

SLIM

INSTRUCTION MANUAL



Safety Light Curtains

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Patents

See www.patents.datasensing.com for patent list.

This product is covered by one or more of the following patents:

Utility patents: IT1427575, US10188007

Original Instructions (ref. 2006/42/EC)

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PREFACE

ABOUT THIS MANUAL

This Product Reference Guide (PRG) is provided for users seeking advanced technical information, including connection, programming, maintenance and specifications. The Quick Reference Guide (QRG) and other publications associated with this product can be downloaded free of charge from the website listed on the back cover of this manual.

Manual Conventions

The following conventions are used in this document:

The symbols listed below are used in this manual to notify the reader of key issues or procedures that must be observed when using the reader:



NOTE

Notes contain information necessary for properly diagnosing, repairing and operating the reader.



CAUTION

The CAUTION symbol advises you of actions that could damage equipment or property.



WARNING

The WARNING symbol advises you of actions that could result in harm or injury to the person performing the task.

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CHAPTER 1

GENERAL INFORMATION

GENERAL DESCRIPTION

The safety light curtains are optoelectronic multi-beam 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/A1: 2013	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 aluminum 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 "[Electrical Connections](#)" on page 27.

The synchronization 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 (see "[User Interface and Diagnostics](#)" on page 39).

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, a user interface facilitates the alignment of both units (see "[Alignment Procedure](#)" on 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.

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

However, specialized 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 (see "[User Interface and Diagnostics](#)" on page 39).

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
- 1 kit of 4pcs. "O" type brackets (ST-K4-SL-O) and specific fasteners
- 2 kits of 2pcs. "C" type brackets (ST-K2-SL-C) and specific fasteners
- An additional kit of "C" type brackets (ST-K2-SL-C) for models with heights above 600 mm

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.

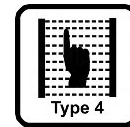
Detection capability

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

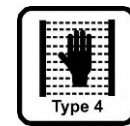
Finger protection



R = 24 mm

Hand protection

R = 34 mm



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

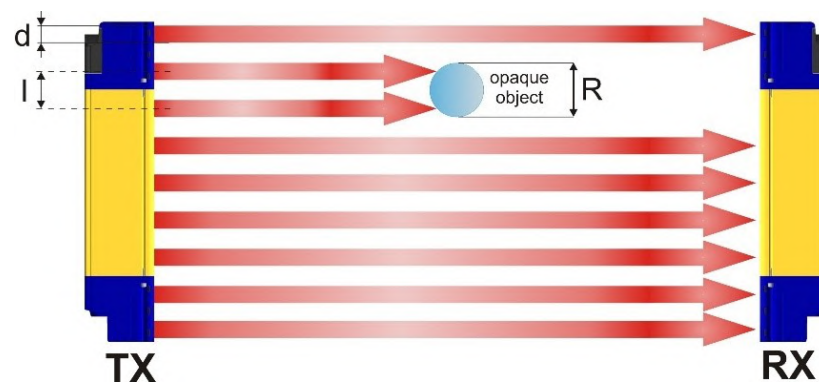


Figure 1 - Detection capability

The resolution value is obtained applying the following formula:

$$R = l + d$$

where:

l = Interaxes between two adjacent optics

d = Lens diameter

Height of the detection zone

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

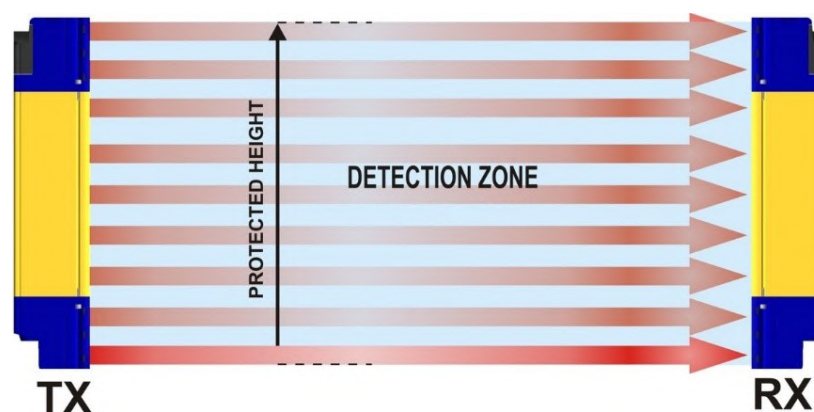


Figure 2 - Detection zone

The SLIM controlled height extends up to the whole height of the product (zero dead-zone).

The available dimensions are listed in the following table:

TYPE		MONITORED HEIGHT		VERSION	
2	Type 2	0150	150 mm	E	EDM, Restart
4	Type 4	0210	210 mm		
		0270	270 mm		
		0300	300 mm		
		...			
		1200	1200 mm		

RESOLUTION	
14	Finger : 14 mm
24	Hand: 24 mm
34	Hand: 34 mm

Figure 3 - Available models an protected heights

Referring to the figure above the protected height is reported in the table here below.

	MODEL	CONTROLLED HEIGHT Hp (mm)
	SLX-XX-0150-E	150
	SLX-XX-0210-E	210
	SLX-XX-0270-E	170
	SLX-XX-0300-E	300
	SLX-XX-0330-E	330
	SLX-XX-0360-E	360
	SLX-XX-0390-E	390
	SLX-XX-0420-E	420
	SLX-XX-0450-E	450
	SLX-XX-0480-E	480
	SLX-XX-0510-E	510
	SLX-XX-0540-E	540
	SLX-XX-0570-E	570
	SLX-XX-0600-E	600
	SLX-XX-0630-E	630
	SLX-XX-0660-E	660
	SLX-XX-0690-E	690
	SLX-XX-0720-E	720
	SLX-XX-0750-E	750
	SLX-XX-0780-E	780
	SLX-XX-0810-E	810
	SLX-XX-0840-E	840
	SLX-XX-0870-E	870
	SLX-XX-0900-E	900
	SLX-XX-0930-E	930
	SLX-XX-0960-E	960
	SLX-XX-0990-E	990
	SLX-XX-1020-E	1020
	SLX-XX-1050-E	1050
	SLX-XX-1080-E	1080
	SLX-XX-1110-E	1110
	SLX-XX-1140-E	1140
	SLX-XX-1170-E	1170
	SLX-XX-1200-E	1200

Minimum installation distance

The safety device must be positioned at a specific safety distance (Figure 4).

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

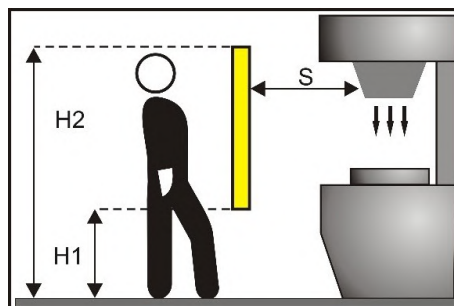


Figure 4 - Installation distance (vertical positioning)

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/s
- t1 = Response time of the ESPE in seconds (see "[Available Models and Response Times](#)" on page 47)
- 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 the 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



NOTE

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 (Figure 5) 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 (see "Technical Data" on page 44)
- 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

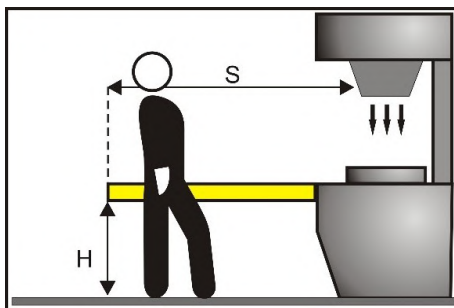


Figure 5 - Installation distance (horizontal positioning)

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 stopping time (including the 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

	SL4-14-0600-E	SL4-34-0600-E
t1	11 ms	10 ms
t2	100 ms	100 ms
T	111 ms	110 ms
C	0 mm	160 mm
S	222 mm	380 mm



NOTE

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.

TYPICAL APPLICATIONS

The new SLIM safety light curtains, with their 15 x 32 mm profile, the absence of dead zone, their pigtail cable, and the large choice of available lengths (with 30 mm modularity) are the perfect solution to protect machines where space saving and simplicity of use are the main requirements.

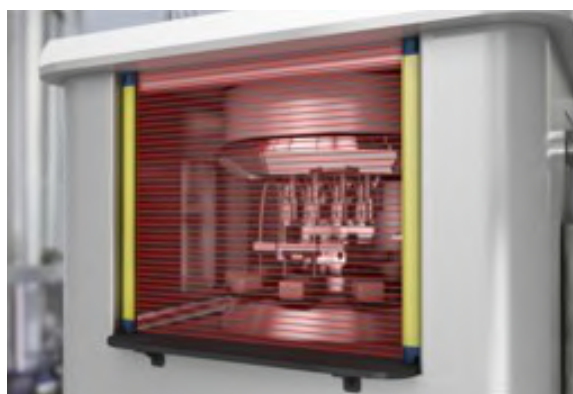
In particular, the safety curtains can be used in:

- Primary packaging machinery (packing, filling, labelling, etc.)
- Cutting machinery
- Automatic assembly machines and lines
- Automatic and semi-automatic quality inspection machinery
- Material handling machinery
- Bending and metal-working machinery
- Process lines

Used mainly in following industries:

- Food & Beverage
- Electronics
- Metal working
- Textile
- Wood

Example 1: Hazardous point protection on an automatic machine



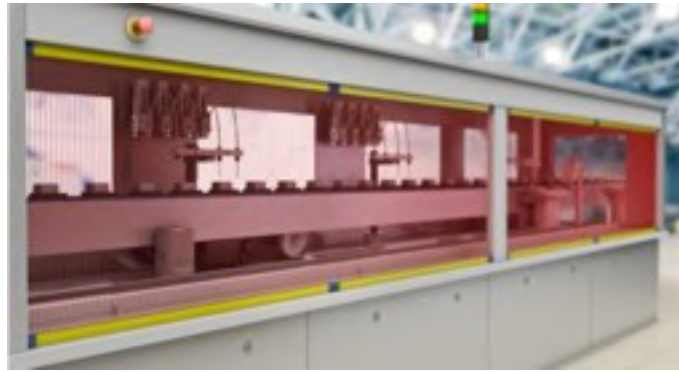
The operator positions the products and takes them back after working and must be protected against possible harm by movable parts of the machine.

SLIM safety light curtain is especially suitable and flexible for this kind of applications: the 34 heights available from 150 to 1200 mm, the absence of any dead zone and the flexible pigtail on the rear of the light curtain makes it easy to find the right model to fit exactly the dimension of the opening through which the operator could reach the hazardous point.

The small dimensions of the profile of SLIM (15 mm x 32 mm) makes it also possible to hide the light curtain inside the structure of machine itself.

Depending on the risk evaluated on the machine, a Type 2 or a Type 4 light curtain can be used.

The three resolutions (14mm, 24mm and 34mm) of SLIM light curtain make it also possible to choose just the resolution needed to fulfill the safety requirements in terms of safety distance to be kept between the light curtain and the hazardous point, depending on the stopping time of the machine.

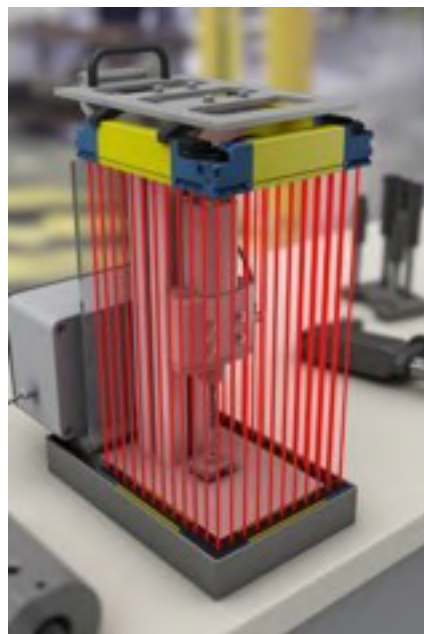
Example 2: Hazardous point protection along an assembling line

SLIM safety light curtains can be installed in line to each other, thanks to cascading, without losing resolution across the junction of one unit to the next one.

Three units can be cascaded and used as a single light curtain, reaching the total length of 3600 mm.

The small dimensions of the profile of SLIM (15 mm x 32 mm) makes it also possible to hide the light curtain inside the structure of machine itself.

The benefit of this kind of use is the absence of any physical obstacle along all the opening area, and the use of just 2 safety outputs for all three units, with saving of safety units into the cabinet.

Example 3: Hazardous point protection over three sides in a small semi-automatic machine

The operator positions the products and takes them back after working and must be protected against possible harm by movable parts of the machine.

Thanks to cascading and 15 mm width, SLIM safety light curtains can be cascaded at 90° angles, keeping at least 20 mm resolution even in the angle.

The benefit of this kind of use is the absence of any physical obstacle along all the three sides of the machine to be protects, leaving maximum movement freedom to the operator, and the use of just 2 safety outputs for all three units, with saving of safety units into the cabinet.

SAFETY INFORMATION



CAUTION

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](#)" on page 6 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 "[Installation](#)" on page 11, "[Mechanical Mounting](#)" on page 20, "[Electrical Connections](#)" on page 27, "[Alignment Procedure](#)" on 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 to "[Installation](#)" on page 11).
- 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 Restart button must be located outside the dangerous zone because the operator must check the dangerous zone during all Restart operations.



NOTE

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

CHAPTER 2

INSTALLATION

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/A1: 2013.

- 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](#)" on page 44.
- 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.

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.



