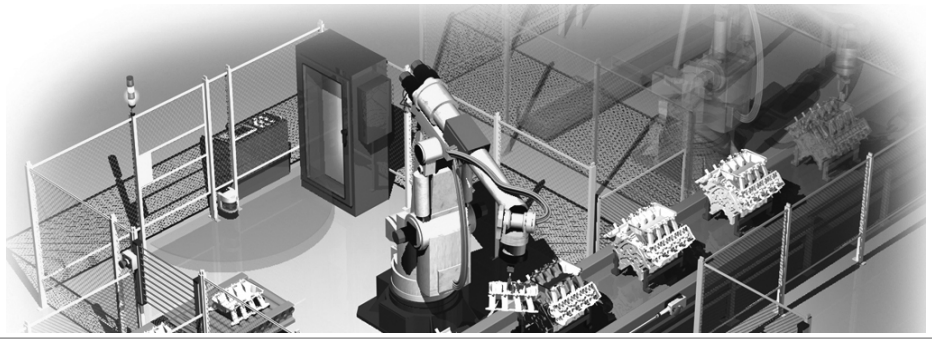
SafeZone Singlezone & Multizone Safety Laser Scanner User Manual

Allen-Bradley
Guardmaster®









Allen-Bradley • Rockwell Software

Rockwell Automation

Allen Bradley 442L-SFZNMZ-MEM | gesrepair.com

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in the guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control (available from your local Rockwell Automation sales office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.
SHOCK HAZARD 	Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

It is recommended that you save this user manual for future use.

Related Safety Information

You are responsible for the safety of the entire installed control systems and for meeting all applicable laws, codes, and safety requirements.

ATTENTION 	As the installer of this control system, you must be knowledgeable of other applicable standards pertaining to safety recommendations related to: ➡ Machine Construction ➡ General Electrical ➡ Machine Guarding ➡ Print of operation guards, safety light curtains, mechanical guards, and two-hand control In addition to local laws and codes, you are responsible for the safety recommendations detailed in all applicable codes and standards, including: ➡ OSHA Regulations ➡ ANSI Standards ➡ NFPA ➡ CSA ➡ IEC ➡ ISO
IMPORTANT	Rockwell Automation reservest the right to make revisions to these installation instructions and disclaims liability for all incidental and consequential damages related to the furnishing, performance and use of this material.

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Section 1 — About this Document

Please read this section carefully before working with this documentation and the SafeZone safety laser scanner.

1.1 Function of this document

These operating instructions are designed to address the technical personnel of the machine manufacturer or the machine operator in regards to correct mounting, electrical installation, commissioning, operation and maintenance of the SafeZone safety laser scanners.

These operating instructions do not provide instructions for operating the machine, the system or the vehicle on which the safety laser scanner is, or will be, integrated. Information on this is to be found in the appropriate operating instructions of the machine, the system or the vehicle.

1.2 Target group

These operating instructions are addressed to planning engineers, developers and the operators of machines and systems which are to be protected by one or several SafeZone safety laser scanners. They also address people who integrate the SafeZone safety laser scanners into a machine, a system or a vehicle, initialize its use, or who are in charge of servicing and maintaining the device.

1.3 Scope

IMPORTANT	These operating instructions are only applicable to the SafeZone safety laser scanner.

For the configuration and diagnostics of these devices you require SCD software version 2.23 or higher. To check the version of the software, on the ? menu select Module info...

1.4 Depth of information

These operating instructions contain information on the SafeZone safety laser scanner:

- installation and mounting
- electrical installation
- commissioning and configuration
- care and maintenance
- fault, error diagnosis and troubleshooting
- part numbers
- accessories
- conformity and approval

Planning and using protective devices such as the SafeZone safety laser scanner also requires specific technical skills that are not detailed in this documentation.

When operating the SafeZone safety laser scanner, the national, local and statutory rules and regulations must be observed.

Recommendation Users should refer to the Allen-Bradley Guardmaster home page on the Internet at: www.ab.com/safety.

Here users will find information on:

- Application examples
- A list of frequently asked questions regarding the SafeZone safety laser scanners
- These operating instructions in different languages for viewing and printing

1.5 Abbreviations

AGV	Automated guided vehicle
ANSI	American National Standards Institute
AWG	American Wire Gauge = standardization and classification of wires and cables by type, diameter etc.
SCD	Safety Configuration and Diagnostic Software
EDM	External device monitoring
ESD	Electrostatic discharge
ESPE	Electro-sensitive protective equipment
FPLC	Fail-safe programmable logic controller
OSSD	Output signal switching device = signal output of the protective device that is used to stop the dangerous movement
RIA	Robotic Industries Association

1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.

Display indicators show the status of the 7-segment display on the SafeZone safety laser scanner:

- Constant indication of characters, e.g. U
- Flashing indication of characters, e.g. 8
- Alternating indication of characters, e.g. L and 2

LED symbols describe the status an LED:

- The LED is constantly illuminated.
- The LED is flashing.
- The LED is off.

These symbols identify which LED is described.

- The "Error/Contamination" LED is flashing.
- The "OSSDs deactivated" LED is constantly illuminated

➡Take action… Instructions for taking action are shown by an arrow. Read carefully and follow the instructions for action.

ATTENTION	Indicates an actual or potential risk or health hazard. Observation and implementation of the instruction will protect you from accidents. Read each one carefully and follow the instructions that are associated with each topic.

Software notes show the location in the SCD software where you can make the appropriate settings and adjustments. In the SCD software on the View menu, Dialog Box, select the item File Cards to go straight to the stated dialog fields. Alternatively, the software wizard will guide you through the appropriate setting.

The term "dangerous state"

The *dangerous state* (standard term) of the machine is always shown in the drawings and diagrams of this document as a movement of a machine part. In practical operation, there may be a number of different dangerous states:

- Machine movements
- Vehicle movements
- Electrical conductors
- Visible or invisible radiation
- A combination of several risks and hazards

Section 2 — On Safety

This section deals with your own safety and the safety of the equipment operators.

➡ Please read this section carefully before working with the SafeZone safety laser scanner or with the machine protected by the SafeZone multizone safety laser scanner.

2.1 Specialist personnel

The SafeZone safety laser scanner must be installed, connected, commissioned and serviced only by specialist personnel. Specialist personnel are defined as persons who

- Due to their specialist training and experience have adequate knowledge of the power-driven equipment to be checked

and

- Who have been instructed by the responsible machine operator in the operation of the machine and the current valid safety guidelines

and

Are sufficiently familiar with the applicable official health and safety regulations, directives and generally recognized engineering practice (e.g. DIN standards, VDE stipulations, engineering regulations from other EC member states) that they can assess the work safety aspects of the power-driven equipment

and

- Who have access to the operating instructions and who have read them.

As a rule these are specialist personnel from the ESPE manufacturer or also those persons who have been appropriately trained at the ESPE manufacturer, are primarily involved in checking ESPE and are allocated the task by the organization operating the ESPE.

2.2 Device applications

The SafeZone safety laser scanner is used to protect persons and equipment. It is intended to be used to monitor hazardous areas indoors.

The SafeZone safety laser scanner is not intended for outdoor use.

The SafeZone safety laser scanner cannot provide protection from flying parts or from emitted radiation.

The SafeZone safety laser scanner complies with the requirements in the standard on the radiated emissions as defined for class A (industrial application). It may cause radio interference in residential areas.

The safety level of the SafeZone safety laser scanner corresponds to Category 3 in compliance with EN 954-1 and ISO EN 13849-1, SIL CL 2.

The SafeZone safety laser scanner is suitable for:

- Hazardous area protection
- Hazardous point protection
- Access protection
- Vehicle protection

IMPORTANT	Depending on the application, other protective devices and measures may be required in addition to the safety laser scanner.

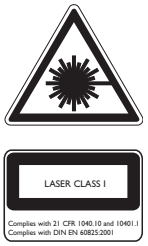
2.3 Correct use

The SafeZone safety laser scanner must only be used as defined in Section 2.2 “Device Applications” above. It must only be used by qualified personnel on the machine where it has been installed and initialized by specialist personnel in accordance with these operating instructions. It is only permitted to be used on machines on which the dangerous state can be stopped immediately by the SafeZone safety laser scanner and/or it is possible to prevent the machine being placed in operation.

Note: If the device is used for any other purposes or modified in any way—also during mounting and installation—any warranty claim against Rockwell Automation shall become void.

2.4 General safety notes and protective measures

NOTICE	The SafeZone safety laser scanner is of laser safety class I (eye safe). Take appropriate measures for working with laser scanners.



ATTENTION	Read safety notes. Observe the following statements in order to ensure the correct use of the SafeZone multizone safety laser scanner.



- This device meets the norms of OSHA 21 CFR 1040.10 as well as IEC 60825:2001. “Caution: use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.”
- During the mounting, installation and usage of the SafeZone safety laser scanner, observe the standards and directives applicable in your country. There is an overview of important regulations in Section 2.6 “Applicable directives and standards” on page 6.
- National/international rules and regulations apply to the installation, commissioning, use and periodic technical inspections of the SafeZone safety laser scanner, in particular - Machine Directive 98/37/EC
  - Work Equipment Directive 89/655/EEC
  - The work safety regulations/safety rules
  - Other relevant health and safety regulations
- Manufacturers and users of the machine on which the SafeZone safety laser scanner is used are responsible for obtaining and observing all applicable safety regulations and rules.
- The test notes (see Section 8 “Commissioning” on page 36) in these operating instructions (e.g. on use, mounting, installation or integration into the machine controller) must be observed. Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must check the effectiveness of the protective device. The person who makes the change is also responsible for the correct protective function of the device. When making configuration changes, always use the password hierarchy provided by Rockwell Automation to ensure that only authorized persons make changes to the configuration.
- Tests must be carried out by specialist personnel or specially qualified and authorized personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- Operating instructions must be made available to the operator of the machine where the SafeZone safety laser scanner is used. The machine operator is to be instructed in the use of the device by specialist personnel and must be instructed to read the operating instructions.

- Suitable power supplies are available from Rockwell Automation. The external voltage supply of this device must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60204.
- Included in this document is a checklist for checking by the manufacturer and OEM (see Section 13.1 "Manufacturer's checklist" on page 54). This checklist should be used when checking the equipment that is protected with the SafeZone multizone safety laser scanner.

2.5 Environmental protection

The SafeZone safety laser scanner is constructed in such a way as to minimize adverse affects to the environment. It uses only a minimum of power and natural resources.

Disposal

➡ Always dispose of unserviceable or irreparable devices in compliance with local/national rules and regulations on waste disposal.

2.6 Applicable directives and standards

Important directives and standards, valid for the use of opto-electronic safety systems in Europe, are listed below. Further regulations may be of importance to you, depending on the type of use. Users can obtain further information of machine-specific standards from national institutions (e.g. DIN, BSI, ANSI, OSHA, etc.), the authorities or applicable trade association.

Application and installation of safety systems

Machine Directive 98/37/EC, e.g.:

- Safety of machinery—Basic concepts, general principles for design (EN 292)
- Industrial automation systems—Safety of integrated manufacturing systems—Basic requirements (ISO 11161)
- Safety of machinery—Electrical equipment of machines—Part 1: General requirements (IEC/EN 60204)
- Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs (EN 294, IEC 13852)
- Safety requirements for robots (EN 775, ISO 10218)
- Safety of industrial trucks. Driverless trucks and their systems (DIN/EN 1525)
- Safety of machinery—The positioning of protective equipment in respect of approach speeds of parts of the human body (EN 999, ISO 13855)
- Safety of machinery—Principles for risk assessment (EN 1050, ISO 14121)
- Safety of machinery—Safety-related parts of control systems~Part 1: General principles for design (EN 954 part 1 and part 2, ISO 13849 part 1 and part 2)
- Safety of machines—Electro-sensitive protective equipment—Part 1: General requirements (IEC/EN 61496-1) as well as part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR) (IEC/EN 61496-3)
- Performance Criteria for Safeguarding (ANSI B11.19)
- Machine tools for manufacturing systems/cells (ANSI B11.20)
- Safety requirements for Industrial Robots and Robot Systems (ANSI/RIA R15.06)
- Safety Standard for guided industrial vehicles and automated functions of named industrial vehicles (ANSI B56.5)

IMPORTANT	The SafeZone safety laser scanner meets the requirement of "Control Reliability."

Section 3 — Product Description

ATTENTION 	Please read this section before mounting, installing and commissioning the device. Because this device is used to monitor a hazardous area, it is important to read this entire section before mounting and installing the device.

This section provides information on the special features and properties of the SafeZone multizone safety laser scanner. It describes the structure and the operating principle of the device, in particular the different operating modes.

3.1 Special features

- Scanning ranges of four and five meters
- 190° scanning angle
- Singlezone has a single field set and multizone has up to four field sets
- The contour of the protective safety field can be monitored (contour change can e.g. be the opening of a door to the outside)
- Integrated external device monitoring (EDM)
- Integrated restart interlock/restart interlock delay for which parameters can be set
- Status display with LEDs and seven-segment display
- Simple replacement of the I/O module (in this way the functionality can be easily enhanced)
- Selection of either 60 ms minimum or 120 ms maximum response time
- Configuration using PC or notebook with SCD software
- Configuration memory in the system plug. Down times are shortened by the easy replacement of the SafeZone safety laser scanner
- Increased immunity to external light and dust

3.2 Function

The SafeZone safety laser scanner only operates correctly as a protective device if the following conditions are met:

- The control of the machine, system or vehicle must be electrical.

- It must be possible to transfer the dangerous state of the machine, the equipment or the vehicle to a safe state at any time using the OSSDs on the SafeZone safety laser scanner after integration in the controller.
- The SafeZone safety laser scanner must be mounted and configured such that it detects objects as they enter the hazardous area (see Section 4 “Installation and mounting” on page 18).

3.2.1 Principles of operation

The SafeZone safety laser scanner is an optical sensor that scans its surroundings in two dimensions using infrared laser beams. It is used to monitor a hazardous area on a machine or a vehicle.

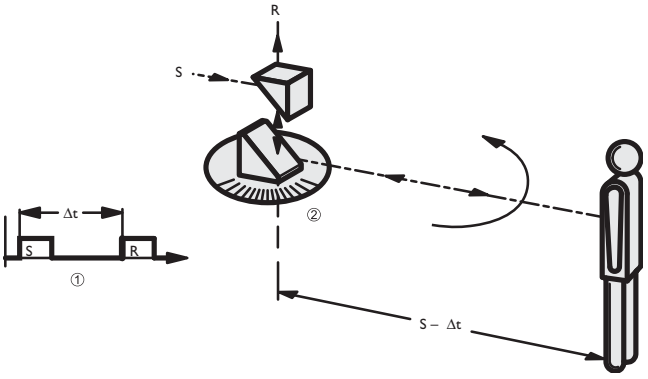


Figure 1: Principle of operation, time of flight measurement by the SafeZone safety laser scanner

The SafeZone safety laser scanner works on the principle of time of flight measurement ①. It sends out very short pulses of infrared light (S). At the same time an “electronic stopwatch” is started. When the light is reflected off of an object, it is received by the safety laser scanner (E). From the time between sending and receiving (Δt) the SafeZone multizone safety laser scanner calculates the distance to the object.

In the SafeZone safety laser scanner there is also a mirror rotating at constant speed ② that deflects the light pulses such that they cover an arc of 190°. By determining the angle of rotation of the mirror, the SafeZone safety laser scanner determines the direction of the object.

From the measured distance and the direction of the object, the safety laser scanner determines the exact position of the object.

