



> Laser Sentinel Safety Laser Scanner

**ORIGINAL INSTRUCTIONS (ref. 2006/42/EC)**

Patents. See www.patents.datalogic.com for patents list.

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Laser Sentinel Instruction Manual
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- END -

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1 GENERAL VIEW



Fig. 1 - Laser Sentinel (front view)

1. Display
2. LED Indicators
3. Laser scanner output window
4. Keypad
5. Memory group cover



Fig. 2 - Laser Sentinel Display



LED 1: Object Detection in Safety Zone (OSSD 11/12).

LED 2: not available

LED 3: not available

LED 4: Object Detection in Warning Zone.

LED 5: Interlock.

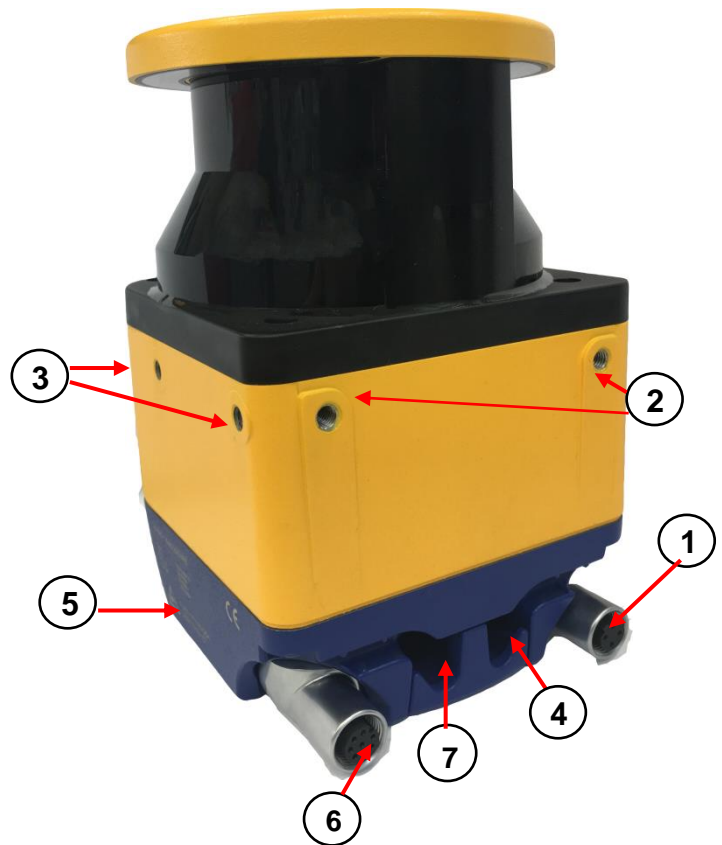
Button 1: to browse quickly the Menu functions.

Button 2: to browse quickly the Menu and confirm the selected function.

Button 3: to browse quickly the Menu functions.



Note: For further information refer to paragraph 10.4.



1. Ethernet Connector
2. Direct Mounting Holes (2)
3. Bracket Mounting Holes (4)
4. I/O Connector
5. Device Class and Warning Labels
6. Not available
7. Not available

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION

The Laser Sentinel is an electro-sensitive protective equipment (ESPE). It employs active opto-electronic protective devices responsive to the diffuse reflection of a radiation (AOPDDR), according to the definition and requirements of international safety standard IEC 61496-3. The optical radiation is a Class 1 infrared laser generated within the device.

If the device is applied to a machine that presents a risk of personal injury, it provides protection by making the machine revert into a safe condition before a person reaches the hazardous points.

The working principle is: the invisible beam of the laser creates a two dimensional safety area that must be necessarily crossed in order to reach the dangerous point. In this way the dangerous movement of the machine can be stopped before anyone reaches the hazard point.

The safety area can be horizontal and by using a Graphic User Interface, its shape can be planned according to the application needed.

The beam is emitted in short interval pulses and they are reflected by the objects in the safety area. The device calculates the distance from the objects by measuring the time interval between the transmission of the pulse and its reception after being reflected (time-of-flight principle).

The safety area is scanned by a mirror that deflects the light pulses over 275 ° around the device by rotating at a constant speed. In this way, all the opaque objects that have a certain dimension can be detected in the safety area.

Within the sensing range of the device, two areas can be monitored simultaneously: one is the Safety Zone, that is used to detect operators or objects entering into a hazardous area; the other is one Warning Zone that can be defined with a longer distance than a Safety Zone, allowing a configuration to detect objects that are closely approaching the Safety Zone.

2.2 REFERENCE STANDARDS AND REGULATIONS

The safety laser scanner is a safety system used as an accident-prevention protection device and is manufactured in accordance with the international Standards in force for safety, in particular:

STANDARD	DESCRIPTION
IEC 61496-3:2008	Safety of machinery - Electro-sensitive protective equipment - Part 3: Particular requirements for Active Optoelectronic Protective Devices responsive to Diffuse Reflection (AOPDDR).
EN 61496-1:2013/AC:2015 Type 3	Safety of the machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests.
EN ISO 13849-1:2015 (Cat. 3, PL d,)	Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
IEC 61508-1:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety related systems. Part 1: General requirements.
IEC 61508-2:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety related systems. Part 2: Requirements for electrical/electronic/programmable electronic safety related systems.
IEC 61508-3:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety related systems. Part 3: Software requirements.

STANDARD	DESCRIPTION
IEC 61508-4:2010 (SIL 2)	Functional safety of electrical/electronic/programmable electronic safety related systems. Part 4: Definitions and abbreviations.
IEC 62061:2005/A2:2015 (SIL 2 CL 2)	Safety of machinery. Functional safety of electrical/electronic/programmable electronic safety related control systems.
IEC 60825-1:2014	Safety of laser products – Part 1: Equipment classification and requirements.
IEC TS 62046:2008	Safety of machinery – Application of protective equipment to detect the presence of persons.
EN 60529:1991/A1:2000/A2:2013	Degrees of protection provided by enclosures (IP Code).

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



The information provided in the paragraphs following this symbol is very important for safety and may prevent accidents.
Always read this information accurately and carefully follow the advice to the letter.

As the required knowledge may not be completely included in this manual, we suggest the customer to contact Datalogic Technical Service for any further information relative to the functioning of the safety laser scanner and the safety rules that regulate the correct installation of the device (refer to chapter 5).

2.3 PACKAGE CONTENTS

Package contains the following objects:

- Laser Sentinel
- Quick Guide of Laser Sentinel
- Periodical checklist and maintenance schedule

2.4 BASIC INFORMATION

In order to program the device, the user has to follow the indications related to an application configuration:

1. **Expert application configuration** (refer to paragraph 8.3.1).

3 TYPICAL APPLICATIONS

The safety laser scanner is used to detect people who are approaching a hazardous area, before reaching it, in order to prevent hazardous circumstances (for example, a mechanical movement) that may cause an accident.

The protective detection is done by defining a safety area (the red zone in the figures), whose shape and dimensions must be designed according to the risk assessment of the machine. The user must consider the position of the hazardous point, the shape of the machine and of the environment that surrounds it, and the time needed to stop the dangerous movement.

To better ensure people's safety, it is possible to define a Warning Zone (the yellow zone in the figures): if a person or an object is approaching too close to the safety area, the safety laser scanner will trigger warning devices. This area cannot be used for safety purposes.

The possible application to employ the Laser Sentinel is: Horizontal (to monitor an area that must be crossed in order to reach the hazardous point)

The following application examples should be considered just as references for instructional purposes.



Laser Sentinel cannot be used for Vertical Applications.

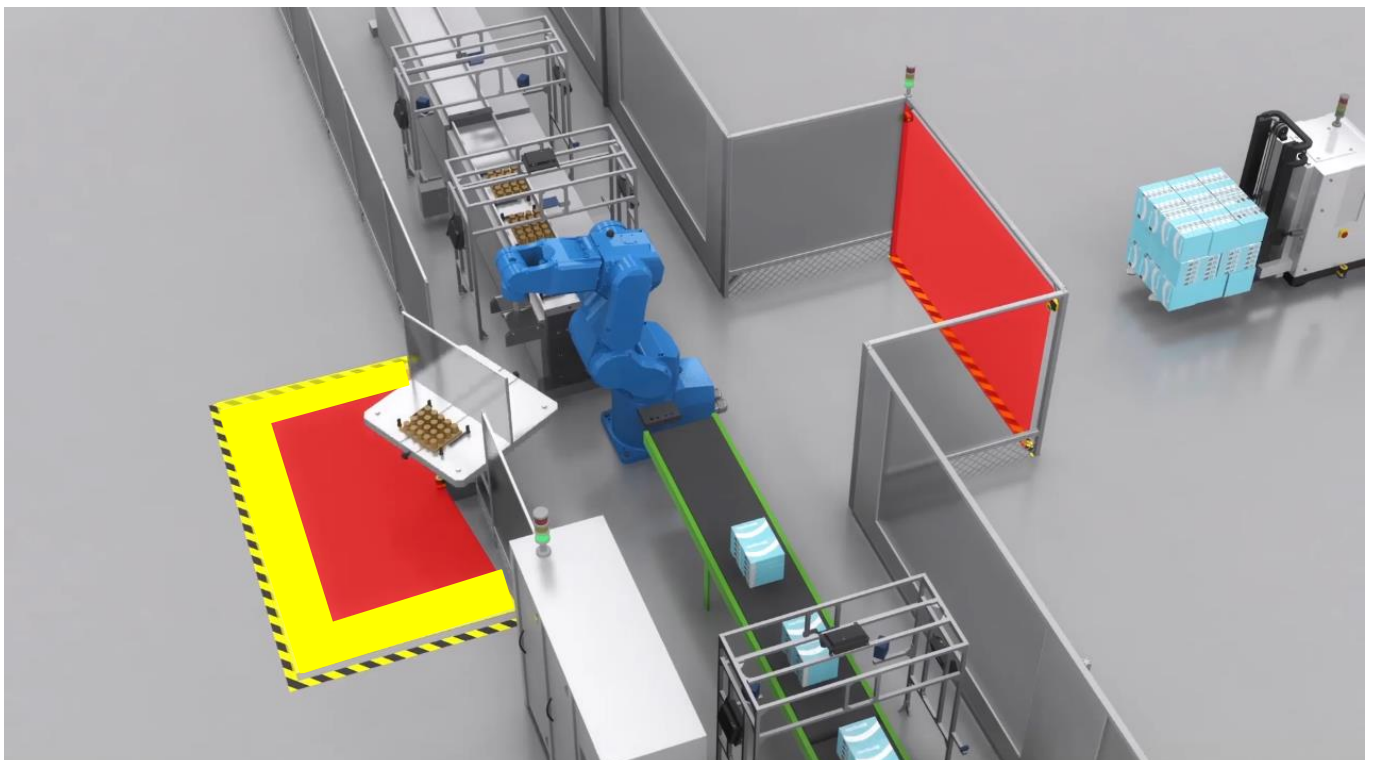


Fig. 3 - Applications Example

3.1 HORIZONTAL APPLICATION CONFIGURATION

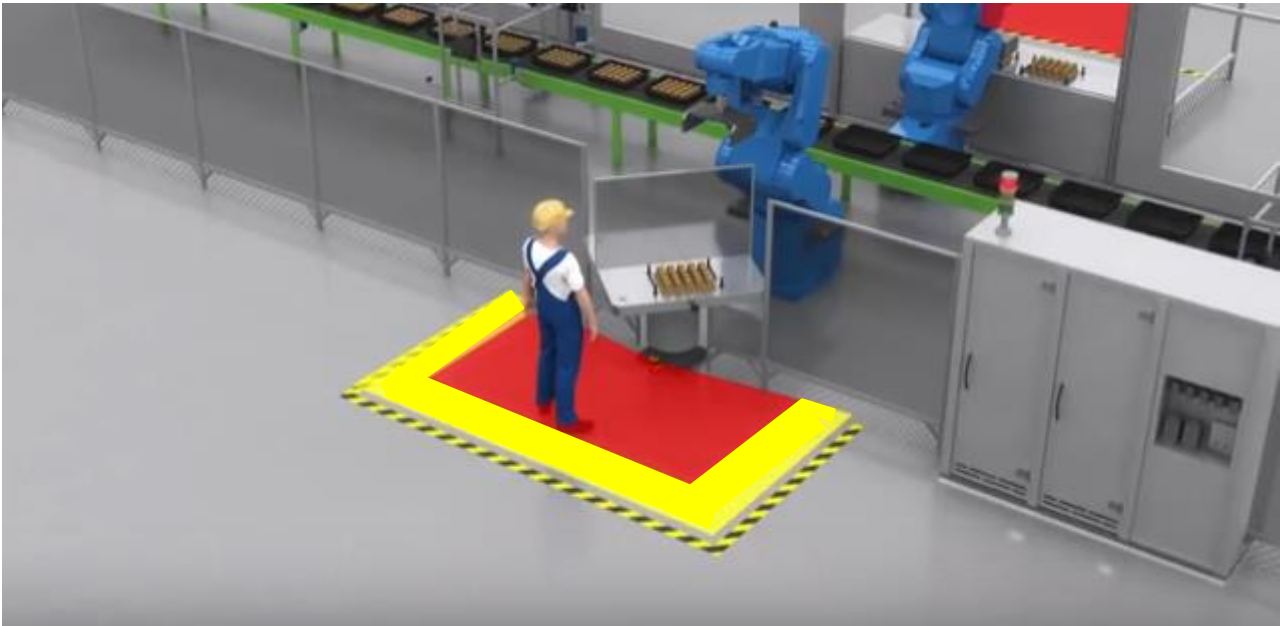


Fig 4 – Static horizontal configuration (2)

The device uses a horizontal protective field (the red area in the figures) to detect the presence of an object or a person.

The Laser Sentinel will scan the environment surrounding the hazardous point to detect approaching objects or people. If someone is detected in the safety zone (with a given detection capability), a stopping signal is sent to the machine by the device. This signal will stop the machine by putting the OSSDs in OFF state.

In this example a Warning Zone has been defined (yellow zone in the figure) in order to give a preliminary warning if someone is detected, to prevent operators from accidentally stopping the working process of the machine. The warning signals are sent using non safe outputs assigned to the area.

4 SAFETY INFORMATION



For a correct use of the Sentinel laser scanner, the following points must be observed:

- The machine stopping system 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 and during all the working cycle phases.
- The device mounting and connections, must be carried out by qualified personnel only, according to the indications included in the special sections (refer to chapters 6 and 7) and in the applicable standards.
- The safety laser scanner must be securely placed in a particular position so that access to the dangerous zone is not possible without passing throughout the safety area (refer to chapter 5).
- The personnel operating in the dangerous area must be well trained and must have adequate knowledge of all the operating procedures of the safety laser scanner.
- In case of Manual Restart, the Restart button must be located outside the safety area to let the operator control the safety zone during resetting or testing sessions.
- Please carefully read the instructions for the correct functioning before powering the device.
- The requirements for the electrical safety and electromagnetic compatibility and the regulations or standards in all countries and/or regions, must be met by the power supply where the Laser Sentinel is used. If the device power supply is shared with the machine or the other electronic devices, voltage reduction to the Laser Sentinel or noise influence to the device may occur due to the temporary increasing of the current consumption on the machine or the other electronic devices. We do not recommend sharing the Laser Sentinel power supply with the one for the machine or the other electronic devices, because the device may go to the error status in such circumstance.
- Do not place the connection cables in contact with or near high-voltage cables and/or cables with undergoing high current variations (e.g. motor power supplies, inverters, etc.).
- Do not connect any of the Laser Sentinel inputs to DC power sources outside of the declared range or to any AC power source, in order to avoid the risk of electric shock.
- Every access to the configuration tools must be allowed only to restricted and highly qualified personnel. The configuration upload through the GUI is allowed only by password.
- Only highly qualified personnel can replace the spare parts, by using the specified tools and following the indicated instructions (refer to chapter 11).

5 INSTALLATION

5.1 PRECAUTIONS TO TAKE FOR THE INSTALLATION



Make sure that the protection level assured by the Laser Sentinel is compatible with the danger level of the working machine, according to EN ISO 13849-1 or EN 62061.

- It must not be possible for operators to approach the dangerous zone without being detected by the Laser Sentinel.
- Attach guard plates or other physical barriers to prevent access to dangerous areas that are not protected by the Laser Sentinel.
- The dimensions of the smallest object to be detected must be larger than the minimum detection capability of the device (refer to paragraph 9.2).
- The OSSDs must be used as stopping devices and not as command devices. The machine must have its own START command.
- The operator must use just the components mentioned in the document and follow the indicated procedures (refer to chapters 6, 7, 8 and 11).
- Improper use of the safety device can lead to malfunctioning.
- The device must only be repaired by authorized personnel.
- It must not be permitted to reach under, over or around, crawl beneath or step over the detection zone of the safety laser scanner.
- The safety laser scanner must be mounted securely and must not be able to be moved.
- Make sure that the Laser Sentinel output window is not obstructed by any objects.

5.2 PRECAUTIONS FOR ENVIRONMENT INTERFERENCE

- The presence of intense electromagnetic interference, could affect the correct functioning of the device. This condition shall be carefully evaluated by seeking the advice of Datalogic Technical Service.
- A sudden change in the environment temperature (for example with very low minimum peaks), can generate a small condensation layer on the laser and so compromise regular functioning.
- The operating distance of the device can be reduced in the presence of smog, fog or airborne dust.
- The installation must be done by qualified personnel and before performing it, make sure the window is clean and without scratches, dust, and finger prints.
- Failure to inspect the window or set the proper environmental condition during installation may cause a reduction in the detection capability of the scanner.

5.2.1 Light interference

Reflecting surfaces located near the safety device may cause passive reflections. These can affect the detection of an object inside the safety zone. The passive light sources can be an incandescent lamp, sunlight, a fluorescent light, a strobe light or other infrared light sources (e.g. infrared laser).

Do not install the safety device near strong and/or flashing light sources.

Ambient light may interfere with the functioning device. If the installation requires direct exposure to ambient light, the scanner must be positioned so that the light does not enter the output window within $\pm 5^\circ$ of the detection plane.

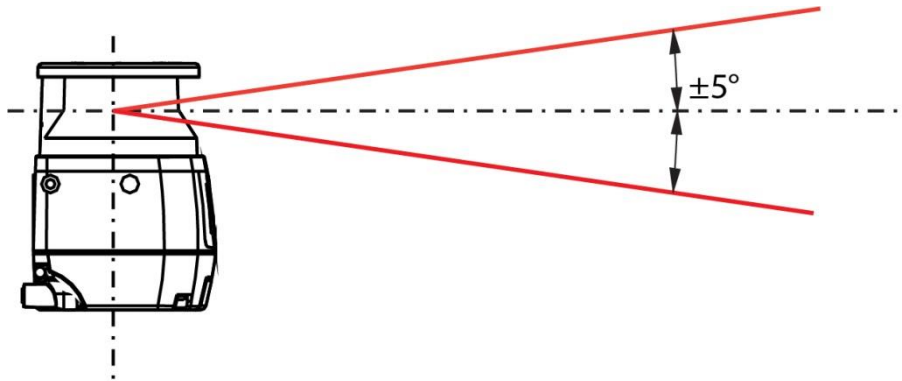
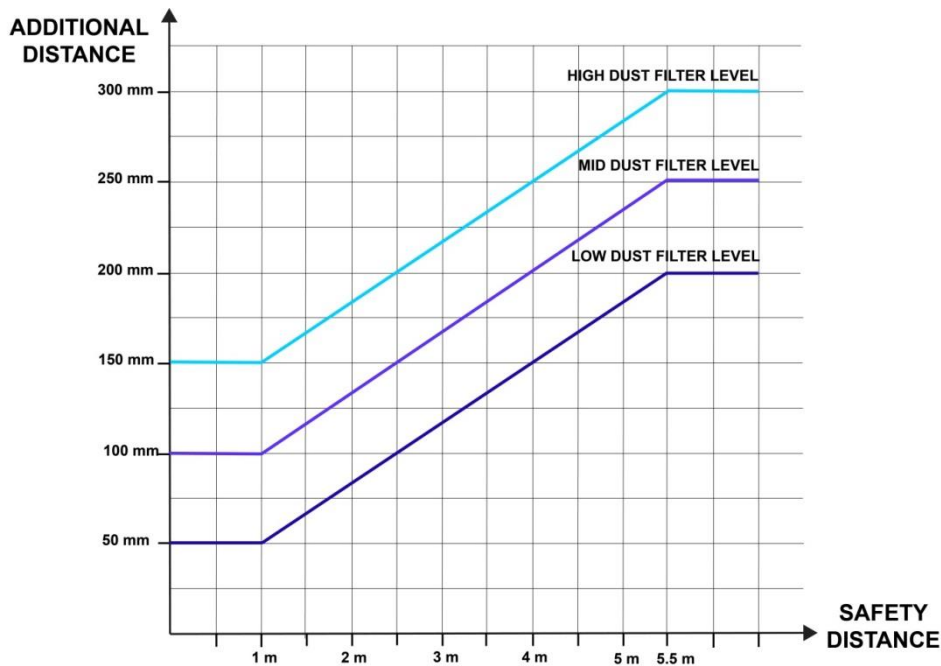


Fig. 5 - Light Interference Avoidance



In all applications where strong light within $\pm 5^\circ$ of the detection plane cannot be avoided, an additional distance must be applied to the Minimum Safety Distance Calculations. This distance also depends on the Dust Filter Level setting. See the chart below, par. 5.4.1 and par. 9.6.



Note: In any case where bright light is present outside the $\pm 5^\circ$ range, the additional distance is still highly recommended.

5.2.2 High reflecting background

If there is a high reflecting background within 2.5 meters of the safety zone boundary, for example a metallic glossy surface, the Laser Sentinel might fail to recognize the exact distance of the detected object.

In this circumstance, it is recommended to reduce or remove the reflecting background.

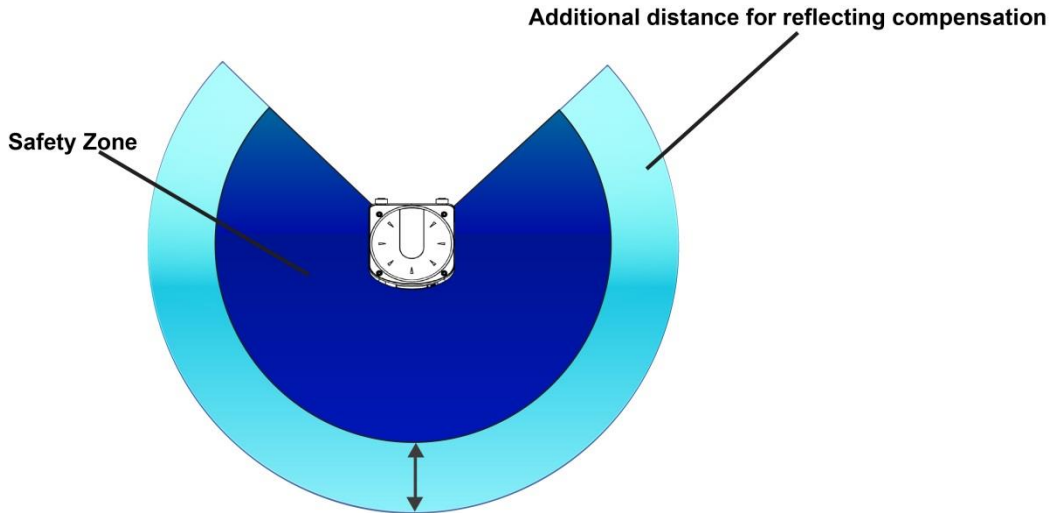
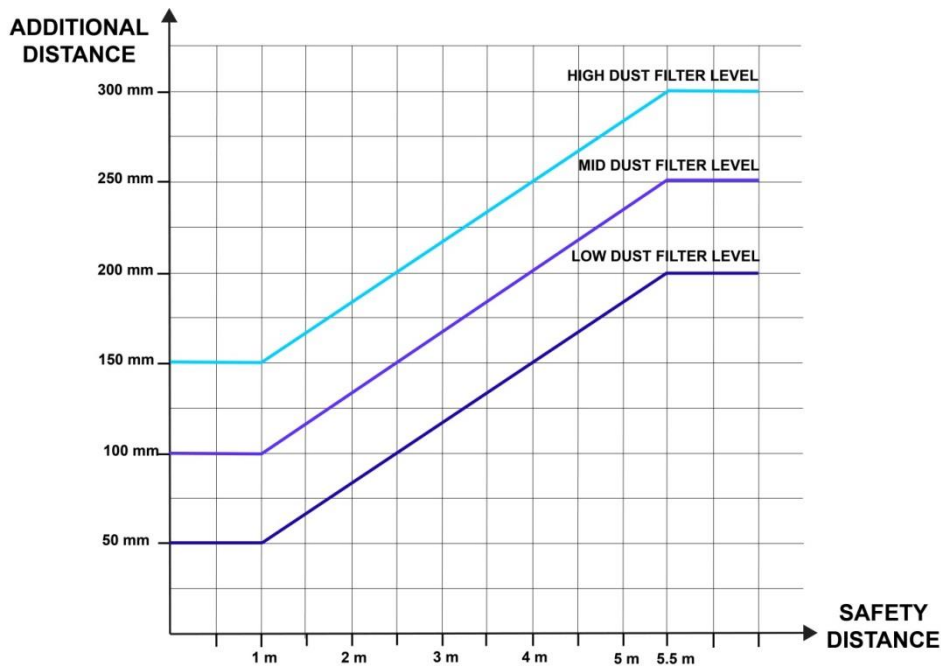


Fig. 6 - High Reflecting Background



In all applications where high reflective backgrounds within 2.5 meters of the Safety Zone boundary cannot be avoided, an additional distance must be applied to the Minimum Safety Distance Calculations. This distance also depends on the Dust Filter Level setting. See the chart below, par. 5.4.1 and par. 9.6.