Figure 1 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 curtain at sufficient height in order to completely cover the access to the dangerous area (Figure 2) becomes necessary.

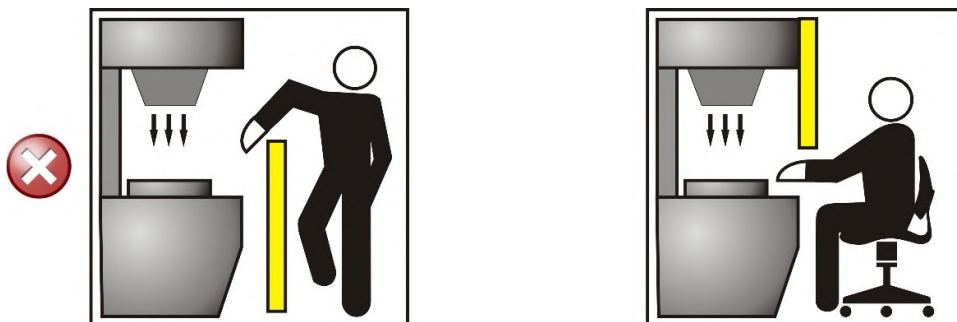


Figure 1 - Wrong light curtain positioning

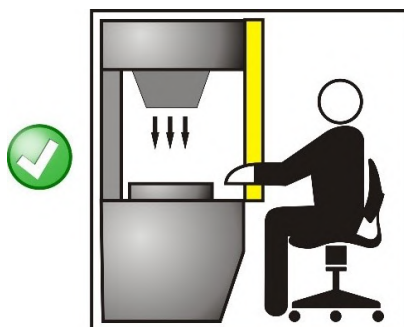


Figure 2 - Correct light curtain positioning



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 Figure 4.

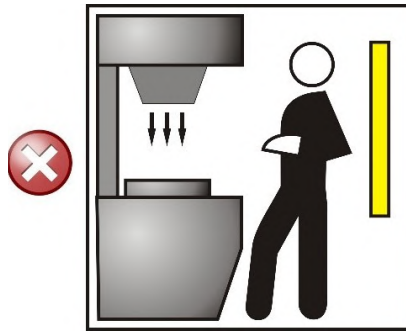


Figure 3 - Wrong light curtain positioning

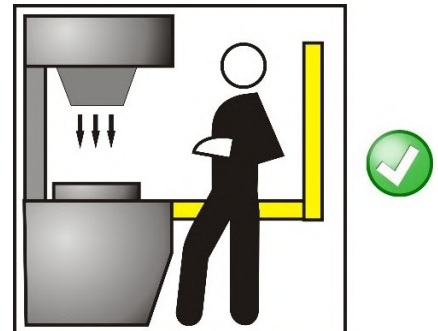


Figure 4 - Correct light curtain positioning

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.

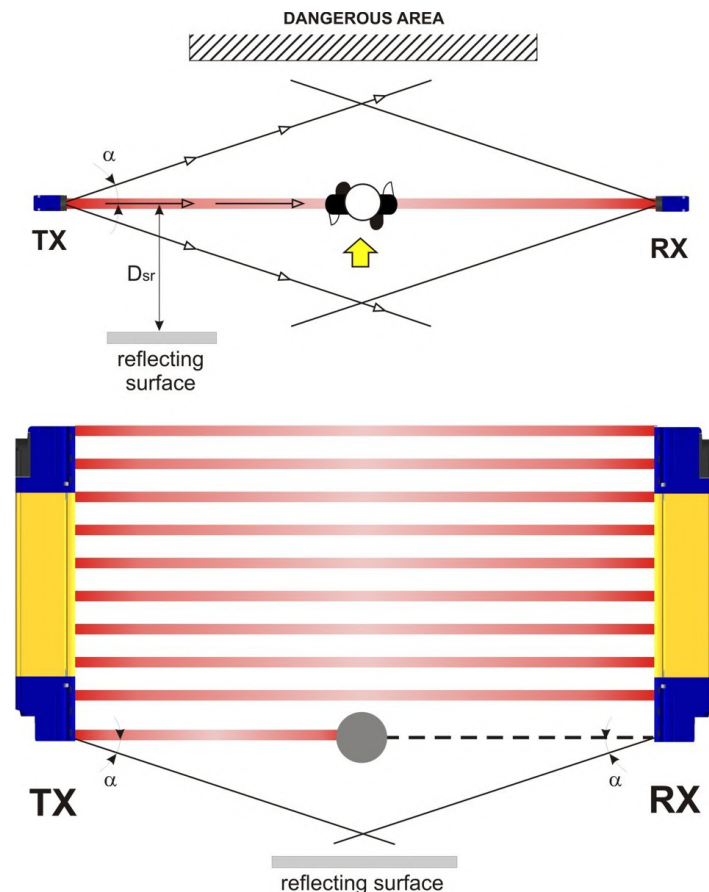


Figure 5 - Distances from reflective surfaces

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° ($\alpha = \pm 2.5^\circ$)

for ESPE Type 2 EAA = 10° ($\alpha = \pm 5^\circ$)

In the diagrams shows the minimum distance from the reflecting surface (DSR), based on the operating distance:

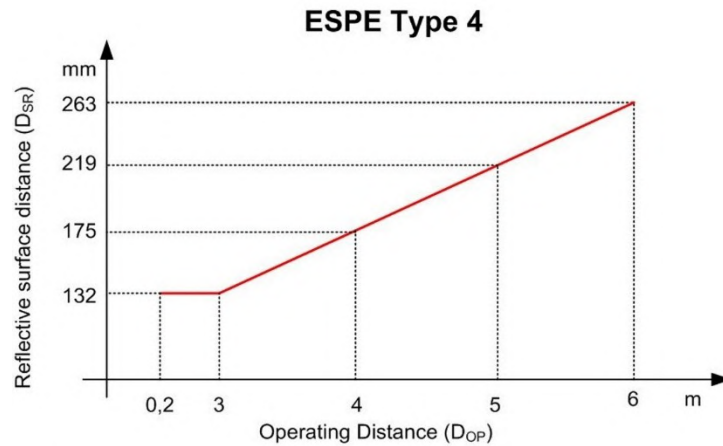


Figure 6 - Minimum distance from reflective surface for Type 4 ESPE

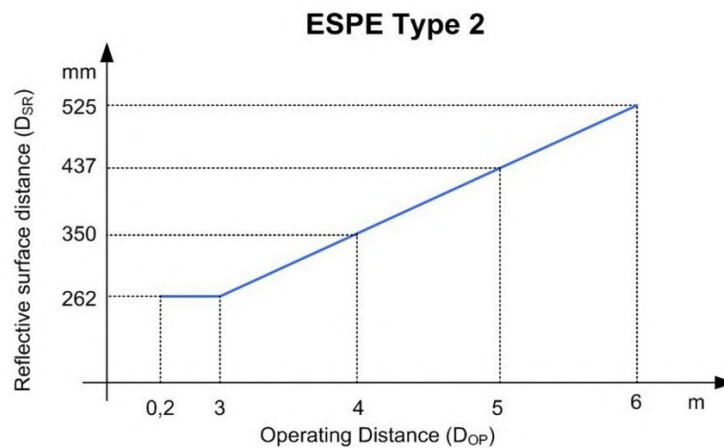


Figure 7 - Minimum distance from reflective surface for Type 2 ESPE

The formula to get Dsr is the following:

For ESPE Type 2:

$D_{sr} (m) = 0.26$ for operating distance < 3 m

$D_{sr} (m) = 0.5 \times \text{operating distance} (m) \times \tan 5^\circ$ for operating distance ≥ 3 m

For ESPE Type 4:

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

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

Distance between homologous devices

The following graphic shows the distance from the interfering devices (Ddo) according to the operating distance (Ddo) 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 Ddo distance from the TXA – RXA emitter-receiver couple axis.

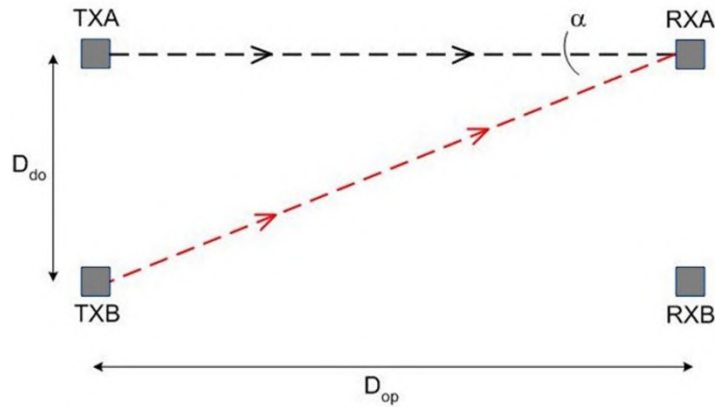
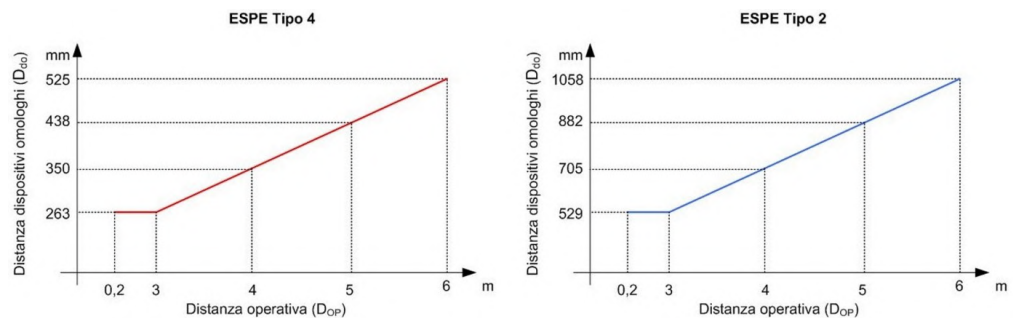


Figure 8 - Distance between homologous devices

This minimum Ddo distance depends on:

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



The formula to get Ddo is the following:

For Type 4 ESPE:

Ddo (mm) = 263 for Type 4 ESPE for operating distance < 3 m

Ddo (m) = operating distance (m) x tg 5° for operating distance ≥ 3 m

For Type 2 ESPE:

Ddo (mm) = 529 for Type 2 ESPE for operating distance < 3 m

Ddo (m) = operating distance (m) x tg 10° for operating distance ≥ 3 m



The interfering device (TBX) must be positioned at the same Ddo 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:

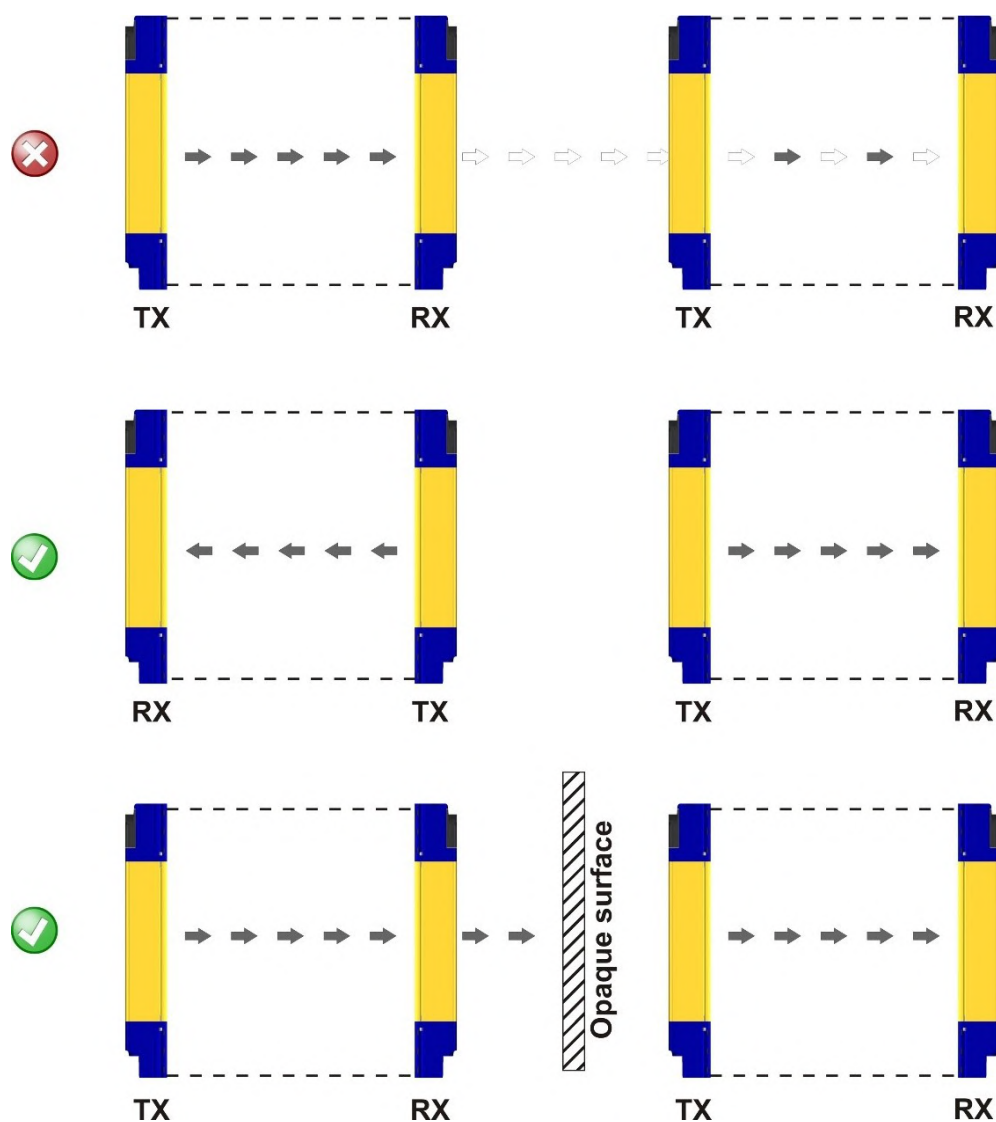


Figure 9 - Recommended positioning for homologous devices

Minimum distance for cascaded system

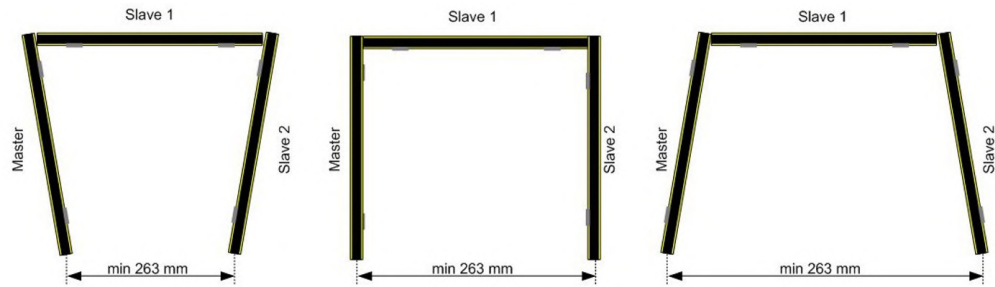


Figure 10 - Minimum distance for cascaded system

In a cascade system with a protective field width of up to 3m a minimum distance D_{do} of 263mm must be maintained between Master and Slave 2 unit in order to avoid interference.

