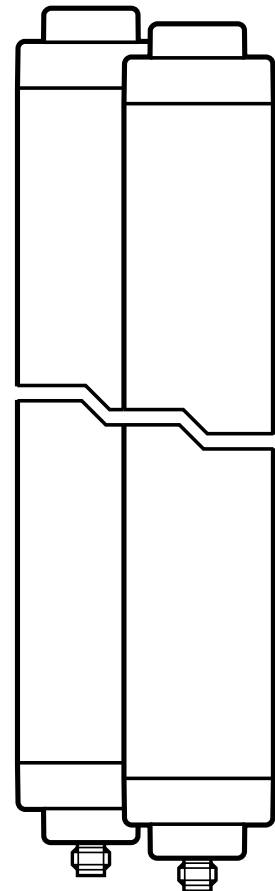


Original operating instructions  
Photoelectric safety sensors  
(Safety light curtain)  
with floating blanking  
(blanking function)

UK

**OY8xxS**

11510709 / 00 01 / 2023



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# 1 Preliminary note

The instructions are part of the unit. They are intended for authorised persons according to the EMC and Low Voltage Directives and safety regulations. The instructions contain information about the correct handling of the product. Read the instructions before use to familiarise yourself with operating conditions, installation and operation. Follow the safety instructions.

## 1.1 Symbols used

▶ Instruction

> Reaction, result

→ Cross-reference

○ LED off

● LED on

⊗ LED flashes



Important note

Non-compliance can result in malfunction or interference.



Information

Supplementary note.



Access prevention finger protection



Access prevention hand protection



Access prevention bodies or parts of bodies



Access prevention body protection

## 1.2 Warning signs used

 **WARNING**

Warning of serious personal injury.

Death or serious irreversible injuries may result.

## 2 Safety instructions

- Follow the operating instructions.
- In case of non-observance of notes or standards, especially when tampering with and/or modifying the unit, any liability and warranty is excluded.
- The unit must be installed, connected and put into operation by a qualified electrician trained in safety technology.
- The applicable technical standards for the corresponding application must be complied with.
- For the installation, the standards EN 60204, EN 999 and ISO 13855 have to be observed.
- In case of malfunction of the unit please contact the manufacturer. Tampering with the unit is not allowed.
- Disconnect the unit externally before handling it. Disconnect all relay load circuits that are supplied independently.
- After setup, the system has to be subjected to a complete function check.
- Only use the unit under the specified operating conditions (→ 12 Technical data). In case of special operating conditions please contact the manufacturer.
- In case of any questions concerning safety - if required - contact the safety expert in charge of your country.

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### **WARNING**

**In case of improper handling of the product, the safety and physical integrity of persons and machinery cannot be guaranteed.**

Death or serious irreversible injuries may result.

- ▶ Observe all notes on installation and handling in these instructions.
- ▶ The photoelectric safety sensors must only be used under the specified operating conditions and in accordance with use as prescribed below.

## **2.1 Safety-related requirements regarding the application**

It must be ensured that the safety requirements of the respective application correspond to the requirements stated in these instructions.

Observe the following requirements:

- ▶ Adhere to the specified operating conditions (→ 12 Technical data). Use of the photoelectric safety sensors in the vicinity of chemically and biologically active media as well as ionising radiation is not permitted.
- ▶ For applications in the food industry, contact your ifm branch office to check the compatibility of the materials of the photoelectric safety sensors with the chemicals used.
- ▶ Adhere to the principle of normally closed operation for all external safety circuits connected to the system.
- ▶ If the photoelectric safety sensors go into the state defined as safe due to an internal fault, measures have to be taken to maintain the safe state when the installation resumes operation.
- ▶ Replace damaged units.

The protective function of the photoelectric safety sensors is only ensured with the following conditions:

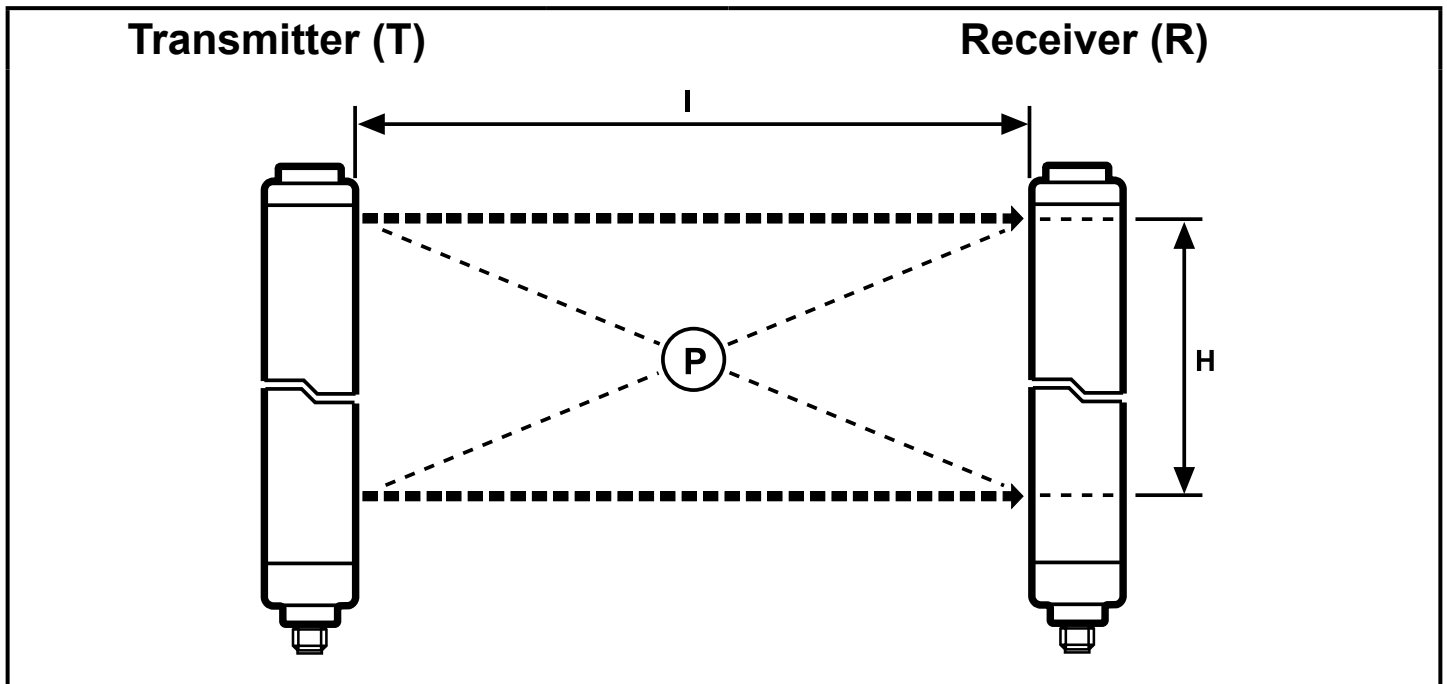
- The machine control can be electrically controlled and the hazardous machine motion can be stopped immediately at any time of the operation cycle.
- There is no danger for machine operators due to ejection of materials or machine parts.
- The hazardous area is only accessible via the protected area.

### 3 Items supplied

- 2 photoelectric safety sensors (1 transmitter and 1 receiver)
- up to a total length of 1311 mm: 4 angle brackets, 4 slot nuts with M6 thread and suitable nuts
- starting with 1311 mm total length: 6 angle brackets, 6 slot nuts with M6 thread and suitable nuts
- 1 copy operating instructions photoelectric safety sensors, reference no. 706234.

If one of the above-mentioned components is missing or damaged, please contact one of the ifm branch offices. **UK**

### 4 Functions and features



P = protected area; l = protected area width (range); H = protected area height

The OY safety light curtains are multi-beam optoelectronic protective devices according to IEC 61496 and consist of one transmitter and one receiver.

## 5 Function

The protected area (P) is generated between the transmitter and the receiver and is defined by the protected area height (H) and the protected area width (range) (l).

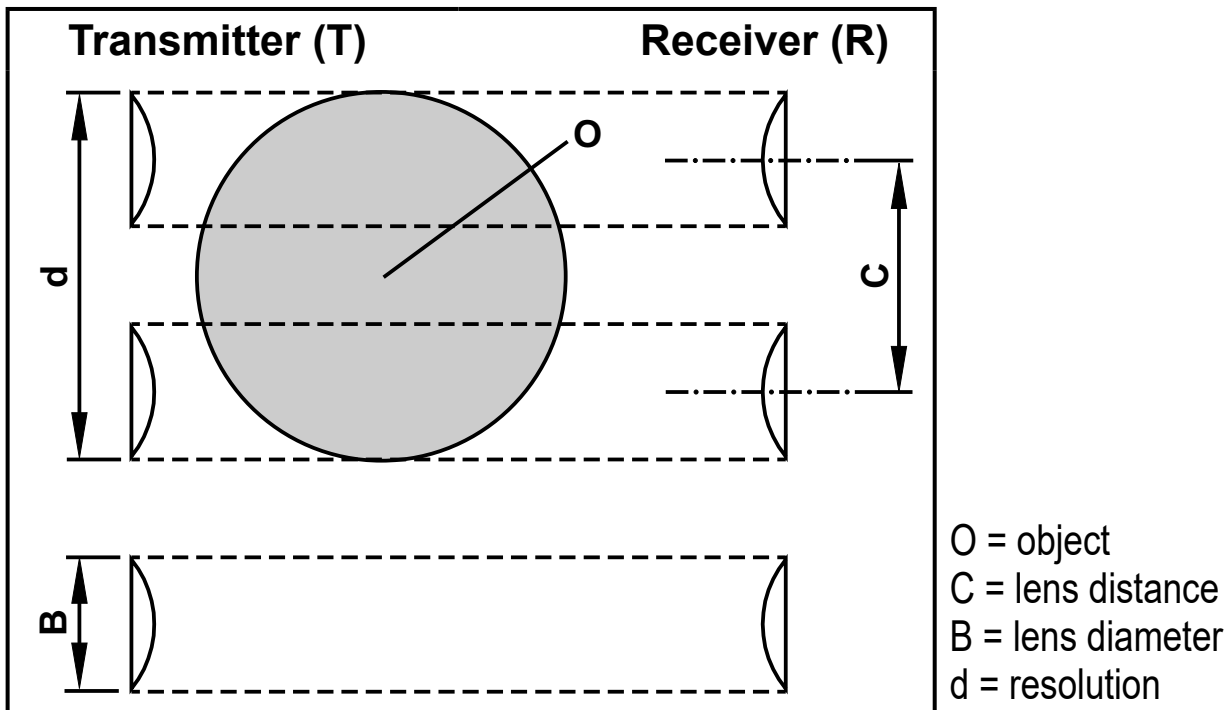
The protected area height is the height protected by the safety light curtain. It depends on the design (→ 12 Technical data). If the safety light curtains are installed horizontally, this value indicates the depth of the protected area.