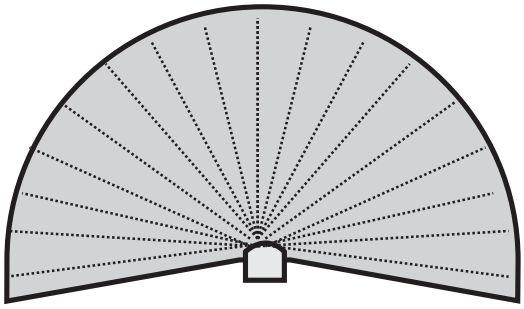


Figure 2: Principle of operation of the SafeZone safety laser scanner—light pulses

The SafeZone safety laser scanner uses light pulses precisely radiated in specific directions. Thus the laser scanner does not continuously cover the area to be monitored. In this way resolutions of between 30 mm and 150 mm are achieved.

Due to its active scanning principle, the SafeZone safety laser scanner does not require receivers or reflectors. This has the following advantages:

- Ease of installation.
- You can easily adapt the monitored area to the hazardous area on a machine.
- In comparison with contact sensors, there is less wear when electro-sensitive scanning is used.

3.2.2 Field set comprised of protective safety field and warning field

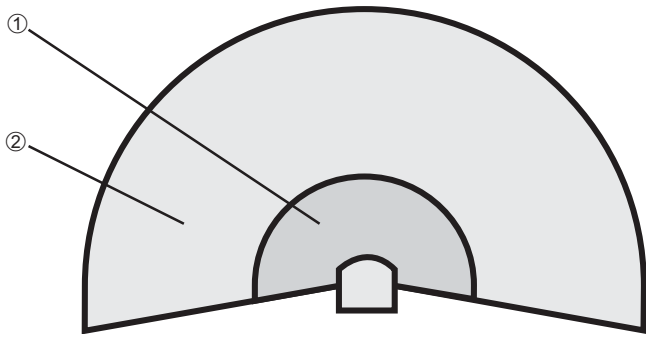


Figure 3: Protective safety field and warning field

The protective safety field ① secures the hazardous area on a machine or vehicle. As soon as the safety laser scanner detects an object in the protective safety field, it switches the OSSDs to the off status and thus initiates the shutdown of the machine or stop of the vehicle.

You can define the warning field ② such that the safety laser scanner detects an object before the actual hazardous area and e.g. triggers a warning signal.

The protective safety field and warning field form a pair, the so-called field set. With the aid of the SCD you can configure these field sets and transfer them to the SafeZone safety laser scanner. If the area to be monitored changes, then you can re-configure the SafeZone safety laser scanner in software without additional mounting effort.

The SafeZone Singlezone has a single configurable field set. The SafeZone Multizone has up to four configurable field sets. The SafeZone Multizone allows switching between field sets if the monitoring situation changes (see Section 3.2.3 “Monitoring cases” below).

3.2.3 Monitoring cases

Four monitoring cases can be defined in the SafeZone multizone and selected during operation using static control input. Each monitoring case includes:

- The input conditions, the so-called control signals, that control the activation of the monitoring case.
- A field set, comprising protective safety field and warning field.
- If necessary, a simultaneous field set without separate outputs.

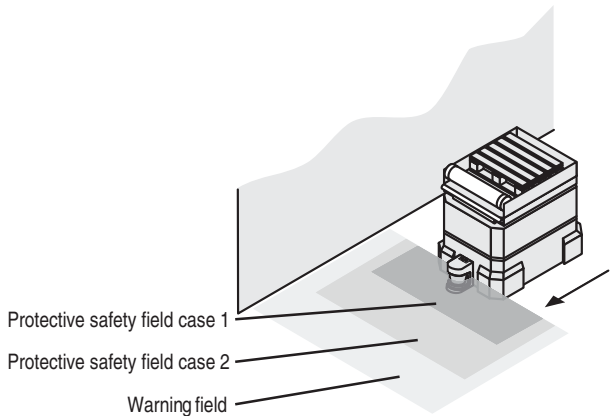


Figure 4: SafeZone multizone safety laser scanner with two defined monitoring cases on an AGV

3.2.4 Device components

The SafeZone safety laser scanner comprises three components:

- The sensor head with the opto-electronic acquisition system
- The I/O module, this defines the functionality of the SafeZone safety laser scanner
- The system plug with the configuration memory (the system plug contains all electrical connections)

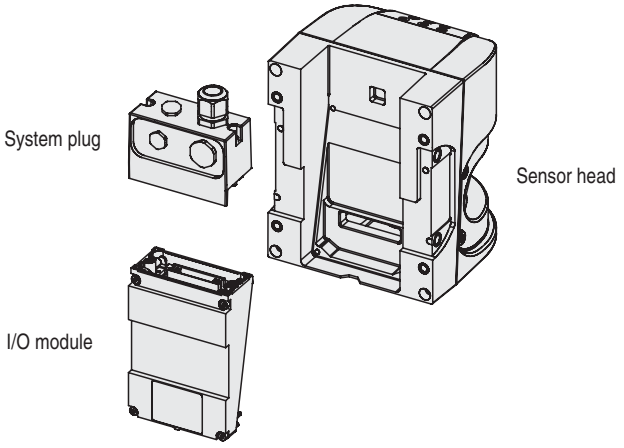


Figure 5: Sensor head, I/O module and system plug

3.3 Applications

3.3.1 Stationary applications

Hazardous area protection

On dangerous stationary machines, the SafeZone safety laser scanner switches the output signal switching devices (OSSDs) to the off status if the protective safety field is interrupted. The SafeZone safety laser scanner initiates the shutdown of the machine or the shutdown of the dangerous state.

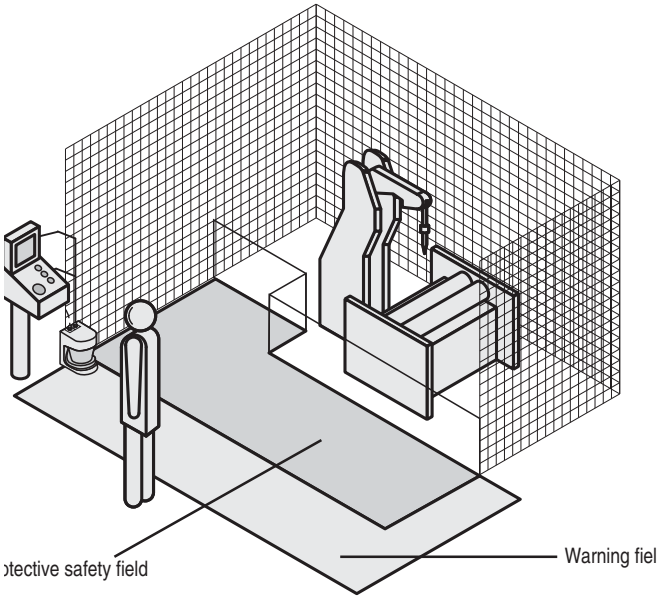


Figure 6: Hazardous area protection with one monitored area

Hazardous area protection with multiple monitored areas (position-related protective safety field switching)

Using the SafeZone safety laser scanner, you can define up to four monitoring cases to match the protective safety field and warning field to the situation on the machine and to monitor changing hazardous areas~e.g. during different machine production phases~depending on the situation.

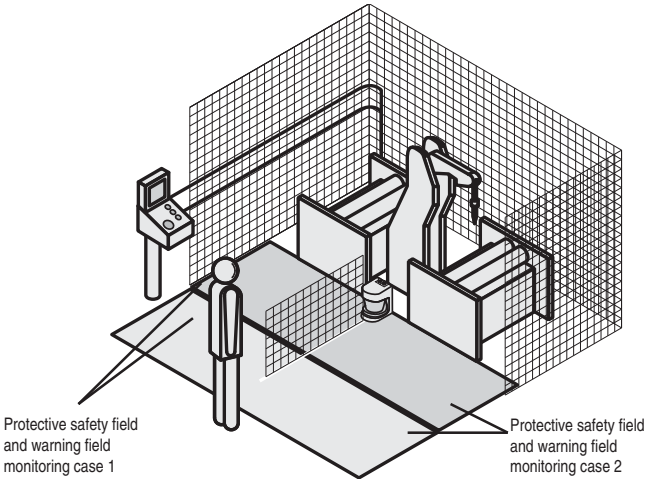


Figure 7: Hazardous area protection with multiple monitored areas

Interior protection

On large machines the SafeZone safety laser scanner can be used to protect the interior. The machine can only be restarted if the SafeZone safety laser scanner does not detect any object in the protective safety field. This is particularly important for interiors that can only be seen with difficulty from the outside, or cannot be seen at all.

In this application, the SafeZone safety laser scanner ① only has a secondary protective function. The primary safety function that stops the dangerous movement is provided in the example by a light curtain ②, while the SafeZone safety laser scanner monitors the restarting of the machine.

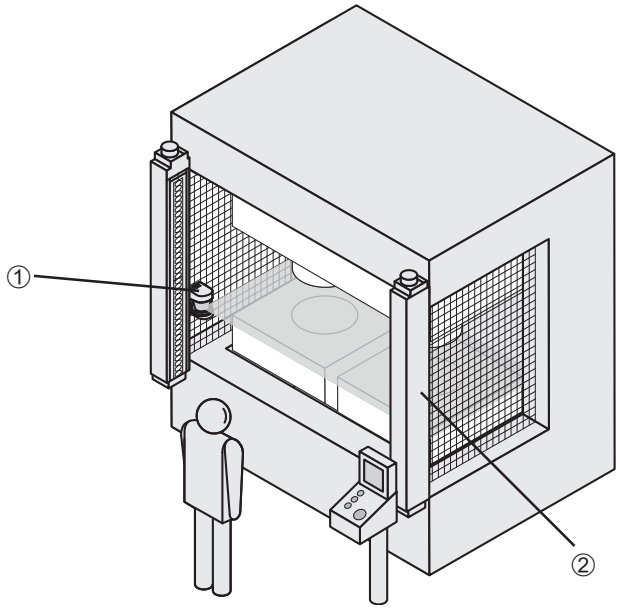


Figure 8: Interior protection

Hazardous point protection (vertical protection)

The SafeZone safety laser scanner can also be used vertically. Mounting in this way requires less space on the machine or equipment. Hazardous point protection is necessary if the operator is near the dangerous state of the machine. Hand protection must be configured to protect the hazardous point.

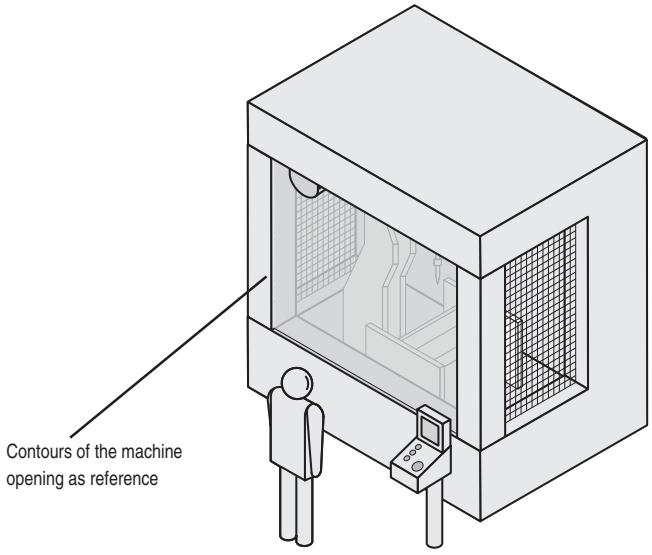


Figure 9: Protecting hazardous points

Access protection (vertical protection)

You can also use the SafeZone safety laser scanner vertically for access protection. Access protection can be used when the access to the machine can be defined by physical means. With access protection the SafeZone safety laser scanner detects the entry of a person.

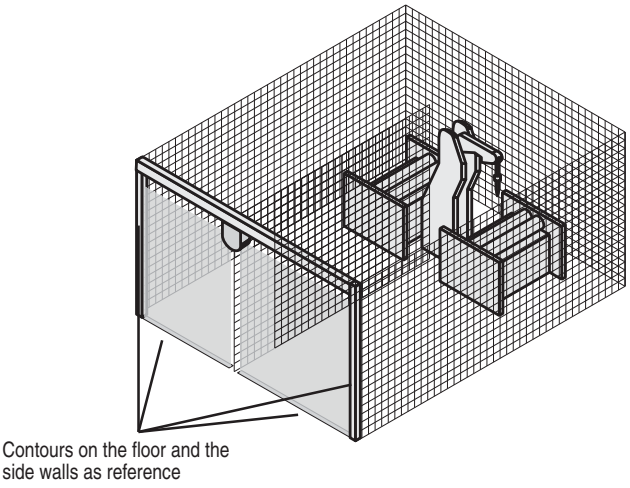


Figure 10: Access protection

3.3.2 Mobile applications

The SafeZone safety laser scanner can be used both on manually controlled vehicles, e.g. fork lift trucks, and also on automated guided vehicles (AGV) or trolleys.

You can use the SafeZone safety laser scanner on vehicles, e.g. to protect the route of a vehicle through a factory building. If there is a person or an obstacle in the hazardous area, the SafeZone safety laser scanner ensures that the vehicle reduces speed and stops if necessary.

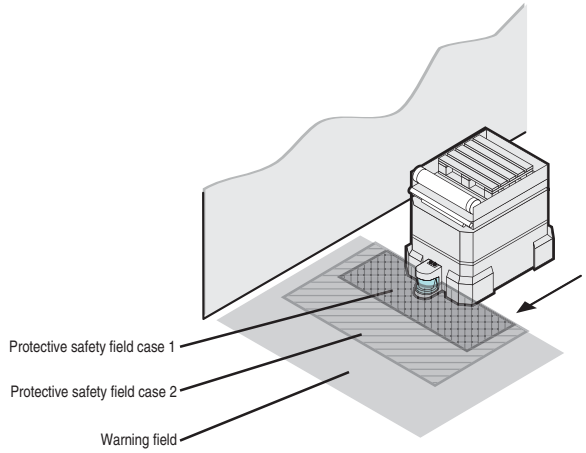


Figure 11: Field switching

3.3.3 Other applications (not for personnel protection)

Along with safety-related applications, you can also use the SafeZone safety laser scanner for applications in which people do not need to be protected.

Collision protection

Along with people, you can also protect vehicles from colliding with other objects.

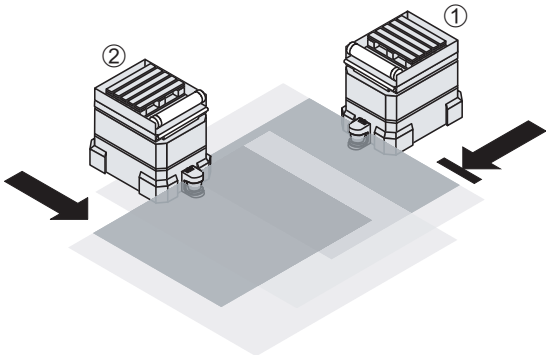


Figure 12: Collision protection

As soon as vehicle ② reaches the warning field of vehicle ①, vehicle ① slows down. When vehicle ② reaches the protective safety field of vehicle ①, vehicle ① stops.

Currently there are two SafeZone variants offered. The SafeZone Singlezone is offered with a 4 meter protective safety field range and Single field set (Warning and protective safety fields) and the SafeZone Multizone is offered with a 5 meter protective safety field and up to four configurable field sets.

