Original Instruction Manual Safety Light Curtain OY36

Devices for bodyprotection

- ✓ **Safety Category Type 4**
- ✓ **Simple installation and configuration**
- ✓ **Diagnostics inside**
- ✓ **Compact profile (35x41,2xlength)**
- ✓ **Short response time**
- ✓ **Self testing**
- ✓ **Connection with M12-Connector**

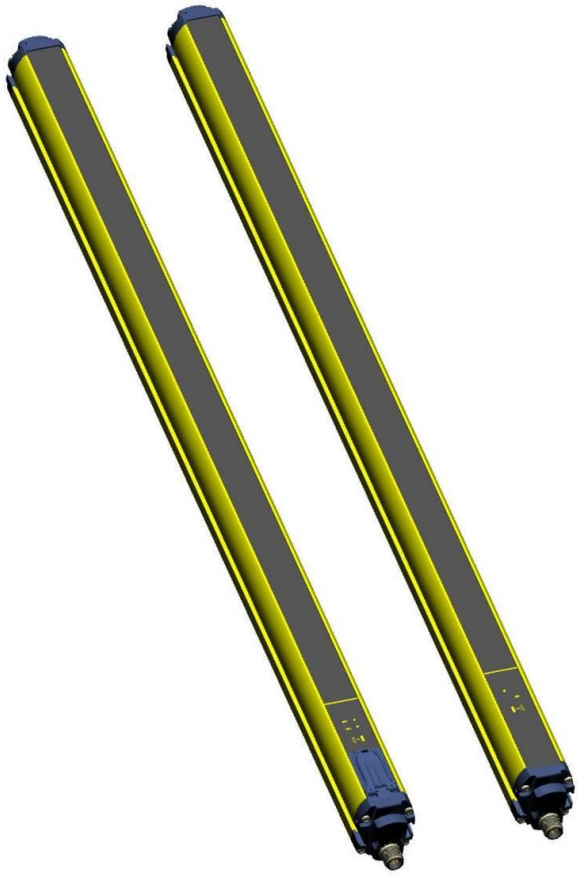


TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. General Description of the safety light curtains

The safety light curtains of the OY36 series are optoelectronic multibeam devices that are used to protect working areas that, in presence of machines, robots, and automatic systems in general, can become dangerous for operators that can get in touch, even accidentally, with moving parts.

The light curtains of the OY36 series are Type 4 intrinsic safety systems used as accident-prevention protection devices and are manufactured in accordance with the international Standards in force for safety, in particular:

EN 61496-1: 2015 Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests

EN 61496-2: 2013 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices

The device, consisting of one emitter and one receiver housed inside strong aluminium profiles, generates infrared beams that detect any opaque object positioned within the light curtain detection field.

The emitter and the receiver are equipped with the command and control functions. The connections are made through a M12-connector located in the lower side of the profile.

The synchronisation between the emitter and the receiver takes place optically, *i.e.* no electrical connection between the two units is required.

The microprocessors guarantee the check and the management of the beams that are sent and received through the units: the microprocessors – through some LEDs – inform the operator about the general conditions of the light curtain and about eventual faults (*see section 7 "Diagnostic functions"*).

During installation, two yellow LEDs facilitate the alignment of both units (*see section 5 "Alignment procedures"*).

As soon as an object, a limb or the operator's body accidentally interrupts the beams sent by the emitter, the receiver immediately opens the OSSD output and blocks the machine (if correctly connected to the OSSD).

Note: The following abbreviations, defined by the Standards in force, will be used in this manual:

AOPD	Active opto-electronic protective device
ESPE	Electro-sensible protective equipment
OSSD	Output signal switching device
TX	Transmitter
RX	Receiver
EDM	External Devices Monitoring

Some parts or sections of this manual containing important information for the user or installing operator are preceded by a note:

Notes and detailed descriptions about particular characteristics of the safety devices in order to better explain their functioning.

Special instructions regard the installation process.

The information provided in the paragraphs following this symbol is very important for safety and may prevent accidents.

Always read this information accurately and carefully follow the advice to the letter.

This manual contains all information necessary for the selection and operation of the safety devices.

However, special knowledge not included in this technical description is required for the planning and implementation of a safety light curtain on a power-driven machine. As the required knowledge may not be completely included in this manual, we suggest the customer to contact the technical service of ipf electronic for any necessary information relative to the functioning of the OY36 light curtains and the safety rules that regulate the correct installation.

1.1.1. Package contents

Package contains the following objects:

- Receiver (RX)
- Emitter (TX)
- Installation Quick Guide of OY36 curtain
- 4 angled fixing brackets and specific fasteners

1.2. How to choose the device

There are at least three different main characteristics that should be considered when choosing a safety light curtain, after having evaluated the risk assessment:

1.2.1. Resolution

The resolution of the device is the minimum dimension that an opaque object must have in order to obscure at least one of the beams that constitute the sensitive area.

The resolution strictly depends on the part of the body to be protected.

As shown in Fig.1, the resolution only depends on the geometrical characteristics of the lenses, diameter and distance between centres, and is independent of any environmental and operating conditions of the safety light curtain.

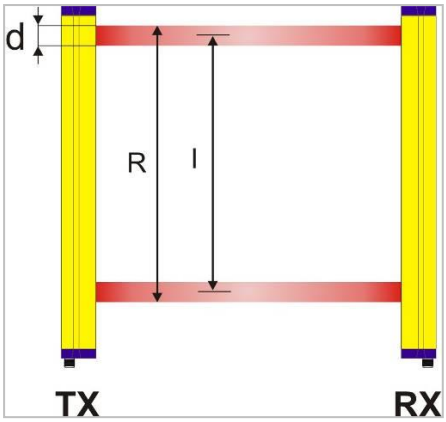


Fig. 1

The resolution value is obtained applying the following formula:

$$R = I + d$$

where:

I = *Distance between two adjacent optics*
d = *Lense Diameter*

The following table shows the values of the optic interaxis (**I**), the resolution (**R**) and the optic diameter (**d**), of the safety light curtains.

Article-No.	Optic interaxis [mm] **(I)**	Number of Optics **(n)**	Resolution [mm] **(R)**	Ø Optics [mm] **(d)**	Operating distance [m]
OY360110	500	2	515	15	0.5 … 50
OY360111	400	3	415	15	0.5 … 50
OY360112	300	4	315	15	0.5 … 50
OY360113	400	4	415	15	0.5 … 50

1.2.2. Controlled height

It is important to distinguish between “Height of the sensitive area” and “Height of the controlled area” (see Fig.2).

- The height of the sensitive area is the distance between the lower and the upper limits respectively of the first and the last lens.
- The height of the controlled area is the effectively protected area; it delimits the area where an opaque object with larger or equal dimensions respect to the resolution of the safety light curtain may certainly cause the interruption of a beam.

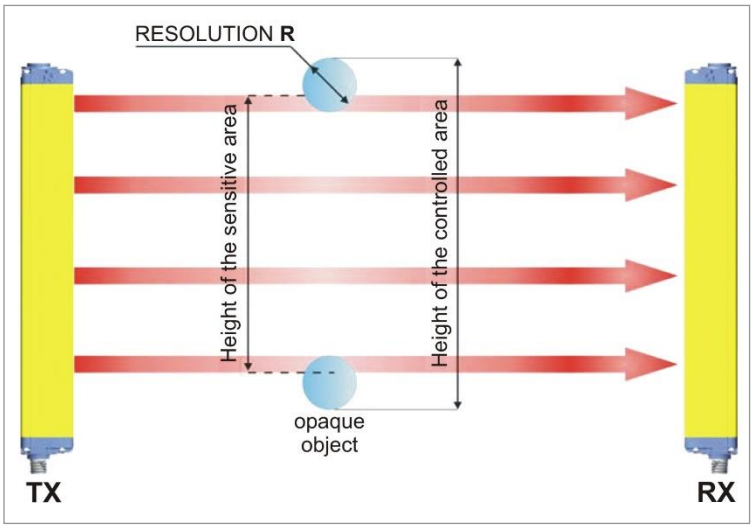


Fig. 2

1.2.3. Minimum Installation Distance

It is important to carefully calculate the distance between the point where the safety device will be placed and the possible danger associated with the machine to be protected (see section 2 "*Installation mode*" for the calculation of the safety distance).

1.3. Typical applications

The OY36 safety light curtains of the series are used in all automation fields where control and protection of the access to dangerous zones is necessary.

In particular they are used to stop the moving mechanical parts in:

- Palletisers / depalletisers;
- Packaging machines, handling machines, storing machines;
- Automatic and semi–automatic assembly lines;
- Automatic warehouses;
- Robotics.

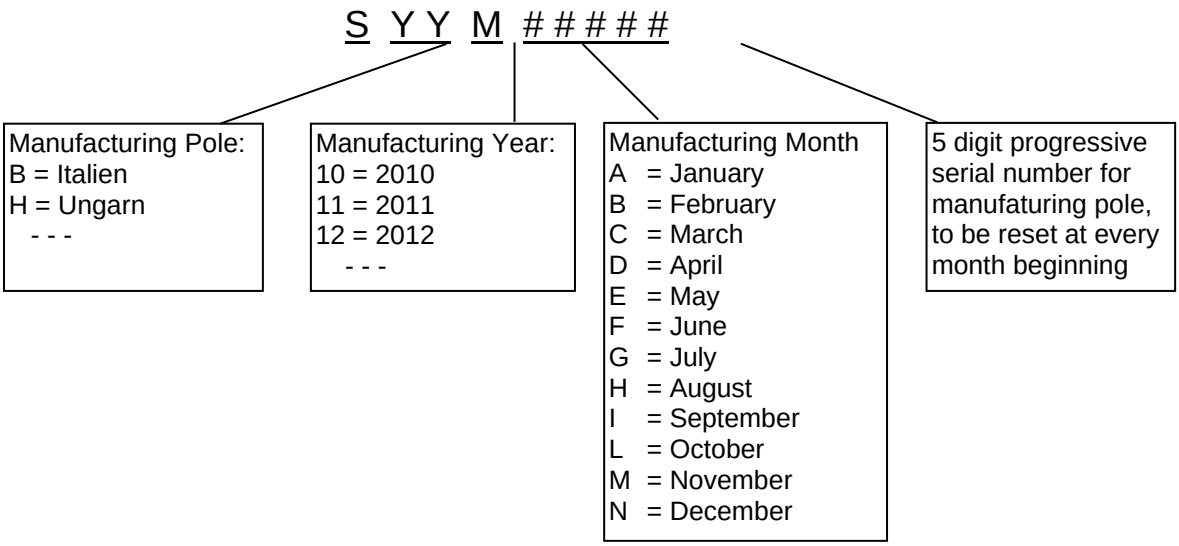
☞ In food industry applications, ipf electronic Technical Service has to verify the compatibility of the material of the safety light curtain housing with any chemical agents used in the production process.

1.4. Serial Number

The serial number is printed on the backside of the device.

Make sure that the assigned pair (transmitter – receiver) is provided with the same serial number

The serial number consists of 9 positions:



1.5. Safety Information

The following points must be observed for a correct and safe use of the OY36 safety device:

- The stopping system of the machine must be electrically controlled.
- This control system must be able to stop the dangerous movement of the machine within the total machine stopping time T as per paragraph 1.3.3, and during all working cycle phases.
- Mounting and connection of the safety light curtain must be carried out by qualified personnel only, according to the indications included in the special sections (refer to sections 2; 3; 4; 5; 6) and in the applicable standards.
- The safety light curtain must be securely placed in a particular position so that access to the dangerous zone is not possible without the interruption of the beams (refer section 2 "Installation mode").
- The personnel operating in the dangerous area must be well trained and must have adequate knowledge of all the operating procedures of the safety light curtain.
- The TEST button must be located outside the protected area because the operator must check the protected area during all Test operation.
- The RESET/RESTART button must be located outside the protected area because the operator must check the protected area during all Reset/Restart operations.
- The function of the external device monitoring (EDM) is active only if the specific wire is correctly connected to the device. Please carefully read the instructions for the correct functioning before powering the light curtain.
- Please carefully read the instructions for the correct functioning before powering the light curtain.

2. INSTALLATION MODE

2.1. Precautions to be observed for the choice and installation

Make sure that the protection level assured by the OY36 device (Type 4) is compatible with the real danger level of the machine to be controlled, according to **EN 954-1** and **EN 13849-1**.

- The outputs (OSSD) of the ESPE must be used as machine stopping devices and not as command devices. The machine must have its own START command.
- The dimension of the smallest object to be detected must be larger than the resolution level of the device.
- The ESPE must be installed in a room complying with the technical characteristics indicated in section 9 "Technical Data".
- Do not install device near strong and/or flashing light sources or close to similar devices.
- The presence of intense electromagnetic disturbances could jeopardise device functioning. This condition shall be carefully assessed by seeking the advice of ipf electronic Technical service.
- The operating distance of the device can be reduced in presence of smog, fog or airborne dust.
- A sudden change in environment temperature, with very low minimum peaks, can generate a small condensation layer on the lenses and so jeopardise functioning.

