwanted muting activations or hazardous situations.
- Muting cannot be activated if the protected field is interrupted (“SAFE” LED lights up red).
- A muting lamp must be connected to the safety light curtain; this indicates the activity of the muting function. If the muting lamp is not connected or is defective, activating muting or override will cause the safety contacts to open and the plant will be disabled due to a muting lamp malfunction (see Chapter 8.2 “Error messages and diagnostics”). The muting lamp should be positioned at a point where it is clearly visible from all sides of the work area.



Fig. 19 shows an example of a muting function application.

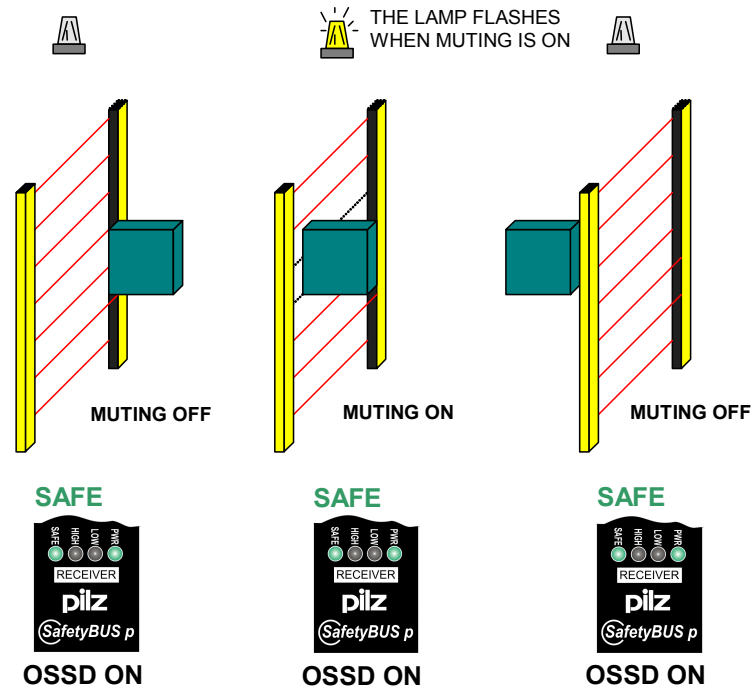


Fig. 19

Simultaneity of the muting sensors

The “Simultaneity of the muting sensors” setting can be used to set the maximum time that is permitted to elapse between activation of both muting sensors.

The following times can be set: 0.5 s, 1 s, 3 s, 4 s.

If the second muting sensor is not activated within the preset time, the muting function will not start and the safety light curtain will remain in normal mode.

A message appears in the safety light curtain's error stack in the SafetyBUS p Configurator in the PSS WIN-PRO system software.

The required time can be defined in the editor, in the “Settings” field under “Muting sensors”.

Muting duration

This setting can be used to adjust the maximum muting duration.

The following times can be set: 10 min, 1 h, 8 h and “infinity (= ca. 90 h)”.

Once the set time has elapsed the muting function is ended and the safety light curtain returns to normal mode, even if the muting sensors are still activated when the time elapses. A message appears in the safety light curtain's error stack in the SafetyBUS p Configurator in the PSS WIN-PRO system software.

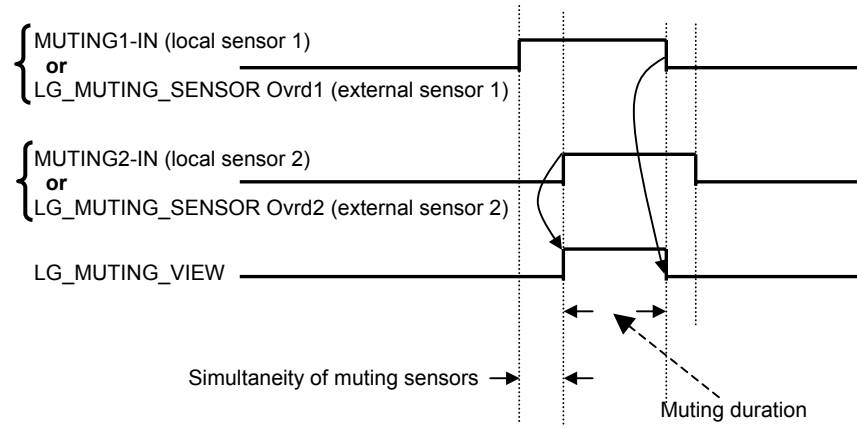
The required muting duration can be defined in the editor, in the “Settings” field.



If the “infinity” setting is selected, the muting sensors must be tested at intervals that are compatible with the process. This can be done by shutting down the plant or by idling the muting channel, for example.

If the “infinity” setting is selected, the level of safety that can be achieved may be reduced.

Timing diagram for the muting function



Installing the muting sensors

The muting sensors must identify the conveyed material (pallets, vehicles...) and, based on length measurements and speed, allow the protected field to be interrupted without shutting down the plant.



Where there are variable transport speeds within the muting area, you must consider the effect this will have on the overall duration of the muting process.

Fig. 20 shows the example of a PSEN opSB-4 safety light curtain installed on a conveyor with the respective muting sensors, where the muting sensors are connected locally.

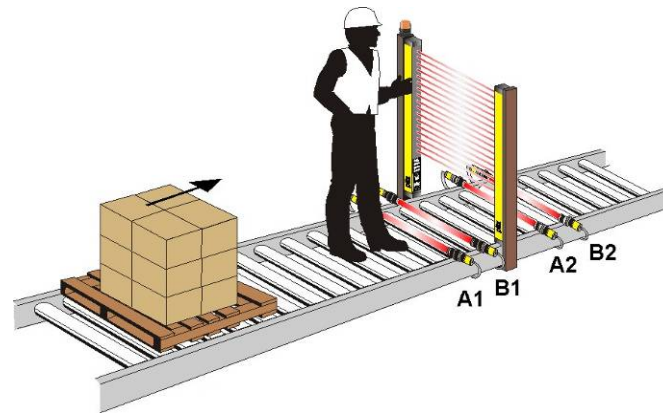


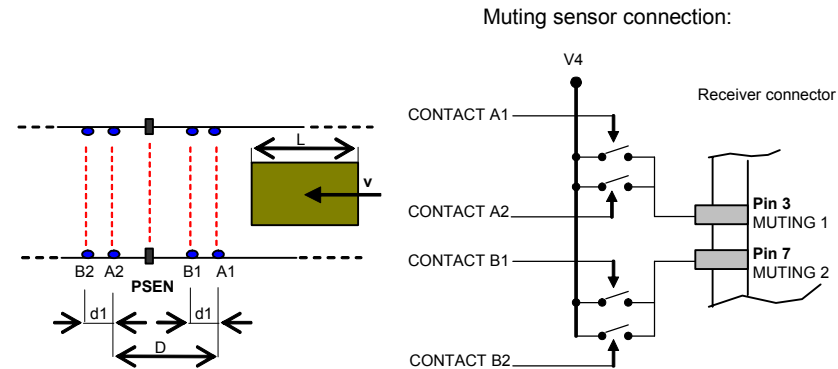
Fig. 20

As the package passes through, the safety function is temporarily suspended via the muting sensors A1, A2, B1 and B2. The outputs on these sensors are connected to muting inputs 1 (A1; A2) and 2 (B1; B2) on the safety light curtain receiver (RX).