For protective field width of more than 3m refer to Figure 10 for D_{do} calculation.

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:

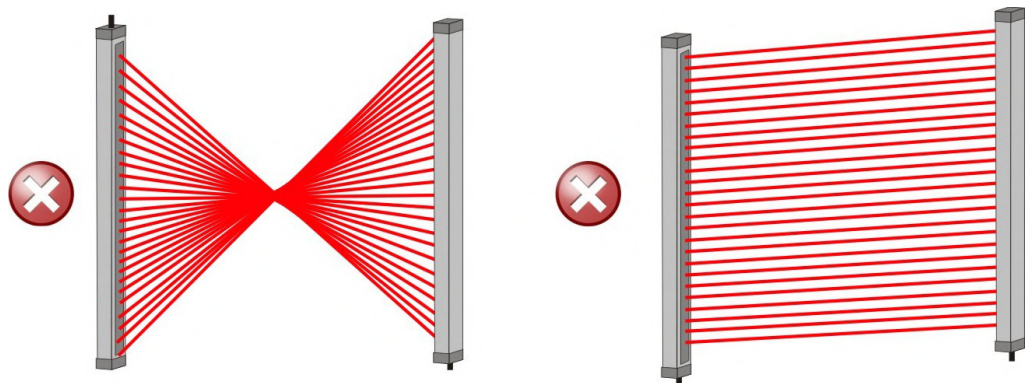


Figure 11 - Wrong light curtain TX-RX orientations

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.

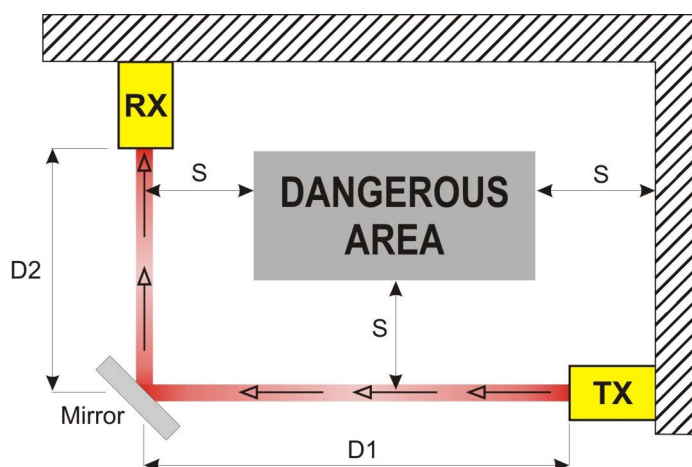


Figure 12 - Use of deviating mirrors

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	MAX. OPERATING DISTANCE
0	6 m
1	4.8 m

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

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.

Check that:

- The ESPE remains in Safe State (OSSD led lit RED) intercepting the beams along the detection zone using the specific test piece, following the scheme shown in Figure 13 (see "[Accessories](#)" on page 51).

TP-14 for light curtains with 14 mm resolution:SLx-14-xxxx-E

TP-24 for light curtains with 24 mm resolution:SLx-24-xxxx-E

TP-34 for light curtains with 30 mm resolution:SLx-34-xxxx-E

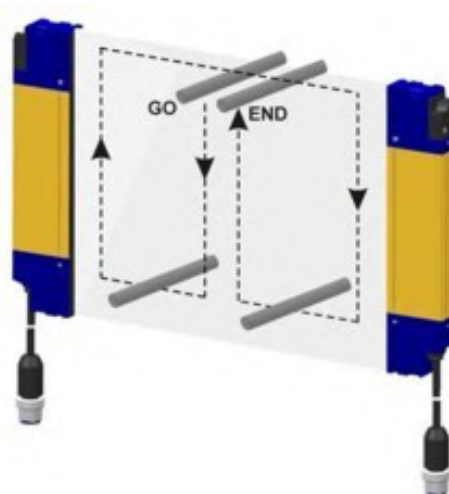


Figure 13 – First installation check with test piece

- ESPE has to be correctly aligned: press slightly on the product side in both directions, ESPE shall remain in Normal Operation (OSSD LED lit GREEN).
- 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 "[Minimum installation distance](#)" on page 6).
- The safety distance between the dangerous parts and ESPE must comply with the requirements indicated in "[Minimum installation distance](#)" on page 6.
- 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, ensure that it remains in Normal Operation for at least 10-15 minutes when the beams are not intercepted and remains in Safe State for the same period when intercepted with the proper Test Piece (see "[Accessories](#)" on page 51).
- Verify the correspondence of all the accessory functions, activating them in the different operating conditions.

CHAPTER 3

MECHANICAL MOUNTING

FIXING WITH “O” TYPE BRACKETS

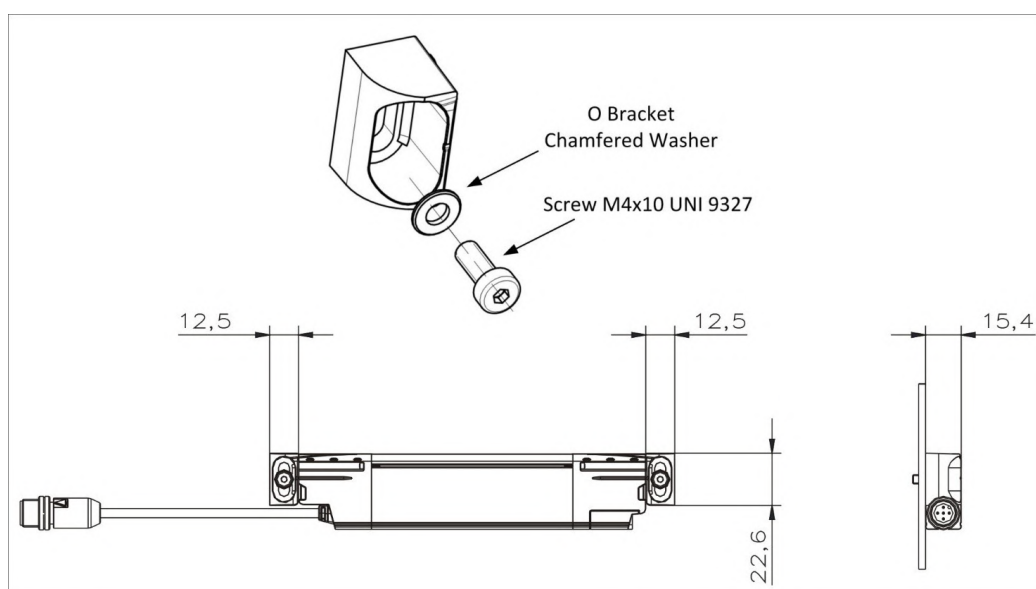


Figure 1 - “O” type brackets

- Drill two holes in the support with inter-axis $L\phi$ as specified in table.
- Fit two "O" type fixing brackets in the correct position, without completely tightening M4 screws (1).
- Position the product between the two brackets engaging the end parts in the brackets themselves. (2)
- Tighten the screws to a maximum torque of 1.2 Nm.
- For ESPE length longer than 600 mm, a double-sided tape strip in the middle is suggested in case of vibrations (3).

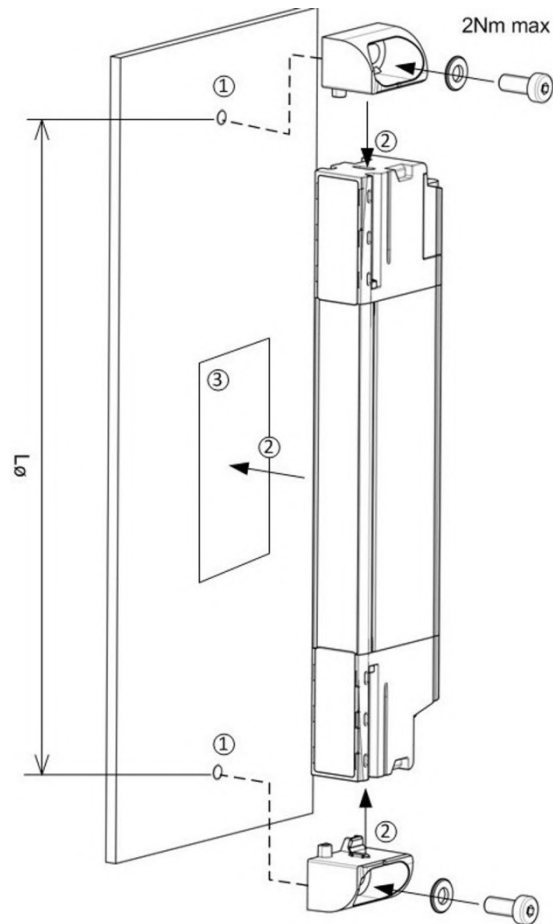


Figure 2 - Fixing with "O" type brackets

MODEL	L (mm)
SLx-xx-0150-E	162.20
SLx-xx-0210-E	222.10
SLx-xx-0270-E	282.00
SLx-xx-0300-E	312.00
SLx-xx-0330-E	341.90
SLx-xx-0360-E	371.90
SLx-xx-0390-E	401.70
SLx-xx-0420-E	431.70
SLx-xx-0450-E	461.70
SLx-xx-0480-E	491.60
SLx-xx-0510-E	521.60
SLx-xx-0540-E	551.50
SLx-xx-0570-E	581.50
SLx-xx-0600-E	611.50

FIXING WITH “C” TYPE BRACKETS

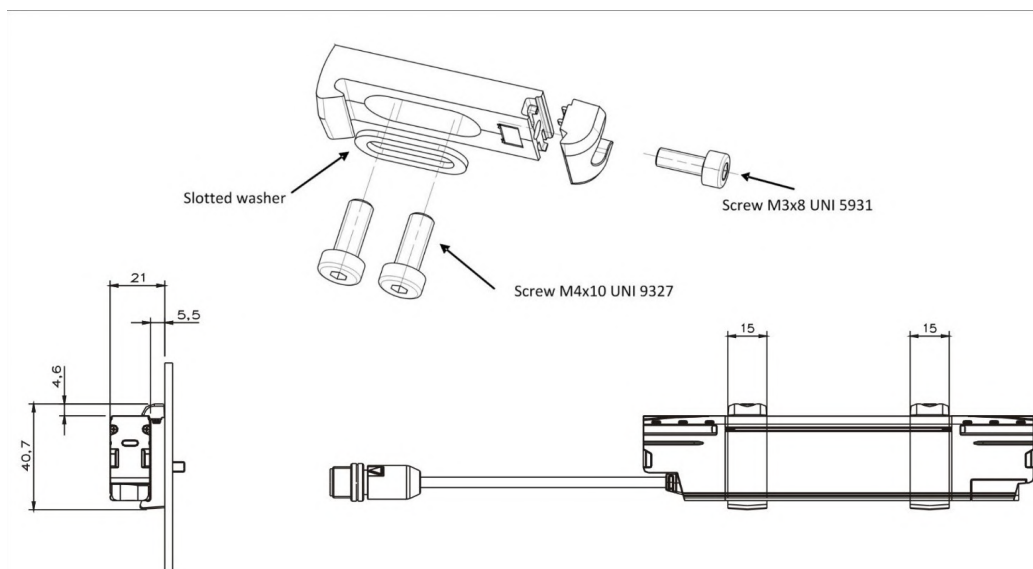


Figure 3 - “C” type brackets

- Mount the “C” type brackets in the desired position. The distance suggested for each “C” type bracket, related to product length, is equal to about $\frac{1}{4}$ of the length, measuring from the light curtain head face to the tail face. Tighten the screws M4 to a torque of 1.2 Nm.
- Position the upper clamp of the “C” type bracket by starting the M3 screw without tightening it (2).
- Place the product slightly tilted in the lower seat of the “C” type bracket using dedicated longitudinal groove of the bar (3).
- Rotate the product until fitting it in the upper clamp (4).
- Tighten the M3 screw to a maximum torque of 1.2 Nm (5).
- For lengths up to 600 mm, 2 “C” type brackets are sufficient, for greater lengths it is recommended to use 3 “C” type brackets, the third one as an additional support in the middle.

