



> SG4 BASE Safety Light Curtains



ORIGINAL INSTRUCTIONS (ref. 2006/42/EC)

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"SG4 BASE" Instruction Manual

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1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

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

NORM	DESCRIPTION
EN 61496-1: 2013	Safety of machinery: electrosensitive protective equipment. Part 1: General prescriptions and tests.
EN 61496-2: 2013	Safety of machinery: electrosensitive protective equipment - Particular requirements for equipment using active optoelectronic protective devices.
EN ISO 13849-1: 2015	Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design
EN 61508-1: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 1: General requirements
EN 61508-2: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
EN 61508-3: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 3: Software requirements
EN 61508-4: 2010	Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 4: Definitions and abbreviations
EN 62061:2005/A2: 2015	Safety of machinery. Functional safety of electrical/ electronic/programmable electronic safety-related control systems.

The device, consisting of one emitter and one receiver contained inside 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 one or more connectors as specified in cfr. **ELECTRICAL CONNECTIONS page 26**.

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

The microprocessor guarantees the check and the management of the beams that are sent and received through the units: the microprocessor – through some LEDs – informs the operator about the general conditions of the safety light curtain (cfr. **USER INTERFACE AND DIAGNOSTICS page 41**).

The receiver is the main controller for all functions. It monitors all safety actions in case of failure and performs general functions as well.

During installation, an user interface facilitates the alignment of both units (cfr. **ALIGNMENT PROCEDURE page 32**).

As soon as an object, or a limb or the operator's body accidentally interrupts one or some of the infrared beams sent by the emitter, the receiver immediately opens the OSSD outputs or trigger Safety State over connected safety Fieldbus.

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 regarding the installation process.

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

However, specialised 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 Datasensing Technical Service for any necessary information relative to the functioning of the light curtains and the safety rules that regulate the correct installation (cfr. **USER INTERFACE AND DIAGNOSTICS page 41**).

1.2 PACKAGE CONTENTS

Package contains the following objects:

- Receiver (RX)
- Emitter (TX)
- Quick Guide of safety light curtain
- Periodical checklist and maintenance schedule
- Mini-DVD with instruction manual and other documents
- 4 angled fixing brackets and specific fasteners
- 2 additional angled fixing brackets for models with heights included between 1200 and 1800 mm

1.3 NEW FEATURES COMPARED TO SE4-PLUS (EDM)

With respect to SE4-PLUS (EDM) series, the SG4 BASE safety light curtain series presents new important features:

- Higher operating distance
- Shorter response time (see cfr. **TECHNICAL DATA** page 48)
- Range enlargement with 150 to 1800 mm controlled heights
- New profile compatible with SE accessories
- New fastening system with rotating brackets
- TEST line with reversed activation logics (active high)
- Advanced alignment for receiver and transmitter units

Furthermore, SG4 BASE has 2 selectable functions, i.e.:

- EDM function
- Manual/automatic Restart

1.4 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.

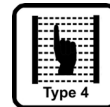
1.4.1 Detection capability

The detection capability (or resolution) of the device is the minimum diameter that an opaque object must have in order to obscure at least one of the beams that constitute the detection zone and to actuate the sensing device.

The resolution is related to the part of the body to be protected.

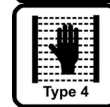
R=14 mm

Finger protection



R=30 mm

Hand protection



As shown in **Fig 1 - page 9**, 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.

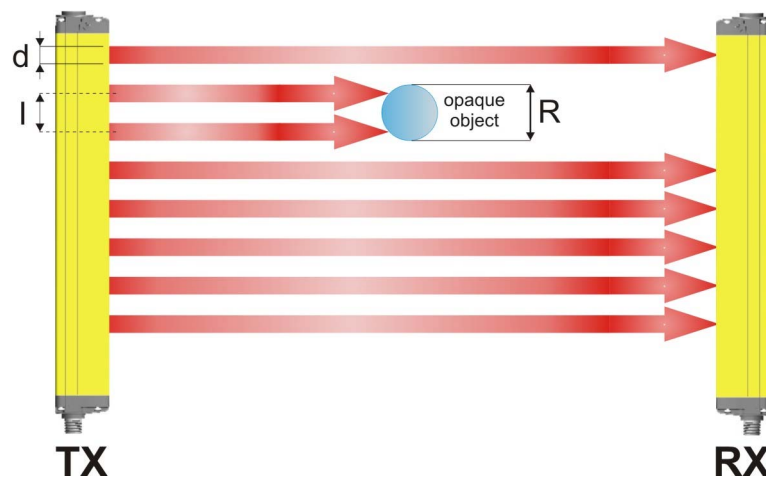


Fig 1 - Detection capability

The resolution value is obtained applying the following formula:

$$R = l + d$$

where:

l=Interaxes between two adjacent optics

d=Lens diameter

1.4.2 Height of the detection zone

The controlled height is the height protected by the safety light curtain.

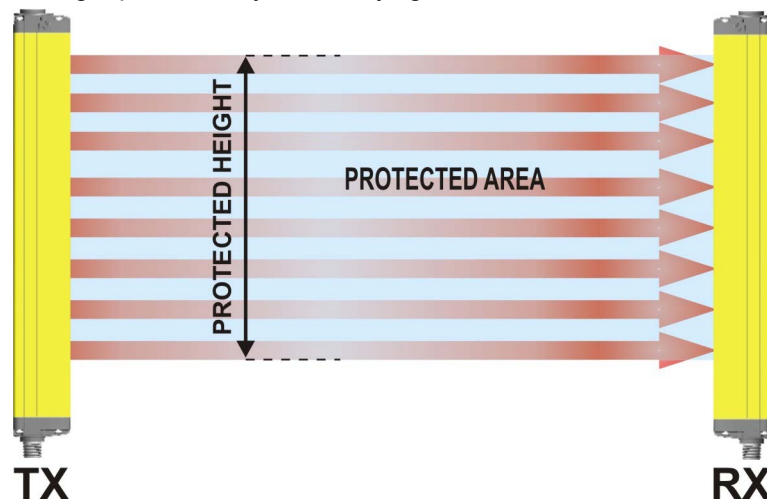
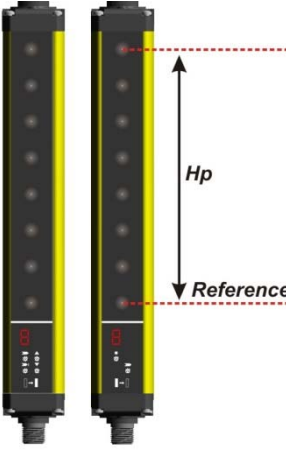


Fig 2 - Detection Zone

	Model 14mm	Model 30mm	Controlled height Hp (mm)
	SG4-14-015-OO-E/X	SG4-30-015-OO-E/X	150
	SG4-14-030-OO-E/X	SG4-30-030-OO-E/X	300
	SG4-14-045-OO-E/X	SG4-30-045-OO-E/X	450
	SG4-14-060-OO-E/X	SG4-30-060-OO-E/X	600
	SG4-14-075-OO-E/X	SG4-30-075-OO-E/X	750
	SG4-14-090-OO-E/X	SG4-30-090-OO-E/X	900
	SG4-14-105-OO-E/X	SG4-30-105-OO-E/X	1050
	SG4-14-120-OO-E/X	SG4-30-120-OO-E/X	1200
	SG4-14-135-OO-E/X	SG4-30-135-OO-E/X	1350
	SG4-14-150-OO-E/X	SG4-30-150-OO-E/X	1500
	SG4-14-165-OO-E/X	SG4-30-165-OO-E/X	1650
	SG4-14-180-OO-E/X	SG4-30-180-OO-E/X	1800

1.4.3 Minimum installation distance

The safety device must be positioned at a specific safety distance (**Fig 3 - page 11**).

This distance must ensure that the dangerous area cannot be reached before the dangerous motion of the machine has been stopped by the Safety Control System.

The safety distance depends on 4 factors, according to the EN ISO 13855 Standard:

- Response time of the ESPE (the time between the effective beam interruption and the opening of the OSSD contacts)
- Machine stopping time including Safety Control System computing and actuating time if present.
- ESPE resolution
- Approaching speed of the object to be detected

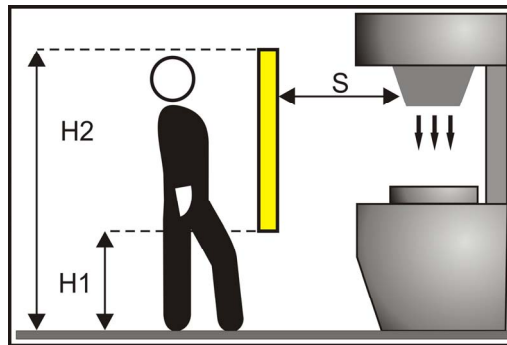


Fig 3 - Installation distance (vertical positioning)

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

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

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 cfr. **TECHNICAL DATA page 48**)
- t₂ = Machine stopping time in seconds (including the Safety Control System)
- C = Additional distance based on the possibility to insert the body or one of body parts inside the dangerous area before the protective device trips.
C=8 (R -14) for devices with resolution ≤ 40 mm
C=850 mm for devices with resolution > 40 mm
- R = Resolution of the system



K value is:

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

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

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

If the safety light curtain must be mounted in a horizontal position (**Fig 4 - page 12**) the distance between the dangerous area and the most distant optical beam must be equal to the value calculated using the following formula:

$$S = 1600 \text{ mm/s} (t_1 + t_2) + 1200 - 0,4 H$$

where:

- S = Minimum safety distance in mm.
- t1 = Response time of the ESPE in seconds (cfr. **TECHNICAL DATA page 48**)
- t2 = Machine stopping time in seconds (including the Safety Control System)
- H = Beam height from ground; this height must always be less than 1,000 mm.

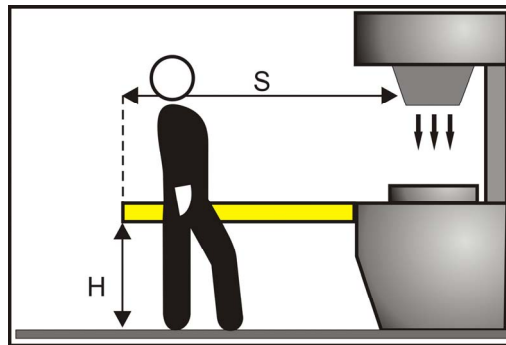


Fig 4 - Installation distance (horizontal positioning)

Practical examples

Let's suppose to have a light curtain with height = 600 mm

To calculate the distance of the device from the ESPE, in a vertical position, the following formula is used:

$$S = K \cdot T + C$$

where:

- S = Minimum safety distance in mm.
- t1 = ESPE response time
- t2 = Machine total stopping time (Including safety control system).
- T = (t1 + t2) Overall system stopping performance
- C = $8 * (R - 14)$ for devices with resolution ≤ 40 mm
- R = Resolution of the system

In all cases, if $K = 2000 \text{ mm/sec}$ then S will be > 500 mm.

Distance will have then to be recalculated using $K = 1600 \text{ mm/sec}$.

	SG4-14-060-OO-E/X	SG4-30-030-OO-E/X
T	0.393 sec	0.394 sec
C	0 mm	128 mm
S	641.6 mm	758.4 mm



The reference standard is EN ISO 13855 "Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body".
The following information is to be considered as indicative and concise.
For correct safety distance please refer to complete standard EN ISO 13855.

1.5 TYPICAL APPLICATIONS

Example 1: Operating point protection on drilling machines

The operator positions the part and takes it back after machining. The operator must be protected against possible abrasions while working.

Solution: SG 14mm safety light curtain is especially suitable for this kind of application, which requires the installation of the device directly on the machine.

Advantages: Highly reduced profile size guarantees installation flexibility for machine dimensions.



Fig 5 - Operating point protection on drilling machines

Example 2: Bending presses

The safety device must protect the operator from being squashed between the top and bottom tool or the machined part during the fast approach phase.

Solution: If only one beam of the safety light curtain is darkened while the press is moving down, the mobile tool bar will stop.

Advantages: The safety light curtain can be used in most bending operations thanks to its easy installation and compact dimensions.

As well as offering excellent reliability, SG ensures increased plant productivity as it reduces the dead times necessary for machine accessing, adjustment and maintenance.



Fig 6 - Bending presses

Example 3: Paper cutting machines

These machines typically cut paper to a specific size for newspapers or special applications. The operator must be protected against abrasion or cuts by cutter blades.

Solution: SG 30mm safety light curtain is especially suitable for this kind of application, which require the installation of the device directly on the machine.

Advantages: Highly reduced profile and the two side slots ensure installation flexibility for machine dimensions.



Fig 7 - Paper cutting machines

Example 4: Milling machines

A milling machine is a machine tool used for the shaping of metals and other solid materials. Operator hands and body must be protected from being dragged, entangled or cut by the tool / spindle.

Solution: SG 30mm safety light curtain is the best solution considering the required safety levels and application type. When even just one of the light curtain beams is interrupted, the machine is immediately stopped.

Advantages: Highly reduced profile size guarantees installation flexibility for machine dimensions.

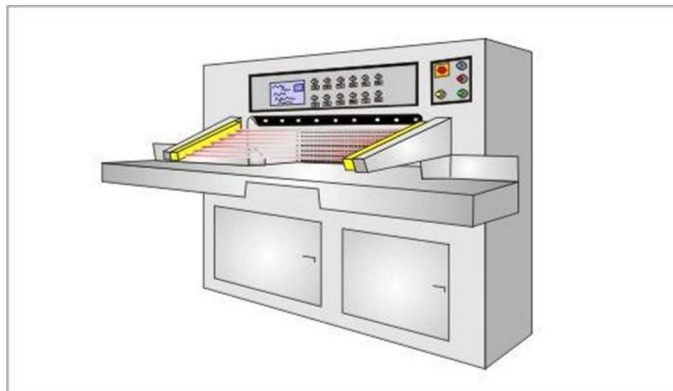


Fig 8 - Milling machines

1.6 SAFETY INFORMATION



For a correct and safe use of the safety light curtains, the following points must be observed:

- 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 **Minimum installation distance page 11** 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 **INSTALLATION page 16**, **MECHANICAL MOUNTING page 25**, **ELECTRICAL CONNECTIONS page 26**, **ALIGNMENT PROCEDURE page 32**) 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 **INSTALLATION page 16**).
- 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.

Only for models SG4-xx-xxx-OO-E:

- 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.



Please carefully read the instructions for the correct functioning before powering the light curtain on.

2 INSTALLATION

2.1 PRECAUTIONS TO BE OBSERVED FOR THE CHOICE AND INSTALLATION



Make sure that the protection level assured by the light curtain device is compatible with the real danger level of the machine to be controlled, according to EN ISO 13849-1: 2015 or EN 62061:2005/A2: 2015.

- Use only matched emitter and receiver pairs with same serial no.
- 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 an environment complying with the characteristics indicated in **TECHNICAL DATA page 48**.
- The ESPE must not be installed close to strong and/or flashing light sources, in particular close to the front window of receiving unit.
- The presence of intense electromagnetic disturbances could affect device's correct operation.
- This condition shall be carefully assessed with the advice of DATASENSING 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 thus jeopardize correct operation.

2.2 GENERAL INFORMATION ON DEVICE POSITIONING

The safety light curtain should be carefully positioned in order to provide the necessary protection. Access to the dangerous area must only be possible by passing through the protecting safety light beams.



Fig 9 - page 17 shows some examples of possible access to the machine from the top and the bottom sides. These situations may be very dangerous and so the installation of the safety light curtain at sufficient height in order to completely cover the access to the dangerous area (Fig 10 - page 17) becomes necessary.

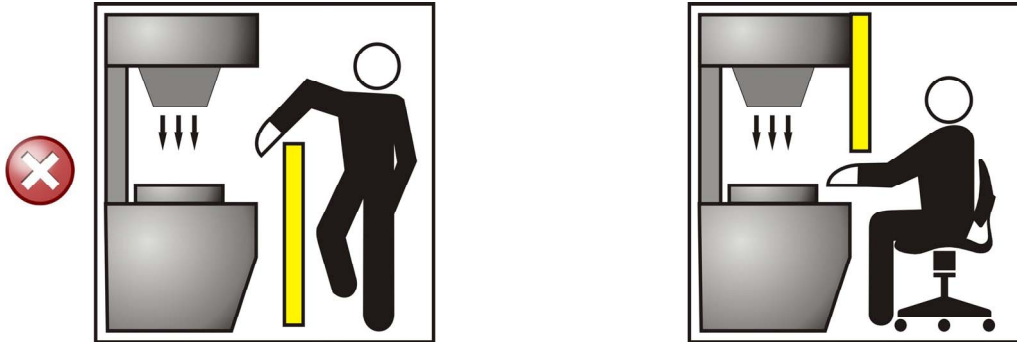


Fig 9 - Wrong light curtain positioning

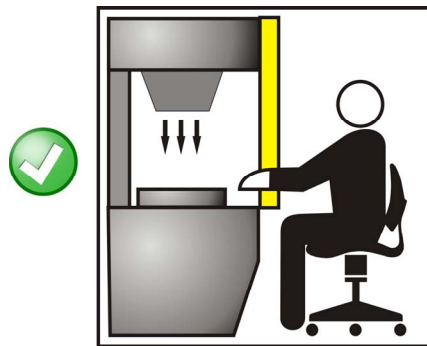


Fig 10 - Correct light curtain positioning



If the operator is able to enter in the dangerous area, an additional mechanical protection must be mounted to prevent the access.

Under standard operating conditions, machine starting must not be possible while operators are inside the dangerous area.

Where it is not possible to install safety light curtain very near to the dangerous zone, a second light curtain must be mounted in a horizontal position in order to prevent any lateral access, as shown in Fig 12 - page 17.

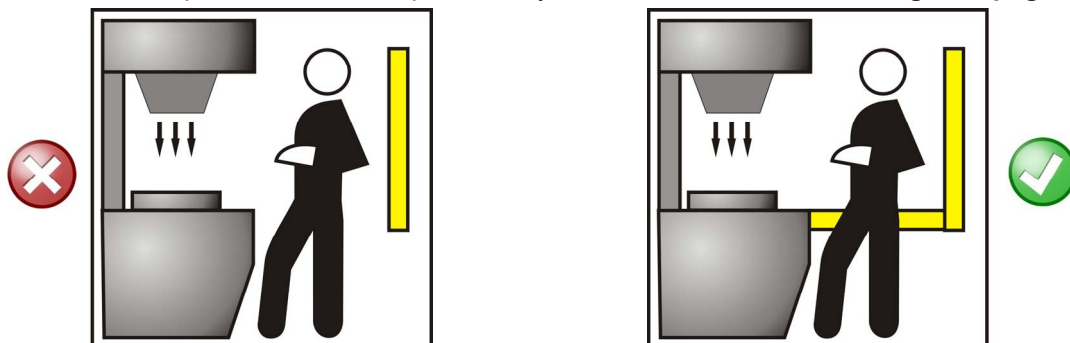


Fig 11 - Wrong light curtain positioning

Fig 12 - Correct light curtain positioning

2.2.1 Minimum distance from reflecting surfaces

Reflecting surfaces placed near the light beams of the safety device (over, under or laterally) can cause passive reflections. These reflections can affect the recognition of an object inside the controlled area. Moreover, 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.