Additional distances based on the highly reflective background influence range of 2.5 meters are relative to a reflective background test target of 300 cd/m²/lx. For higher values of background reflectance, further risk analysis must be done in order to evaluate the effective influence range and eventually to increase the additional distance.

5.3 ZONE WITH LIMITED DETECTION CAPABILITY

Laser Sentinel may not properly detect an object located at a distance of 10 cm or less from the safety zone origin. This zone is called “zone with limited detection capability.”

In this circumstance, it is recommended to make the risk assessment taking into account the possibility that an object can cross a zone with limited detection capability. If possible, responsible personnel must provide an additional solution.

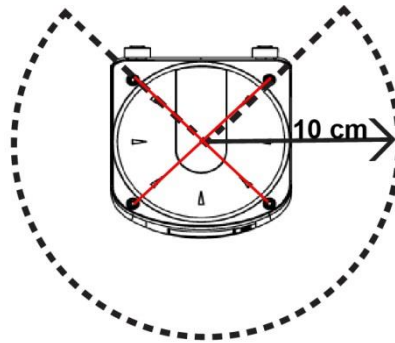


Fig. 7 - Limited Detection Capability

5.4 DEVICE POSITIONING AND MINIMUM DISTANCE CALCULATIONS

The Laser Sentinel must be carefully positioned, in order to fulfill its safety function. In fact, access to the dangerous area must only be possible by passing through the safety zone.

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

The safety zones must be designed taking into account the minimum safety distance from the point where the risk is located. This distance must ensure that the hazardous area cannot be reached before the dangerous movement of the machine has been stopped by the ESPE.

According to the EN ISO 13855 Standard, the safety distance depends on the following factors:

- The Response Time of the ESPE (the time between the operator's detection and the opening of the OSSD).
- Machine stopping time (the time between the activation of the ESPE and the real stop of the dangerous movement of the machine)
- ESPE detection capability
- Type of approach: Parallel or Orthogonal to the Detection Zone
- Additional components to compensate reflection-based measurement errors
- Additional components to compensate reaching over: positioning of the scan plane, switching time between monitoring cases.

According to safety requirement EN ISO 13855, the general calculation for the minimum safety distance is given by the following formula:

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

Where:

- S** = Minimum safety distance (mm)
- K** = Approach speed parameter (mm/s)
- T** = Total response time (ESPE + machine) (s)
- C** = Total additional distance (mm)

The **K** parameter depends on how dangerously the operator approaches the machine. The operator must be prevented from inserting body parts inside the hazardous area before the safety device activates.

5.4.1 Minimum Safety Distance Calculations for Horizontal Applications



The Minimum Safety Distance cannot exceed the nominal maximum limit of the Safety Zone for the scanner, (5.5 m).

If the device is mounted with a detection angle of less than 30° with respect to the horizontal plane (floor), the application is horizontal (parallel approach).

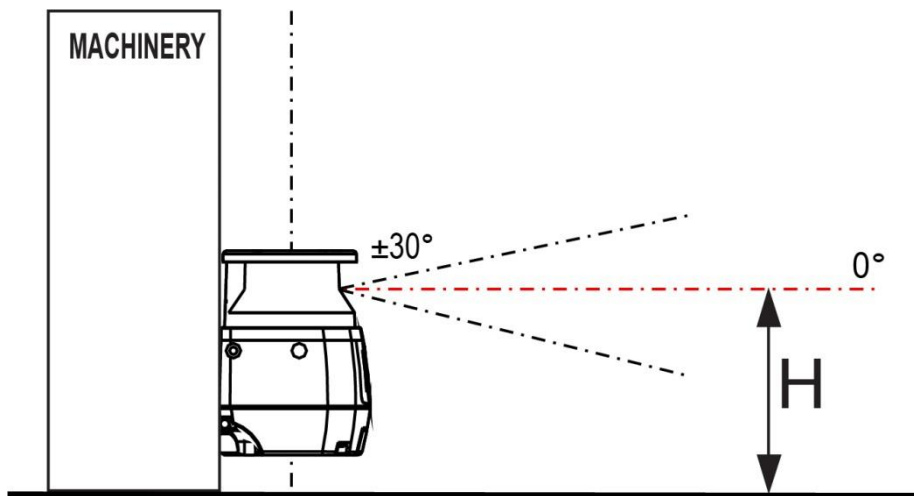


Fig. 8 - Detection plane and Approaching Direction

The minimum safety distance **S** is given by:

$$S = (K \cdot T) + C; C_{MIN} = 850 \text{ mm}; H_{MIN} = 15(d - 50 \text{ mm})$$

Where:

- S** = Minimum safety distance (mm)
- K** = 1600 mm/s
- T** = $t_1 + t_2$
- C** = $C_{HEIGHT} + C_{TOLERANCE} + C_{AMBIENT INTERF}$

t_1 = Response time of the ESPE (s) (refer to paragraph 9.4)

t_2 = Machine stopping time (s) (see machine specifications)

$$C_{HEIGHT} \geq (1200 - 0.4H) \text{ mm}$$

H = Height of the nominal scan plane with respect to the machine reference plane (floor)

d = Detection capability of the ESPE

C_{TOLERANCE} = 150 mm

C_{DUST FILTER LEVEL} = additional distance (refer to paragraph 9.6)

C_{AMBIENT INTERF} = environment interference conditions (refer to paragraphs 5.2.1 and 5.2.2)



Note: For applications with approach parallel to the detection plane, EN ISO 13855 defines the parameter K = 1600 mm/s.



Note: For horizontal applications the minimum safety distance also depends on the height of the nominal scan plane for the safety area. As the height **H** is reduced the total additional distance **C** is increased.



If the scan plane is higher than 300mm, ensure that people cannot reach the hazardous area by crawling underneath the scan plane!

Example of additional distance due to Height:

With a given machine stopping time of 0.4 s and a selected Laser Sentinel Response Time of 62 ms, and without any ambient interference

:

$$S = [(1600 \text{ mm/s} \cdot (0.062 \text{ s} + 0.4 \text{ s})) + [(1200 \text{ mm} - 0.4H) + 150 \text{ mm} + 0 \text{ mm}]]$$

If H = 300 mm then C_{HEIGHT} = 1080 mm
 $S = [739.2] + (1080 + 150 \text{ mm} + 0 \text{ mm}) = 1969.2 \text{ mm}$

If H = 1200 mm then C_{HEIGHT} = 720 mm
 $S = [739.2] + (720 + 150 \text{ mm} + 0 \text{ mm}) = 1609.2 \text{ mm}$

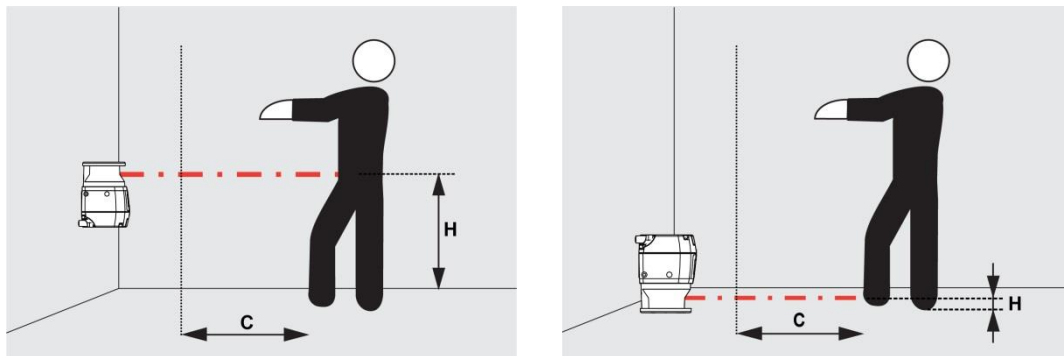


Fig. 9 - Safety Distance

Example of additional distance due to Ambient Interference:

From the previous example with a height of 300 mm, but in the presence of high reflective backgrounds and/or direct bright light:

Minimum safety distance for dust filter level High: **2.5 m + 200 mm = 2.7 m**

$$S = [(1600 \text{ mm/s} \cdot (0.062 \text{ s} + 0.4 \text{ s})) + (1080 + 150 \text{ mm})] = 1969.2$$

If Dust Filter Level = High then $C_{\text{AMBIENT INTERF}} = 177 \text{ mm}$

$$S = [(739.2)] + (1080 + 150 \text{ mm} + 177 \text{ mm}) = 2146.2 \text{ mm}$$

If Dust Filter Level = Low then $C_{\text{AMBIENT INTERF}} = 77 \text{ mm}$

$$S = [(739.2)] + (1080 + 150 \text{ mm} + 0 \text{ mm}) = 2046.2 \text{ mm}$$

5.5 UNPROTECTED ZONE

The unprotected zone (a) must be small enough to ensure that a person cannot approach the danger zone or stay between the danger zone and the safety zone without being detected. This can require additional mechanical protection.

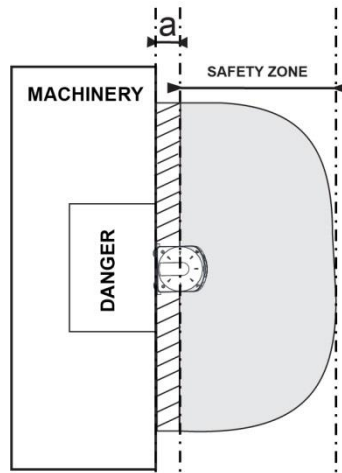


Fig. 10 - Safety Distance Example

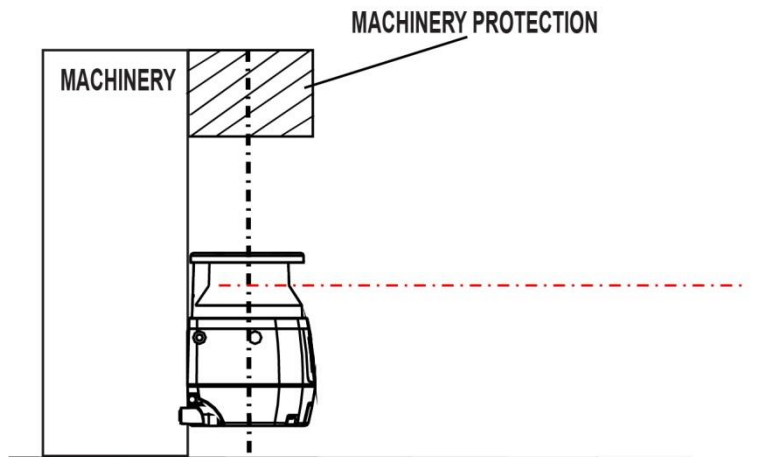
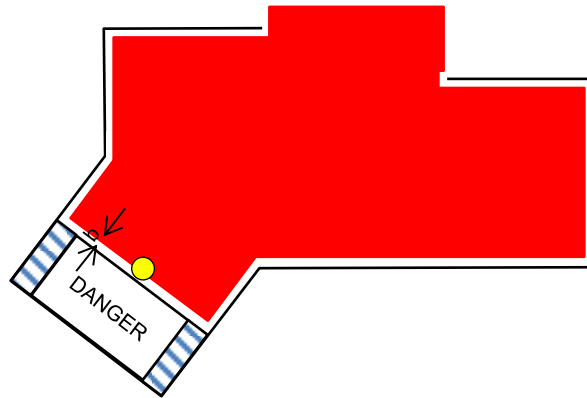


Fig. 11 - Safety Distance Example (Side View)

5.6 DISTANCE TO WALL



The Safety Zone must maintain a tolerance of at least 40 mm from any wall of fixed object. This value is generally enough to guarantee normal operation, however according to the real reflectance characteristics of the wall, a higher value may be necessary. Verify the correct placement of the Safety Zone during the initial configuration before commissioning.

5.7 DEVICES ORIENTATION

The installation may require different safety laser scanners in the same location. In this state, it is possible that the devices interfere with each other and the OSSD might go to the OFF-state.

In order to prevent a dangerous failure, there are specific mounting requirements to follow.

- Tilt the Laser Sentinel so that the scanning plane does not enter the output window of any other scanner.

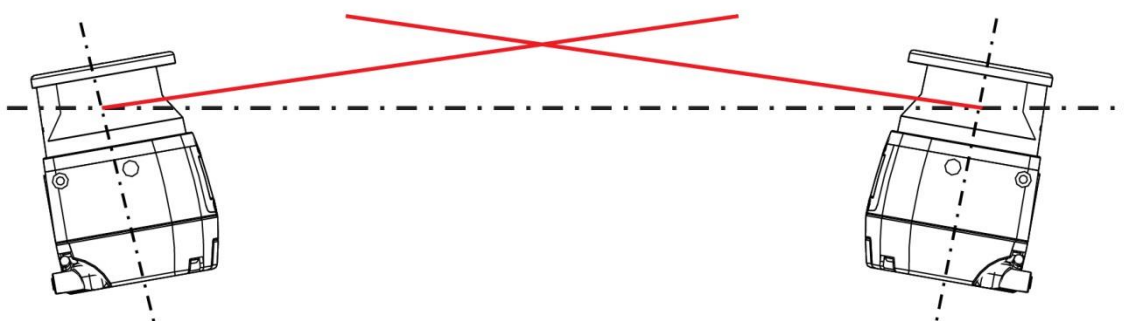


Fig. 12 - Scanners Mounted at Different Scanning Angles

- Mount the devices at different heights so that there is an offset equal to or greater than the height of the scanner output window.

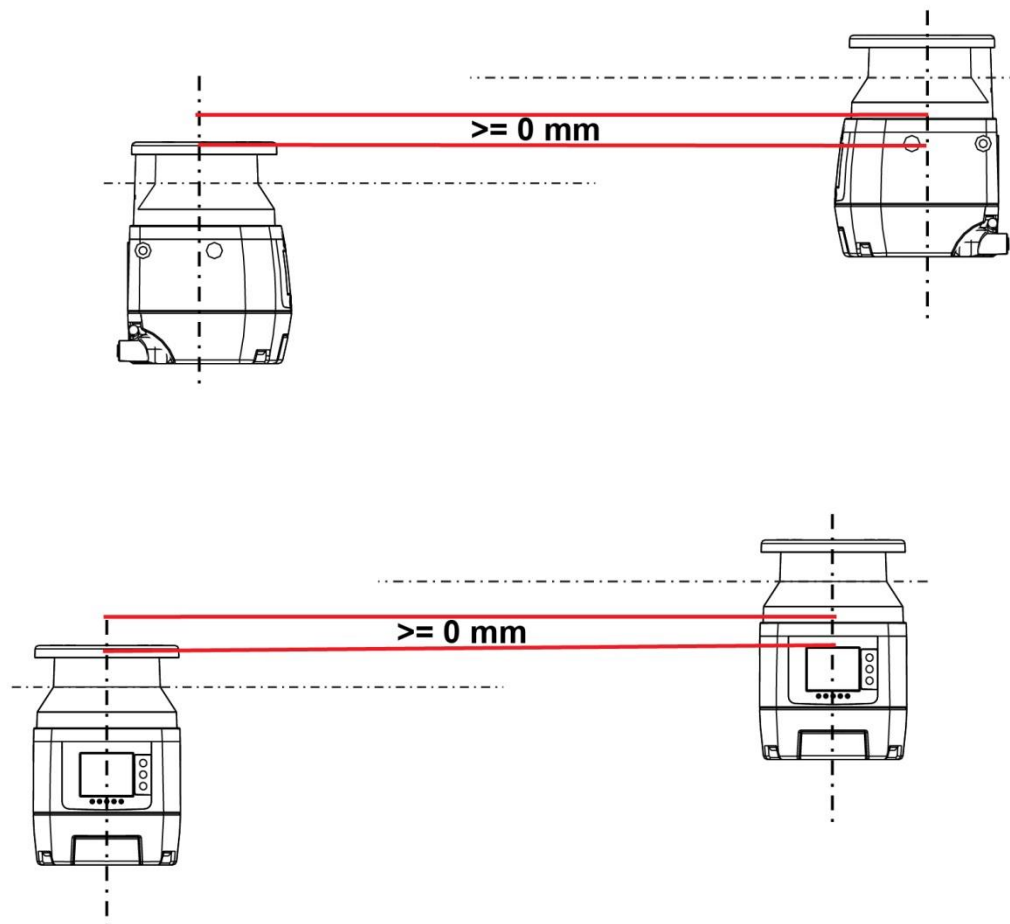


Fig. 13 - Scanners Mounted at Different Scanning Heights

- Set the devices to different response time
- The minimum detectable object size is a fixed value: 70 mm.

- Install a shielding plate to block scanning signal interference.

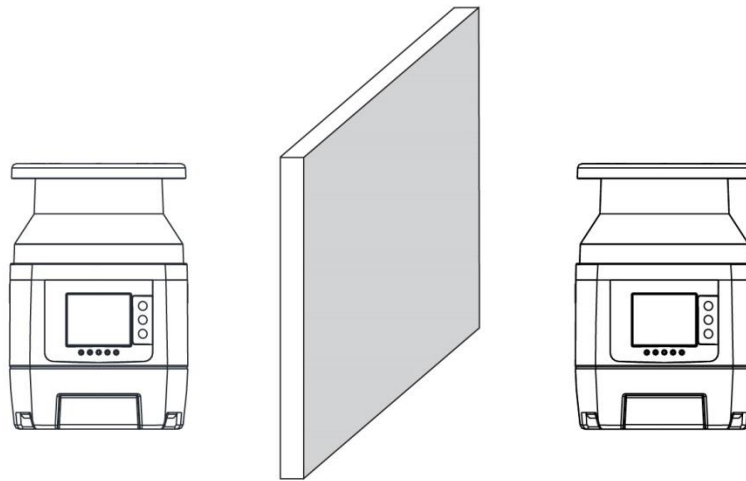


Fig. 14 - Shielding Plate Between Scanners

- Make the safety area smaller.

5.8 CHECKS AFTER FIRST INSTALLATION

After the initial installation and before starting up, machine test operations must be carried out by qualified personnel, or under the strict supervision of the person in charge of the machine safety.

The checks to carry out are listed below:

- 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 paragraph 9.4).
- The safety distance between the dangerous parts and ESPE must comply with the requirements indicated in paragraph 5.4. The safety zone must be designed so that the approach towards any dangerous point of the machine can be possible only passing through it, and the distance that a person is obliged to cover must be longer than the minimum safety distance.
- A person must not remain between safety zone and dangerous parts of the machine undetected.
- Access to the dangerous areas of the machine must not be possible from any unprotected area.
- Verify the correspondence of all the accessory functions, activating them in the different operating conditions.
- The machine builder must define the type and frequency for the checks of the machine and its safety system based on the risk assessment. Regular checks are recommended in order to prevent external influences or modification (such as damages or tampering).
- Safety checks must be carried out at least annually.
- Safety checks must be carried out only by qualified personnel.
- Safety checks must be documented in a traceable manner.
- If the check session reveals hypothetical faults, the machine must be shut down immediately. Then, the electrical and mechanical installations must be checked for further verifications by qualified personnel.
- The risk evaluation of the machine may determine that further, or more frequent, checks are required depending on the application conditions.
- Together with the regular checks, it is suggested to perform a visual check of the machine and the safety device.
- The machine builder must check the display and the status LED: if a machine is switched ON, and at least one LED below the safety laser scanner's display is not functioning properly, it may be a failure.
- Test the device by triggering the safety function, for example the machine builder can observe the reaction of the OSSDs.
- For all the device's applications: check if the Laser Sentinel shows the interruption of the safety field using the LEDs and/or the display.
- Horizontal application: stop the safety field using an appropriate test object and verify if the machine stops.

- Activate a protective field, which is interrupted by at least one test object and check the expected reaction.
- If the check reveals a fault, the machine must be shut down immediately. In this case, the mounting and electrical installation of the safety laser scanner must be checked by qualified personnel.
- In case of Manual Restart, the Restart button must be placed outside the dangerous zone.

5.9 GETTING STARTED

Here are the basic steps in order to start a safety configuration.

1. **Package Contents:** Verify that the Laser Sentinel and all the parts supplied with the equipment are present and intact when opening the packaging (refer to paragraph 2.3).
2. Read all safety information in chapter 4 and application notes in chapter 5 before proceeding.
3. **Mechanical Mounting:** Laser Sentinel can be installed to operate in different positions, make sure to follow the exact procedure (refer to chapter 6).
4. **Electrical Connections:** Laser Sentinel must be connected to the application through the required accessory cables (refer to chapter 7).
5. **Software Configuration:** Software configuration of Laser Sentinel can be accomplished by the Configuration procedure using the DLSentinel GUI (refer to chapter 8).

6 MECHANICAL MOUNTING

For mechanical mounting, the Laser Sentinel has two different procedures depending on the operation necessities. The two mounting possibilities are: direct mounting or angle adjustment bracket mounting (if the pitch and the roll angles need to be adjusted).

Optionally, the protection bracket can be added to applications using the angle adjustment brackets.



Note: Required tool adjustable torque driver with 3 mm hex bit.

6.1 DIRECT MOUNTING

The device has two M5X10 mm deep threaded holes on the back and these can be used to directly mount it on the wall (2.5-3 Nm Torque).