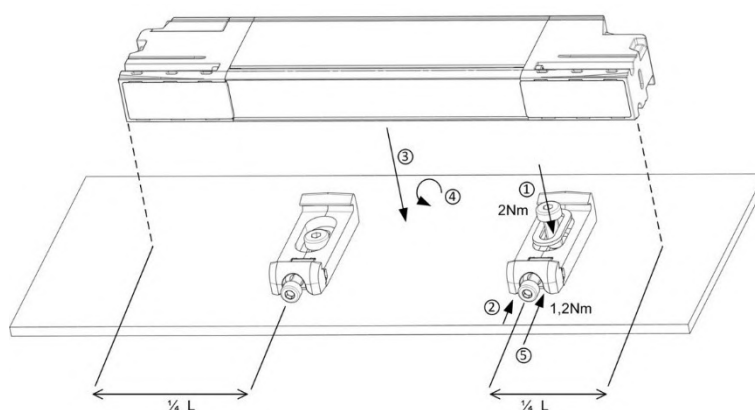


Figure 4 - Fixing with “C” type brackets

FIXING WITH "L" TYPE BRACKETS

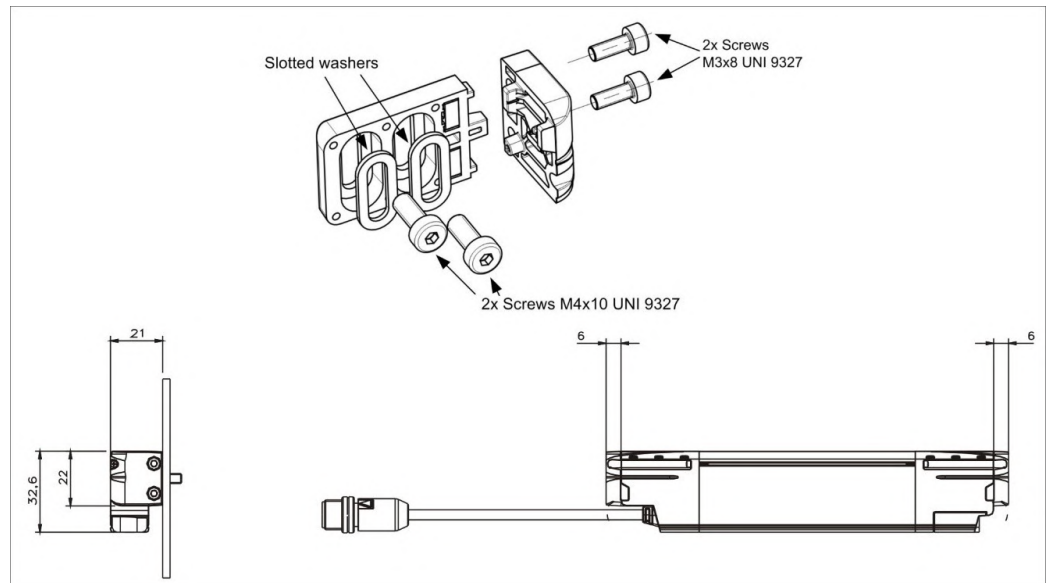


Figure 5 - "L" type brackets

- Mount the "L" type bracket at the desired height. Tighten the M4 screws to a torque of 1.2 Nm. (1)
- Mount the side plate of "L" type bracket so that the product end face sticks out of the side plate upper coupling face by a maximum of 1 mm. (2)
- Fit the product in the lower bracket by matching the relevant reference shapes (3)
- Fix the "L" part of the upper bracket working on the M3 screws. (4)
- Tighten the M3 screws to a torque of 1.2 Nm.

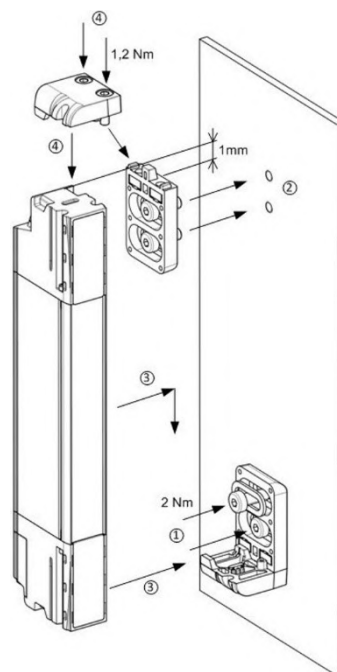


Figure 6 - Fixing with "L" type brackets

FIXING WITH “L” TYPE BRACKETS AND “C” TYPE BRACKETS

- Mount the “L” type bracket in the lower side at the desired height. Tighten the screws M4 to a torque of 2 Nm and the screws M3 to a torque of 1.2 Nm. (1)
- Mount the “C” type bracket at the desired height. The distance suggested, related to product length, for the “C” type bracket is equal to about $\frac{1}{4}$ of the length, measuring the head or the tail plane of the light curtain. Tighten the M4 screws to a torque of 1.2 Nm. (2)
- Position the upper clamp of the “C” type bracket by partially tightening the M3 screw (3).
- Place the product slightly tilted in the lower seat of the “C” type bracket using dedicated longitudinal groove of the bar (see “C” type bracket assembly) (4)
- Slide the product until mechanical stop on the “L” type bracket (5).
- Tighten the M3 screw of the “C” type bracket to a torque of 1.2 Nm. (6)

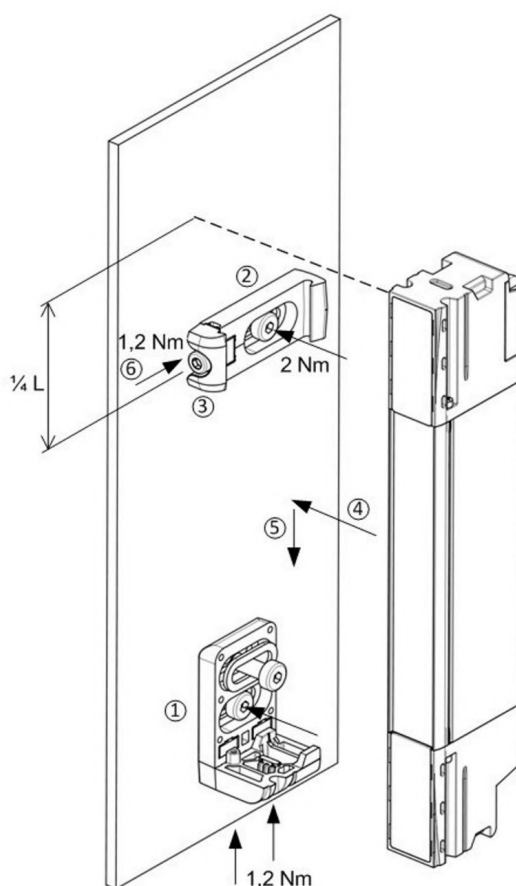


Figure 7 - Mixed fixing with “L” type and “C” type brackets

CASCADE RESOLUTION WITH DIFFERENT BRACKETS

Fixing with “O” type brackets

Cascade resolution at junction drops to 40 mm.

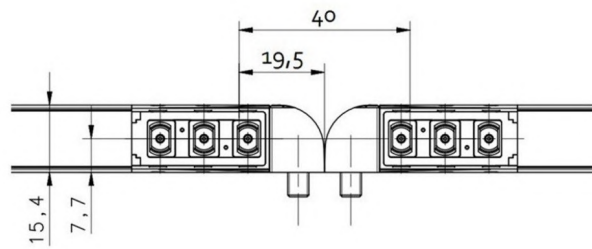


Figure 8 - Fixing with “O” type brackets

Fixing with “C” type brackets

Cascade resolution at junction remains 14 mm.

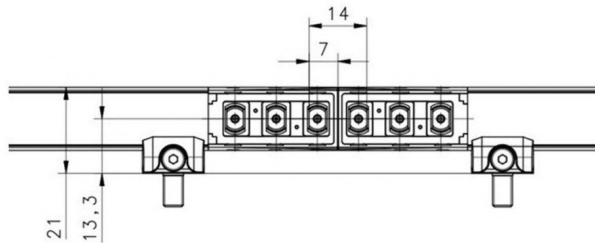


Figure 9 - Fixing with “C” type brackets

Fixing with “L” type brackets

Cascade resolution at junction drops to 26 mm.

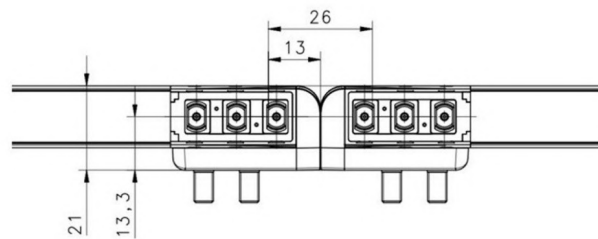


Figure 10 - Fixing with “L” type brackets

CASCADE 90° RESOLUTION

When cascading two SLIM light curtains at 90° like in Figure 11, the resolution at junction drops to 18mm if "C" type brackets are used or any bracket combination that allows the top of one light curtain to touch the side of the other.

For 24mm and 34mm resolution models the resolution is always maintained in cascade junctions when properly fixed with provided brackets.

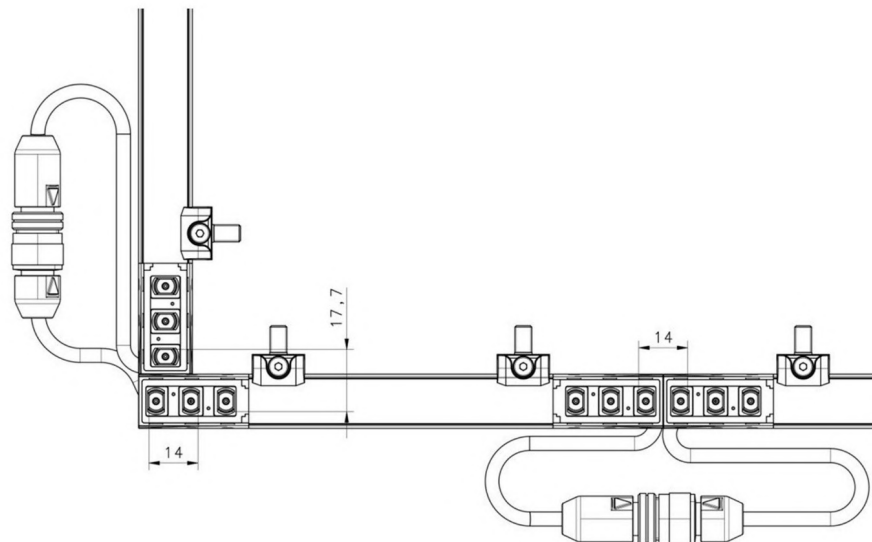


Figure 11 - Cascade resolution at 90° junction

CHAPTER 4

ELECTRICAL CONNECTIONS

PIN-OUT AND CONFIGURATION PIN CONNECTION

All electrical connections to the emitting and receiving units are made through a male M12 connector, carried by a pig-tail cable located on the lower part of the two units.

For both the receiver and the emitter M12 5-pole connector is used.

Receiver (RX)

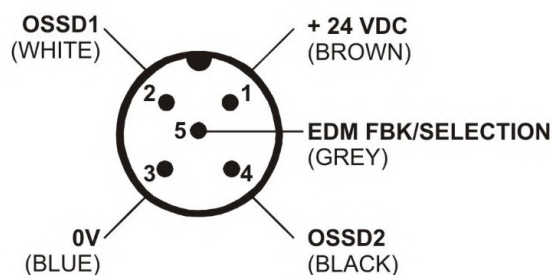
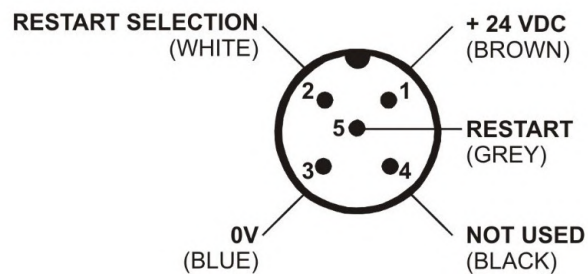


Figure 1 - Receiver

FUNCTION	CONNECTION TO	STATUS
EDM FBK / SELECTION	Normally closed contact for a force-guided relay	EDM ENABLE
	OSSD1	EDM DISABLE

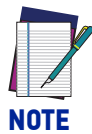
Emitter (TX)**Figure 2 - Emitter**

FUNCTION	CONNECTION TO	STATUS
RESTART	Normally closed contact to 24 Vcc	MANUAL RESTART
	RESTART SELECTION	AUTOMATIC RESTART
	FLOATING	ALIGN MODE

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.**
 - The power supply must provide safe mains isolation (SELV/PELV), no PE (Protective Earth) is therefore required.
 - The RESTART wire must be connected through a N.C. button to the supply voltage of the ESPE.



NOTE

To meet the requirements of the relevant product standards (e.g. EN 61496-1: 2013), the external voltage supply for the devices must be able to filter out the 10ms-100% dip on rated voltage allowed in EN 60204-1.