The contacts for these sensors are monitored via the receiver (RX). Optoelectronic, mechanical, proximity sensors etc. can be used as muting sensors, using a closed contact when the object requiring detection is present.

The following examples illustrate the application of the muting function:

- Application with four optoelectronic sensors:



D : Minimum distance for the muting sensors to maintain activation; the length of the object is the key factor: $D < L$.

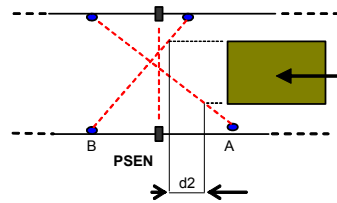
d₁ : Distance required in order to activate muting; the object's approach speed is the key factor for this distance:

$$d_{1max.} [cm] = v [m/s] * t_{Gl} [s] * 100$$

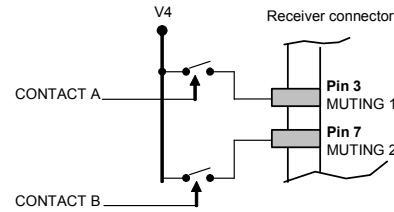
$$d_{1min.} [cm] \geq 0.1 \text{ cm}$$

T_{Gl}: Time selected for the "Simultaneity of the muting sensors" setting (0.5 s, 1 s, 3 s, 4 s)

- Application with two optoelectronic sensors:



Muting sensor connection:



d_2 : Distance required in order to activate muting; the object's approach speed is the key factor for this distance:

$$d_{2max.} [cm] = v [m/s] * t_{Gj} [s] * 100$$

$d_{2min.}$ Should be arranged so that both the muting sensors cross within the monitored area.

T_{Gj} : Time selected for the "Simultaneity of the muting sensors" setting (0.5 s, 1 s, 3 s, 4 s)



- In each case, the muting sensors must be positioned so that muting cannot be activated by somebody passing through the protected field.

English

Override function

This function can be used to activate the muting function when the plant needs to be started even though there is an object within the protected field. The aim is to clear the danger zone of any material that may have accumulated due to a fault in the operating cycle.

Example:

There is a pallet within the protected field and the conveyor cannot be switched on because the safety light curtain will not enable its outputs (one or more of the beams are interrupted), so the accumulated material cannot be transported away. Activating the override function enables this type of intervention.

Requirement for activating the override function:

Bit *LG_MUTING_EXTOVR* must be set. The output signal *LG_OSSD* is reset (safety light curtain is interrupted)

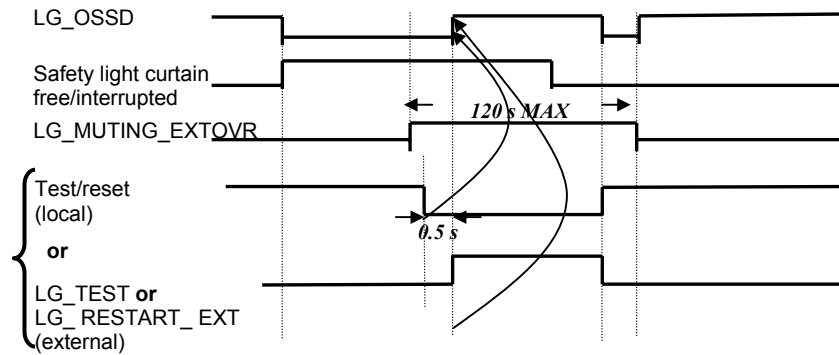
- **Local activation of override function:** Press the test/reset button for ca. 0.5 s and keep it held down until all the accumulated material has been cleared away.
- **External activation of override function:** Activation via an external command (*LG_TEST* or *LG_RESTART_EXT*)

While the override function is active the muting lamp will flash to signal the suspension of the safety light curtain.

The maximum duration of the override function is 120 s. After this time the override function switches off, even if the "Test/reset" button is operated. If the button is released before this time has elapsed, the override function switches off immediately.

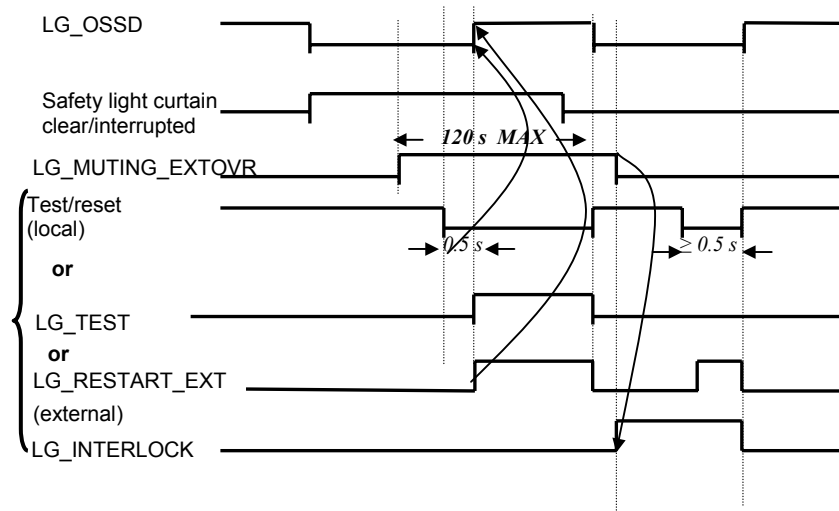
Once the override function has elapsed, the output signal *LG_OSSD* is reset. To return to the normal operating status, the *LG_MUTING_EXTOVR* bit must be reset and, in the case of a manual reset, a restart must be performed.

Timing diagram for automatic reset (local or external activation of override function)



English

Timing diagram for manual reset (local or external activation of override function)



Partial muting function (selection of muting zone)

Safety curtains in the PSEN opSB-4 series have an additional partial muting function, which permits the blanking of selected zones only within the protected field.

This function enables up to 4 zones (optical groups) to be blanked. The blanking width depends on the height of the protected field (partial or total muting) and the resolution of the respective safety light curtain.

Monitoring and blanking of the 4 zones enables a range of configurations:

- One zone is blanked (zone A, zone B, zone C, zone D). The top light curtain beam in Zone D will not switch to partial muting but will maintain normal operation, as it is responsible for optical synchronisation between the emitter (TX) and receiver (RX).
- Several zones are blanked: zone A + B; zone A + B + C or zone A + B + C + D.
- Whole of the protected field is blanked, in other words, total muting.

The required configuration can be defined in the editor, in the “Settings” field under “Muting zone”.

The following overview illustrates the configuration options on the different safety light curtain models.