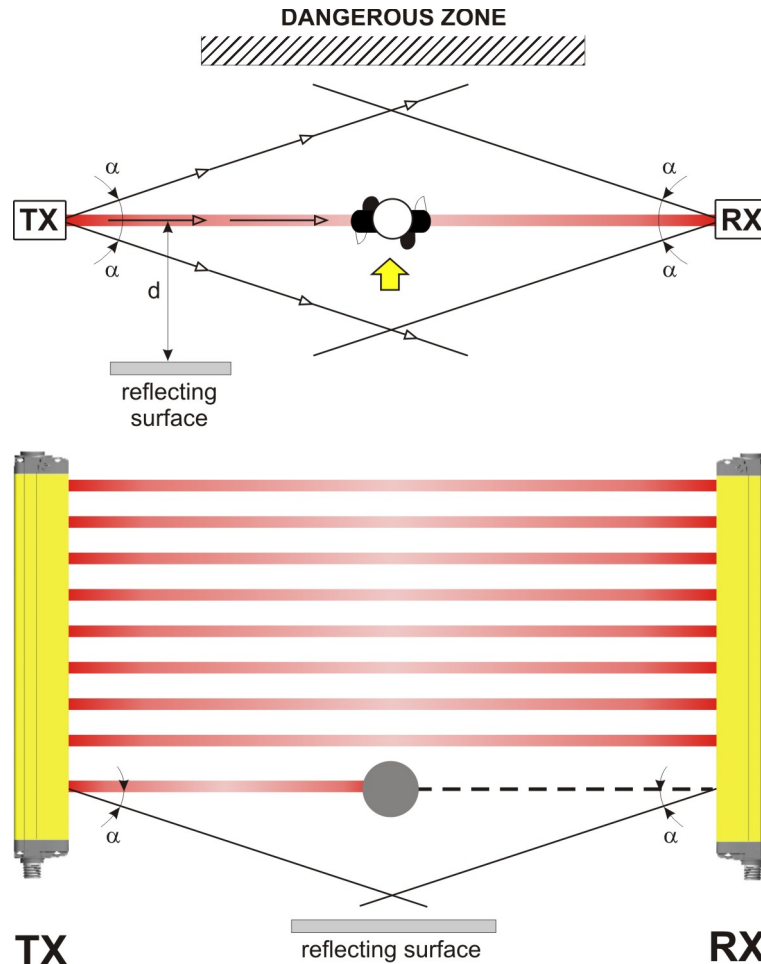


Fig 13 - Distance from reflecting surfaces

It is 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° ($\alpha = \pm 2.5^\circ$)

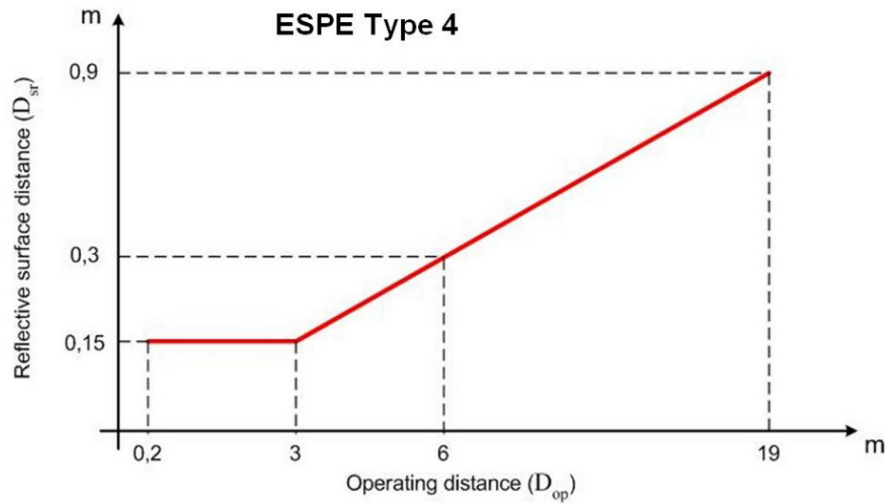


Fig 14 - Minimum distance from reflective surface

The formula to get D_{sr} is the following:

For ESPE Type 4:

$D_{sr} \text{ (m)} = 0.13$ for operating distance < 3 m

$D_{sr} \text{ (m)} = 0.5 \times \text{operating distance (m)} \times \tan 2\alpha$ for operating distance ≥ 3 m

2.2.2 Distance between homologous devices

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

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 TXB interfering device must be positioned outside a minimum D_{do} distance from the TXA – RXA emitter-receiver couple axis.

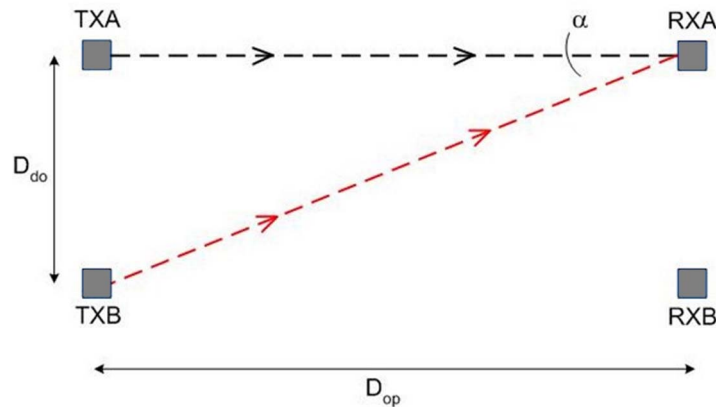


Fig 15 - Distance between homologous devices

This minimum D_{do} distance depends on:

- the operating distance between emitter (TXA) and receiver (RXA)
- the effective aperture angle of the ESPE (EAA)

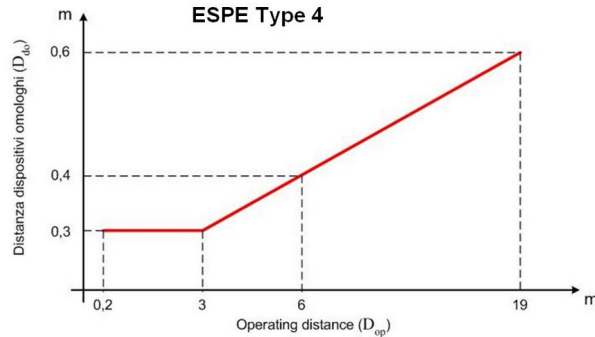


Fig 16 - ESPE Type4

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	0,3
6	0,4
10	0,5
19	0,6



The interfering device (TXB) must be positioned at the same D_{do} distance, calculated as shown above, even if closer to TXA respect to RXA. 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.

The figure provides two examples:

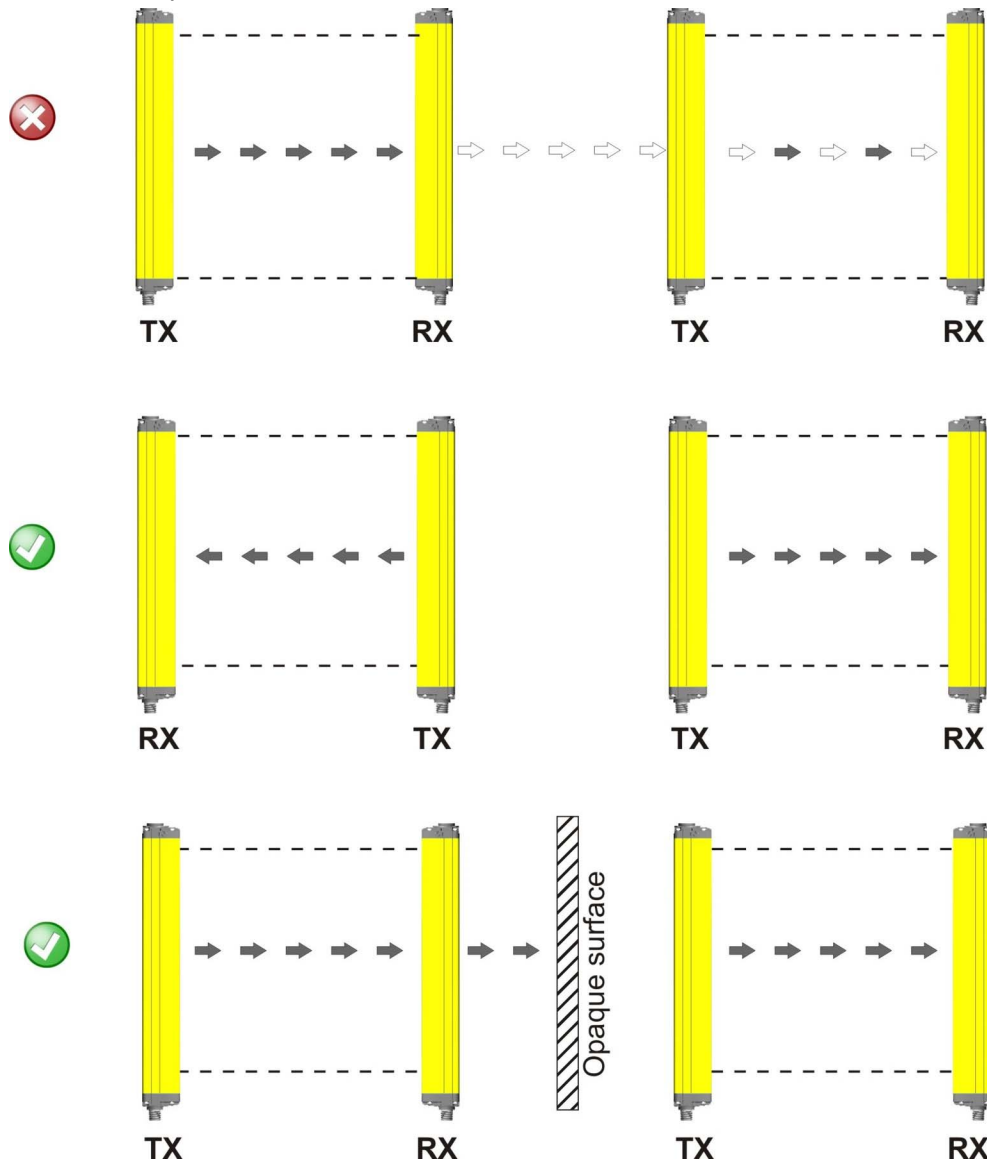


Fig 17 - Recommended positioning for homologous devices



If two light curtains have to be mounted near each other as reported in the first example of Fig 17 - page 21.

2.2.3 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 pointing to the same direction.

The configurations shown in the figure must be avoided:

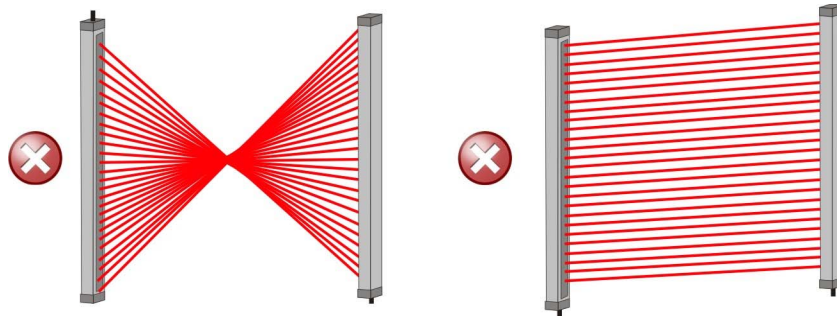


Fig 18 - Wrong light curtain TX-RX orientations

2.2.4 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.

The figure shows a possible solution to control two different access sides, using one mirror placed at 45° with respect to the beams.

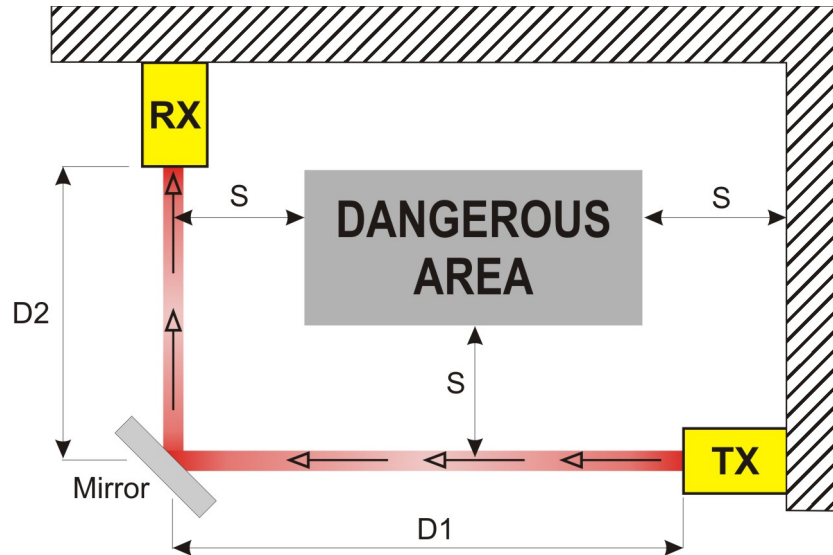


Fig 19 - Use of deviating mirrors

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 very small displacements of the mirror is enough to lose alignment.
- The use of DATASENSING laser pointer accessory is recommended under these conditions.
- The minimum safety distance (S) must be respected for each single section of the beams.
- The effective operating range decreases by about 20% by using only one deviating mirror.

The following table shows estimated operating distances relating to the number of mirrors used.

Number of mirrors	Operating Distance (14mm)	Operating Distance (30mm)
0	6.0 m	19 m
1	4.8 m	15.2 m

- The presence of dust or dirt on the reflecting surface of the mirror causes a drastic reduction in the range.

2.2.5 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 (➡ lit RED) intercepting the beams along the protected area using the specific test piece, following the scheme in **Fig 20 - page 24**.

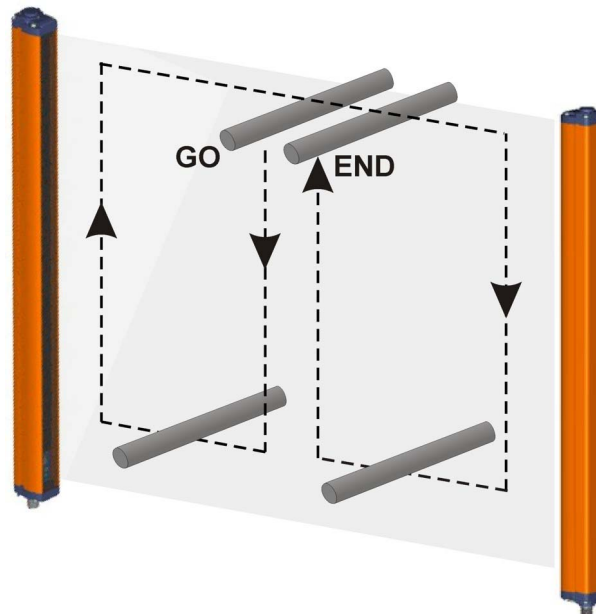


Fig 20 - Path of the test piece

TP-14 for light curtains with 14 mm resolution:SG4-14-xx-x

TP-30 for light curtains with 30 mm resolution:SG4-30-xx-x

- ESPE has to be correctly aligned, press slightly on the product side in both directions the red LED must not turn on ➡ I.
- 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 cfr. **INSTALLATION page 16**).
- The safety distance between the dangerous parts and ESPE must comply with the requirements indicated in cfr. **INSTALLATION page 16**).
- 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.



Only for SG4-xx-xxx-OO-E models:

The activation of the TEST function causes the opening of the OSSD outputs (red LED ➡ I on and controlled machine stop).

3 MECHANICAL MOUNTING

The emitting (TX) and receiving (RX) units 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 cfr. **TECHNICAL DATA** page 48).

The two units shall be positioned so as to be aligned and parallel as much as possible. The next step is the fine alignment, as shown in chapter **ALIGNMENT PROCEDURE** page 32.

Two types of brackets can be used to fix the two units:
Angled fixing brackets are supplied with all models (**Fig 21 - page 25**).

Adjustable supports for correcting unit inclination on the axes are available on request (see cfr. **ACCESSORIES** page 53).

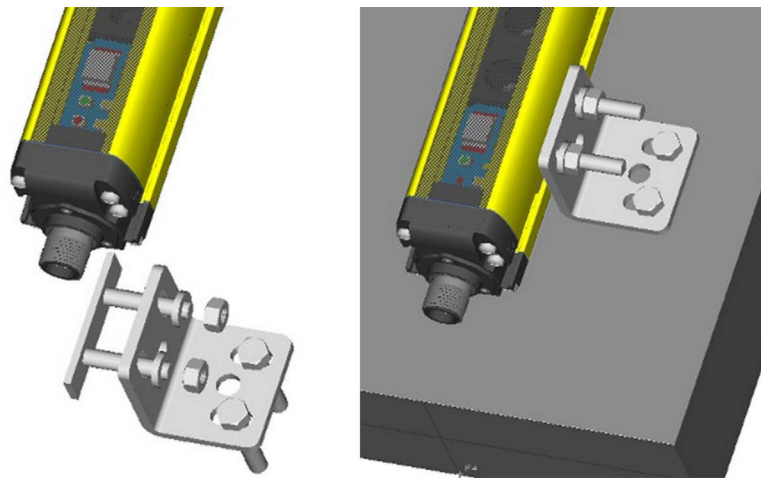


Fig 21 - Angle brackets

Rotating brackets (**Fig 22 - page 25**), available upon request, can be used as an alternative or together with angled brackets.

For fixing with rotating bracket, refer to **Fig 23 - page 26**.

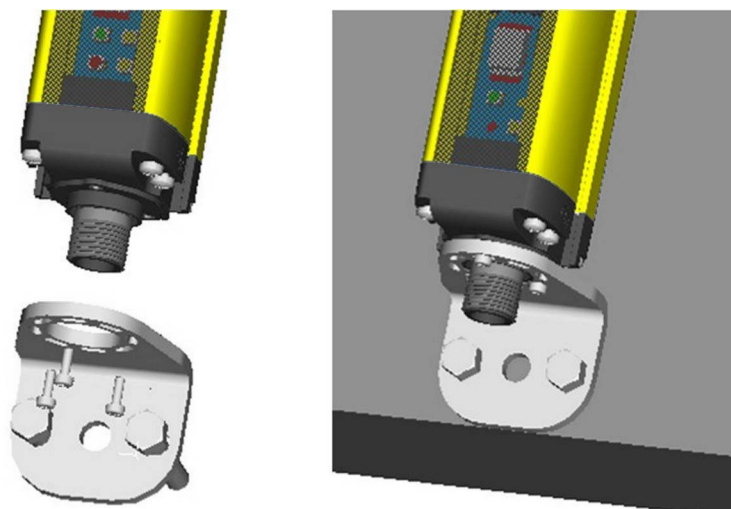


Fig 22 - Rotating brackets

Anti-vibration shock absorbers together with fixing brackets are recommended in applications with particularly strong vibrations to reduce the impact of the vibrations.