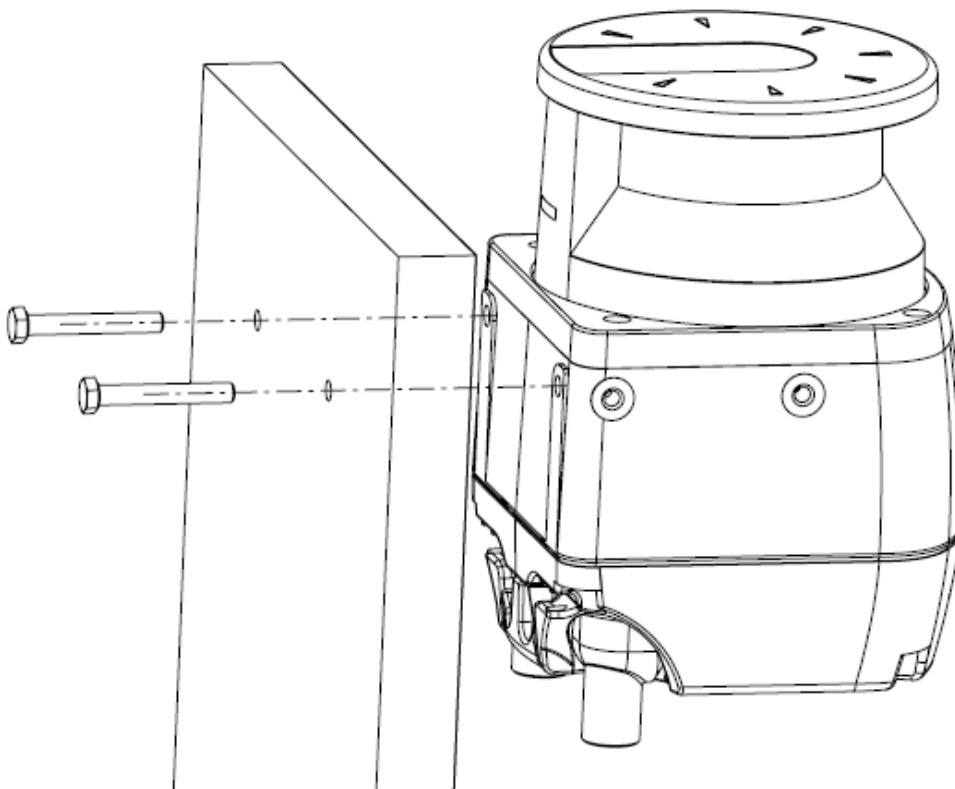


Fig. 15 - Direct Mounting



Note: If necessary, different types of M5 screws may be employed, but these are not supplied in the Laser Sentinel mounting kit and must be supplied by the user.



Note: If the direct mounting procedure is chosen, it is not possible to add the protection bracket to the device.

6.2 PROTECTION BRACKET MOUNTING (SLS-BRACKET-C) (OPTIONAL)

The protection bracket is an optional accessory, which provides protection to the device if it is located in a specific work environment where for example the device may be hit by falling objects or subject to collision.

Fasten the Protection Bracket **(1)** on the back of the Laser Sentinel, by using two M5 screws **(2)** (Maximum 2.5-3 Nm Torque).



Note: The SLS-BRACKET-C must be mounted on the device, before the other fastening accessories.

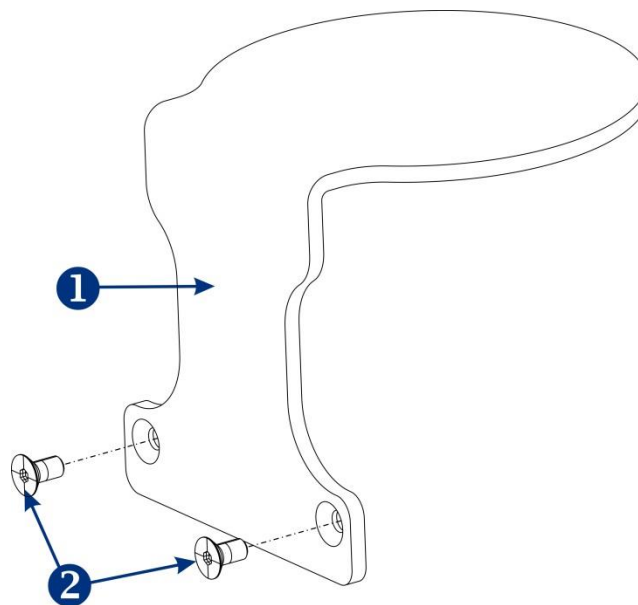


Fig. 16 - Protection Bracket Mounting

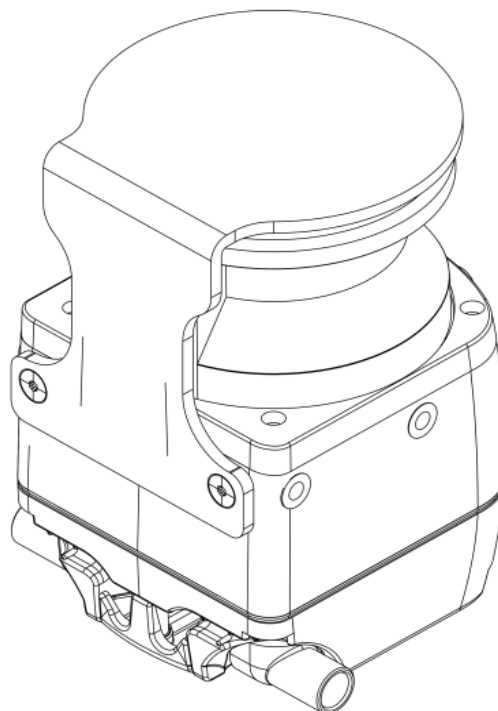


Fig. 17 - Protection Bracket Mounted to Scanner (2)

6.3 ANGLE ADJUSTMENT BRACKET MOUNTING

First, you have to provide two M5 threaded holes 10 mm deep with 73 mm spacing on the intended wall or the mounting surface.



Note: If necessary, different types of M5 screws may be employed, but these are not supplied in the Laser Sentinel mounting kit and must be supplied by the user.

6.3.1 Pitch and roll angle adjustment bracket (SLS-BRACKET-A)

The Bracket System (10) is already assembled, in order to quickly start the installation.

1. If necessary, loosen the M4 Roll Adjustment Screws (5) and then align the M5 Wall Mounting Screws (4).
2. Secure the bracket, by repeatedly alternating between the two holes and by screwing the screws (4) (already inserted) and in the end tighten them.



Note: Still, do not tighten the M4 Roll Adjustment screws for the roll angle (5).

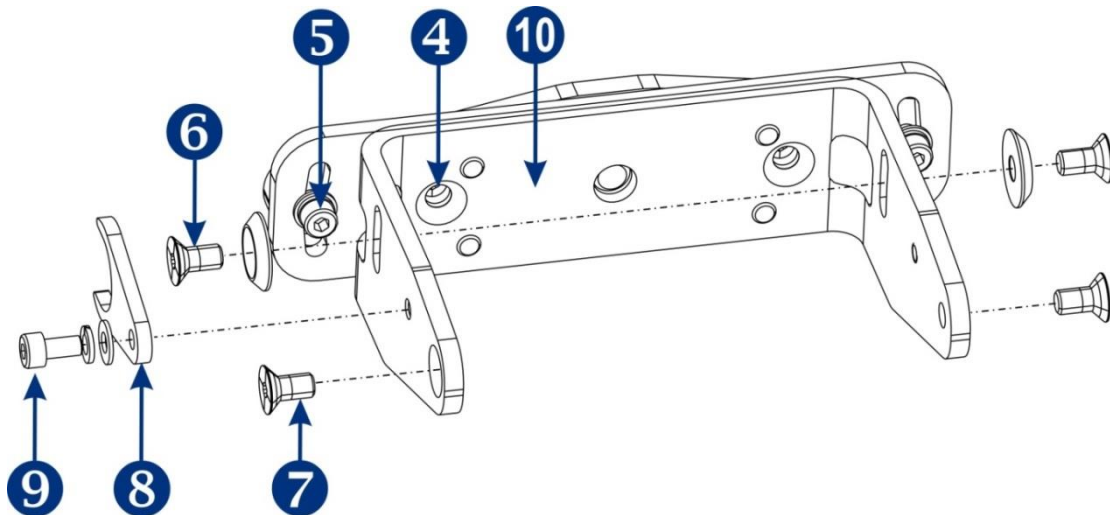


Fig. 18 - Pitch and Roll Angle Adjustment

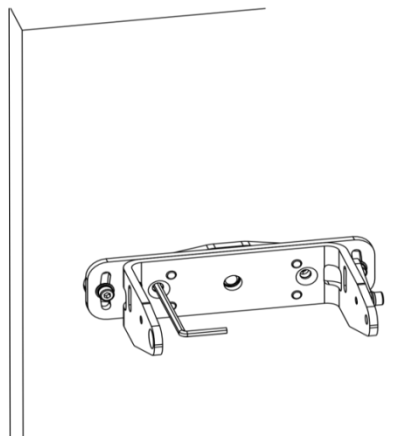


Fig. 19 - SLS-BRACKET-A Mounted

6.3.2 Pitch angle adjustment bracket (SLS-BRACKET-B)

Through the bracket's holes, screw and tighten the M5 Wall Mounting Screws (4).

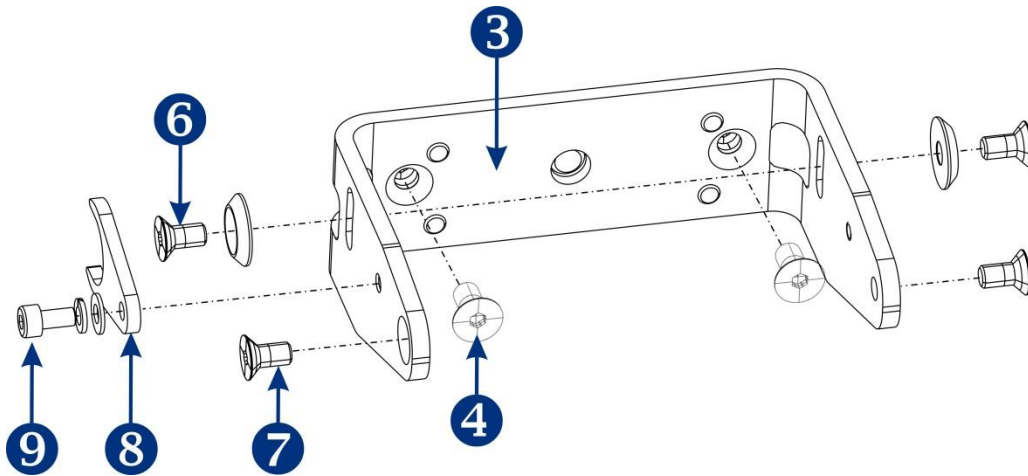


Fig. 20 - Pitch Angle Adjustment

6.4 SCANNER MOUNTING AND PITCH ANGLE ADJUSTMENT



Make sure to comply with the indication of using the specific Torques for the different procedures, in order to avoid permanently damaging device.



Note: the pitch angle adjustment is a procedure related to both SLS-BRACKET-A and SLS-BRACKET B.

The Positioning Memory Bracket (one piece) (8) saves the inclination angle set for the installation. This allows for quick installation without further mechanical adjustments if it is ever necessary to replace the unit.

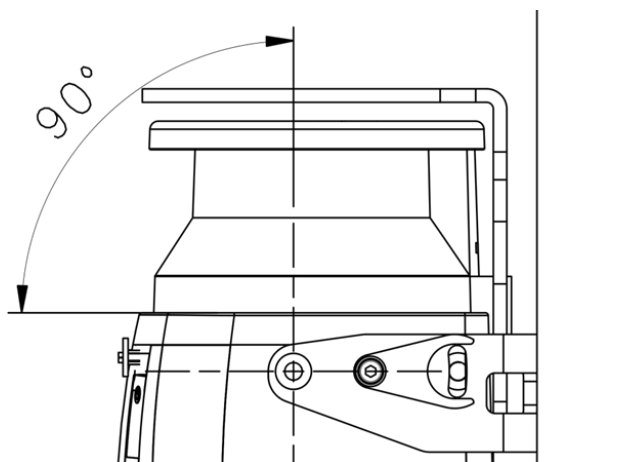


Fig. 21 - Scanner Mounting and Pitch Angle Adjustment

To mount the device with 90° vertical inclination:

1. Mount the Positioning Memory Bracket **(8)** with the M4 screw (and washers) **(9)** to the main bracket **(3)** but do not tighten it.
2. Align the Positioning Memory Bracket with the center of the main bracket slot, then tighten the M4 screw **(9)** (2.2-2.5 Nm Torque).
3. Mount the scanner to the main bracket using the M5 Pitch Adjustment Screws (with washers) **(6)** and the M5 Scanner Fastening Screws **(7)**. Tighten all four screws (2.5-3 Nm Torque).

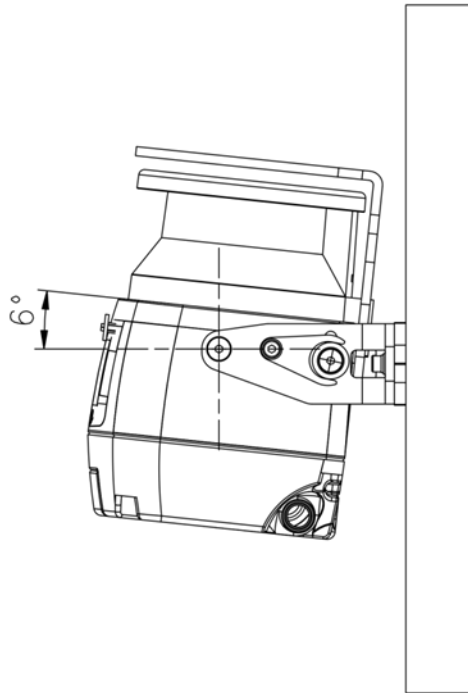


Fig. 22 - Scanner Mounting and Pitch Angle Adjustment (side view)

To place a device with a specific pitch angle:

1. Screw without tightening the M5 Scanner Fastening Screws **(7)**, the M5 Pitch Adjusting Screws **(6)** and the Positioning Memory Bracket **(8)** with the M4 screw **(9)**.
2. Rotate the device in order to reach the desired pitch angle within the allowed range ($\pm 6^\circ$).
3. Tighten the M5 Scanner Fastening Screws **(7)** (2.5-3 Nm Torque) and then the M5 Pitch Adjusting Screws **(6)**.
4. In the end, tighten the Positioning Memory Bracket M4 screw **(9)** (2.2-2.5 Nm Torque).

6.5 ROLL ANGLE ADJUSTMENT



Note: The roll angle adjustment is a procedure related only to SLS-BRACKET-A.

Rotate the brackets to reach the desired roll angle within the allowed range ($\pm 8.5^\circ$) and then tighten the M4 Roll Adjusting Screws **(5)** (2.2-2.5 N/m Torque).

6.6 SAFETY INFORMATION REGARDING MOUNTING

Make sure that the protection level assured by the Laser Sentinel is compatible with the danger level of the working machine, according to EN ISO 13849-1 or EN 62061.



Note: For further information refer to chapter 5.

Dangerous Machine Status:

- Make sure that the machine is OFF (not operating) status during mounting, electrical installation, and commissioning.
- Make sure that the safety laser scanner's outputs do not affect the machine during mounting, electrical installation, and commissioning.
- The device mounting and connections, must be carried out by qualified personnel only, according to the indications included in the special sections (refer to chapters 6 and 7) and in the applicable standards.
- The safety laser scanner must be securely placed in a particular position so that access to the dangerous zone is not possible without passing throughout the safety area (refer to chapter 5).
- Please carefully read the instructions for the correct functioning before powering the device.

Hazard due to safety device malfunctioning:

- If unsuitable brackets are used the device may become damaged. Only use Datalogic approved brackets for mounting.
- Personnel or parts of the body may not be detected in case of non-observance.
- Take appropriate measures for vibration damping if vibration and shock specifications exceed the values and test conditions specified in chapter 12.
- Do not carry out any repairs to the device components.
- Do not open the device components if the document's procedures are not followed.
- The Laser Sentinel optics cover is an optical component. Make sure that the optics cover does not become dirty or scratched during mounting.
- Avoid fingerprints on the optics cover.
- Check the integrity of all the components and of all parts.
- If the components show damage, contact Datalogic.
- Install the device so that the status indicators are clearly visible.
- Make sure to observe the minimum safety distances calculated for your machine.

- Install the safety laser scanner so that it is not possible to crawl beneath, climb over or stand behind the safety area.
- Protect the device from dirt and damage by mounting it in the proper way.
- The device's view must not be restricted and obstructed.
- The safety laser scanner must be correctly aligned, even during mounting: if the safety laser scanner is intended to monitor an area of 275 ° on a corner, the safety laser scanner may be mounted rotated by a maximum of 2.5 ° about the vertical axis.

7 ELECTRICAL CONNECTIONS

7.1 LASER SENTINEL CONNECTORS

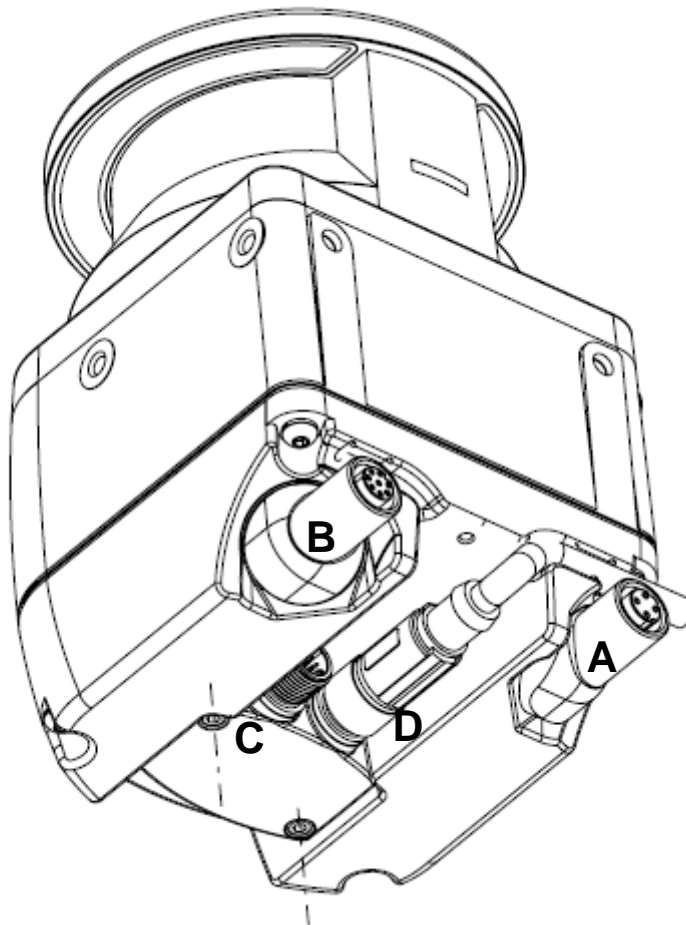
The SLS-B5 model includes:

- A. M12 4 pole rotatable side connector (for PC connection);
- B. M12 8 pole rotatable side connector (unused);
- C. M12 12 poles connector, on the memory group (unused);
- D. M12 8 poles connector, on the memory group (for machine interface).

The SLS B5 must be connected to the machine interface through the M12 8 pole connector using color-coded cable wiring according to safety equipment regulations. Datalogic provides accessory cables with color-coded wiring in compliance with the regulations and standards, for a safe use of the Laser Sentinel (refer to chapter 15).



Note: All color-coded wiring indications in this manual refer to Datalogic accessory cables.



7.2 POWER SUPPLY CONNECTIONS

All power connections to the Laser Sentinel must strictly comply with standard regulations. The device requires a supply voltage of 24 Vdc. Power must be supplied in accordance with SELV/PELV (IEC 60204-1) for all the devices electrically connected to the safety laser scanner. Make sure that the safety laser scanner is provided with an appropriate electrical fuse protection and the earthing system method is the same for all the devices connected to the Laser Sentinel.



Note: The safety laser scanner's external power supply must be capable of bridging a brief power failure of 20 ms, as per IEC 60204-1.



Note: A functional earth is available on the Pin number 8 of the M12 connector. User can connect or leave floating the functional earth in order to achieve in the application a best compliance with electromagnetic interferences.

7.3 MEMORY GROUP UNMOUNTING FOR CABLE CONNECTION

Follow the memory group unmounting procedure to connect the M12 8 poles connector for machine interface.



Note: Adjustable torque driver with 2.5 mm hex key.

1. Orient the device with the optic head pointed downward to better access the underside of the device (connectors location).
2. Unscrew the two of M3 screws of the protective cover; then remove it.



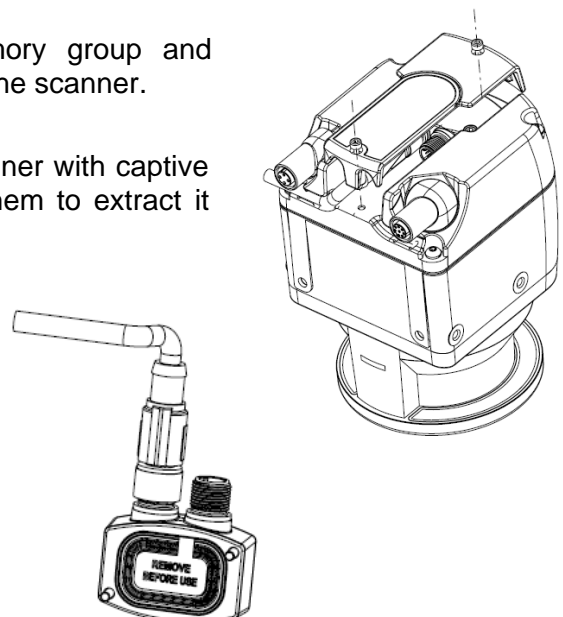
Note: The protective cover is tightened with captive screws, so the operator only has to loosen the screws to extract the cover from the device.

3. Loosen the two M3 fixing screws of the memory group and disconnect the memory group by extracting it from the scanner.



Note: the memory group is tightened to the scanner with captive screws, so the operator only needs to loosen them to extract it from the scanner.

4. Connect the power M12 8 poles connector
5. Insert the memory group and tighten the two M3 fixing screws (Torque 1 Nm).
6. Replace the protective cover, screw and tighten the two M3 screws (Torque 1 Nm).



7.4 PC CONNECTIONS

Laser Sentinel needs to be connected to the PC for configuration and/or monitoring. The operator must create an Ethernet network between the two devices by employing M12-RJ45 connector cable. (refer to chapters 15 for accessory cables and 8 for Ethernet network setup).



Note: The device must be powered off during any connection operation. Power up the device after connecting it to the PC for the configuration.



Note: During configuration, the device will be working using its previously saved configuration. Make sure to follow the safety instructions.

7.5 MACHINE INTERFACE CONNECTIONS

The Laser Sentinel B5 model has one OSSD pair and also includes three programmable signals. These signals allow the user to configure the device with different functions: the detection of a person or an object in the Warning Zone, the switching of the detection areas by employing external signals (Area Switch), the restart of the device caused by the OSSD Off-status (Restart) and restoring the device after a failure condition (Reset).



Note: For further information about the device functions, refer to chapter 9)



Make sure that the signals are aligned with the pin features and their specific function. In addition, they must be correctly connected to the external device.

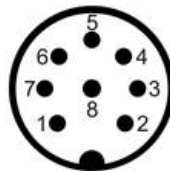


Fig. 23 - Connector (M12, 8-POLE)

The features of all the electrical pins are shown in the chart below.

TYPE	SIGNAL	COLOR	DESCRIPTION	PIN OUT
POWER	POWER SUPPLY	BROWN	24 Vdc	2
	GND_ISO	BLUE	0 V	7
INPUT	MULTI IN	GREEN	Selectable by GUI	3
	MULTI IN	YELLOW	Selectable by GUI	4
INPUT/OUTPUT	MULTI IN/OUT	WHITE	Selectable by GUI	1
SAFETY OUTPUT	OSSD 1/1	GRAY	Safety Output	5
	OSSD 1/2	PINK	Safety Output	6
OTHER	F_EARTH	RED	Functional Earth	8

The **Multi In** are Input Pins, which are configurable depending on the safety application needed. These input signals can have the RESTART and RESET function, as well as being employed as Area switches.

The **Multi In/Out** is a Pin that can be configured either as input or output.

SIGNAL	FUNCTION	CONNECTION
MULTI - IN	RESTART / RESET	
	AREA SWITCH	
MULTI -OUT	WARNING	
OSSD	OSSD1/1 OSSD1/2	

7.6 DEFAULT CONNECTIONS BY APPLICATIONS

Through the GUI, once the initialization is completed, it is possible to select the functions of each electrical Pins, depending on the desired application. Depending on selected input/output signals, the external devices must be correctly connected and selected.



Note: The B5 model has three configurable inputs signals (Pins 1, 3 and 4).

By properly configuring the device signals, these are the possible safety applications:

- A. Warning + Automatic restart;
Conf. A: Single Zone set (no inputs available for the area switching) with one Safety Area, one OSSD pair, with a Warning output signal and automatic Restart.
- B. Warning + Manual restart;
Conf. B: Single Zone set (no inputs available for area switching) with one Safety Area, one OSSD pair, with a Warning output signal and manual Restart.
- C. Warning + Automatic Restart + 2 Zone set;
Conf. C: Two Zone Sets with one Safety Area for each set, connected on the same OSSD pair, with a Warning output signal and automatic Restart.