The table shows the possible settings for the various models:

Muting zones for partial/total muting	A	B	C	D	A+B	A+B+C	A+B+C+D	TOTAL
Model	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to	Length (mm) from...to
PSEN opSB-4F-14-030	0 ... 42	42 ... 84	84 ... 126	126 ... 168	0 ... 84	0 ... 126	0 ... 168	0 ... 294
PSEN opSB-4F-14-045	0 ... 63	63 ... 126	126 ... 189	189 ... 252	0 ... 126	0 ... 189	0 ... 252	0 ... 441
PSEN opSB-4F-14-060	0 ... 98	98 ... 196	196 ... 294	294 ... 392	0 ... 196	0 ... 294	0 ... 392	0 ... 588
PSEN opSB-4F-14-075	0 ... 105	105 ... 210	210 ... 315	315 ... 420	0 ... 210	0 ... 315	0 ... 420	0 ... 735
PSEN opSB-4F-14-090	0 ... 147	147 ... 294	294 ... 441	441 ... 588	0 ... 294	0 ... 441	0 ... 588	0 ... 882
PSEN opSB-4H-30-030	0 ... 74	74 ... 147	147 ... 221	221 ... 276	0 ... 147	0 ... 221	0 ... 294	0 ... 294
PSEN opSB-4H-30-045	0 ... 110	110 ... 221	221 ... 331	331 ... 423	0 ... 221	0 ... 331	0 ... 441	0 ... 441
PSEN opSB-4H-30-060	0 ... 147	147 ... 294	294 ... 441	441 ... 570	0 ... 294	0 ... 441	0 ... 588	0 ... 588
PSEN opSB-4H-30-075	0 ... 147	147 ... 294	294 ... 441	441 ... 588	0 ... 294	0 ... 441	0 ... 588	0 ... 735
PSEN opSB-4H-30-090	0 ... 147	147 ... 294	294 ... 441	441 ... 588	0 ... 294	0 ... 441	0 ... 588	0 ... 882
PSEN opSB-4H-30-105	0 ... 147	147 ... 294	294 ... 441	441 ... 588	0 ... 294	0 ... 441	0 ... 588	0 ... 1029
PSEN opSB-4H-30-120	0 ... 294	294 ... 588	588 ... 882	882 ... 1158	0 ... 588	0 ... 882	0 ... 1176	0 ... 1176
PSEN opSB-4H-30-135	0 ... 221	221 ... 441	441 ... 662	662 ... 882	0 ... 441	0 ... 662	0 ... 882	0 ... 1323
PSEN opSB-4H-30-150	0 ... 294	294 ... 588	588 ... 882	882 ... 1158	0 ... 588	0 ... 882	0 ... 1176	0 ... 1470
PSEN opSB-4H-30-165	0 ... 404	404 ... 809	809 ... 1213	1213 ... 1617	0 ... 809	0 ... 1213	0 ... 1617	0 ... 1617
	Muted optics	Muted optics	Muted optics	Muted optics	Muted optics	Muted optics	Muted optics	Muted optics
PSEN opSB-4B-2-050	1°	-	-	-	1°-2°	-	-	1°-2°
PSEN opSB-4B-3-080	1°	2°	-	-	1°-2°	1°-3°	-	1°-3°
PSEN opSB-4B-4-090	1°	2°	3°	-	1°-2°	1°-3°	1°-4°	1°-4°
PSEN opSB-4B-4-120	1°	2°	3°	-	1°-2°	1°-3°	1°-4°	1°-4°

English

7. PROGRAMMING AND CONFIGURATION

7.1. Settings in the SBp Configurator

A device address must be set in order to operate the safety light curtain on SafetyBUS p; this is defined in the “SBp Configurator”. Set the required device address using the rotary switches on the safety light curtain's receiver (RX).

The rotary switch labelled “x1” is used to set the units, and the rotary switch labelled “x10” is used to set the tens.

When operating the safety light curtain with a Pilz PSS, device addresses $32_{DEC} \dots 95_{DEC}$ are permitted on SafetyBUS p 0 and device addresses $132_{DEC} \dots 195_{DEC}$ are permitted on SafetyBUS p 1.

Please note:

If the safety light curtain is being operated on SafetyBUS p 1, the setting on the rotary switches must always be 100 less than that of the device address (e.g. for device address 140_{DEC} set 40_{DEC} on the rotary switches).

The I/O-Groups to which the safety light curtain belongs must also be defined in the SBp Configurator. For this the safety light curtain can be divided into sections A and B. Section A and section B may belong to different I/O-Groups. There might only be a section A (all functions belong to section A), or there might be a section A and a section B (no functions can be configured in Group B yet).

For configuration details please refer to the online help on the SBp Configurator.

7.2. Configure functions

The light curtain functions are set in the “Editor for Safety Light Curtains of the PSEN opSB-4 Series”.

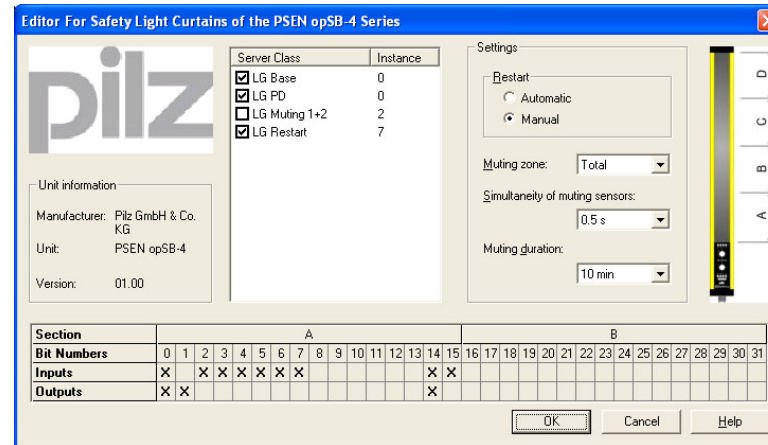


Fig. 21:

- Open the editor in the SBp Configurator by double-clicking on the light curtain within the bus structure.
- Select the required functions in the editor under “Server Class” and “Settings”.
- Several server classes may be selected at the same time. However, only select the server classes that you need for the application.

English

7.2.1. Server classes

A server class occupies one or more virtual inputs/outputs on the safety light curtain. The overview in the lower section of the window in the editor shows all the activated inputs and outputs, plus their bit numbers.

The tables below show the bit names of the inputs/outputs and the corresponding bits in the process images (PII/PIO), for each server class.

LG Base: Basic light curtain function

Name	Instance 0		Description
	Bits PII	Bits PIO	
LG_OSSD	0	-	Status of output signal (OSSD) 0: Light curtain interrupted 1: Light curtain clear
LG_Reset	-	0	External reset 0: Normal operation 1: Reset light curtain
LG_Test	-	1	Perform test 0: Normal operation 1: Perform test (LG_OSSD = 0)

LG PD: Process diagnostics

Name	Instance 0		Description
	Bits PII	Bits PIO	
LG_PD	2-7	-	Process diagnostics D

For details of diagnostic data please see Chapter 8.2 "Error messages and diagnostics".

LG Muting 1+2: Muting

Name	Instance 2		Description
	Bits PII	Bits PIO	
LG_Muting_View	8	-	Status of integrated muting function 0: Muting inactive 1: Muting active
LG_Muting_Sensor (1)	10	-	Status of muting sensors connected to the safety light curtain 0: Muting sensor idle (no object detected) 1: Muting sensor busy (object detected)
LG_Muting_Sensor (2)	11	-	Status of muting sensors connected to the safety light curtain 0: Muting sensor idle (no object detected) 1: Muting sensor busy (object detected)
LG_Muting_ExtOvrd	-	9	Sets enable for the override function 0: Override function inactive (normal mode) 1: Override function can be activated (e.g. via test/reset button)

English

LG_Muting_SensorO vrd (1)	-	10	Status of external muting sensors (1) 0: Ext. muting sensor idle (no object detected) 1: Ext. muting sensor busy (object detected)
LG_Muting_SensorO vrd (2)	-	11	Status of external muting sensors (2) 0: Ext. muting sensor idle (no object detected) 1: Ext. muting sensor busy (object detected)

LG_Restart: Restart safety light curtain

Name	Instance 7		Description
	Bits PII	Bits PIO	
LG_Restart:Loc	14	-	Status of local test/reset button 0: Test/reset button operated 1: Test/reset button not operated
LG_Interlock	15	-	Status of reset lock 0: Reset lock inactive 1: Reset lock active
LG_Restart_Ext	-	14	External reset button 0: No external reset requested 1: External reset requested