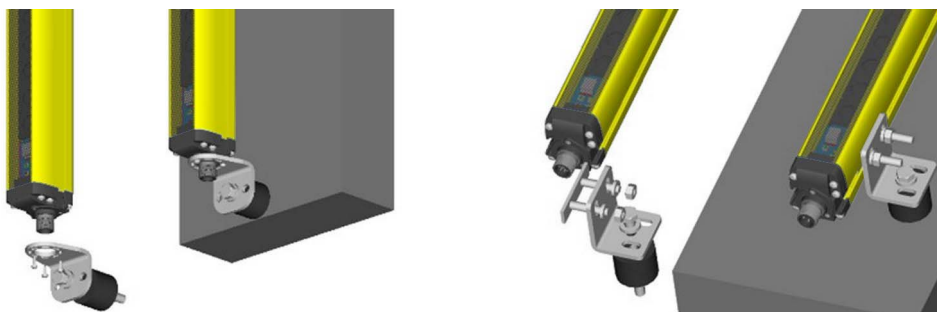


Fig 23 - Fixing brackets

Fig 23 - page 26 and table below show the recommended mounting positions according to the safety light curtain length.

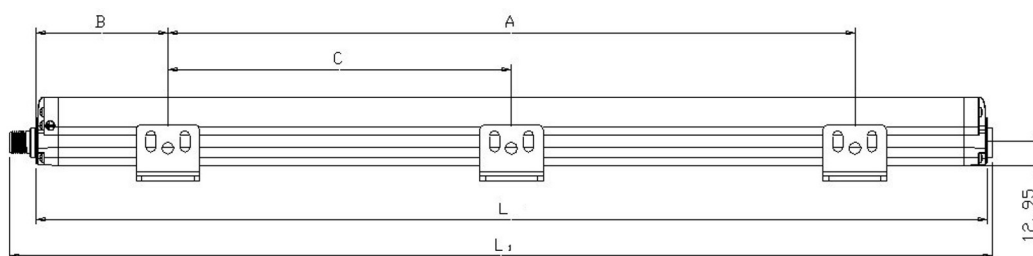


Fig 24 - Dimensions (mm)

VERSION	L (mm)	A (mm)	B (mm)	C (mm)
015	216.3	108	54	-
030	366.2	216	75	-
045	516.3	316	100	-
060	666.2	366	150	-
075	816.3	466	175	-
090	966.2	566	200	-
105	1116.2	666	225	-
120	1266.3	966	150	483
135	1416.2	1066	175	533
150	1566.3	1166	200	583
165	1716.3	1266	225	633
180	1866.3	1366	250	683

4 ELECTRICAL CONNECTIONS

4.1 PIN-OUT AND CONFIGURATION PIN CONNECTION

4.1.1 MODELS SG4-xx-xxx-OO-X

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 5-poles connector is used, while for emitter a M12 4-poles connector is used.

RECEIVER (RX):

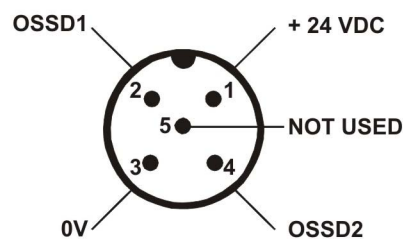


Fig 25 - Receiver

1 =	brown	= +24 VDC
2 =	white	= OSSD1
3 =	blue	= 0 V
4 =	black	= OSSD2
5 =	grey	= NOT USED

EMITTER (TX):

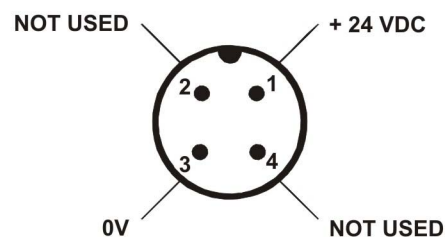


Fig 26 - Emitter

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

4.1.2 MODELS SG4-xx-xxx-OO-E

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 8-pole connector is used, while for emitter a M12 4-pole connector is used.

RECEIVER (RX):

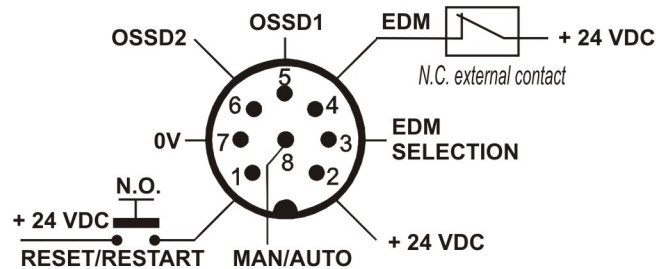


Fig 27 - Receiver

1 =	white	= RESET/RESTART (*)
2 =	brown	= +24 VDC
3 =	green	= EDM SELECTION
4 =	yellow	= EDM
5 =	grey	= OSSD1
6 =	pink	= OSSD2
7 =	blue	= 0 V
8 =	red	= MANUAL/AUTOMATIC RESTART

(*) *automatic RESTART --> RESET function*
manual RESTART --> RESET / RESTART function

To set manual restart, connect Pin 8 (MAN/AUTO) with Pin 6 (OSSD2).

To set automatic restart, connect Pin 8 (MAN/AUTO) with Pin 5 (OSSD1).

To deactivate EDM function, connect Rx Pin 3 to 24VDC on Receiver.

EMITTER (TX):

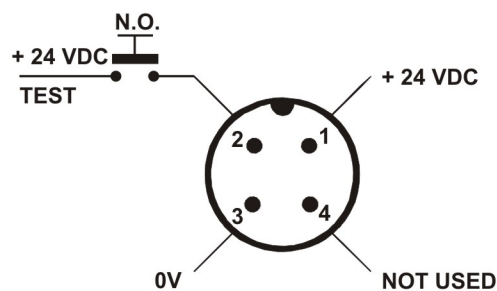


Fig 28 - Emitter

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

Function	Connection to	Status
TEST	+24 VDC Not connected or 0V	TEST ON TEST OFF
RESET	+24 VDC Not connected or 0V	RESET ON RESET OFF
SELECT RANGE	+24 VDC Not connected or 0V	SHORT (9 m) LONG (19 m)
EDM	Normally closed contact for a force-guided relay	-
ENABLE EDM	+24 VDC Not connected or 0V	EDM OFF EDM ON
MAN/AUTO RESTART SELECTION	OSSD1 OSSD2	AUTOMATIC RESTART MANUAL RESTART

4.2 NOTES ON CONNECTIONS

For the correct operation of the safety light curtains, the following precautions regarding the electrical connections have to be respected:

- Do not place connection cables in contact with or near high-voltage cables and/or cable undergoing high current variations (e.g. motor power supplies, inverters, etc.).
- Do not connect in the same multi-pole cable the OSSD wires of different light curtains.

Only for SG4-xx-xxx-OO-E models:

- The TEST wire must be connected through a N.O. button to the supply voltage of the ESPE.
- The RESET/RESTART wire must be connected through a N.O. button to the supply voltage of the ESPE.



The TEST button must be located in such a way that the operator can check the protected area during any test (see cfr. FUNCTION SETTING page 35).

The RESET/RESTART button must be located in such a way that the operator can check the protected area during any reset operation (see cfr. FUNCTION SETTING page 35).

- The device is already equipped with internal overvoltage and overcurrent suppression devices.
- The use of other external components is not recommended.

Example: connection to the safety relay SE-SR2

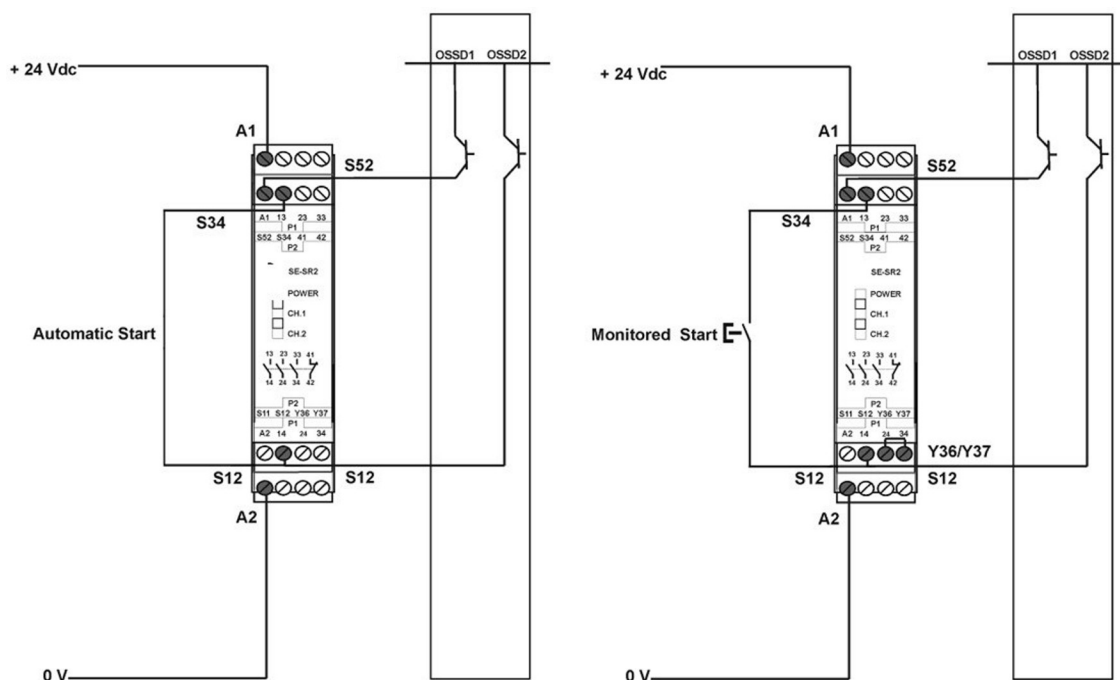


Fig 29 - Connection to SE-SR2 Safety Relays

The figures show the connection between the safety light curtains and the safety relay of the SE-SR2 series functioning in the Automatic Restart mode (left side) and Manual Restart with monitoring (right side).

- Do not use varistors, RC circuits or LEDs in parallel at relay inputs or in series at OSSD outputs.
- The OSSD1 and OSSD2 safety contacts cannot be connected in series or in parallel, but can be used separately, conforming to the plant's safety requirements.
- If one of these configurations is erroneously used, the device enters into the output failure condition (see cfr. **USER INTERFACE AND DIAGNOSTICS page 41**).

- Connect both OSSDs to the device to control.
- Failure to connect an OSSD to the activating device jeopardizes the system safety degree that the light curtain has to control.

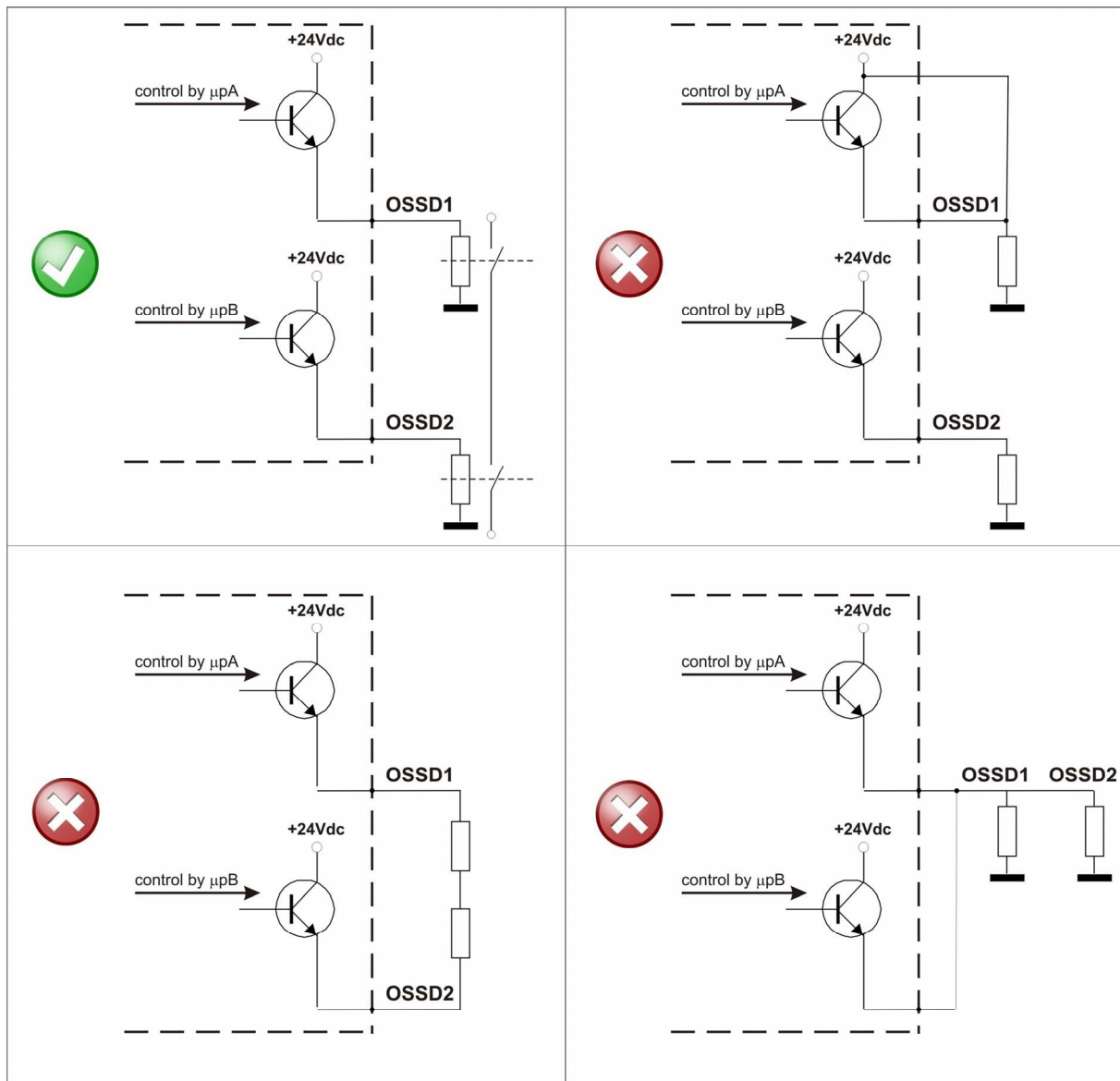


Fig 30 - OSSDs connection

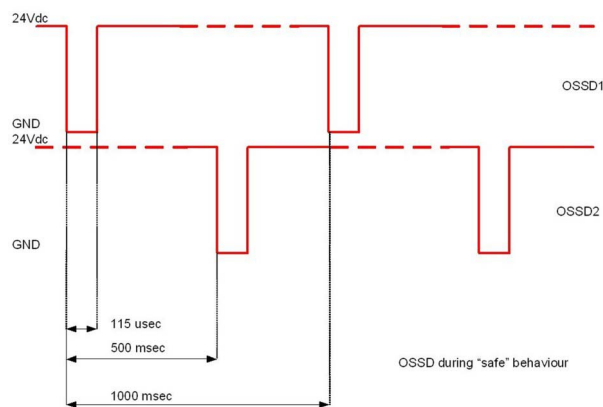


Fig 31 - Behaviour of OSSDs

4.3 EARTH CONNECTION

Safety light curtain units are preset for easy ground connection. A special compartment, positioned onto caps and marked with the special symbol shown in **Fig 32 - page 32**, allows connection with ground cable by means of an additional screw coming with the equipment.

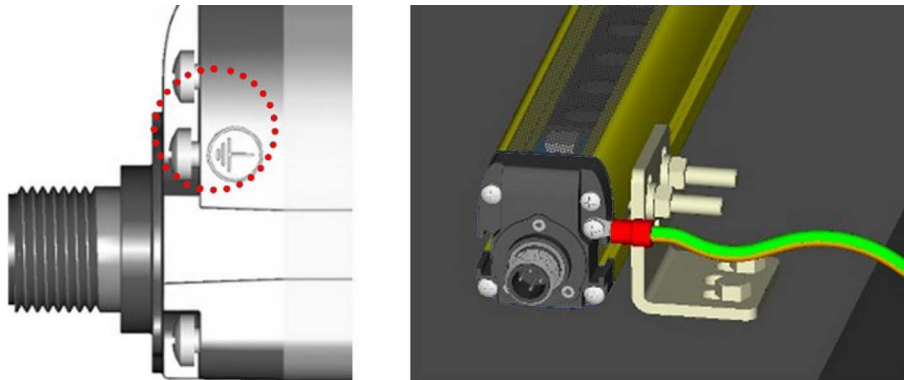


Fig 32 - Ground connection configuration

Ground connection configuration is the most common and guarantees the best immunity against electromagnetic disturbances. Safety light curtain can function even without ground connection.

This condition has to be carefully evaluated according to the EMC disturbance immunity and necessary insulation class considering the plant or entire system where the light curtain is installed.

- The ground connection of the two units is not necessary for Class III, while the use of a duly-insulated low-voltage feeder type SELV or PELV is compulsory. In this case, we recommend covering the earth symbol present on the caps of the two units with a blank sticker.
- The ground connection of the two units is compulsory for Class I, while the use of a duly-insulated feeder type SELV or PELV is not compulsory but anyway recommended.

The following table is a summary of SG2-E electrical protections.

Electrical protections	Class I	Class III
Ground Connection	Compulsory	Not necessary
Ground connection symbol	Compulsory	Not necessary
Power supply by generators SELV / PELV	Recommended	Compulsory

5 ALIGNMENT PROCEDURE

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

A good alignment prevents outputs instability caused by dust or vibrations.

The alignment is perfect if the optical axes of the first and the last emitting unit's beams coincide with the optical axes of the corresponding elements of the receiving unit.

The beam used to synchronise the two units is the first after the connector.

SYNC is the optics connected with this beam and LAST is the optics connected to the last beam after the SYNC unit.