CAUTION

The Restart button must be located in such a way that the operator can check the dangerous zone during any reset operation (see "Commissioning and Configuration" on 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

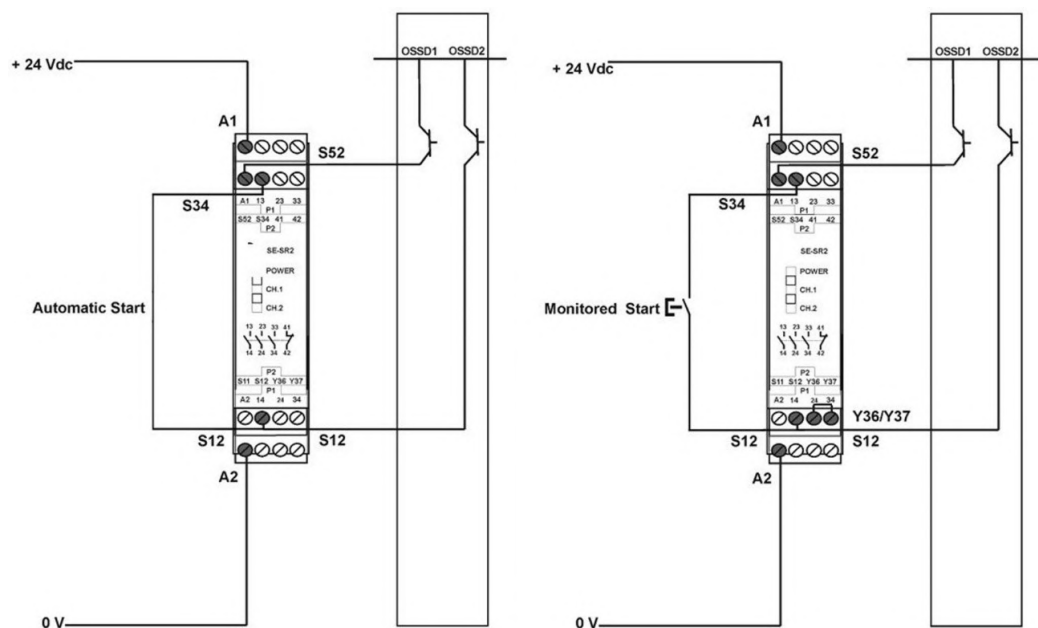


Figure 3 - Connection to SE-SR2 Safety Relays

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 the output failure condition (see "[User Interface and Diagnostics](#)" on page 39).
- 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.

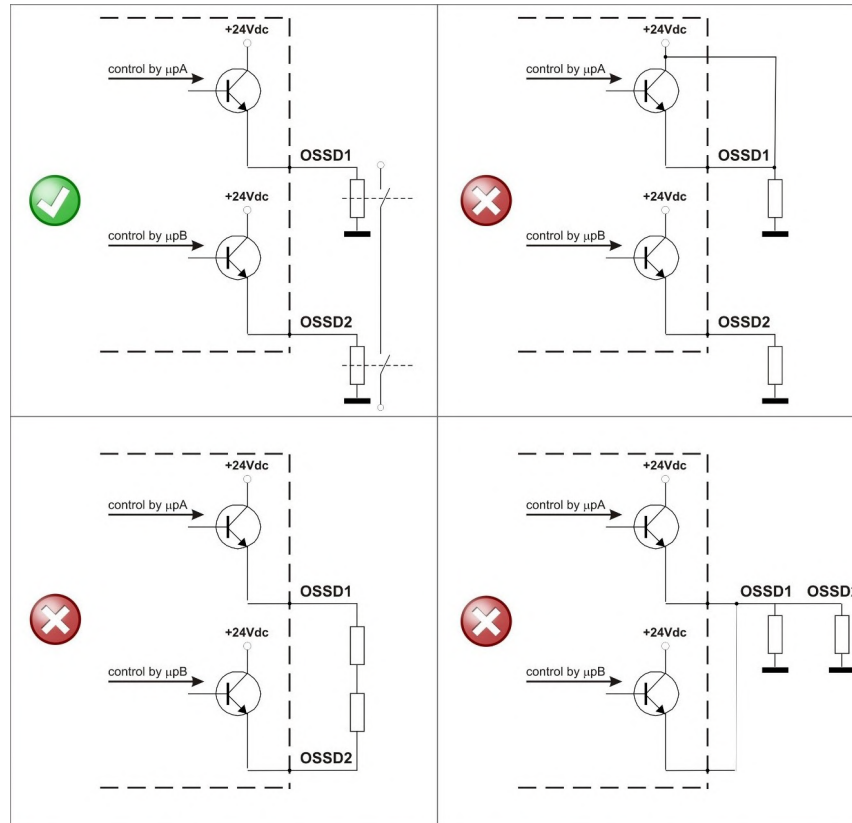


Figure 4 - OSSDs connection

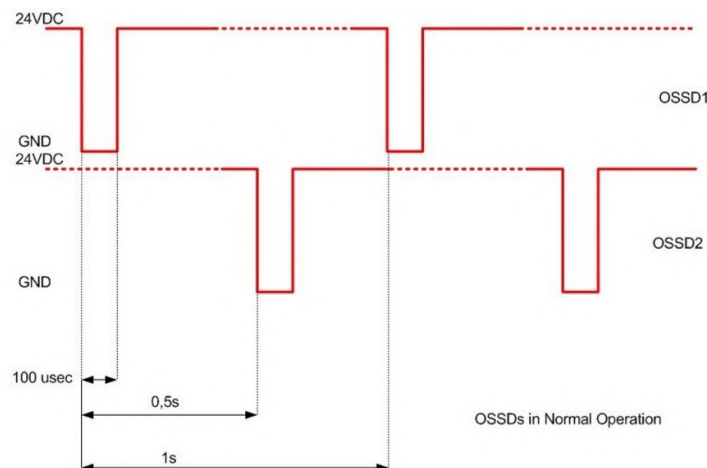


Figure 5 - OSSDs test timing pattern

CASCADE CONNECTION

Up to three SLIM light curtains can be connected in a cascade series.

The cascade connection allows to monitor up to three areas with only two Safety Outputs connected to Master unit.

Master unit takes care of collecting safety optic scan results from Slave units and the synchronization between them to avoid mutual interference.

Each SLIM unit can either be used as Master or Slave, only depending on cable connection.

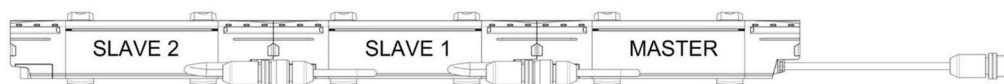


Figure 6 - Cascade composition

For cascaded system connection three Cascade Cables are available as accessory:

MODEL	DESCRIPTION	L +/- 10 (mm)	CODE
CS-H1-03-B-001	CASCADE cable 0.1 m	90	95A252950
CS-H1-03-B-005	CASCADE cable 0.5 m	490	95ASE2550
CS-H1-03-B-01	CASCADE cable 1 m	990	95ASE2560

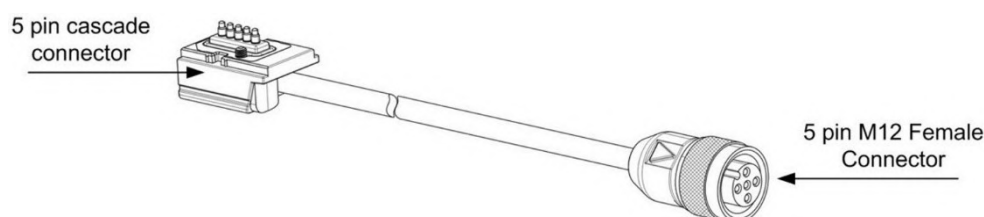


Figure 7 - Cascade accessory cables

To connect the cascade unit:

- Fix all cascade units with proper brackets as described in "[Mechanical Mounting](#)" on [page 20](#). (1)
- Remove Terminator Caps at the end of Master and Slave 1 (if present) by loosening the two fixing screws for both emitter and receiver. (2)
- Fasten the cascade cables in place of removed terminator caps, ensure all cables bend radius it's not less than 4mm (3)
- Connect Slaves M12 male connectors to M12 Female connectors from cascade cables (4).

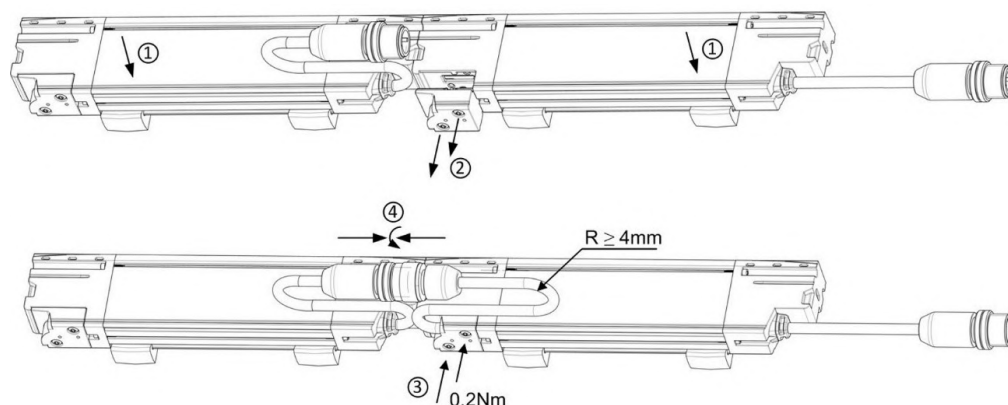


Figure 8 - Mounting

CHAPTER 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 synchronize the two units is the closest one to the pig-tail cable: SYNC optic.

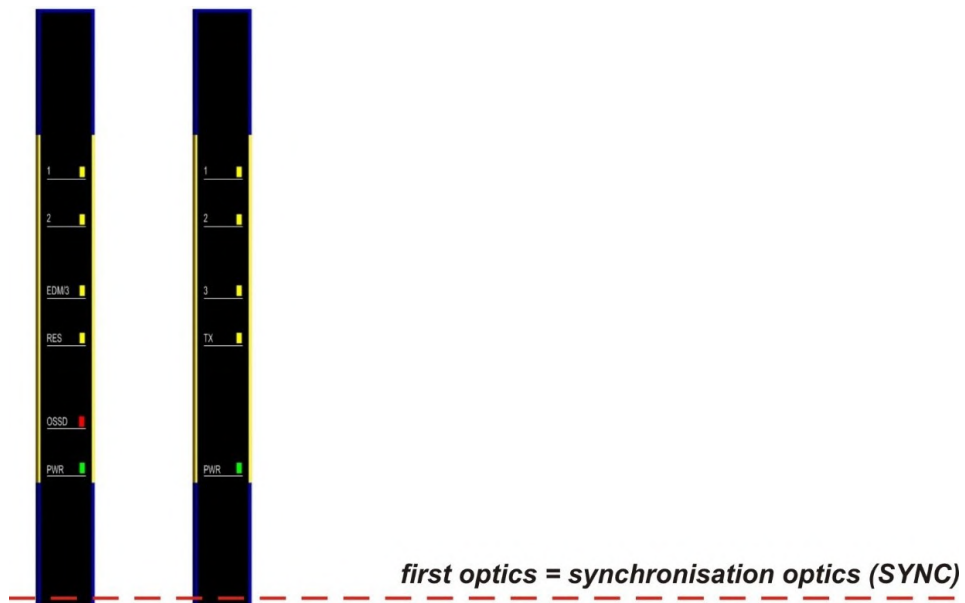


Figure 1 - Synchronization Optics

In alignment mode user interface inform the user about quality and level of alignment.



To activate Alignment Mode, leave Restart input floating on TX unit at power on (see "Pin-out and configuration pin connection" on page 27).



NOTE

To check alignment level for periodical maintenance ESPE must be restarted in Alignment Mode.

For cascaded system start the alignment procedure always from Master unit, then proceed with Slaves.



NOTE

OSSDs are not enabled on alignment mode.

CHAPTER 6

COMMISSIONING AND CONFIGURATION

RESTART MODE SELECTION AND RESTART FUNCTION

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 condition.

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

- **Automatic Restart**, After activation, ESPE resets to Normal Operation once the object has been removed from the controlled area.
- **Manual Restart**, After activation, ESPE resets to Normal Operation only once the RESTART function has been activated (see [Figure 3 on page 36](#)) and provided that the object has been removed from the controlled area.

This condition, called interlock, is signaled on the display (see ["User interface" on page 39](#)).

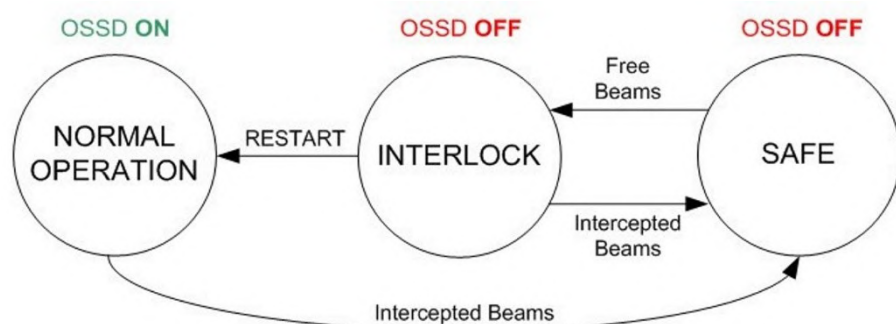


Figure 1 - Auto/Manual Restart selection

Select either automatic or manual restart by properly connecting **RESTART** input and **RESTART SELECTION** output of TX connector (see "Electrical Connections" on page 27).