Overview of PII of PSEN opSB-4 safety light curtains as SafetyBUS p subscribers (I/O-Device)

Bit	Name	Server class	Instance
0	LG_OSSD	LG Base	0
1	Not assigned	-	-
2 ... 7	LG_PD	LG PD	0
8	LG_Muting View	LG Muting 1+2	2
9	Not assigned		
10	LG_Muting_Sensor (1)	LG Muting 1+2	2
11	LG_Muting_Sensor (2)	LG Muting 1+2	2
12 ... 13	Not assigned	-	-
14	LG_Restart:Loc	LG Restart	7
15	LG_Interlock	LG Restart	7
16	Not assigned	-	-
17 ... 31	Not assigned	-	-

English

Overview of PIO of PSEN opSB-4 safety light curtains as SafetyBUS p subscribers (I/O-Device)

Bit	Name	Server class	Instance
0	LG_Reset	LG Base	0
1	LG_Test	LG Base	1
2 ... 8	Not assigned	-	-
9	LG_Muting_ExtOvrd	LG Muting 1+2	2
10	LG_Muting_SensorOvrd (1)	LG Muting 1+2	2
11	LG_Muting_SensorOvrd (2)	LG Muting 1+2	2
12 ... 13	Not assigned	-	-
14	LG_Restart_Ext	LG Restart	7
15 ... 31	Not assigned		

7.2.2. Configurations in the “Settings” field

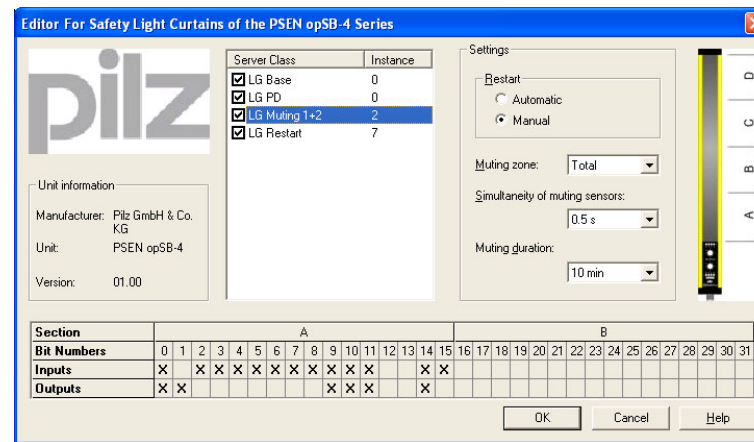
The following configurations can be made in the “Settings” field:

- Restart (see Chapter 6.2 “Restart”)
- Muting zone (see Chapter 6.3 “Muting function”)
- Simultaneity of muting sensors (see Chapter 6.3 “Muting function”)
- Muting duration (see Chapter 6.3 “Muting function”)

7.3. Programming example

The safety light curtain is connected to a PSS-range programmable safety system (e.g. PSS SB CPU 3) via SafetyBUS p. The reset button for the restart function and the key switch for activating the override function are connected to centralised inputs on the PSS. The muting sensors and muting lamp are connected to the safety light curtain. The local input for the test/reset button is unused and must be wired to the V4 output.

Configuration of the safety light curtain



English

Server

The following servers are activated:

Name	Instance	Description
LG Base	0	Basic light curtain functions: - Status of output signal (OSSD) - External reset - Perform test
LG PD	0	Process diagnostics: Transfer of process data bit from PSEN opSB-4 to PSS
LG Muting 1+2	2	Muting with 2 sensors: Muting function integrated within safety light curtain

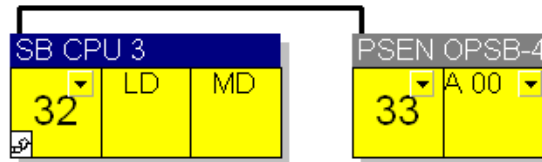
LG Restart	7	Restart safety light curtain
------------	---	------------------------------

Settings

Name	Setting	Description
Restart	Manual	After the protected field has been interrupted, the safety light curtain does not return to its normal mode until the object has been removed from the protected field and the restart has occurred manually
Muting zone	Total	When muting occurs, the whole protected field is blanked (total muting)
Simultaneity of the muting sensors	0.5 s	Maximum time that is permitted to elapse between activation of both muting sensors
Muting duration	10 min	Maximum time that muting is active

SafetyBUS p configuration

The PSS has device address 32. The safety light curtain has device address 33. Section A is assigned to I/O-Group 0.



English

Programming

Programming was carried out in OB101. It may also be carried out elsewhere, e.g. in a PB or FB.

Listing for OB101

```

SEG 0
// Read in status of safety light curtain
// and link to other enable signals

L   E   033.00 .LG_OSSD      // Status of OSSD;
                                // 1 = Light curtain clear
U   M   080.00 .Enable_1    // Enable signal from
                                // another device (e.g. gate)
U   M   081.00 .Enable_2    // Enable signal from
                                // another device
                                // (e.g. safety mat)
=   M   089.00 .Enable_total // Overall enable signal
                                // for further use

SEG 1
// Send the signal from the reset button connected to the PSS
// to the safety light curtain

L   E   000.01 .External_Start_Button // Read in signal
                                // from reset button
=   A   033.14 .LG_Restart_Ext      // Send signal to
                                // light curtain

```

```

SEG 2
// Read in signal from the key switch connected to the PSS
// and use it as an enable for the muting override
// function

L   E   000.04 .Enable_Override    // Read in signal
                                     // from key switch
=   A   033.09 .LG_Muting_ExtOvrd  // Send signal to
                                     // light curtain

SEG 3
// Read in status of muting function (active/inactive) and
// local muting sensors from light curtain
// and provide for further use,
// e.g. for status display (visualisation) or similar

L   E   033.08 .LG_Muting_View     // Status of
                                     // muting function;
                                     // 1 = Muting active
=   M   082.00
L   E   033.10 .LG_Muting_Sensor1  // Status of
                                     // muting sensor 1
=   M   082.01
L   E   033.11 .LG_Muting_Sensor2  // Status of
                                     // muting sensor 2
=   M   082.02

BE

```

Description of segments

Segment 0

The status of the safety light curtain is read in and linked to other enable signals. The result is an overall enable signal, which can be used to enable or stop a hazardous movement, for example.

The status of the safety light curtain (LG_OSSD, in this case E33.00) does **not** need to be processed in two channels because the signal is generated safely within the safety light curtain and is transmitted to the PSS safely via SafetyBUS p. The same applies to other signals to and from the safety light curtain.

Segment 1

The reset button is connected to input E 0.1 on the PSS and is intended to reset the safety light curtain via SafetyBUS p. To do this, the PSS reads the signal from the pushbutton and sends it to the safety light curtain, i.e. writes to output A 33.14. A 33.14 corresponds to the bit LG_Restart_Ext in the safety light curtain's process image of outputs (PIO).

Segment 2

The override enable signal enables muting to be overridden by pressing the reset/test button or via the LG_Restart (or LG_Test) signal.

A key switch is connected to input E 0.4, and this generates the override enable signal. The PSS reads the signal from the key switch and sends it to the safety light curtain, i.e. writes to output A 33.09. A 33.09 corresponds to the bit LG_Muting_ExtOvrd in the safety light curtain's process image of outputs (PIO).