The protected area width (range) is the maximum distance between transmitter and receiver (→ 12 Technical data).

If the protected area is clear, the two outputs (OSSDs) of the receiver are active.

If an object (O) with a diameter greater than or equal to the resolution (d) enters the protected area, the outputs are switched off.

The resolution (d) (detection capability) of the safety light curtain depends on the lens diameter (B) and the lens distance (C) and remains constant at all application conditions.



To ensure that an object (O) is reliably detected in the protected area, the dimensions of the object (O) must be at least as great as the resolution (d).



# 6 Installation

## 6.1 Installation instructions

The following conditions are to be ensured before installation of the photoelectric safety sensors:

- The degree of protection of the electro-sensitive equipment (ESPE) has to correspond with the risk assessment of the machine to be monitored.
- The safety system ensures a safety function and is not required for the operation of a machine.
- It must be possible to stop any hazardous motion of the machine immediately. In this respect the shutdown delay of the machine has to be determined.
- The object to be detected must be greater than or equal to the resolution of the photoelectric safety sensor.



Install the photoelectric safety sensors so that the hazardous area can only be accessed via the protected area. Depending on the application other mechanical protective equipment may be necessary.

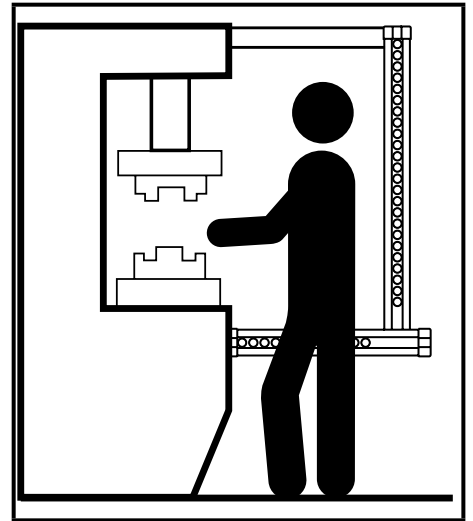
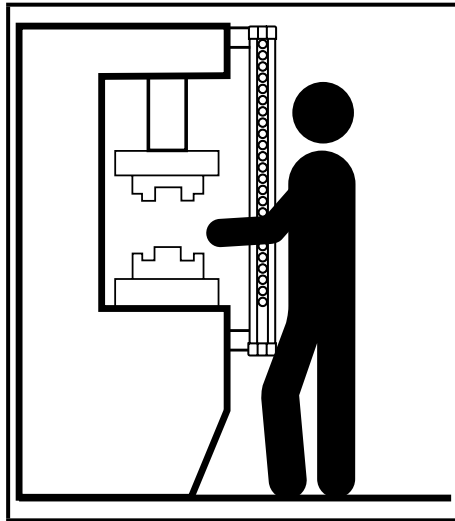
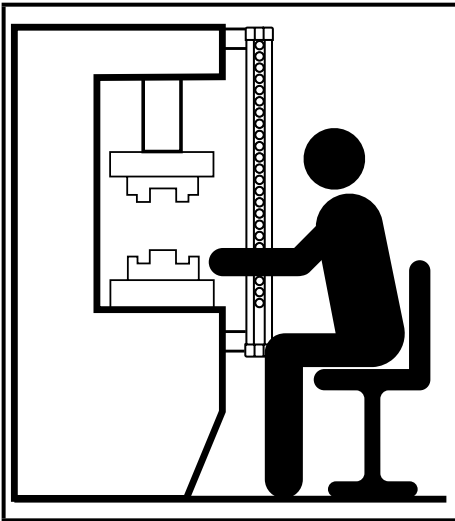
The operating conditions at the mounting location must not affect the functioning of the photoelectric safety sensors. Please note especially:

- The transmitter and the receiver must not be affected by intensive light sources (emitters, sunlight etc.).
- The ambient temperature must be within the range indicated (→ 12 Technical data).
- Fogging of the lenses due to considerable temperature fluctuations can affect the functioning of the photoelectric safety sensors. Take appropriate measures to prevent this.
- Certain operating conditions can affect the functioning of the photoelectric safety sensors. For mounting locations where fog, rain, smoke or dust may occur, it is recommended to take appropriate measures.
- The standards EN 999 and ISO 13855 must be adhered to.

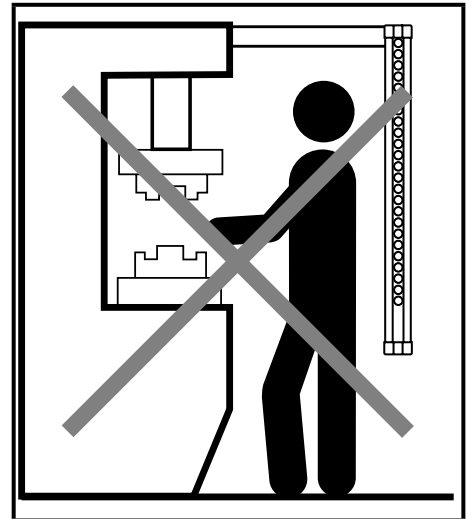
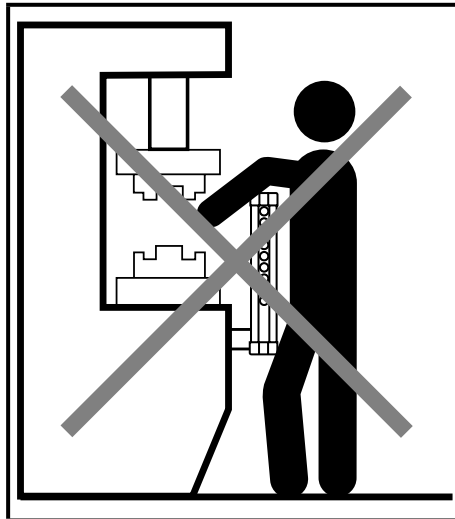
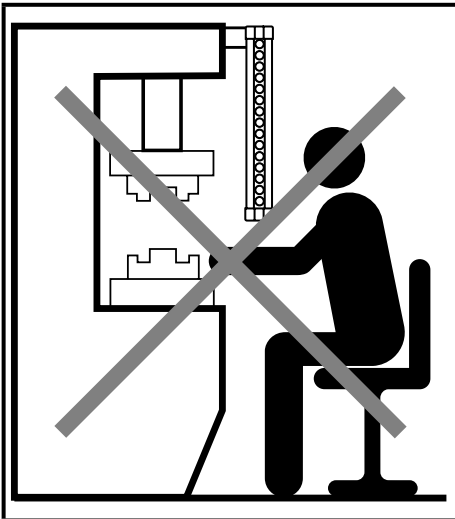


Observe the following illustrations for correct installation of the photoelectric safety sensors.

### Correct installation

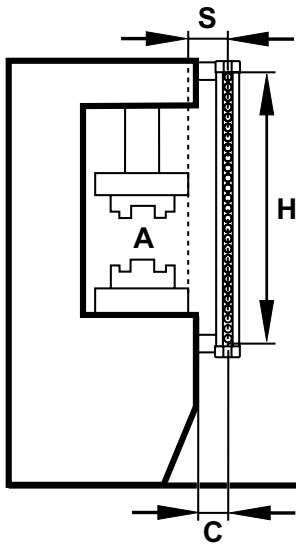


### Wrong installation



## 6.2 Calculation of the minimum safety distance

There must be a minimum safety distance between the photoelectric safety sensor and the point of danger. This distance must be ensured so that the point of danger cannot be accessed before the hazardous state of the machine has been stopped.



► Install the photoelectric safety sensor at a distance that is greater than or equal to the minimum safety distance (S) so that the hazardous area (A) can only be accessed after complete standstill of the hazardous machine motion.

According to the European Standard EN 999:2008, the following formula is to be used to calculate the minimum safety distance (S):

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

$$C = 8 (d - 14)$$

A = hazardous area  
H = protected area height

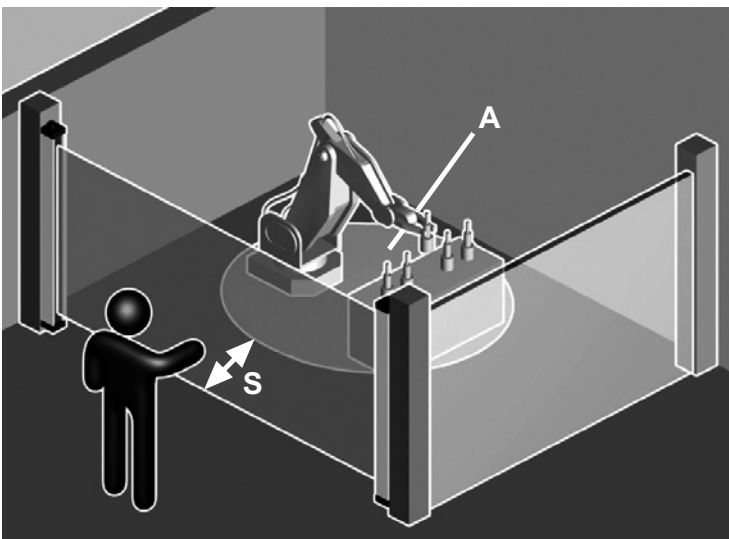
S = min. safety distance  
C = additional distance

|                      |  |      |
|----------------------|--|------|
| <b>S</b>             | Minimum safety distance  | mm   |
| <b>K</b>             | Speed of approach of the object towards the hazardous area   | mm/s |
| <b>t<sub>1</sub></b> | Total response time of the protective equipment, from release to switching off   | s    |
| <b>t<sub>2</sub></b> | Total response time of the machine, from the stop signal to switching off or to passing into the state defined as safe | s    |
| <b>C</b>             | Additional distance  | mm   |
| <b>d</b>             | Resolution (detection capacity)  | mm   |



Non-compliance with the minimum safety distance may lead to restrictions to or loss of the safety function.