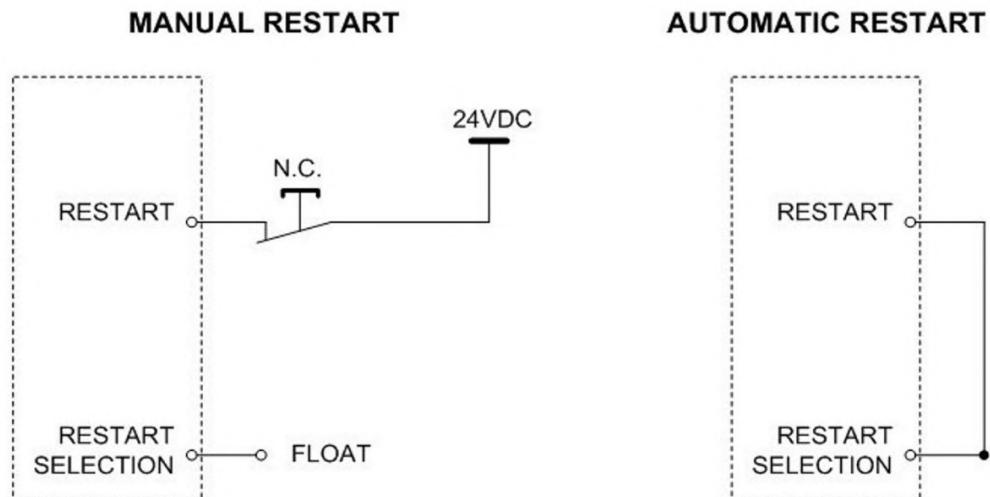


Figure 2 - Auto/Manual Restart selection



NOTE

Leave **RESTART SELECTION** floating when selecting Manual Restart mode.

Since mode selection is read by TX unit, at startup RX unit always start in alignment mode (see "Alignment Procedure" on page 32) then switches to selected functioning mode after first correct alignment.



WARNING

Carefully assess risk conditions and restart modes.

In applications protecting access to dangerous areas, the automatic restart mode is potentially unsafe if it allows the operator to pass completely beyond the sensitive area. In this case, the manual restart or, for example, the manual restart of the SE-SR2 relay is necessary.

Time chart (Manual Restart)

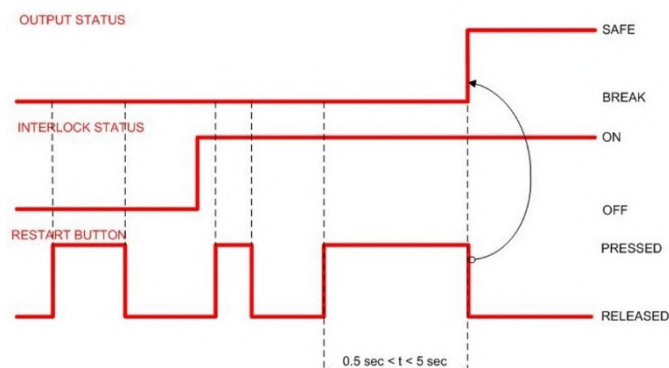


Figure 3 - Manual Restart timing

EDM FUNCTION

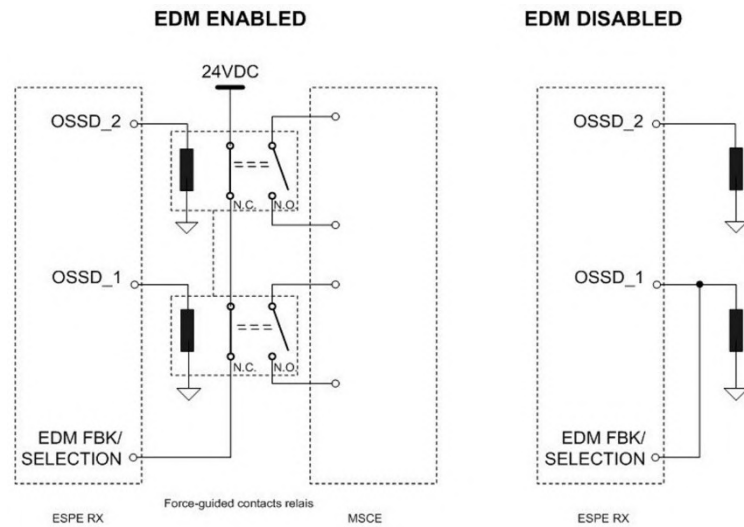


Figure 4 - EDM connection

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

EDM enabled

Connect EDM FBK/SELECTION input at normally closed contacts to 24 VDC of the devices to be monitored.

When in Normal Operation led LED/3 is lit to indicate the EDM function is enabled.



Figure 5 - EDM UI indication

When EDM function is enabled EDM FBK/SELECTION input is monitored to be antivalent to OSSDs status. Monitoring timings are specified in Figure 6:

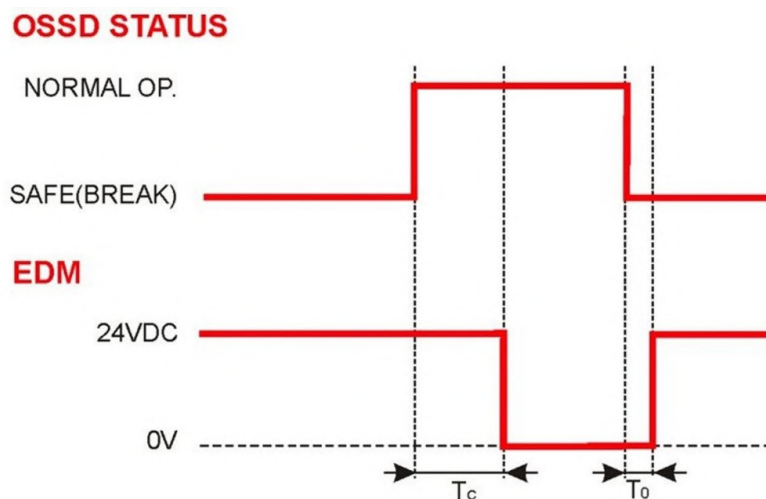


Figure 6 - EDM timings

TC ≤350 msec: time after OSSD OFF-ON switch when EDM test is performed.

T0 ≤100 msec: time after OSSD ON-OFF switch when EDM test is performed.

EDM disabled

Connect EDM FBK/SELECTION input to OSSD1 to disable the EDM function.

CHAPTER 7

USER INTERFACE AND DIAGNOSTICS

USER INTERFACE

Light Curtain operating status is visualized through a LED User Interface present on both the receiver and emitter units.

The table below shows all LEDs signaling modes: the operator can evaluate the main causes of the system stop or failure through the display and signaling LEDs.












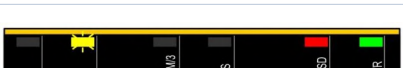





NOTE

With a Cascade configuration, the user interface on the Receiver Master unit shows the operating status and diagnostic messages, while on the Receiver Slave units it shows the alignment status.

TX side

ESPE WORKING MODE	INDICATION	LED CONFIGURATION	RECOMMENDATIONS
		BLINK INDIFFERENT OFF ON	
Normal operation	Emission		
Failure lockout	F1: Failure on microprocessor		Internal Failure, check for operating condition (see "Technical Data" on page 44) and any cause of electrical interference, power cycle the ESPE.
	F2: Failure on optics		Failure on optic scan, check for any cause of electrical interference, power cycle the ESPE
	F12: Cascade Failure		Failure on cascade communication, check cascade connection or terminator cap fixing (see "Cascade connection" on page 31)
	F13: Failure on restart		Failure on Restart function, check RESTART SELECTION connection (see "Restart mode selection and Restart function" on page 35)
If failure persists after recommended checks and ESPE power cycle, please contact Datasensing.			

RX side

ESPE WORKING MODE	INDICATION	LED CONFIGURATION	RECOMMENDATIONS
			
Alignment	Not aligned, SYNC not engaged		Refer to " Alignment Procedure " on page 32 for correct Alignment Procedure or properly connect RESTART input on TX unit to enter Normal Operation mode (see " Restart mode selection and Restart function " on page 35)
	Minimum signal level, SYNC engaged		
	Maximum signal level		
Normal operation Manual restart only	Interlock free beams		Press RESTART button for at least 0.5sec to restart ESPE in Normal Operation
Normal operation	OSSD ON		Normal operation
	OSSD OFF		Safe status, remove any blocking object or correctly align the ESPE
	EDM active		EDM Function Enabled
Lockout error	F1: failure on microprocessor		Internal Failure, check for operating condition (see " Technical Data " on page 44 and any cause of electrical interference, power cycle the ESPE
	F2: failure on optics		Failure on optic scan, check for any cause of optical and electrical interference, power cycle the ESPE
	F3: failure on EDM		Failure on EDM, check connection to relay (see " EDM function " on page 37), then power cycle the ESPE
	F12: cascade failure		Failure on cascade communication, check cascade connection or terminator cap fixing (see " Cascade connection " on page 31)
	F13: failure on restart		Failure on Restart function, check for Restart Button connection and any cause of optical interference, then power cycle the ESPE
	F23: failure on OSSDs		Failure on Safety Outputs, check for proper connection (see " Electrical Connections " on page 27) and any cause of electrical interference, then power cycle the ESPE
	Power supply failure		Check for proper connection (see " Electrical Connections " on page 27)
If failure persists after recommended checks and ESPE power cycle, please contact Datasensing.			

CHAPTER 8

PERIODICAL CHECKS

The following is a list of recommended check and maintenance operations that should be periodically carried-out by qualified personnel (see ["Controls after first installation" on page 19](#)).

Check that:

- The ESPE remains in Safe State (Red OSSD LED ON) during beam interruption along the entire detection zone, using the appropriate "Test Piece" according to the scheme in [Figure 13 on page 19](#).

TP-14 for light curtains with 14 mm resolution:	SLx-14-xxxx-E
TP-24 for light curtains with 24 mm resolution:	SLx-24-xxxx-E
TP-34 for light curtains with 30 mm resolution:	SLx-34-xxxx-E

- 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 ["Commissioning and Configuration" on page 35](#)).
- The safety distance between the dangerous areas and the ESPE are in accordance with the instructions included in see ["Installation" on page 11](#).
- 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.

GENERAL INFORMATION AND USEFUL DATA



NOTE

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 Technical Support 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 units shall be sent to Datasensing Technical Support department.

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.

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.

CHAPTER 9

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**

PRODUCT DISPOSAL

Under current Italian and European laws, Datasensing is not obliged to take care of product disposal at the end of its life.

Datasensing recommends disposing of the product in compliance with local laws or contact authorized waste collection centers.

APPENDIX A

TECHNICAL DATA

SAFETY CATEGORY
Type 2 (rif. EN 61496-1: 2013)
SIL 1 (rif. EN 61508)
SIL CL 1 (rif. EN 62061:2005/A1: 2013)
PL c, Cat. 2 (rif. EN ISO 13849-1: 2015)
PFHd [1/h] = 1.04E -08
MTTFd [years] = 273

SAFETY CATEGORY
Type 4 (rif. EN 61496-1: 2013)
SIL 3 (rif. EN 61508)
SIL CL 3 (rif. EN 62061:2005/A1: 2013)
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)	1.6 W max (55 mA at 28.8 VDC)
Consumption (RX)	4.2 W max (145 mA at 28.8 VDC – no load on OSSD)
OSSD outputs	2 PNP
OSSD short-circuit protection	0.6 A type
OSSD output current	0.3 A max / each output
OSSD output voltage - status ON	Vdd – 1 V min
OSSD output voltage - status OFF	0.2 V max
OSSD capacitive load	1 μ F at 24 VDC max
OSSD Test pulses width	100 μ s (see "Notes on connections" on page 29)
OSSD Test pulses frequency	1/s
Response times	7-17 ms (see "Available Models and Response Times" on page 47)
Controlled height	150...120 mm
Auxiliary functions	Manual/Automatic Restart; EDM
Electrical protection	Class III (see "Notes on connections" on page 29)
Connections	M12 5-pole for emitter M12 5-pole for receiver
Cable length (for power supply)	20 m max.