Table 1: Functions of the I/O module

Functions	SafeZone	SafeZone
Pairs of output signal switching devices (OSSDs)	1	1
External device monitoring (EDM)	Yes	Yes
Restart interlock/delay	Yes	Yes
Application diagnostic output (warning field interrupted, control switch, restart or reset pressed, error/contamination	3	3
Switchable field sets	4	1
Programmable monitoring cases	4	1
Static control inputs for switching between the monitoring cases (complementary or 1-of-n)	2	—

3.3.4 Possible applications for the SafeZone multizone safety laser scanner variants

Table 2: Possible applications for the I/O modules

Typical Application	Functionality Required
Protection of a robot insertion station	One field set
Protection of a pipe bending machine	Up to four switchable field sets
Protection of a material processing system‘	Up to four switchable field sets
Protection of an automated guided vehicle AGV with bi-directional travel	In each direction of travel up to four switchable field sets

3.4 Configurable functions

3.4.1 Field sets

Configuring the protective safety field and warning field

With the aid of the SCD software you can configure the field set, which comprises a protective safety field and a warning field. During this process you configure the shape and size of the protective safety field and the warning field. You can realize any field shape required.

Device symbol SafeZone safety laser scanner, context menu Edit field sets....

IMPORTANT	The area to be monitored is scanned radially by the SafeZone safety laser scanner. The SafeZone safety laser scanner cannot “see around a corner.” The area behind objects that are in the area to be monitored (pillars, columns, etc.) can thus not be monitored.

- The protective safety fields (①) can cover up to 190° and have a radius of up to 4 or 5 m.
- The warning fields (②) can cover up to 190° and have a radius of up to 49 m. Detection is dependent on the reflectivity (e.g. objects with a reflectivity of 20% can be detected in a radius of up to 20 m).

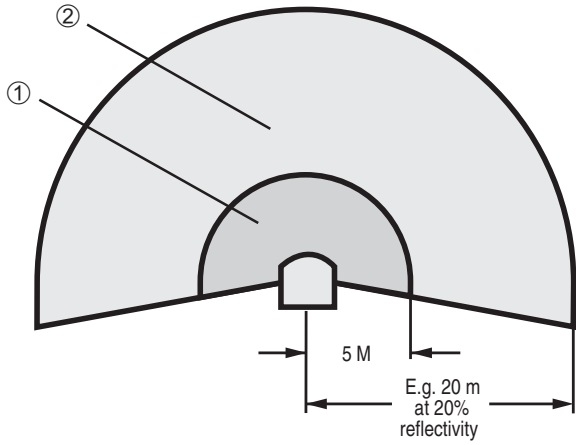


Figure 13: Protective safety field ① and warning field ②

ATTENTION	Check the protective safety field configuration. Prior to commissioning the machine or vehicle, check the configuration of the protective safety fields using the instructions in Section 8 "Commissioning" (page 36) and using the checklist (page 54).

Protective safety field suggested by the safety laser scanner

You can also have the SCD software suggest a protective safety field. The safety laser scanner scans the visible room contour several times. During this process possible measurement errors are taken into account. From the data obtained in this way the SCD software determines the contour of the protective safety field.

You can obtain the suggestion for the protective safety field in the field set editor in the SCD software: Device symbol SafeZone safety laser scanner, command Edit field sets.... In the field set editor window that opens, Suggest protective safety field button.

The size determined for the protective safety field is:

- As large as the visible room contour.
- In those places where there is no room contour within the scanning range, as large as the maximum scanning range of the safety laser scanner (4 or 5 m).

IMPORTANT	The measurement error tolerances of the SafeZone safety laser scanner are automatically subtracted from the protective safety field suggested. As a result the protective safety field is slightly smaller than the surface acquired.

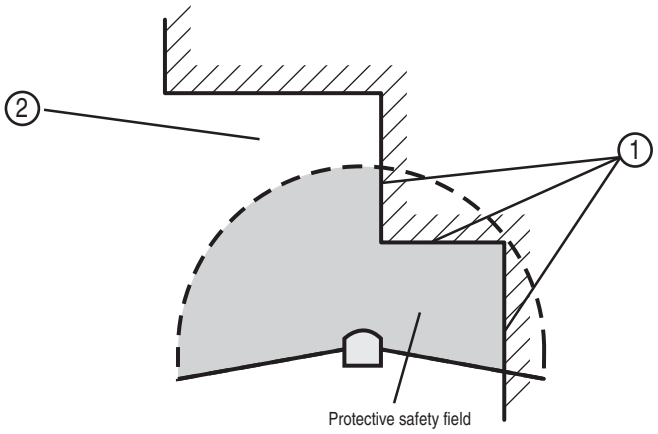


Figure 14: Reading protective safety field and warning field

In those places at which the room contour is smaller than the nominal scanning range (e.g. at ①), the protective safety field corresponds to the room contour (less the measurement tolerances). In those places where the room contour is larger than the nominal scanning range ②, the protective safety field corresponds to the nominal scanning range (4 or 5 m).

WARNING	Check the protective safety field suggested. The scanner cannot calculate the safety distance necessary for your application. Calculate the safety distance based on the description in Section 4 "Installation and mounting" on page 18. Prior to commissioning the machine or vehicle, check the configuration of the protective safety fields using the instructions in Section 8 "Commissioning" on page 36 and using the checklist on page 54.

3.4.2 Application

With the SCD software you can configure the SafeZone safety laser scanner for the required application. For each application you first set the resolution (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., file card Application):

- Possible resolution for stationary applications:
  - 30 mm (hand detection with smaller safety distance)
  - 40 mm (hand detection with larger safety distance)
  - 50 mm (leg detection with smaller protective safety field size)
  - 70 mm (leg detection with larger protective safety field size)
  - 150 mm (body detection)
- Possible resolution for mobile application:
  - 70 mm (leg detection)

IMPORTANT	For mobile applications a resolution of only 70 mm is required for leg detection, as a lower resolution is sufficient for the detection of a human leg due to the movement of the vehicle.

The maximum protective safety field range is dependent on the resolution selected, and the basic response time for the application is in turn dependent of the protective safety field range. The following tables show the values that can be configured:

Table 3: Maximum protective safety field range—SafeZone multizone 5 m range

Application	60 ms Basic Response Time	120 ms Basic Response Time
Stationary		
30 mm (hand detection)	1.90 m	2.80 m
40 mm (hand detection)	2.60 m	3.80 m
50 mm (leg detection)	3.30 m	4.80 m
70 mm (leg detection)	4.70 m	5 m
150 mm (body detection)	5 m	5 m
Mobile		
70 mm (leg detection)	4.7 m	5 m

Table 3B: Maximum protective safety field range—SafeZone singlezone 4 m range

Application	60 ms Basic Response Time	120 ms Basic Response Time
Stationary		
30 mm (hand detection)	1.90 m	2.80 m
40 mm (arm detection)	2.60 m	3.80 m
50 mm (leg detection)	3.30 m	4.00 m
70 mm (leg detection)	4.00 m	4.00 m
150 mm (whole body	4.00 m	4.00 m
Mobile		
70 mm (leg detection)	4.00 m	4.00 m

IMPORTANT	If the application involves multiple sampling, that basic response time may require added supplements. Refer to Section 11.2 "OSSD response times" (page 42) for more information.

3.4.3 Using the contour of the protective safety field as a reference

If the beams of the protective safety field reach as far as an obstacle (e.g. the floor in vertical applications or the walls in horizontal applications), the SafeZone multizone safety laser scanner can also monitor the contour of the protective safety field.

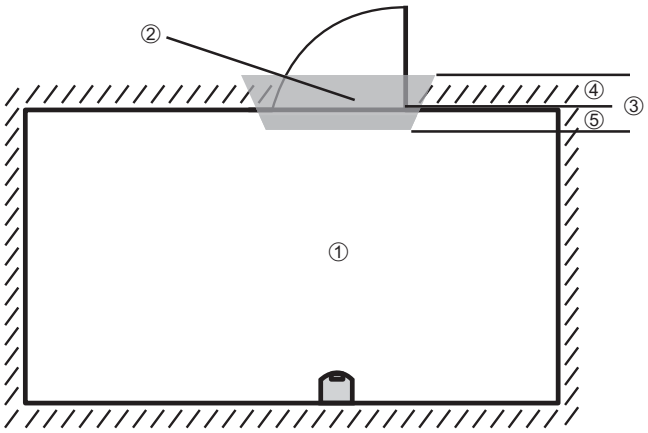


Figure 15: Schematic diagram of contour as reference

For contour monitoring you define part of the protective safety field ① as a contour segment ②. Within the contour segment a tolerance band ③ is defined. This comprises a positive ④ and a negative ⑤ tolerance band.

The OSSDs on the SafeZone safety laser scanner change to the off status if

- There is an object in the protective safety field.
- The room contour changes by more than the tolerance band (in the example by opening the door or by changing the position of the SafeZone safety laser scanner).

IMPORTANT	You can define any number of contour segments. The contour segments must not be narrower than the configured resolution. At the points where a contour has been configured as a reference you cannot define a warning field.

You define the contour as a reference in the SCD field set editor: Device symbol SafeZone safety laser scanner, command Edit field sets... In the field set editor window. Tools menu. Add contour command.

Vertical operation

In vertical operation (for access protection and hazardous point protection) according to IEC/EN 61496-3 you must always configure and activate the contour as reference function. If the radius of a protective safety field exceeds 4 meters, then it must be ensured that changes to the positioning of the safety laser scanner resulting in a movement of the protective safety field of more than 100 mm are detected.

Recommendation Use vertical passage limits at the side (e.g. door frames) and the floor as the reference. If in this case the position of the SafeZone safety laser scanner is changed in one or more planes, the distance to the reference changes and the SafeZone multizone safety laser scanner switches its OSSDs to the OFF state.

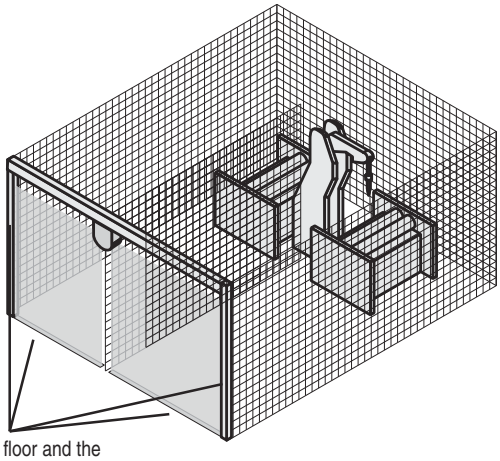


Figure 16: Protective safety field as reference for vertical operation

Horizontal operation

If the protective safety field reaches the walls of a room partially or entirely, the SafeZone safety laser scanner can also monitor the contour of the protective safety field. The OSSDs on the SafeZone multizone safety laser scanner then change to the off status if the room contour changes due the opening of a door, even if there is no object in the protective safety field.

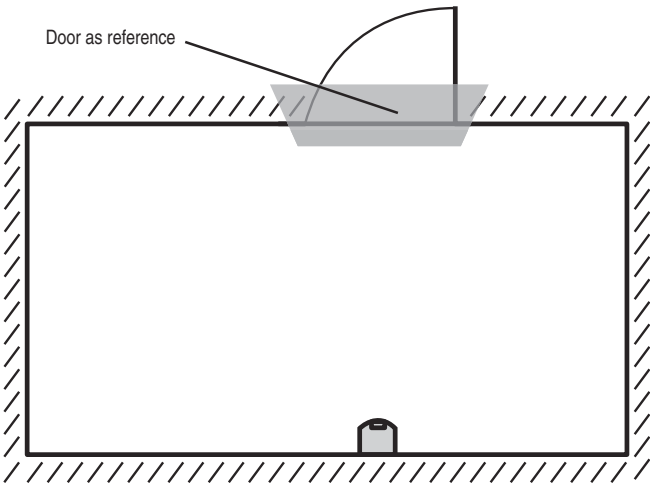


Figure 17: Protective safety field as reference for horizontal operation

IMPORTANT	It is not possible to define any warning field in the areas of the contour segments. This is only possible between contour segments.
ATTENTION 	Each output signal switching device (OSSD) is only allowed to be connected to one switching element (e.g. relay or contactor).

3.4.4 External device monitoring (EDM)

The EDM function monitors the contact elements activated by both the OSSDs (e.g. contactors). The machine is only allowed to start if both contactors are in the de-energized state on reset, that is they are deactivated.

The SafeZone safety laser scanner monitors the contactors after every interruption of the protective safety field and before the restart of the machine. The EDM can in this way identify if one of the contactors has welded in the following manner.



You can configure the external device monitoring in the SCD (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., file card Scanner name).

- If no internal restart interlock is configured, then
  - the system locks completely (lock-out).
  - the error message appears in the 7-segment display.
- If an internal restart interlock is configured, then
  - the SafeZone safety laser scanner deactivates its OSSDs.
  - the adjacent LED illuminates.
  - the error message appears in the 7-segment display.
  - with the flashing LED the SafeZone safety laser scanner signals that the control switch for restarting or resetting the restart must be operated.

Notes

- You will find examples on the connection of the external device monitoring in Section 6.3 “Example circuits” on page 34.
- If you do not use the external device monitoring function, leave the inputs disconnected (see Section 5.1.1 “Pin assignments of the I/O modules” on page 32).

3.4.5 Application diagnostic output

The application diagnostic output, when not configured, sources 24V DC. When configured for contamination or status of outputs (OSSDs) or both, the ADO will turn off to signal one of the configured states (see Table 21 on page 40).

The SafeZone safety laser scanner has a configurable application diagnostic output (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., file card Scanner name).

For the application diagnostic output you must decide

- Whether it is deactivated.
- Whether an output signal is only active when the front screen is contaminated.
- Whether an output signal is only active when an error occurs.
- Whether an output signal is activated for both the front screen contamination and on errors.

3.4.6 Restart

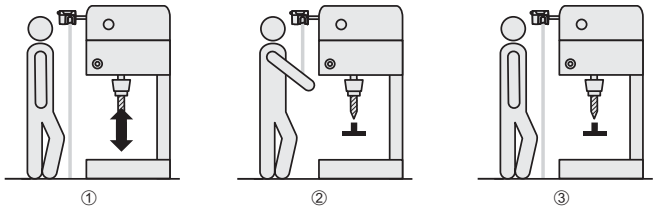


Figure 18: Schematic of operation with restart interlock

Restart interlock

The dangerous state of a machine ① or a vehicle is interrupted as soon as there is an object in the protective safety field ② and is not enabled again ③, even if there is no longer an object in the protective safety field. The OSSDs are only enabled again when the operator operates the control switch for restarting or resetting.

The restart interlock can be implemented in two different ways:

- With the internal restart interlock of the SafeZone safety laser scanner:
  The outputs on the SafeZone safety laser scanner are enabled after the connected control switch is operated.
- With the restart interlock of the machine controller:
  The SafeZone safety laser scanner has no effect on the restart.

ATTENTION	Place the control switch for restart or reset outside the hazardous area in a place where it can clearly be seen from the hazardous area. Place the control switch for restart or reset outside the hazardous area such that it cannot be operated by a person in the hazardous area. Ensure that the person who operates the control switch has a full view of the hazardous area.

Restart delay

On the SafeZone safety laser scanner, instead of a restart interlock you can configure a restart delay of 2 to 60 seconds. This enables the machine or the vehicle to start automatically when the protective safety field becomes clear, and the pre-set time has elapsed. It is not possible to combine restart interlock and restart delay.

ATTENTION	It is important to configure the SafeZone safety laser scanner with restart interlock if a person cannot be detected at every point in the hazard area for the SafeZone safety laser scanner. Operators may be at risk if restart interlock is not configured. Check, if necessary, whether it is possible to prevent personnel from approacing the hazard point by design measures (see Section 4.1.2 “Measures to protect areas not covered by the SafeZone safety laser scanner" on page 21).