Note: If you leave the OSSD pair floating (not connected), for example during a test configuration, the Laser Sentinel may fail some diagnostic checks. For all applications, each wire of the OSSD pair should be connected to a minimum load of 25 mA.

- D. No Warning + Automatic Restart + 2 Zone set;
Conf. D: Two Zone Sets with one Safety Area for each set, connected to the same OSSD pair, with automatic Restart.

- E. No Warning + Manual Restart + 2 Zone set;
Conf. E: Two Zone Sets with one Safety Area for each set, connected to the same OSSD pair, with Manual Restart

- F. No Warning + Automatic Restart + 3 Zone set.
Conf. E: Three Zone Sets with one Safety Area for each set connected to the same OSSD pair, with automatic Restart.



Make sure that the signals are aligned with the pin features and their specific function. In addition, they must be correctly connected to the external device.

The chart bellows shows the possible electrical configurations:

Laser Sentinel-B5 INPUT/OUTPUT CONFIGURATION EXAMPLES										
EXAMPLE	A	B	C	D	E	F	COLOR	PIN NUMBER		
ZONE SETS	1	1	2	2	2	3				
WARNING OUTPUTS	1	1	1	0	0	0				
RESTART	AUTOMATIC	MANUAL	AUTOMATIC	AUTOMATIC	MANUAL	AUTOMATIC				
	+ 24 VDC							BROWN	2	
	0 VDC							BLUE	7	
	NO FUNCTION	NO FUNCTION	AREA SWITCH INPUT 1	AREA SWITCH INPUT 1	AREA SWITCH INPUT 1	AREA SWITCH INPUT 1	GREEN	3		
	NO FUNCTION	RESTART	AREA SWITCH INPUT 2	AREA SWITCH INPUT 2	AREA SWITCH INPUT 2	AREA SWITCH INPUT 2	YELLOW	4		
	WARNING OUTPUT	WARNING OUTPUT	WARNING OUTPUT	NO FUNCTION	RESTART INPUT	AREA SWITCH INPUT 3	WHITE	1		
	OSSD 1/1							GREY	5	
	OSSD 1/2							PINK	6	
	F_EARTH							RED	8	



Note: For further information about the device functions and GUI settings, refer to paragraph 8).

7.7 ELECTRICAL CONNECTIONS EXAMPLES

This section includes electrical connections examples between the Laser Sentinel and the most common components and interface modules employed for the safety applications.

A : Warning + Automatic Restart

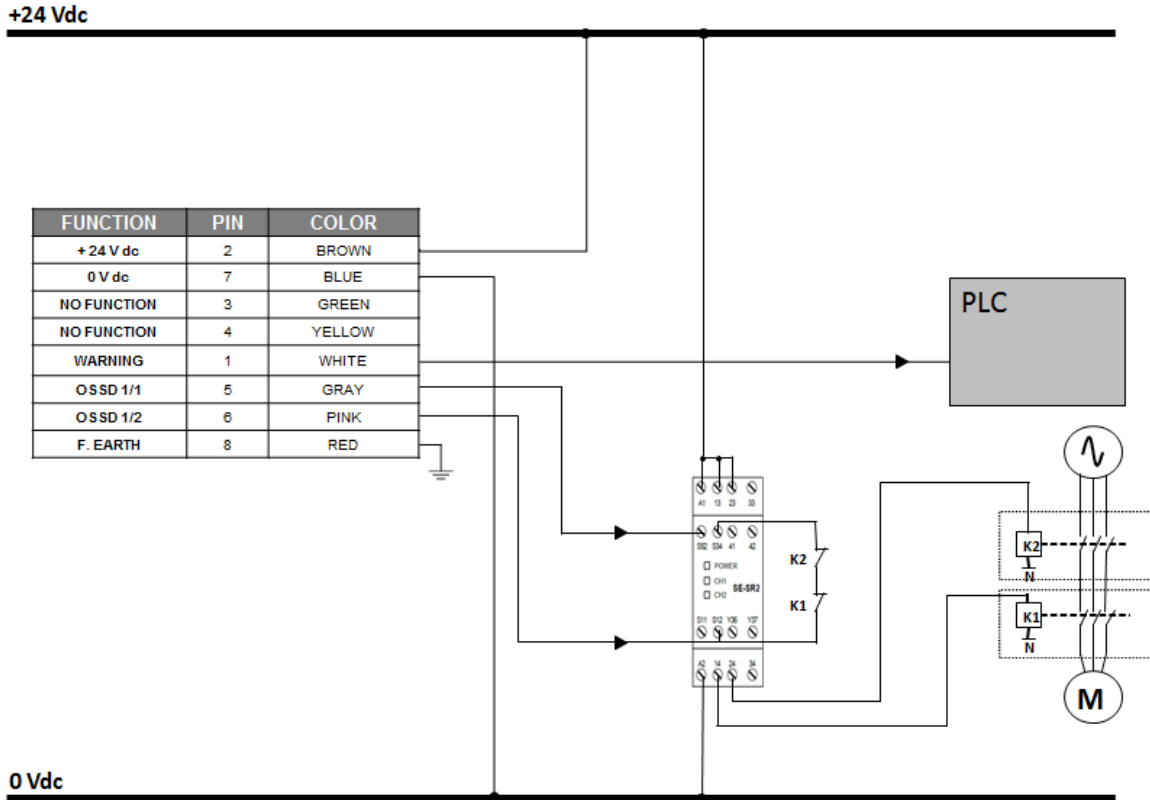


Fig. 24 - Connection example (Warning + Automatic Restart)

B : Warning + Manual Restart

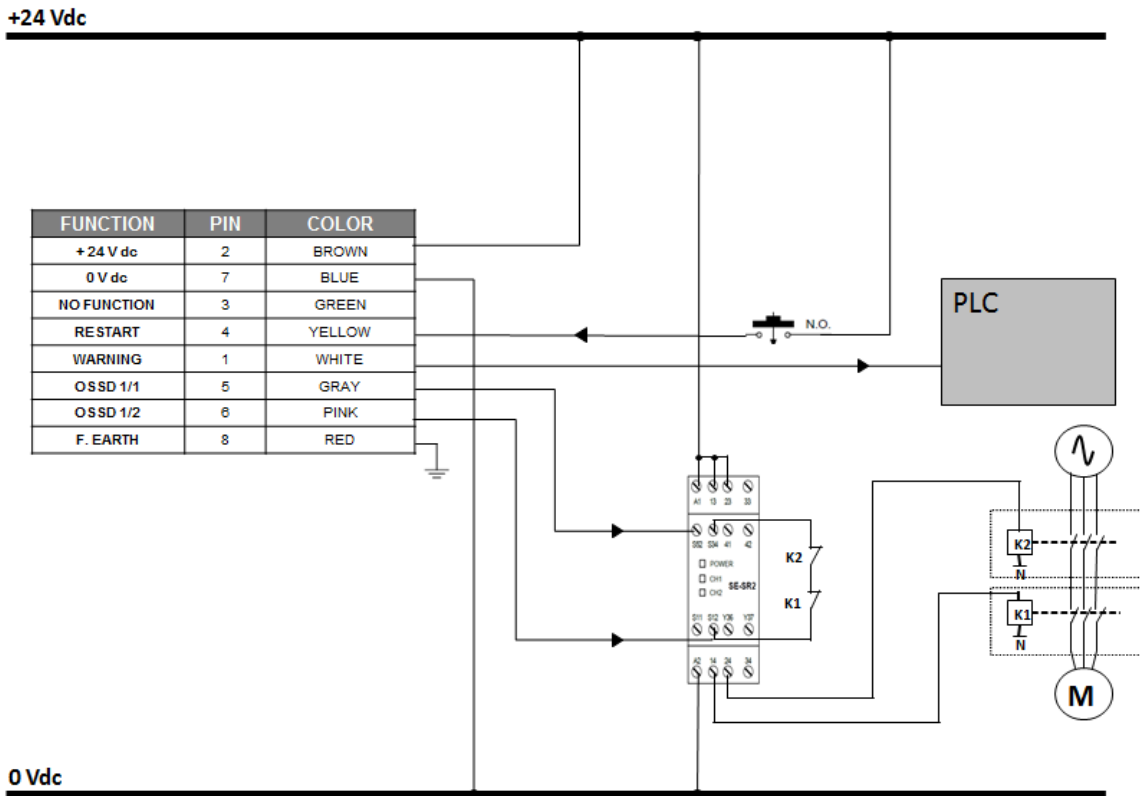


Fig. 25 - Connection Example (Warning + Manual Restart)

C : Warning + 2 Area switches (SE-SR2 safety unit: manual restart)

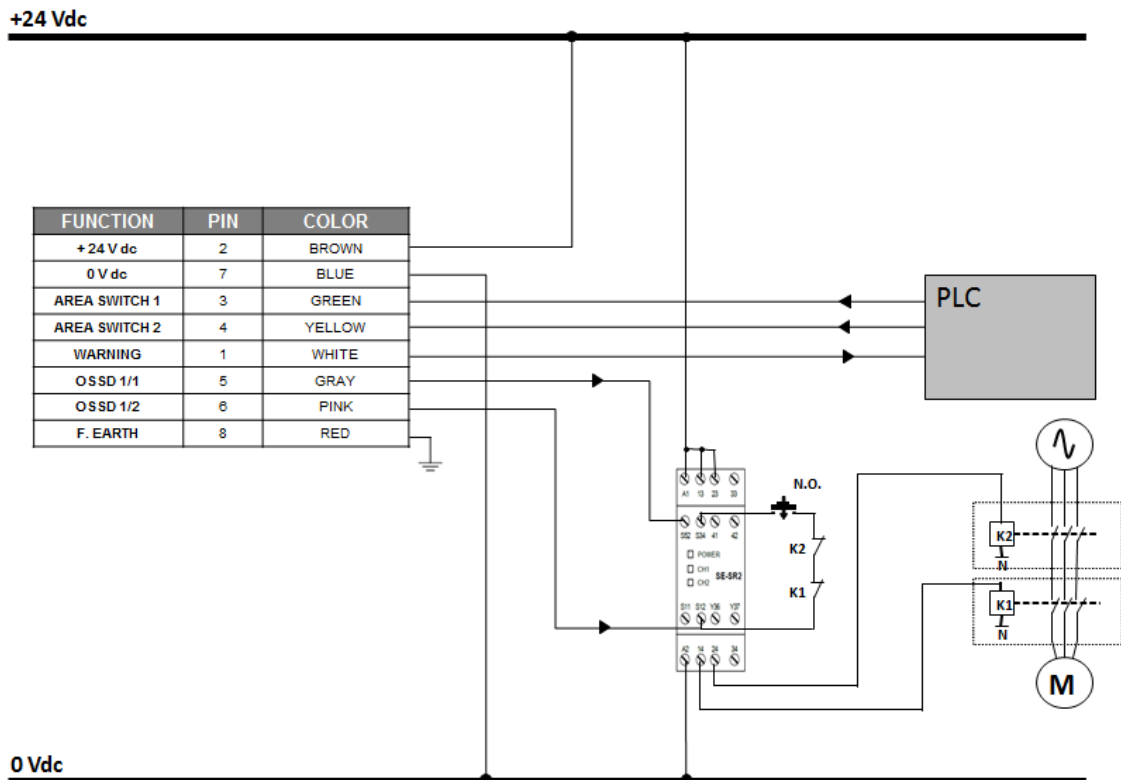


Fig. 26 - Connection Example (Warning + 2 Area Switches)

8 LASER SENTINEL SET UP AND CONFIGURATION

This chapter is dedicated to the Laser Sentinel set up and configuration, in particular by using the DLSentinel software. The aim of this chapter is to guide the user through all the fundamental procedures of configuring the device.

In order to employ the safety laser scanner, DLSentinel is necessary to create a safety configuration, in which the user will insert all the parameters, configure inputs and output and create monitored areas. For further information about DLSentinel, refer to the DLSentinel User's Manual.

8.1 INSTALLING DLSENTINEL GUI

The DLSentinel client application software needs to be installed on your PC to configure the safety laser scanner.

8.1.1 Minimum System Requirements

To ensure proper interfacing with the system, the personal computer must meet the following minimum requirements:

COMPONENT	RECOMMENDED	MINIMUM
Processor(s)	Pentium 4	Pentium 4
Clock frequency	≥ 3 GHz	≥ 2 GHz
RAM	2 GB	1 GB
Free hard drive space	70 MB	70 MB
Monitor resolution	1280x768	1024x768
Supporting Operating System	Windows XP Windows 7 Windows 8 Windows 10	

Besides the components listed in the table above, your PC must be equipped with the following hardware and software drivers:

- Installed Ethernet network card and installed driver
- One free 100 Mbps Ethernet port

8.1.2 Program installation

DLSentinel is a Datalogic safety laser scanner configuration tool providing several important advantages:

- Intuitive Graphical User Interface for rapid configuration
- Defined configuration directly stored in the device
- Discovery and IP address setting features to facilitate remote configuration
- Device Monitoring

To install DLSentinel:

1. On the PC that will be used for configuration, (running Windows XP, 7, 8, or 10), download the DLSentinel.zip file. Extract the file, run the installation program and follow the installation procedure.
2. When the installation is complete the DLSentinel entry is created in the Start > All Programs menu under "Datalogic" as well as a desktop icon. Double-click the desktop icon to run it.



Note: A dedicated computer running DLSentinel must be connected to a safety laser scanner through the Ethernet port to perform the configuration and monitoring features.

8.2 CHOOSING THE APPLICATION

In order to help the user with the device installation, the GUI allows selecting the application Type. Depending on which device model is used for the configuration and for the safety monitoring, there are different features and functions.

8.3 EXAMPLE CONFIGURATIONS

This section provides configurations examples in order to help the user to properly set the Laser Sentinel.

8.3.1 Expert Configuration: SLS-B5

SLS-B5 model allows the user to choose the Expert application. It employs an M12 8 poles connector, in which three pins are already set for specific functions (GND_ISO, POWER SUPPLY, F_EARTH) and two are used for the OSSD pair (OSSD1/1 and OSSD1/2).

As a result, it is possible to assign specific functions only to the remaining three pins which can be used as follows:

MULTI-IN	RESTART1, AREA SWITCH 1, RESTART/RESET, RESET, NO FUNCTION
MULTI I/O	MULTI-IN, MULTI-OUT
MULTI OUT	WARNING1, NO FUNCTION



Note: For further information refer to chapter 7.

8.3.2 Case 1: 1 Output Warning Automatic Restart

For example, if the user wants to create a new configuration in EXPERT mode, one of the possible applications is: 1 Safety Zone, 1 Warning Zone and Automatic Restart.



Note: In this situation it is possible to use only one Zone Set (which is assigned to one OSSD pair).

1 OUTPUT WARNING AUTOMATIC RESTART			
PINOUT	COLOR	SIGNAL	FUNCTION
3	GREEN	MULTI IN	NO FUNCTION
4	YELLOW	MULTI IN	NO FUNCTION
5	GREY	OSSD 1/1	OSSD 1/1
6	PINK	OSSD 1/2	OSSD 1/2
1	WHITE	MULTI IN/OUT	WARNING
7	BLUE	GND_ISO	GND_ISO
2	BROWN	POWER SUPPLY	POWER SUPPLY
8	RED	F_EARTH	F_EARTH

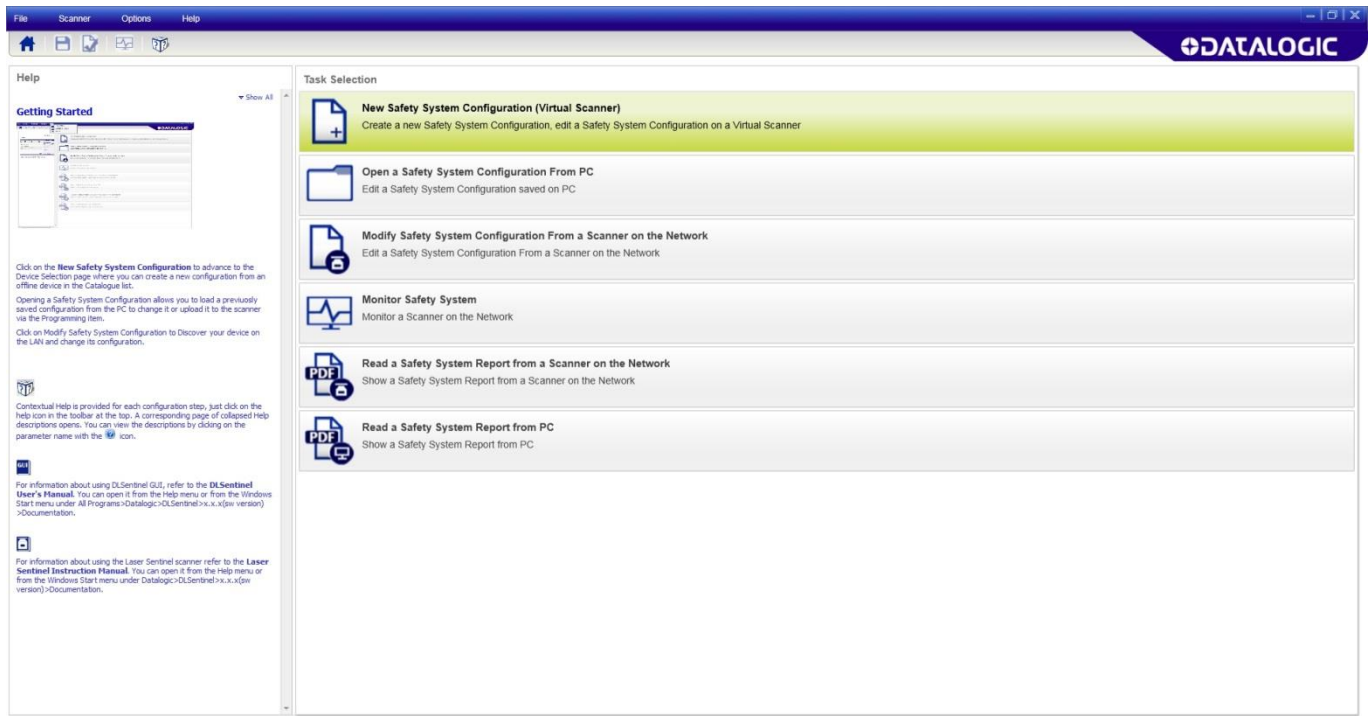
In order to configure the Laser Sentinel, these are the steps to follow:



Note: For further information regarding a device configuration refer to DL.Sentinel User's Manual.

8.4 LASER SENTINEL NEW CONFIGURATION

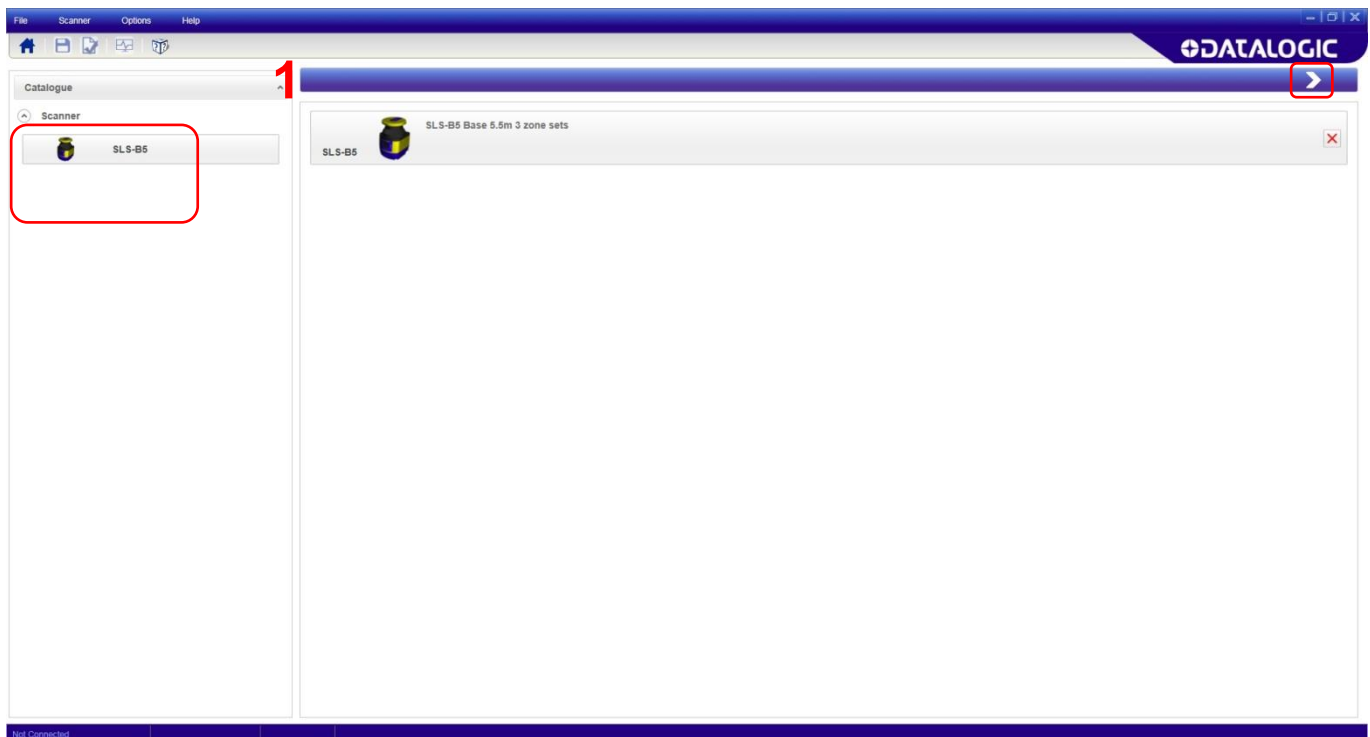
Open DL Sentinel and in Task Selection panel select **New Safety System Configuration**.



1. After choosing **New System Configuration**, the subpanel on the left side, allows the selection of a device from the **Catalogue** by double-clicking on the tab.



Note: To proceed with the configuration, click on the white right-pointing arrow of the right side on the main panel.

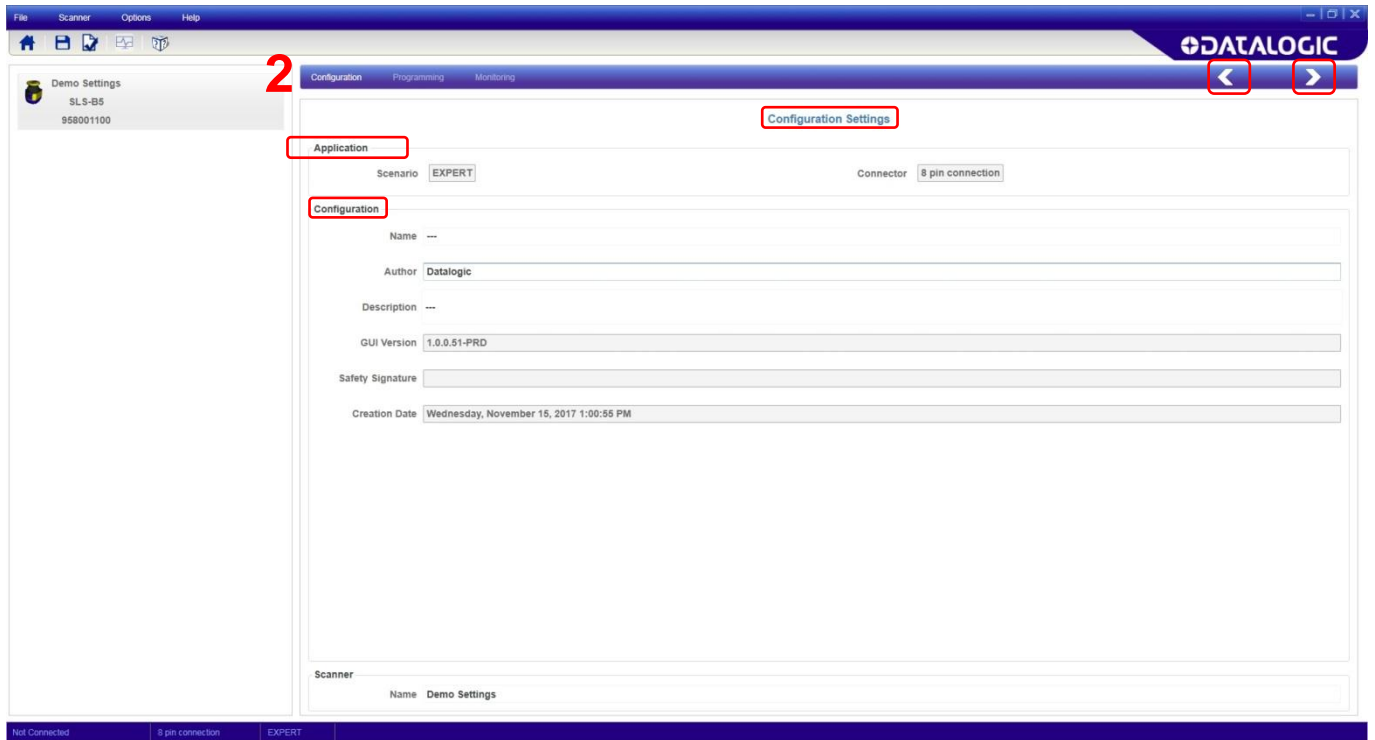


Click on the white right-pointing arrow on the upper right side of the main panel.