### Application example:



A = hazardous area  
S = min. safety distance

## 6.3 Vertical installation of the safety light curtains

### 6.3.1 Safety light curtains resolution 14 mm



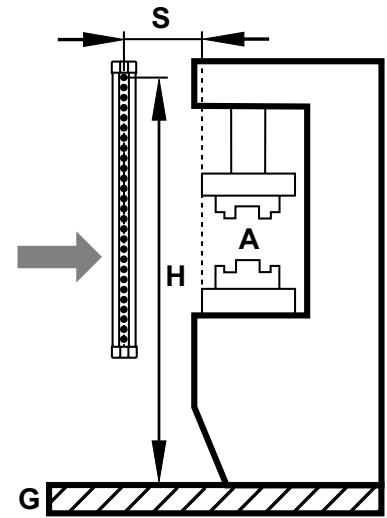
These designs are suitable for access prevention of fingers (finger protection).

The minimum safety distance (S) is determined using the following formula:

$$S = 2000 (t_1 + t_2) + 8 (d - 14)$$

This formula applies to minimum safety distances (S) between 100 and 500 mm. If the calculation shows that S is greater than 500 mm, the distance can be reduced to a minimum value of 500 mm by using the following formula:

$$S = 1600 (t_1 + t_2) + 8 (d - 14)$$



A = hazardous area

H = height

S = min. safety distance

G = reference level

### 6.3.2 Safety light curtains resolutions 20 mm and 40 mm



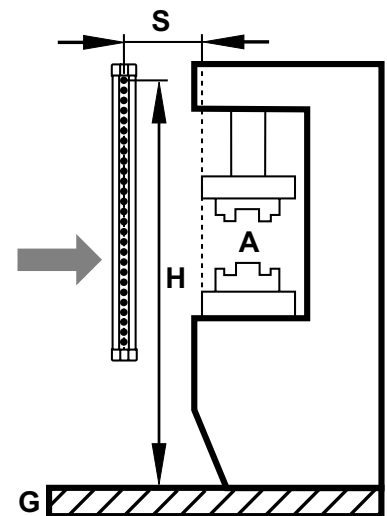
These designs are suitable for access prevention of hands (hand protection).

The minimum safety distance (S) is determined using the following formula:

$$S = 2000 (t_1 + t_2) + 8 (d - 14)$$

This formula applies to minimum safety distances (S) between 100 and 500 mm. If the calculation shows that S is greater than 500 mm, the distance can be reduced to a minimum value of 500 mm by using the following formula:

$$S = 1600 (t_1 + t_2) + 8 (d - 14)$$



A = hazardous area

H = height

S = min. safety distance

G = reference level

If due to the special configuration of the machine it should be possible to reach the hazardous area from above, the highest light beam of the safety light curtain should be at a height (H) (measured from the reference level (G)) whose value is determined to the specifications in ISO 13855.

### 6.3.3 Safety light curtains resolution 90 mm



These versions are suitable for access prevention for bodies or parts of bodies.

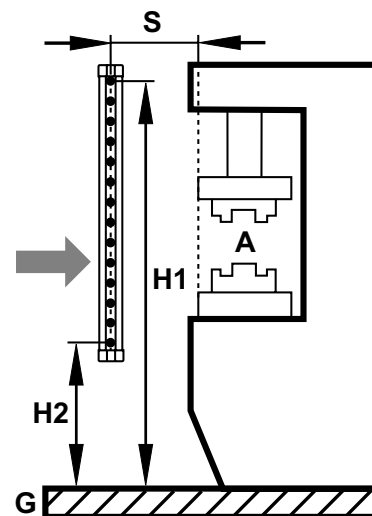


They must not be used for finger or hand protection!

The minimum safety distance (S) is determined using the following formula:

$$S = 1600 (t_1 + t_2) + 850$$

The height (H1) of the upper light beam measured from the reference level (G) must not be shorter than 900 mm while the height (H2) of the lowest light beam must not exceed 300 mm (ISO 13855).



A = hazardous area  
Hx = height

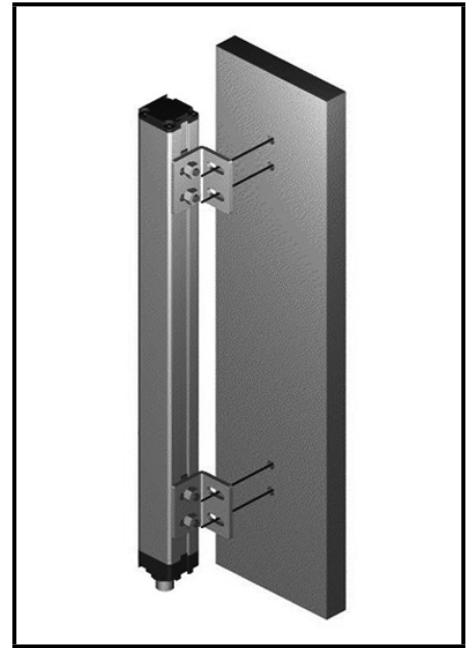
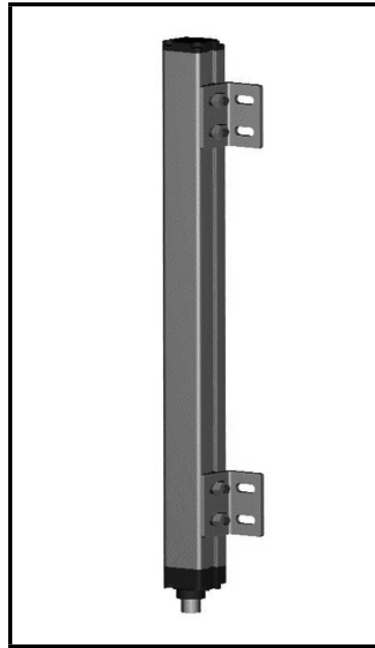
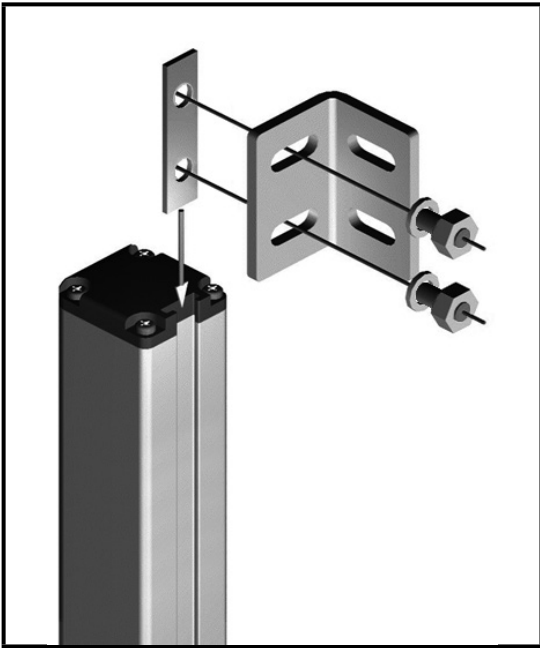
S = min. safety distance  
G = reference level

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## 6.4 Fixing and optical alignment



Correct alignment of the transmitter and the receiver is decisive for the proper function of the photoelectric safety sensors.

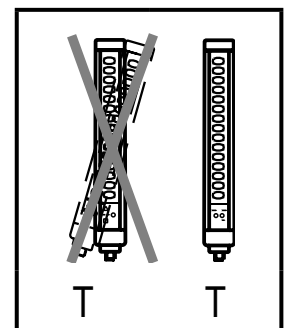
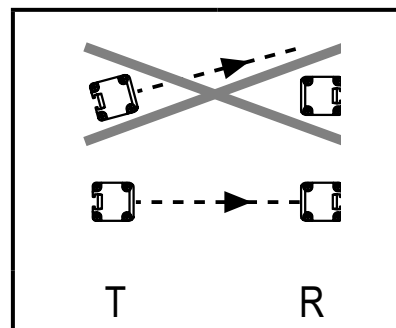
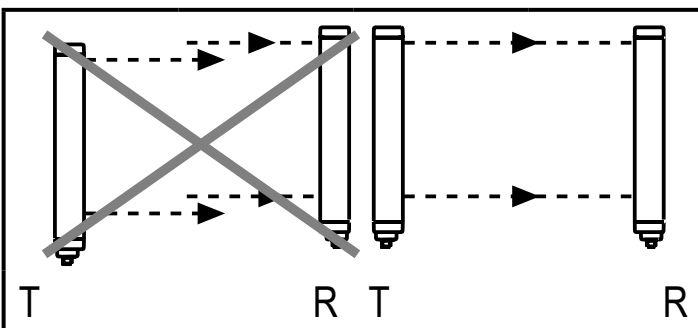


- ▶ Install the transmitter and the receiver using the supplied mounting accessories so that they are exactly opposite each other.
- ▶ Align the transmitter and the receiver so that they are in parallel at the same height and the plugs face the same direction.



Adjustable brackets can be used to ensure easy optical alignment (available as accessories).

### 6.4.1 Optical alignment



T = transmitter; R = receiver

The indication LEDs of the receiver help to correctly align the photoelectric safety sensors.

- ▶ Align the transmitter so that the green LED of the receiver lights.
- ▶ Fix the transmitter and the receiver.