IMPORTANT	The SafeZone safety laser scanner cannot differentiate between a contaminated front screen and an obstacle directly in front of it. To ensure high availability, the SafeZone multizone safety laser scanner has been designed such that it reliably detects dark black bodies such as wide black cord or shoe leather from a distance of 5 cm in front of the front screen. Black objects that are closer to the front screen may not be detected.

ATTENTION	Secure the area close to the SafeZone safety laser scanner if operated without restart interlock. Make the area near the device inaccessible by means of physical measures (hard guard or recessing) or, in addition to the SafeZone safety laser scanner, use a proximity switch with 5 cm acquisition range. Without this additional protection you will endanger persons who move from the protective safety field into the area near the device.

Permissible configuration

Table 4: Permissible configuration of the restart interlock

Restart Interlock of the SafeZone	Restart Interlock Machine/Vehicle	Permissible Application
Deactivated	Deactivated	Only if it is not possible to leave the protective safety field to approach the hazardous point. Ensure that this is
Deactivated	Activated	All, if the hazardous area can be completely seen by the
Activated	Deactivated	Only if it is not possible to leave the protective safety field to approach the hazardous point. Ensure that this is
Activated	Activated	All, if the hazardous area cannot be completely seen by the operator. The restart interlock of the SafeZone safety laser scanner takes over the function for resetting the protective device.

Reset

IMPORTANT	The reset function is often also called "preparation for restart." In these operating instructions the term reset is typically used.

If you want to activate the restart interlock on the SafeZone safety laser scanner (internal) and also a restart interlock on the machine (external), then each restart interlock needs its own control switch.

✓ ● After operating the control switch for the internal restart interlock (with protective safety field unoccupied)

- The SafeZone multizone safety laser scanner switches on its OSSDs.
- The adjacent LED on the safety laser scanner illuminates green.

The external restart interlock prevents the machine from restarting. After resetting the SafeZone safety laser scanner the operator must press the control switch to restart the machine controller.

ATTENTION 	Ensure that the correct sequence is followed! The controller must be configured such that the machine only restarts if the SafeZone safety laser scanner is first reset and then the control switch for restarting the machine controller is pressed.

IMPORTANT	You will find examples on the connection of the internal restart interlock in Section 6.3 "Example circuits" on page 34.

If you do not use the restart interlock, leave the inputs disconnected (see Section 5.1.1 "Pin assignments of the I/O modules" on page 32).

You can configure the type of restart in the SCD (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., file card Scanner name).

3.4.7 Multiple sampling

When multiple sampling is set, an object must be scanned several times before the SafeZone safety laser scanner switches off its OSSDs. In this way you can reduce the probability that objects falling through the scan plane, for example welding sparks or other particles, result in the shutdown of the equipment.

With a multiple sampling configuration of (e.g., 3) an object must be scanned three times in succession before the SafeZone safety laser scanner switches off the OSSDs.

IMPORTANT	The total response time is increased by the multiple sampling. With a multiple sampling greater than 2, note that you must add a supplement to the basic response time (see Section 11.2 "OSSD response times" on page 42)!

On the SafeZone safety laser scanner, a multiple sampling of 2 is the minimum setting. You can set the multiple sampling up to 16 with the aid of the SCD software.

Table 5: Recommended multiple sampling

Recommended multiple sampling	Application
2 times	Stationary under clean ambient conditions
4 times	Mobile
8 times	Stationary under dusty ambient conditions

Recommendation Using multiple sampling you can increase the availability of a machinery.



You can configure the multiple sampling in the SCD software for each monitoring case (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., Monitoring case name, file card Scanner name).

3.4.8 Monitoring cases

If you are using the SafeZone multizone, you can define up to four monitoring cases.

IMPORTANT	Ensure that the safety distance to the dangerous state is properly established in any monitoring case to protect the hazardous area. See Section 4 "Installation and mounting" on page 18.

It is possible to switch between these monitoring cases during operation using static control inputs.

Park mode

For mobile applications in which vehicles are parked for a time, the SafeZone multizone safety laser scanner can be switched to park mode. In the park mode the OSSDs are deactivated and the laser beam in the safety laser scanner will shutdown. In this way the power consumption of the device is reduced.

The park mode can be configured for a monitoring case. To switch to the park mode, the input must be configured such that the related monitoring case with the park mode is activated.

Recommendation If you park vehicles beside each other, switch them to the park mode. In this way you prevent the SafeZone multizone safety laser scanner on the vehicles from optically interferring with each other and the SafeZone multizone safety laser scanner from possibly entering an error (lockout) condition.



You can configure the monitoring cases in the SCD software (device symbol SafeZone multizone safety laser scanner system, context menu Configuration draft, Edit...).

3.4.9 Static control inputs

The SafeZone multizone safety laser scanner has two two-channel static control inputs through which the four possible monitoring cases can be switched.



You can configure the control input in the SCD software (device symbol SafeZone multizone safety laser scanner system, context menu Configuration draft, Edit..., file card Inputs).

If you are using static sampling, decide between complementary or 1-of-n sampling depending on the control features available.

IMPORTANT	When switching the monitoring cases using static control inputs, please note the following points: ➡ Ensure that the control for the monitoring case switching has a sufficiently high level of safety. ➡ Ensure that the circuit for the control inputs is suitable for the ambient conditions to be expected so that systematic effects and thus errors on the switching of the monitoring cases can be excluded. ➡ Ensure that the control—using static control inputs—provides switching between the monitoring cases in the correct time frame. Note that at the time of the switching there may be a person in the protective safety field. Only by means of switching in the correct time frame (i.e. before the hazard occurs at this point for the person) is protection provided (see Section 4.5 "Timing for monitoring case switching" on page 27).

Static complementary sampling

A control input comprises a pair of two connections. For correct switching one connection must be inverted in relation to the other.

The following table shows the levels that must be present at the connections for the control input to define the logical input state 1 and 0 at the related control input.

Table 6: Level at the connections for the control inputs for complementary sampling

Connection 1	Connection 2	Logical Input State
1	0	0
0	1	1
1	1	Error
0	0	Error

Using the control input pair on the SafeZone multizone safety laser scanner; four monitoring cases can be switched.

Static 1-of-n sampling

With 1-of-n sampling you use each of the two control input connections. All connections must be used, only one connection is ever allowed to be 1.

Table 7: Truth table for 1-of-n sampling

A1	A2	B1	B2
1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

Input delay

If the control device which is used to switch the static control inputs cannot switch within 10 ms (for 60 ms basic response time) or 20 ms (for 120 ms basic response time) to the related input condition (e.g. due to switch bounce times), you must choose an input delay. For the input delay choose the time in which your defined control device can switch to a corresponding input condition.

Independent of the basic response time chosen for the SafeZone multizone safety laser scanner, you can increase the input delay in 30-ms steps (for 60 ms basic response time) or 60-ms steps (for 120 ms basic response time).

The following figures, derived from experience, are a guide for the various switching methods given.

Table 8: Figures from experience for the necessary input delay

Switching method	Input delay required
Electronic switching using controller or complementary electronic outputs with 0 to 10 ms bounce time	10 ms
Contact (relay) controls	30…150 ms
Control using independent sensors	130…480 ms

3.4.10 Checking of the monitoring case switching

To check the switching between monitoring cases, configure a series of monitoring cases. Here you can define either an arbitrary sequence, a unique sequence, or two alternative sequences.

Arbitrary sequence: It is allowed to switch from one monitoring case to any other defined monitoring case.

Unique sequence: It is only allowed to switch from a monitoring case to another specifically defined monitoring case.

Alternative sequence: It is allowed to switch from a monitoring case to one of two specifically defined monitoring cases.

Recommendation Use the checking of the monitoring cases as an additional medium to exclude risks. For example, deviations of a vehicle from a corridor or a plant from the stipulated production process can be detected.

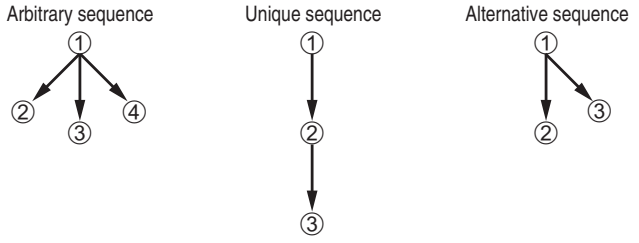


Figure 19: Schematic layout of the monitoring case switching

Within a monitoring case, the SafeZone multizone can monitor two field sets simultaneously (e.g. hazardous area on the left and hazardous area on the right). For this purpose choose any further field set with the related monitoring case as the simultaneous field set.

You configure a monitoring case with simultaneous field set in the SCD.

3.4.11 Naming applications and laser scanners

A name can be assigned to the application configured and to the laser scanner(s). The names are saved in the devices after the configuration is transferred. The name chosen may, for example, be the identifier for the system or the machine.

If you assign unique application names, you may "reserve" the devices for certain duties. A machine maintenance person comparing exchanged devices with the configuration data saved in the SCD software will be notified that the application name does not match. He may then exchange these devices for those with the correct application name.

You can enter the application or scanner names in the SCD software (device symbol SafeZone safety laser scanner system, context menu Configuration draft, Edit..., file card Application).

3.5 Indicators and outputs

3.5.1 LEDs and 7-segment display

The LEDs and the 7-segment display indicate the operational status of the SafeZone safety laser scanner. They are on the front face of the safety laser scanner. Above the LEDs there are symbols that are used in the remainder of these operating instructions to describe the LEDs.

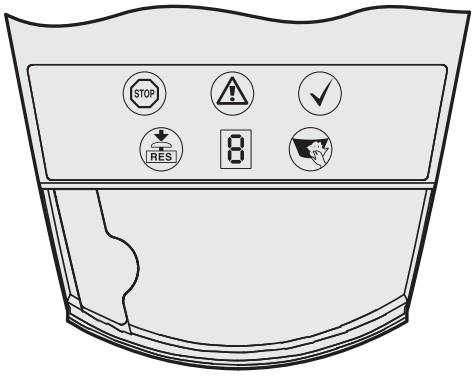


Figure 20: Operational status indicators on the SafeZone safety laser scanner

The symbols have the following meaning:

OSSDs deactivated (e.g. if object in the protective safety field, reset necessary, lock-out)

Reset required


Warning field interrupted (object in warning field)


Front screen contaminated



OSSDs deactivated (e.g. if object in the protective safety field, reset necessary, lock-out)


OSSDs activated (no object in protective safety field)

3.5.2 Outputs

Using the outputs on the SafeZone safety laser scanner you shutdown the dangerous state on a machine, equipment or a vehicle and evaluate the operational status of the SafeZone safety laser scanner. The SafeZone safety laser scanner has the following outputs:

- OSSDs
- Warning field
- Application diagnostic output (contamination of the front screen/ error)
- Reset required

The outputs are brought out at the system connection (see Section 5.1 “System connection” on page 31).

IMPORTANT	All outputs are only allowed to be used for the purpose specified. Note that the signals at the application diagnostic outputs for “warning field,” “contamination of the front screen/ error” and “reset necessary” are not safe. For this reason the warning field is not allowed to be used for tasks related to personnel protection.

ATTENTION 	No protective function without sufficient safety distance. The SafeZone safety laser scanner’s safety function depends on the system being mounted with the correct safety distance from the hazardous area.

Section 4 — Installation and Mounting

This section describes the preparation and completion of the mounting of the SafeZone safety laser scanner.

Mounting requires four steps:

- Definition of the application and the necessary mounting location for the laser scanner
- Calculation of the protective safety field sizes

You can enter the calculated protective safety field sizes with the aid of the SCD software. Or leave the SafeZone safety laser scanner to suggest the protective safety fields. In the latter case it is necessary to check whether the suggested sizes correspond to those calculated. Thus in any circumstance you must calculate the protective safety field size.

- Definition of the switching point between monitoring cases
- Mounting the safety laser scanner with or without mounting kits

IMPORTANT	• Mount the SafeZone safety laser scanner in a dry place and protect the device from dirt and damage. • Avoid strong electrical fields. These can be produced by welding cables, induction cables in the immediate vicinity and also by mobile telephones operated in close physical proximity. • Ensure that there are no obstacles in the area to be monitored in the field of view of the SafeZone safety laser scanner that could cause interference or shadowing. Such shadowed areas cannot be monitored by the SafeZone safety laser scanner. If there are unavoidable shadowed areas, check whether there is a risk. Take additional safety precautions as necessary. • Keep the area to be monitored free of smoke, fog, steam or other forms of air impurities. Otherwise the function of the SafeZone safety laser scanner may be impaired causing nuisance stops. • Avoid placing highly reflective objects in the scan plane of the SafeZone safety laser scanner. Examples: Retroreflectors can affect the measurement results of the SafeZone safety laser scanner. Mirrored objects can hide part of the area to be monitored. • Mount the SafeZone safety laser scanner such that it is not saturated by incidental sunlight. Do not position stroboscopic and fluorescent lights directly in the scan plane as these may affect the SafeZone safety laser scanner in specific circumstances. • Mark the protective safety field on the floor, if this is reasonable for the application (see EN 61496, part 1, Section 7).

The following steps are necessary after mounting and installation:

- Completing the electrical connections (Section 5 “Electrical installation” on page 31)
- Configuration of the protective safety field (Section 7 “Configuration” on page 35)
- Commissioning and checking of the installation (Section 8 “Commissioning” on page 36)
- Checking of the SafeZone safety laser scanner functionality and safe shutdown of the machine, vehicle or equipment (Section 8.2 “Test notes” on page 36)

4.1 Stationary application in horizontal operation

This type of protective device is suitable for machines and equipment on which a hazardous area is not enclosed by a fixed protective device.

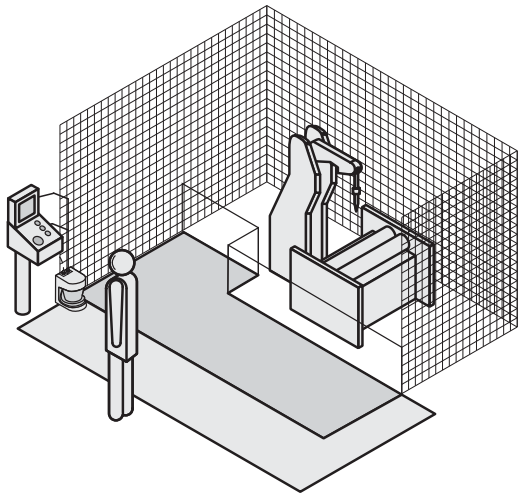


Figure 21: Horizontally mounted stationary application

For a horizontally mounted stationary application determine

- The protective safety field size to observe the necessary safety distance.
- The height of the scan plane.
- The restart behavior.
- Measures to protect areas not covered by the SafeZone safety laser scanner.

IMPORTANT	Once you have defined the protective safety field size, mark the boundaries of the protective safety field on the floor. This avoids inadvertent entrance into the protective safety field and makes it possible to subsequently check the shape of the protective safety field.

4.1.1 Protective safety field size

The protective safety field must be so configured that a safety distance (S) to the hazardous area is maintained. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

IMPORTANT	If you are using the SafeZone multizone, you can define several monitoring cases with different protective safety fields. In such cases you must calculate the protective safety field size for all protective safety fields used.

You can operate the SafeZone safety laser scanner in stationary horizontal operation with 50 mm or with 70 mm resolution. For each resolution you can choose between 60 ms and 120 ms response time. The maximum protective safety field range for the SafeZone safety laser scanner is given by the resolution and the response time.