2. CONFIGURATION SETTINGS:

Configuration Settings displays the **Application** type:

- **Scenario** to select the configuration type (depending on the application).
 - **Expert**: provides the maximum configuration possibilities for the device. It contains the entire set of parameters, regardless of the devices use.
- **Connector** to select the connector type (depending on the device model and application).
 - **8-pin connection**: The configuration will manage the pins relative to this connector.



It is possible to edit some parameters in **Configuration**, such as:

- **Name**: A name to identify the configuration.
- **Author**: A name to identify the author.
- **Description**: A short text description to identify the configuration.
- **GUI Version**: (Read-only). The software version of DLSentinel.
- **Safety Signature**: (Read-only). This is automatically generated to be a unique identifier that includes the scanner, configuration, creation date-time.
- **Creation Date**: (Read-only). The date and time the configuration was created.
- **Scanner**: A name to identify the scanner.

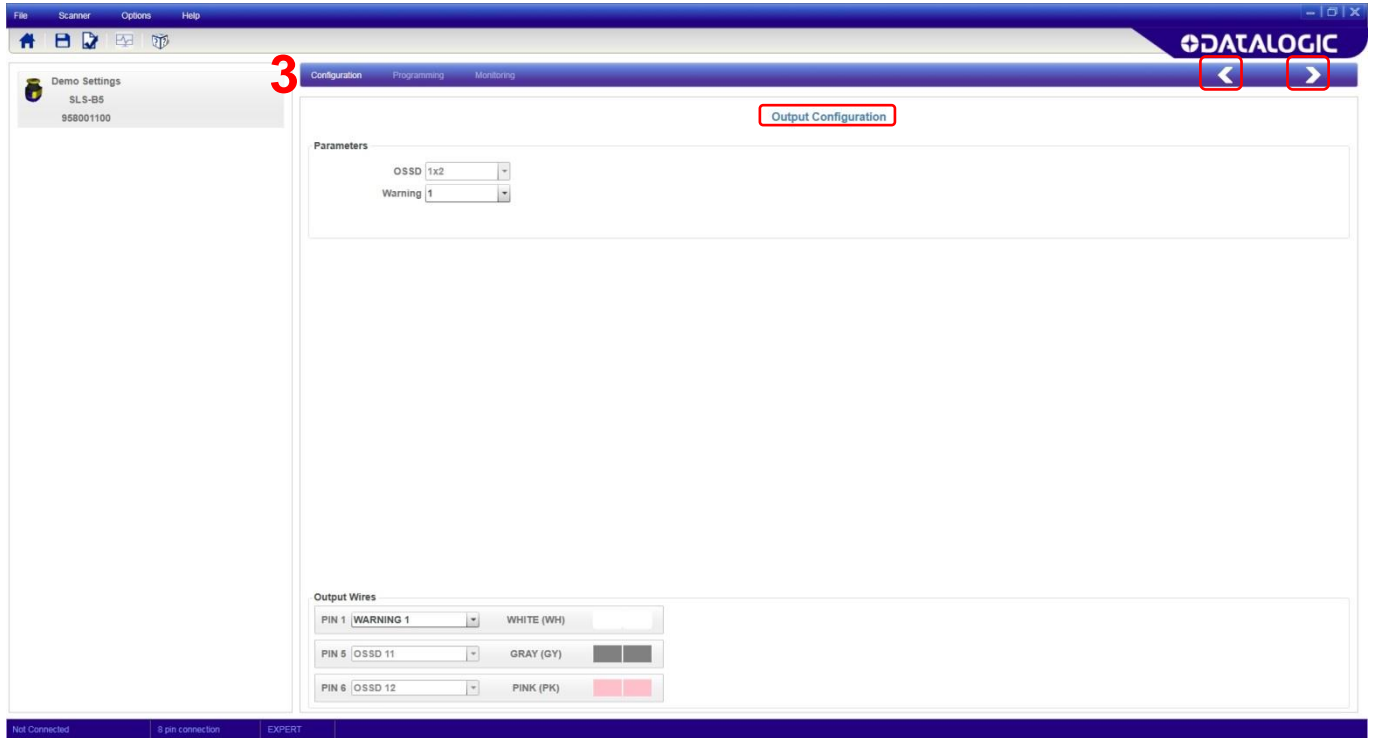


Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

3. OUTPUT CONFIGURATION

The OSSD pair is a read-only function for the B5 model and also Pins 5 and 6 cannot be modified; because they are automatically assigned to OSSD 1/1 and OSSD 1/2.

If the Warning function is selected, Pin 1 must be assigned to this function.



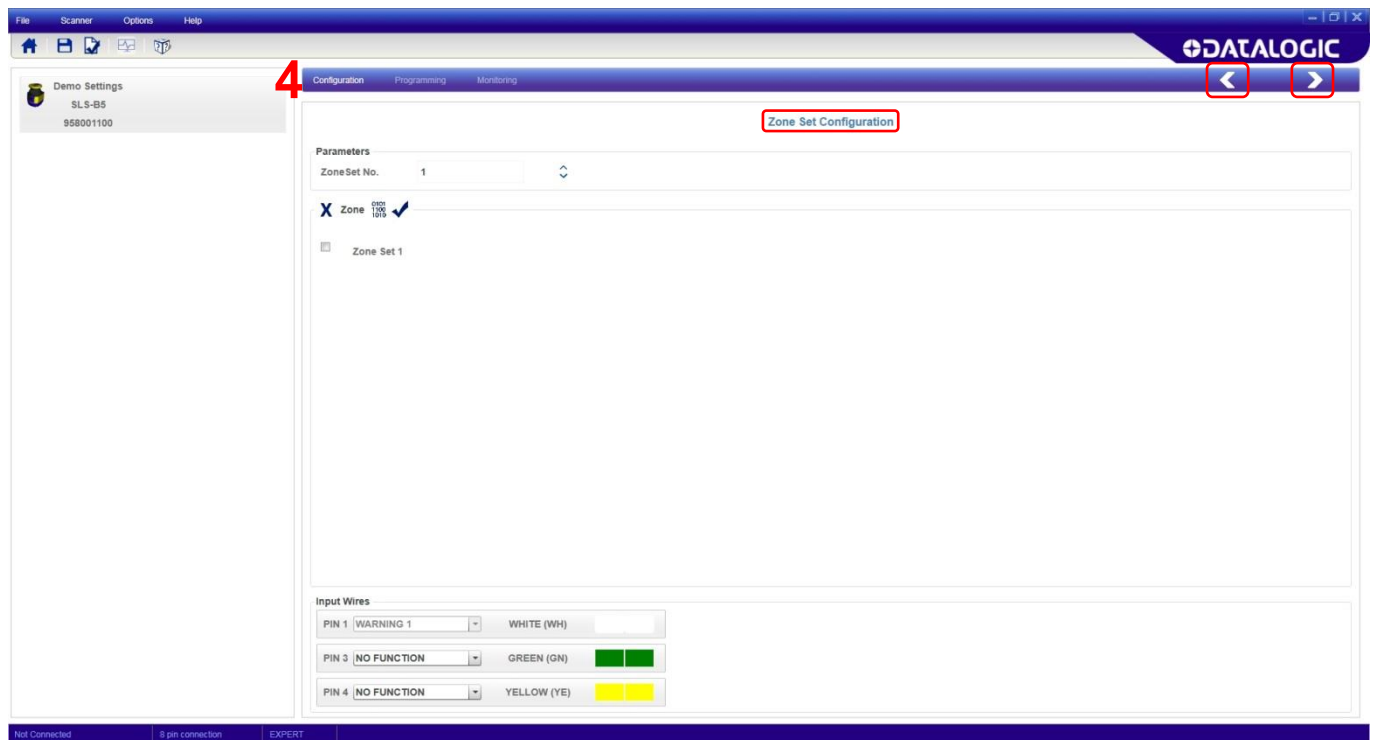
Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

4. ZONE SET CONFIGURATION

This configuration step allows the user to set the Zone Set parameters.

In this case the configuration includes only one Zone Set so it is not necessary to insert or edit any parameter.

Also the Input Wires parameters do not require any assignment.

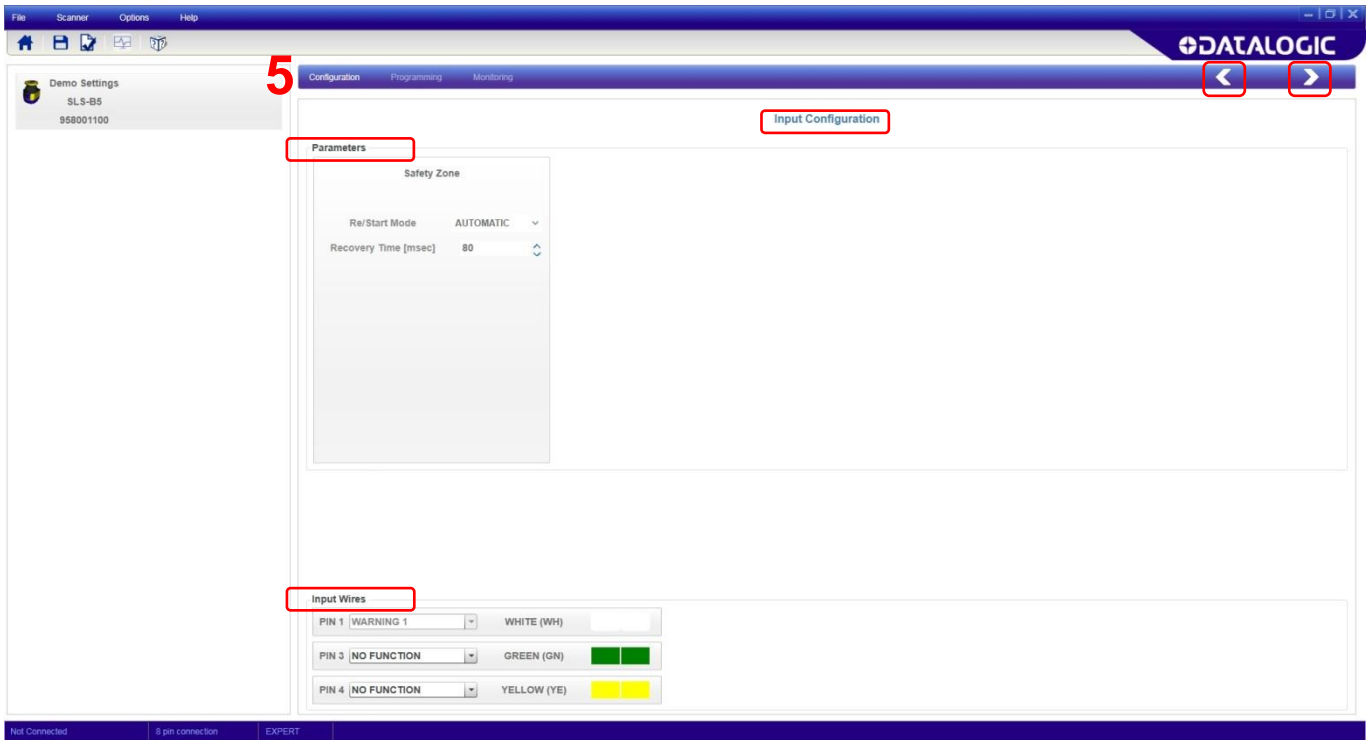


Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

5. INPUT CONFIGURATION

The next step is to set the automatic restart from the panel of the **Safety Zone** and insert the **Recovery Time**. (Refer to par. 9.3)

The Input Wires are already set as consequence of the previous choices.



Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

6. DETECTION CONFIGURATION

Detection Configuration allows the user to select the Number of Scans required to validate detection. This parameter has a direct impact on the Response Time (refer to par. 9.4).

For this model the Detection Capability is fixed at 70mm, for both Safety and Warning Zones.



It is not possible to set the Dust Filter Level parameter for the Warning Zone.

Select the Dust Filter Level (refer to per. 9.6).

The screenshot shows the 'Detection Configuration' window in the Datalogic software. A red circle with the number '6' is placed over the 'Configuration' tab. The 'Response Time' section shows 'Number of Scans' set to 2 and 'Response Time [msec]' set to 62. The 'Detection' section is divided into 'Safety Zone' and 'Warning Zone'. The 'Safety Zone' has 'Detection Capability [mm]' set to 70 and 'Dust Filter Level' set to LOW. The 'Warning Zone' has 'Detection Capability [mm]' set to 70 and 'Dust Filter Level' set to a disabled state. Both zones have graphical representations of detection ranges on a grid. The 'Safety Zone' graph shows a red curve with '5500' labels. The 'Warning Zone' graph shows a yellow curve with '50000' and '40000' labels. At the bottom of the main panel, there are two navigation arrows: a white left-pointing arrow and a white right-pointing arrow, both highlighted with red boxes. A status bar at the bottom indicates 'Not Connected', '8 pin connection', and 'EXPERT'.



Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

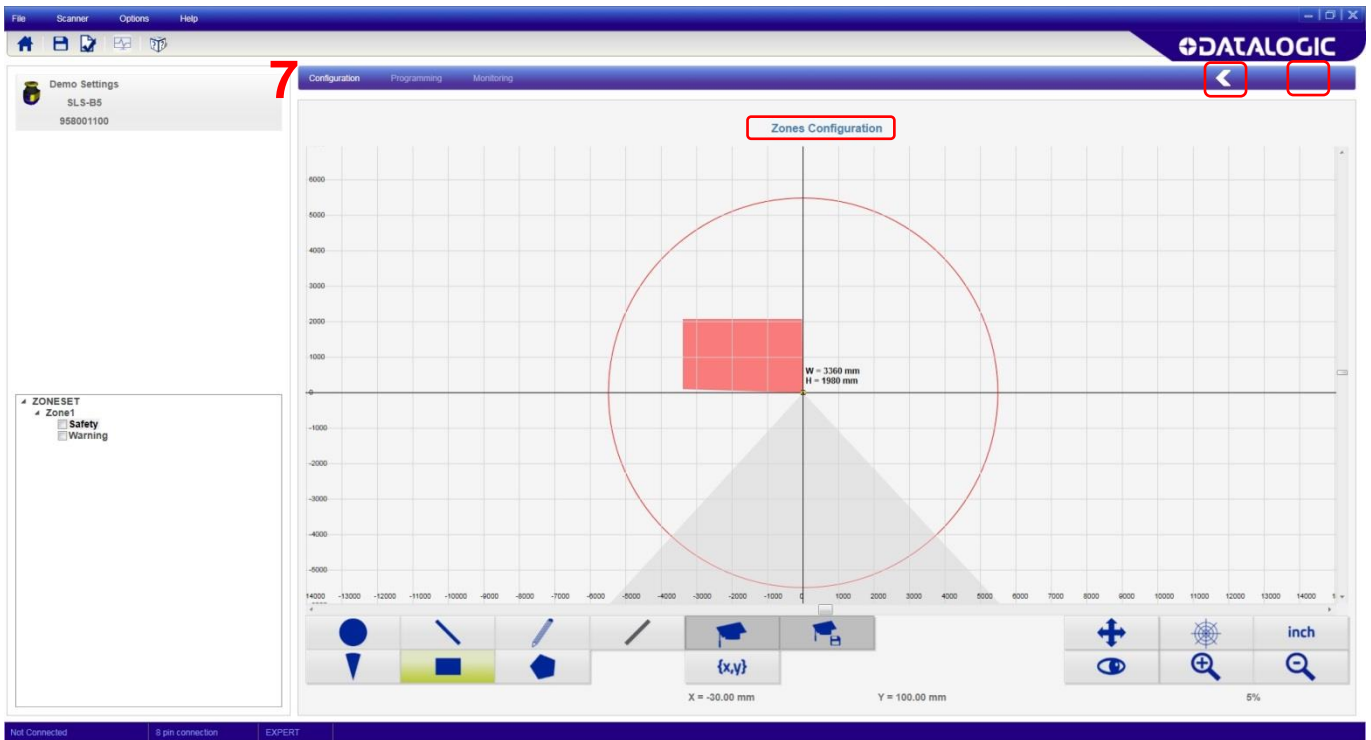
7. ZONES CONFIGURATION

This step allows the user to draw Safety and Warning Zones by using the toolbar located under the graphic.

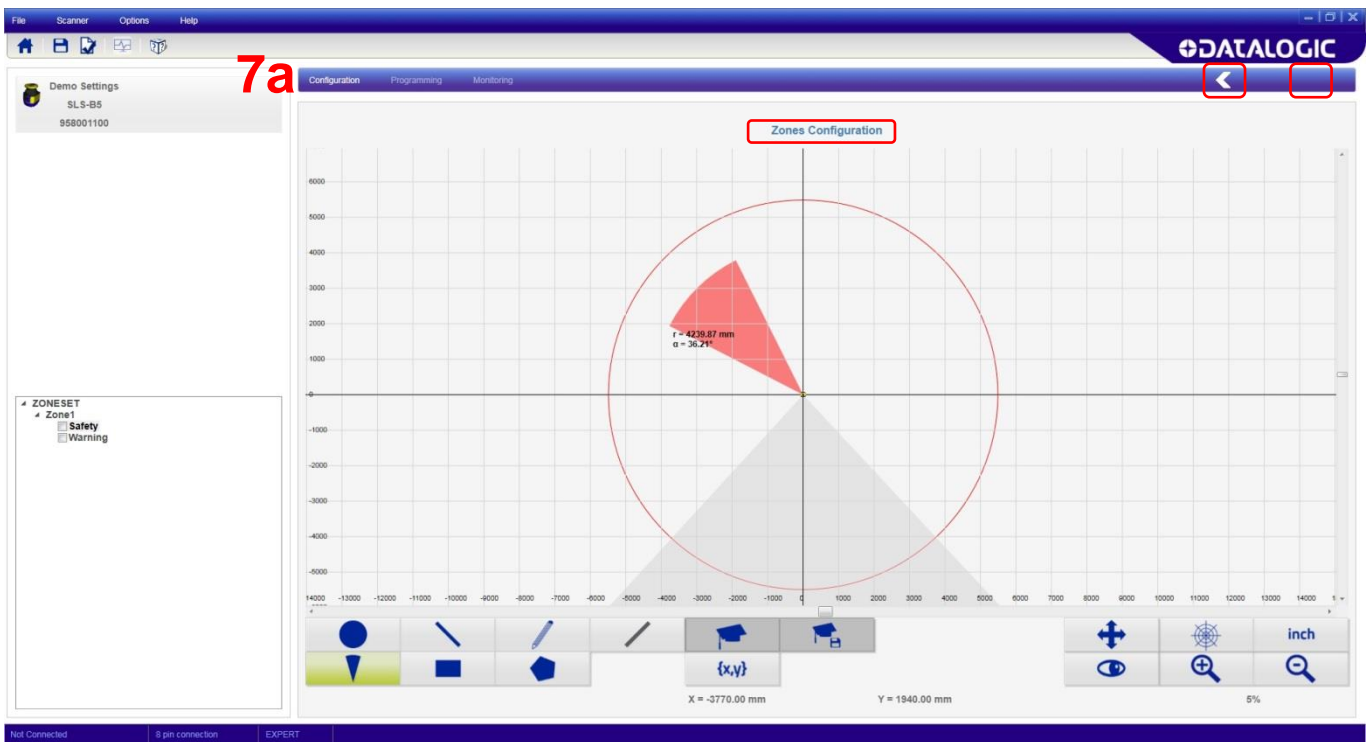
Each area can be drawn separately by clicking on its number in the Zone Set subpanel on the left.

If the user right-clicks on the selected area on the graphic, it is possible to edit the shape of it.

It is also possible to modify the area by clicking on the **Show Points** button.



The user can select different area shapes (7a).



Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

8. PROGRAMMING

Once the configuration is done, it is possible to load it on the device by selecting the function **Programming** on the menu. Follow the steps below:

1. By clicking on Programming, DLSentinel will enter Discovery mode to search for a connected device.
2. The User Interface opens and displays the device with its own default IP Address (192.168.0.10).
3. Double-click on the discovered device to place it in the Device Configuration panel.
4. Click on the white right-pointing arrow on the upper right side on the main panel to proceed.
5. A pop-window will appear suggesting to align the IP Address of the device with the computer LAN. Click OK to proceed and insert the DLSentinel password in order to proceed (default password "**admin**", if not changed).
6. Then change the IP Address parameters in the Network Configuration window to align them with the computer LAN.



Laser Sentinel also reserves the successive IP Address for internal functions.

7. Click OK to accept the new IP Address parameters. The device enters the Offline status, click ok to proceed.
8. DLSentinel will automatically rediscover the device with new IP Address. Double-click on the device to enter Programming.

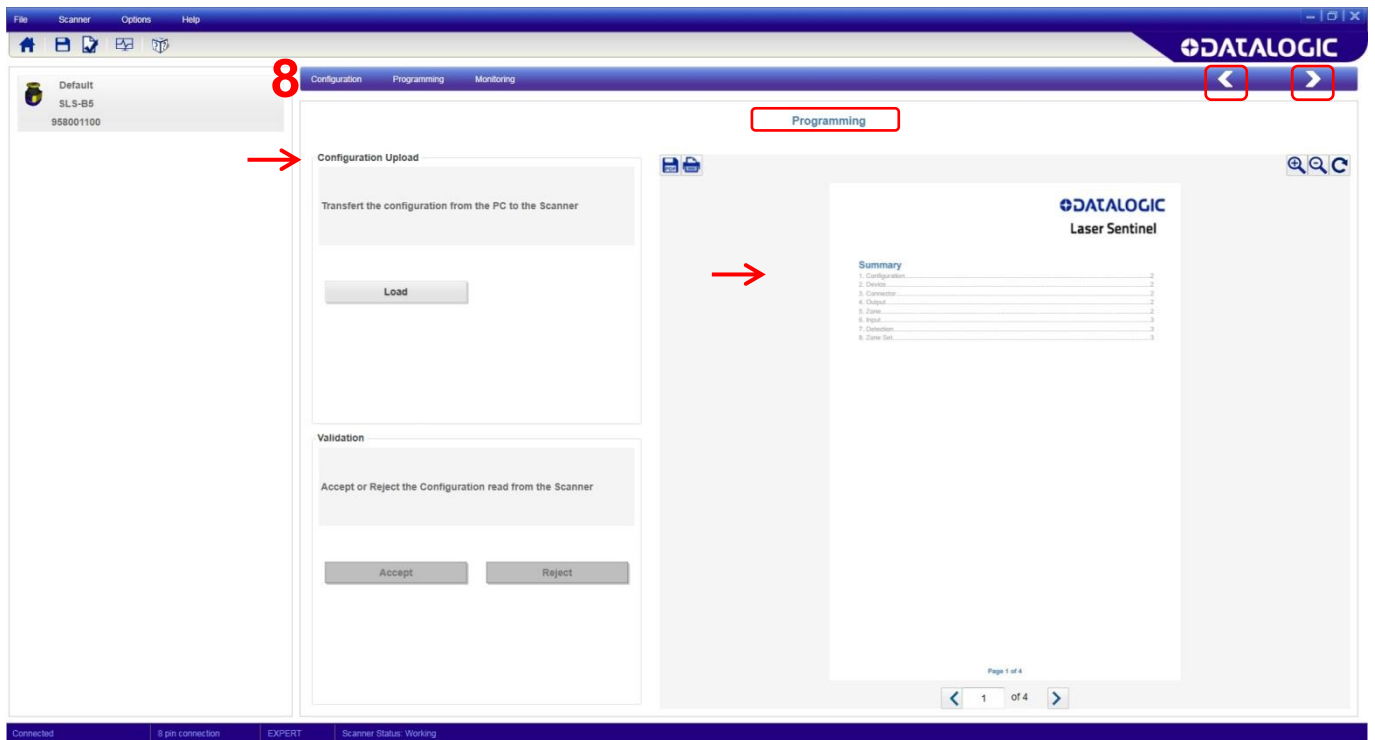
Now it is possible to conclude the configuration:

- In **Configuration Upload** click on Load to upload the configuration on the device. To send the configuration to the device you must insert the password (default password “**admin**”, if not changed).
Then test its functioning by entering **Monitoring**.
Once the new configuration is uploaded, Laser Sentinel will display the icon below:



Fig. 27 - Pending Configuration Acceptance Icon displayed

- **Report** file is displayed on the right side of the panel. This document sums up the configuration steps with all the chosen parameters. It is possible to save it as a PDF file and print it.