2.2. General information on device positioning

The safety light curtain should be carefully positioned, to reach a very high protection standard. Access to the dangerous area must only be possible by passing through the protecting safety light beams.

2.2.1 Minimum installation distance

The safety device must be placed at a specific safety distance (Fig.3). This distance must ensure that the danger zone cannot be reached before the dangerous motion of the machine has been stopped by the ESPE.

The safety distance depends on 4 factors, according to the EN 999, 775 and 294 Standards:

1 Response time of the ESPE (the time between the effective beam interruption and the opening of the OSSD contacts).

2 Machine stopping time (the time between the effective opening of the contacts of the ESPE and the real stop of the dangerous movement of the machine).

3 ESPE resolution.

4 Approaching speed of the object to be detected.

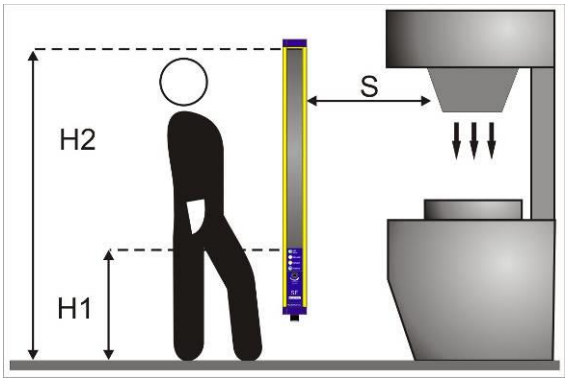


Fig. 3

The following formula is used for the calculation of the safety distance:

$$S = K (t1 + t2) + C$$

where:

S = Minimum safety distance in mm.

K = Speed of the object, limb or body approaching the dangerous area in mm/sec.

t1 = Response time of the ESPE in seconds (*see section 9 "Technical data"*)

t2 = Machine stopping time in seconds.

d = Resolution of the system.

C = 850 mm for device with resolution > 40mm.

Note: The value of K is:

2,000mm/s if the calculated value of S is ≤ 500mm

1,600mm/s if the calculated value of S is > 500mm

When devices with > 40mm resolution are used, the height of the top beam has to be ≥ 900mm (H2) while the height of the bottom beam has to be ≤ 300mm (H1).

2.2.2. Minimum distance from reflecting surfaces

Reflecting surfaces placed near the light beams of the OY36 device (over, under or laterally) can cause passive reflections. These reflections can compromise the recognition of an object inside the controlled area (see Fig.4).

However, if the **RX** receiver detects a secondary beam (reflected by the side-reflecting surface) the object might not be detected, even if the object interrupts the main beam.

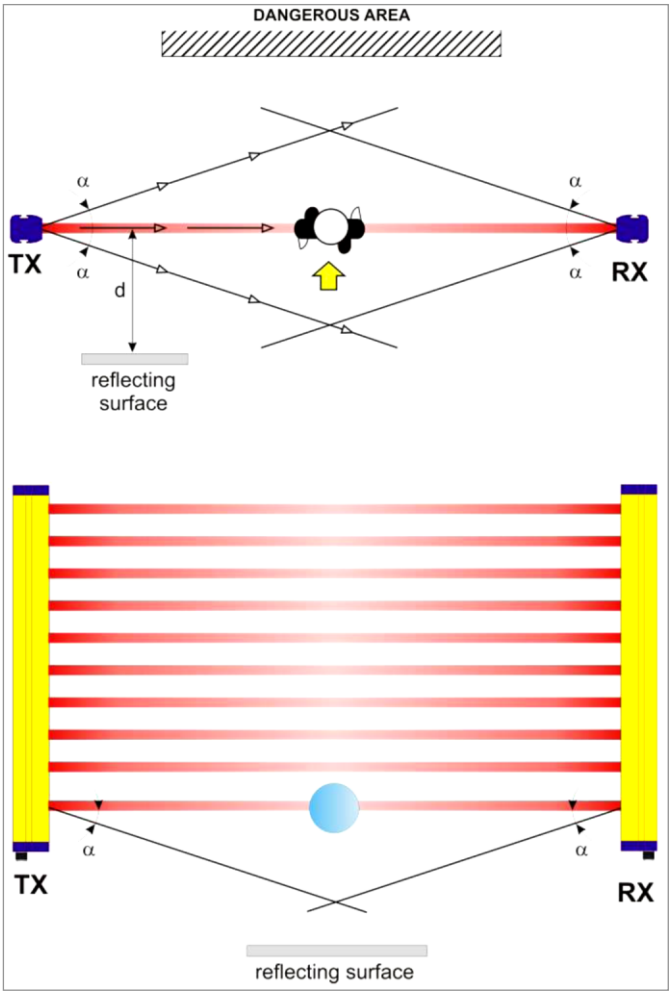


Fig. 4

It is thus important to position the safety light curtain according to the minimum distance from reflecting surfaces.

It is thus important to position the safety light curtain according to the minimum distance from reflecting surfaces.

The minimum distance depends on:

- operating distance between emitter (**TX**) and receiver (**RX**);
- real aperture angle of ESPE (EAA); especially:

for ESPE type 4 EAA = 5° (α = ± 2,5°)

Diagram of Fig. 5 shows the minimum distance from the reflecting surface (Dsr), based on the operating distance:

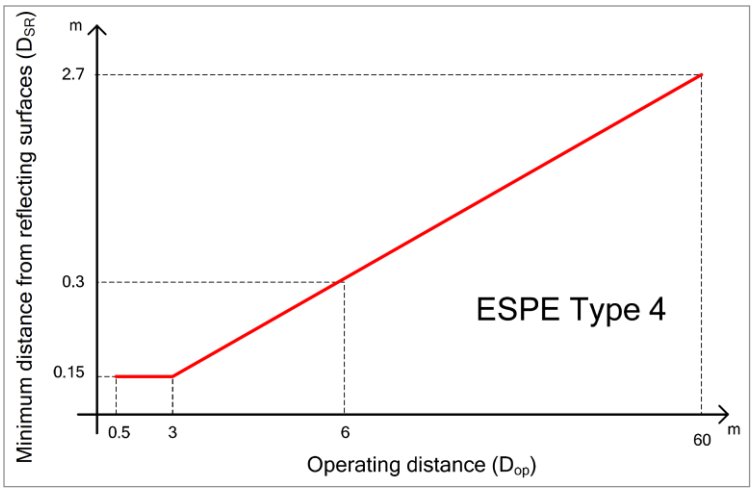


Fig. 5

The formula to get D_{sr} is the following

- D_{sr} (m) = 0,15 for operating distances < 3m
- D_{sr} (m) = 0,5 x operating distance (m) x tan 2α for operating distances ≥ 3m

2.2.3. Distance between homologous devices

If different safety devices have to be installed in adjacent areas, the emitter of one device must not interfere dangerously with the receiver of the other device.

The TX_B interfering device must be positioned outside a minimum D_{do} distance from the TX_A – RX_A emitter-receiver couple axis.

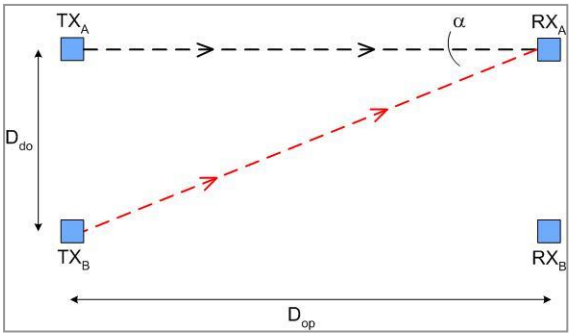


Fig. 6

This minimum D_{do} distance depends on:

- the operating distance between emitter (TX_A) and receiver (RX_A)
- the effective aperture angle of the ESPE (EA_A)

The following graphic shows the distance from the interfering devices (D_{do}) according to the operating distance (D_{op}) of the couple (TX_A – RX_A).

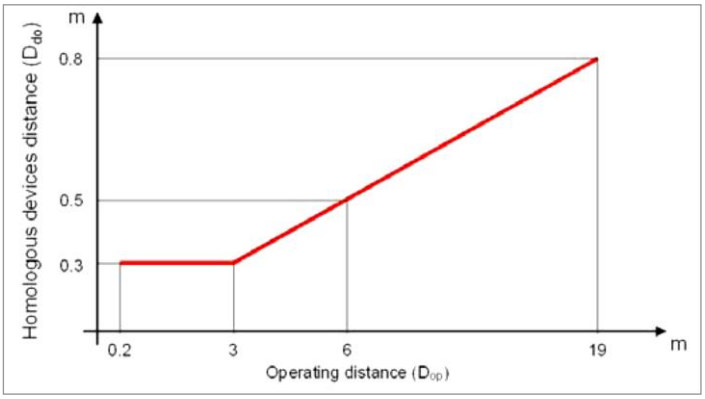


Fig. 7

The following table shows, for convenience, the values of the minimum installation distances relative to some operating distances:

Operating distance (m)	Minimum installation distance (m)
3	0.30
6	0.50
10	0.65
19	0.80

WARNING: the interfering device (TX_B) must be positioned at the same D_{do} distance, calculated as shown above, even if closer to TX_A respect to RX_A.

Installation precautions have to be taken to avoid interference between homologous devices. A typical situation is represented by the installation areas of several adjacent safety devices aligned one next to the other, for example in plants with different machines.

Fig. 8 provides two examples:

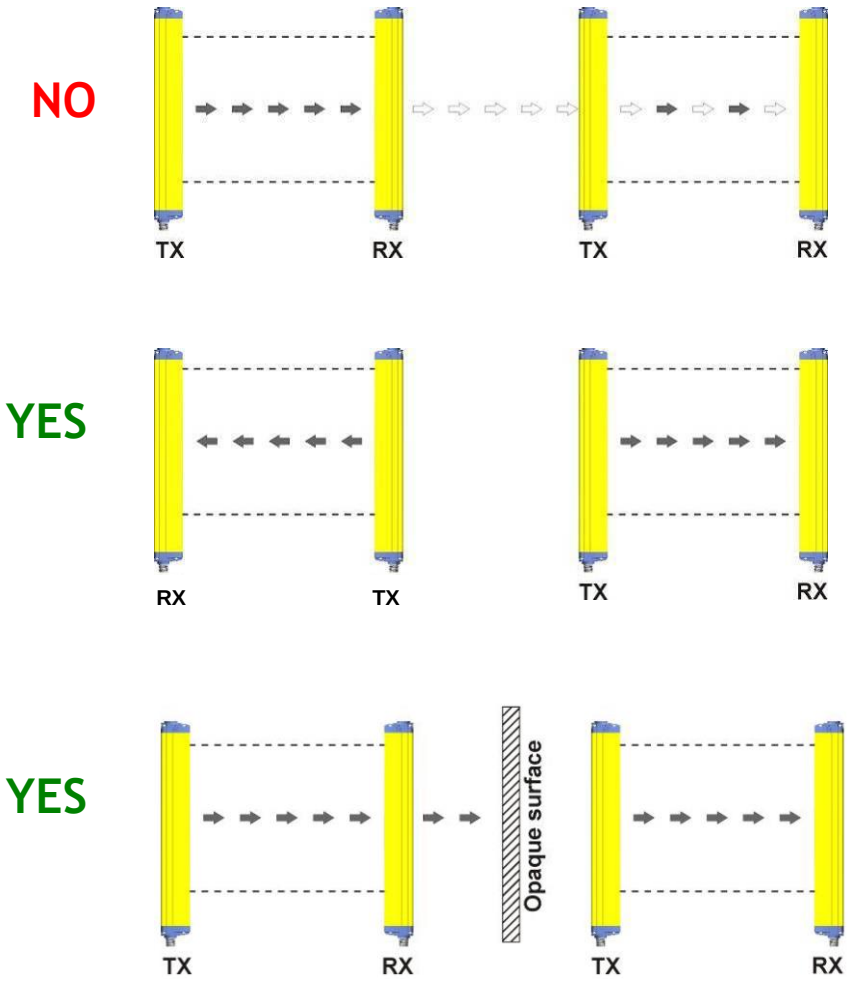


Fig. 8

2.2.4. Emitter and receiver orientation

The two units shall be assembled parallel each other, with the beams arranged at right angles with the emission and receiving surface, and with the connectors orientated towards the same direction.