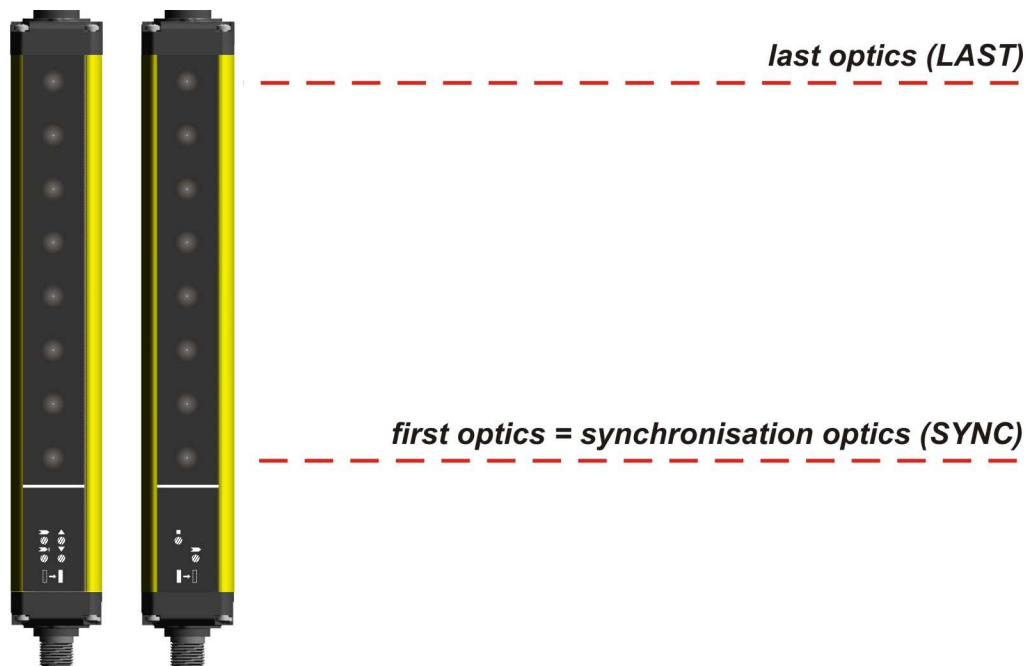


Fig 33 -

Signals are clearly identified through symbols allowing immediate reading, independent of bars directions. A short description of the signalling LEDs is necessary to avoid misunderstandings.

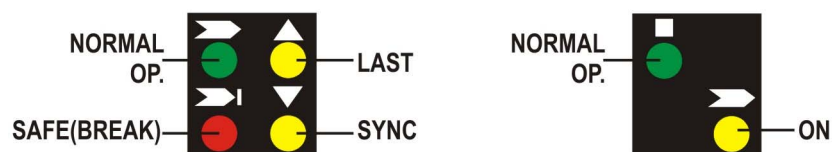


Fig 34 - Receiver & Emitter

5.1 CORRECT ALIGNMENT PROCEDURE

The light curtain alignment can be effected only after having completed the mechanical installation and the electrical connections as described above.

Compare alignment results with those given in the following table:

SG4-xx-xxx-00-X:

Display	LED  NORMAL OP.	LED  SAFE (BREAK)	Condition	Alignment status
	ON	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 25 and 50%	
	ON	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 50 and 75%	
	ON	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 75 and 100%	MAXIMUM



Ensure that the green LED ( NORMAL OP.) is steady ON.

- Delimit the area in which the green LED () is steady through some micro adjustments - for the first and then for the second unit - so to have the maximum alignment (4) and then place both units in the centre of this area.
- Fix the two units firmly using brackets. Verify that the green LED () on the RX unit is ON and beams are not interrupted, then verify that the red LED SAFE (BREAK)  turns ON if even one single beam is interrupted (condition where an object has been detected). This verification shall be made with the special cylindrical "Test Piece" having a size suitable to the resolution of the device used (refer cfr. **Controls after first installation page 23**).
- Switch OFF and ON the device in normal operating mode.

The alignment level is monitored also during device standard operating mode via display (see cfr. **Diagnostic messages page 41**)

Once the curtain has been aligned and correctly fastened, the display signal is useful both to check the alignment and show a change in the environmental conditions (occurrence of dust, light disturbance and so on) via signal level monitoring.

SG4-xx-xxx-00-E:

Display	LED  NORMAL OP.	LED  SAFE (BREAK)	LED yellow  SYNC	LED yellow  LAST	Condition	Alignment status
	OFF	ON	ON	ON	SYNC NOK LAST NOK SYNC OK LAST NOK	Not aligned
	OFF	ON	OFF	ON	SYNC OK LAST OK	Not aligned
	OFF	ON	OFF	OFF	MIDDLE OPTICS NOK	Not aligned
	ON	OFF	OFF	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 0 and 25%	MINIMUM align.
	ON	OFF	OFF	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 25 and 50%	-
	ON	OFF	OFF	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 50 and 75%	-
	ON	OFF	OFF	OFF	Each beam is over the min. operating threshold and the number of beam over the threshold is included between 75 and 100%	MAXIMUM align.

- Keep the receiver in a steady position and set the emitter until the yellow LED ( SYNC) is OFF. This condition shows the alignment of the first synchronisation beam.
- Rotate the emitter, pivoting on the lower optics axis, until the yellow LED ( LAST) is OFF.



Ensure that the green LED ( NORMAL OP.) is steady ON.

- Delimit the area in which the green LED () is steady through some micro adjustments - for the first and then for the second unit - so to have the maximum alignment (4) and then place both units in the centre of this area.
- Fix the two units firmly using brackets. Verify that the green LED () on the RX unit is ON and beams are not interrupted, then verify that the red LED SAFE (BREAK)  turns ON if even one single beam is interrupted (condition where an object has been detected). This verification shall be made with the special cylindrical "Test Piece" having a size suitable to the resolution of the device used (refer cfr. **Controls after first installation page 23**).
- Switch OFF and ON the device in normal operating mode.

The alignment level is monitored also during device standard operating mode via display (cfr. **USER INTERFACE AND DIAGNOSTICS page 41**).

Once the curtain has been aligned and correctly fastened, the display signal is useful both to check the alignment and show a change in the environmental conditions (occurrence of dust, light disturbance and so on) via signal level monitoring.

6 FUNCTIONS SETTING

6.1 RESET MODE

SG4-xx-xxx-OO-E models:

The interruption of a beam due to an opaque object causes the opening of OSSD outputs and the stop of the safety light curtain SAFE (BREAK) ➡ I condition.



Carefully assess risk conditions and reset modes.

In applications protecting access to dangerous areas, the automatic reset mode is potentially unsafe if it allows the operator to pass completely beyond the sensitive area (see Fig 12 - page 17).

In this case, the reset, using for example the manual reset of the SE-SR2 relay, (cfr. Notes on connections page Errore. Il segnalibro non è definito. might be necessary.

ESPE standard operation can be reset (OSSD safety contact closing = NORMAL OP. condition ➡) in two different ways:

- **Automatic restart** - After its activation ESPE resets to standard operating condition once the object has been removed from the controlled area.
- **Manual restart** - After its activation ESPE resets to standard operating condition only once the reset function has been enabled and provided that the object has been removed from the controlled area. This condition, called interlock, is signalled on the display (see cfr. **USER INTERFACE AND DIAGNOSTICS** page 41).

Time chart (Manual Restart)

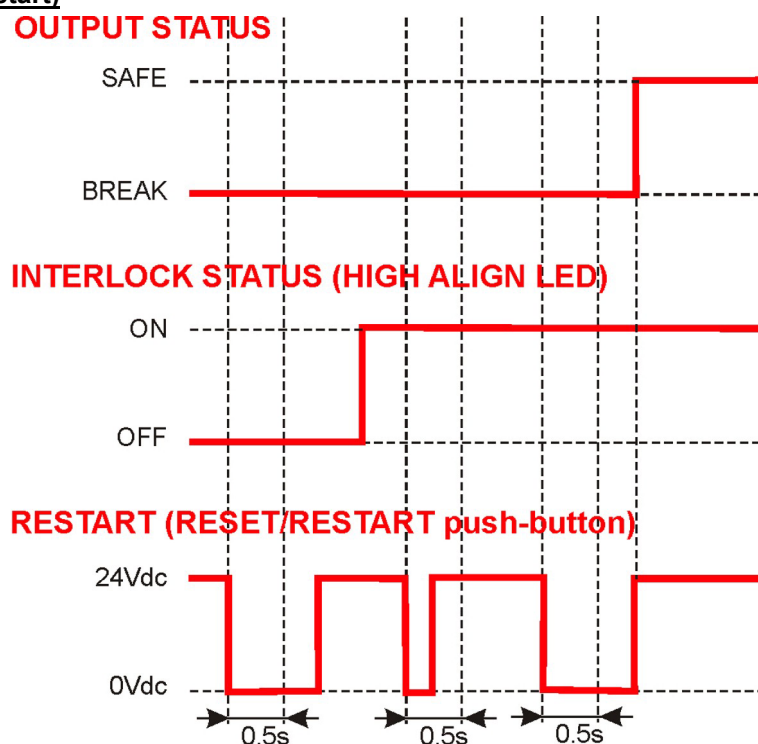


Fig 35 - Time chart (Manual Restart)

The automatic or manual restart can be selected by connecting the receiver (see cfr. **ELECTRICAL CONNECTIONS** page 26).

7 FUNCTIONS

This chapter deals with all the functions of the light curtain.

7.1 TEST

The TEST function can be activated by keeping a normally open external contact (TEST push-button), open for at least 0.5 seconds.

The TEST signal is active high.

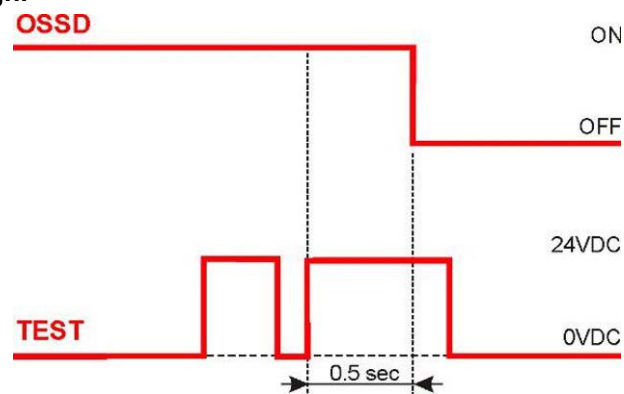


Fig 36 - Test timings

7.2 RESET

The RX light curtain has a RESET function which is activated after an internal error.

The reset can be made only in case of optical error, OSSD error EDM or manual/automatic restart selection (see cfr. **USER INTERFACE AND DIAGNOSTICS page 41**).

The RESET function can be activated by keeping a normally open external contact (RESET/RESTART push-button), open for at least 5 seconds.

The RESET signal is active high.

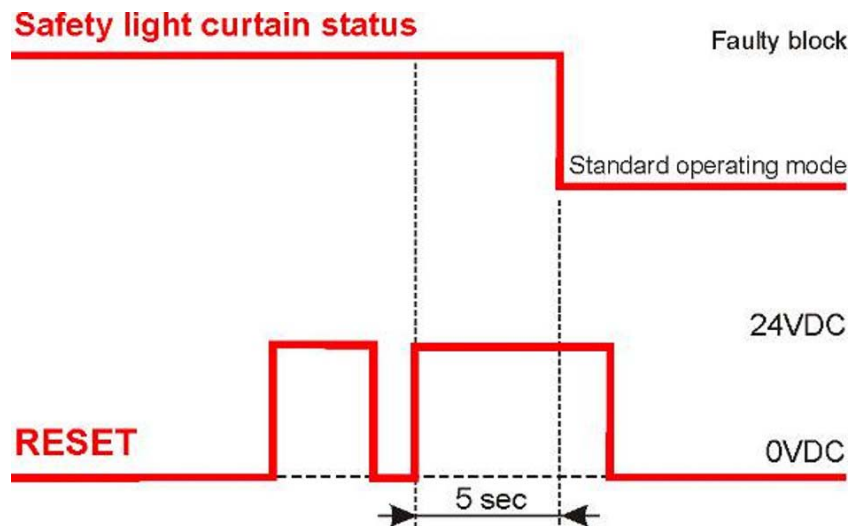


Fig 37 - Reset timings

7.3 EDM

The light curtain has a function for monitoring actuation external devices (EDM). This function can be enabled or deactivated.

EDM enabled:

- Disconnect or connect to the ground pin 3 of receiver M12 8-pole connector (EDM enabling = ON).
- Connect EDM input (pin 4 of M12 8-pole - RX) to a 24 VDC normally closed contacts of the device to be monitored.

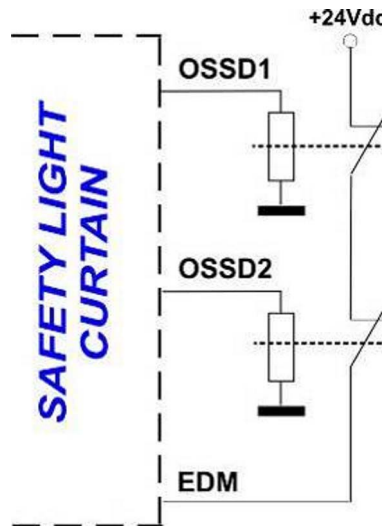


Fig 38 -



The decimal dot on the display shows that the function is enabled.

EDM deactivated:

- Connect to 24 VDC pin 3 of receiver M12 8-pole connector (EDM enabling = OFF).
- Disconnect or connect to the ground EDM input (pin 4 of M12 8-pole - RX).

This function checks normally closed contact switch on OSSD status change.

OSSD STATUS

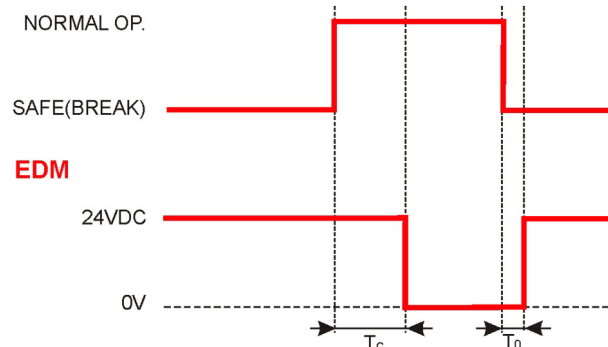


Fig 39 - OSSD status

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

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

7.4 ALIGNMENT AID FUNCTION

Light curtain is equipped with a system which informs the operator on the alignment obtained.

The alignment function can be activated when powering the device, by keeping the normally open RESET/RESTART contact closed for at least 0.5 seconds (see Fig 30 - page 31).

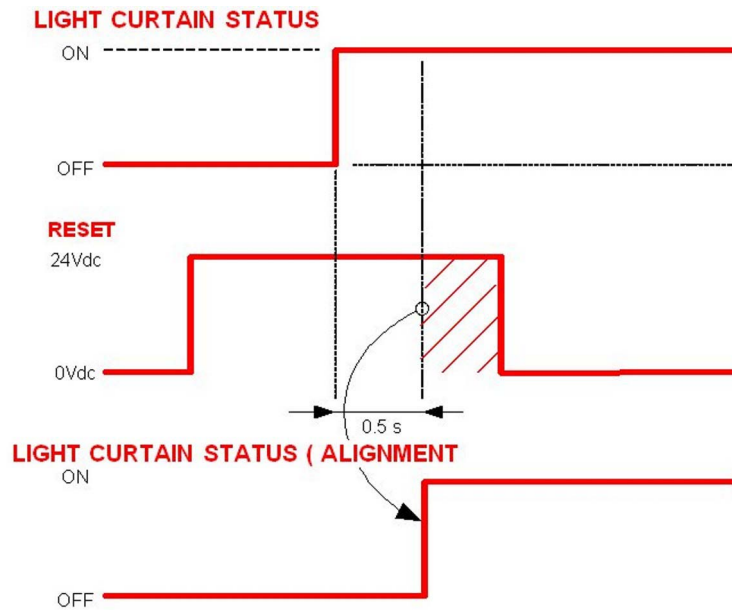


Fig 40 -

When the best alignment has been reached, restart the device to return to the standard operating mode, by powering off and on again the Rx unit.



The alignment level is monitored also during device standard operating mode via display (see cfr. USER INTERFACE AND DIAGNOSTICS page 41).

Once the curtain has been aligned and correctly fastened, the display signal is useful both to check the alignment and show any changes in the environmental conditions (occurrence of dust, light disturbance and so on).



OSSDs are not active on the alignment mode.

8 USER INTERFACE AND DIAGNOSTICS

8.1 USER INTERFACE

Curtain operating status is displayed onto a 1-digit display both on receiver and emitter.

Light curtain also has four LEDs on the receiver and two LEDs on the emitter.

Fig 41 - page 41 shows all signalling LEDs modes: OFF, ON and BLINKING.

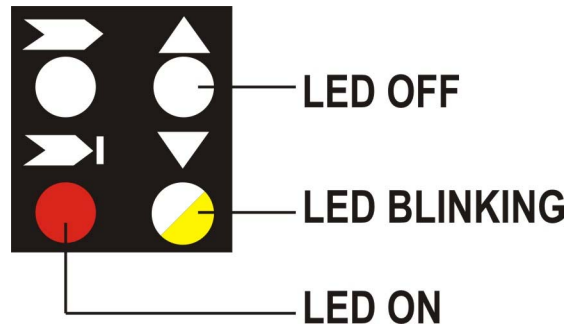


Fig 41 - Signalling LEDs

8.2 DIAGNOSTIC MESSAGES

The operator can evaluate the main causes of the system stop or failure through the display and signalling LEDs.

Diagnostic messages SG4-xx-xxx-OO-X models

For Receiver:

Function	State	Meaning	LED	DIGIT
Normal operation	Emission (OSSD ON) (green ON)	Light curtain working in normal operating conditions		
	Interruption (OSSD OFF) (red ON)	Light curtain working in safety block conditions.		
	Signal level	Minimum (1 bar) Medium (2 bar) Maximum (3 bar)		
Function	Type	Check and repair	LED	DIGIT
Error status	OSSD error (red ON)	Check OSSD connections. Make sure that they are not in contact with one another or with the supply cables, then Reset. If the failure continues contact DATASENSING.		
	Internal error (red ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		
	Optical error (red ON)	Reset. If the failure continues contact DATASENSING.		

For Emitter:

Function	State	Meaning	LED	DIGIT
Normal operation	Emission (green ON yellow ON)	Light curtain in normal operating condition		
Function	Type	Check and repair	LED	DIGIT
Error status	Internal error I (green ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		
	Optical error (green ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		
	No power supply (LEDs OFF)	Check connections and input voltage correct value. If the failure continues contact DATASENSING.		

Diagnostic messages SG4-xx-xxx-OO-E models

For Receiver:

Function	State	Meaning	LED	DIGIT
Normal operation	Alignment	See ALIGNMENT PROCEDURE page 32		A
	TEST (red ON)	Light curtain being tested. OSSD status shall be OFF		8
	Emission (OSSD ON) (green ON)	Light curtain working in normal operating conditions		8
	Interruption (OSSD OFF) (red ON)	Light curtain working in safety block conditions.		8
	Interlock Beams free (red ON yellow ON)	Light curtain in interlock, waiting for restart. OSSD status must be OFF		1
	Interlock Beams interrupted (red ON yellow ON)	Light curtain in interlock. OSSD status must be OFF		8
	Signal level	Minimum (1 bar) Medium (2 bar) Maximum (3 bar)		≡
	EDM enabled	EDM function is selected	-	8.
Function	Type	Check and repair	LED	DIGIT
Error status	OSSD error (red ON)	Check OSSD connections. Make sure that they are not in contact with one another or with the supply cables, then Reset. If the failure continues contact DATASENSING.		F0
	Internal error (red ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		FU
	Optical error (red ON)	Reset. If the failure continues contact DATASENSING.		Fb
	EDM error (red ON)	Check EDM connections and lines. If the failure continues contact DATASENSING.		FE
	Restart selection error (red ON)	Check the man/auto restart connection. If the failure continues contact DATASENSING.		Fr

	No power supply (LEDs OFF)	Check connections and input voltage value. If the failure continues contact DATASENSING.		
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For Emitter:

Function	State	Meaning	LED	DIGIT
Normal operation	TEST (green ON)	Light curtain being tested. OSSD status on the receiver must be OFF		
	Emission (green ON yellow ON)	Light curtain in normal operating condition		
Function	Type	Check and repair	LED	DIGIT
Error status	Internal error (green ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		
	Optical error (green ON)	Switch OFF and switch ON the power supply circuit. If the failure continues contact DATASENSING.		
	No power supply (LEDs OFF)	Check connections and input voltage correct value. If the failure continues contact DATASENSING.		