Note: To proceed with the configuration, click on the white right-pointing arrow on the upper right side on the main panel. To go back to the previous page, click on the white left-pointing arrow.

9. MONITORING

Once the configuration is uploaded, it is possible to test it by selecting the function **Monitoring** on the menu. Use this function to check the configuration status and if it is properly functioning.



Note: If the Monitoring is selected before uploading the new configuration, it displays the previous configuration and the present OSSD and Warning status.

On the panel on the left, the DLSentinel shows the device status (if it is correctly functioning). It is also possible to view some parameters, for example the pin assignment and the response time.



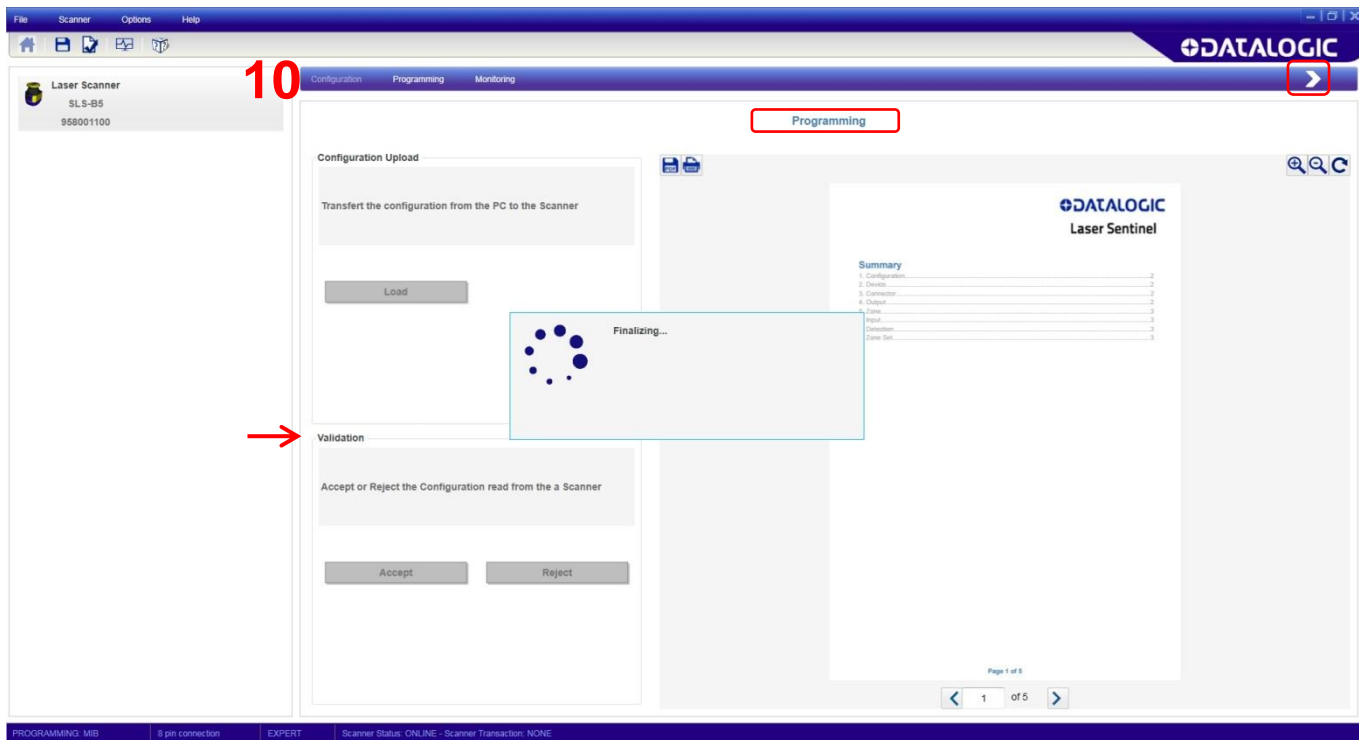
Note: To go back to the previous page, click on the white left-pointing arrow.

10. PROGRAMMING

- **Validation** after testing the configuration in monitoring and checking the Safety Report, you can accept or reject the configuration.
After Validation procedure, Laser Sentinel will display the icon below:



Fig. 28 - Configuration Accepted Icon displayed



8.4.1 Case 2: 1 Output Warning Manual Restart

Another possible case of configuration includes the Manual Restart function.

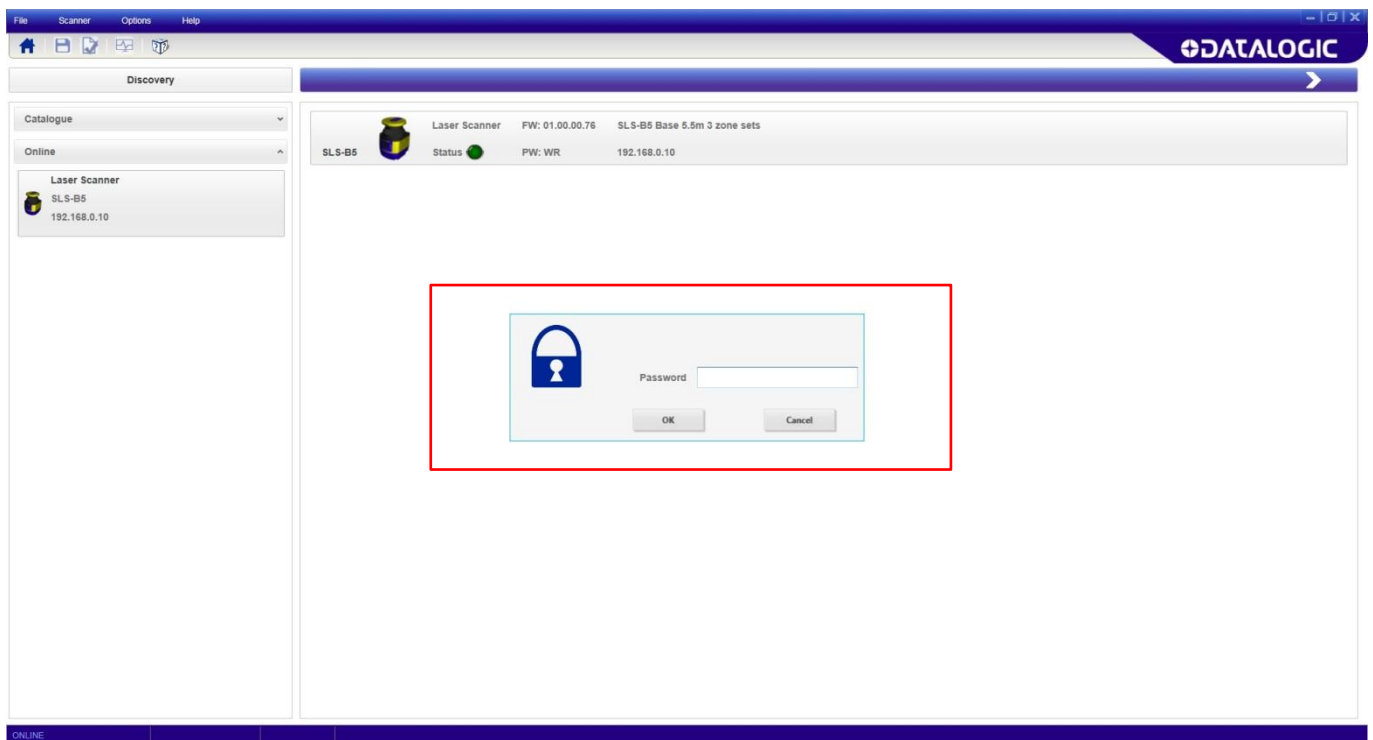
Here Pin 4 will be assigned to the Restart function.

1 OUTPUT WARNING MANUAL RESTART			
PINOUT	COLOR	SIGNAL	FUNCTION
3	GREEN	MULTI IN	<i>NO FUNCTION</i>
4	YELLOW	MULTI IN	RESTART
5	GREY	OSSD 1/1	OSSD 1/1
6	PINK	OSSD 1/2	OSSD 1/2
1	WHITE	MULTI IN/OUT	WARNING
7	BLUE	GND_ISO	GND_ISO
2	BROWN	POWER SUPPLY	POWER SUPPLY
8	RED	F_EARTH	F_EARTH

8.5 FIRMWARE UPDATE

In order to update the firmware, proceed as follows:

1. Start the DLSentinel GUI and select the new configuration task.
2. Select an online device using the Discovery function.
3. Once the device is selected, click on the menu on Scanner and choose the firmware update option.
4. Insert the device password (default password “**admin**” if not changed by the User) in order to access to the firmware update option.



5. In the Firmware update section (**Package section**), click on ZIP Archive to search and select a previously downloaded new firmware version.
6. Once the new firmware version is selected, click on Load (**Configuration Upload**).
7. When the firmware version is completely loaded, the user enters in the Offline-Test modality to create a configuration and test the new firmware version.
8. If the firmware version is compatible with the device (so that the device configuration is correct with no failures) the user has to click on Accept, otherwise click on Reject (**Validation**).

9 FUNCTIONS

9.1 ZONE SETTING CONFIGURATION AND SELECTION

A Zone Set defines the area within the Laser Sentinel operating range to be monitored (Safety, and if present, Warning Zone). More than one Zone Set can be configured to define either separate or overlapping areas and these can be switched alternatively using combinations of input signal states.

To create a Zone Set, the user must configure it through the DLSentinel GUI.



Note: the B5 model with has one OSSD pair, so that only one safety area can be defined for each zone set.

9.1.1 Zone set input selection

When only one Zone Set is configured, it corresponds to the single monitored area of the Laser Sentinel and no input signals are needed to manage it.

Laser Sentinel allows the user to setup one to three Zone Sets (these operate independently from one another, by using the input configuration “Area Switch”. To a given combination of inputs assigned as “Area Switch” inputs, one and only one safety configuration will be monitored by the device.

When the input signal combination changes, the safety area assigned to this combination will be monitored.

When the device is functioning, since these Area Switch combinations are exclusive, Laser Sentinel monitors one Zone Set at a time. It is not possible to assign more than one Zone Set to the same input signals “Area Switch” combination.



Note: Laser Sentinel B5 model has three configurable inputs. To switch the Zone Sets, it is possible to use a minimum of two and maximum of three of them.

The Input combination which makes the Zone Sets change (Area Switch) must be univocal and must not be susceptible to false external signals.

It is not possible to switch between two Zone Sets by using only one “Area Switch” input. One electrical wire is not sufficient to create the Area Switching because in the case of a missing signal (i.e. broken wire) an undesired and unsafe Area Switch would result. Also a system malfunction could cause the Area Switch which would not be detected as an error.

So in order to start the Zone Set Switching on the device, the user must:

- Configure at least two Area Switch Inputs
- Define the input combinations.
- Make sure that the system, which generates the input combination, is able to dynamically switch the state of the inputs within the required time and without passing through intermediate invalid combination states.

It is possible to insert a delay for the input switching (INPUT DELAY, up to 100 ms), to guarantee the correct timing during the Area Switching. This parameter allows handling the delays caused by the activation and deactivation of Area Switching which otherwise could put the device in undesired or invalid and temporary switching zone input combinations. As a consequence, this would cause the device to enter the fault state.

9.1.2 Zone set switching

Two Zone Sets

In order to make the device monitor two different areas, the user must configure the input combination by selecting the signal “Area Switch”.

1. Set two inputs as Area Switch (Zone Sets Configuration step).
2. Choose the needed number of active inputs in order to create univocal combinations.

As previously explained, only two configurations are possible:

Zone Set 1

Area Switch 1 = 1, Area Switch 2 = 0;

Zone Set 2

Area Switch 1= 0, Area Switch 2= 1;

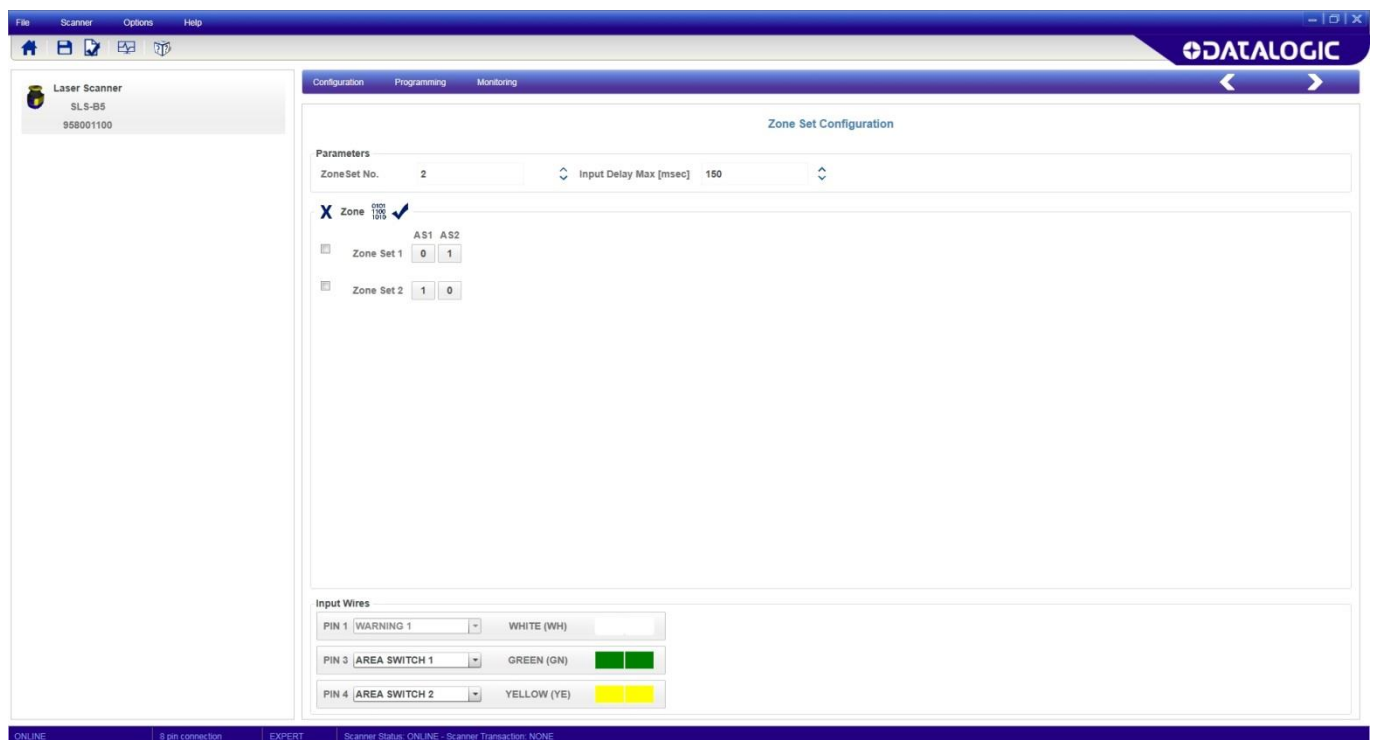


Fig. 29 - Zone Set 1



Note: The Laser Sentinel model Laser Sentinel-B5 has three configurable inputs. To switch the Zone Sets, it is possible to use a minimum of two and maximum of three of them.

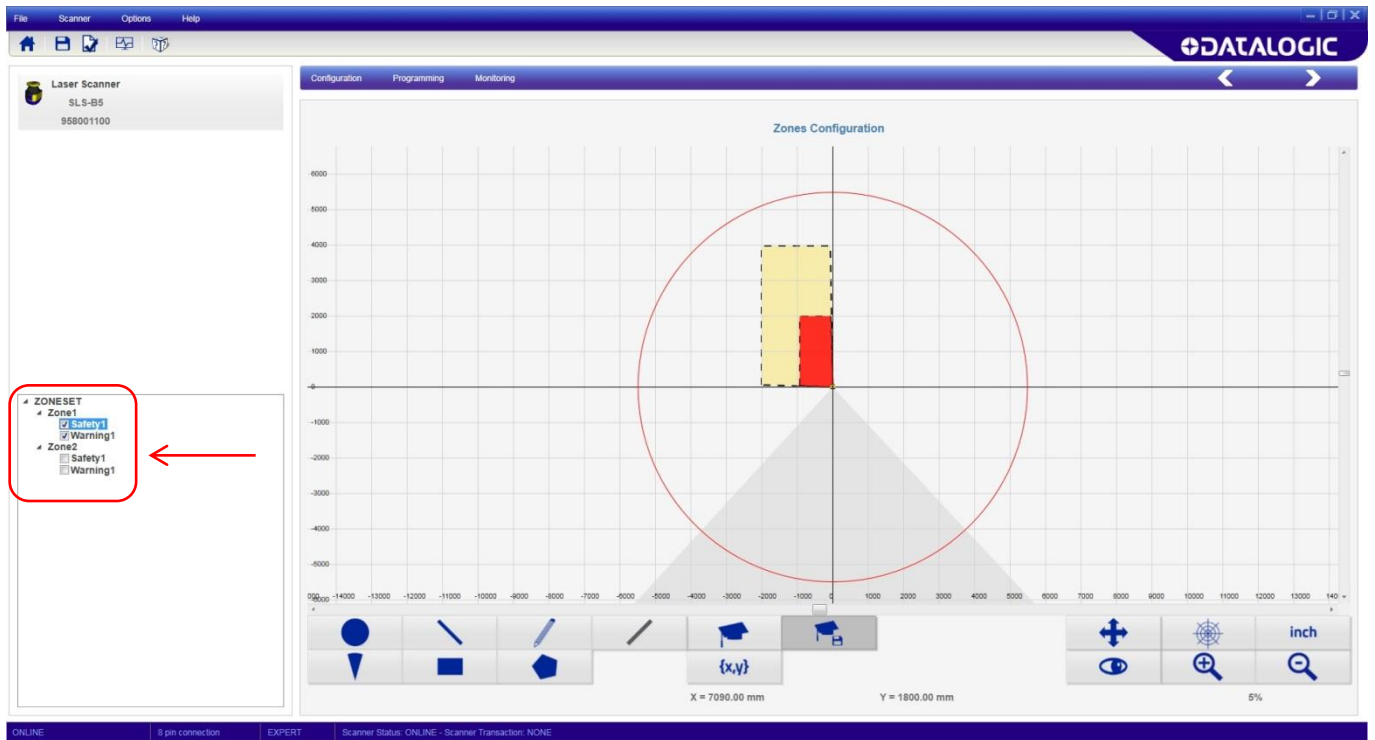


Fig. 30 - Zone Set 2

Three Zone Sets

In order to make the device monitor three different areas, the user must configure the input combination by selecting the signal “Area Switch”.

1. Set three inputs as Area Switch (Zone Sets Configuration step)
2. Create univocal combinations.

If the user configures three Zone Sets as a result there will be three possible univocal combinations. The device verifies if the input combinations are correct, so that combination ambiguity does not occur. If the device is configured with three Zone Sets, the allowed combinations are [100, 010 and 001].



The Laser Sentinel has three configurable Inputs, if the user chooses to employ three Zone Sets there will be no available I/O for other functions. For example it will not be possible to employ the Manual Restart or send an electrical warning signal.

The following figures will show the possible input combination in case of three Zone Sets.

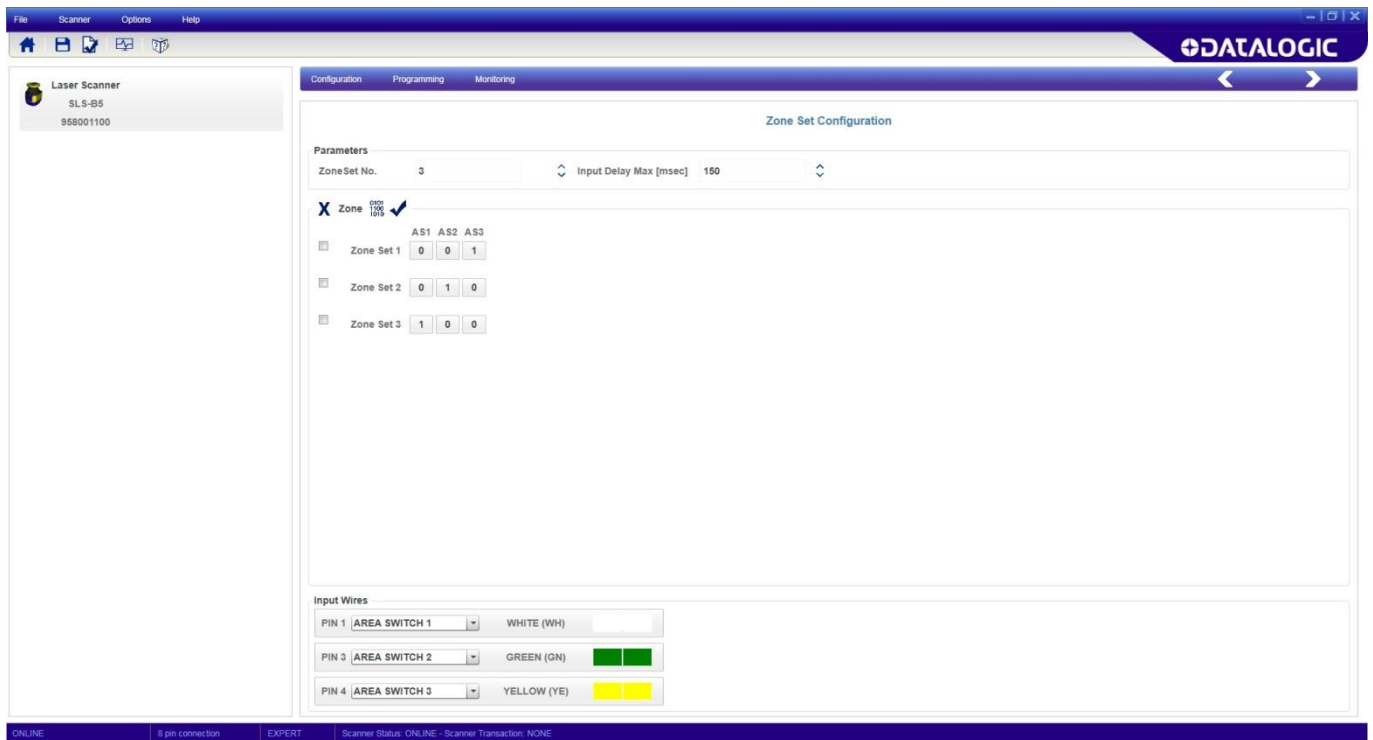


Fig. 31 - Zone Set 2

9.2 DETECTION CAPABILITY SETTING

The detection capability is the capacity to detect an object of given dimensions within the detection zone. In particular, for the Laser Sentinel, the test piece taken as reference is an opaque cylinder with at least 300mm height and the diameter equal to the detection capability measured in millimeters.