The configurations shown in Fig. 9 must be avoided:

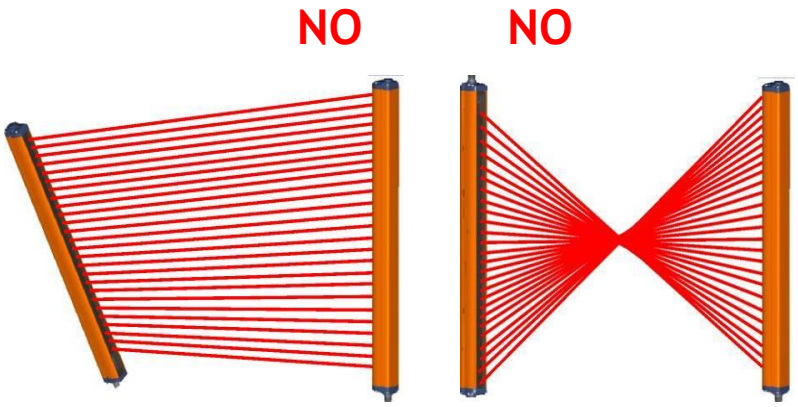


Fig. 9

2.2.5. Use of deviating mirrors

The control of any dangerous area, with several but adjacent access sides, is possible using only one safety device and well-positioned deviating mirrors.

Fig.10 shows a possible solution to control three different access sides, using two mirrors placed at 45° respect to the beams.

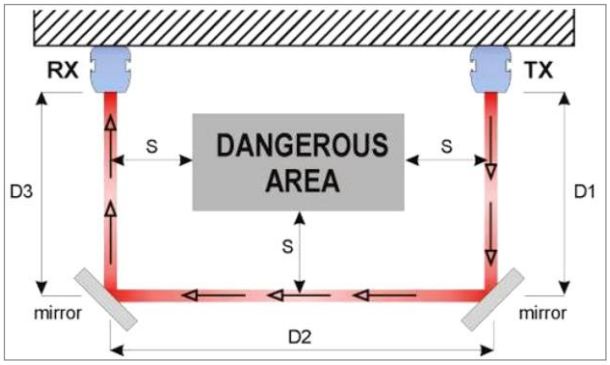


Fig. 10

The operator must respect the following precautions when using the deviating mirrors:

- The alignment of the emitter and the receiver can be a very critical operation when deviating mirrors are used. Even a very small angular displacement of the mirror is enough to loose alignment. A laser pointer (available as an accessory) can be used to avoid this problem.
- The minimum safety distance (S) must be respected for each single section of the beams.
- The effective operating range decreases by about 15% by using only one deviating mirror, the percentage further decreases by using 2 or more mirrors (for more details make refer to the technical specifications of the mirrors used).

- Do not use more than three mirrors for each device.
- The presence of dust or dirt on the reflecting surface of the mirror causes a drastic reduction in the range.

2.2.6. Controls after first installation

The control operations to carry-out after the first installation and before machine start-up are listed hereinafter. The controls must be carried-out by qualified personnel, either directly or under the strict supervision of the person in charge of machinery Safety.

Verify, that:

- ESPE remains blocked (▶I) intercepting the beams along the protected area using the specific test piece, following the Fig.11 scheme.

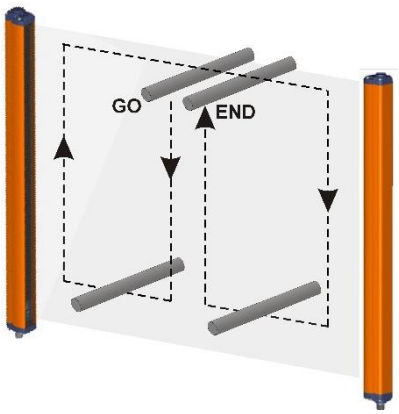


Fig. 11

- ESPE has to be correctly aligned, press slightly on the product side in both directions, the red LED must not turn on ▶I.
- The activation of the TEST function causes the opening of the OSSD outputs (red LED ▶I on and controller machine stop).
- The response time at machine STOP, including the ESPE and machine response times, must be included in the limits defined in the calculation of the safety distance (refer to section 2 "*Installation mode*").
- The safety distance between the dangerous parts and ESPE must comply with the requirements indicated in section 2 "*Installation mode*".
- A person must not access or remain between ESPE and the dangerous parts of the machine.
- Access to the dangerous areas of the machine must not be possible from any unprotected area.
- ESPE must not be disturbed by external light sources, ensuring that it remains in normal operating function for at least 10-15 minutes and placing the specific test piece in the protected area in the SAFE condition for the same period.
- Verify the correspondence of all the accessory functions activating them in the different operating conditions.

3. MECHANIAL MOUNTING

The emitting (**TX**) and receiving (**RX**) bars must be installed with the relevant sensitive surfaces facing each other. The connectors must be positioned on the same side and the distance must be included within the operating range of the model used (*see section 9 "Technical data"*).

Once positioned the two units, the two bars should be aligned and parallel as much as possible.

The next step, if necessary, is the fine alignment, as shown in section 5 *"Alignment procedures".*

To mount the device, use the threaded pins supplied, inserting them into the slots on the two bars.

Angled fixing brackets

Angled fixing brackets are supplied with all OY36 models (Fig.12).

Fixing brackets can be used where no large mechanical compensation is required during the alignment operation.

Adjustable supports for correcting unit inclination on the axes are available on request (see section 13 *"Accessories*").

For fixing with angled brackets, refer to Fig.12.

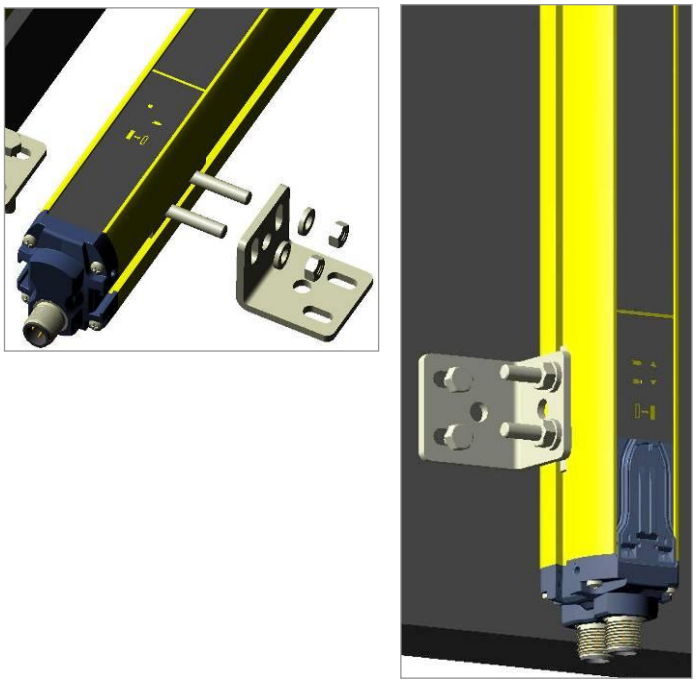


Fig. 12

Rotating brackets

Should it prove necessary to adjust the angular position of the light curtain, it is recommended to use the AO000249 rotating mounting brackets, which, thanks to the cylindrical surfaces of the caps, allow the product to rotate 360° around its own axis.

For further information, please refer to chapter 13 "*Accessories*".

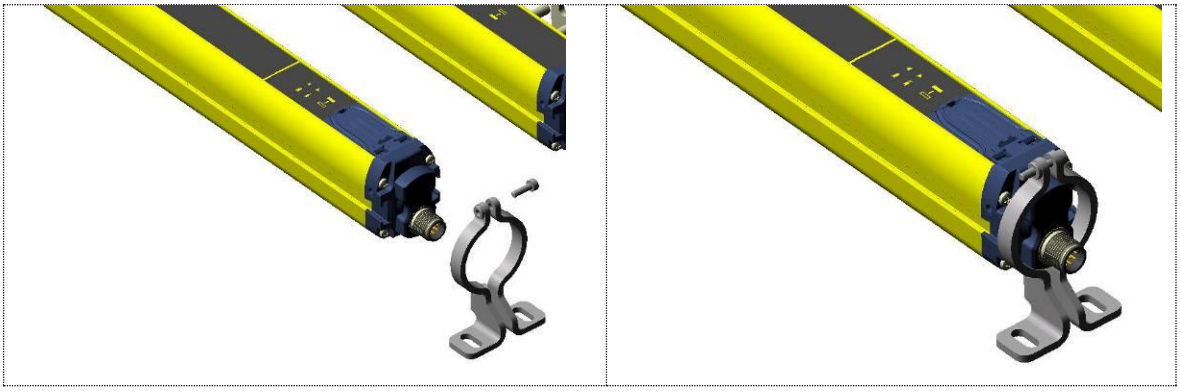


Fig. 13

The rotating supports for the correction of the bar inclination of ±5° max. are available on request (see section 13 *"Accessories"*).

In case of applications with particularly strong vibrations, anti-vibration shock absorbers, together with threaded pins, rigid brackets and/or rotating supports, are recommended to reduce the impact of the vibrations.

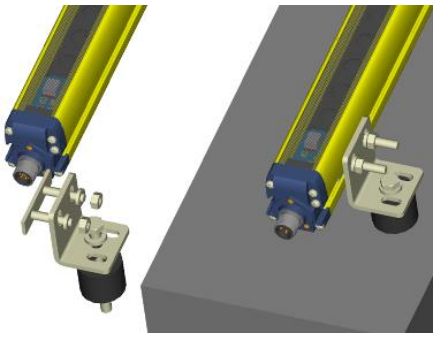


Fig. 14

The recommended mounting positions according to the light curtain length are shown in Fig.15 and in the following table.

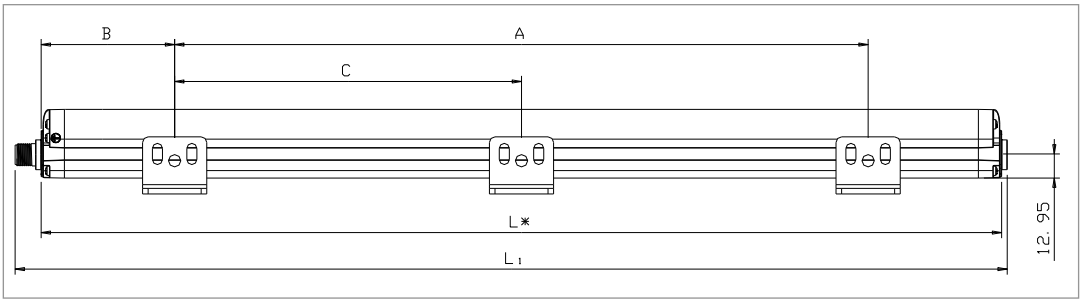


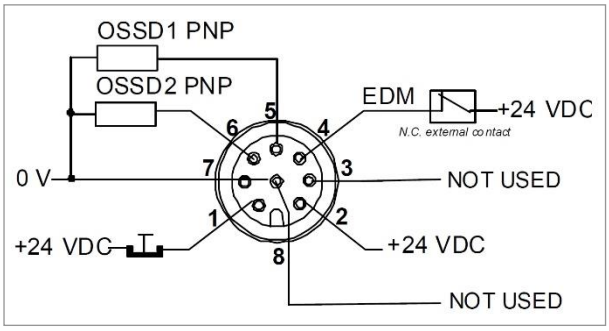
Fig. 15

MODEL	L* (mm)	A (mm)	B (mm)	C (mm)
OY360110	653	342	150	-
OY360111	953	542	200	-
OY360112	1,053	602	220	-
OY360113	1,353	942	200	472

4. ELECTRICAL CONNECTIONS

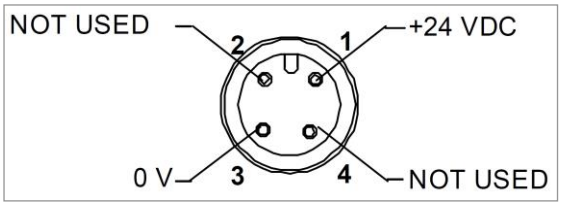
All electrical connections to the emitting and receiving units are made through a male M12-connector, located on the lower part of the two units. For receiver a M12- connector 8-pin is used, while for emitter a M12- connector 4-pin is used.

RECEIVER (RX):



1 = white = TEST / START
2 = brown = +24V DC
3 = green = NOT USED
4 = yellow = EDM
5 = grey = OSSD 1
6 = pink = OSSD 2
7 = blue = 0V
8 = red = NOT USED

Transmitter (TX):



1 = brown = +24 VDC
2 = white = NOT USED
3 = blue = 0V
4 = black = NOT USED

4.1. Notes on connections

For the correct functioning of the OY36 safety light curtains, the following precautions regarding the electrical connections have to be respected.

- Use only shielded cables for the connection of the two units.
- The light curtain has been developed to offer an adequate immunity level against disturbances in the most critical working conditions.
- It is possible to connect to ground the device housing using the mechanical part supplied for ground connection (refer to configuration illustrated in Fig.16).