- If you choose a 50 mm resolution, the maximum protective safety field range is less than for a 70 mm resolution, however you can mount the SafeZone safety laser scanner as low as required.
- If you choose a 70 mm resolution, you can configure the largest protective safety field range (5 m) but must position the scan plane of the SafeZone multizone safety laser scanner at 300 mm.

ATTENTION	Ensure that a human leg can be detected in horizontal stationary applications with 70 mm resolution. Mount the scan planes for horizontal stationary applications with 70 mm resolution at a height of at least 300 mm (see "Height of the scan plane at 70 mm resolution" on page 26).

Recommendation Due to the choice of two resolutions and two response times, it may be necessary to repeatedly calculate the protective safety field size (iterative calculation).

➡ Perform your protective safety field calculation initially based on a resolution of 50 mm and a basic response time of 60 ms.

➡ If the calculated protective safety field is larger than the maximum protective safety field range at 50 mm resolution, calculate it again using the same resolution and the higher response time.

➡ If the protective safety field calculated is larger than the maximum protective safety field range achievable, then re-calculate the protective safety field with the lower resolution.

The safety distance S depends on:

- Approach speed of the body or parts of the body
- Stopping/run-down time of the machine or system (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- Response time of the SafeZone safety laser scanner
- Supplements for general measurement errors and any measurement errors related to reflection
- Supplement for prevention of reaching over
- Height of the scan plane
- Possibly the time for switching between the monitoring cases

Calculation of the safety distance S:

➡ First, calculate S using the following formula:
$S = (K \times (TM + TS)) + ZG + ZR + C$

Where...

K = Approach speed (1600 mm/s, defined in EN 999)

T_M = Stopping/run-down time of the machine or system

T_S = Response time of the SafeZone multizone safety laser scanner combined with the downstream controller

Z_G = General safety supplement = 100 mm

Z_R = Supplement for measurement error related to reflection

C = Supplement for prevention of reaching over

Response time Ts of the SafeZone safety laser scanner

The response time T_S of the SafeZone safety laser scanner depends on

- The resolution used
- The multiple sampling used

See Section 11.2 "OSSD response times" on page 42.

Supplement ZR for measurement error related to reflection

ATTENTION	Avoid mounting retroreflectors at a distance of less than one meter from the boundary of the protective safety field. With retroreflectors positioned at a distance of less than 1 m from the boundary of the protective safety field a supplement, ZR, of 200 mm must be added to the protective safety field.

Supplement C for protection against reaching over

With a protective safety field installed horizontally, there is a risk that people may reach over the protective safety field and in this way reach the hazardous area before the SafeZone safety laser scanner shuts down the hazardous motion. For this reason the calculation of the safety distance must take into account a supplement to prevent persons from finding themselves in a hazardous situation by reaching over the protective safety field (see EN 294, table 1) before the SafeZone safety laser scanner detects the intrusion to the protective safety field.

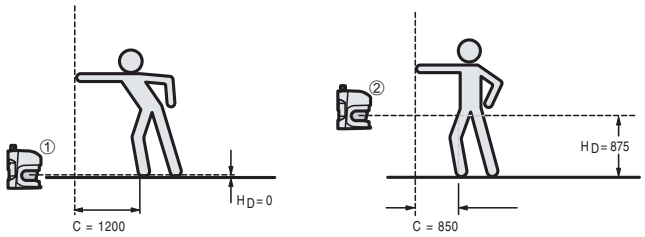


Figure 22: Risk of reaching over (mm)

The necessary supplement for the safety distance is dependent on the height of the scan plane for the protective safety field. At low heights ① the supplement is larger than at greater heights ②.

ATTENTION	Prevent the possibility of crawling beneath the protective device if you mount it higher than 300 mm. Prevent people from being able to crawl beneath the protective safety field by means of appropriate mounting of the SafeZone safety laser scanner. If you mount the protective device higher than 300 mm, then prevent crawling beneath by means of additional measures. For applications that are accessible to the public, the mounting height may need to be reduced to 200 mm (see the appropriate public regulations).

How to calculate the supplement C:

- ➡ If there is enough empty space in front of your machine or equipment, use 1200 mm for the supplement C.
- ➡ If the safety distance is to be kept as small as possible, calculate C using the following formula:
  $C = 1200\ mm - (0.4 \times H_D)$

Here H_D is the height at which the protective safety field is mounted.

IMPORTANT	The minimum supplement to prevent reaching over is 850 mm (arm length).

In summary there are three practical methods of mounting the scan plane for the SafeZone safety laser scanner. The optimal method depends on the related application.

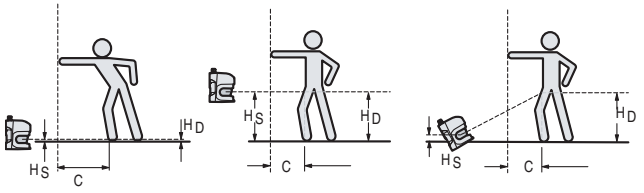


Figure 23: Mounting methods for the scan plane

Table 9 provides assistance in making the selection.

Table 9: Advantages and disadvantages of mounting methods

Mounting Orientation	Benefit	Disadvantage
Scanner low ($H_S < 300$ mm) Inclination of the scanner plane	No external effects due to saturation, crawling	Larger supplement C
Scanner high ($H_S > 300$ mm) Inclination of the scanner plane	Lower protective safety field supplement C	Danger of crawling beneath (at the front and side)
Scanner low ($H_S < 300$ mm) Inclination of the scanner plane	Lower protective safety field supplement C	Danger of crawling beneath (at the front),
H_D = Detection height H_S = Scanner mounting height		

Height of the scan plane at 70 mm resolution

Due to the radial sampling of the protective safety field, the optical resolution will be lower the further away you get from the scanner.

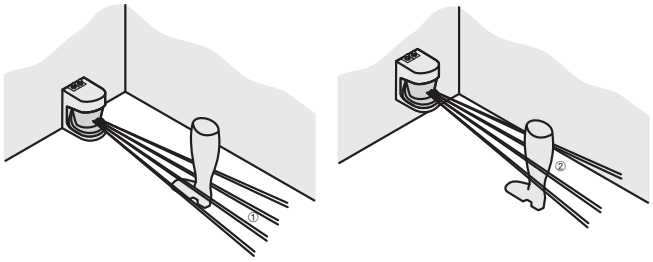


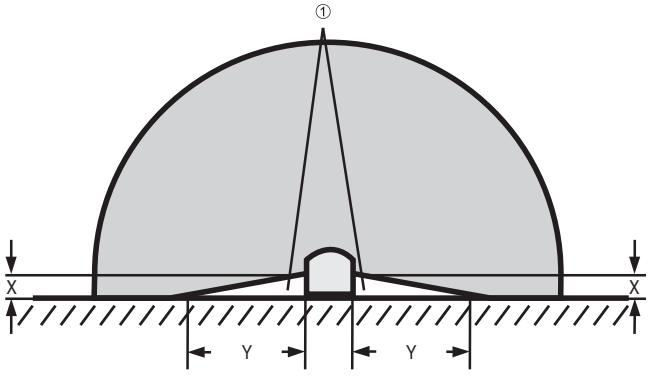
Figure 24: Relationship between resolution and protective safety field mounting height

If you choose a resolution of 70 mm in the SCD software for hazardous area protection, a human leg may, in certain circumstances, not be detected. The reason in this case would be that the beams miss the ankle on the left and right ①.

If you mount the SafeZone safety laser scanner higher, the scan plane is at fibula height and the leg is also detected with an object resolution of 70 mm ②.

4.1.2 Measures to protect areas not covered by the SafeZone safety laser scanner

During mounting, areas may be found that are not covered by the safety laser scanner.



These areas ① become larger if the SafeZone safety laser scanner is mounted using the mounting kits.

Figure 25: Unprotected areas for stationary applications

Table 10: Size of the unprotected areas

Mounting Method	Size of Unprotected Areas	
	X	Y
Direct mounting	109 mm	618 mm
With mounting kit 1	112 mm	635 mm
With mounting kit 1 and 2	127 mm	720 mm
With mounting kit 1, 2 and 3	142 mm	805 mm

ATTENTION	Prevent unprotected areas. Mount the SafeZone safety laser scanner such that there are no unprotected areas. Take one of the precautions given in the following: ➡ Install hard guards to prevent standing behind. ➡ Install the SafeZone safety laser scanner in a recess.

Mounting with hard guards

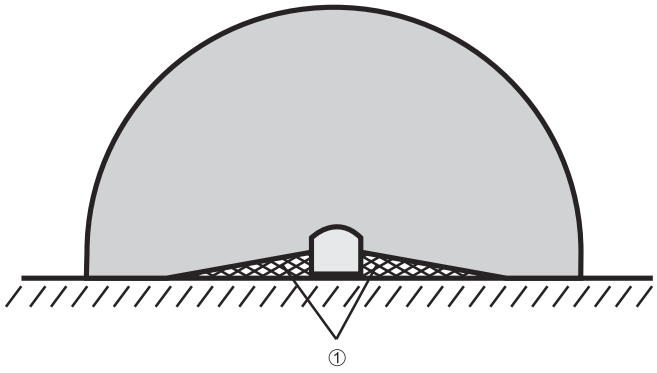


Figure 26: Example of mounting with hard guards

➡ Fit the hard guard such ① that the areas not covered by the safety laser scanner are completely protected against personnel standing in them.

Mounting in a recess

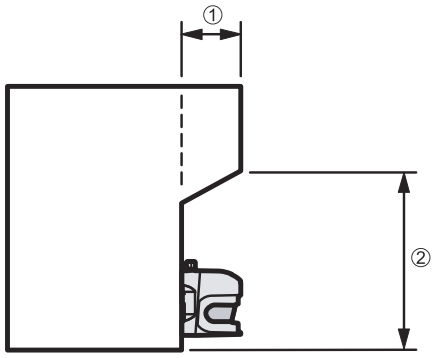


Figure 27: Form of the recess

➡ Design the recess ① to be sufficiently deep enough that it completely covers the area not protected by the safety laser scanner (Figure 26) and such that standing in an unscanned area ② is not possible.

IMPORTANT	Prevent crawling beneath the recess by limiting the height of the recess such that nobody can crawl beneath.

4.2 Stationary Vertical Operation for Access Protection

Access protection can be used when the access to the machine can be defined by physical means. For access protection the SafeZone safety laser scanner detects the entry of an entire body.

IMPORTANT	To ensure adequate access protection, a response time of ~ 90 ms and a resolution of 150 mm or finer is required. To protect the SafeZone multizone scanner against inadvertent adjustment or manipulation, use the contour of the surrounding area as a reference (see Section 3.4.3 "Using the contour of the protective safety field as a reference" on page 12).

4.2.1 Safety distance

For access protection, a safety distance (S) must be maintained between protective safety field and hazardous area. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

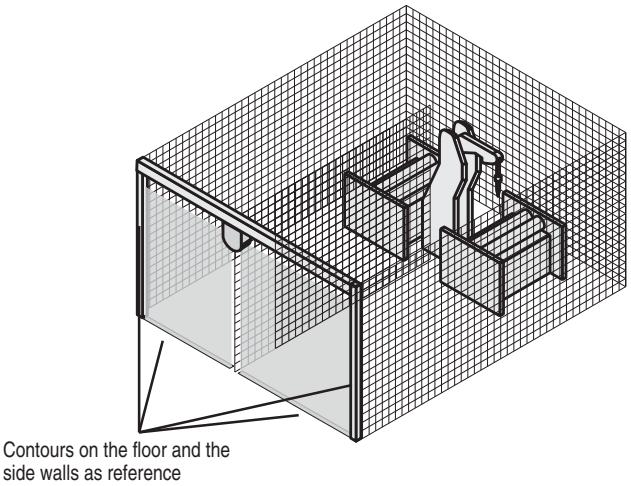


Figure 28: Access protection

The safety distance S as defined in EN 999 and EN 294 depends on:

- Reach or approach speed
- Stopping/run-down time of the machine or system (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement. On request Rockwell safety services can perform a detailed stopping/run-down measurement on your equipment.)
- Response time of the SafeZone safety laser scanner
- Supplement C against reaching through

Calculation of the safety distance S:

➡ First, calculate S using the following formula:
$S = (K \times (T_M + T_S)) + C$

Where...

K	=	Approach speed (1600 mm/s, defined in EN 999)
T_M	=	Stopping/run-down time of the machine or system
T_S	=	Response time of the SafeZone multizone safety laser scanner
C	=	Supplement against reaching through (850 mm)

Response time Ts of the SafeZone safety laser scanner

ATTENTION 	The overall response time of the SafeZone safety laser scanner must not be more than 90 ms for access protection. If a critical response time is exceeded (for an object diameter of 150 mm and a speed of 1.6 m/s that is 90 ms) a person may no longer be detected under certain circumstances. The critical response time is exceeded if the basic response time is too high, possibly due to multiple sampling or due to the usage of external OSSDs. In specific cases agreed with the responsible authorities higher response times may be allowed (for example by increasing the detection time available by positioning the scanner at an angle). In this case ensure that the areas the scanner cannot see are protected by additional measures.

The response time TS of the SafeZone safety laser scanner depends on

- The multiple sampling used.
- The transmission speed to external OSSDs over communication lines.

See Section 11.2 “OSSD response times” on page 42.

4.3 Stationary vertical operation for hazardous point protection

Hazardous point protection is necessary if the operator must remain near the dangerous state of the machine. Hand protection must be released for hazardous point protection.

IMPORTANT	To provide hand protection with hazardous point protection a resolution of at least 40 mm is required. The SafeZone multizone safety laser scanner provides a maximum resolution of 30 mm.

ATTENTION 	Never use the SafeZone safety laser scanner for applications in which finger protection is required Due to the maximum resolution of 30 mm, the SafeZone safety laser scanner is not suitable for finger protection.

- To protect the protective device against inadvertent adjustment or manipulation, use the contour of the surroundings as a reference for the SafeZone safety laser scanner (see Section 3.4.3 “Using the contour of the protective safety field as a reference” on page 12).

4.3.1 Safety distance

For hazardous point protection, a safety distance must be observed between protective safety field and hazardous point. This safety distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.

You can operate the SafeZone multizone safety laser scanner with 30 mm or 40 mm resolution for hazardous point protection. At each resolution you can choose a response time between 60 ms and 120 ms (due to the proximity of the hazardous point in the majority of cases only the shorter response time can be used). The maximum protective safety field range and the minimum distance to the hazardous point is given by the resolution and the response time.

- If you choose 30 mm resolution, the protective safety field that can be configured is smaller (for smaller hazardous points to be protected), however you can mount the SafeZone multizone safety laser scanner nearer to the hazardous point.
- If you choose 40 mm resolution, the protective safety field that can be configured is larger (thus for larger hazardous points to be protected), however you must mount the SafeZone multizone safety laser scanner further away from the hazardous point.

ATTENTION 	Danger due reaching around or reaching behind. Always mount the scanner such that reaching around and behind is impossible. Provide suitable additional precautions as necessary.