The safety laser scanner, configured with a given detection capability, will be able to detect objects within the Safety zone; the device is also capable of detecting objects located in the Warning zone, but the probability of detection errors could be greater than the one guaranteed for the Safety Zone (due to specific object color or reflecting surface).

The detection capability is a parameter that the user selects through the GUI. The user selects the detection capability depending on the application requirements, because it is a critical parameter in the calculation of the minimum safety distance from the hazard point.

The detection capability influences also the maximum range of detection of the scanner.



Note: The Laser Sentinel B5 model has a defined detection capability value, that is 70 mm.

Detection Capability	Max Range
70 mm	5.5 m

The Laser Sentinel has a limited detection capability that extends from the front window to 5.5 m.



The operator is responsible for the configuration and to ensure that the zone of limited detection does not create hazardous circumstances.

9.3 AUTOMATIC AND MANUAL RESTART

If Laser Sentinel detects an opaque object, the OSSD outputs switch to the OFF-status (the opening of the safety contacts). The restart mode allows the safety laser scanner to return to a normal operating condition.

The restart of the device (the closing of the OSSD safety contacts) can be carried out in two different ways: Automatic or Manual Restart.

Automatic Restart: when an opaque object is detected, the safety laser scanner enters in the safe condition. After the object has been removed from the safety area, the device starts its normal functioning again.

The response time is the time between the object introduction in the Safety area and the OSSDs achieving the STOP condition. The recovery time is the time between the object removal from the protected area and the OSSDs achieving the GO condition.

The Automatic Restart can be set through the GUI and the minimum recovery time for device restart is 80 ms. This time can be increased up to 60000 ms through the GUI.



Note: OSSD 1/1 1/2 has both Automatic and Manual Restart functions.

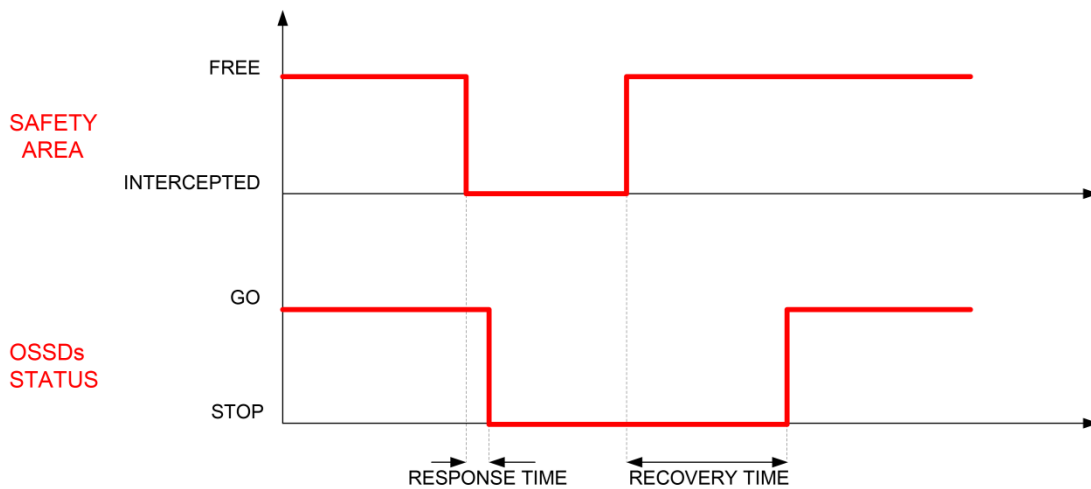


Fig. 32 - Restart timing (auto)

Manual Restart: after the safety laser scanner has detected an opaque object in the Safety area, it will return to normal operation only by pressing the Restart button (normally open push-button) after the object has been removed from the Safety zone.

The Restart push-button must be kept pressed between a minimum of 500 ms and a maximum of 4.5 seconds. When the Restart push-button is released, the OSSD outputs switch to normal operation.

There are two intermediate states (internally controlled) between the stop and the restart of the safety laser scanner: the Interlock ON (the device can be restarted to its normal function, because the detected object has been removed from the Safety zone) and the Interlock OFF (the device is OFF because the object has not been removed from the Safety zone).



The Interlock ON will be signaled by a led located under the device display (refer to chapter 10.4).



Note: The Manual Restart input must be connected to a 24 Vdc normally open contact.



If an object is not removed from the Safety zone and the operator attempts to restart the device, by pressing the button for more than 500 ms, the safety laser scanner switches to failure lockout.

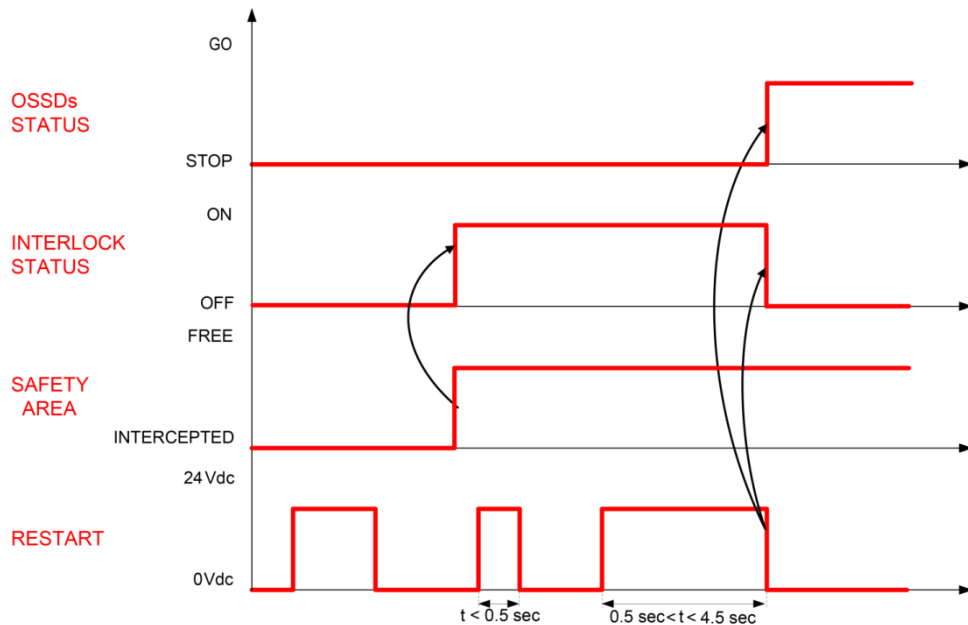


Fig. 33 - Restart timing (manual)

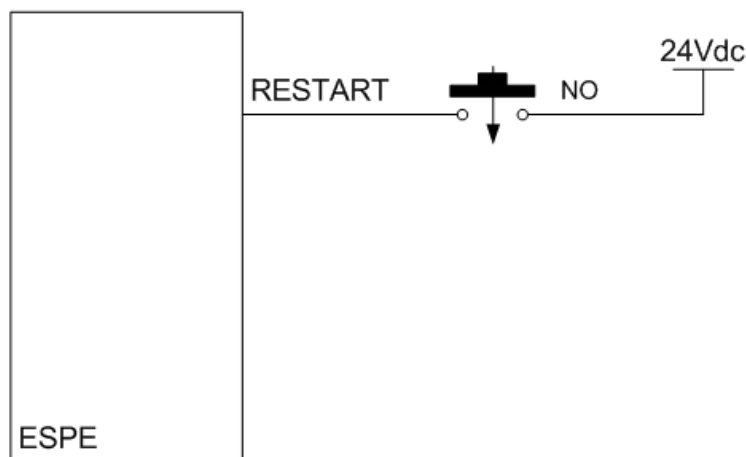


Fig. 34 - Restart connection (manual)

9.4 RESPONSE TIME AND SCAN CYCLE SETTING

The response time of the Laser Sentinel is the time from when an object enters the safety zone to when the OSSD goes to the OFF-status due to the detection of it.

The Laser Sentinel scans cyclically with a constant speed and it employs 30 ms to do one complete rotation.



Note: The minimum response time of the safety laser scanner is 62 ms, which is the time needed by the device to make two rotations. That is the time to switch back on the OSSD in case of fault or for the device to do some internal checks/test.

The number of scans of the response time may be increased, if the device is operating in a dirty environment caused by floating dust particles (here the user may need to collect more data in order to prevent the OSSD's OFF status).

The response time can be configured through the GUI: from a value of 62 ms to 482 ms, increasing the number by 30 ms multiples.



If the safety distance is not appropriate for the application, the machine may not stop before the dangerous area is reached.



If the application requires changes, this may require reconfiguration of the safety zones or re-installation of the Laser Sentinel.

9.5 OSSD

The OSSD (Output Signal Switching Device) is a safety output for safety-related part of a machine control system. When the device detects an object or a person in the Safety zone, the OSSD goes to the OFF-status (the machine stops). The device generates signals to monitor the OSSD status and these periodically force the OSSD into a temporary OFF condition if the OSSD is ON (when there is no object detected in the Safety zone). If the OFF signal does not return to the internal control circuit, the safety laser scanner will switch into fault status. An OSSD pair must always be wired to a safety-related part of a machine control system, in order to ensure safety.



In order to avoid dangerous conditions, the user must never wire only one OSSD to a safety-related part of a machine control system.



The OSSD 1/1 1/2 safety contacts cannot be connected in series or in parallel, but they have to be used separately (in the double channel safety controller input). An erroneous configuration will cause the device to switch the output into failure condition. Connect both OSSDs to the device to control: otherwise the degree of system safety, that the safety laser scanner has to control, will be put in danger.

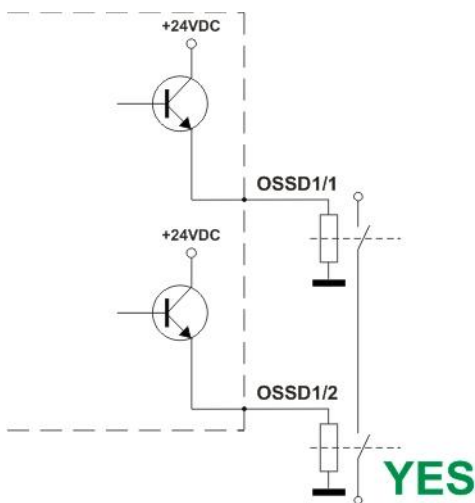


Fig. 35 - Correct connection of the load

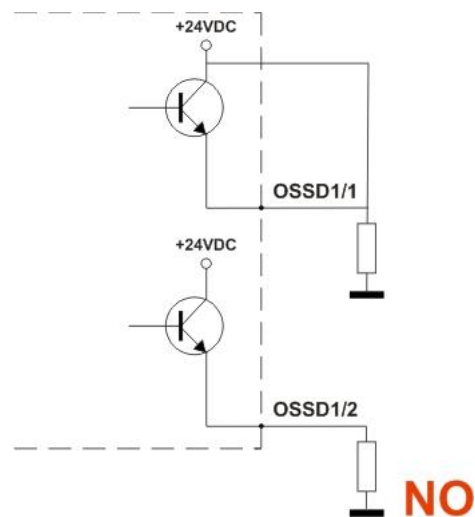


Fig. 36 - Incorrect connection of the load (I)

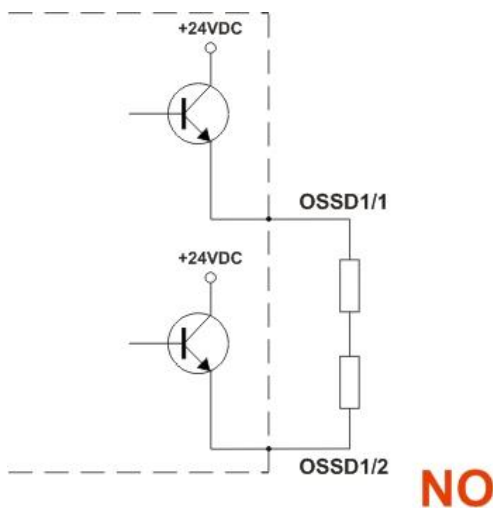


Fig. 37 - Incorrect connection of the load (II)

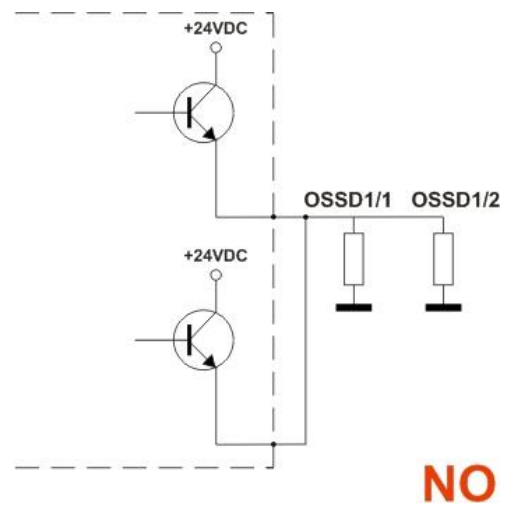


Fig. 38 - Incorrect connection of the load (III)

9.6 DUST FILTERING

The Dust Filter Level must be set according to different conditions specific to the application. In general, it is the sensibility to various levels of airborne particles that impact the response of the Laser Sentinel detection.

A **Low** Dust Filter Level (default) is used in cleaner environments where airborne particles have little effect on object detection.

A **High** Dust Filter Level is used in dirty environments to filter (ignore) detection of airborne particles from being confused with objects to detect. The Laser Sentinel is less sensitive to dust and therefore avoids shutting down the machinery unnecessarily.

This parameter should be set to the lowest value that still allows the machinery to work without detections due to dust.

In addition to the level of airborne particles in the Laser Sentinel environment, some special lighting conditions also affect the detection sensibility.

These conditions are:

- the presence of bright light within +/- 5 ° of the detection plane (see par. 5.2.1)
- high reflective backgrounds within 2.5 m of the Safety Zone boundary (see par. 5.2.2)



These special conditions require additional distance to be added to the Minimum Safety Distance calculations to avoid a person or object arriving at the danger zone before the machine shuts off. This distance also depends on the Dust Filter Level setting. See paragraphs 5.2.1, 5.2.2 and 5.4.1.

9.7 RESET

Reset is a function that allows restoring normal operation after a failure lockout condition, due to system error, without disconnecting the power supply.

The aim of the Reset is to return the system to a power-on phase, by resetting all the variables and starting a new integrity test session.

The minimum pulse width of the Reset function is 500 ms (constant value). If the width is less than the required value, then the Reset function will not be activated. To activate the Reset function, the push-button (switch), connected between 24 Vdc and the Reset input, must be pressed and held for at least 500 ms (non-critical failure status).



Note: If the error is not solved, the device will return to the lockout failure condition again.



Note: The Reset function may not restore the lockout status of the device; in this case a power cycle is necessary.

9.8 SAFETY REPORT GENERATION AND ACCEPTANCE

The Safety Report is a file that sum up all the parameters selected for a configuration and is generated by the GUI after creating a configuration.

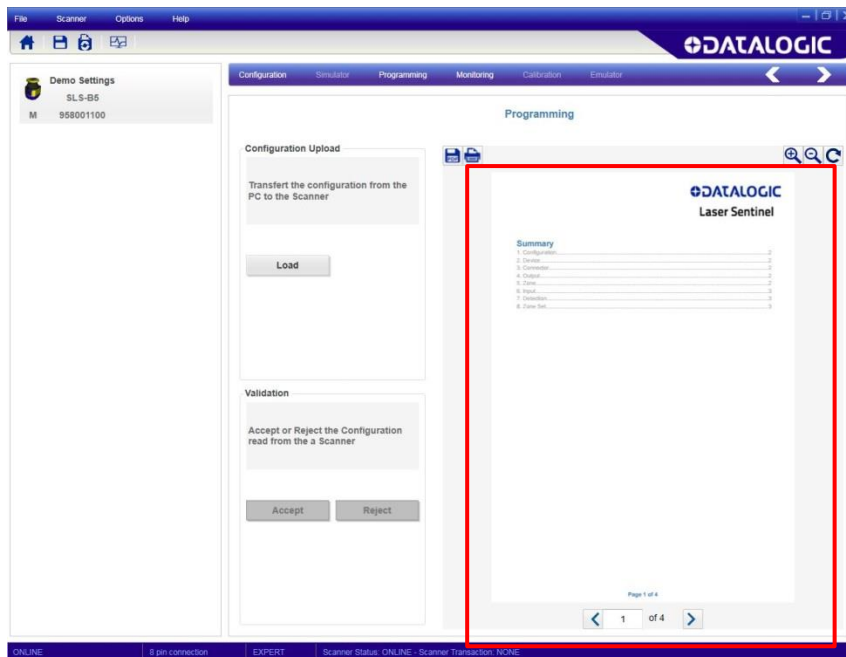
The Report file is displayed on the right side of the panel. It is possible to save it as PDF file and print it.

Follow the steps below to create the Report file:

1. Once the configuration has been created or loaded, enter the **Programming** function.
2. Upload the configuration in **Configuration Upload**. The **Report** file is generated by the GUI. Make sure to read and check all the selected parameters.
3. Then test its functioning by entering **Monitoring**.
4. After testing the configuration in **Monitoring** and checking the **Report** accept or reject the configuration in **Validation**.



By validating the configuration you take on responsibility for the created configuration accepting the hazard due to configuration errors.


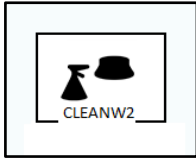



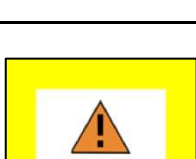
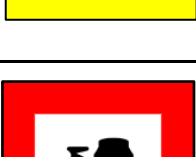



10 DIAGNOSTIC

10.1 MONITORING BY DISPLAY

DISPLAYED ICON	NAME	DESCRIPTION
	Device On	The device is correctly functioning (OSSDs GO Condition). No presence detected in the Safety and Warning Area. (Configuration accepted)
	Warning Zone Signal	The device is correctly functioning. The device has detected a presence in the Warning Area. (Configuration accepted)
	Safety Zone Signal	The device is correctly functioning (OSSDs STOP Condition). The device has detected a presence in the Safety Zone. (Configuration accepted)
	Info or Warning Event	The device is correctly functioning; an info or warning event has been detected by the device. (Configuration accepted)
	Device On	The device is correctly functioning (OSSDs GO Condition). No presence detected in the Safety and Warning Area. (Pending Configuration Acceptance)
	Warning Zone Signal	The device is correctly functioning. The device has detected a presence in the Warning Area. (Pending Configuration Acceptance)
	Safety Zone Signal	The device is correctly functioning (OSSDs STOP Condition). The device has detected a presence in the Safety Zone. (Pending Configuration Acceptance)
	Info or Warning Event	The device is correctly functioning; an info or warning event has been detected by the device. (Pending Configuration Acceptance)

10.2 DIAGNOSTIC NOTES, WARNINGS AND ERRORS

Displayed Icon	Displayed Fault Code	Device Status	OSSD Status	Description/Action
	DLDNF	NORMAL	OFF	Downloading new firmware.
	DLDNC	NORMAL	OFF	Downloading new configuration.
	CLEANW2	NORMAL	ON	It is suggested to clean the window to avoid entering lockout condition.
	ITLOCK 1	NORMAL	OFF	Interlock. Waiting for the restart of OSSD.
	INTF6	NORMAL	ON	Non safety related internal test failure. Reset the system by using the reset function or cycle power to device. If failure persists, contact Datalogic Technical Support.
	EXTTEMP	NORMAL	ON	The device is operating in an environment that exceeds the specified operating temperature range: restore correct ambient temperature conditions.
	BOOTF	NORMAL	OFF	Invalid boot. Re-boot the system until the normal condition is restored. If warning persists, contact Datalogic Technical Support.
	CLEANW1	NORMAL	OFF	Window needs to be cleaned; repeat this action until the normal condition is restored. Otherwise damaged part must be replaced, contact Datalogic Technical Support.
	INPUTCF1	LOCKOUT	OFF	Check input connection or sequence.

Displayed Icon	Displayed Fault Code	Device Status	OSSD Status	Description/Action
	INPUTCF2	LOCKOUT	OFF	Check input sequence.
	OSSDF1	LOCKOUT	OFF	Check OSSD connections or integrity of the external switching device. If failure persists, contact Datalogic Technical Support.
		LOCKOUT	OFF	
	OSSD1F3	LOCKOUT	OFF	A short circuit to GND has been detected: check OSSD connections or integrity of the external switching device. If failure persists, contact Datalogic Technical Support.
	INTF1	LOCKOUT	OFF	Internal Failure. Reset the system by using the reset function or cycle power to device. If failure persists, contact Datalogic Technical Support.
	INTF2	LOCKOUT	OFF	
	INTF3	LOCKOUT	OFF	
	INTF4	LOCKOUT	OFF	
	INTF5	LOCKOUT	OFF	
	INTF7	LOCKOUT	OFF	
	INTF8	LOCKOUT	OFF	
	INTF9	LOCKOUT	OFF	
	INTF10	LOCKOUT	OFF	
	INTF11	LOCKOUT	OFF	
	INTF12	LOCKOUT	OFF	
	INTF13	LOCKOUT	OFF	
	INTF14	LOCKOUT	OFF	
	INTF15	LOCKOUT	OFF	
	INTF16	LOCKOUT	OFF	
	INTF17	LOCKOUT	OFF	
	INTF18	LOCKOUT	OFF	
INTF20	LOCKOUT	OFF		

10.3 SAFETY



Hazard due to lack of effectiveness of the safety device.

Operators to be protected may not be recognized in case of nonobservance.

- Immediately put the machine out of operation if the behavior of the machine cannot be clearly identified.
- Immediately put the machine out of operation if you cannot clearly identify or locate the fault, or if you cannot safely remedy the fault.
- Secure the machine such that it cannot be switched on unintentionally.



Hazard due to unexpected starting of the machine.

- When any work is taking place, use the protective device to secure the machine or to ensure that the machine is not switched on unintentionally.



Hazard due to lack of effectiveness of the protective device.

Operators to be protected may not be recognized in case of nonobservance.

- Do not carry out any repairs to the device components.
- Do not make any changes to or tamper with the device components.
- With the exception of the procedures described in this document, the device components must not be opened.



Note: If you cannot remedy the fault with the help of the information provided in this chapter, please contact Datalogic Technical Service.

10.4 LEDES AND DISPLAY









The safety laser scanner is equipped with three lateral buttons, a graphical display and four status LEDs are located below the display.

Diagnostic and Status LEDs




The safety laser scanner has diagnostic LEDs for initial diagnostics.

The OFF state and ON state LEDs can be found below the safety laser scanner display.

When it is not possible to see the display, e.g. due to the mounting situation or because it is hidden from the operator's position check the GUI status (**Monitoring**).

-  LED 1: led assigned to safety zone (red led indicates that the safety zone is occupied; green zone indicates that no presence is detected in the safety zone).
-  LED 2: not available
-  LED 3: not available
-  LED 4: Warning zone occupied.
-  LED 5: Interlock.
-  Button 1: to browse quickly the Menu functions (up).
-  Button 2: to enter and confirm the selected Menu function.
-  Button 3: to browse quickly the Menu functions (down).

Display Menu

To enter the Display Menu push the squared button (). The menu is divided in three main areas: Information, Settings and Exit. By using the up () and down () arrows button, it is possible to browse the menu.

By entering Information, it is possible to access to Hardware and Configuration options.

By entering Settings, it is possible to access to Display Settings and Reset options.

To exit every menu option, push the squared button after selecting it.

Diagnostics using the display

The display supplies information about the status of the safety laser scanner, and for diagnostics and troubleshooting.



Note: The refresh rate of the display is slower than the switching rate of the OSSD output. Therefore it may occur that the display may not be synchronized with the OSSD output in the case of rapidly switching states.

10.5 PERIODICAL CHECKS

The following list includes recommended check and maintenance operations that should be periodically carried out by qualified personnel.