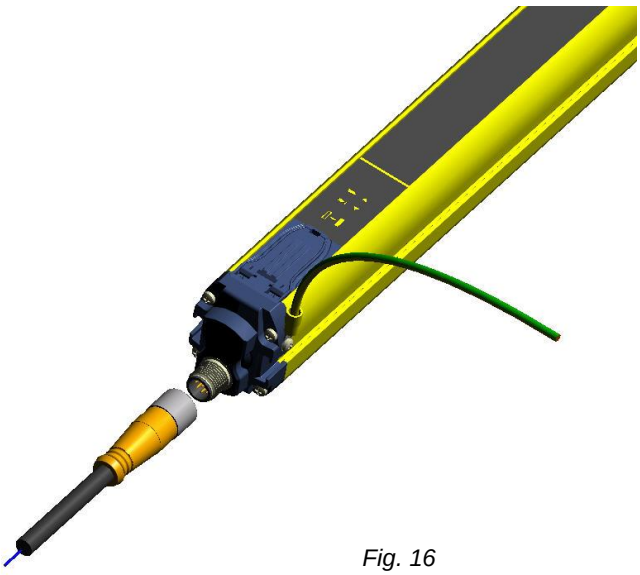


Fig. 16

- Do not place connection cables in contact or near high-voltage cables (e.g. motor power supplies, inverters, etc.);
- Do not connect in the same multi-pole cable the OSSD wires of different light curtains;
- The TEST/START wire must be connected through a N.C. button to the supply voltage of the ESPE. A daily manual test is necessary to verify the correct functioning of the safety light curtain. Push the specific button to activate the test.
- The TEST/START button must be located in such a way that the operator can check the protected area during any Test, Override and Reset operation. (see section 6 *"Functioning mode"*).
- The EDM wire has to be connected to a 24V DC normally closed contact, before powering. The monitoring function, if selected, is not activated if at powering the wire is not correctly connected; in this case the light curtain enters in a failure condition.

- The device is already equipped with internal overvoltage and overcurrent suppression devices. The use of other external components is allowed but not recommended.
- The ground connection of the two units depends on the electrical protection class to be guaranteed (*see section 9 "Technical Data" for more information*).
- This connection can be carried-out using the screw supplied, which can be put into the proper threaded hole on the cap (*see Fig.17*).

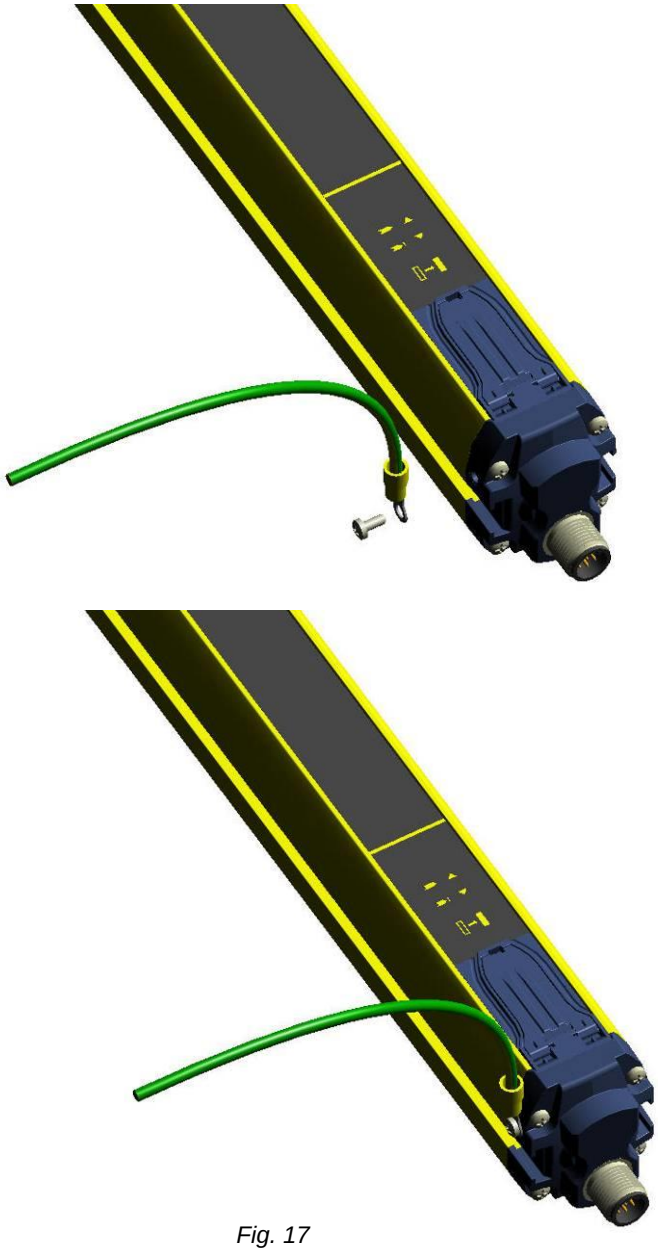


Fig. 17

- The OSSD1 and OSSD2 safety contacts cannot be connected in series or in parallel, but can be used separately (Fig.18). If one of these configurations is erroneously used, the device enters into the output failure condition (see cap.7 "Diagnostic functions").
- Connect both OSSD to the activating device. The avoided connection of an OSSD to the activating device jeopardises the system safety degree that the light curtain has to control.

YES

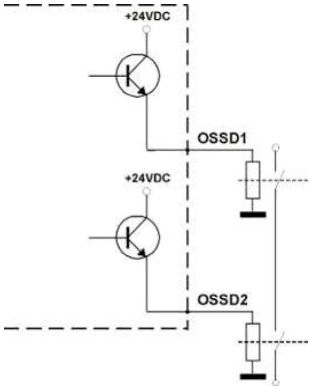


Fig. 18

NO

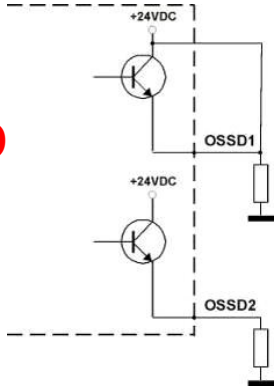


Fig. 19

NO

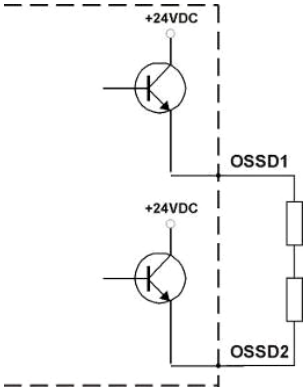


Fig. 20

NO

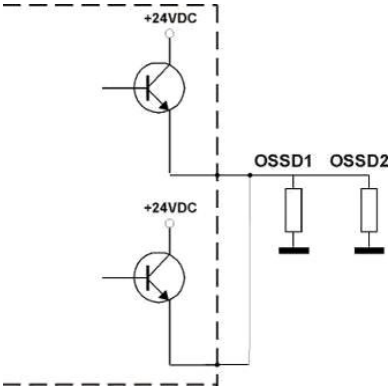


Fig. 21

5. ALIGNMENT PROCEDURE

The alignment between the emitting and the receiving units is necessary to obtain the correct functioning of the light curtain.

The alignment is perfect if the optic axes of the first and the last emitting unit's beams coincide with the optic axes of the corresponding elements of the receiving unit. Two yellow LED indicators (HIGH ALIGN, LOW ALIGN) facilitate the alignment procedure.

5.1. Correct light curtain alignment procedure

When the mechanical installation and the electrical connections have been effected – as explained inthe previous paragraphs – it is possible to carry-out the alignment of the safety light curtain, according to the following procedure:

- Disconnect the power supply to the light curtain.
- Press the TEST/START button and keep it pressed (open the contact).
- Re-connect the power supply.
- Release the TEST/START button.
- Check the green LED on the bottom of the TX unit (POWER ON) and the yellow LED (NORMAL OPERATION); if they are ON, the unit is running correctly.
- Verify that one of the following conditions is present on the RX unit:
  1. Red LED (SAFE) ON: non-alignment condition.
  2. Green LED (NORMAL OPERATION) ON: light curtain already aligned condition; in this case also the two yellow LEDs will be ON (HIGH ALIGN, LOW ALIGN).
- Continue with the following steps to change from condition 1 to condition 2:

  A Keep the receiving unit in a steady position and set the transmission unit until the yellow LED on the bottom (LOW ALIGN) is ON. This condition shows the effective alignment of the first lower beam.

  B Rotate the transmission unit until the upper yellow LED (HIGH ALIGN) is ON; in this condition red LED (SAFE) must turn off and green LED (NORMAL OPERATION) must turn ON.

  Note: ensure that the green LED (NORMAL OPERATION) modo is ON and steady.

  C Delimit the area in which the green LED (NORMAL OPERATION) is steady through some micro adjustments - for the first and then for the second unit - then place both units in the centre of this area.
- Fix the two units firmly using pins and brackets.
- Disconnect the power supply to the light curtain.
- Re-connect the power supply.
- Verify that the green LED is ON on the RX unit (condition where the beams are free, NORMAL OPERATION) and verify that, if even one single beam is obscured, the green LED turns OFF and the red LED turns ON (condition where an object has been detected, SAFE).

6. FUNCTIONING MODE

6.1. Dip-switch selectable functions

A slot situated in the front side of the RX unit (Fig. 22), that can be easily opened using a screwdriver, facilitates the access to the internal dip-switches.

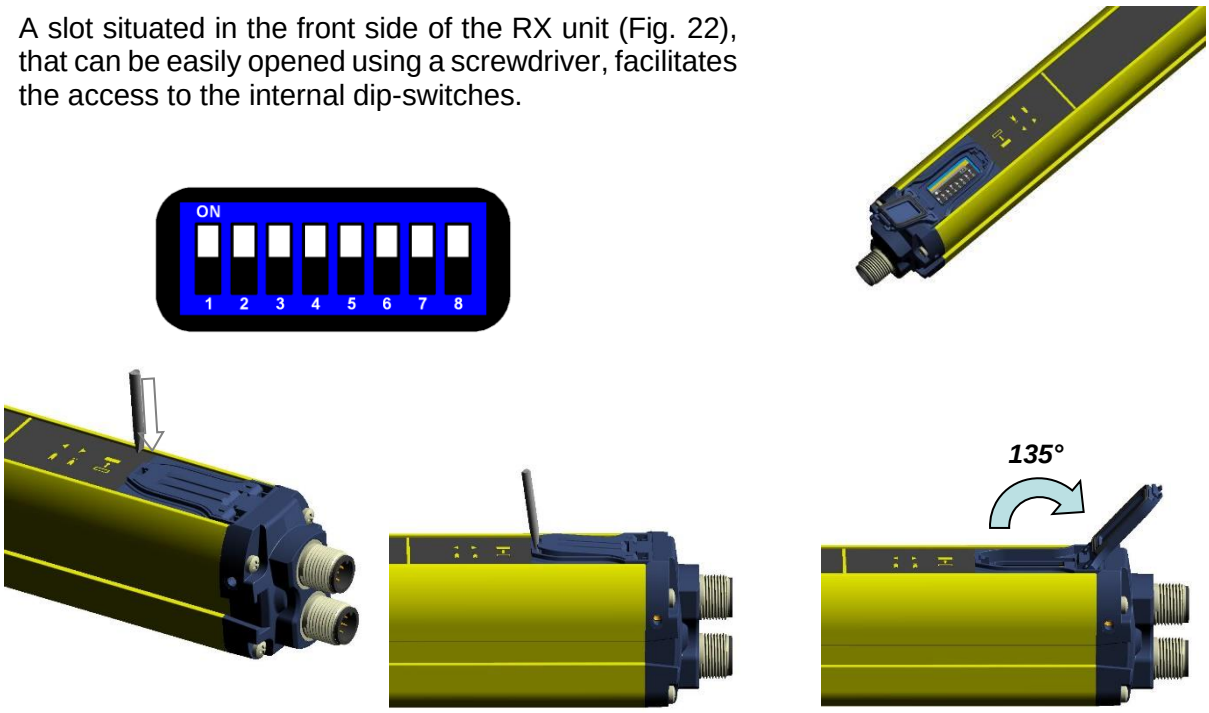


Fig. 22

Insert a screwdriver point into the dedicated pocket of the hinged lid and lever up slightly until the snap happens. Rotate the lid until you reach the 135° angle. A light brake will provide to keep the wide position. To close the lid press on the zone where is the pocket until you get the closing snap.

By means of the dip-switches it is possible to set the functions described in the following table:

DIP-sw	Function	ON	OFF
1,5	-	-	-
2,6	-	-	-
3,7	EDM	deactivated	activated
4,8	Reset	Automatik	Manual

The device does not accept configuration changes during normal functioning. A change is accepted only beginning from the successive powering of the device. Particular attention has to be taken during the configuration dip-switch management and use.

Note: Like shown in the figure and in the previous table, each functions is associated with two different dipswitches; it is necessary that the two different dip-switches associated to a particolar function are configured in the same way.

6.2. Standard configuration

The device is supplied with the following standard configuration:

EDM deactivated
Automatic Reset

Note: The EDM function can be activated only if the specific input is correctly connected to the appropriate device.

For further details of these functions see sections 6.3 and 6.4.

6.3. Restart Mode

An opaque object detected by the beams causes the switching of the OSSD outputs (i.e. the opening of the safety contacts - SAFE condition).