## 6.5 Distance of reflecting surfaces



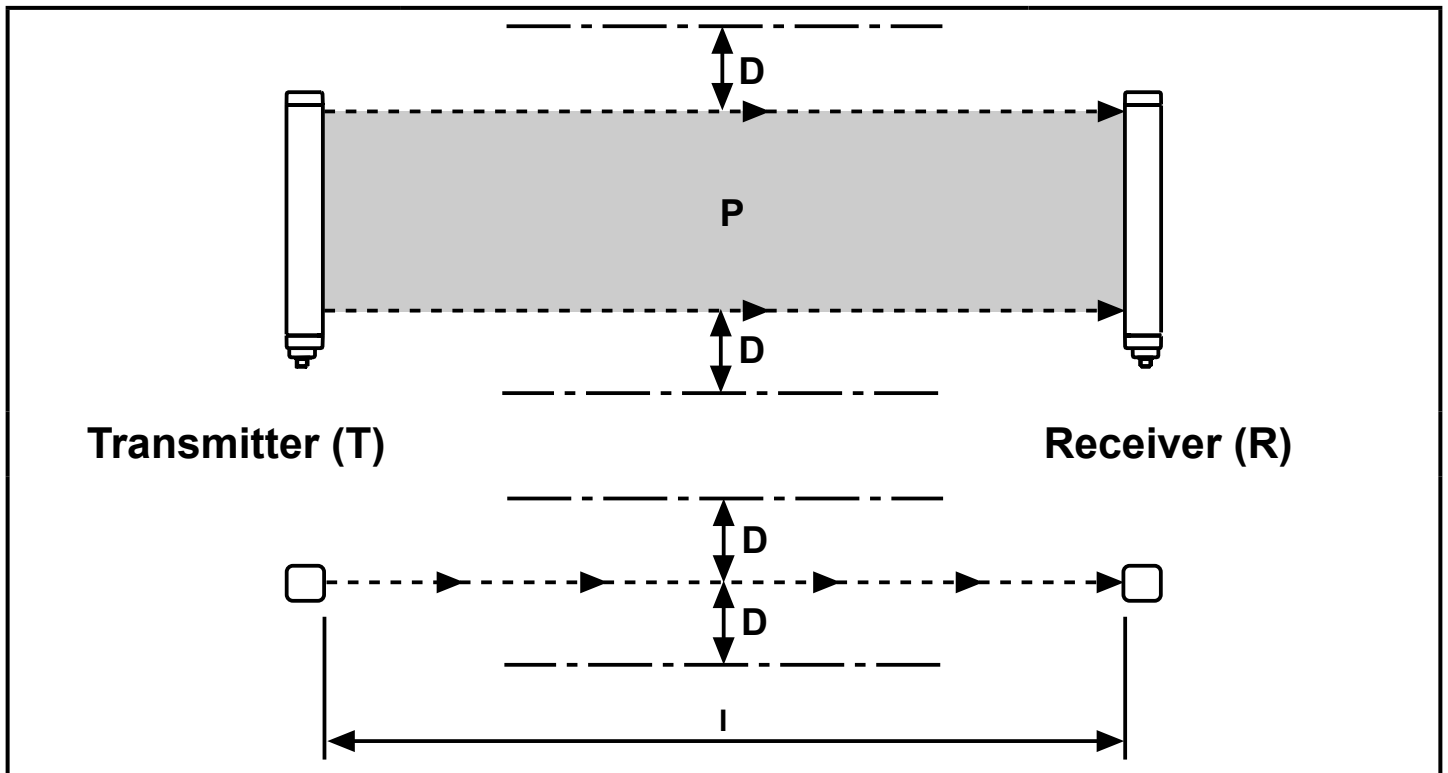
Reflective surfaces close to photoelectric safety sensors can disable the safety function of the system.

The minimum distance ( $D$ ) depends on the protective area width ( $I$ ) taking into consideration the projection and receiving angles.



The minimum distance ( $D$ ) between reflective surfaces and the protected area ( $P$ ) must be observed. In case of non-compliance an object which has to be detected cannot be sensed. In case of improper handling of the product, the safety and physical integrity of persons and machinery cannot be guaranteed.

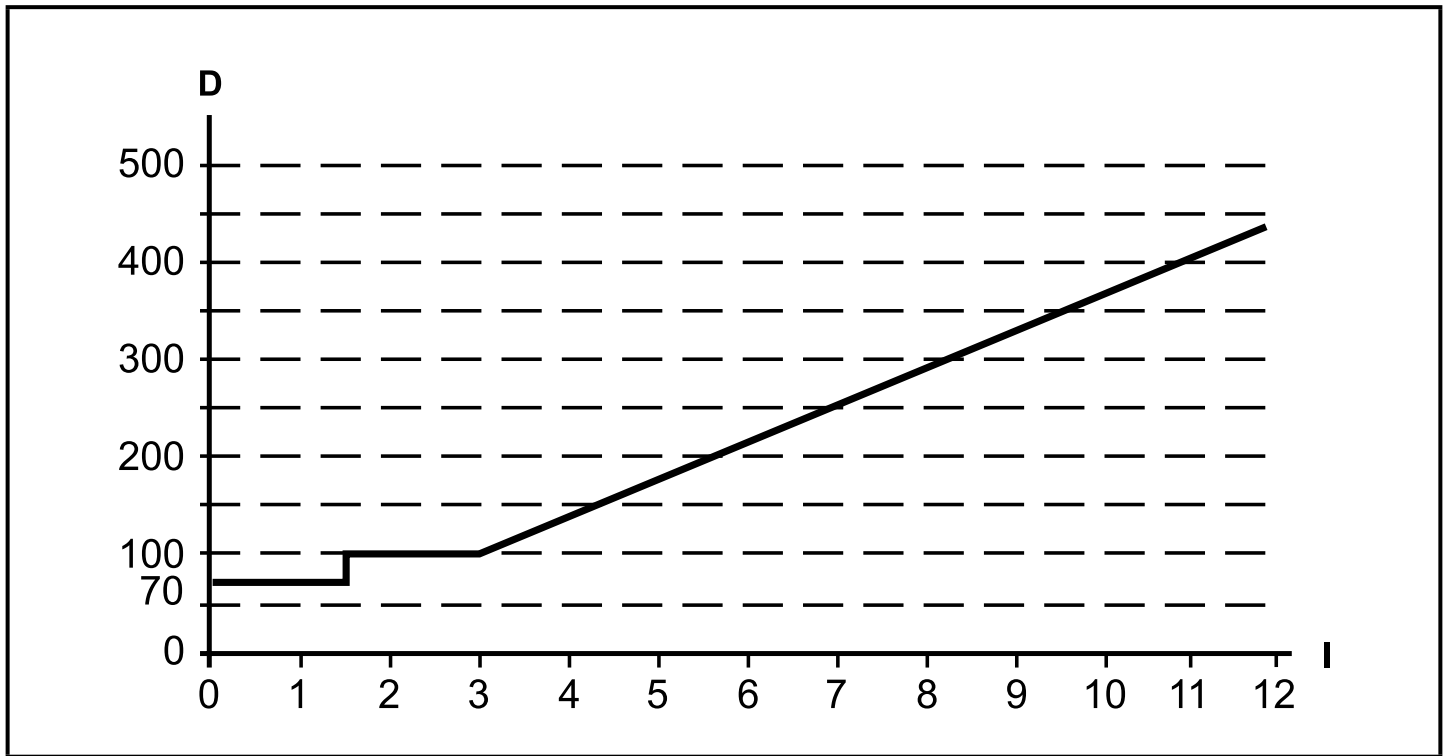
UK



$D$  = minimum distance;  $I$  = protected area width (range);  $P$  = protected area

- After installation, test by intended interruption of the protected area ( $P$ ) if reflective surfaces affect the function of the photoelectric safety sensors.

## Minimum distance to reflective surfaces



$D$  = minimum distance in [mm];  $I$  = protected area width (range) [m]



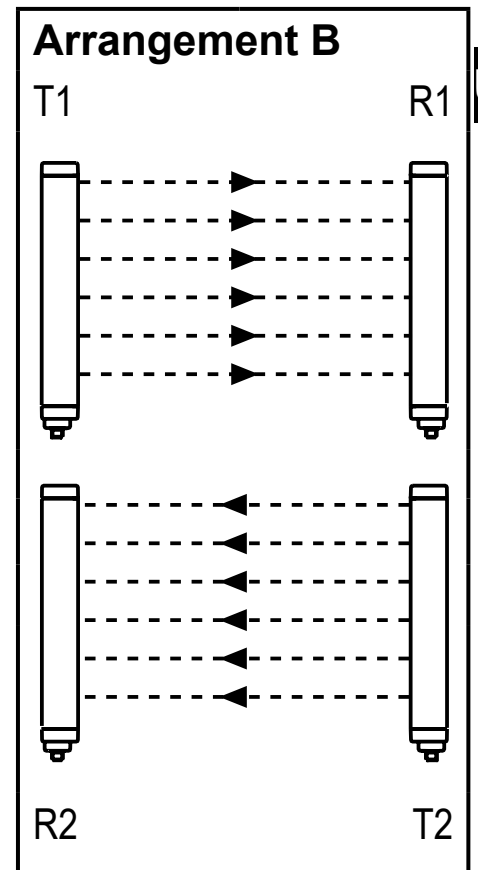
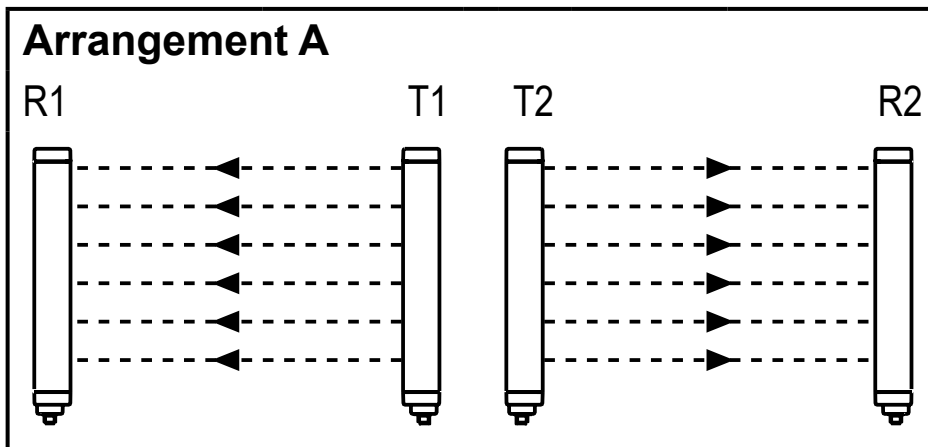
## 6.6 Multiple systems



The use of several safety light curtains can lead to malfunction and disable the protective function.

Therefore, the safety light curtains are to be installed so that the beam sent by the transmitter of a system can only be detected by the respective receiver.