9 PERIODICAL CHECKS

The following is a list of recommended check and maintenance operations that should be periodically carried-out by qualified personnel (cfr. **Controls after first installation page 23**)

Check that:

- The ESPE stays locked () during beam interruption along the entire protected area, using the suitable "Test Piece" (according to the **Fig 20 - page 24** scheme).
- The ESPE is correctly aligned. Press slightly product side, in both directions and the red LED  must not turn ON.
- 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 cfr. **INSTALLATION page 16**).
- The safety distance between the dangerous areas and the ESPE are in accordance with the instructions included in **INSTALLATION page 16**.
- 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 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.

9.1 GENERAL INFORMATION AND USEFUL DATA



Safety MUST be a part of our conscience.

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, DATASENSING is at your disposal to carry out the installation.

The device uses fuses that are not self-resetting. Consequently, in presence of short-circuits causing the cut-off of these fuses, both safety light curtains (RX and TX) shall be sent to DATASENSING Repair Service Department.

A power failure caused by interferences may cause the temporary or trigger Safety State over connected safety Fieldbus, but the safe functioning of the light curtain will not be compromised.

9.2 WARRANTY

The warranty period for this product is 36 months.

See the General Terms and Conditions of Sales at www.datasensing.com for further details.

DATASENSING will not be liable for any damages to persons and things caused by the non-observance of the correct installation modes and device use.

In presence of a non-functioning device, always return the emitting and receiving units for repair or replacement.

10 DEVICE MAINTENANCE

DATASENSING safety light curtains do not require special maintenance operations.

To avoid the reduction of the operating distance, optic protective front surfaces must be cleaned at regular intervals.

Use soft cotton cloths dampened in water.

Do not apply too much pressure on the surface in order to avoid making it opaque.

Please do not use on plastic surfaces or on light curtain painted surfaces:

- **alcohol or solvents**
- **wool or synthetic cloths**
- **paper or other abrasive materials**

10.1 PRODUCT DISPOSAL



For information about the disposal of Waste Electrical and Electronic Equipment (WEEE), please refer to the website at www.datasensing.com.

11 TECHNICAL DATA

SAFETY CATEGORY:	Type 4 (rif. EN 61496-1: 2013)
	SIL 3 (rif. EN 61508)
	SIL CL 3 (ref. EN 62061:2005/A2: 2015)
	PL e, Cat. 4 (rif. EN ISO 13849-1: 2015)
	PFHd [1/h] = 2,64E-09
	MTTFd [years] = 444

ELECTRICAL DATA	
Power supply (Vdd):	24 VDC $\pm$ 20%
Consumption (TX):	2.5 W max
Consumption (RX):	3.5 W max (without load)
Outputs:	2 PNP
Short-circuit protection:	1.4 A max
Output current:	0.5 A max su ciascuna uscita
Output voltage – status ON:	Vdd – 1 V min
Output voltage – status OFF:	0.2 V max
Capacitive load:	2.2 μ F @ 24Vcc max
Response times:	see chapter AVAILABLE MODELS AND RESPONSE TIMES page 49
Controlled height:	150..1800 mm
Auxiliary functions:	Reset / Test / EDM
Electrical protection:	Classe I / Classe III (see chapter ELECTRICAL CONNECTIONS page 26)
Connections:	
for receiver:	M12 5-pole (SG4-xx-xxx-OO-X) M12 8-pole (SG4-xx-xxx-OO-E)
for emitter:	M12 4-pole
Cables length (for power supply):	50 m. max

OPTICAL DATA	
Emitting light (λ):	Infrared, LED (950 nm)
Resolution:	14 - 30 mm
Operating distance:	0.2...19 m per 30 mm 0.2...6 m per 14 mm
Ambient light rejection:	EN 61496-2: 2013

MECHANICAL AND ENVIRONMENTAL DATA	
Operating temperature:	0...+ 55 °C
Storage temperature:	- 25...+ 70 °C
Temperature class:	T6
Humidity:	15...95 % (no condensation)
Mechanical protection:	IP 65 EN 60529
Vibrations:	Width 0.35 mm, Frequency 10 ... 55 Hz 20 sweep per axis, 1octave/min EN 60068-2-6
Shock resistance:	16 ms (10 G) 1,000 shocks per axis EN 60068-2-29
Housing material:	Painted aluminium (yellow RAL 1003)
Front side material:	PMMA
Cover material:	PC LEXAN
Weight:	1.35 kg per linear meter for single unit

12 AVAILABLE MODELS

Model	Controlled height (mm)	No. Beams	Response time (msec)	Resolution (mm)
SG4-14-015-OO-E/X	150	16	11	14
SG4-14-030-OO-E/X	300	32	15	14
SG4-14-045-OO-E/X	450	48	18	14
SG4-14-060-OO-E/X	600	64	22	14
SG4-14-075-OO-E/X	750	80	25	14
SG4-14-090-OO-E/X	900	96	29	14
SG4-14-105-OO-E/X	1050	112	33	14
SG4-14-120-OO-E/X	1200	128	36	14
SG4-14-135-OO-E/X	1350	144	40	14
SG4-14-150-OO-E/X	1500	160	43	14
SG4-14-165-OO-E/X	1650	176	47	14
SG4-14-180-OO-E/X	1800	192	50	14
SG4-30-015-OO-E/X	150	8	9	30
SG4-30-030-OO-E/X	300	16	11	30
SG4-30-045-OO-E/X	450	24	13	30
SG4-30-060-OO-E/X	600	32	14	30
SG4-30-075-OO-E/X	750	40	16	30
SG4-30-090-OO-E/X	900	48	18	30
SG4-30-105-OO-E/X	1050	56	19	30
SG4-30-120-OO-E/X	1200	64	21	30
SG4-30-135-OO-E/X	1350	72	23	30
SG4-30-150-OO-E/X	1500	80	25	30
SG4-30-165-OO-E/X	1650	88	26	30
SG4-30-180-OO-E/X	1800	96	28	30

	<i>EN ISO 13849-1</i>	<i>EN 954-1</i>	<i>EN IEC 61508</i>	<i>EN IEC 62061</i>	<i>Prob. of danger failure/hour</i>	<i>Life span</i>	<i>Mean Time to Dangerous Failure</i>	<i>Average Diagnostic Coverage</i>	<i>Safe Failure Fraction</i>	<i>Hardware Fault Tolerance</i>
Product	PL	CAT	SIL	SIL CL	PFHd (1/h)	T1 (years)	MTTFd (years)	DC	SFF	HFT
SG4-14-120-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-14-135-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-14-150-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-14-165-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-14-180-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-015-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-030-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-045-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-060-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-075-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-090-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-105-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-120-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-135-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-150-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-165-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1
SG4-30-180-OO-E/X	e	4	3	3	2,64E-09	20	444	98,80%	99,30%	1

13 OVERALL DIMENSIONS

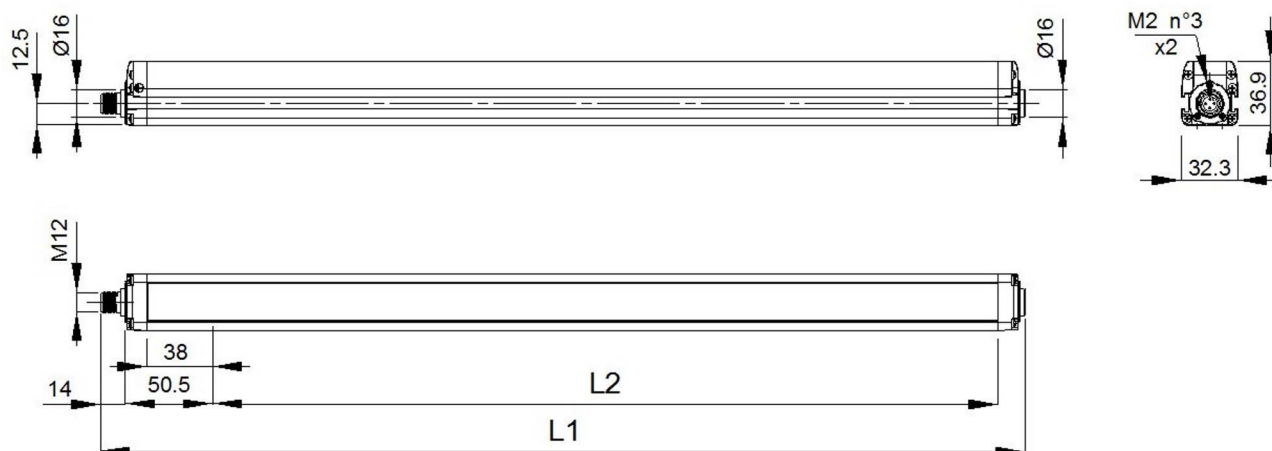


Fig 42 - Dimensions (mm)

MODEL 14mm	MODEL 30mm	L1 (mm)	L2 (mm)
SG4-14-015-OO-E/X	SG4-30-015-OO-E/X	233.3	153.3
SG4-14-030-OO-E/X	SG4-30-030-OO-E/X	383.2	303.2
SG4-14-045-OO-E/X	SG4-30-045-OO-E/X	533.2	453.3
SG4-14-060-OO-E/X	SG4-30-060-OO-E/X	683.2	603.2
SG4-14-075-OO-E/X	SG4-30-075-OO-E/X	833.2	753.3
SG4-14-090-OO-E/X	SG4-30-090-OO-E/X	983.2	903.2
SG4-14-105-OO-E/X	SG4-30-105-OO-E/X	1133.2	1053.2
SG4-14-120-OO-E/X	SG4-30-120-OO-E/X	1283.3	1203.3
SG4-14-135-OO-E/X	SG4-30-135-OO-E/X	1433.2	1353.2
SG4-14-150-OO-E/X	SG4-30-150-OO-E/X	1583.3	1503.3
SG4-14-165-OO-E/X	SG4-30-165-OO-E/X	1733.3	1653.3
SG4-14-180-OO-E/X	SG4-30-180-OO-E/X	1883.3	1803.3

14 INCLUDED ACCESSORIES

Metal angled fixing bracket (ST-KSTD)

MODEL	DESCRIPTION
ST-KSTD	Angled fixing bracket (4 pcs kit)

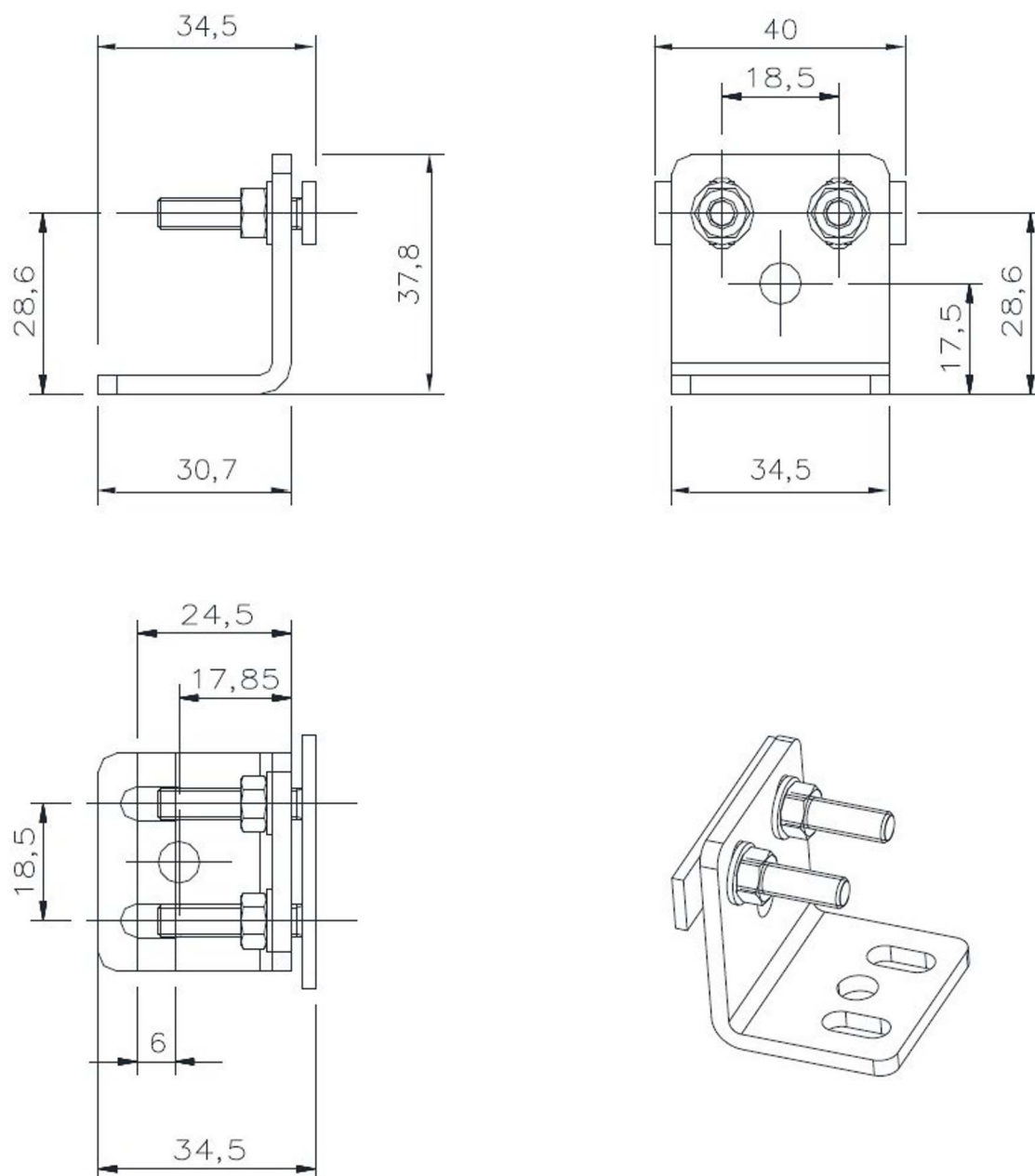


Fig 43 - Dimensions (mm)

15 ACCESSORIES

(dimensions in mm)