Segment 3

The PSS reads the status of the muting function (muting active/inactive) and the status of the local muting sensors (sensors connected directly to the safety light curtain); flags are then assigned. In this way they are available for further processing, e.g. for status display on a graphics system or similar...

8. DIAGNOSTICS

8.1. Function indicators

4 LEDs on the receiver (RX) and 2 LEDs on the emitter (TX) provide the user with information about the operating status of the PSEN opSB-4 safety light curtain (Fig. 22).

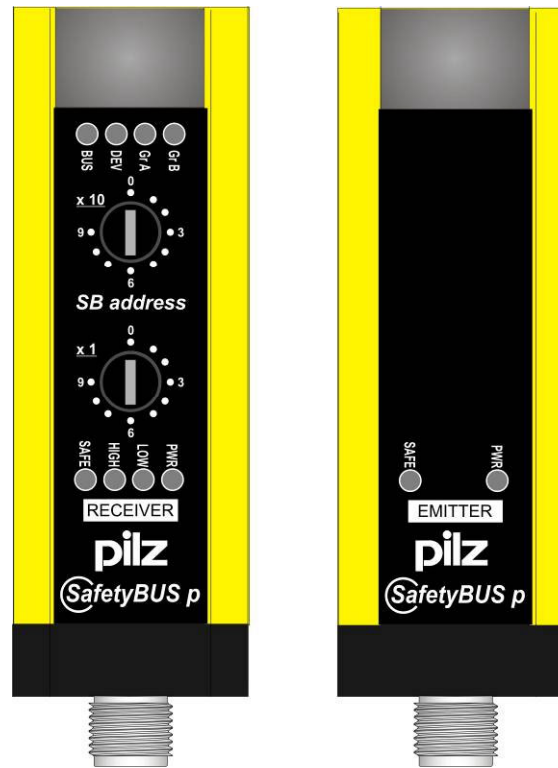


Fig. 22

8.1.1. LEDs on the receiver (RX)

The key to the LEDs on the receiver (RX) depends on the operating mode:

During alignment:

In this status, the output signal LG_OSSD is switched off.

The safety light curtain is always in alignment mode when Group A is in "STOP".

- SAFE LED (Safe/Break):
 - Lights up green:** Emitter (TX) and receiver (RX) are aligned and the protected field is clear.
 - Lights up red:** Emitter (TX) and receiver (RX) are not aligned or an object is breaking the protected field.
- HIGH LED (Alignment High):
 - Lights up yellow:** Optimum alignment between the top emitter optic and the corresponding receiver optic (top beam on the device).
- LOW LED (Alignment Low):
 - Lights up yellow:** Optimum alignment between the bottom emitter optic and the corresponding receiver optic (bottom beam on the device).
- PWR LED (Power):
 - Lights up green:** Correct supply voltage is available for the safety light curtain.

In operation (Group A is in "RUN")

- SAFE LED (Safe/Break):
 - Lights up green:** The protected field is clear.
 - Lights up red:** The protected field is interrupted, the output signal LG_OSSD is reset.
- HIGH LED (Alignment High):
 - Lights up yellow:** "Test/reset" button must be operated after a restart or after the protected field has been interrupted (reset request).
 - Flashes yellow:** Diagnostic/error display (see Chapter 8.2 "Error messages and diagnostics").

- **LOW LED (Alignment Low):**
 - Flashes yellow:** Diagnostic/error display (see Chapter 8.2 “*Error messages and diagnostics*”).
- **DEV LED (device):**
 - Lights up green:** The SafetyBUS device is operating without error
 - Lights up red:** There is an error in both I/O-Groups
 - Flashes red:** There is an error in one I/O-Group
 - LED off:** A system error is preventing the safety light curtain from starting up
- **BUS LED:**
 - Lights up green:** Connection to the PSS has been established
 - Flashes green:** The connection to SafetyBUS p is established, but the PSS does not recognise the safety light curtain (faulty device address or configuration)
 - LED off:** No connection to SafetyBUS p established (faulty wiring or PSS not in operation)
- **GrA LED (I/O-Group A):**
 - Lights up green:** I/O-Group A has “RUN” status
 - LED off:** I/O-Group B has “STOP” status
- **GrB LED (I/O-Group B):**
 - Lights up green:** I/O-Group B has “RUN” status
 - LED off:** I/O-Group B has “STOP” status
- **PWR LED**
 - Lights up green:** Correct supply voltage is available for the safety light curtain.

8.1.2. LED indicators on the emitter (TX)

The key to the LEDs on the emitter (TX) is as follows:

- **SAFE LED:**
 - Lights up yellow:** The emitter (TX) is transmitting correctly.
- **PWR LED**
 - Lights up green:** Correct supply voltage is available for the safety light curtain.

8.2. Error messages and diagnostics

If there are errors on the safety light curtain, the LEDs can be used for diagnostics on the safety light curtain. It is also possible to evaluate the safety light curtain's error stack, as well as process status diagnostics LG_PD. The error stack can be displayed in the SafetyBUS p Configurator in the PSS WIN-PRO system software. Process status diagnostics can be evaluated by the user program.

Error/status - Remedy	PD bits	LEDs	Error stack
Normal operation	000000	Receiver (RX): Safe = lights up green High = off Low = off Pwr = lights up green	
Muting active	000001	Receiver (RX): Safe = lights up green High = off Low = off Pwr = lights up green	
Muting override active	000010	Receiver (RX): Safe = lights up green High = lights up yellow Low = off Pwr = lights up green	
Protected field is interrupted	001001	Receiver (RX): Safe = lights up red High = off Low = off Pwr = lights up green	
Restart required	001101	Receiver (RX): Safe = lights up red High = lights up yellow Low = off Pwr = lights up green	
Test is being performed	010100	Receiver (RX): Safe = lights up red High = off Low = off Pwr = lights up green	
Max. permitted time for override function was exceeded Remedy: <ul style="list-style-type: none"> Remove activation of override function and reset override function 	100000	Receiver (RX): Safe = lights up red High = lights up yellow Low = off Pwr = lights up green	F-54,10

One of the muting sensors switched too late Remedy: <ul style="list-style-type: none"> • Ensure that the muting sensors operate correctly • Ensure that the muting sensors are positioned correctly • Ensure there are no errors in the wiring of the muting sensors 	100001	Does not affect the LEDs	F-54,0d
One of the muting sensors switched too late Remedy: <ul style="list-style-type: none"> • Clear muting zone • Ensure that objects pass through the muting zone within the specified time ("Muting duration") • Increase the simultaneity of the muting sensors in the safety light curtain editor 	100010	Does not affect the LEDs	F-54,0f
An object passed through the muting zone too slowly or has not left the muting zone Remedy: <ul style="list-style-type: none"> • Clear muting zone • Ensure that objects pass through the muting zone individually • Ensure that objects pass through the muting zone within the specified time ("Muting duration") • Increase the muting duration in the safety light curtain editor 	100011	Does not affect the LEDs	F-54,0e
Error due to muting lamp: Remedy: <ul style="list-style-type: none"> • Ensure that the muting lamp is operating correctly • Ensure there are no errors in the muting lamp wiring 	101111	<u>Receiver (RX):</u> Safe = lights up green High = flashes yellow Low = flashes yellow Pwr = lights up green	F-54,0c
Max. permitted time for override function was exceeded Remedy: <ul style="list-style-type: none"> • Remove activation of override function and reset override function 	110001	<u>Receiver (RX):</u> Safe = lights up red High = lights up yellow Low = off Pwr = lights up green	F-54,11
Internal error; I/O groups go to a stop condition Contact Piiz		<u>Receiver (RX):</u> Safe = lights up green High = off Low = flashes yellow Pwr = lights up green	F-53.01