OPTICAL DATA	
Light emission (I)	Infrared, LED (850 Nm)
Risk group EN 62471	Exempt
Resolution	14 - 24 - 34 mm
Operating distance	0.2...6 m
Ambient light rejection	EN 61496-2: 2013

MECHANICAL AND ENVIRONMENTAL DATA	
Operating temperature	-10...+55 °C
Storage temperature	-25...+70 °C
Temperature class	T6
Humidity	15...95 % (non condensing)
Mechanical protection	IP65 (EN 60529)
Vibrations	Width 0.35 mm, Frequency 10...55 Hz 20 sweep per axis, 1 octave/min (EN 60068-2-6)
Shock resistance	10G (16 ms) 1,000 shocks per axis (EN 60068-2-29)
Housing material	Painted aluminum (yellow RAL 1003)
Front glass material	PMMA
Cap material	Painted Zamak (Blue RAL 5002)
Weight	W [g] = L [mm] x 5 + 50 (single unit TX or RX)

APPENDIX B

AVAILABLE MODELS AND RESPONSE TIMES

AVAILABLE MODELS

CONTROLLED HEIGHT	14mm RESOLUTION		24mm RESOLUTION		34mm RESOLUTION	
	BEAMS NO.	RESPONSE TIME	BEAMS NO.	RESPONSE TIME	BEAMS NO.	RESPONSE TIME
150	15	7	8	7	6	7
210	21	8	11	7	8	7
270	27	8	14	8	10	8
300	30	8	16	8	11	8
330	33	9	17	8	12	8
360	36	9	19	8	13	9
390	39	10	20	8	14	9
420	42	10	22	9	15	9
450	45	10	24	9	16	9
480	48	10	25	9	17	10
510	51	11	27	9	18	10
540	54	11	28	9	19	10
570	57	11	30	9	20	10
600	60	11	32	9	21	10
630	63	12	33	10	22	11
660	66	12	35	10	23	11
690	69	13	36	10	24	11
720	72	13	38	10	25	11
750	75	13	40	10	26	11
780	78	13	41	10	27	12
810	81	14	43	11	28	12
840	84	14	44	11	29	12
870	87	14	46	11	30	12
900	90	14	48	11	31	12
930	93	15	49	11	32	13
960	96	15	51	11	33	13
990	99	16	52	12	34	13
1020	102	16	54	12	35	13
1050	105	16	56	12	36	14
1080	108	16	57	12	37	14
1110	111	17	59	12	38	14
1140	114	17	60	12	39	14
1170	117	17	62	13	40	15
1200	120	17	64	13	41	15

	EN ISO 13849-1	EN 954-1	EN ISO 13849-1	EN IEC 61508	Prob. of danger failure/hour	Life span	Mean Time to Dangerous Failure	Average Diagnostic Coverage	Safe Failure Structure	Hardware Fault Tolerance
Product	PL	CAT	SIL	SIL CL	PFHd (1/h)	T1 (years)	MTTFd (years)	DC	SFF	HFT
SL2-xx-xxxx-E	c	2	1	1	7.89E-09	20	191	98.80%	98.93%	0
SL4-xx-xxxx-E	e	4	3	3	2.64E-09	20	144	98.80%	98.93%	1

CASCADE RESPONSE TIMES

For cascade systems, independently of unit length, response times are the following:

- 2-Unit Cascade: 18 ms
- 3-Unit Cascade: 20 ms



NOTE

Make sure that installation conditions indicated in "Minimum distance for cascaded system" on page 17 are met for 3-unit cascade systems.

APPENDIX C

OVERALL DIMENSIONS

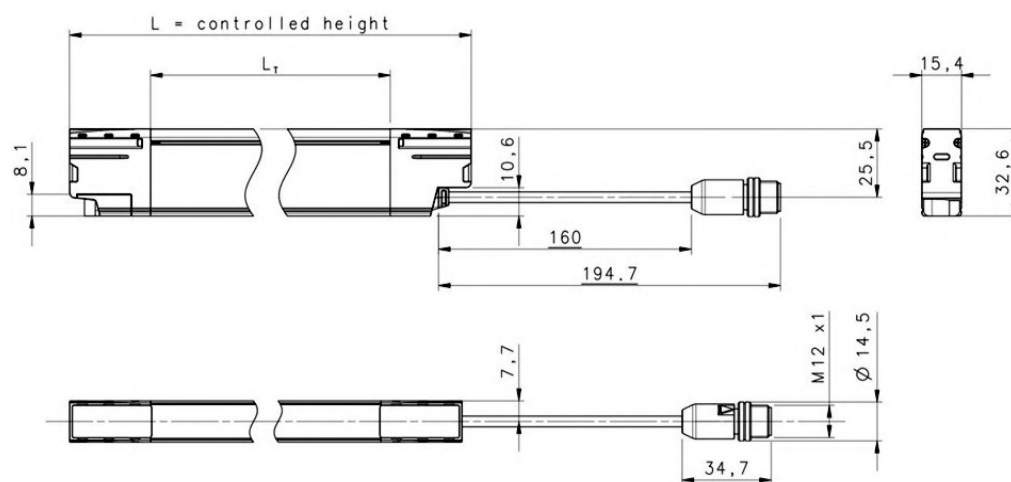


Figure 1 - Overall dimensions (mm)

MODEL	L	LT = (L-63)
SLx-xx-0150-E	150	87
SLx-xx-0210-E	210	147
SLx-xx-0270-E	270	207
SLx-xx-0300-E	300	237
...
SLx-xx-1170-E	1170	1107
SLx-xx-1200-E	1200	1137

SLx- = Type 2 or Type 4
 -xx- = Resolution 14, 24, and 34 mm

APPENDIX D

INCLUDED ACCESSORIES

“C” TYPE BRACKETS KIT

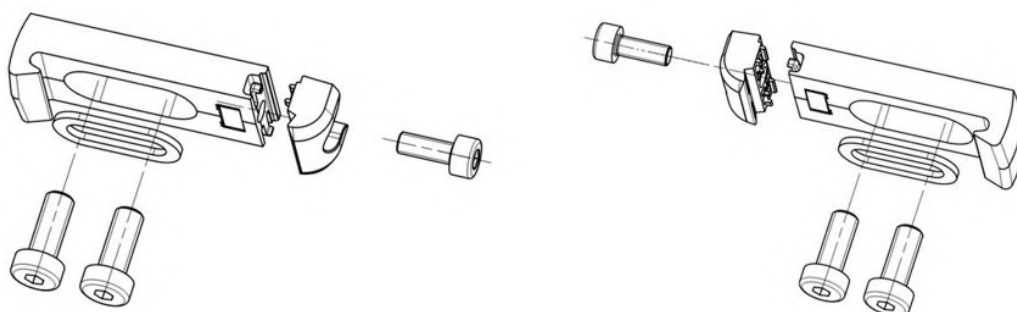


Figure 1 - “C” type brackets kit

“O” TYPE BRACKETS KIT

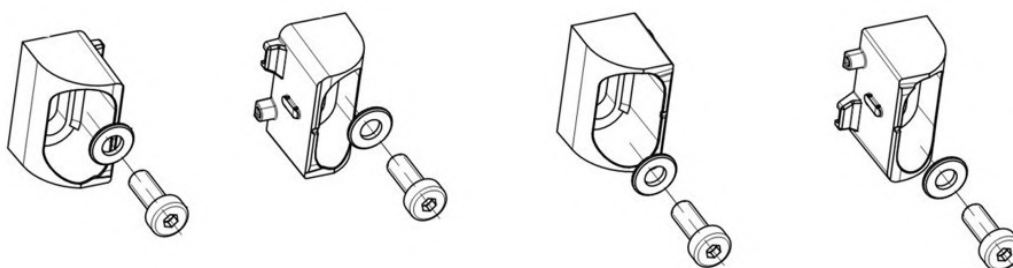


Figure 2 - “O” type brackets kit

APPENDIX E

ACCESSORIES

(ST-K2-SL-C) “C” TYPE BRACKETS KIT

MODEL	DESCRIPTION	CODE
ST-K2-SL-C	“C” type brackets (2 pcs kit)	95ASE2510

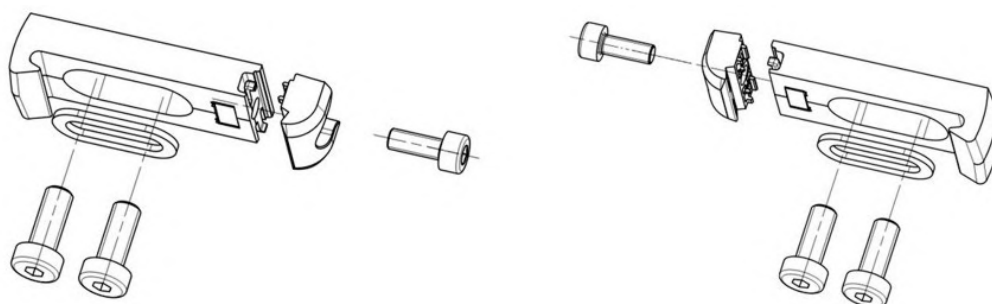


Figure 1 - “C” type brackets kit

(ST-K4-SL-O) “O” TYPE BRACKETS KIT

MODEL	DESCRIPTION	CODE
ST-K4-SL-O	“O” type brackets (2 pcs kit)	95ASE2520

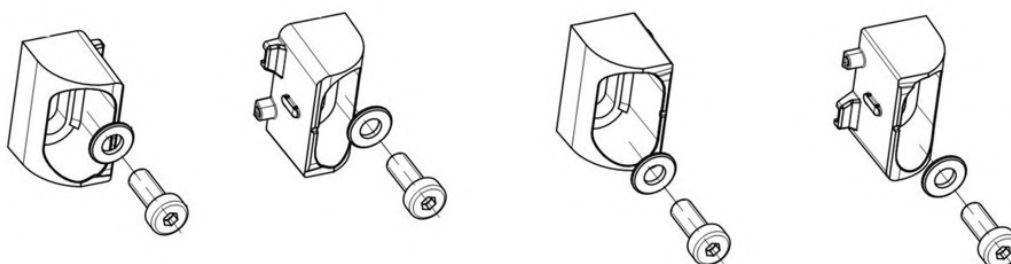


Figure 2 - “O” type brackets kit

(ST-K2-SL-L) “L” TYPE BRACKETS KIT

MODEL	DESCRIPTION	CODE
ST-K2-SL-L	“L” type brackets (2 pcs kit)	95ASE2540

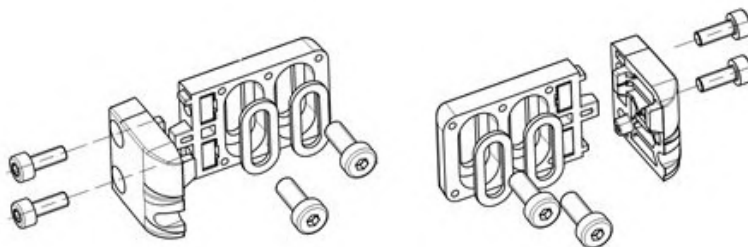


Figure 3 - “L” type brackets kit

(ST-K2-SL-C-OR) “C” TYPE ORIENTABLE BRACKETS KIT

MODEL	DESCRIPTION	CODE
ST-K2-SL-C-OR	“C” type orientable brackets (2 pcs kit)	95ASE2530

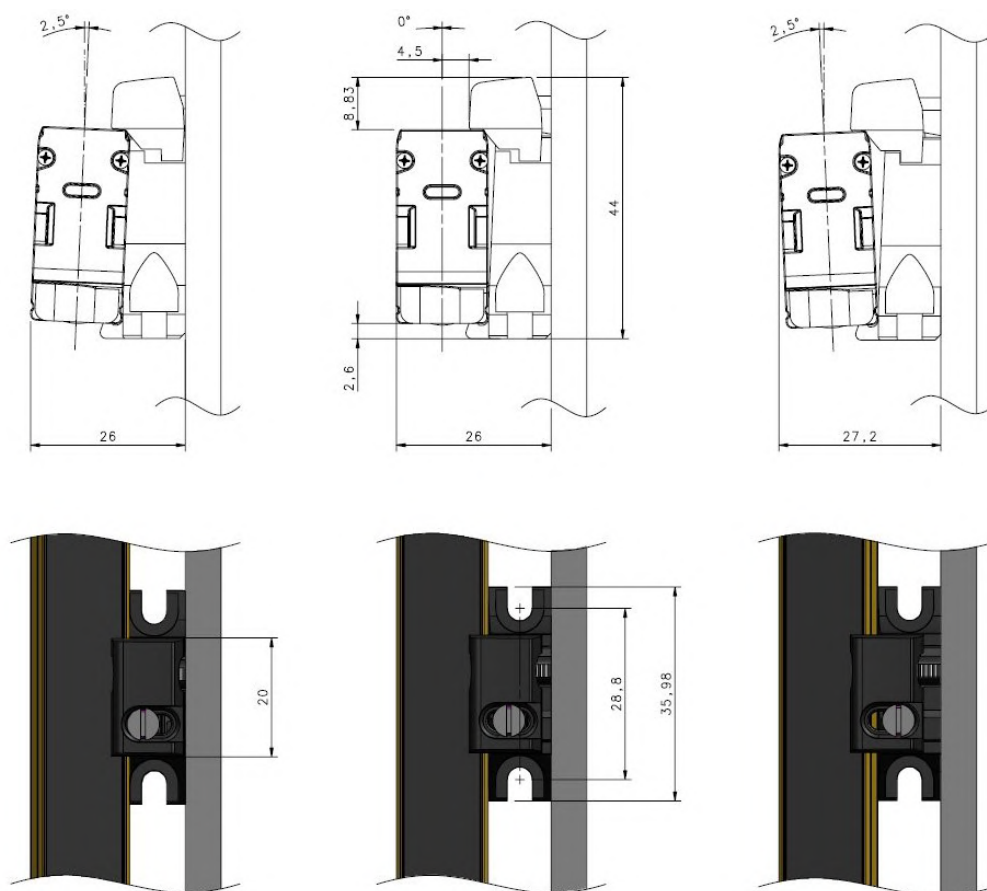


Figure 4 - “C” type orientable brackets kit

(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

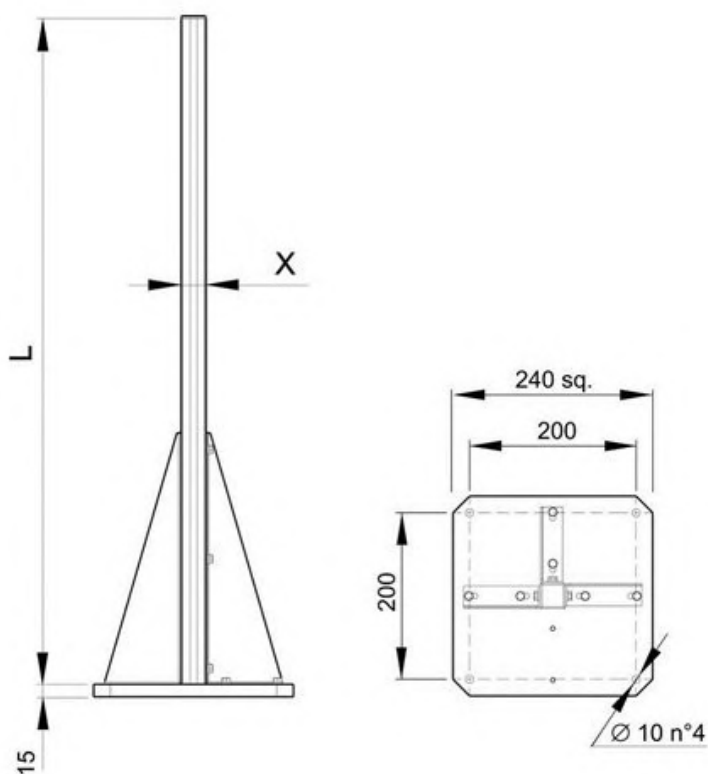


Figure 5 - Dimensions (mm)