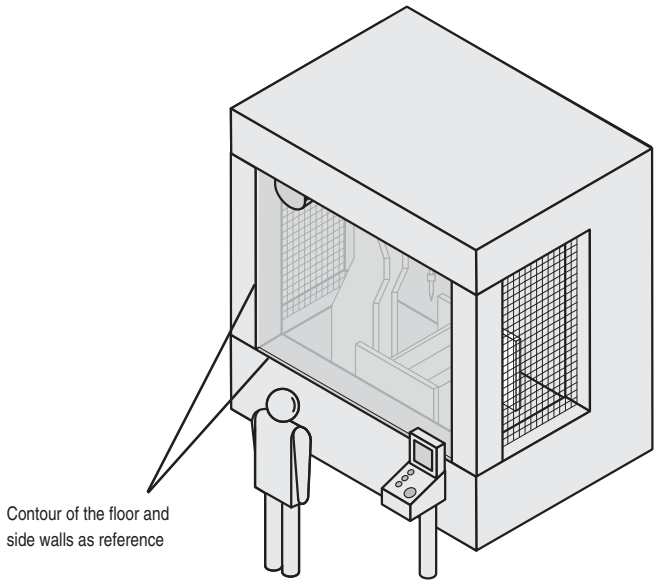


Figure 29: Safety distance to the hazardous area

The safety distance as defined in EN 999 and EN 294 depends on:

- Stopping/run-down time of the machine or system (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- Response time of the SafeZone safety laser scanner
- Reach or approach speed
- Resolution of the SafeZone safety laser scanner

Calculation of the safety distance S:

➡ First, calculate S using the following formula:
$S = 2000 \times (T_M + T_S) + 8 \times (d - 14\ mm)$ [mm]

Where...

S	=	Safety distance (mm)
T_M	=	Stopping/run-down time of the machine or system
T_S	=	Response time of the SafeZone safety laser scanner
d	=	Resolutions of the SafeZone safety laser scanner (mm)

IMPORTANT	The reach/approach speed is already included in the formula.

➡ If the result S is ≤ 500 mm, then use the determined value as the safety distance.

➡ If the result S > 500 mm, you may be able to reduce the safety distance using the following calculation:
$S = 1600 \times (T_M + T_S) + 8 \times (d - 14\ mm)$ [mm]

➡ If the new value S is > 500 mm, then use the newly calculated value as the minimum safety distance.

➡ If the new value S is ≤ 500 mm, then use 500 mm as the minimum safety distance.

Response time of the SafeZone safety laser scanner

The response time T_S of the SafeZone safety laser scanner depends on

- The resolution used
- The multiple sampling used

See Section 11.2 “OSSD response times” on page 42.

4.4 Mobile applications

If the dangerous state is produced by a vehicle (e.g. AGV or fork lift), the hazardous area that is produced by the movement of the vehicle is protected by the SafeZone safety laser scanner.

IMPORTANT	The SafeZone safety laser scanner may only be used to protect vehicles powered by electric motor. Due to the movement of the SafeZone safety laser scanner in a mobile application, a resolution of 70 mm is sufficient for the detection of people. In the following calculations only take into account the velocity of the vehicle, not the speed of the person walking. This is based on an understanding that the person will recognize the danger and stand still. If the application is to protect vehicles from collisions, then it will be necessary to establish guidelines. These are application specific and can therefore not be described within this manual. Contact the relevant authorities and clarify the guidelines that must be taken into account with regard to your application.

For a horizontally mounted mobile application, determine:

- Protective safety field length
- Protective safety field width
- Height of the scan plane
- Restart configuration
- Methods of preventing unprotected areas

4.4.1 Protective safety field length

You must configure the protective safety field such that a safety distance to the vehicle is maintained. This ensures that a vehicle monitored by the SafeZone safety laser scanner comes to a stop before a person or object is reached.

You can define different monitoring cases with different protective safety fields. You can switch these using the static control input.

Calculation of the protective safety field length:

➡ Calculate the necessary protective safety field length using the formula:
$SL = S_A + Z_G + Z_R + Z_F + Z_B$

Where...

A	=	Stopping distance (mm)
Z_G	=	General safety supplement = 100 mm
Z_R	=	Supplement for any measurement error of the SafeZone multizone safety laser scanner related to reflection
Z_F	=	Supplement for any lack of ground clearance of the vehicle
Z_B		Supplement for the reduction in the braking performance of the vehicle as defined in the related vehicle documentation

Stopping distance

The stopping distance comprises the braking distance for the vehicle, the distance covered during the response time of the safety laser scanner and the response time of the vehicle controller.

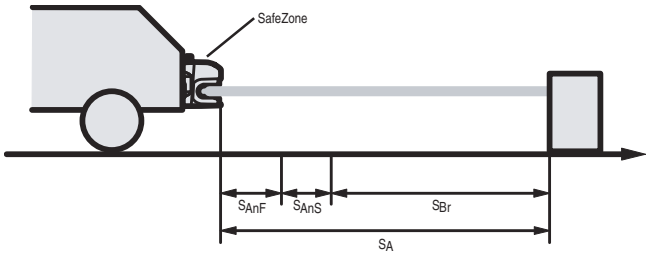


Figure 30: Stopping distance

IMPORTANT	Take into account that the braking distance for a vehicle is not linear with increasing velocity, but increases in a square function.

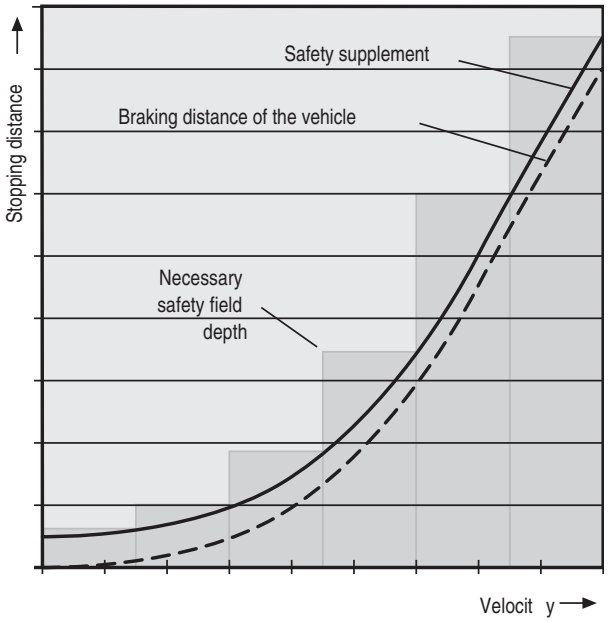


Figure 31: Braking distance as a function of the vehicle velocity

Calculation of the stopping distance:

➡ Calculate the stopping distance using the formula:
$S_A = S_{Br} + S_{AnF} + S_{AnS}$

Where...

S_{Br}	=	Braking distance from the vehicle documentation
S_{AnF}	=	Distance covered during the response time of the vehicle controller from the vehicle documentation
S_{AnS}	=	Distance covered during the response time of the safety laser scanner

Distance covered during the response time of the safety laser scanner

The distance covered during the response time of the safety laser scanner depends on

- The response time of the safety laser scanner.
- The maximum velocity of the vehicle in your mobile application.

The response time T_S of the SafeZone multizone safety laser scanner depends on

- The multiple sampling used.

See Section 11.2 “OSSD response times” on page 42.

Calculation of the distance covered during the response time of the safety laser scanner:

➡ Calculate the distance using the formula:
$S_{AnS} = T_S \times V_{max}$

Where...

= Response time of the safety laser scanner

V_{max} = Maximum velocity of the vehicle from the related vehicle documentation

Supplement Z_R for measurement error related to reflection

With retroreflectors in the background at a distance of less than 1 m from the boundary of the protective safety field, the supplement Z_R is 200 mm.

Supplement due to lack of ground clearance

This supplement is necessary because a person is generally detected above the foot and the braking action can therefore not take into account the length of the foot in front of the detection point. If a vehicle has no ground clearance, a person need additional protection at foot level.

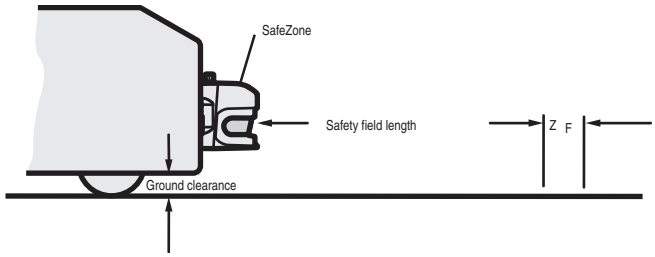


Figure 32: Supplement due to lack of ground clearance

➡ The supplement for foot space below 120 mm is 150 mm. If you wish to further reduce this supplement, read the supplement necessary from the following diagram:

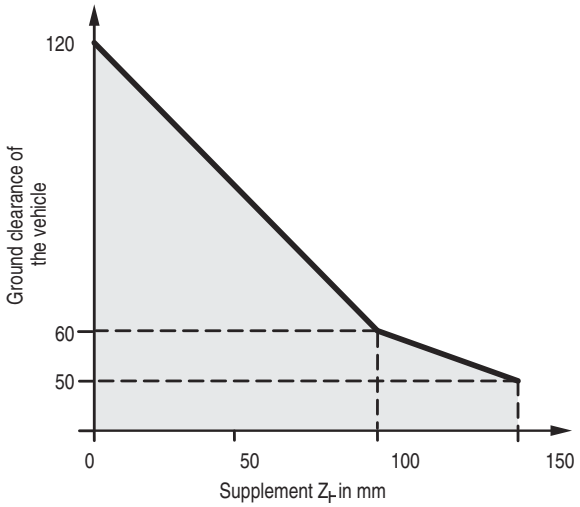


Figure 33: Diagram of ground clearance of the vehicle

4.4.2 Protective safety field width

The width of the protective safety field must take into account the width of the vehicle, the supplements for the measurement error and the lack of ground clearance.

Calculation of the protective safety field width:

➡ Calculate the protective safety field width SB using the formula:
$S_B = F_B + 2 \times (Z_G + Z_R + Z_F)$

Where...

F_B = Vehicle width

Z_G = General safety supplement = 100 mm

Z_R = Supplement for any measurement error of the SafeZone multizone safety laser scanner related to reflection

Z_F = Supplement for any lack of ground clearance of the vehicle

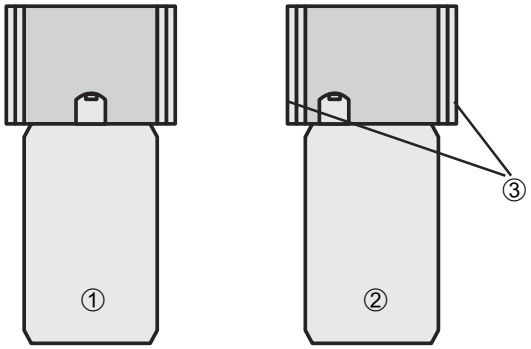


Figure 34: Protective safety field width

Note: Normally, an installer will mount the SafeZone safety laser scanner in the middle of the vehicle ①. If this is not the case, then you must define the protective safety field asymmetrically ②. (The SCD represents the fields as they appear in the monitoring on the scanner.) Ensure that there are supplements on the right and left of the vehicle ③.

4.4.3 Height of the scan plane

ATTENTION

Mount the SafeZone safety laser scanner such that the scan plane is at a maximum height of 200 mm.

Any item lying flat on the floor will be reliably detected. Tilting the protective safety field, which will result in objects with a diameter of 200 mm not being detected, is not allowed. We recommend aligning the scan plane at 150 mm.

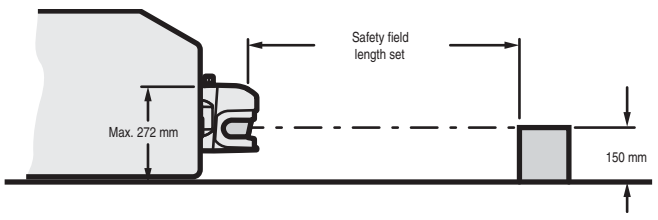


Figure 35: Mounting height

4.4.4 Methods of preventing unprotected areas

When the SafeZone safety laser scanner is mounted on a plane surface, there are areas in front of the mounting surface that are not covered by the safety laser scanner.

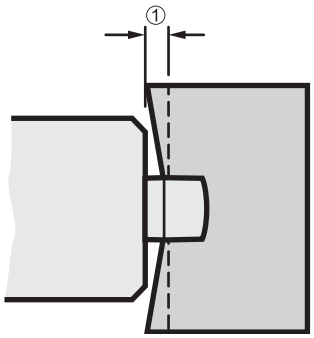


Figure 36: Unprotected areas for mobile applications

These unprotected areas ① become larger if you mount the SafeZone safety laser scanner using mounting kits.

Table 11: Unprotected areas

Mounting Method	Size of the Unprotected Areas
Direct mounting	109 mm
With mounting kit 1	112 mm
With mounting kit 1 and 2	127 mm
With mounting kit 1, 2 and 3	142 mm

ATTENTION 	Secure the unprotected areas. If a vehicle is accelerated to a maximum velocity of 0.3 m/s in less than three seconds when in operation, you must prevent personnel from entering the unprotected areas by means of mechanical trim panels, switch strips or fitting the SafeZone safety laser scanner in the vehicle trim panels.

Fitting in the vehicle trim

Build the SafeZone safety laser scanner into the vehicle trim such that the unprotected areas are ≤ 70 mm and the SafeZone safety laser scanner projects a maximum of 109 mm beyond the front of the vehicle. The vehicle may then be accelerated to a velocity of 0.3 m/s within a second.

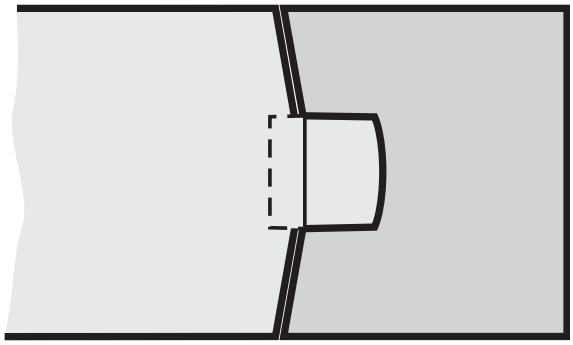


Figure 37: Fitting the SafeZone safety laser scanner in the vehicle trim

Additionally, protect the area near to the scanner (5 cm wide area in front of the front screen) using a proximity switch with 5 cm acquisition range. Otherwise make the area near the scanner impassable with a bar or a recess. The vehicle may then be accelerated as required.

IMPORTANT	Note that the system must be fitted e.g. in a trim panel without impairing the optical beam path. The attachment of an additional front screen is thus not permitted. Any slot for the field of view must be adequately sized (see Fig. 69 in Section 11.5 "Dimensional drawings" on page 50).

Recommendation If, when observing all necessary safety precautions, you are able to avoid the use of a restart interlock, you will increase the availability of your vehicle.

4.5 Timing for monitoring case switching

If you switch between several monitoring cases, along with the safety distance to the dangerous state there is a further safety-relevant aspect that you must address.

If you can switch within 10 or 20 ms, the chosen protective safety field is available within the response time of the SafeZone safety laser scanner. For this reason you can initiate the switching at the time at which you actually want to switch from one monitoring case to the other.

However, you must advance the timing of the switching if you

- Have entered an input delay for your switching method (see "Input delay" on page 17).
- Control external OSSDs instead of the internal OSSDs The following diagram shows the relationships:

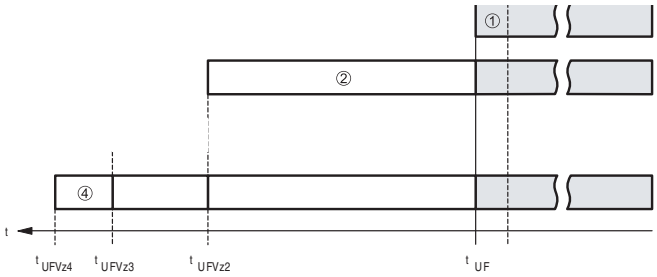


Figure 38: Advancement for the switch timing

- If the input conditions are present at the control inputs within 10 or 20 ms (cf. ①), the timing for the switching (tUF) does not need to be advanced.
- If an input delay for the control inputs needs to be taken into account (cf. ②), the timing for the switching $_{(tUFVz2)}$ must be advanced by the input delay.
- If external OSSDs are used, the timing for the switching $_{(tUFVz4)}$ must be further advanced by 20 ms (cf. (④).