15.1 (ST-KSTD) METAL ANGLED FIXING BRACKET

MODEL	DESCRIPTION	CODE
ST-KSTD	Angled fixing bracket (4 pcs kit)	95ACC1670

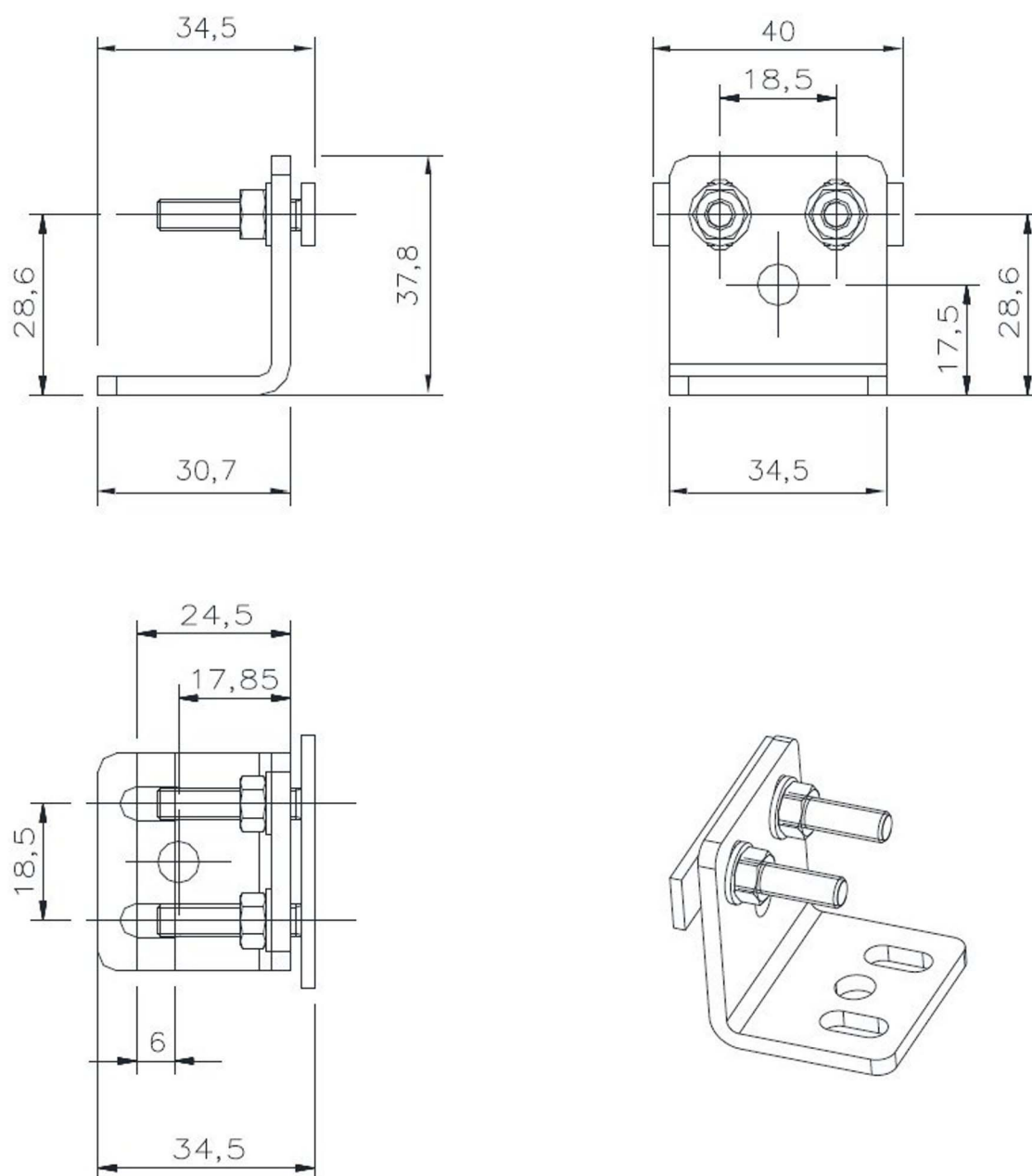
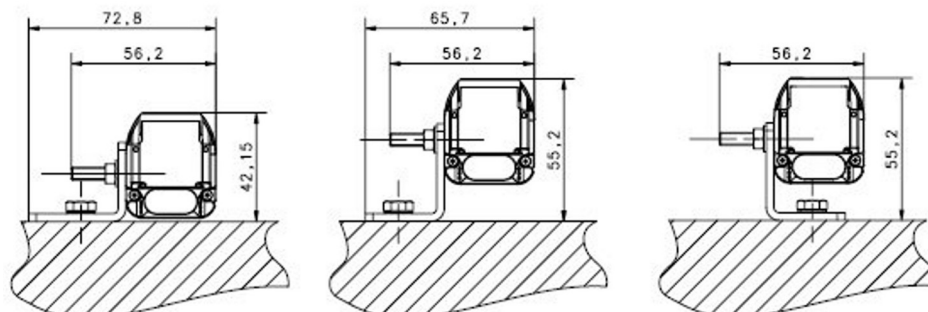
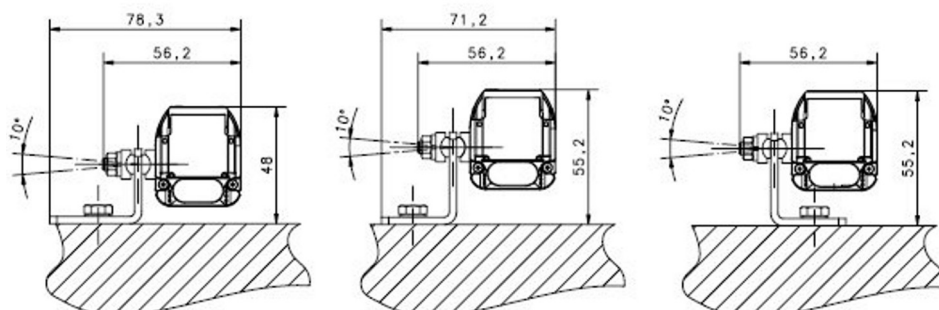
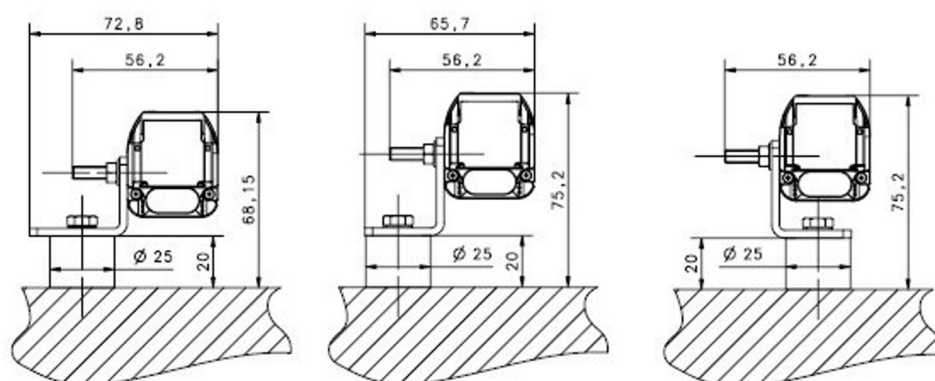
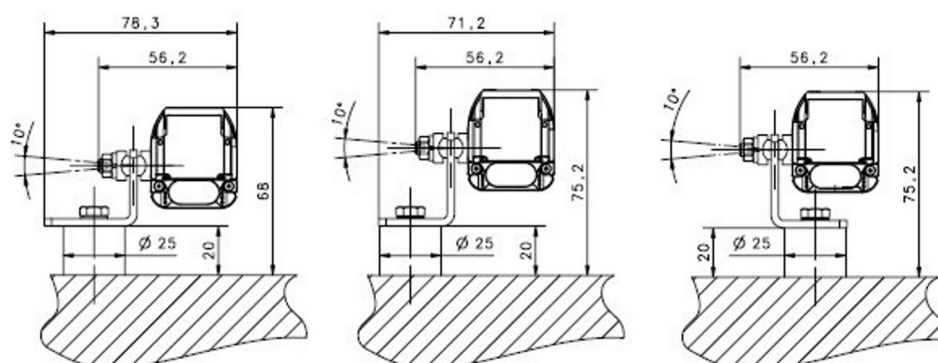


Fig 44 - ST-KSTD

Angled fixing bracket mounting with orientable and antivibration supports

MODEL	DESCRIPTION	CODE
ST-K4OR	Orientable supports (4 pcs kit)	95ACC1680
ST-K6OR	Orientable supports (6 pcs kit)	95ACC1690
ST-K4AV	Antivibration supports (4 pcs kit)	95ACC1700
ST-K6AV	Antivibration supports (6 pcs kit)	95ACC1710


Fig 45 - Angled fixing bracket

Fig 46 - Angled fixing bracket + Orientable support

Fig 47 - Angled fixing bracket + Antivibration support

Fig 48 - Angled fixing bracket + Orientable support + Antivibration support

15.2 (ST-KPXMP) PLASTIC ANGLED FIXING BRACKET

MODEL	DESCRIPTION	CODE
ST-KP4MP	Angled fixing bracket (4 pcs kit)	95ASE1100
ST-KP6MP	Angled fixing bracket (6 pcs kit)	95ASE1110

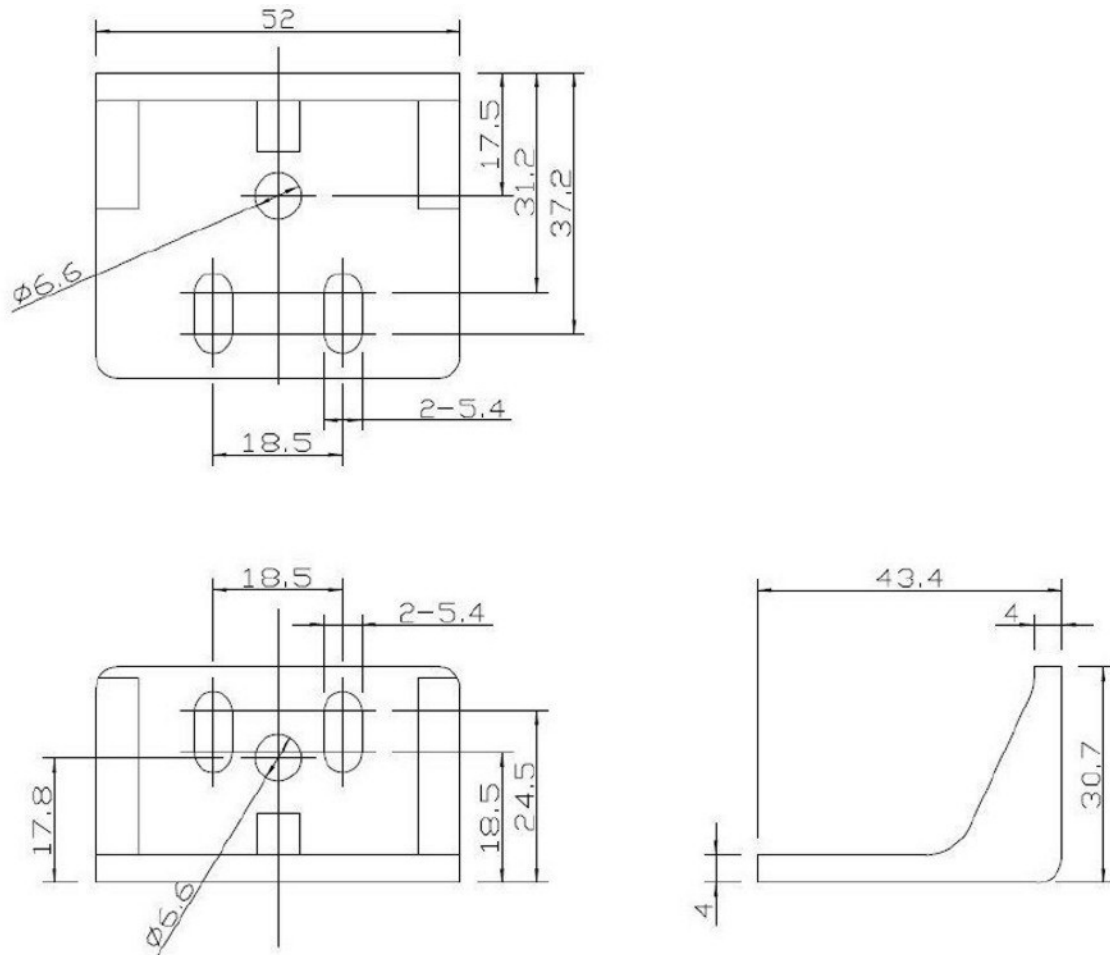
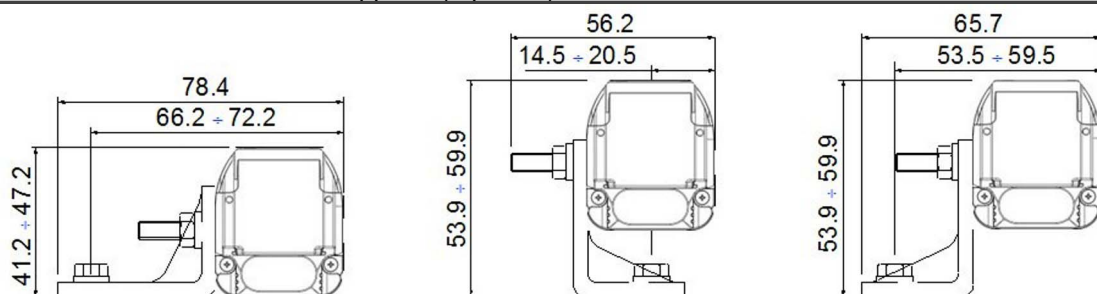
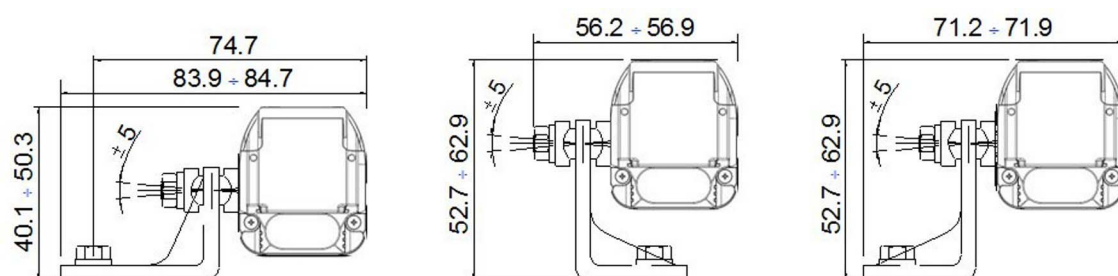
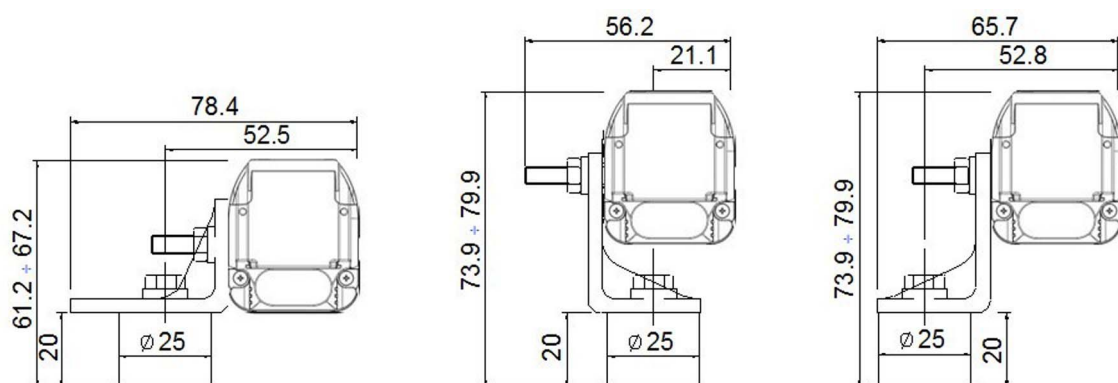
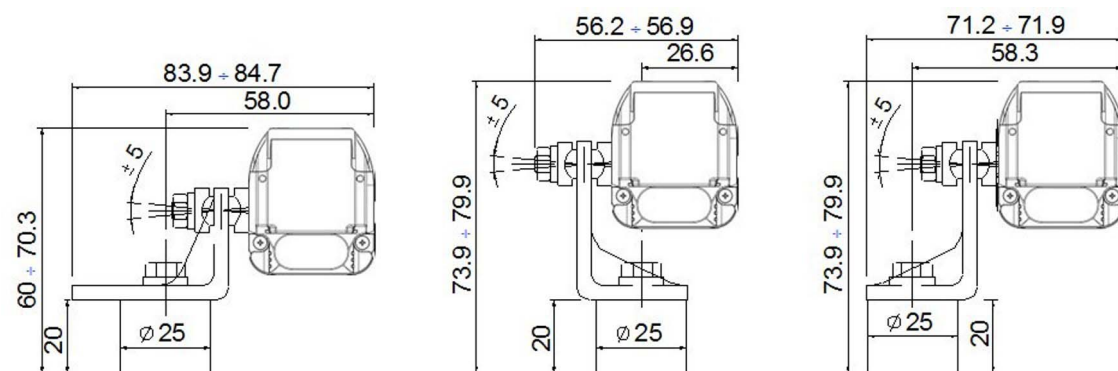


Fig 49 - ST-KPxMP

Angled fixing bracket mounting with orientable and antivibration supports

MODEL	DESCRIPTION	CODE
ST-K4OR	Orientable supports (4 pcs kit)	95ACC1680
ST-K6OR	Orientable supports (6 pcs kit)	95ACC1690
ST-K4AV	Antivibration supports (4 pcs kit)	95ACC1700
ST-K6AV	Antivibration supports (6 pcs kit)	95ACC1710


Fig 50 - Angled fixing bracket

Fig 51 - Angled fixing bracket + Orientable support

Fig 52 - Angled fixing bracket + Antivibration support

Fig 53 - Angled fixing bracket + Orientable support + Antivibration support

15.3 (ST-K4ROT) METAL ROTATING FIXING BRACKET

MODEL	DESCRIPTION	CODE
ST-K4ROT	Rotating fixing bracket (4 pcs kit)	95ACC1280

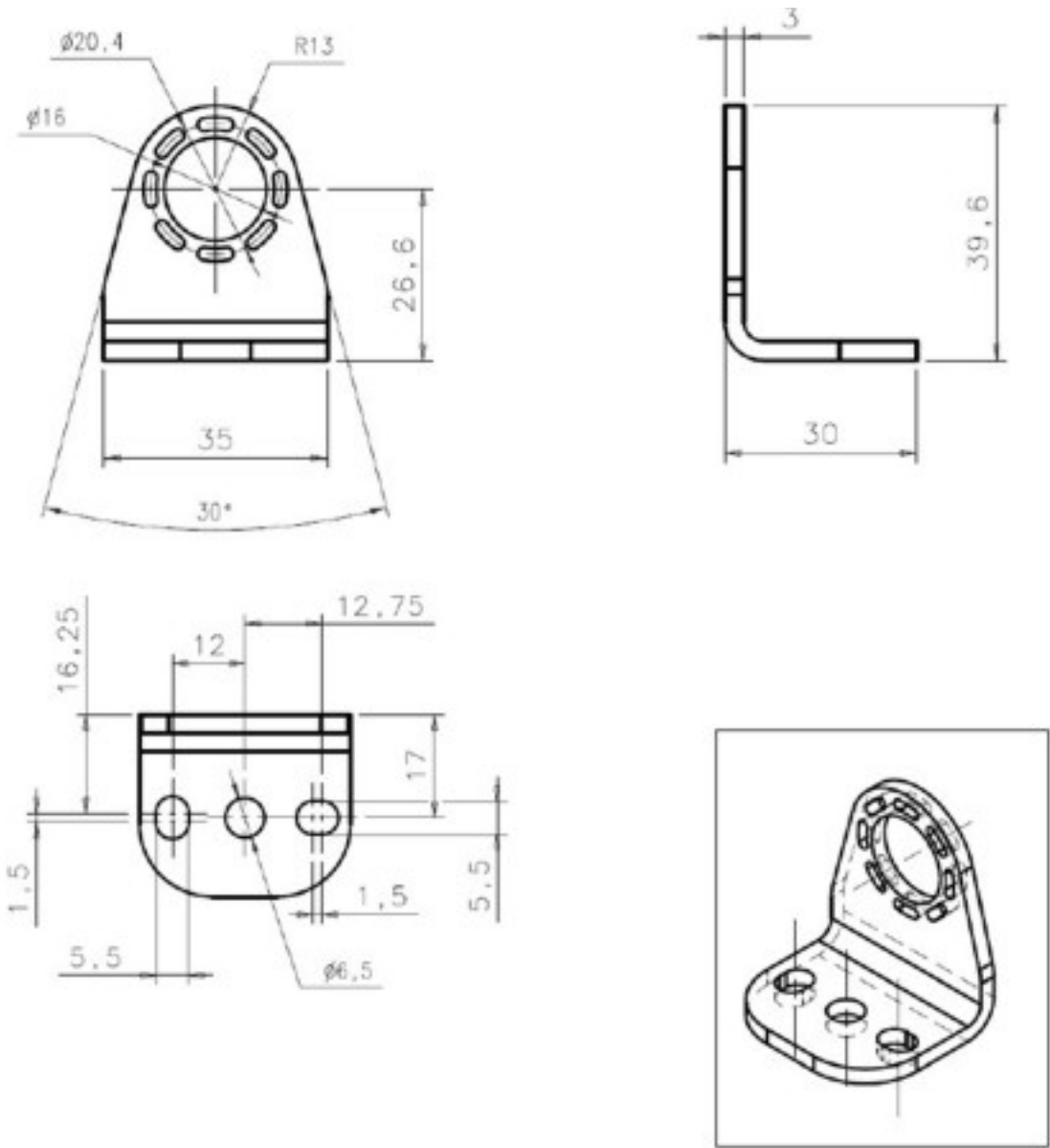


Fig 54 - Dimensions (mm)

15.4 (SG-PSB) PROTECTIVE STANDS

MODEL	DESCRIPTION	L (mm)	CODE
SG-PSB 600	Protective stand H=600 mm	600	95ASE2240
SG-PSB 1000	Protective stand H=1000 mm	1000	95ASE2250
SG-PSB 1200	Protective stand H=1200 mm	1200	95ASE2260
SG-PSB 1650	Protective stand H=1650 mm	1650	95ASE2270
SG-PSB 1900	Protective stand H=1900 mm	1900	95ASE2280



Fig 55 - Dimensions (mm)

Mounting kit

MODEL	DESCRIPTION	CODE
ST-PS4-SG-SE	Mounting kit (4 pcs kit)	95ASE1750
ST-PS6-SG-SE	Mounting kit (6 pcs kit)	95ASE1760