(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

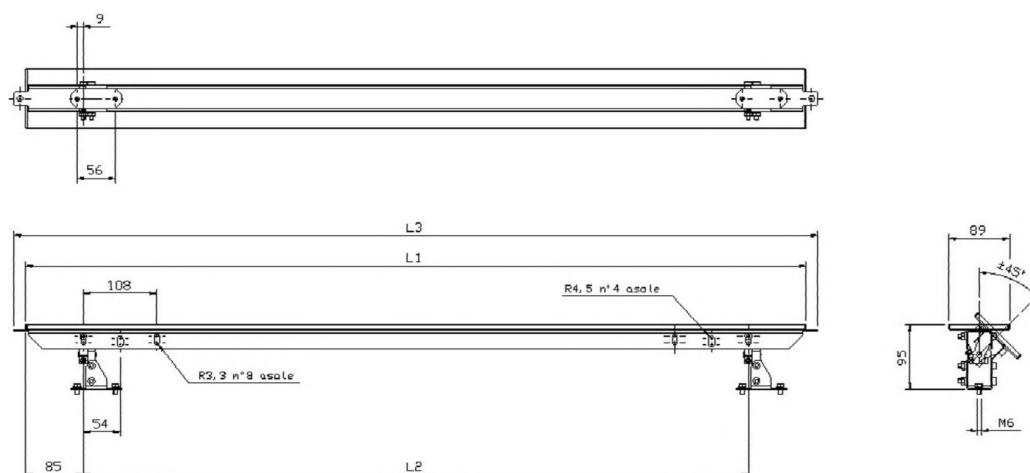


Figure 6 - Deviating mirrors (mm)

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

MODEL	DESCRIPTION	CODE
SG-DM 150	Deviating mirror version 150 mm	95ASEE1670

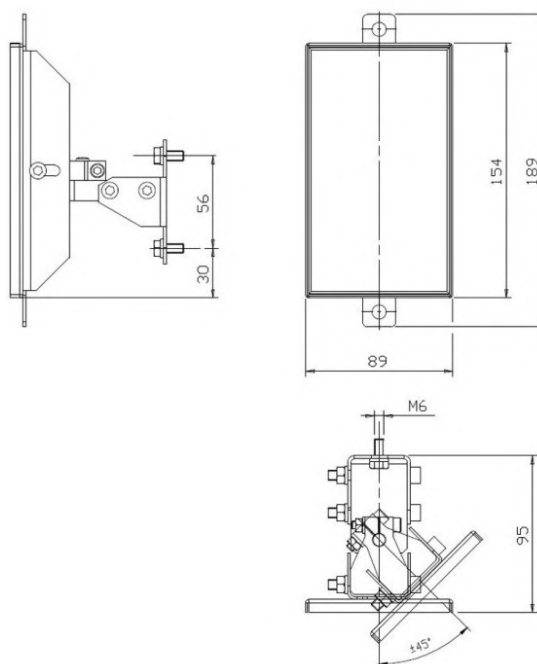


Figure 7 - SG-DM 150 (mm)

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)	95ASEE1940

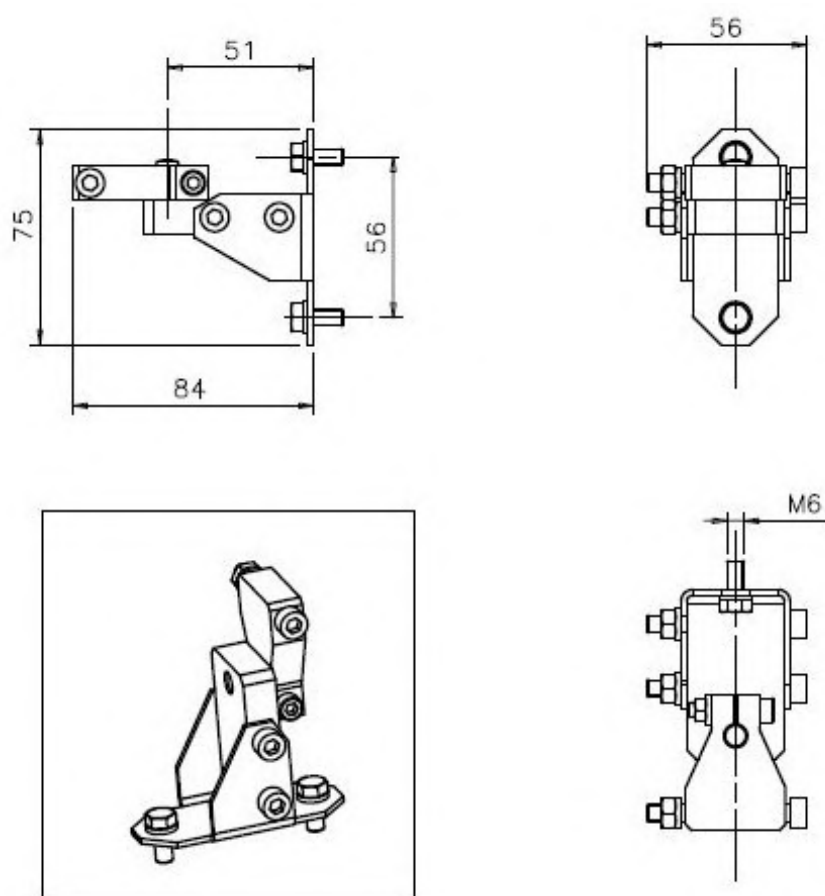


Figure 8 - Mounting kit

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

(TP) TEST PIECE

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

CONNECTION 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

CASCADE CABLES

MODEL	DESCRIPTION	$L \pm 10$ (mm)	CODE
CS-H1-03-B-001	Cascade cable 0.1 m	90	95A25950
CS-H1-03-B-005	Cascade cable 0.5 m	490	95ASE2550
CS-H1-03-B-01	Cascade cable 1 m	990	95ASE2560

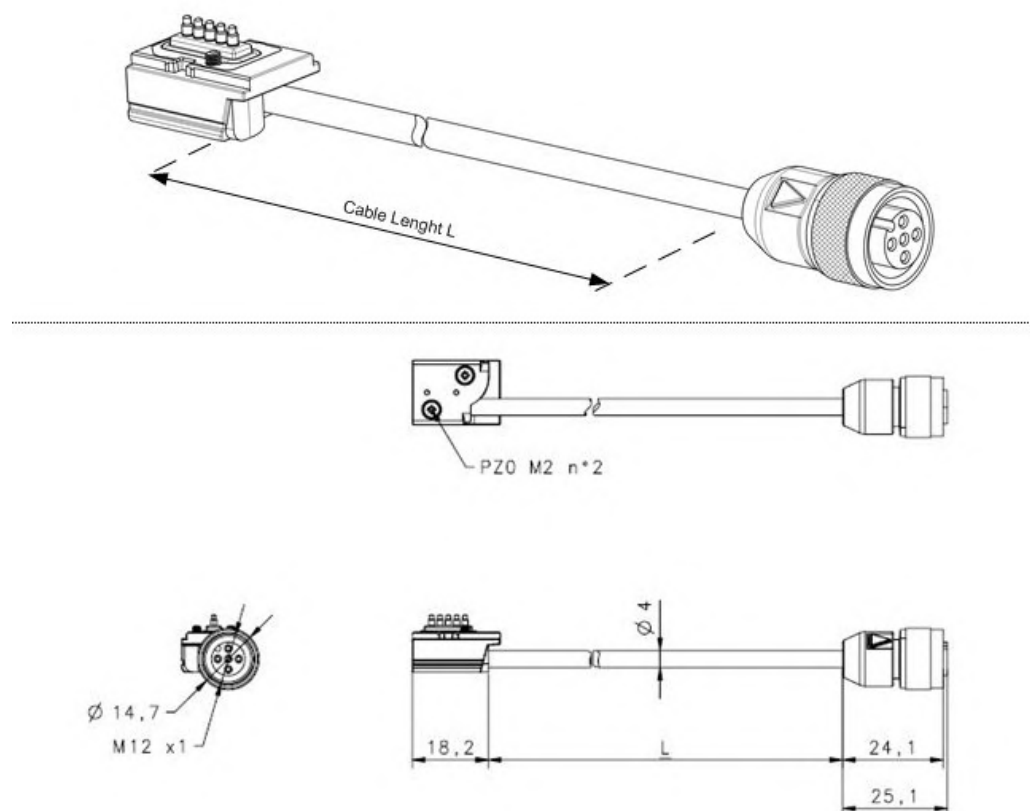


Figure 9 - Cascade cables

(SE-SR2) SAFETY RELAY

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

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

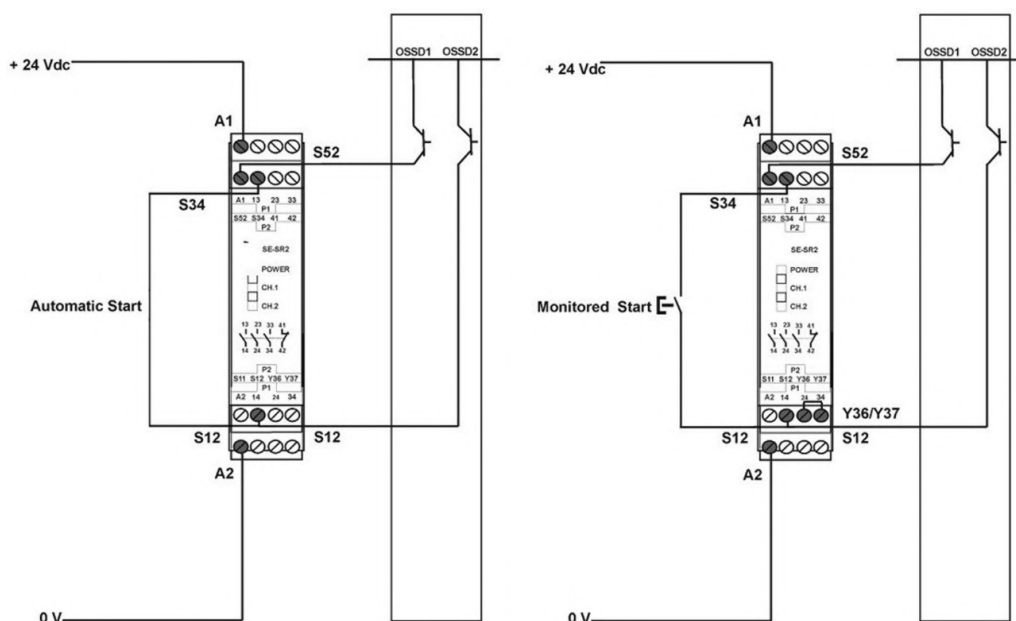


Figure 10 - Safety relay

(CSME-03VU24-Y14) EDM RELAY BOX

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

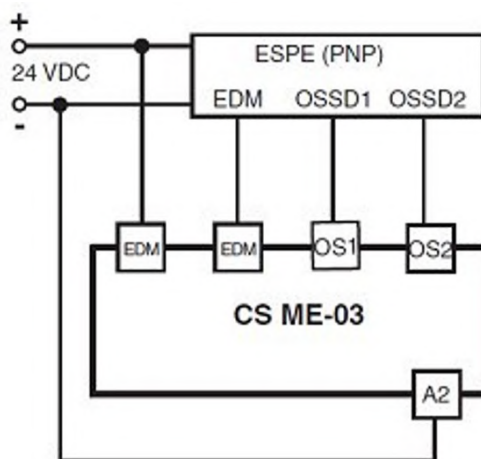


Figure 11 - EDM relay

GLOSSARY

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.

Block condition (=BREAK)

Status of the light curtain taking place when a suitably-sized opaque object (see "[Detection capability](#)" on page 3) 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.

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.

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.

Detection zone

Zone within which a specified test piece will be detected by the ESPE

EDM (External device monitoring)

Device used by the ESPE to monitor the status of the external command devices.

Emitter (TX)

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

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.

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.

Interlock

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

Machine operator

Qualified person allowed to use the machine.

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.

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.

N.O.

Normally opened

N.C.

Normally closed

Normal Operation

Operating state of ESPE when all beams are free, OSSD LED lit GREEN in SL light curtain OSSD1 and OSSD2 are switched ON.

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.

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 (RX)

Unit receiving infrared beams, consisting of a set of optically-synchronized 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

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

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.

Safe State

Operating state of ESPE when at least one beam is intercepted, OSSD LED lit RED in SLIM light curtain. OSSD1 and OSSD2 are both switched OFF.

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 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.

Working point

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

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