<p>Error due to environmental influences; I/O groups go to a stop condition Remedy:</p> <ul style="list-style-type: none"> • Ensure that the safety light curtain is not disrupted by environmental influences • Ensure that the safety light curtain is not influenced by external light sources 		<p><u>Receiver (RX):</u> Safe = lights up green High = off Low = flashes yellow Pwr = lights up green</p>	F-53,02
<p>Safety light curtain has been influenced by an external light source; I/O groups go to a stop condition Remedy:</p> <ul style="list-style-type: none"> • Ensure that the safety light curtain is not influenced by external light sources 		<p><u>Receiver (RX):</u> Safe = lights up green High = off Low = flashes yellow Pwr = lights up green</p>	F-53.03
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = lights up green High = off Low = flashes yellow Pwr = lights up green</p>	F-53.04
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53,0c
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53,1e
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53,1f
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53.20
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53.21
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p><u>Receiver (RX):</u> Safe = off High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	F-53.22
<p>Internal error; I/O groups go to a stop condition Contact Pilz</p>		<p>Does not affect the LEDs</p>	F-54.14

English

<p>The received configuration data is faulty Remedy:</p> <ul style="list-style-type: none"> • Ensure that the correct device description file is used for the safety light curtain (appropriate type, version) • Copy the original device description file into the relevant directory again (see system software's online help) • Delete the safety light curtain in the SBp Configurator and reconfigure it 		<p>Does not affect the LEDs</p>	<p>F-54.15</p>
<p>Safety light curtain cannot be restarted because the "Test/reset" button is operated Remedy:</p> <ul style="list-style-type: none"> • Release the "Test/reset" button • Ensure that the "Test/reset" button is operating correctly 		<p><u>Receiver (RX):</u> Safe = lights up red High = off Low = off Pwr = lights up green</p>	<p>F-54.1f</p>
<p>If a "Test/reset" button is connected to the safety light curtain, it was operated during restart Remedy:</p> <ul style="list-style-type: none"> • Release the "Test/reset" button • Ensure that the "Test/reset" button is operating correctly 		<p><u>Receiver (RX):</u> Safe = lights up red High = off Low = off Pwr = lights up green</p>	<p>F-54.20</p>
<p>Safety light curtain cannot be restarted because the "Test/reset" button is operated Remedy:</p> <ul style="list-style-type: none"> • Release the "Test/reset" button • Ensure that the "Test/reset" button is operating correctly 		<p><u>Receiver (RX):</u> Safe = lights up red High = off Low = off Pwr = lights up green</p>	<p>F-54.21</p>
<p>Fault at the output Remedy:</p> <ul style="list-style-type: none"> • Check the output connections • Check the load on the outputs and make sure it complies with the specifications in the technical details (see Chapter 10). 		<p><u>Receiver (RX):</u> Safe = lights up red High = flashes yellow Low = flashes yellow Pwr = lights up green</p>	
<p>The supply voltage is outside the recommended limit Remedy:</p> <ul style="list-style-type: none"> • Check the supply voltage 		<p><u>Receiver (RX):</u> Safe = off High = off Low = off Pwr = off</p>	
<p>The supply voltage is outside the recommended limit Remedy:</p> <ul style="list-style-type: none"> • Check the supply voltage 		<p><u>Receiver (RX):</u> Safe = off High = off Low = off Pwr = lights up green</p>	
<p>Communication failure Remedy:</p> <ul style="list-style-type: none"> • Check the supply voltage 		<p><u>Emitter (TX):</u> Safe = flashes yellow PWR = lights up green</p>	

Supply voltage error Remedy: • Check the supply voltage		<u>Emitter (TX):</u> Safe = off PWR = off	
The supply voltage is outside the recommended limit Remedy: • Check the supply voltage		<u>Emitter (TX):</u> Safe = off PWR = lights up green	

English

9. REGULAR CHECKS AND MAINTENANCE

Qualified personnel must carry out the following checks regularly.

Ensure that:

- The “SAFE” LED is constantly red when you pass the test rod from top to bottom along the length of the whole sensing area, at any distance from either unit.
- The safety light curtain switches to an OFF state when the local test/reset button is operated (“SAFE” LED lights up red - OSSD output signal is set - monitored machine switches to a safe condition).
- The reaction time at a machine stop, incl. the reaction time of the safety light curtain and the machine overrun time, is within the limits defined through the calculation of the safety distance (see Chapter 2 “*Installation*”).
- The minimum safety distance between the danger zone and the protected field is in accordance with the details stated in Chapter 2 “*Installation*”.
- Nobody can access and remain in the danger zone between the PSEN opSB4 safety light curtain and the hazardous machine parts.
- The danger zone cannot be accessed from any unprotected area.
- There is no visible damage to the safety light curtain and/or the external electrical connections.

The frequency with which checks are performed depends on the respective application and on the conditions under which the safety light curtain is operated.

9.1. Maintenance

Safety light curtains in the PSEN opSB-4 series require no particular maintenance, except for cleaning the optical covers. Moist cotton cloths should be used for cleaning.



We recommend that you do not use:

- Alcohol or solvents,
- Cloths made of wool or synthetic material.

9.2. General information and useful data



Safety devices are only beneficial if they are installed correctly, in accordance with the regulations.

If you find that you do not have the necessary expertise to install the safety devices correctly, please contact our technical support.

Electronic fuses protect the devices against short circuit. Once these have reacted you will need to disconnect the power supply for at least 20 seconds and rectify the short circuit. When you reconnect the power supply the fuses will have reset and the safety light curtain can automatically resume normal operation.

Faults that result in a power supply failure may cause the outputs to open temporarily, but do not adversely affect the safe operation of the safety light curtain.

Install and replace emitter and receiver only in pairs. Emitter and receiver have the same serial number. Guideline for repair: Always send both emitter **and** receiver for repair. *(During repair, both units are programmed with the current software version).*

10. TECHNICAL DETAILS

Supply voltage	24 VDC ±20% (SELV/PELV)
Current consumption, emitter (TX)	See Chapter 11 "List of available models"
Current consumption, receiver (RX)	See Chapter 11 "List of available models"
Leakage current	< 1 mA
Reaction time	(See table: "Available models")
Emitter, wavelength	Infra-red (880 nm)
Resolution	14 mm finger protection (PSEN opSB-4F) 30 mm hand protection (PSEN opSB-4H) 300...500 mm body protection (PSEN opSB-4B)
Operating range	0.2...6 m (PSEN opSB-4F), 0.2...15 m (PSEN opSB-4H), 0.5...25 m (PSEN opSB-4B)
Category	Type 4
Operating temperature	-10...+55 °C
Storage temperature	-25...+70 °C
Humidity	15...95 % (non-condensing)
Protection class	Class 1 if necessary (see Chapter 4.3: "Notes on wiring")
Protection type	IP65 (EN 60529)
Ambient brightness	IEC-61496-2
Vibration	Amplitude 0.35 mm, frequency 10 ... 55 Hz, 20 sweeps for all axes; 1 octave/min., (EN 60068-2-6)
Shock resistance	16 ms (10 G) 1,000 shocks for all axes (EN 60068-2-29)
Reference standards	EN 61496-1; prEN 61496-2
Housing material	Varnished aluminium (yellow RAL 1003)
Material of upper and lower cover	PC MAKROLON
Material for optics	PMMA
Connections	4-pin M12 connector on TX 8-pin M12 connector on RX-I/O 5-pin M12 connector on RX-BUS
Cable runs	Conforms to SafetyBUS p standard
Weight	Max. 1.2 Kg / m per unit
Local inputs/outputs	
Supply voltage (V4)	24 VDC ±2% (isolated from Vcc)
Power supply to the inputs/outputs	Max. 240 mA
Overvoltage limitation	32.5 V
Current limitation	Min. 350 mA
Current at the inputs:	
Muting	Max. 5 mA
Test/reset button	Max. 5 mA
Muting lamp	Lamp 24 V 3W min. (125 mA) / 5W max. (200 mA)
Cable runs:	Max. 10 m
SafetyBUS p	
Transmission rate	Max. 500 kBit/s
Cable runs	Max. 3,500 m
Transmission type	Differential two-wire cable