The following important rules for installation are to be observed to avoid mutual interference of several systems:



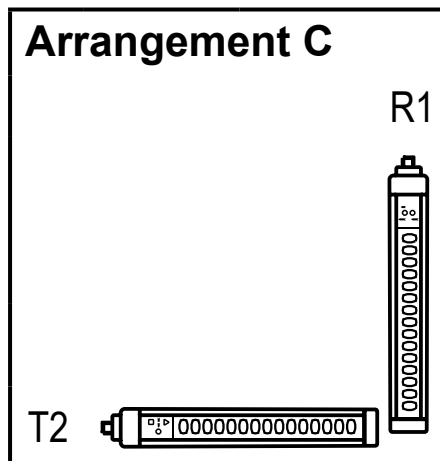
UK

### Possible arrangements:

A: Position of both transmitters next to each other

B: Position transmitter 1 and receiver 2 on top of each other

C: Combination in "L" shape



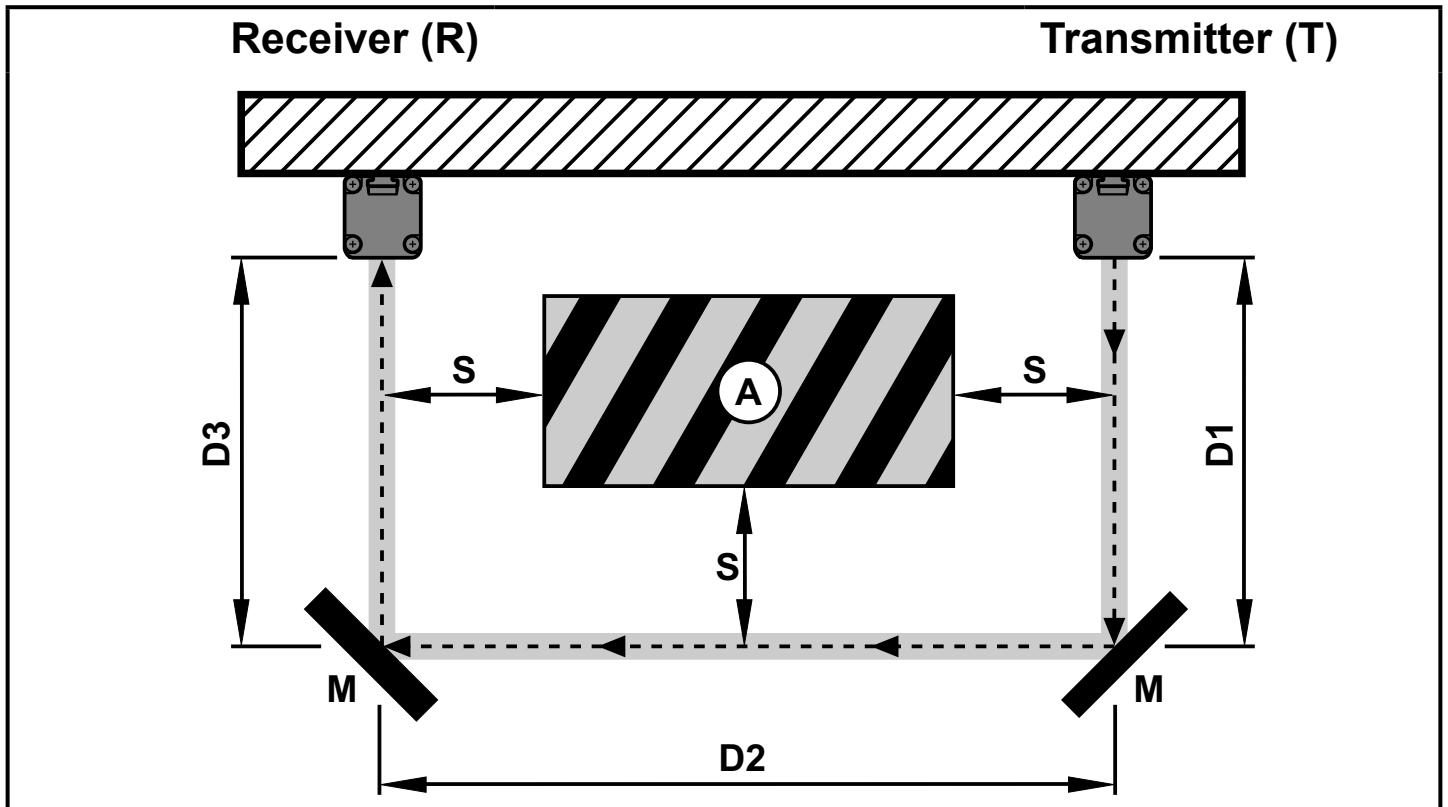
T = transmitter; R = receiver

## 6.7 Use of corner mirrors

To protect and monitor hazardous areas with access from several sides one or several mirrors can be used (available as accessory). By using mirrors the light beam emitted by the transmitter can be sent via several access sides.

- ▶ To obtain a reflection angle of  $90^\circ$  the mirrors are to be oriented in an angle of inclination of  $45^\circ$ .

The following image shows an application where U-shaped access protection is implemented using two mirrors.




A = hazardous area  
M = corner mirror


S = min. safety distance  
Dx = side length


- ▶ Install the mirrors so that the minimum safety distance (S) is adhered to at each side of the hazardous area.
- ▶ During installation make sure that the reflecting area is plane and that no vibrations affect the safety device.
- The range is the sum of the length of all sides ( $D1 + D2 + D3$ ) of the access to the protected area. The maximum range of the photoelectric safety sensors is reduced by 15% for each mirror.
- Do not use more than three mirrors.

## 7 Electrical connection

► Disconnect power. Also disconnect any independently supplied relay load circuits.

 The nominal voltage is 24 V DC. This voltage may vary between 19.2 V and 28.8 V.

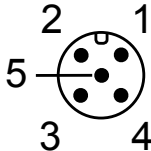
 In case of a single fault, the supply voltage must not exceed a maximum of 28.8 V DC. Therefore a safe separation between current supply and transformer is necessary.

 To guarantee functional reliability an output capacity of min. 2000  $\mu\text{F}$  / A has to be ensured if a power supply with diode bridge is used.

UK

► Connect the devices to the following table:

### 7.1 Transmitter wiring diagram

| Pin layout  | Pin | Name          | Type  | Description                        |
|---|-----|---------------|-------|------------------------------------|
|  | 1   | L+ (24 V DC)  | Input | Operating voltage                  |
|   | 2   | Range 0       |       | Configuration protected area width |
|   | 3   | L- (0 [V DC]) |       | Operating voltage                  |
|   | 4   | Range 1       |       | Protected area width configuration |
|   | 5   | FE            |       | Functional earth                   |

For information about available sockets / connectors see:

[www.ifm.com](http://www.ifm.com) → Product line → Accessories

The protected area width (range) to be used is configured via range 0 and range 1.

### Configuration protected area width (range)

| Range 0 | Range 1 | Description   |
|---------|---------|---|
| 24 V    | 0 V     | Selection range low<br>- for models with a resolution of 14 mm: 0...3 m<br>- for models with a minimum resolution of 20 mm: 0...6 m   |
| 0 V     | 24 V    | Selection range high<br>- for models with a resolution of 14 mm: 0...5 m<br>- for models with a minimum resolution of 20 mm: 3...18 m |
| 0 V     | 0 V     | Transmitter in test function ( 8.4 Test function)   |
| 24 V    | 24 V    | No function, configuration error  |



For proper function of the safety light curtains, pins 2 and 4 of the transmitter have to be connected according to the indications in the above table.

## 7.2 Receiver wiring diagram

| Pin layout | Pin | Name    | Type   | Description                          |
|------------|-----|---------|--------|--------------------------------------|
|            | 1   | OSSD1   | Output | Static safety-related output 1       |
|            | 2   | 24 V DC | –      | Operating voltage 24 V DC            |
|            | 3   | OSSD2   | Output | Static safety-related output 2       |
|            | 4   | SEL_C   | Input  | Safety light curtains operating mode |
|            | 5   | SEL_A   | Input  |                                      |
|            | 6   | SEL_B   | Input  |                                      |
|            | 7   | 0 V DC  | –      | Operating voltage 0 V DC             |
|            | 8   | FE      | –      | Functional earth                     |

For information about available sockets / connectors see:

[www.ifm.com](http://www.ifm.com) → Product line → Accessories



Note: Lay the cables of the photoelectric safety sensors separately from sources of interference such as power lines.

► Connect the transmitter and the receiver to the functional earth.

## 8 Operating modes

The OY series safety light curtains with blanking function support automatic operation only. In case of a clear protected area, the outputs (OSSDs) are automatically re-enabled.



Please make sure if this is compatible with the risk assessment of your machine.

Manual operation with start / restart button is only supported in connection with the safety relays G1501S, G1502S and G1503S. For most applications, this safety function is mandatory.

UK

Outputs OSSD1 and OSSD2 follow the status of the safety light curtains:

|                            |                                 |
|----------------------------|---------------------------------|
| Protected area clear       | Outputs = active logic "1"      |
| Protected area interrupted | Outputs = deactivated logic "0" |

### 8.1 Floating blanking function

The safety light curtains have a floating blanking function that cancels the monitoring of up to three neighbouring beams. This function is suitable for applications where the protected area is interrupted by the material to be processed or a part of the machine.



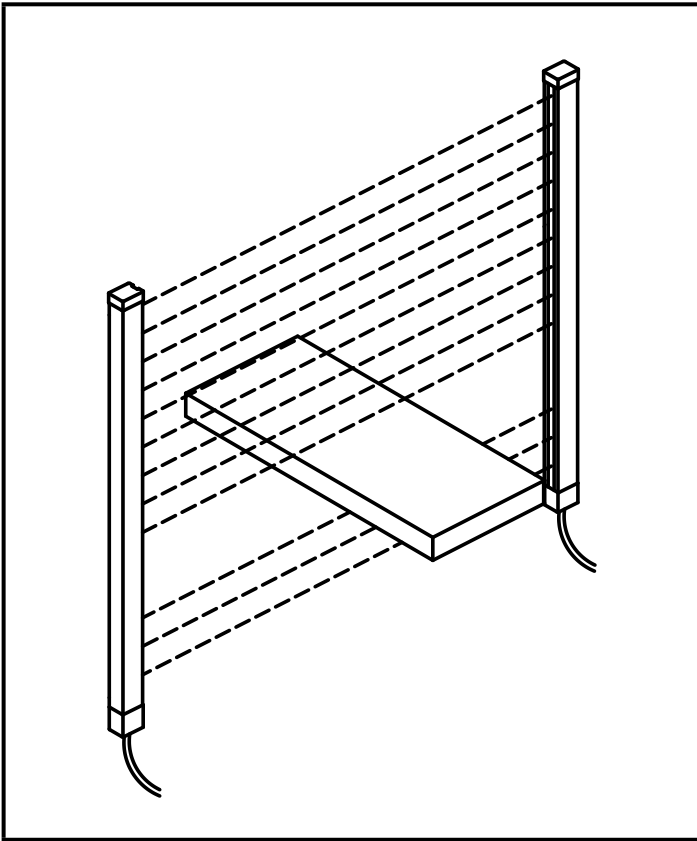
The synchronisation beam (first beam above the display) is excluded from the blanking function.