ATTENTION	Define the timing for the switching such that the SafeZone safety laser scanner already detects a person in the protective safety field before the dangerous state occurs. At the time of the switching there may be personnel in the protective safety field. Only by means of switching in the correct time frame (i.e. before the hazard occurs at this point for the person) is protection provided.
IMPORTANT	In the phases before and after the switching, the safety distances calculated for the individual monitoring cases apply on their own. The considerations above serve only for the selection of the optimal timing of the switching. If the timing for the switching cannot be exactly defined, e.g. due to the variable processing speed of the machine, or if advancing of the timing results in premature termination of the monitoring of the initial area, you must → → Have both hazardous areas monitored temporarily using simultaneous monitoring.

The following figure shows an example for a gantry robot that is protected using two monitoring cases.

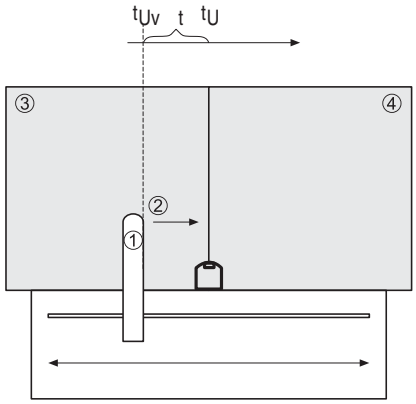


Figure 39: Example of advancing the timing for the switching

The gantry robot ① moves to the right ②. On the left hand side the dangerous movement is monitored by a monitoring case ③. When the gantry robot arrives at the point $_{tUv,}$ switching must have already been performed due to the advancing of the switching necessary so that at time t_U the right monitoring case ④ is active.

Note: For the movement to the left, that is for the switching to the monitoring case ③, the same applies.

How far you must advance the timing for the switching depends on

- The input delay your switching method requires to provide the input condition for case switching (see "Input delay" on page 17).

4.6 Mounting steps

IMPORTANT	Special features to note during mounting: Mount the SafeZone safety laser scanner such that it is protected from moisture, dirt and damage. Ensure that the front screen field of view is not restricted. Mount the scanner such that the indicators are easy to see. Always mount the SafeZone safety laser scanner such that you can plug in and remove the system connection. Avoid excessive shock and vibration loading on the safety laser scanner. On applications that suffer from heavy vibration, prevent the mounting screws from coming loose using screw locking devices. Regularly check the tightness of the mounting screws. Prevent personnel from being able to crawl beneath, stand behind or climb over the protective safety field by means of appropriate mounting of the SafeZone safety laser scanner.

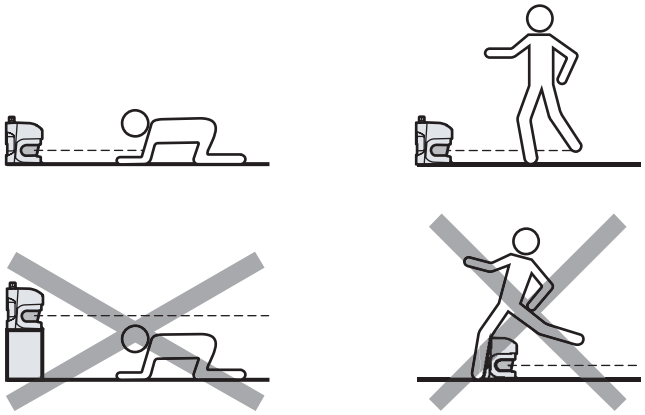


Figure 40: Prevent crawling beneath, standing behind, climbing over

The origin of the scan plane is 63 mm above the bottom edge of the SafeZone safety laser scanner. If you mount the SafeZone safety laser scanner using mounting kit 3, then the origin of the scan plane is 102 mm above the bottom edge of mounting kit 3 (see Section 11.5.3 “Scan plane origin” on page 51).

There are four possible ways of mounting the SafeZone safety laser scanner:

- Direct mounting without mounting kit
- Mounting with mounting kit 1
- Mounting with mounting kit 1 and 2
- Mounting with mounting kit 1, 2, and 3

The mounting kits build one on another. For mounting with kit 2 you will therefore also need kit 1. For fixing with mounting kit 3 you will therefore also need mounting kits 1 and 2. You will find the part numbers for the mounting kits in Section 12.2 “Accessories and replacement parts” on page 53.

IMPORTANT	Observe the maximum torque of the fastening hardware for the SafeZone M6 on rear = 12 km max M8 on side = 16 km max

Direct mounting

The SafeZone safety laser scanner has four threaded holes M6 x 8 on its rear face. Using these holes you can directly mount the SafeZone safety laser scanner by drilling through the mounting surface from the rear.

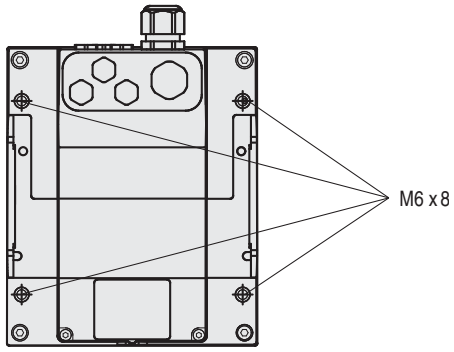


Figure 41: Threaded holes for direct mounting

Recommendation	Use mounting kit 1. This will make the device easier to remove.

4.6.2 Mounting with mounting kit 1

With the aid of mounting kit 1 you can mount the SafeZone safety laser scanner indirectly on the mounting surface. This is always necessary if you cannot drill through the mounting surface from the rear.

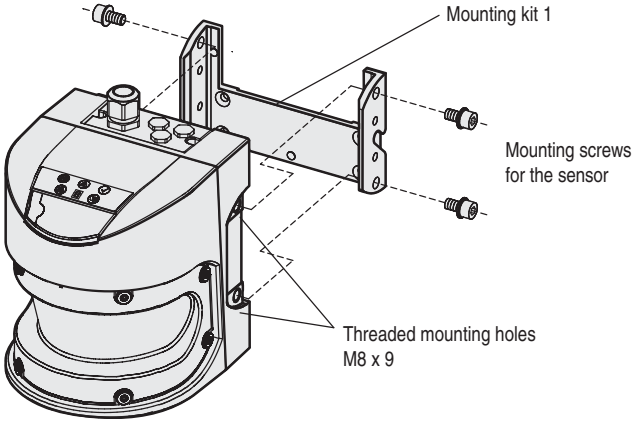


Figure 42: Mounting with mounting kit 1

➡ Mount kit 1 on the mounting surface.

➡ Mount the SafeZone safety laser scanner on mounting kit 1.

4.6.3 Mounting with mounting kit 2

With the aid of mounting kit 2 (only in conjunction with mounting kit 1) you can align the SafeZone safety laser scanner in two planes. The maximum adjustment angle is ±11° in both planes.

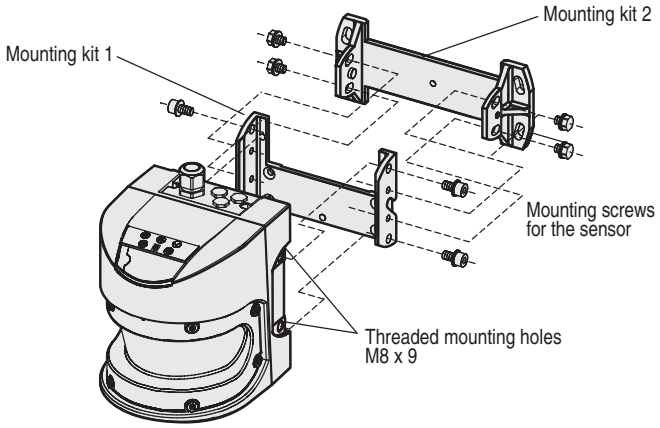


Figure 43: Mounting with mounting kit 2

➡ Mount kit 2 on the mounting surface.

➡ Mount kit 1 on mounting kit 2.

➡ Mount the SafeZone safety laser scanner on kit 1.

➡ Adjust the SafeZone safety laser scanner longitudinally and cross-wise.

4.6.4 Mounting with mounting kit 3

With the aid of mounting kit 3 (only in conjunction with mounting kits 1 and 2) you can mount the SafeZone multizone safety laser scanner such that the scan plane is parallel to the mounting surface. This enables stable floor mounting or ensures that mounting kit 2 remains precisely adjustable cross-wise on uneven wall surfaces.

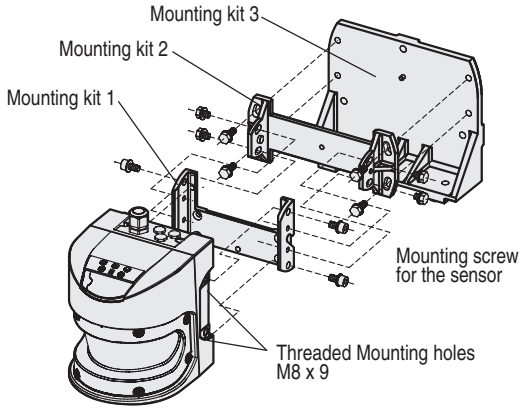


Figure 44: Mounting with mounting kit 3

➡ Mount kit 3 on the mounting surface.

➡ Mount kit 2 on kit 3.

➡ Mount kit 1 on kit 2.

➡ Finally mount the SafeZone safety laser scanner on mounting kit 1.

➡ Adjust the SafeZone safety laser scanner longitudinally and cross-wise.

IMPORTANT	During mounting, please observe the dimensional drawings in "Technical specifications" (see Section 11.5 "Dimensional drawings" on page 50).

4.6.5 Adhesive label Important information

➡ On completion of mounting, you must affix the self-adhesive label Important information supplied with the SafeZone safety laser scanner:

- Use only the information label in the language which the operators of the machine understand.
- Affix the label such that it is clearly visible for the users/ operators during operation. The label must not be covered even after additional items have been mounted.

4.6.6 Using multiple SafeZone safety laser scanners

The SafeZone safety laser scanner is so designed that mutual interference between several scanners is unlikely. To completely exclude erroneous switching, you must mount the scanners as shown in the following examples.

IMPORTANT	In all circumstances observe EN 999.

Use the mounting kits 1 to 3 to adjust the scanners to different angles (see Section 12.2 "Accessories and replacement parts" on page 53).

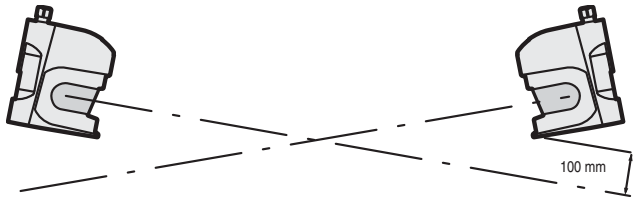


Figure 45: Opposite mounting

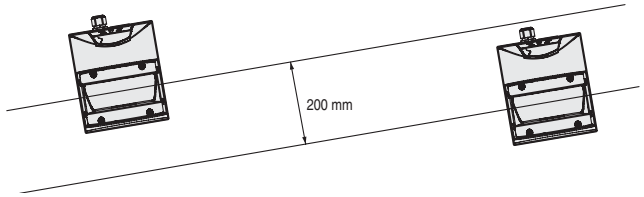


Figure 46: Inclined, parallel mounting

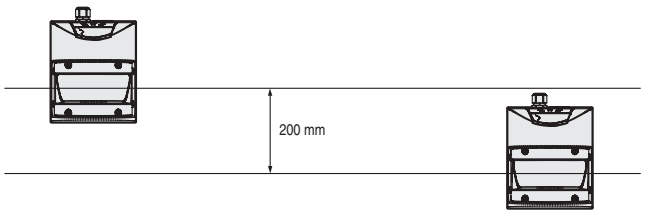


Figure 47: Offset parallel mounting

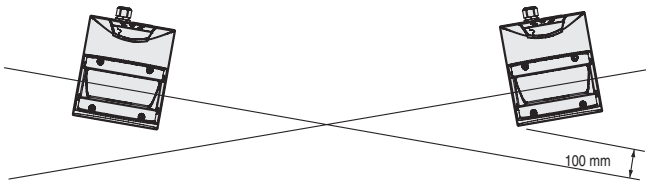


Figure 48: Mounting on a cross

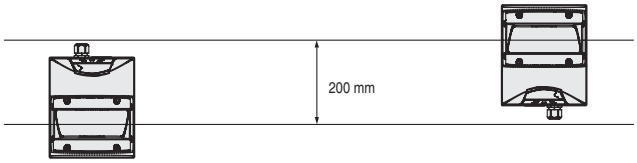


Figure 49: Reverse mounting, parallel

Section 5 — Electrical Installation

ATTENTION 	Switch the entire machine/system off line. The machine/system could inadvertently start up while you are connecting the devices. Ensure that the entire machine/system is disconnected during the electrical installation.

IMPORTANT	Route all cables and connection cables such that they are protected from damage. If you use the SafeZone safety laser scanner for the protection of hazardous areas: Ensure that any control systems or other devices forming part of the safety installation meet the stipulated control category. Ensure that the SafeZone safety laser scanner is adequately protected electrically. You will find the electrical data necessary for determining the correct fuse in Section 11.4 “Data sheet” on page 45.

The electrical connections for the SafeZone safety laser scanner are made at the system connector. It contains connections for the inputs, outputs and the supply voltage. You can either make connections directly to the terminal strip on the system connector or use a pre-assembled system connector from Rockwell (see Section 5.3 “Pre-assembled system plugs” on page 33).

5.1 System connection

All input and output connections for the SafeZone safety laser scanner are located on the system connector. This comprises of a 30-pin screw terminal connector and is located in the system connector.

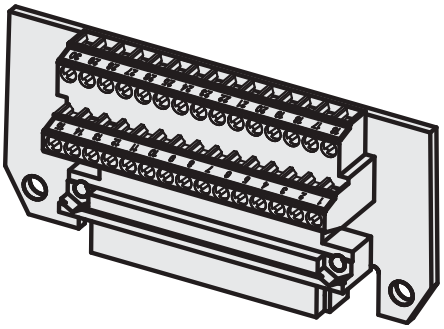


Figure 50: Screw terminal strip on the system plug

ATTENTION 	If the cable fitting is missing or not tightened, or if mounting screws are missing or not tightened on the system connector, the IP65 enclosure rating is not met. All inputs and outputs for the SafeZone safety laser scanner are to be used only in the context specified.

5.1.1 Pin assignments of the I/O modules

Pin	Signal	Function	SafeZone Singlezone	SafeZone Multizone
1	+24V DC	Supply voltage SafeZone Multizone	X	X
2	0V DC	Supply voltage SafeZone Multizone	X	X
3	OSSD1	Output signal switching device	X	X
4	OSSD2	Output signal switching device	X	X
5	RESET	Input, reset	X	X
6	EDM	Input, external device monitoring	X	X
7	ERR	Application diagnostic output~error/	X	X
8	RES_REQ	Output, reset required	X	X
9	WF	Output, object in warning field	X	X
10	A1	Static control input A		X
11	A2	Static control input A		X
12	B1	Static control input B		X
13	B2	Static control input B		X
14		Reserved—Do not use		
15		Reserved—Do not use		
16	+24V DC	Supply voltage output		
17	GND			
18		Reserved—Do not use		
19		Reserved—Do not use		
20	+24V DC	Supply voltage output		
21	GND			
22		Reserved—Do not use		
23		Reserved—Do not use		
24				
25	RxD	RS-422 interface for output of measured data		
26	RxD+			
27	TxD+			
28	TxD			
29		Reserved—Do not use		
30		Reserved—Do not use		

5.2 System connector assembly

The system plug has holes on the top and rear. Suitable cable glands for these holes are included with the device.