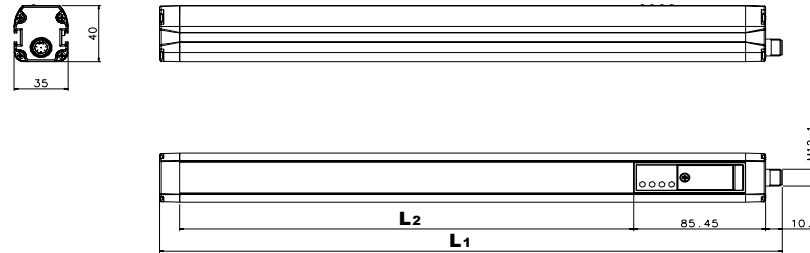
11. LIST OF AVAILABLE MODELS

Model	Length of sensing area	Length of protected area	Number of beams	Resolution (mm)	Reaction time (ms)	Current consumption (mA)		Operating range (m)
						TX	RX	
PSEN opSB-4F-14-030	294	308	42	14	75	58	95	0.2...6
PSEN opSB-4F-14-045	441	455	63		82	64	95	0.2...6
PSEN opSB-4F-14-060	588	602	84		90	71	95	0.2...6
PSEN opSB-4F-14-075	735	749	105		97	80	95	0.2...6
PSEN opSB-4F-14-090	882	896	126		105	90	95	0.2...6
PSEN opSB-4H-30-030	294	327	16	30	58	44	95	0.2...15
PSEN opSB-4H-30-045	441	474	24		61	47	95	0.2...15
PSEN opSB-4H-30-060	588	621	32		64	50	95	0.2...15
PSEN opSB-4H-30-075	735	768	40		67	52	95	0.2...15
PSEN opSB-4H-30-090	882	915	48		70	54	95	0.2...15
PSEN opSB-4H-30-105	1029	1062	56		72	56	95	0.2...15
PSEN opSB-4H-30-120	1176	1209	64		75	58	95	0.2...15
PSEN opSB-4H-30-135	1323	1356	72		78	60	95	0.2...15
PSEN opSB-4H-30-150	1470	1503	80		81	61	95	0.2...15
PSEN opSB-4H-30-165	1617	1650	88		84	63	95	0.2...15
PSEN opSB-4B-2-050	515	n.a.	2		515	55	42	95
PSEN opSB-4B-3-080	815	n.a.	3	415	55	42	95	0.5...25
PSEN opSB-4B-4-090	915	n.a.	4	315	55	42	95	0.5...25
PSEN opSB-4B-4-120	1215	n.a.	4	415	55	43	95	0.5...25

English

12. OVERALL DIMENSIONS

All dimensions are stated in mm.



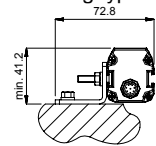
Model	L1 (mm)	L2 (mm)
PSEN opSB-4F-14-030	403	294
PSEN opSB-4F-14-045	550	441
PSEN opSB-4F-14-060	697	588
PSEN opSB-4F-14-075	844	735
PSEN opSB-4F-14-090	991	882
Model	L1 (mm)	L2 (mm)
PSEN opSB-4H-30-030	403	294
PSEN opSB-4H-30-045	550	441
PSEN opSB-4H-30-060	697	588
PSEN opSB-4H-30-075	844	735
PSEN opSB-4H-30-090	991	882
PSEN opSB-4H-30-105	1138	1029
PSEN opSB-4H-30-120	1285	1176
PSEN opSB-4H-30-135	1432	1323
PSEN opSB-4H-30-150	1579	1470
PSEN opSB-4H-30-165	1726	1617
Model	L1 (mm)	L2 (mm)
PSEN opSB-4B-2-050	879	770
PSEN opSB-4B-3-080	1179	1070
PSEN opSB-4B-4-090	1279	1170
PSEN opSB-4B-4-120	1579	1470

13. ACCESSORIES

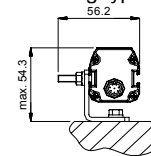
13.1. Fastening bracket

MODEL	DESCRIPTION
Bracket kit PSEN 4	(1) Bracket (4-part kit)
Bracket kit PSEN 4 anti vibr.	(2) Anti-vibration brackets (4-part kit)
Bracket kit PSEN 4 adjust.	(3) Adjustable brackets (4-part kit)

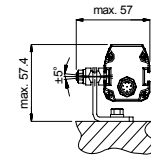
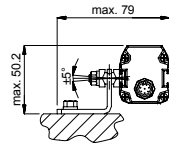
Mounting type A



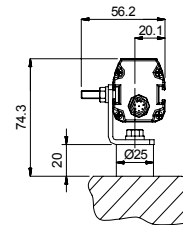
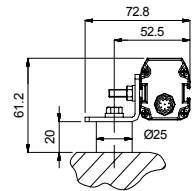
Mounting type B



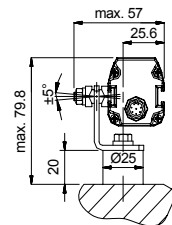
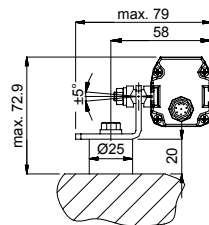
Standard mounting bracket (1)



Standard mounting bracket + adjustable bracket (1 + 3)



Standard mounting bracket + anti-vibration bracket (1 + 2)

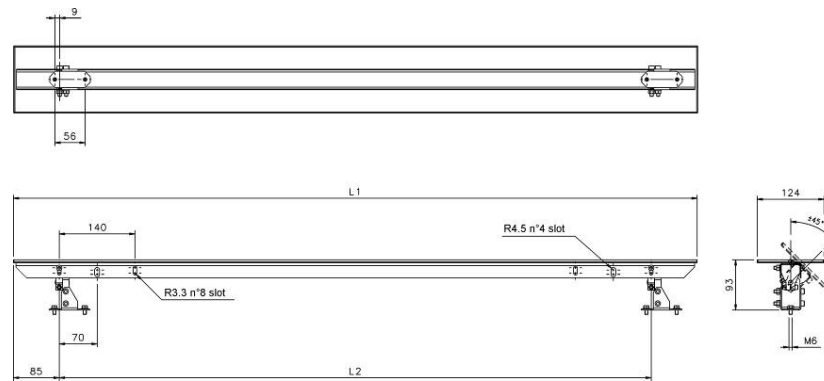


Standard bracket+adjustable bracket+anti-vibration bracket (1 + 2 + 3)