The restart of the ESPE (i.e. the closing of the OSSD safety contacts – NORMAL OPERATION condition) can be carried-out in two different ways:

- **Automatic Restart**: when an opaque object is detected, the ESPE enters in the SAFE condition. Then, after the opaque object has been removed from the controlled area, the ESPE begins its normal functioning again.
- **Manual Restart**: after the ESPE has detected an opaque object in the controlled area, the light curtain begins its normal functioning again only by pressing the Restart button (TEST button) and after the object has been removed from the controlled area.

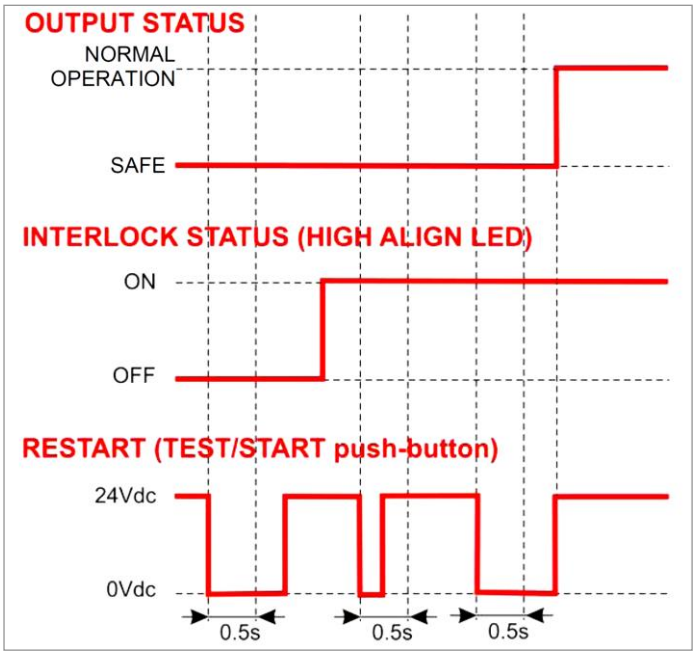


Fig. 23: Timing diagram (manual reset)

Fig. 24 below shows the two functioning modes:

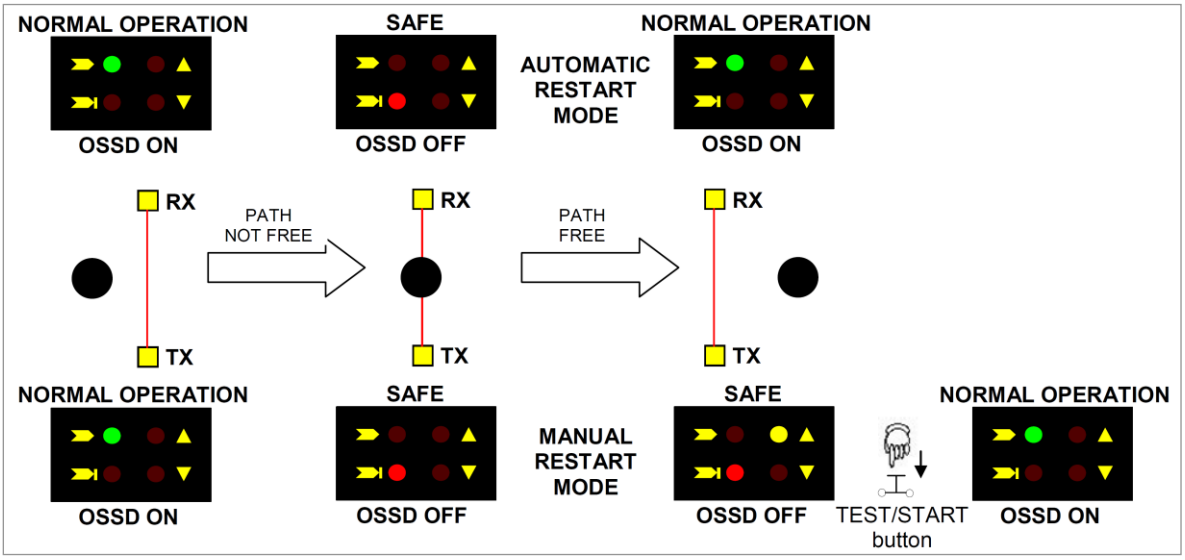
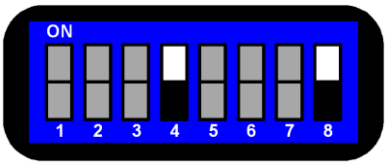


Fig. 24

The selection of the manual/automatic Restart mode is made through the dip–switches placed under the slot of the receiving unit.

In particular, 4 and 8 dip-switches must be ON to activate the automatic restart mode, OFF for the manual Restart mode.



Note: The dip-switches not used for this function are in grey.

The lever position of the specific dip-switch is in white (ON) in the automatic restart mode.

6.4. Test function

The TEST function can be activated by simply pressing the external push-button for at least 0.5 seconds as shown in the following timing diagram.

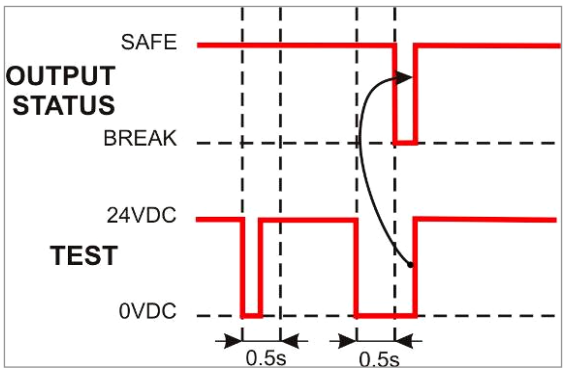


Fig. 25: Test function, automatic version

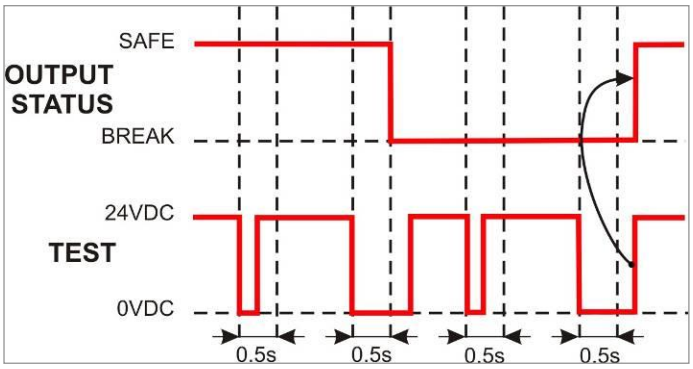


Fig. 26: Test function, manual Version

6.5 Reset function

The light curtain has a Reset function that is activated in presence of an internal failure. The operator has to press the TEST/START button resetting the break condition and thus return to normal functioning. The button has to be kept pressed for at least 5 seconds in one of the following conditions:

- *output failure;*
- *optic failure;*
- *failure of EDM test function.*

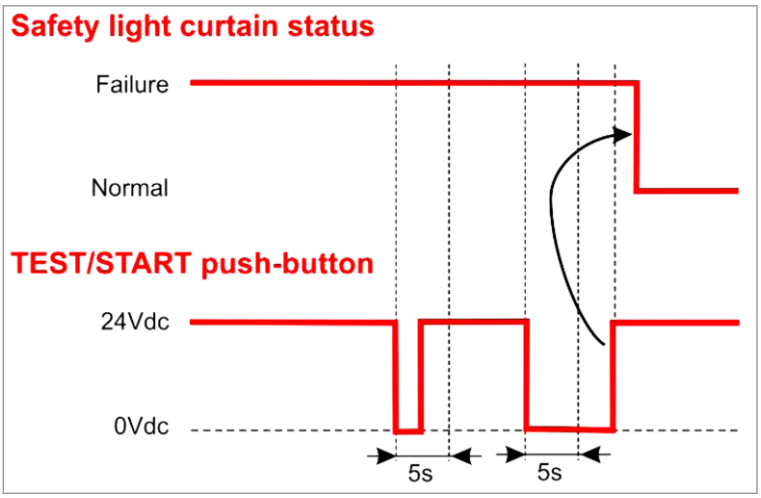
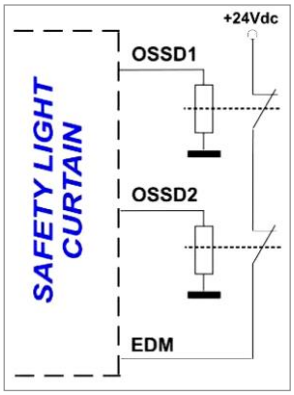


Fig. 27: Timing diagram of the reset function

6.6 EDM function



The External devices monitoring (EDM) function controls external devices by verifying the OSSD status.

To correctly use this function:

- select it using the specific dip-switches

- connect EDM input to the 24Vdc N.C. contact of the device to control.

The function controls the N.C. contact switching according to the changes of the OSSD status.

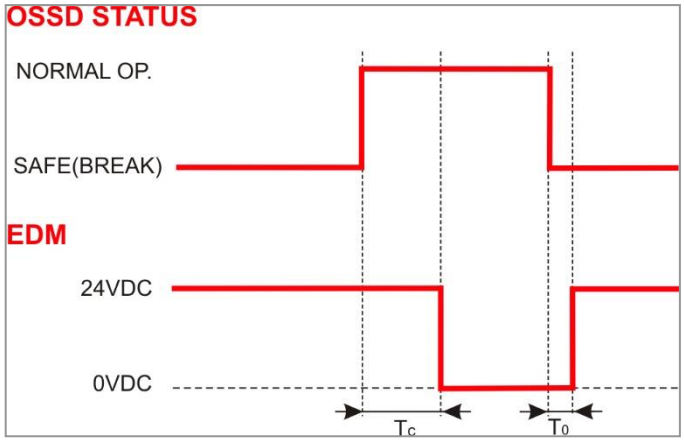


Fig. 28

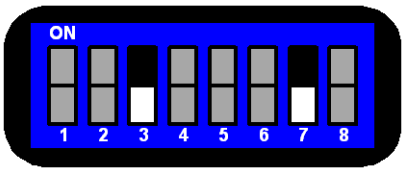
$T_C \geq$ 350ms: time after OSSD OFF-ON switch when EDM test is performed

$T_0 \geq$ 100ms: time after OSSD ON-OFF switch when EDM test is performed

The use of non-conform devices may cause failures.

The periodical testing of the function is recommended.

The correct dip-switch positioning (dip 3 and 7 OFF) for the function activation is shown here aside.



7. DIAGNOSTIC FUNCTIONS

7.1. Visualisation of the functions

The operator can verify the operating condition of the light curtains through four LEDs positioned on the receiving unit and two LEDs on the emitting unit (Fig. 29).

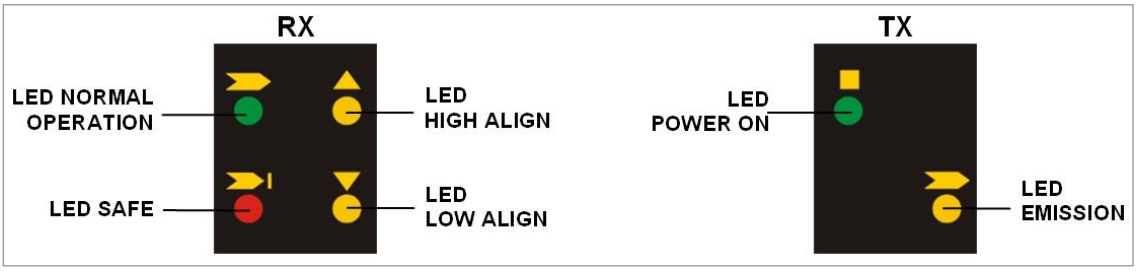


Fig. 29

The LEDs located on the emitter (TX) have the following meanings:

YELLOW LED NORMAL OPERATION: when ON, indicates that the unit is emitting correctly.

GREEN LED POWER ON: when ON, indicates that the unit is correctly powered.

The meaning of the LEDs positioned on the receiving unit **(RX)** depends on the light curtain operating mode.

7.2. Alignment mode

In this condition the outputs are OFF (SAFE state).

GREEN LED NORMAL OPERATION: when ON**,** indicates that no objects have been detected by the device.

RED LED SAFE: when ON**,** indicates that the receiving and the emitting units are not aligned, or that an object has been detected.

YELLOW LED HIGH ALIGN: when ON**,** indicates the correct alignment of the last TX optic with the corresponding RX optic (top side of the device).

YELLOW LED LOW ALIGN: when ON, indicates the correct alignment of the first TX optic with the corresponding RX optic (lower side of the device).

7.3. Operating mode

GREEN LED NORMAL OPERATION: when ON, indicates that no objects have been detected by the device.

RED LED SAFE: when ON, indicates that one object has been detected; in this condition the outputs are OFF.

YELLOW LED HIGH ALIGN: when continuously ON, indicates the INTERLOCK state, so that it is necessary to press the TEST/START button to reset the device consequently to an object interception. This occurs only when the device runs under the manual Reset mode.