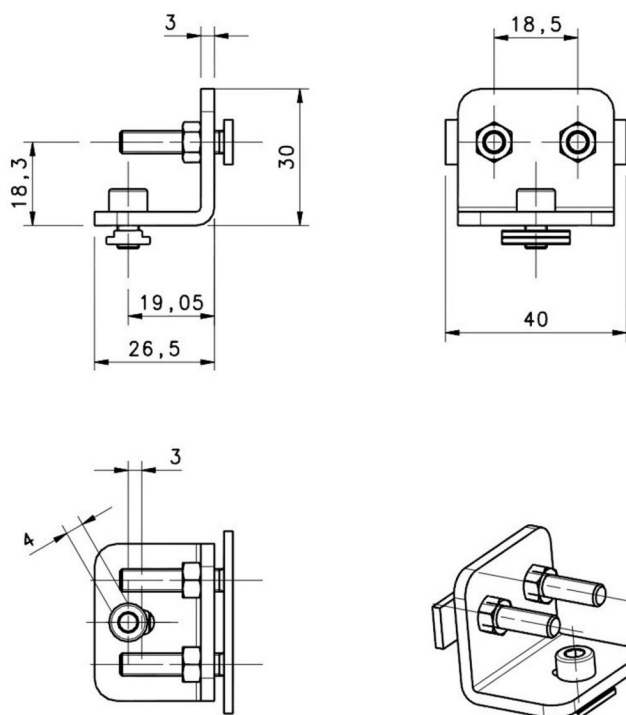


Fig 56 - Fixing kit

15.5 (SG-P) PLATE KIT FOR PROTECTIVE STANDS

MODEL	DESCRIPTION	CODE
SG-P	Plate kit with springs	95ASE2290

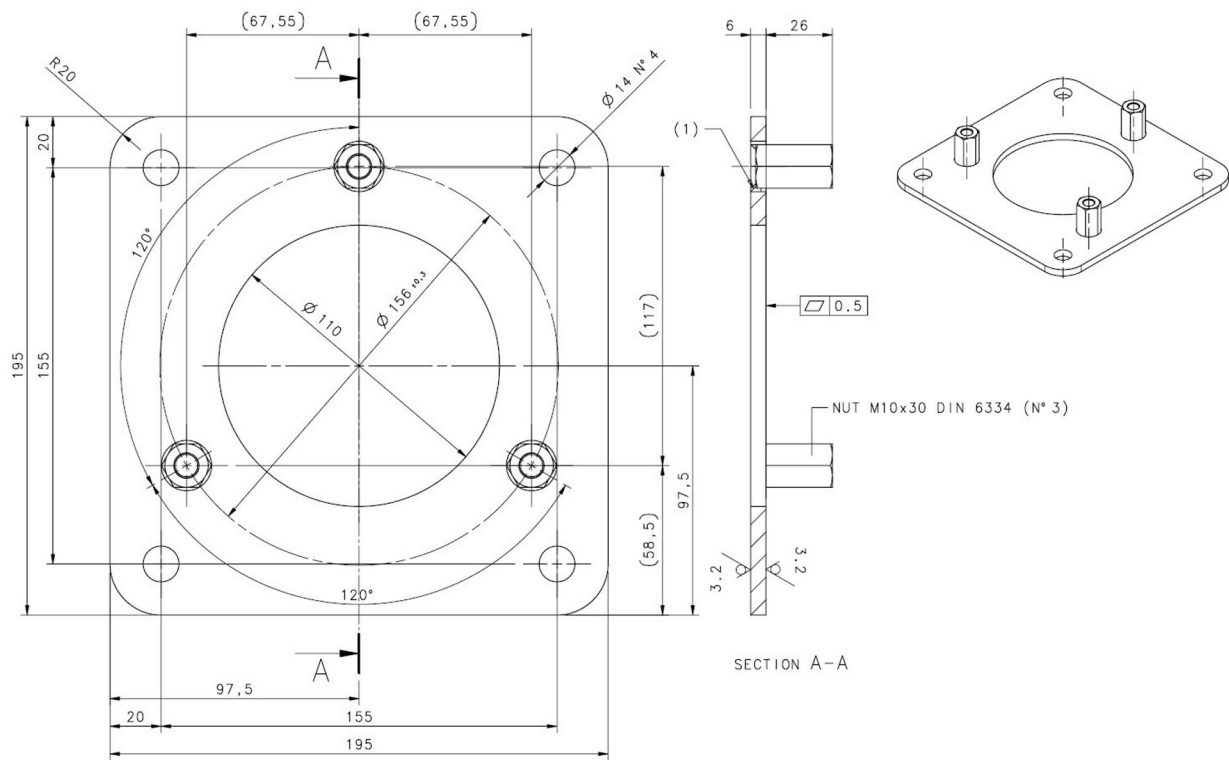


Fig 57 - Dimensions (mm)

Mounting with SG-PSB

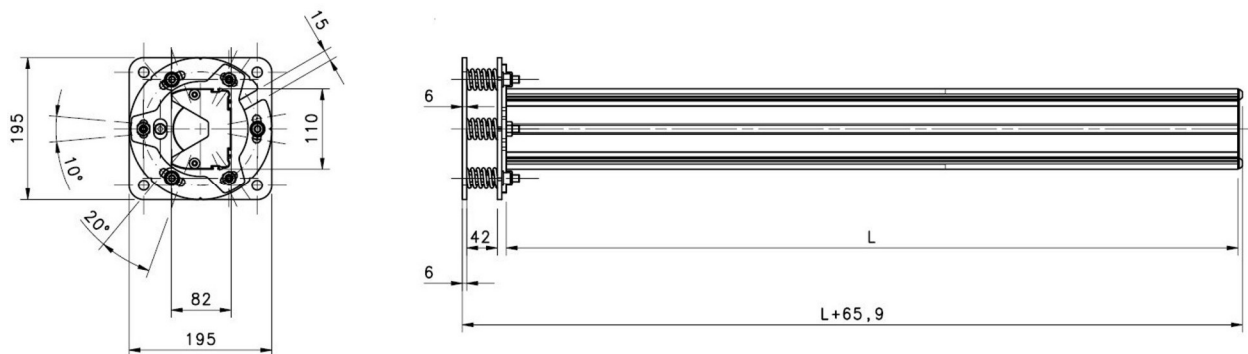


Fig 58 - Mounting

15.6 (SE-S) COLUMNS AND FLOOR STANDS

MODEL	DESCRIPTION	L(mm)	X (mm)	CODE
SE-S 800	Column and floor stand H= 800 mm	800	30x30	95ACC1730
SE-S 1000	Column and floor stand H= 1000 mm	1000	30x30	95ACC1740
SE-S 1200	Column and floor stand H= 1200 mm	1200	30x30	95ACC1750
SE-S 1500	Column and floor stand H= 1500 mm	1500	45x45	95ACC1760
SE-S 1800	Column and floor stand H= 1800 mm	1800	45x45	95ACC1770

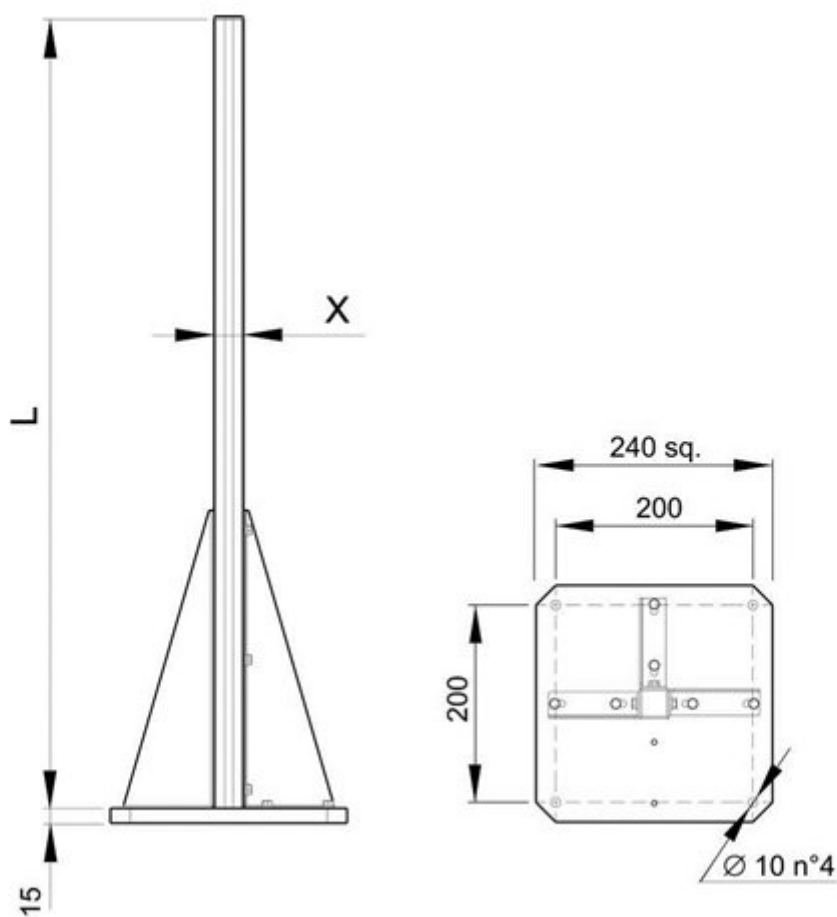


Fig 59 - Dimensions (mm)

15.7 (SG-DM) DEVIATING MIRRORS

MODEL	DESCRIPTION	L1 (mm)	L2 (mm)	L3 (mm)	CODE
SG-DM 600	Deviating mirror version 600 mm	545	376	580	95ASE1680
SG-DM 900	Deviating mirror version 900 mm	845	676	880	95ASE1690
SG-DM 1200	Deviating mirror version 1200 mm	1145	976	1180	95ASE1700
SG-DM 1650	Deviating mirror version 1650 mm	1595	1426	1630	95ASE1710
SG-DM 1900	Deviating mirror version 1900 mm	1845	1676	1880	95ASE1720

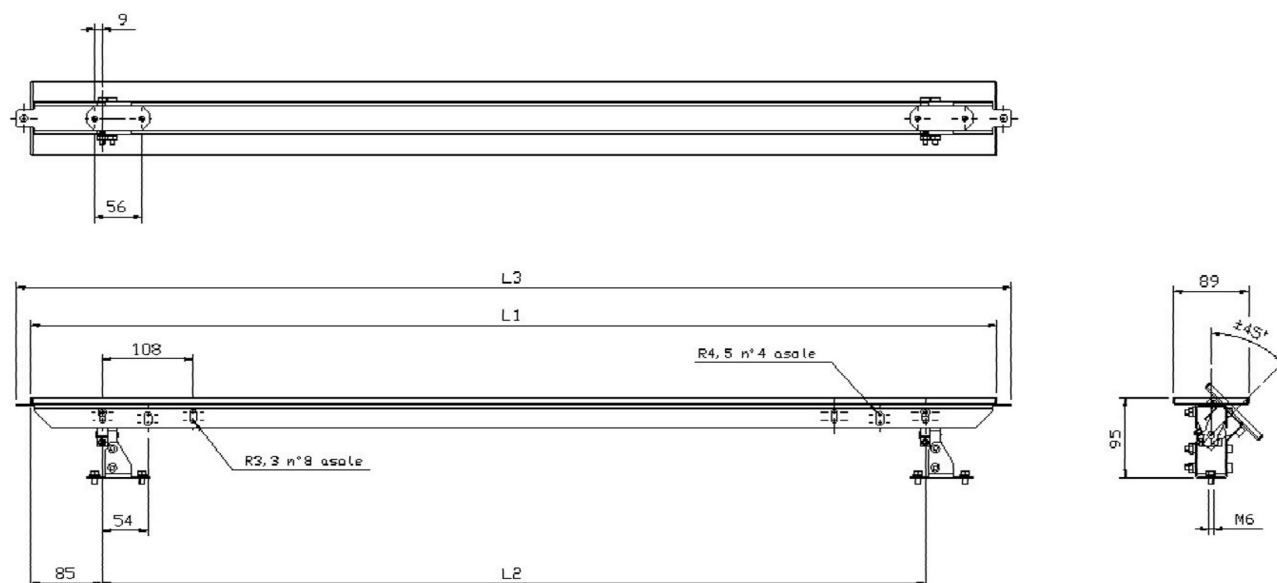


Fig 60 - Dimensions (mm)

The image includes the mirror SG-DM and a mounting kit ST-DM.

MODEL	DESCRIPTION	CODE
SG-DM 150	Deviating mirror version 150 mm	95ASE1670

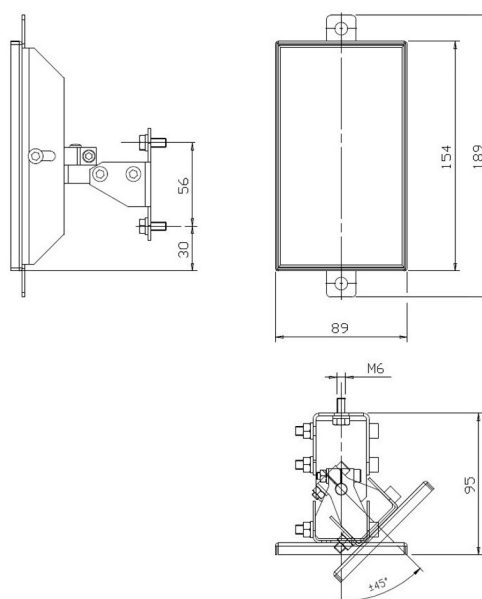


Fig 61 - SG-DM 150 Dimensions (mm)

The image includes the mirror SG-DM and a mounting kit ST-DM.

Mounting kit for SG-DM with SE-S column and floor stands

MODEL	DESCRIPTION	CODE
ST-DM	SG-DM mounting kit (2 pcs kit)	95ASE1940

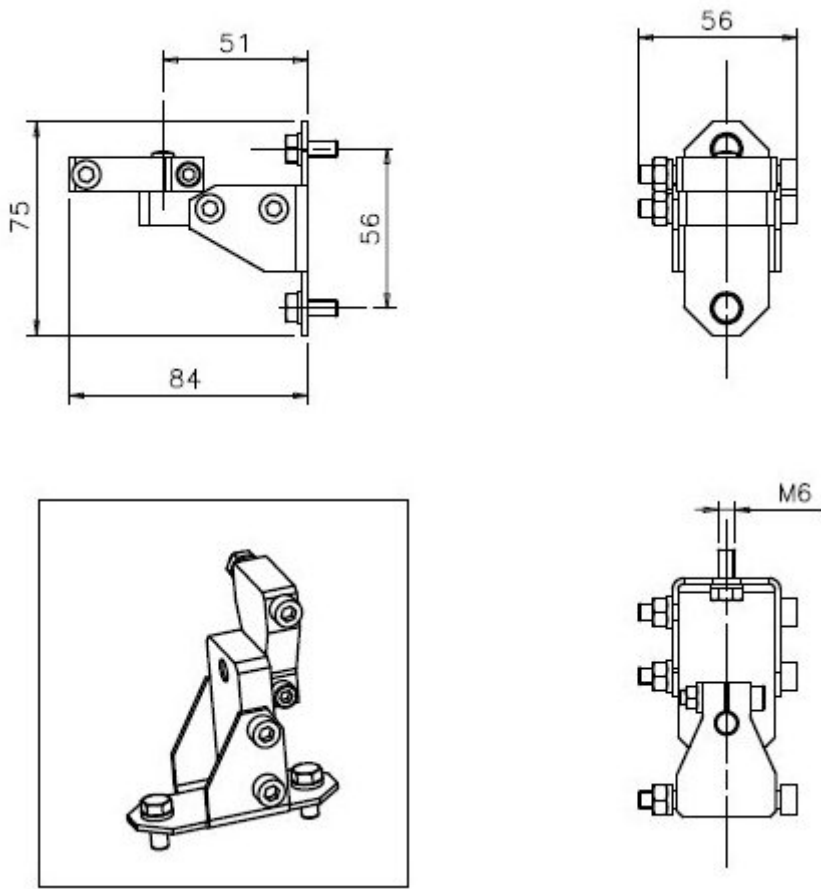


Fig 62 - Mounting kit

For each SG-DM mirror order 1 mounting kit ST-DM.

Mounting kit SG-DM on SG-PSB (ST-PS-DM)

MODEL	DESCRIPTION	CODE
ST-PS-DM	Deviating mirror SG-DM mounting kit (2 T-nuts)	95ASE1770

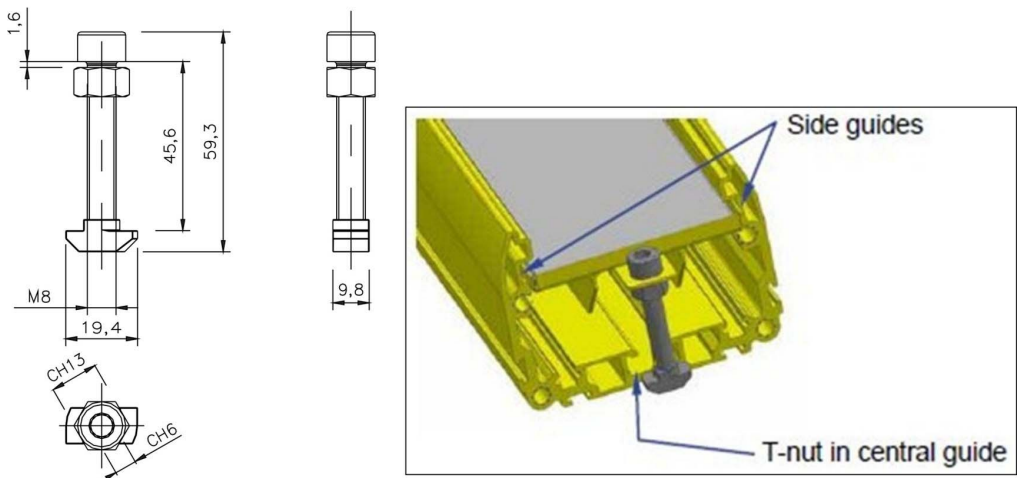


Fig 63 - Mounting kit

For each SG-DM mirror order 1 mounting kit ST-PS-DM.