English

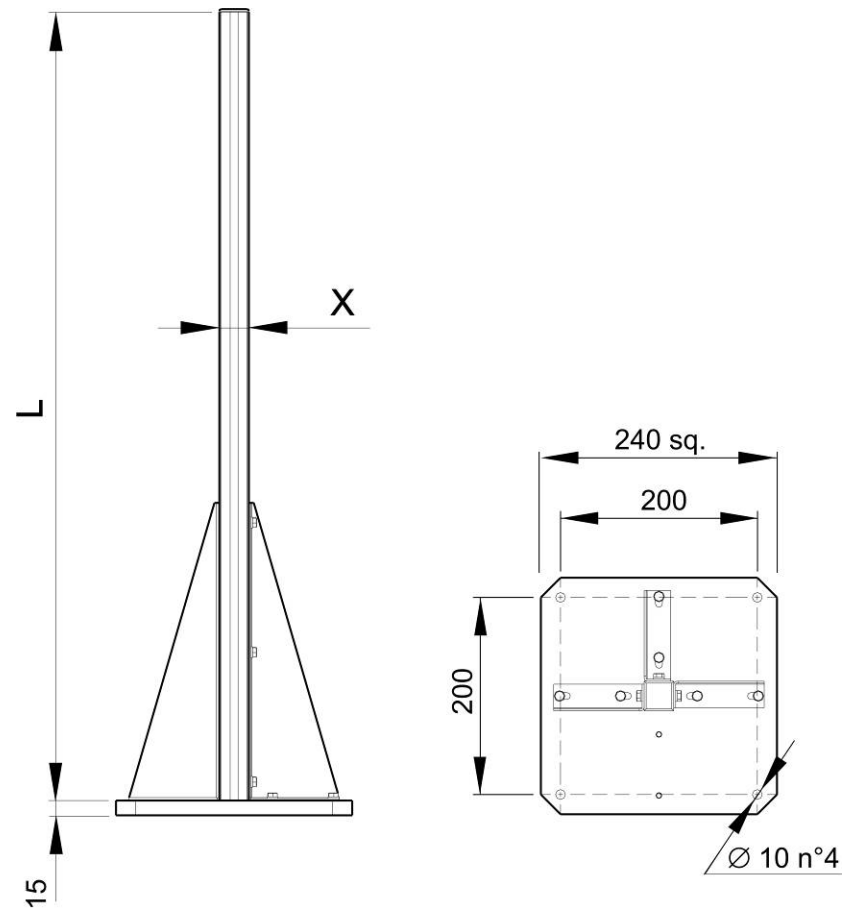
13.2. Deviating mirror

MODEL	DESCRIPTION	L ₁ (mm)	L ₂ (mm)
Mirror 550mm	Deviating mirror H= 550 mm	554	384
Mirror 700mm	Deviating mirror H= 700 mm	704	534
Mirror 900mm	Deviating mirror H= 900 mm	904	734
Mirror 1000mm	Deviating mirror H= 1000 mm	1004	834
Mirror 1270mm	Deviating mirror H= 1270 mm	1264	1094



13.3. Floor brackets

MODEL	DESCRIPTION	L (mm)	X (mm)
Stand 1000mm	Floor brackets H= 1000 mm	1000	30x30
Stand 1200mm	Floor brackets H= 1200 mm	1200	30x30
Stand 1500mm	Floor brackets H= 1500 mm	1500	45x45
Stand 1800mm	Floor brackets H= 1800 mm	1800	45x45

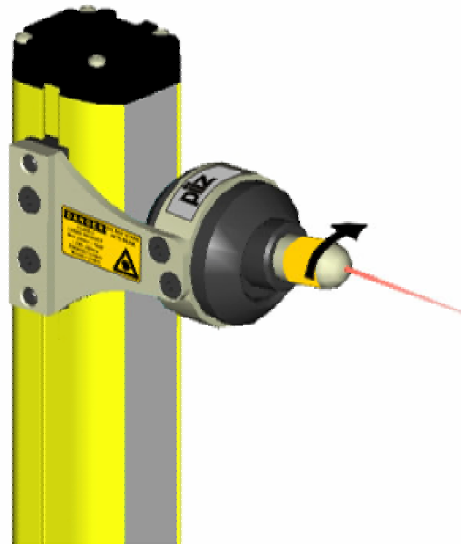


English

13.4. Laser pointer

The laser pointer in the PSEN op2/4 series is a valuable guide when aligning and installing the safety light curtains. The pointer can be moved along the light curtain profile to check the overall alignment of the safety light curtain.

MODEL	DESCRIPTION
LaserPointer for PSEN 4/2	Laser pointer for alignment



13.5. Cable

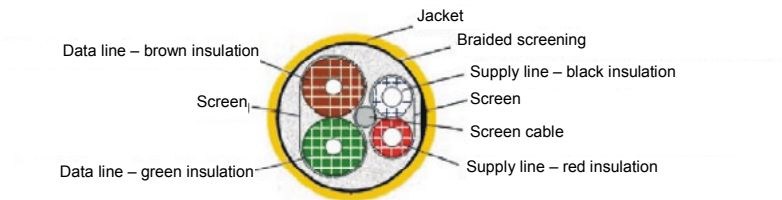
13.5.1. Cable for connection to SafetyBUS p

The safety light curtain is connected to SafetyBUS p using Y cable. In the given example, the branch from the Active Junction is on the left (M12 connector must be removed and then reconnected to the device).

On the stub line, a terminator (terminating resistor) is connected to the last pair of light curtains.

All M12 connectors are coded in such a way that the interfaces cannot be inserted incorrectly.

Low current cable structure



Y cable PIN assignment:

- 1= - = Screen
- 2= red = VCC
- 3= white = GND
- 4= green = Can_H
- 5= brown = Can_L



If a Y cable is shortened and wired with a connector that is suitable for field assembly, make sure the correct PIN assignment is maintained.

The outer braided screening must not be connected to the housing.

MODEL	DESCRIPTION
PSS SB CABLESET 03	Y cable (0.5m and 3 m), 1 x M12 male connector, 2 x M12 female connectors
PSS SB CABLESET 05	Y cable (0.5m and 5m), 1 x M12 male connector, 2 x M12 female connectors
PSS SB CABLESET 10	Y cable (0.5m and 10 m), 1 x M12 male connector, 2 x M12 female connectors
PSS SB CABLESET 15	Y cable (0.5m and 15 m), 1 x M12 male connector, 2 x M12 female connectors
PSS SB BUSCABLE LC	SafetyBUS p bus cable, low current, 4-core, shielded
PSS SB M12 TERMINATOR	SafetyBUS p terminating resistor IP67, M12 male connector

13.5.2. Cable for local I/O connector

MODEL	DESCRIPTION
PSEN op cable axial M12 8-p. shield. 3m	8-core cable, shielded, 3 m, M12, axial
PSEN op cable axial M12 8-p. shield. 5m	8-core cable, shielded, 5 m, M12, axial
PSEN op cable axial M12 8-p. shield. 10m	8-core cable, shielded, 10 m, M12, axial
PSEN op cable angle M12 8-p. shield. 3m	8-core cable, shielded, 3 m, M12, angled
PSEN op cable angle M12 8-p. shield. 5m	8-core cable, shielded, 5 m, M12, angled
PSEN op cable angle M12 8-p. shield. 10m	8-core cable, shielded, 10 m, M12, angled