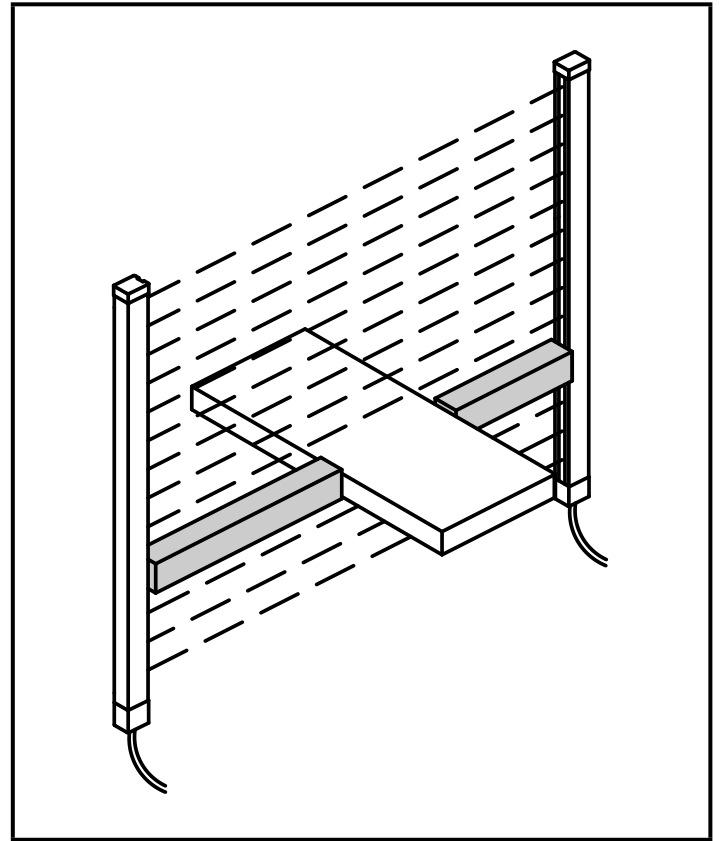
When the blanking function is used, the resolution of the safety light curtains decreases.



If the interrupting object is narrower than the protected area, the clear area has to be protected by means of mechanical equipment. If the object moves vertically, the protective equipment has to move accordingly.



unprotected clear area



clear area protected by mechanical equipment

The safety light curtains support two different types of blanking:

- Blanking without permanent object within the protected area.
- Blanking with a permanent object within the protected area.

### 8.1.1 Blanking without permanent object within the protected area

With this setting, a moving object may interrupt the protected area without deactivating the outputs of the safety light curtains. If the object is removed from the protected area, the outputs remain active. This function reduces the resolution of the safety light curtain (→ 8.1.1 Table Effective resolution A).

Blanking without a permanent object within the protected area permits three different operating modes:

#### 1. Blanking of up to one beam (A1):

If no or only one beam is interrupted, the protected area is considered as clear.

UK

| Protected area status       | Outputs (OSSDs) |
|-----------------------------|-----------------|
| no beam interrupted         | active          |
| 1 beam interrupted          | active          |
| 2 or more beams interrupted | deactivated     |

|                |        |        |             |             |             |
|----------------|--------|--------|-------------|-------------|-------------|
| protected area |        |        |             |             |             |
|                | active | active | deactivated | deactivated | deactivated |

## 2. Blanking of up to two neighbouring beams (A2):

If up to two neighbouring beams are interrupted, the protected area is considered as clear.

| Protected area status                        | Outputs (OSSDs) |
|--|-----------------|
| no beam interrupted                          | active          |
| 1 or 2 neighbouring beams interrupted        | active          |
| 2 non-neighbouring or more beams interrupted | deactivated     |

|                |        |        |        |             |             |
|----------------|--------|--------|--------|-------------|-------------|
| protected area |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
|                |        |        |        |             |             |
| outputs        | active | active | active | deactivated | deactivated |

## 3. Blanking of up to three neighbouring beams (A3):

If up to three neighbouring beams are interrupted, the protected area is considered as clear.

| Protected area status                        | Outputs (OSSDs) |
|--|-----------------|
| no beam interrupted                          | active          |
| 1, 2 or 3 neighbouring beams interrupted     | active          |
| 2 non-neighbouring or more beams interrupted | deactivated     |

|                |        |        |        |             |        |             |
|----------------|--------|--------|--------|-------------|--------|-------------|
| protected area |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
|                |        |        |        |             |        |             |
| outputs        | active | active | active | deactivated | active | deactivated |



## Effective resolution A

The effective resolution of the safety light curtain decreases according to the chosen operating mode.

| Nominal resolution | Operating mode | effective resolution | maximum object size |
|--------------------|----------------|----------------------|---------------------|
| 14 mm              | no blanking    | 14 mm                | 0 mm                |
|                    | A1             | 24 mm                | 8 mm                |
|                    | A2             | 34 mm                | 18 mm               |
|                    | A3             | 44 mm                | 28 mm               |
| 20 mm              | no blanking    | 20 mm                | 0 mm                |
|                    | A1             | 30 mm                | 10 mm               |
|                    | A2             | 40 mm                | 20 mm               |
|                    | A3             | 50 mm                | 30 mm               |
| 40 mm              | no blanking    | 40 mm                | 0 mm                |
|                    | A1             | 70 mm                | 30 mm               |
|                    | A2             | 100 mm               | 60 mm               |
|                    | A3             | 130 mm               | 90 mm               |

| Nominal resolution | Operating mode | Distance between beams | maximum object size |
|--------------------|----------------|------------------------|---------------------|
| 90 mm              | no blanking    | 80 mm                  | 0 mm                |
|                    | A1             | 150 mm                 | 60 mm               |
|                    | A2             | 230 mm                 | 140 mm              |
|                    | A3             | 300 mm                 | 210 mm              |

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### 8.1.2 Blanking with a permanent object within the protected area

With this setting, an object within the protected area, e.g. a part of the machine, can be permanently blanked.



As long as the light curtain is activated, the object has to be within the protected area at all times.

The size of the object must not be below the nominal resolution of the safety light curtain or the distance between the beams (in case of 90 mm designs).

The resolution of the safety light curtain only decreases within and at the limits of the blanked area. If the interrupting object covers the entire width of the protected area, (→ 8.1.2 Table Effective resolution B) applies.

If the object is narrower than the protected area, the values mentioned in (→ 8.1.1 Table Effective resolution A) apply within and at the limits of the blanked area. (B1 is equivalent to A2 and B2 to A3.)

Blanking with a permanent object within the protected area permits two operating modes:

#### 1. Blanking of up to two neighbouring beams (B1):

If no beam is interrupted, the outputs switch off since no permanent object is detected ("b" is indicated on the receiver display). If up to two neighbouring beams are interrupted, the protected area is considered as clear.

| Protected area status                        | outputs (OSSDs) |
|--|-----------------|
| no beam interrupted                          | deactivated     |
| 1 or 2 neighbouring beams interrupted        | active          |
| 2 non-neighbouring or more beams interrupted | deactivated     |

|                |             |        |        |             |             |
|----------------|-------------|--------|--------|-------------|-------------|
| protected area |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
|                |             |        |        |             |             |
| Outputs        | deactivated | active | active | deactivated | deactivated |

## 2. Blanking of up to three neighbouring beams (B2):

If no beam is interrupted, the outputs switch off since no permanent object is detected in the protected area ("b" is indicated on the receiver display). If up to three neighbouring beams are interrupted, the protected area is considered as clear.

| Protected area status                        | Outputs (OSSDs) |
|--|-----------------|
| no beam interrupted                          | deactivated     |
| 1, 2 or 3 neighbouring beams interrupted     | active          |
| 2 non-neighbouring or more beams interrupted | deactivated     |

|                |             |             |        |             |             |             |             |
|----------------|-------------|-------------|--------|-------------|-------------|-------------|-------------|
| protected area |             |             |        |             |             |             |             |
|                |             |             |        |             |             |             |             |
|                | deactivated | active      | active | deactivated | active      | deactivated |             |
|                | outputs     | deactivated | active | active      | deactivated | active      | deactivated |

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## Effective resolution B

The effective resolution of the safety light curtain within and at the limits of the blanked area decreases according to the chosen operating mode.

The following values only apply to objects covering the entire width of the protected area. For narrower objects, (→ 8.1.1 Table Effective resolution A)

| Nominal resolution | Operating mode | Effective resolution at the limits of the blanked area |
|--------------------|----------------|--|
| 14 mm              | no blanking    | 14 mm  |
|                    | B1             | 16 mm  |
|                    | B2             | 26 mm  |
| 20 mm              | no blanking    | 20 mm  |
|                    | B1             | 20 mm  |
|                    | B2             | 30 mm  |
| 40 mm              | no blanking    | 40 mm  |
|                    | B1             | 60 mm  |
|                    | B2             | 90 mm  |

| Nominal resolution | Operating mode | Smallest detectable object |
|--------------------|----------------|----------------------------|
| 90 mm              | no blanking    | 90 mm                      |
|                    | B1             | 140 mm                     |
|                    | B2             | 210 mm                     |

## 8.2 Setting the operating mode

The different operating modes of the OY series safety light curtains can be set via the respective connections to the 8-pole plug of the receiver.

| Operating mode | Connection     |                |               |
|----------------|----------------|----------------|---------------|
|                | SEL_A (PIN 5)  | SEL_B (PIN 6)  | SEL_C (PIN 4) |
| no blanking    | 0 V DC         | 0 V DC         | 0 V DC        |
| A1             | 0 V DC         | 24 V DC        | 24 V DC       |
| A2             | 24 V DC        | 0 V DC         | 24 V DC       |
| A3             | 24 V DC        | 24 V DC        | 0 V DC        |
| B1             | OSSD 1 (PIN 1) | OSSD 2 (PIN 3) | 24 V DC       |
| B2             | OSSD 2 (PIN 3) | OSSD 1 (PIN 1) | 0 V DC        |



The system has to be disconnected from power before changing the operating mode. It is not possible to change operating modes during operation.

## 8.3 Test function

For the test function, the photoelectric safety sensors can e.g. be tested by a process control system or a control module ( → 7.1 Table Protected area width configuration).

The test pulse interrupts the light emission by the transmitter and the outputs carry a 0 signal ( → 10.1 Switching states of the outputs).