15.8 (SG-IP69K) PMMA PROTECTION TUBES

MODEL	DESCRIPTION	L (mm)	CODE
SG -IP69K 150	Tubular IP69K H=150mm	373,5	95ASE1290
SG -IP69K 300	Tubular IP69K H=300mm	520,7	95ASE1300
SG -IP69K 450	Tubular IP69K H=450mm	670,8	95ASE1310
SG -IP69K 600	Tubular IP69K H=600mm	820,7	95ASE1320
SG -IP69K 750	Tubular IP69K H=750mm	970,8	95ASE1330
SG -IP69K 900	Tubular IP69K H=900mm	1120,7	95ASE1340
SG -IP69K 1050	Tubular IP69K H=1050mm	1270,7	95ASE1350
SG -IP69K 1200	Tubular IP69K H=1200mm	1420,8	95ASE1360
SG -IP69K 1350	Tubular IP69K H=1350mm	1570,7	95ASE1370
SG -IP69K 1500	Tubular IP69K H=1500mm	1720,8	95ASE1380
SG -IP69K 1650	Tubular IP69K H=1650mm	1870,8	95ASE1390
SG -IP69K 1800	Tubular IP69K H=1800mm	2020,8	95ASE1400

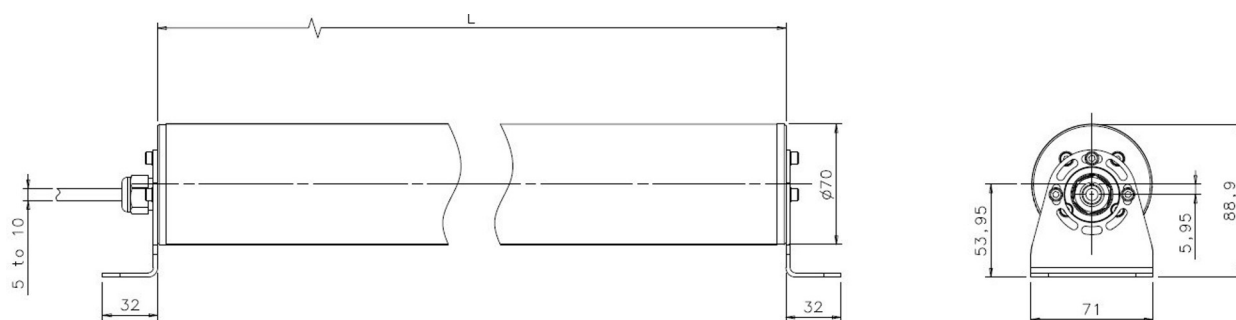


Fig 64 - Dimensions (mm)

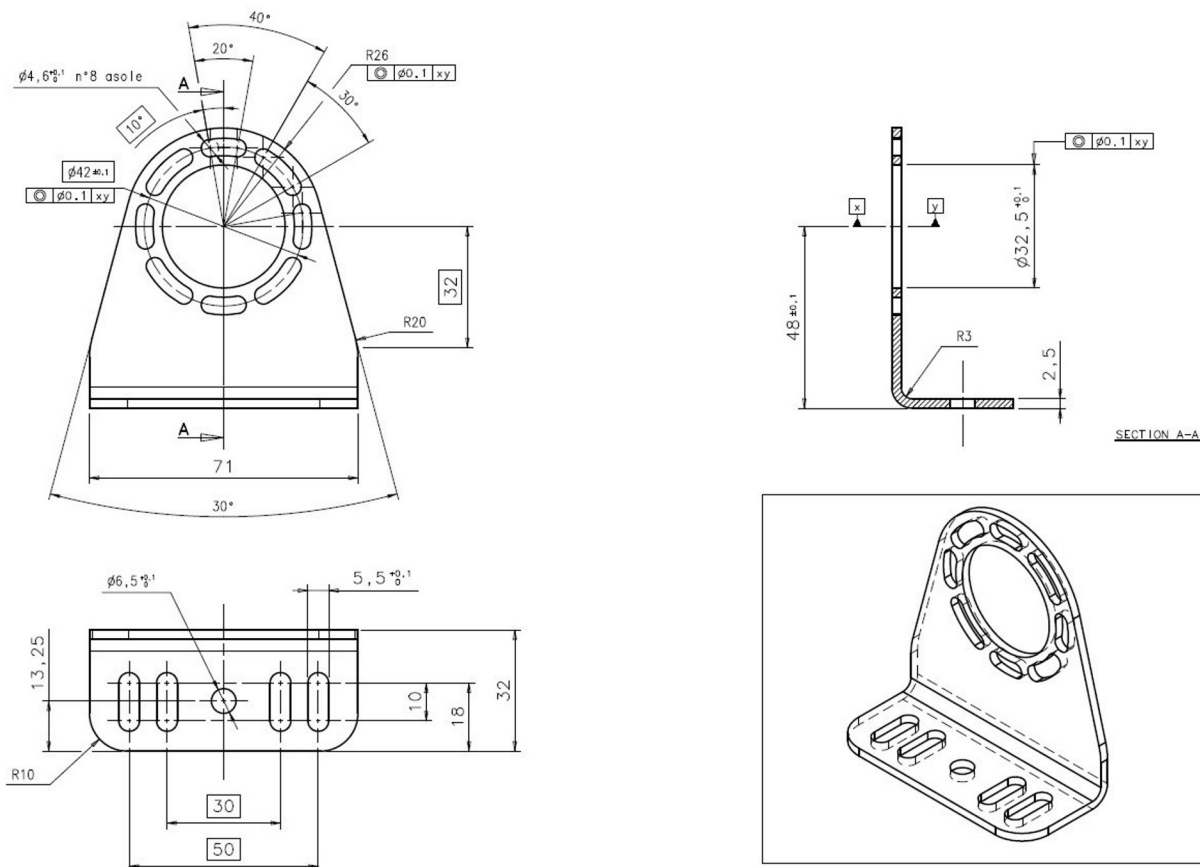


Fig 65 - Mounting kit

15.9 (SG-LS) PMMA LENS SHIELD

MODEL	DESCRIPTION	CODE
SG-LS 150	Lens shield H=150 mm (5 pcs)	95ASE1450
SG-LS 300	Lens shield H=300 mm (5 pcs)	95ASE1460
SG-LS 450	Lens shield H=450 mm (5 pcs)	95ASE1460
SG-LS 600	Lens shield H=600 mm (5 pcs)	95ASE1470
SG-LS 750	Lens shield H=750 mm (5 pcs)	95ASE1480
SG-LS 900	Lens shield H=900 mm (5 pcs)	95ASE1490
SG-LS 1050	Lens shield H=1050 mm (5 pcs)	95ASE1500
SG-LS 1200	Lens shield H=1200 mm (5 pcs)	95ASE1510
SG-LS 1350	Lens shield H=1350 mm (5 pcs)	95ASE1520
SG-LS 1500	Lens shield H=1500 mm (5 pcs)	95ASE1530
SG-LS 1650	Lens shield H=1650 mm (5 pcs)	95ASE1540
SG-LS 1800	Lens shield H=1800mm (5 pcs)	95ASE1560



Each package contains what is necessary to protect a single unit (TX or RX).
To protect both TX and RX , two pieces of the same code are needed.

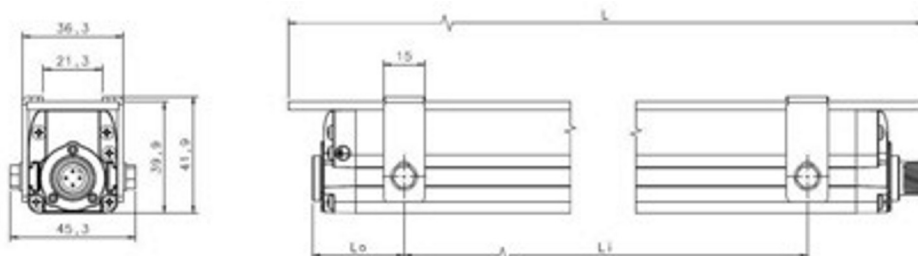


Fig 66 - Dimensions (mm)

n°
2+2
bracket

MODEL	L	Li	Lo
015	245	160	30
030	392	345	45
045	540	400	60
060	686	520	75
075	832	590	115
090	980	640	175
105	1126	740	200
120	1274	445	200
135	1422	520	200
150	1568	595	200
165	1715	670	200
180	1860	745	200

n°
3+3
bracket

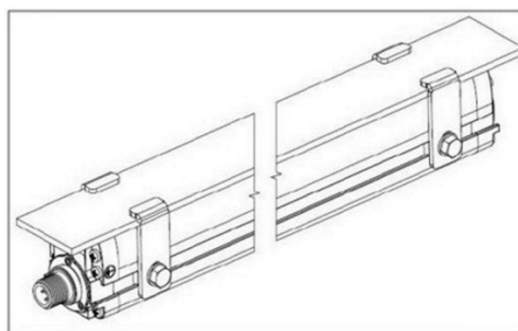


Fig 67 – Mounting kit

15.10 (TP) TEST PIECE

MODEL	DESCRIPTION	CODE
TP-14	Test piece Ø 14mm L=300mm	95ACC1630
TP-20	Test piece Ø 20mm L=300mm	95ACC1640
TP-24	Test piece Ø 24mm L=200mm	95ASE2570
TP-30	Test piece Ø 30mm L=300mm	95ACC1650
TP-34	Test piece Ø 34mm L=200mm	95ASE2580
TP-35	Test piece Ø 35mm L=300mm	95ACC1660
TP-40	Test piece Ø 40mm L=300mm	95ACC1820
TP-50	Test piece Ø 50mm L=300mm	95ACC1790
TP-90	Test piece Ø 90mm L=300mm	95ACC1800

15.11 CONNECTION CABLES

4-pole M12 cables

MODEL	DESCRIPTION	CODE
CS-A1-02-U-03	4-pole M12 cable (axial) 3 m	95ASE1120
CS-A1-02-U-05	4-pole M12 cable (axial) 5 m	95ASE1130
CS-A1-02-U-10	4-pole M12 cable (axial) 10 m	95ASE1140
CS-A1-02-U-15	4-pole M12 cable (axial) 15 m	95ASE1150
CS-A1-02-U-25	4-pole M12 cable (axial) 25 m	95ASE1160

5-pole M12 cables

MODEL	DESCRIPTION	CODE
CS-A1-03-U-03	5-pole M12 cable (axial) 3 m UL2464	95ASE1170
CS-A1-03-U-05	5-pole M12 cable (axial) 5 m UL2464	95ASE1180
CS-A1-03-U-10	5-pole M12 cable (axial) 10 m UL2464	95ASE1190
CS-A1-03-U-15	5-pole M12 cable (axial) 15 m UL2464	95ASE1200
CS-A1-03-U-25	5-pole M12 cable (axial) 25 m UL2464	95ASE1210
CS-A1-03-U-50	5-pole M12 cable (axial) 50 m UL2464	95A252700

8-pole M12 cables

MODEL	DESCRIPTION	CODE
CS-A1-06-U-03	8-pole M12 cable (axial) 3 m UL2464	95ASE1220
CS-A1-06-U-05	8-pole M12 cable (axial) 5 m UL2464	95ASE1230
CS-A1-06-U-10	8-pole M12 cable (axial) 10 m UL2464	95ASE1240
CS-A1-06-U-15	8-pole M12 cable (axial) 15 m UL2464	95ASE1250
CS-A1-06-U-25	8-pole M12 cable (axial) 25 m UL2464	95ASE1260
CS-A1-06-U-50	8-pole M12 cable (axial) 50 m UL2464	95A252710

15.12 (SG-LP) LASER POINTER

MODEL	DESCRIPTION	CODE
SG-LP	Laser pointer	95ASE5590

The laser pointer of the SG-LP series represents a valid alignment and installation support for the safety light curtain series.

The pointer can be moved along the light curtain profile to verify the complete device alignment (top and bottom).

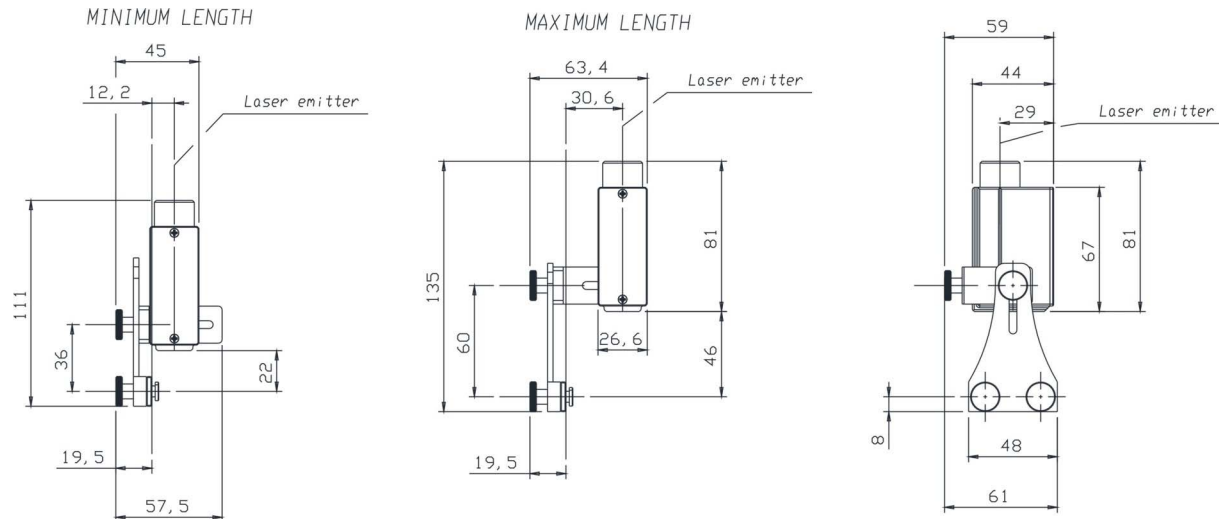


Fig 68 - Dimensions (mm)



Fig 69 - Laser pointer

15.13 (SE-SR2) SAFETY RELAY

MODEL	DESCRIPTION	CODE
SE-SR2	Type 4 safety relay - 3 NQ 1 NC	95ACC6170

The drawing show the connection between the safety light curtain and the Type 4 safety relay of the SE-SR2 series operating in the automatic Restart mode.

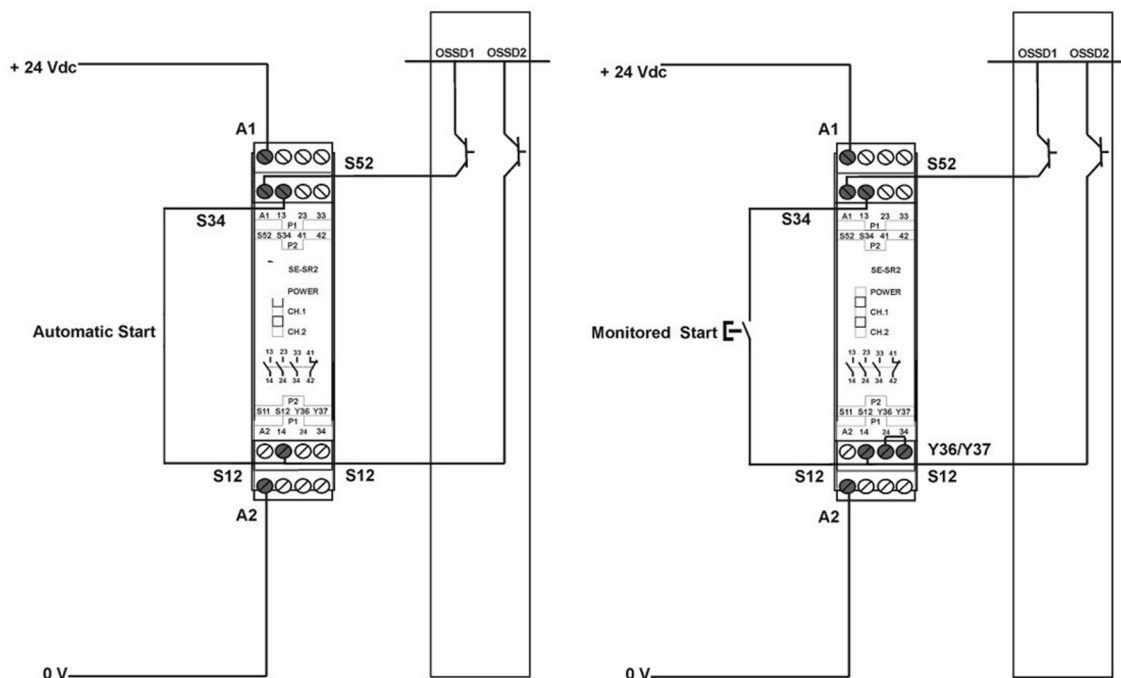


Fig 70 - Safety relay

15.14 (CSME-03VU24-Y14) EDM RELAY BOX

MODEL	DESCRIPTION	CODE
CSME-03VU24-Y14	EDM Relay	95ASE1270

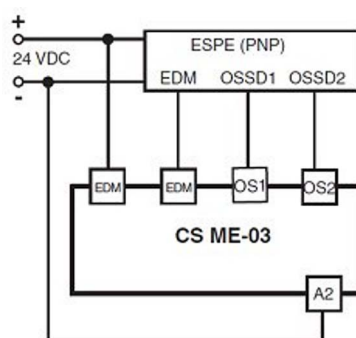


Fig 71 - EDM Relay

16 GLOSSARY

Detection zone: zone within which a specified test piece will be detected by the ESPE

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.

Detection capability (or Resolution): the minimum dimension which an opaque object must have in order to interrupt at least one beams of the ESPE whatever is position across the protected height.

Force-guided contacts: Relay contacts are force guided when they are mechanically connected so that they must switch simultaneously on input change.

If one contact of the series remains "welded", no other relay contact is able to move.

That relay characteristic allows the use of EDM function.

OSSD (Output signal switching device): part of the ESPE connected to machine control system.

When the sensor is enabled during standard operating conditions, it switches to disabled status.

ESPE (Electro-sensitive protective equipment): 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.

AOPD (Active optoelectronic protective device): 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.

Protective device: device having the function to protect the operator against possible risks of injury due to the contact with machine potentially-dangerous parts.

Min.installation distance: min. 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.

EDM (External device monitoring): device used by the ESPE to monitor the status of the external command devices.

MPCE (Machine primary control element): 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.

Emitter (TX): 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.

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.

Start interlocking device (= START): device preventing machine automatic start if the ESPE is live or the voltage is disabled and enabled once again.

Interlock: operating state of ESPE in Manual Restart Mode when all beams are free but the Restart command hasn't been received yet.

Normal Operation: operating state of ESPE when all beams are free, OSSD LED lit GREEN in SL light curtain OSSD1 and OSSD2 are switchen ON.

N.O.: normally opened

N.C.: normally closed

Machine operator: qualified person allowed to use the machine.

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.

Working point: machine position where the material or semifinished product is worked.

Receiver (RX): 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.

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.

Risk: probability of occurrence of an injury and severity of the injury itself.

Block condition (=BREAK): status of the light curtain taking place when a suitably-sized opaque object (see cfr.XREF-1:313]) 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.

Safe State: operating state of ESPE when at least one beam is intercepted, OSSD LED lit RED in [INLINE-1:44 light curtain. OSSD1 and OSSD2 are both switched OFF.

Response time: maximum time between the occurrence of the event leading to the actuation of the sensing device and the output signal switching devices (OSSD) achieving the OFF-state

Test piece: opaque object having a suitable size and used to test safety light curtain correct operation.

Type (of ESPE): the Electro-sensitive 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 EN 61496-1: 2013) defines the minimum requirements needed for ESPE design, manufacturing and testing.

Dangerous area: area representing an immediate or imminent physical hazard for the operator working inside it or who could get in contact with it.

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