- The Laser Sentinel is installed with all the correctly fixed mounting components, without any change on its position: Safety distance is ensured and the detection plane has also not changed.
- The optical window is not dirty or damaged.
- All electrical connectors are correctly fastened and the cable wires are correctly connected to external device.
- If the laser Sentinel is operating in automatic start mode, make sure that the machine stops and does not restart when the test object is in the safety zone.

The frequency of checks depends on the particular application and on the operating conditions of the Laser Sentinel.

If any of these checks are not verified, it is not allowed to continue to work on the machine. In this case the installation of the laser Sentinel must be checked by qualified safety personnel and tested following the “CHECKS AFTER FIRST INSTALLATION” procedure as indicated.

11 DEVICE MAINTENANCE

11.1 GENERAL INFORMATION AND USEFUL DATA

The Laser Sentinel does not include any repairable components; avoid repairing or replacing device's parts not mentioned in the user's guide. If the operator does not follow this instruction, it may cause malfunction due to severe device damages.

11.2 WINDOW CLEANING

The Laser Sentinel optic window needs periodical cleaning, and the frequency depends on the type of environment in which the device operates.



Note: The device may present failure, if the optic window becomes scratched. In case of abrasive particle deposits, pay specific attention to rub gently against the window during cleaning in order to avoid damage. If the optic window becomes scratched, replacement of the optic head is recommended.

It is recommended to use the anti-static cleaner (SLS-CLEANER order no.95ASE2990) and the disposable cloths (SLS-CLOTH order no.95ASE3000) to remove dirt and dust deposits from the optic window.

Otherwise use a soft non-electrostatic cloth and a non-aggressive and non-abrasive cleaning agent.

12 TECHNICAL DATA

POWER AND ELECTRICAL PROTECTION	
Protection class	III (EN 61140 / IEC 61140)
Supply voltage	U _v 24 Vdc (19.2 V ... 30 Vdc) (SELV/PELV) ¹
Residual ripple	± 5% ²
Start-up current (1)	< 0.6 A ³
CURRENT CONSUMPTION (24VDC)	
No output load	0.3 A @ 24 Vdc
With maximum output load	1.1 A @ 24 Vdc
POWER CONSUMPTION	
Power consumption No output load	8 W @ 24 Vdc
Power consumption With maximum output load	27 W @ 24 Vdc
Power-up delay	40 s typ
OSSD (Safety output) (OSSD 1/1 / OSSD 1/2)	
OSSD logic and protection	PUSH-PULL, Overcurrent protection
Output voltage for ON status (HIGH)	U _v -2V @ 250 mA
Output voltage for OFF status (LOW)	0 V
Output current for ON status (HIGH)	250 mA
Leakage current	< 700 µA ⁴
Max Load inductance	2 H
Max Load capacity	2.2 µF

¹ To meet the requirements of the relevant product standards (e.g. EN 61496-1), the external voltage supply for the devices (SELV) must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60204-1 satisfy this requirement.

² The absolute voltage level must not drop below the specified minimum voltage.

³ The load currents for the input capacitors are not taken into account.

⁴ In the case of a fault (0 V cable open circuit) maximally the leakage current flows in the OSSD cable. The downstream controller must detect this status as LOW. A FPLC (fail-safe programmable logic controller) must be able to identify this status.

OSSD (Safety output) (OSSD 1/1, 1/2)	
Test pulse width	300 μ s
Test pulse interval	167 ms
OFF status duration	900 ms
Latency time between output pair	450 ms

OUTPUT (warning and generic)	
Output logic and protection	PUSH-PULL, Overcurrent protection
Output voltage for ON status (HIGH)	Uv-2V @ 250 mA
Output voltage for OFF status (LOW)	0 V
Output current for ON status (HIGH)	250 mA
Leakage current	< 700 μ A ⁵
Load inductance	2 H
Load capacity	2.2 μ F
STATIC INPUT GENERIC	
Input voltage high	> 12 V
Input voltage low	< 5 V
Input current high	2 mA @ 24 Vdc
Input impedance	12 k Ω
MECHANICAL DATA	
Dimensions (W x H x D)	112.5 x 152 x 102
Weight (including system plug)	1.5 kg
Housing material	Aluminum Alloy
Housing color	YellowRAL1003
Optics cover material	PC
Optics cover surface	Acrylic

⁵ In the case of a fault (0 V cable open circuit) maximally the leakage current flows in the OSSD cable. The downstream controller must detect this status as LOW. A FPLC (fail-safe programmable logic controller) must be able to identify this status.

ENVIRONMENTAL DATA	
Humidity	Max 95% non-condensing According to IEC 61496-1 5.4.2 IEC 61496-3 5.4.2; 4.3.1; 5.4.4.3
Enclosure rating (IP) ⁶	IP 65
Operating temperature ⁷	0 : +50 °C
Storage temperature	-20 : +70 °C
Vibration resistance	According to IEC 61496-1 4.3.3.1 ; 5.4.4.1 IEC 60068-2-6 ; Frequency: from 10 Hz to 55 Hz; Scan Speed 1 octave/min ; Range: 0,35 mm ± 0,05 mm
Shock resistance	According to IEC 61496-1 4.3.3.2 ; 5.4.4.2 IEC 60068-2-29; Acceleration: 10 g; Pulse Duration: 16 ms; Number of Shocks: 1000 ± 10 (for each of the three mutually perpendicular axes) IEC 61496-3 5.4.4.1-3 IEC 60068-2-75; Hammer test
OPTICAL DATA	
Wavelength	905 nm
Pulse duration	3 nsec
Average output power	8 mw
Laser class	CLASS 1 (EN 60825-1)
Divergence of collimated beam	0.12 °

⁶ The enclosure rating is valid if the memory group is correctly mounted and all of the safety laser scanner's M12 connectors are sealed using a connection cable or using a protective cap.

⁷ It is recommended to allow for a 15-minute warmup from a cold start.

LIGHT BEAM DIAMETER	
At front screen	8 mm
At middle field distance	10 mm
At max distance	20 mm
Detectable remission	1,8% - 1000%
Maximum homogeneous contamination of the optics cover without preventing the detection capability	- 30% of nominal optic power
FEATURES	
Safety protective field range	5.5 m
Warning field range	40 m with remission of target = 90% (white)
scanning angle	275°
detection capability	70 mm
scan cycle time	30 msec
response time	Programmable 62 ÷ 482 msec
Tolerance zone max	150 mm
angular resolution	0.1°
zones sets	3 Max
Supplement for retro-reflectors on scan plane in front of a safety zone.	Refer to paragraph 5.2.2
Supplement for high ambient light within $\pm 5^\circ$ of the scan plane.	Refer to paragraph 5.2.1
Deviation from ideal flatness of scan field at max safety range m	< 5 cm
Distance of mirror rotational axis (zero point of x and y axis) to rear side of device	52.5 mm
Distance between center point of scan plane and top edge of the housing	37.7 mm

FEATURES	
Function	Manual restart; reset from failure
SAFETY DATA	
Type	Type 3 (EN 61496-1)
Safety integrity level	SIL 2 (IEC 61508)
Category	Category 3 (EN ISO 13849-1)
SIL claim limit	SILCL 2 (EN 62061)
Performance level	PL d (EN ISO 13849-1)
PFHd (mean probability of a dangerous failure per hour)	6.38×10^{-8}
SFF	97.58 %
MTTFd	61 Years
TM (mission time)	20 years (EN ISO 13849-1)
HFT (Hardware Fault Tolerance)	1
State of safety	OSSD in OFF State (open circuit → I OSSD = 0)
Response time to malfunction	<= Response Time
CONNECTORS	
I/O and power	M12 male type A connector (8 poles)
Ethernet to GUI or Data transmission	M12 male type D connector (4 poles)

13 OVERALL DIMENSIONS

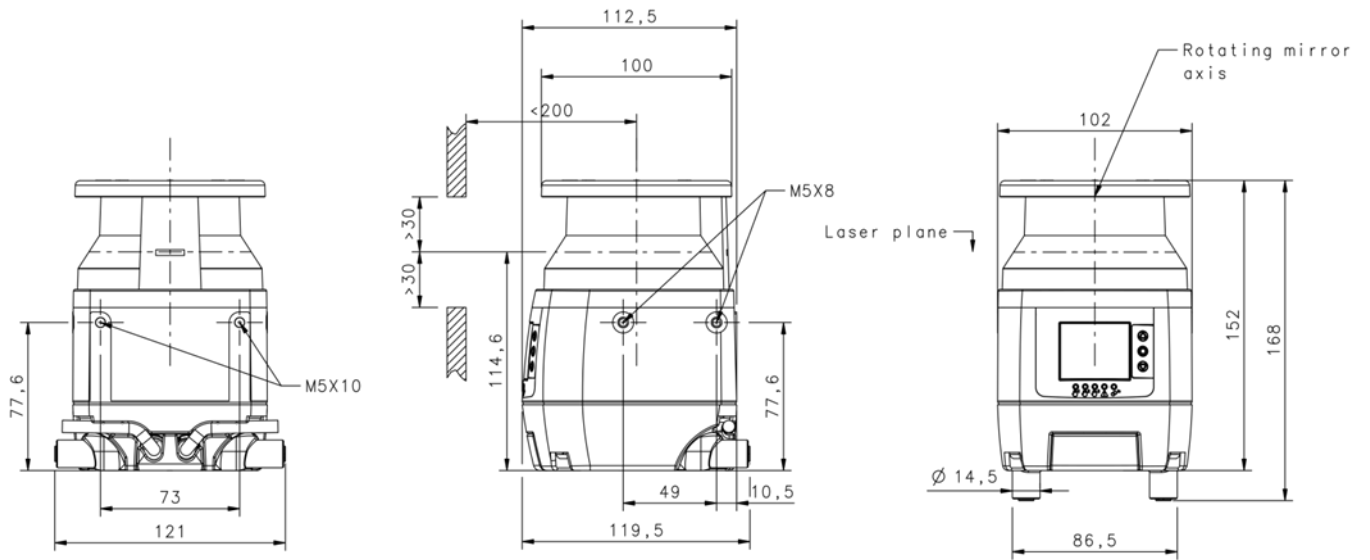


Fig 39 - Overall dimensions (mm)

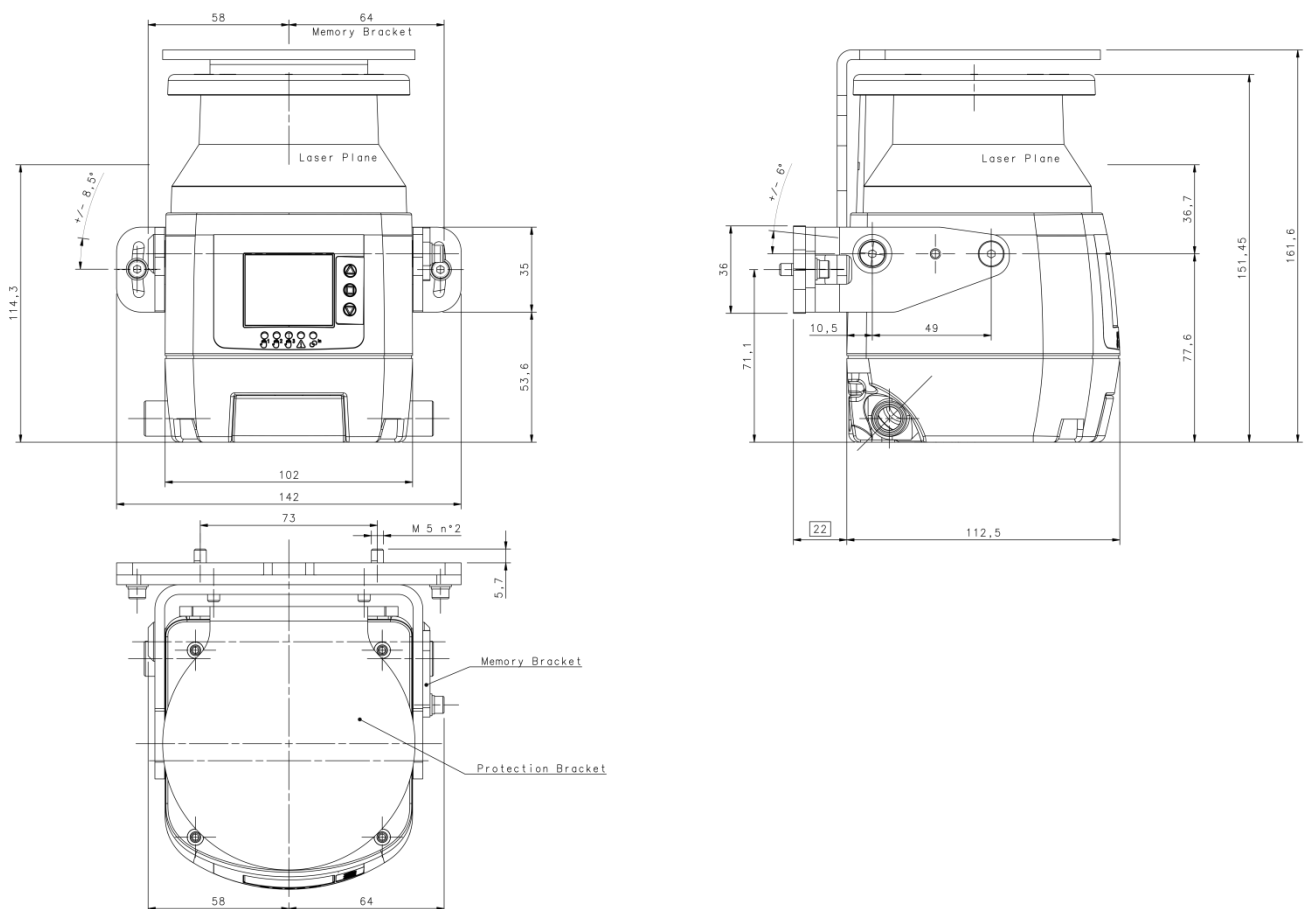


Fig 40 - Overall dimensions (with brackets)

14 SPARE PARTS

14.1 VARIOUS

MODEL	DESCRIPTION	CODE
SLS-CLEANER	Cleaning agent	95ASE2990
SLS-CLOTH	Cleaning cloth	95ASE3000

15 ACCESSORIES

15.1 MOUNTING BRACKETS

MODEL	DESCRIPTION	CODE
SLS-BRACKET-A	Complete bracket system	95ASE2920
SLS-BRACKET-B	Pitch regulation bracket system	95ASE2930
SLS-BRACKET-C	Head protective bracket	95ASE2940

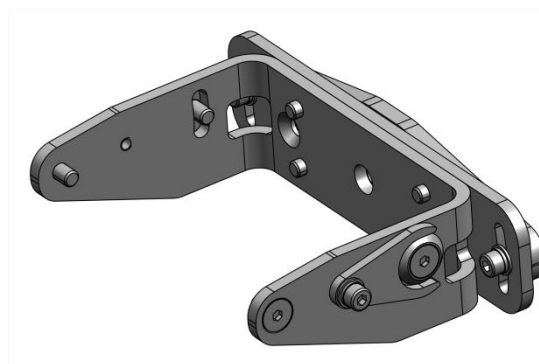


Fig 41 - Kit A

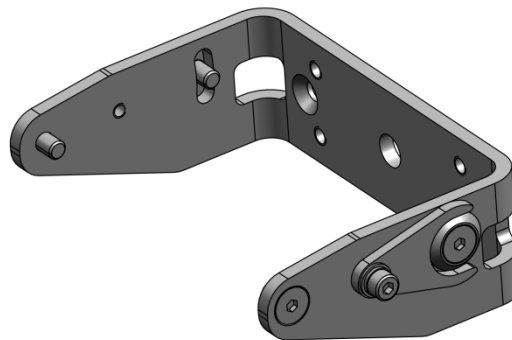


Fig 42 - Kit B

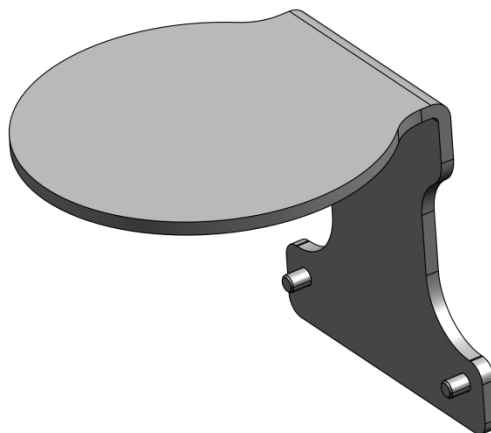


Fig 43 - Kit C

15.2 ETHERNET CABLES

MODEL	DESCRIPTION	CODE
CAB-ETH-M01 M12-IP67 ETHERNET CAB. (1M)	Ethernet cable to Host 1 m	93A051346
CAB-ETH-M03 M12-IP67 ETHERNET CAB. (3M)	Ethernet cable to Host 3 m	93A051347
CAB-ETH-M05 M12-IP67 ETHERNET CAB. (5M)	Ethernet cable to Host 5 m	93A051348
CAB-ETH-M10 M12-IP67 ETHERNET CAB. (10M)	Ethernet cable to Host 10 m	93A051391

15.3 ELECTRICAL CABLES

MODEL	DESCRIPTION	CODE
CS-A1-06-U-03	CS Cable axial M12F 8-pin to free wires 3m no shield	95ASE1220
CS-A1-06-U-05	CS Cable axial M12F 8-pin to free wires 5m no shield	95ASE1230
CS-A1-06-U-10	CS Cable axial M12F 8-pin to free wires 10m no shield	95ASE1240
CS-A1-06-U-15	CS Cable axial M12F 8-pin to free wires 15m no shield	95ASE1250
CS-A1-06-U-25	CS Cable axial M12F 8-pin to free wires 25m no shield	95ASE1260



Note: User supplied cables must adhere to the safety regulations for color-coding and have a maximum length of 50 m.

16 GLOSSARY

NAME	DESCRIPTION
Active opto-electronic protective device responsive to diffuse reflection (AOPDDR)	A device, whose sensing function is performed by optoelectronic emitting and receiving elements. These detect the diffuse reflection of optical radiations generated within the device by an object located in a detection zone (specified in two dimensions).
Application Type	<p>The configuration's classification according to the visibility of the parameters. It can be:</p> <ul style="list-style-type: none"> • Expert - it contains the whole set of parameters, regardless the device's use. <p>Device's configuration contains the whole set of parameters. If the User is not able to set them, the interface will provide default values.</p>
Demo Configuration	A configuration's classification according to the visibility of the parameters. Demo Configuration is made only for demonstration purposes and the User has to insert only a Safety Area and a Warning Area.
Catalogue	A list of all the available models of safety laser scanner and the start point for an Offline configuration. User will use a configuration wizard in the Offline mode.
Coding	The default combination for the input code of a zone set. The input code must respect the hamming distance.
Configuration	<p>The whole set of parameters that determine the device's behavior. It can be classified according to the visibility of the configuration parameter:</p> <ul style="list-style-type: none"> • Horizontal <p>Device's configuration contains the whole set of parameters. If the User is not able to set them, the interface will provide default values.</p> <p>By showing devices positioning, the classification based on topology helps the User to draw a Safety or a Warning Zone.</p>
Configuration Validator	<p>A feature used in DLSentinel to verify complete configuration correctness.</p> <p>Specific Warnings will display incorrect configuration parameters.</p>

NAME	DESCRIPTION
Detection Capability	The minimum size of a detectable object by a device. This parameter can be set for a Safety Zone and a Warning Zone of each Area.
Device	<p>The Safety Laser Scanner and the GUI can use it to:</p> <ul style="list-style-type: none"> • Create a configuration; • Read a configuration; • Write a configuration; • Upload a configuration; • Download a configuration; • Open Report; • Read Log; • Monitoring (receive data);
Download	This is an operation that transfers the configuration from a Device to the GUI.
Dust Filtering	<p>The Dust Filter Level must be set according to different conditions specific to the application. In general, it is the sensibility to various levels of airborne particles that impact the response of the Laser Sentinel detection.</p> <p>A High Dust Filter Level is used in dirty environments to filter (ignore) detection of airborne particles from being confused with objects to detect. The Laser Sentinel is less sensitive to dust and therefore avoids shutting down the machinery unnecessarily.</p> <p>A Low Dust Filter Level is used in cleaner environments where airborne particles have little effect on object detection.</p> <p>Dust Filter Level should be set to the lowest value that still allows the machinery to work without detections due to dust.</p>
Expert Configuration	A configuration's classification according to the visibility of the parameters. This one allows the User to change the whole set of parameters (regardless the device's use).
Failure	Termination of the ability of an item to perform a required function.
Fault	State of an item characterized by its inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources.
Hazardous zone/Dangerous Zone	Any space within and/or around machinery in which a person can be exposed to a hazard.

NAME	DESCRIPTION
Height	Device's height: the distance between the floor and nominal scan plane at the scanner output window.
Input Configuration	It is the name of the configuration panel that contains the parameters used for Start/Restart.
Lock-out condition	Condition, initiated by a fault, preventing normal operation of the protective equipment .When all output signal switching devices (OSSDs) and, where applicable, all final switching devices (FSDs) are signaled to go to the OFF-state.
Minimum distance (S)	Calculated distance between the safeguard and the hazard zone necessary to prevent a person or part of a person reaching the hazard zone before the termination of the hazardous machine function.
Monitoring	<p>The GUI gains data form a device and shows the following information:</p> <ul style="list-style-type: none"> • OSSDs state (Open/Close); • Inputs state (ON/OFF); • Auxiliary Outputs State (ON/OFF); <p>The User can save a static image of monitoring case and use it in Simulation.</p>
Network	It contains all the devices connected to the network and it is the start point for online configuration. The User will employ a configuration wizard for an offline configuration instead.
Number of Scans	When an object is detected in the Safety Zone, the device scans the area a certain number of times before going to OFF status. This number depends on the parameter set in the configuration.
OFF-state	State in which the output circuit is interrupted and does not permit the flow of current. When Laser Sentinel detects an object in the safety zone it switches to this state which causes the dangerous machinery to stop working.
ON-state	State in which the output circuit is complete and permits the flow of current. This is the normal operating state in which the Laser Sentinel is controlling the safety area and the dangerous machinery is operating.
Output signal switching device (OSSD)	Component of the electro-sensitive protective equipment (ESPE) connected to the machine control system. If an object is detected in the Safety Zone, the safety couple of output turns off (OFF-state).

NAME	DESCRIPTION
Programming	A configuration step that allows downloading a configuration. The User can accept or reject the safety configuration report and eventually save or print it.
Recovery Time	The Recovery Time is the time between the object removal from the protected area and the OSSDs achieving the NORMAL OPERATION.
Report	Configuration is the whole set of parameters that defines the behavior of the device. A Report is the document that shows configuration's parameters to the user.
Response Time	Maximum time between the occurrence of the event leading to the actuation of the sensing device and the output signal switching device (OSSD) achieving the OFF-state.
Restart Interlock	Means of preventing automatic restart of the machine after actuation of the sensing device during a hazardous part of the machine operating cycle (after a change in mode of operation of the machine, and/or after a change in the means of start control of the machine).
Safety System Log	It shows the Log file.
Safety Zone	Is the area in which the OSSDs turn OFF, if an object is detected
Teach-in	<p>A feature that scans the configuration in order to process and use the results for:</p> <ul style="list-style-type: none"> • Dust settings - to choose the best Dust Immunity level according to device's environment. • Zone Configurator - to draw automatically Warning or Safety Zone. <p>Note: This feature is available only in the Online mode.</p>
Upload	An operation to transfer the configuration from the GUI to the Device.
Warning Zone	This is the area around the Safety Zone; the device can signal a warning lamp or siren if it detects an object in this area.
Zone	<p>It is an area assigned to an OSSDs couple, for example:</p> <ul style="list-style-type: none"> • Zone 1 -> OSSDs 1/1 1/2; <p>Each zone may have a different behavior. The User can set: Start/Restart, Detection Capability, Input code, Safety and Warning Zone.</p>

NAME	DESCRIPTION
Zone Set	This is an area (zone) that is controlled by the Laser Sentinel. More than one zone can be defined and therefore switched (set) by a combination of inputs.



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