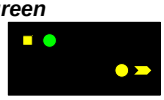
7.4. Fault and diagnostic messages

The operator is able to check the main causes of the system stop and failure, using the same LEDs used for the visualization of the functions.

RECEIVING UNIT:

Failure	Cause	Check and repair
OFF *Blinking yellow*  *Blinking red* *Blinking yellow*	- Output failure	- Check the output connections - Check, if the load characteristics are in accordance with the technical data (see section 9).
OFF *OFF*  *Blinking red* *Blinking yellow*	- Failure of external switching device (EDM test function)	- Control the EDM connections - Check the compatibility of external switching device with EDM test time - Switch OFF and switch ON the device; is failure persists replace external switching device.
OFF *Blinking yellow*  *OFF* *Blinking yellow*	- Microprocessor failure	- Check the correct positioning of the configuration dip-switches - Switch OFF and switch ON the device; if the failure continues, please contact ipf electronic.
OFF *OFF*  *OFF* *Blinking yellow*	- Optic failure	- Check unit alignment - Switch OFF and switch ON the device; if the failure continues, please contact ipf electronic.
OFF *OFF*  *OFF* *OFF*	- Power supply failure - Power supply voltage is outside the allowed range - Main microprocessor failure	- Check power supply - Switch OFF and switch ON the device; if the failure continues, please contact ipf electronic.

EMITTING UNIT:

Failure	Cause	Check and repair
ON green  ***Blinking yellow***	- Emitter side generic failure	- Check power supply; if the failure continues, please contact ipf electronic.
OFF  ***OFF***	- Power supply failure	- Check power supply; if the failure continues, please contact ipf electronic.
ON green  ***OFF***	- Power supply voltage is outside the allowed range - Main microprocessor failure	- Check power supply - Switch OFF and switch ON the device; if the failure continues, please contact ipf electronic.

8. PERIODICAL CHECKS

The following is a list of recommended check and maintenance operations that should be periodically carried-out by qualified personnel.

Verify, that:

- the ESPE stays locked () during beam interruption along the entire protected area, using the suitable “test piece”.
- the ESPE is correctly aligned. Press slightly on the product side in both directions and the red LED () must not turn on.
- enabling the TEST function, the OSSD outputs should open (the red LED  is ON and the controlled machine stops).
- the response time upon machine STOP (including response time of the ESPE and of the machine) is within the limits defined for the calculation of the safety distance (see section 2 "*Installation Mode*").
- the safety distance between the dangerous areas and the ESPE are in accordance with the instructions included in section 2 "*Installation Mode*".
- access of a person between ESPE and machine dangerous parts is not possible nor is it possible for him/her to stay there.
- access to the dangerous area of the machine from any unprotected area is not possible.
- the ESPE and/or the external electrical connections are not damaged.

The frequency of checks depends on the particular application and on the operating conditions of the safety light curtain.

8.1. Maintanance

The OY36-safety devices do not require any particular maintenance, with the exception of the cleaning of the protection front surfaces of the optics.

When cleaning, use a cotton cloth dampened with water.

Do not under any circumstances use:

- alcohol or solvents
- wool or synthetic cloths

8.2 General information and useful data

The safety devices fulfil their safety function only if they are correctly installed, in accordance with the standards in force.

If you are not certain to have the expertise necessary to install the device in the correct way,

ipf electronic Technical Service is at your disposal to carry-out the installation.

Auto-regenerating type fuses are used. Consequently, in presence of a short-circuit, these fuses protect the device.

After the intervention of the fuses, it is necessary to disconnect the power supply and wait for 20 seconds so that the fuses can automatically restart normal functioning.

A power failure caused by interferences may cause the temporary opening of the outputs, but the safe functioning of the light curtain will not be compromised.

8.3. Warranty

ipf electronic guarantees each brand new OY36 system, under standard use conditions, against manufacturing defects in material and workmanship for a period of 24 (twenty four) months from the date of manufacturing.

ipf electronic will not be liable for any damages to persons and things caused by failure to stick to the correct installation modes and device use.

Warranty validity is subject to the following conditions:

- User shall notify ipf electronic the failure within twenty four months from product manufacturing date.
- Failure or malfunction shall not have been originated directly or indirectly by:
  - use for unsuitable purposes;
  - failure to comply with the intended use prescriptions;
  - negligence, unskillfulness, wrong maintenance;
  - repairing, changes, adaptations not made by ipf electronic personnel, tampering with the device, etc.;
  - accidents or crashes (even due to transportation or by force majeure causes);
  - other causes not depending from ipf electronic.

If the device does not work, send both units (receiver and emitter) to ipf electronic. The Customer is responsible for all transport charges and damage risks or material loss during transport, unless otherwise agreed.

All replaced products and parts become a property of ipf electronic.

ipf electronic does not accept any warranty or right other than the above-described ones. No requests for compensation for expenses, activities stop or other factors or circumstances somehow connected to the failure of the product or one of its parts to operate cannot be put forward for any reason.

In case of problems, please contact ipf electronic.

9. TECHNICAL DATA

Power Supply (Vdd):	24V DC ± 20% (SELV/PELV)
Internal capacitance:	23nF (TX) / 120nF (RX)
Emitter consumption (TX):	30mA max. / 0,9W
Receiver consumption (RX):	75mA max. / 2,2W (without load)
OSSD outputs:	2 PNP
Short-circuit protection:	max. 1,4A at 55°C min. 1,1A at -10°C
Output current:	0,5A max. each output
Output voltage – Status ON:	Vdd – 1V min.
Output voltage – Status OFF:	0,2V max
Leakage current:	< 1mA
Capacitive load (pure):	max. 65nF at 25°C
Resistive load (pure):	min. 56Ω at 24V DC
Response time:	see table in section 10
Resolution	see table in section 10
Safety category:	Typ 4
Auxiliary functions:	manual / automatic Restart; EDM; RESET
Electrical protection:	Class I / Class III (** refer to note)
Connections:	TX: Connector M12, 4-poles RX: Connector M12, 8-poles
Cable length:	max. 50m at 50nF capacitive load and Vdd=24V DC
Emission type (λ):	Infrarot, LED (880 nm)
Operating distance:	0,5 … 50m
Ambient light rejection:	IEC-61496-2
Operating temperature:	0 … + 55°C
Storage temperature:	-25 … + 70 °C
Temperature Claas:	T6
Humidity:	15 … 95% (no condensation)
Mechanical Protection:	IP 65 (EN 60529)
Vibrations:	0,35mm width, 10 … 55 Hz frequency 20 sweep for each axis, 1 octave/min (EN 60068-2-6)
Shock resistance:	16ms (10 G) 1.000 Shock for each axis (EN 60068-2-29)
Housing material:	painted Aluminium (yellow RAL 1003)
Lens material:	PMMA
Cap material:	PC Lexan 943A
Weight:	1,2kg per m of total height

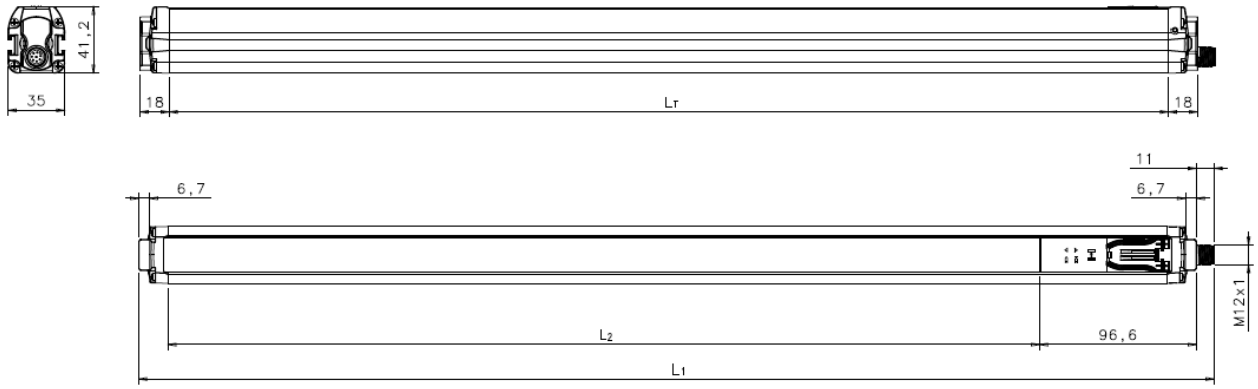
**Electrical protection	Class I	Class III
Protective grounding	compulsory	Not accepted
Symbol for connection protective grounding	compulsory	Not accepted
Protection by means of extra-low voltage with protective separation (SELV und PELV)	recommended	compulsory

10. LIST OF AVAILABLE MODELS

Article-No.	Controlled height (mm)	Interaxis (mm)	Number of beams	Response time (ms)	Resolution (mm)
OY360110	515	500	2	14	515
OY360111	815	400	3	14	415
OY360112	915	300	4	16	315
OY360113	1215	400	4	16	415

	EN ISO 13849-1	*EN 954-1*	*EN IEC 61508*	*EN IEC 62061*	*Prob. of danger failure/hour*	*Life Span*	*Mean Time to dangerous Failure*	*Average Diagnostic Coverage*	*Safe Failure Fraction*	*Hardware Fault Tolerance*
Article-No.	**PL**	**CAT**	**SIL**	**SIL CL**	**PFHd (1/h)**	**T1 (years)**	**MTTFd (years)**	**DC**	**SFF**	**HFT**
OY360110	e	4	3	3	2,62E-09	20	384	98,90%	99,38%	1
OY360111	e	4	3	3	2,62E-09	20	384	98,90%	99,38%	1
OY360112	e	4	3	3	2,62E-09	20	384	98,90%	99,38%	1
OY360113	e	4	3	3	2,62E-09	20	384	98,90%	99,38%	1