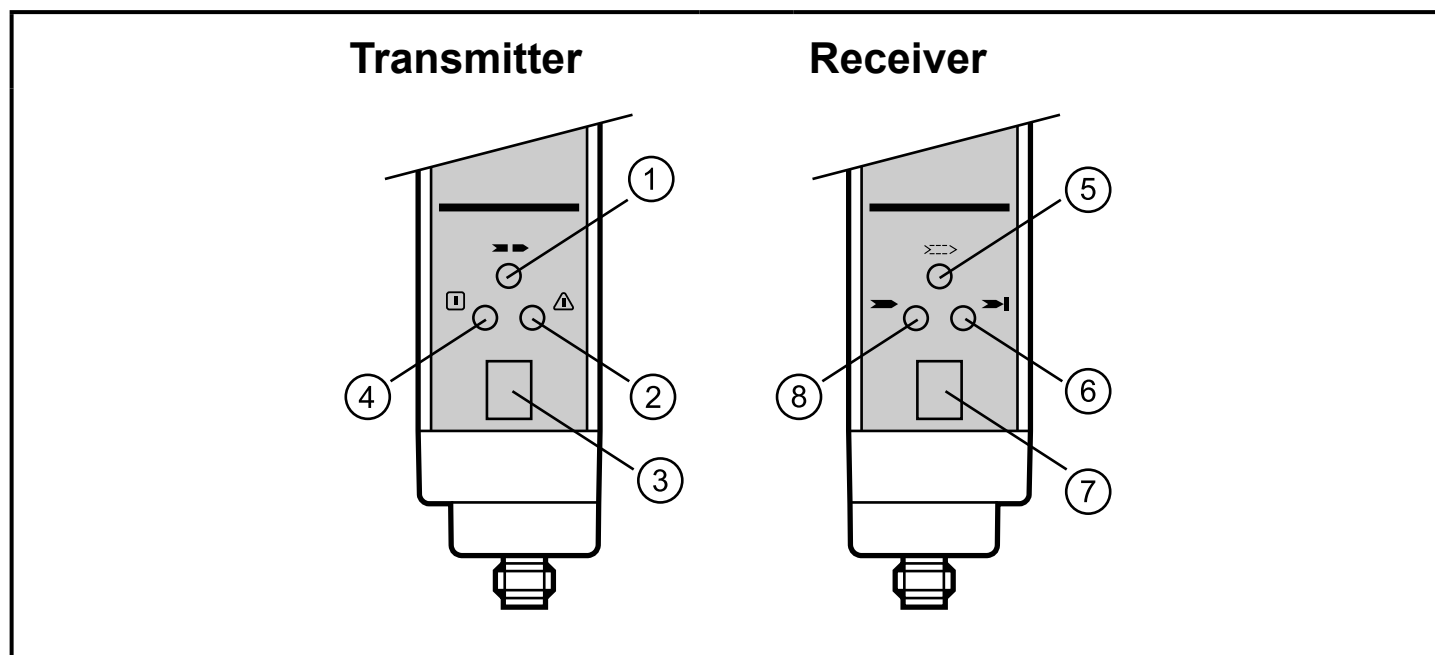


The minimum duration of the test command is 40 ms.

### 8.3.1 Internal test function

Type 4 safety light curtains continuously perform internal tests. The faults are detected within the response time of the respective model leading to switch-off (response times → 12 Technical data).

## 9 Operating and display elements



- 1: LED (yellow)
- 2: LED (red)
- 3: 7-segment display
- 4: LED (green)

- 5: LED (yellow)
- 6: LED (red)
- 7: 7-segment display
- 8: LED (green)

### 9.1 LED states

#### 9.1.1 Transmitter

| Description                              | Transmitter |       |        |         |
|--|-------------|-------|--------|---------|
|  | LED         |       |        | Display |
|  | red         | green | yellow |         |
| Activating the system, introductory test | ●           | ○     | ●      | 8       |
| Normal operation at short range          | ○           | ●     | ○      | L       |
| Normal operation at long range           | ○           | ●     | ○      | H       |
| Test                                     | ○           | ●     | ●      | L       |
| Test                                     | ○           | ●     | ●      | H       |

## 9.1.2 Receiver

| Description   | Transmitter |       |        |         |
|---|-------------|-------|--------|---------|
|   | LED         |       |        |         |
|   | red         | green | yellow | Display |
| Activating the system, introductory test  | ●           | ○     | ●      | 8       |
| Blanking mode A1 (lights for 10 s)  | ●           | ○     | ○      | C       |
| Blanking mode A2 (lights for 10 s)  | ●           | ○     | ●      | C       |
| Blanking mode A3 (lights for 10 s)  | ●           | ○     | ⊗      | C       |
| Blanking mode B1 (lights for 10 s)  | ○           | ●     | ○      | C       |
| Blanking mode B2 (lights for 10 s)  | ○           | ●     | ●      | C       |
| Protected area interrupted,<br>outputs deactivated                                    | ●           | ○     | ○      |         |
| Protected area interrupted, weak signal<br>outputs deactivated                        | ●           | ○     | ●      |         |
| Protected area interrupted,<br>no object detected, (blanking mode B1, B2)             | ●           | ○     | ○      | b       |
| Protected area interrupted, weak signal<br>no object detected, (blanking mode B1, B2) | ●           | ○     | ●      | b       |
| Protected area clear,<br>outputs active, no blanking                                  | ○           | ●     | ○      |         |
| Protected area clear, weak signal<br>outputs active, no blanking                      | ○           | ●     | ●      |         |
| Blanking active   | ○           | ●     | ○      | Г       |
| Blanking active, weak signal  | ○           | ●     | ●      | Г       |
| Initialisation  | ●           | ○     | ○      | -       |

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# 10 Operation

## 10.1 Switching state of the outputs

The safety light curtains have two outputs (OSSDs) on the receiver; the status depends on the condition of the protected area.

All short-circuits between the outputs or between an output and the current supply (24 V DC or 0 V DC) are detected by the safety light curtains as a fault.

| Output | Binary states |   |   | Meaning   |
|--------|---------------|---|---|---|
| OSSD1  | 1             |   |   | Condition protected area is clear.                      |
| OSSD2  | 1             |   |   |   |
| OSSD1  | 1             | 0 | 0 | Condition protected area interrupted or fault detected. |
| OSSD2  | 0             | 1 | 0 |   |

### 10.1.1 The safe state

The safe state is when the output is switched off (zero-current state: logic "0") of at least one of the outputs (OSSDs). If one of the outputs is switched off, the subsequent safety-related logic unit must bring the complete system into the state defined as safe.

### 10.1.2 The switched state

In switched state, the receiver provides a current of 24 V DC (logic "1") to both outputs.

### Output characteristics

The output characteristics follow the characteristics of the input according to IEC 61496:

|           |            |             |
|-----------|------------|-------------|
| Logic "1" | 24 V DC    | max. 500 mA |
| Logic "0" | ≤ 1.5 V DC | < 0.2 mA    |

### 10.1.3 Interface classification

The interface of the devices complies with interface type C class 3 according to the ZVEI position paper CB 24I Ed. 2.0

### Identification key

|        | Interface type |          | Suitable interface type |    |    |
|--------|----------------|----------|-------------------------|----|----|
| Source | C3             | Receiver | C1                      | C2 | C3 |



## 10.2 Functional test of the safety light curtains

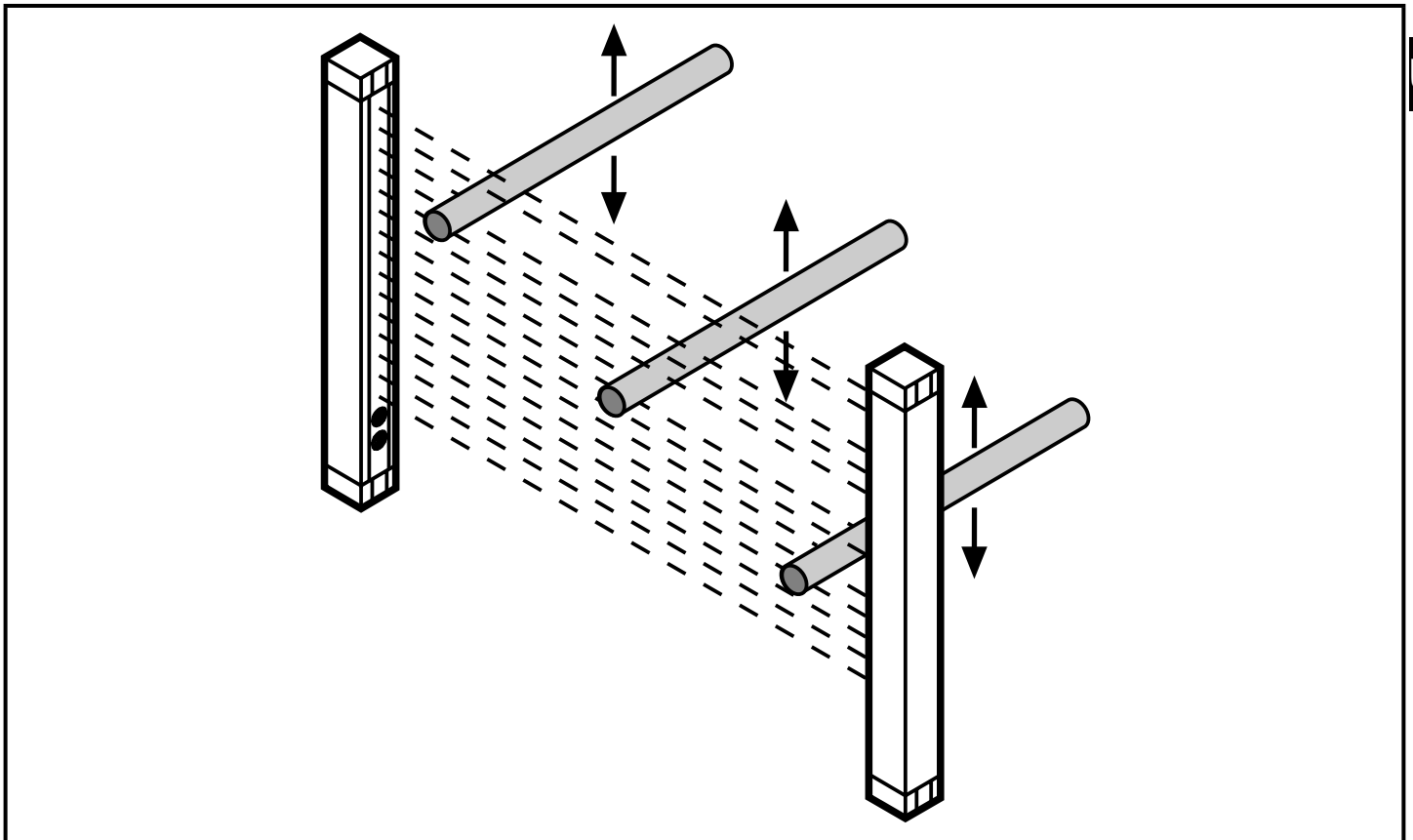


Check the proper function of the safety light curtains before work starts.

For the functional test, a test object in accordance with a resolution of the safety light curtains has to be used.