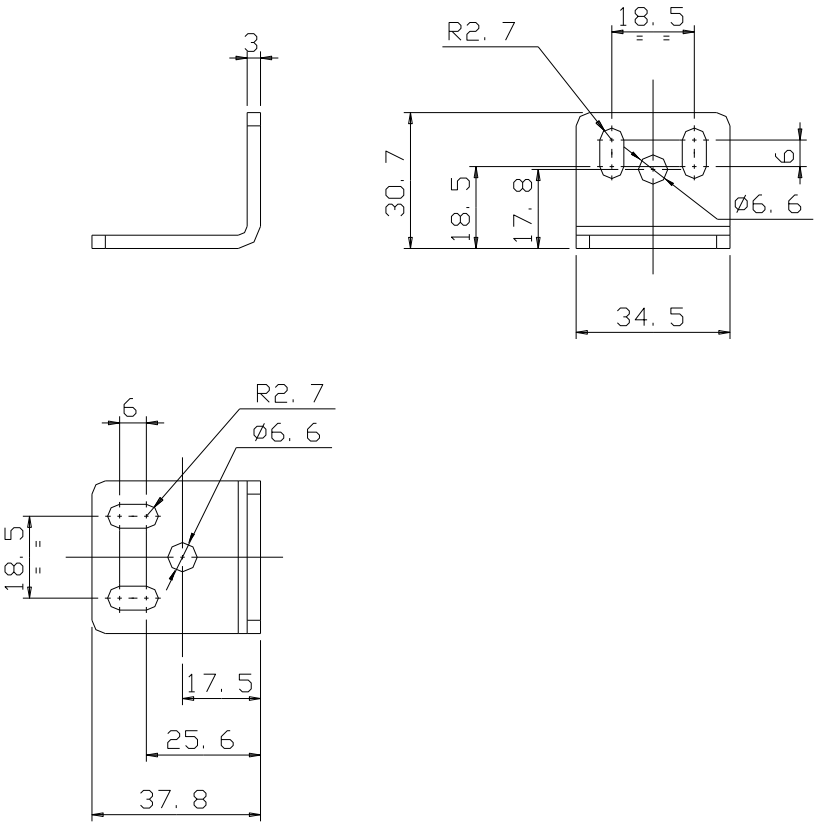
11. OVERALL DIMENSIONS



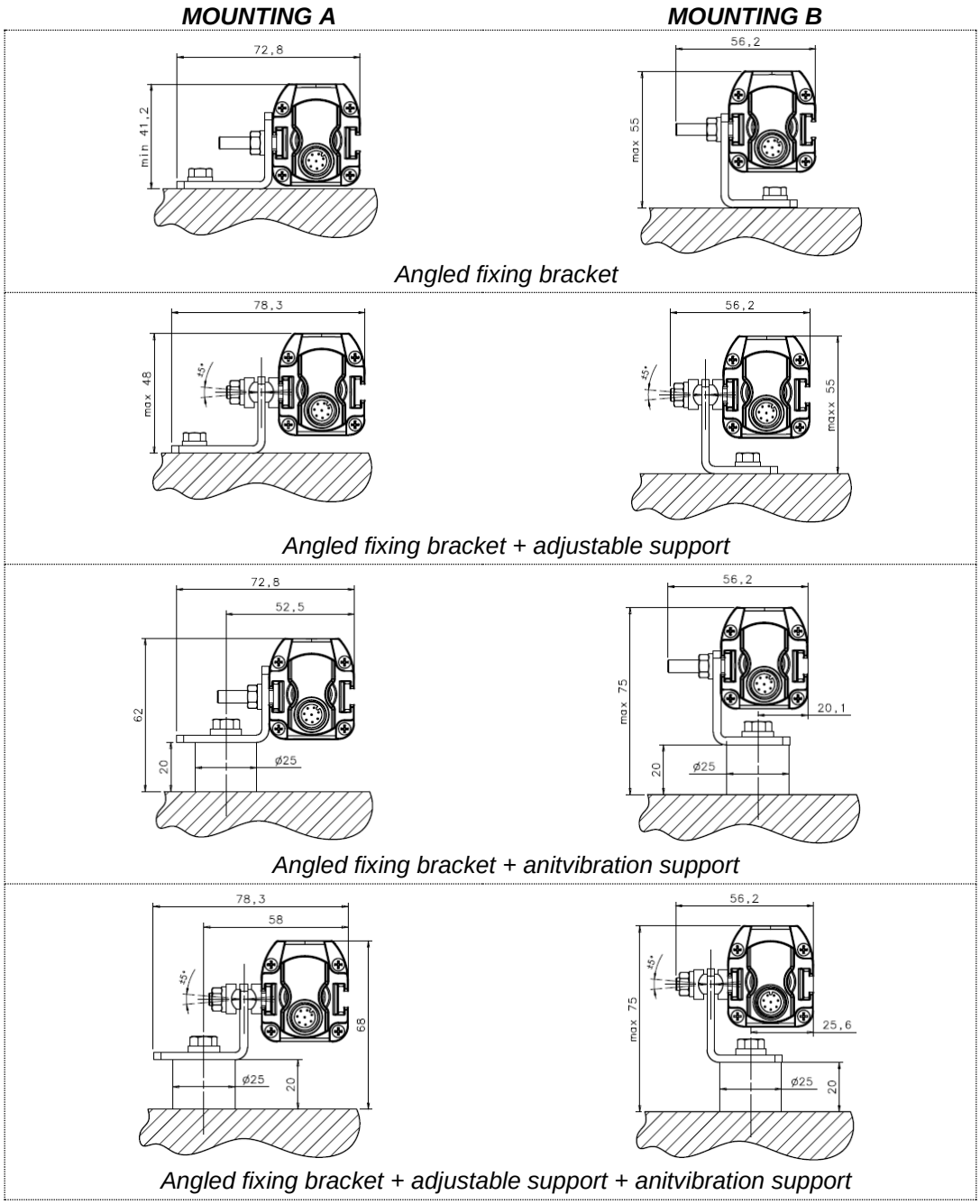
Article-No.	L_T	L_1	L_2
OY360110	617	664	538,4
OY360111	917	964	838,4
OY360112	1017	1064	938,4
OY360113	1317	1364	1238,4

12. OUTFIT

Angled fixing bracket



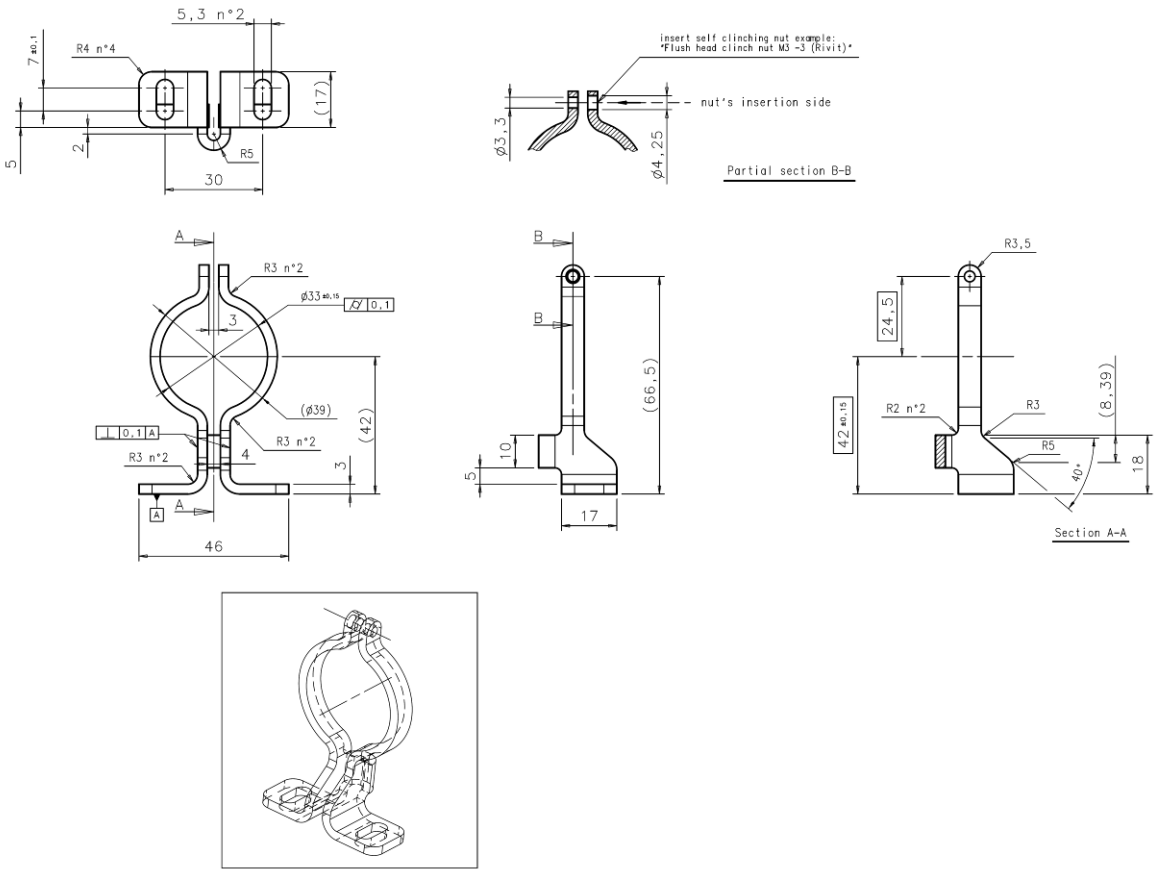
12.1. Angled fixing bracket mounting



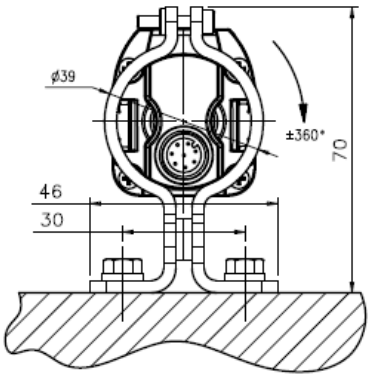
Article-No.	Description
AO000106	Fixing brackets for angle mounting (4 pc kit)
AO000107	Antivibration supports (4 pc kit)
AO000108	Antivibration supports (6 pc kit)
AO000109	Orientable supports (4 pc kit)
AO000110	Orientable supports (6 pc kit)

13. ACCESSOIRES

Rotating fixing bracket



Mounting of the rotating fixing bracket

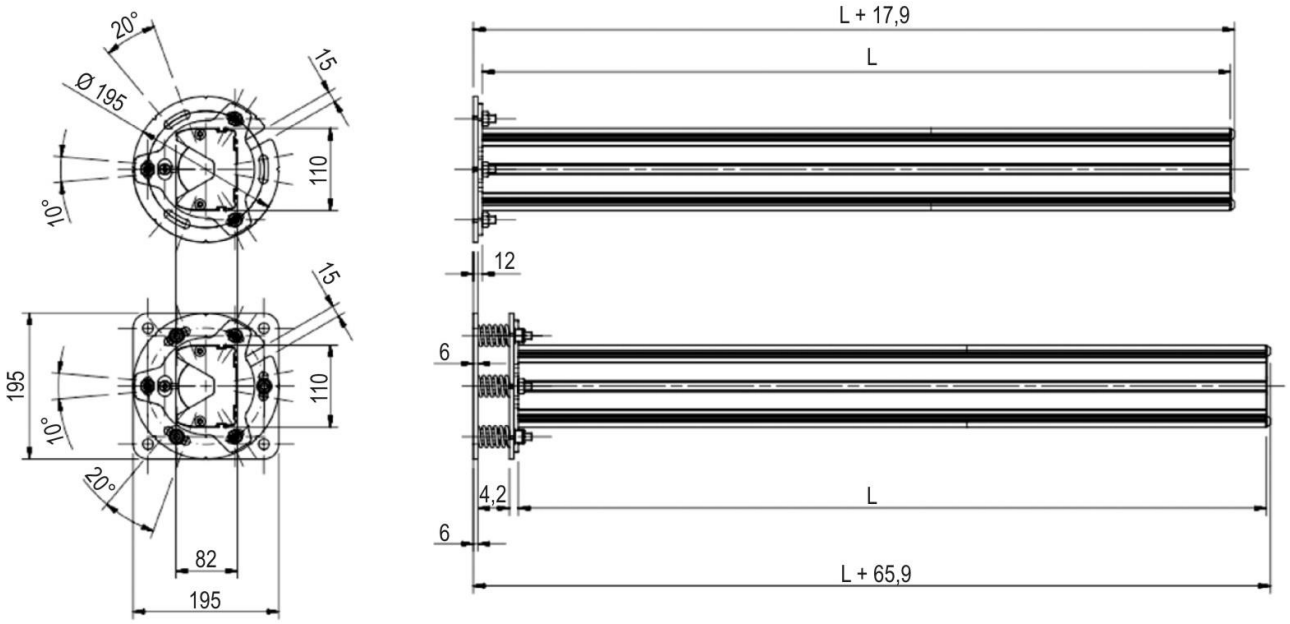


Article-No.	Description
AO000249	Rotating fixing bracket (4 pc kit)

Protective Stands

The protective stand accessory is a protective column formed by an aluminium profile and a steel base (floor stand). The latter is composed of two plates mounted together using 3 load springs.

The special profile, available in different lengths, ensures that the protective stand can contain the models of the OY36 and the OY35 series and even the deviating mirrors shown on the next page.

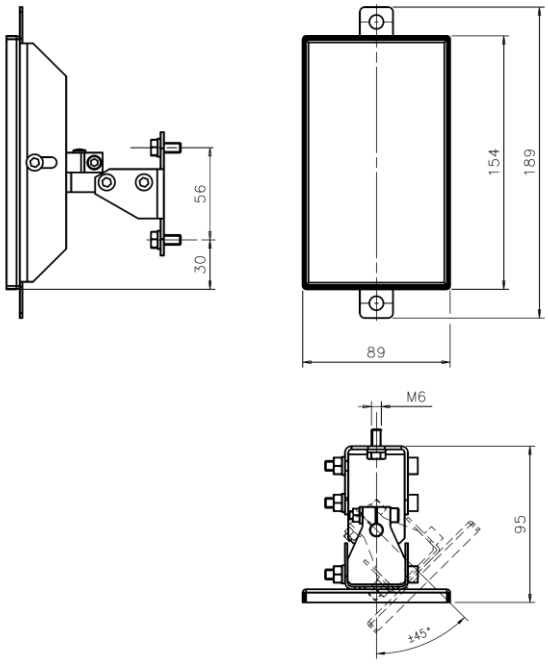


Article-No.	Description
AO000218	Plate Kit for protective stands (with load springs)

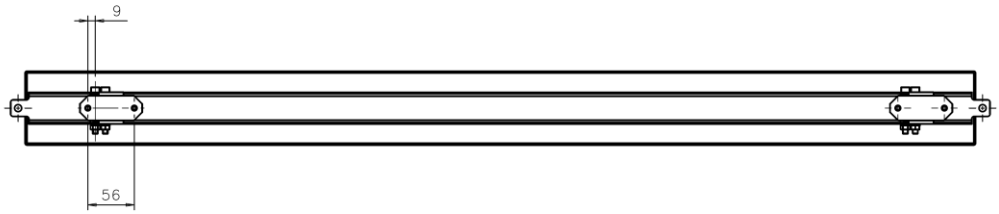
Article-No.	Description	L (mm)
AO000213	Protective stand H = 600mm	600
AO000214	Protective stand H = 1000mm	1000
AO000215	Protective stand H = 1200mm	1200
AO000216	Protective stand H = 1650mm	1650
AO000217	Protective stand H = 1900mm	1900

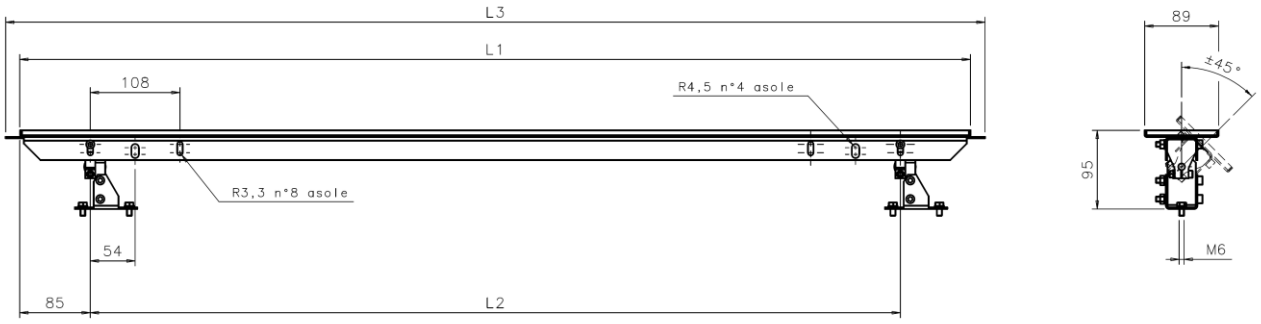
Article-No.	Description
AO000244	fixing bracket (4 pc kit) for deviating mirrors
AO000245	fixing bracket (4 pc kit) for light curtains
AO000247	fixing bracket (6 pc kit) for light curtains

Deviating Mirrors (drawing including stand alone bracket mounting kit)



Article-No.	Description
AO000236	Deviating Mirror 150mm



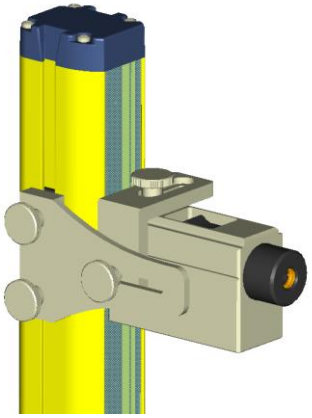


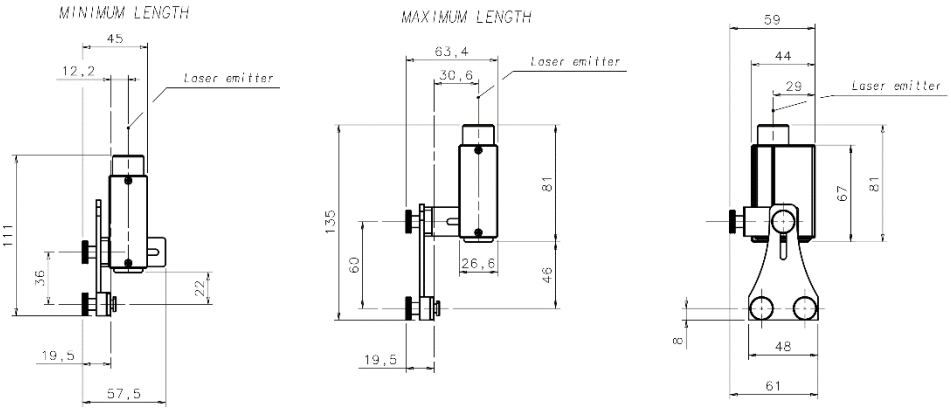
Article-No.	Description	L1 (mm)	L2 (mm)	L3 (mm)
AO000237	Deviating Mirror H = 600mm	545	376	580
AO000238	Deviating Mirror H = 900mm	845	676	880
AO000239	Deviating Mirror H = 1200mm	1145	976	1180
AO000240	Deviating Mirror H = 1650mm	1595	1426	1630
AO000241	Deviating Mirror H = 1900mm	1845	1676	1880
AO000250	stand alone bracket mounting kit			

Laser pointer

The laser pointer **AO000219** is a helping accessory for installation and alignment of safety light curtains.

For testing the complete adjustment of a safety light curtain the pointer is movable along the light barrier profile (upward and downward).

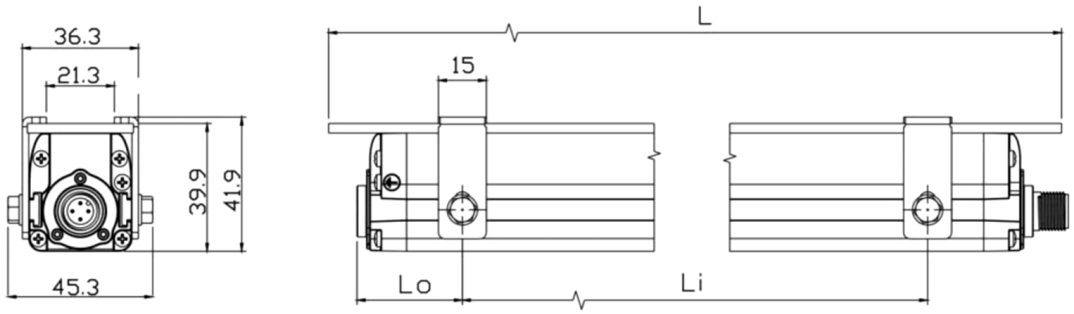




Lens Shield

This accessory for safety light curtains, composed of a PMMA Altuglas plate that can be mounted on the front glass, ensures an effective protection against dust, chips and incandescent drops, deriving from material working near the safety light curtain. The accessory can be easily installed thanks to the fixing brackets supplied in the package that exploit the side groove of the safety light curtain.

Each package contains what is necessary to protect a single unit (TX or RX).

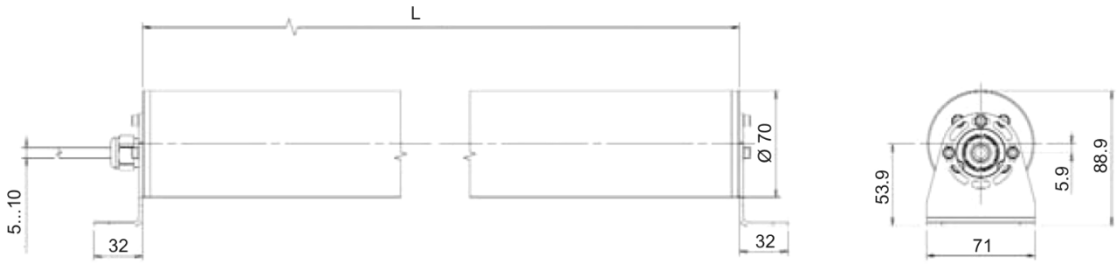


Article-No.	Description	L (mm)	Li (mm)	Lo (mm)
AO000232	Lens shield H = 500mm	642	490	75
AO000233	Lens shield H = 800mm	942	640	175
AO000234	Lens shield H = 900mm	1042	660	200
AO000235	Lens shield H = 1200mm	1342	480	200

Tubular Protection IP69k

This special housing is a PMMA acrylic tube used to protect and seal the safety light curtains of the OY36- and OY35-series. Thanks to this accessory the IP protection of the safety light curtain is increased from IP65 to IP67, IP68 and IP69K.

The Gore-Tex membrane on the caps prevents water or dirt entering as well as internal condensation. The connection cable for the light curtain is protected and kept in its place by a M16 metric chock that prevents the entry of water or dirt.



Article-No.	Description	L (mm)
AO000201	Tubular IP69k, H = 150mm	374
AO000202	Tubular IP69k, H = 300mm	521
AO000203	Tubular IP69k, H = 450mm	671
AO000204	Tubular IP69k, H = 600mm	821
AO000205	Tubular IP69k, H = 750mm	971
AO000206	Tubular IP69k, H = 900mm	1121
AO000207	Tubular IP69k, H = 1050mm	1271
AO000208	Tubular IP69k, H = 1200mm	1421
AO000209	Tubular IP69k, H = 1350mm	1571
AO000210	Tubular IP69k, H = 1500mm	1721
AO000211	Tubular IP69k, H = 1650mm	1871
AO000212	Tubular IP69k, H = 1800mm	2021

15. GLOSSARY

ACTIVE OPTOELECTRONIC PROTECTIVE DEVICE (AOPD)
Its detection function is achieved thanks to the use of optoelectronic receivers and emitters detecting the optical beams interruptions inside the device caused by an opaque object present inside the specified detecting area.
An active optoelectronic protective device (AOPD) can operate both in emitter-receiver mode and in retro-reflective light curtains.

BLOCK CONDITION (=BREAK)
Status of the light curtain taking place when a suitably-sized opaque object (see DETECTING CAPACITY) interrupts one or several light curtain beams.
Under these conditions, OSSD1 and OSS2 light curtain outputs are simultaneously switched OFF within the device response time.

CONTROLLED MACHINE
Machine having the potentially-dangerous points protected by the light curtain or by another safety system.

CROSSING HAZARD
Situation under which an operator crossing the area controlled by the safety device and this latter stops and keeps the machine stopped until the hazard is eliminated, and then enters the dangerous area. Now the safety device could not be able to prevent or avoid an unexpected restart of the machine with the operator still present inside the dangerous area.

DANGEROUS AREA
Area representing an immediate or imminent physical hazard for the operator working inside it or who could get in contact with it.

DETECTING CAPACITY (= RESOLUTION)
Sensor function parameter limit as specified by the manufacturer, which activates the electrosensitive protection equipment (ESPE). In case of an active optoelectronic protective device (AOPD), with resolution we mean the minimum dimension, which an opaque object must have in order to interrupt at least one of the beams that constitute the sensitive area.

EDM
see “External device monitoring” in the glossary.

ELECTROSENSITIVE PROTECTIVE EQUIPMENT (ESPE)
Assembly of devices and/or components working together to activate the protective disabling function or to detect the presence of something and including at least: a sensor, command/control devices and output signal switching devices.

EMITTER
Unit emitting infrared beams, consisting of a set of optically synchronised LEDs. The emitting unit, combined with the receiving unit (installed in the opposite position), generates an optical “curtain”, i.e. the detecting area.

EXTERNAL DEVICE MONITORING (EDM)
Device used by the ESPE to monitor the status of the external command devices.

FINAL SWITCHING DEVICE (FSD)
Part of the control system involving machine safety conditions. It breaks the circuit to the machine primary control element (MPCE) when the output signal switching device (OSSD) becomes inactive.

FORCE-GUIDED CONTACTS
Contacts can be guided forcibly when they are connected mechanically so that they can switch simultaneously, when the input stage is active.
If one contact of the series remains “hanged”, no other relay contact is able to move.
This function allows the control of the EDM status.

MACHINE OPERATOR
Qualified person allowed to use the machine.

MACHINE PRIMARY CONTROL ELEMENT (MPCE)
Electrically powered element having the direct control of machine regular operation so as to be the last element, in order of time, to operate when the machine has to be enabled or blocked.

MIN. INSTALLATION DISTANCE
Minimum distance necessary to allow machine dangerous moving parts to completely stop before the operator can reach the nearest dangerous point. This distance shall be measured from the middle point of the detecting area to the nearest dangerous point. Factors affecting min. installation distance value are machine stop time, total safety system response time and light curtain resolution.

N.O.
normally opened

N.C.
normally closed

OFF STATUS
Status when the output circuit is interrupted and does not allow current stream.

ON STATUS
Status when the output circuit is operational and allows current stream.

OUTPUT SIGNAL SWITCHING DEVICE (OSSD)
Part of the ESPE connected to machine control system. When the sensor is enabled during standard operating conditions, it switches to disabled status.

PROTECTED AREA
Area where a specified test object is detected by the ESPE.

PROTECTIVE DEVICE
Device having the function to protect the operator against possible risks of injury due to the contact with machine potentially-dangerous parts.

QUALIFIED OPERATOR
A person who holds a professional training certificate or having a wide knowledge and experience and who is acknowledged as qualified to install and/or use the product and to carry out periodical test procedures.

RECEIVER
Unit receiving infrared beams, consisting of a set of optically-synchronised phototransistors. The receiving unit, combined with the emitting unit (installed in the opposite position), generates an optical “curtain”, i.e. the detecting area.

RESPONSE TIME
Max. time elapsing between the occurrence of the event leading to sensor activation and the reaching of the inactive state by the output signal switching device (OSSD).

RESTART INTERLOCKING DEVICE (=RESTART)
Device preventing machine automatic restart after sensor activation during a dangerous phase of machine operating cycle, after a change of machine operating mode, and after a variation in machine start control devices.

RISK
Probability of occurrence of an injury and severity of the injury itself.

SAFETY LIGHT CURTAIN
It is an active optoelectronic protective device (AOPD) including an integrated system consisting of one or several emitting elements and one or several receiving elements forming a detection area with a detecting capacity specified by the supplier.

START INTERLOCKING DEVICE (= START)
Device preventing machine automatic start if the ESPE is live or the voltage is disabled and enabled once again.

TEST PIECE
Opaque object having a suitable size and used to test safety light curtain correct operation.

TYPE (OF ESPE)
The Electrosensitive Protective Equipment (ESPE) have different reactions in case of faults or under different environmental conditions. The classification and definition of the "type" (ex. type 2, type 4, according to IEC 61496-1) defines the minimum requirements needed for ESPE design, manufacturing and testing.

WORKING POINT
Machine position where the material or semi-finished product is worked.