For information about available test rods see:

[www.ifm.com](http://www.ifm.com) → Product line → Accessories.



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- ▶ Let the test object enter the protected area and move it slightly downwards. First of all in the centre and then close to the transmitter and the receiver.
- ▶ Make sure that the red LED on the receiver is continuously lit during the movement in the protected area.



Observe the notes on maintenance of the safety light curtains → 14 Maintenance, repair and disposal.



Notes on set-up → 17.1 Check list.




## 12 Technical data


|   |  |
|---|--|
| Meets the requirements of: Type 4 IEC 61496-1, SIL 3 IEC 61508, SILcl 3 IEC 62061, ISO 13849-1:2015 category 4 PL e |  |
| Electrical design   | DC / PNP   |
| Operating voltage   | 24 DC (19.2...28.8)  |
| Current consumption   |  |
| Transmitter [mA]  | 83   |
| Receiver [mA]   | 125  |
| Outputs (OSSDs)   | 2 x PNP  |
| Current rating per output [mA]  | 500 (24 V)   |
| Max. capacitive load CL_max [ $\mu$ F]  | 2.0  |
| Power-on delay time [s]   | < 18   |
| Mission time T <sub>M</sub> [h]   | 175200   |
| Protected area width (range) [m]  | for resolution of 14 mm:<br>- low range: 0...2, high range: 0...5<br>for resolution of 20 mm and higher:<br>- low range: 0...6, high range: 3...18 |
| EMC   | IEC 61496-1  |
| Vibration   | IEC 61496-1  |
| Shock   | IEC 61496-1  |
| Ambient temperature [°C]  | 0...55   |
| Max. perm. relative air humidity [%]  | 95   |
| Application   | class C according to EN 60654-1,<br>(weatherproof application)   |
| Protection  | IP 65 / III  |
| Housing material  | Aluminium / PC   |
| Type of light   | Infrared 950 nm  |
| Display   | LED yellow, LED green, LED red,<br>7-segment display   |
| Connection  |  |
| Transmitter   | M12, 5-pole  |
| Receiver  | M12, 8-pole  |
| Max. cable lengths [m]  | 100 *)   |

\*) for wire cross-section of 0.34 mm<sup>2</sup>


### 12.2.1 Safety light curtains resolution 14 mm

|  |       | OY801S             | OY804S             | OY805S             | OY806S             | OY807S             | OY808S             |
|---|-------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Total length L  | [mm]  | 261                | 711                | 861                | 1011               | 1161               | 1311               |
| Protected area height   | [mm]  | 160                | 610                | 760                | 910                | 1060               | 1210               |
| Response time   | [ms]  | 6                  | 11,5               | 13,5               | 15,5               | 17                 | 19                 |
| Safety-related reliability PFH <sub>D</sub>                                       | [1/h] | 1.0 <sup>-08</sup> | 1.5 <sup>-08</sup> | 1.6 <sup>-08</sup> | 1.8 <sup>-08</sup> | 1.9 <sup>-08</sup> | 2.1 <sup>-08</sup> |
| Test pulse duration t <sub>i</sub>  | [μs]  | 90                 | 90                 | 90                 | 90                 | 90                 | 90                 |
| Test pulse interval T   | [ms]  | 15,1               | 33,1               | 39,1               | 45,1               | 51,1               | 57,1               |
| Ratio t <sub>i</sub> / T  | [%]   | 0,7                | 0,3                | 0,2                | 0,2                | 0,2                | 0,2                |

### 12.2.2 Safety light curtains resolution 20 mm

|  |       | OY815S             | OY816S             | OY817S             | OY818S             | OY819S             |
|---|-------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Total length L  | [mm]  | 711                | 861                | 1011               | 1161               | 1311               |
| Protected area height   | [mm]  | 610                | 760                | 910                | 1060               | 1210               |
| Response time   | [ms]  | 11.5               | 13.5               | 15.5               | 17                 | 19                 |
| Safety-related reliability PFH <sub>D</sub>                                       | [1/h] | 1.5 <sup>-08</sup> | 1.6 <sup>-08</sup> | 1.8 <sup>-08</sup> | 1.9 <sup>-08</sup> | 2.1 <sup>-08</sup> |
| Test pulse duration t <sub>i</sub>  | [μs]  | 90                 | 90                 | 90                 | 90                 | 90                 |
| Test pulse interval T   | [ms]  | 33,1               | 39,1               | 45,1               | 51,1               | 57,1               |
| Ratio t <sub>i</sub> / T  | [%]   | 0,3                | 0,2                | 0,2                | 0,2                | 0,2                |

### 12.2.3 Safety light curtains resolution 40 mm

|  |       | OY825S             | OY826S             | OY827S             | OY828S             | OY829S             |
|---|-------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Total length L  | [mm]  | 711                | 861                | 1011               | 1161               | 1311               |
| Protected area height   | [mm]  | 610                | 760                | 910                | 1060               | 1210               |
| Response time   | [ms]  | 8.5                | 9.5                | 10.5               | 11.5               | 12.5               |
| Safety-related reliability PFH <sub>D</sub>   | [1/h] | 1.2 <sup>-08</sup> | 1.2 <sup>-08</sup> | 1.3 <sup>-08</sup> | 1.4 <sup>-08</sup> | 1.5 <sup>-08</sup> |
| Test pulse duration t <sub>i</sub>  | [μs]  | 90                 | 90                 | 90                 | 90                 | 90                 |
| Test pulse interval T   | [ms]  | 17,1               | 19,1               | 21,1               | 23,1               | 25,1               |
| Ratio t <sub>i</sub> / T  | [%]   | 0,5                | 0,5                | 0,4                | 0,4                | 0,4                |

# 13 Troubleshooting

The LEDs of the transmitter and the receiver indicate faulty operating states (→ 9 Operating and display elements). In case of a fault, the 7-segment display shows an "F" followed by an error code. Additionally, the red LED is lit. For a detailed fault description see the following tables.

## 13.1 Transmitter fault diagnosis

| Display | Possible cause               | Troubleshooting                              |
|---------|------------------------------|--|
| P       | wrong range or changed range | check connections pins 2 and 4               |
| A       | internal fault               | Send device to ifm branch office for repair. |
| 3       |                              |  |
| 4       |                              |  |

## 13.2 Fault diagnosis receiver

| Display | Possible cause                    | Troubleshooting  |
|---------|-----------------------------------|--|
| 0       | Static OSSD outputs overloaded    | Check current through OSSD outputs, reduce load to max. 500 mA (2 µF).   |
| 1       | Interfering transmitter detected  | Find interfering transmitter and take one of the following measures: <ul style="list-style-type: none"> <li>- Exchange position of transmitter and receiver.</li> <li>- Change location of the interfering transmitter so that the receiver is not influenced.</li> <li>- Screen the beams coming from the interfering transmitter using a mat protective device.</li> </ul> |
| 2       | OSSD falsely connected to 24 V DC | Check OSSD connection  |
| 3       | Internal fault                    | Send device to ifm branch office for repair.   |
| 4       |                                   |  |
| 5       | Fault at the static OSSD outputs  | Check connections at terminals 1 and 3 (OSSD). If the defect remains, send device to ifm branch for repair.  |

| Display | Possible cause                           | Troubleshooting                                |
|---------|--|--|
| 6       | Short circuit at the static OSSD outputs | Check connections at terminals 1 and 3 (OSSD). |
| A       | Internal fault                           | Send device to ifm branch office for repair.   |
| C       | User configuration rejected              | Check configuration                            |
| H       | Internal fault                           | Send device to ifm branch office for repair.   |

## 14 Maintenance, repair and disposal

- Maintain the optoelectronic protective equipment in accordance with the applicable national regulations within the requested intervals. The tests must be performed by qualified persons.
- It is recommended to regularly clean the front panes of the transmitter and the receiver.
- Clean the unit with a clean, damp cloth. In particularly dusty environments we recommend to spray the cleaned front pane with an antistatic product.
- Do not use any aggressive or abrasion-developing cleaning agents since they could attack the surfaces. To avoid electrostatic charging on the front, do not use any woollen cloths.



Scratches on the front panes of the photoelectric safety sensors may deviate the light beams and impair the protective function.

- Only the manufacturer is allowed to repair the unit.
- After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

## 15 Terms and abbreviations

|                    |   |  |
|--------------------|---|--|
| Blanking           |   | Optional function ensuring that objects in the protected area which are larger than the detection capacity will not cause the OSSDs to switch off. |
| ESPE               |   | Electro-Sensitive Protective Equipment.  |
| CCF                | Common Cause Failure                          |  |
| $DC_{avg}$         | Average Diagnostic Coverage                   |  |
| Muting             |   | Temporary bridging of a safety function by safety-related parts of the control system.   |
| $MTTF_d$           | Mean Time To Dangerous Failure                |  |
| OSSD               | Output Signal Switching Device                | Output signal switch element, static safety-related output.  |
| PFH<br>( $PFH_D$ ) | Probability of (dangerous) Failure per Hour   |  |
| PL                 | Performance Level                             | Capability of safety-related parts to perform a safety function under predictable conditions to fulfil the expected risk reduction.                |
| SIL                | Safety Integrity Level                        | Safety integrity level<br>SIL 1-4 according to IEC 61508. The higher the SIL, the lower the probability that a safety function will fail.          |
| $SIL_{cl}$         | Safety Integrity Level <sub>claim limit</sub> | Safety integrity level <sub>claim limit</sub><br>(according to IEC 62061)  |
| $T_M$              | Mission Time                                  | Operational life   |
| T1                 | Test interval                                 |  |

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# 16 Appendix

## 16.1 Check list

This check list serves as help for setting up the safety light curtains. The requirements in this check list should be met, however depending on the application and the directives / standards referred to.

1. Were the directives / standards valid for safety of machinery complied with?
2. Is access prevention / primary guarding of the point of danger only possible through the protected area of the safety light curtains?
3. Have steps been taken to prevent reaching under, over or around the light guards to prevent attempts to defeat them?
4. Has the stop or shutdown delay of the machine been measured and adapted according to the installation of the safety light curtains?
5. Have the safety light curtains been duly fixed and secured against loosening or movement?
6. Have the safety light curtains been checked according to the function and maintenance descriptions in these operating instructions?
7. Has external monitoring (EDM) of the control unit (e.g. contactor, valve etc.) been used?
8. Is the state defined as safe for switching on / off of the safety light curtains initiated?
9. Is /are there any soiling or scratches on the light-emitting surface?
10. Are the installation instructions of these operating instructions adhered to?



This check list does not replace checking or set-up by a person trained in safety matters.