- One cable gland with M20 cable fitting
- Two blanking plugs for the unused outlets

Note: You can also purchase the SafeZone multizone safety laser scanner with pre-assembled system connectors (see Section 5.3 “Pre-assembled system connector” on page 33 and Section 12 “Ordering information” on page 52).

ATTENTION



The length of the spare cable should be such that the system plug cannot inadvertently be plugged into a neighboring SafeZone safety laser scanner.

From experience 20 to 30 cm spare cable at the scanner have proven to adequate. In this way you avoid the inadvertent connection of the system connector to an adjacent SafeZone safety laser scanner and operation of a SafeZone safety laser scanner with an incorrect configuration. The spare cable enables you to easily change out the SafeZone safety laser scanner.

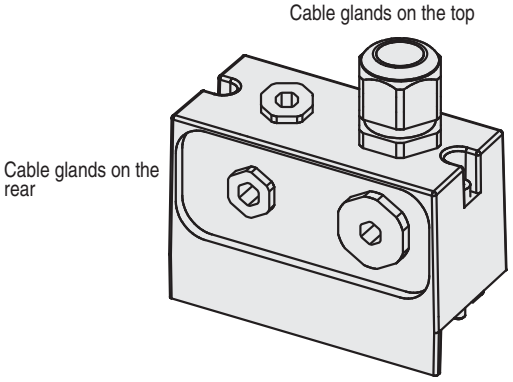


Figure 51: System connector for SafeZone safety laser scanner

Depending on the application use suitable cable glands on the top or rear.

Cable Gland	Cable Diameter [mm	Usage
M20	6…12 (0.24…0.47)	• System cables (supply voltage, outputs, static
M12 (only if supplied)	3…6.5 (0.12…0.26)	• Control switch for restart or reset • RS-422 data cables

Use the following cable cross-sections for the individual connections:

Cable	Recommended Cable	Shielded
System cables (supply voltage, outputs, static input)	9…13 conductors, 0.5…1 mm^2	No
Control switch for restart or reset	2 x 0.25 mm^2	No
RS-422 data cables	4 x 0.25 mm^2	Yes

Recommendation If you do not want to assemble the system connector yourself, you will find suitable cables in the ordering information (see Section 12 "Ordering information" on page 52).

5.3 Pre-assembled system connectors

The following pre-assembled system connector with cable outlet on the top are available for the connection of the SafeZone multizone safety laser scanner (see also Section 12 "Ordering information" on page 52):

Pin	Signal	Wire Color	SafeZone Singlezone	SafeZone Multizone
1	+24V DC	Brown	X	X
2	0V DC	Blue	X	X
3	OSSD1	Grey	X	X
4	OSSD2	Pink	X	X
5	RESET	Red	X	X
6	EDM	Yellow	X	X
7	ERR	White/black	X	X
8	RES_REQ	Red/blue	X	X
9	WF	White/brown	X	X
10	A1	White/red		X
11	A2	White/orange		X
12	B1	White/yellow		X
13	B2	White/green		X
Top mounted cable entries (cable glands to the rear sealed with blanking plugs) are available.				

Section 6 — Application and Circuit Examples

The examples shown are only provided as an aid for your planning. You may need to consider additional protection measures for your application.

In the examples with protective safety field switching, note that at the time of the switching there may already be a person in the protective safety field. Only by means of switching in the correct time frame (i.e. before the danger occurs at this point) is reliable protection provided (see Section 4.5 "Timing for monitoring case switching" on page 27).

6.1 Stationary Applications

6.1.1 Applications with one monitored area (SafeZone safety laser scanner)

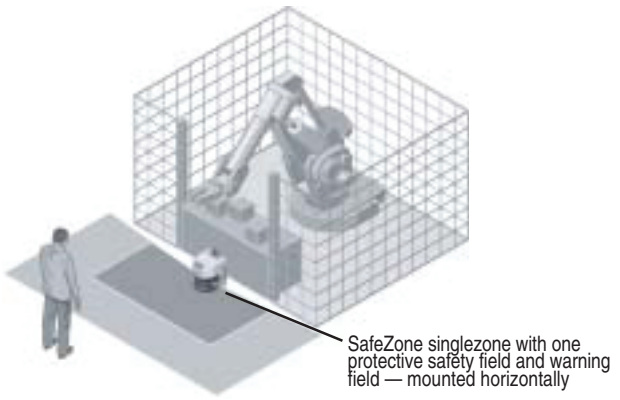


Figure 52: Hazardous area protection with SafeZone singlezone safety laser scanner

The area is permanently monitored by the SafeZone singlezone safety laser scanner.

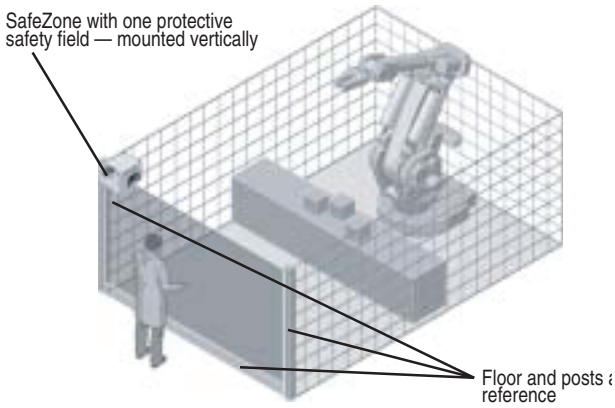


Figure 53: Access protection with SafeZone safety laser scanner

The access is monitored permanently. For safety against manipulation of the SafeZone safety laser scanner the floor is used as a reference. If the position of the SafeZone safety laser scanner changes (e.g. due to change to the mounting), the SafeZone safety laser scanner shuts down.

6.1.2 Applications with multiple monitored areas (SafeZone multizone safety laser scanner)

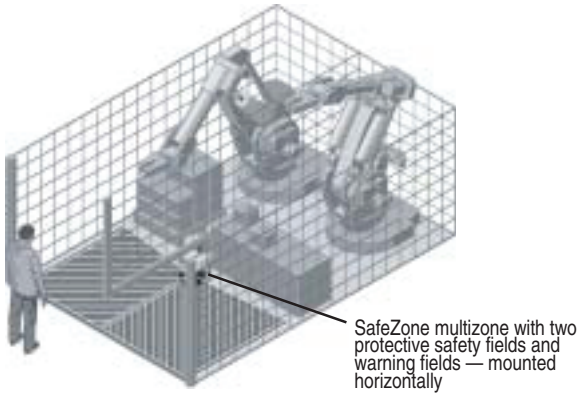


Figure 54: Hazardous area protection with SafeZone multizone safety laser scanner

The two areas to be monitored are switched using the static control inputs depending on the phase of the process on the machine. For example the area ① or the area ② can be monitored, both areas can be monitored or none.

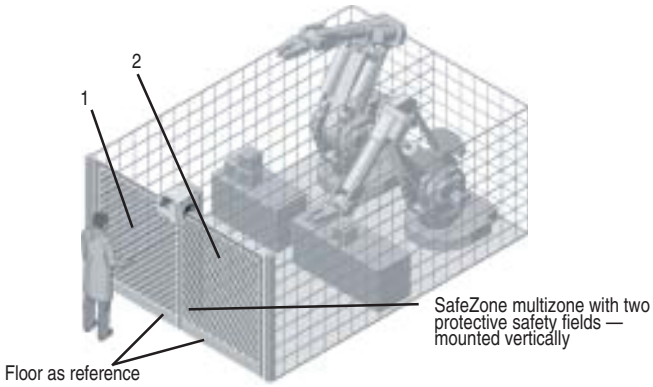


Figure 55: Access protection with SafeZone multizone safety laser scanner

The two areas to be monitored are switched using the static control inputs depending on the process phase. For example the area ① or the area ② can be monitored, both areas can be monitored or none. For safety against manipulation on the SafeZone multizone safety laser scanner, e.g. the floor is used as a reference in each case. If the position of the SafeZone multizone safety laser scanner changes (e.g. due to change to the mounting), the SafeZone multizone safety laser scanner shuts down.

6.2 Mobile applications

6.2.1 Vehicle monitoring for unidirectional travel (SafeZone safety laser scanner)



Figure 56: Vehicle monitoring with SafeZone safety laser scanner

The SafeZone safety laser scanner monitors the area in one direction of travel and stops the vehicle as soon as there is an object in the protective safety field.

6.3 Example circuits

IMPORTANT	Only use relays with positively-driven contacts. The protection elements connected in parallel with the contactors are used for arc-suppression. Ensure that there is adequate arc-suppression at the relay contacts. Take into account that arc-suppressors may lengthen the response time.

Sketch key

- 1) = output circuits
  These contacts are to be connected to the controller such that, with the output circuit open, the dangerous state is disabled. For categories 3 and 4 in compliance with EN 954-1, the interfacing must be two-channel (x-/y paths). Observe the maximum values for the loading of the outputs (see Section 11.4 “Data sheet” on page 45).
- H2 = indication for error/contamination
- H3 = indication for waiting for restart
- H8 = indication for warning field interruption

6.3.1 Restart interlock and external device monitoring

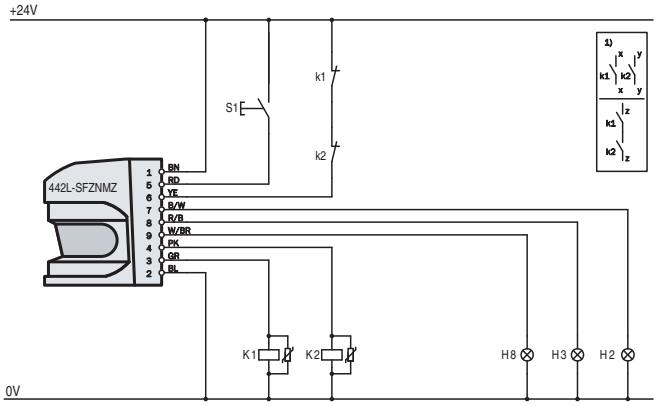


Figure 57: Example circuits for restart interlock and external device monitoring

SafeZone safety laser scanner in conjunction with relays/contactors; operating mode: with restart interlock and external device monitoring.

6.3.2 Protective safety field switching with two static inputs

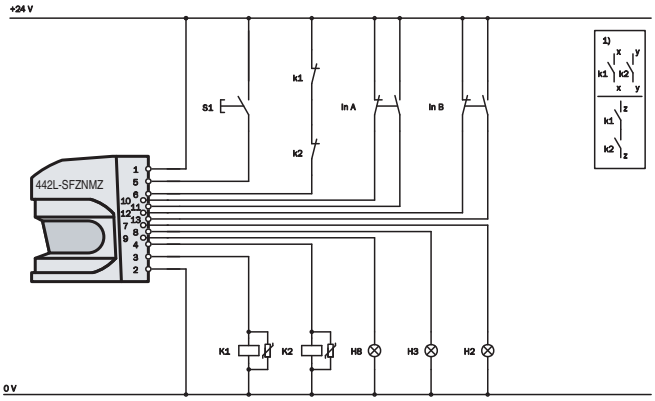


Figure 58: Example of circuit for protective safety field switching using the static input

SafeZone safety laser scanner in conjunction with relays/contactors; operating mode: with restart interlock and external device monitoring; protective safety field switching by means of control input A (In A) and B (in B).

Section 7 — Configuration

7.1 Default delivery status

The SafeZone safety laser scanner is delivered in a safe default status.

- The device status is Waiting for configuration.
- Thus the switching outputs (OSSDs) are deactivated (the red LED illuminates: STOP ●).
- The 7-segment display indicates 6.

7.2 Preparation of the configuration

How to prepare the configuration:

➡ Make sure that the safety laser scanner has been correctly mounted and that the electrical connections are correct and in place.

➡ Have the necessary tools at hand.

To configure the safety laser scanner you need:

- SCD Software CD
- Installation manual for SafeZone safety laser scanner on CD
- PC/notebook with Windows 9x/NT 4/2000 Professional/ME/XP and an serial RS-232 interface (PC/notebook not in the scope of delivery)
- 442L-ACRS232 connection cable for connecting PC and SafeZone safety laser scanner (not in the scope of delivery)

Configuring the SafeZone safety laser scanner with the aid of the SCD software:

For configuration and diagnostics using the SCD software, connect the PC to the configuration connection.

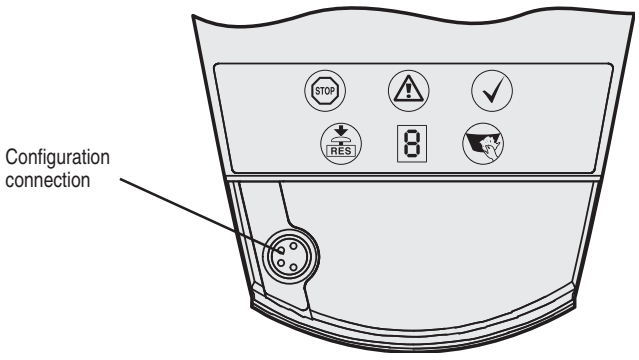


Figure 59: Configuration connection

IMPORTANT	Avoid adverse effects of EMC on the configuration cable. Ensure that the configuration cable is not put in close proximity to high power electrical drives or cables carrying high power.

To configure the device, please read the user manual for the SCD software and use the online help function of the program.

Section 8 — Commissioning

8.1 Initial commissioning

ATTENTION	
	Commissioning requires a thorough check by qualified personnel. Before operating a system protected by the SafeZone safety laser scanner for the first time, make sure that the system is first checked and approved by qualified personnel. Please read the notes in Section 2 "On safety" on page 4. Prior to approving the machine, check whether the access to the hazardous area is completely monitored by the protective devices. Check also at regular intervals after approval of the machine (e.g. in the morning at the start of work) as to whether the SafeZone safety laser scanner correctly switches the OSSDs as soon as there is an object in the protective safety field. This test should be performed along all protective safety field boundaries as per the specific regulations for the application (see Section 8.2 "Test notes" on page 36).

8.1.1 Power up sequence

After power up, the SafeZone safety laser scanner runs through the power up cycle. During the power up cycle, the 7-segment display indicates the device status.

During the initial commissioning of a SafeZone safety laser scanner the following indications are possible:

Table 16: 7-segment display during and after the power up sequence on initial commissioning

Step	Display	Meaning
1		Power-up cycle, testing the 7-segment display. All segments are activated sequentially.
2		Power up cycle, during initial commissioning: device in configuration mode
	Other display	Safety lock activated. Malfunction in external conditions or in the device itself. See Section 10.4 "Errors displayed by the 7-segment display" on page 41.

Table 17: LED indication after the power up sequence

Display					Meaning
					
l	m	m	m	m	Power-up cycle, step 1
l	l	l	l	m	Power-up cycle, step 2
l	m	m	m	m	Power-up cycle, step 3 Device status Waiting for configuration or Object in the protective safety field, OSSDs
Other display					Safety lock activated. Malfunction in the external conditions or in the device itself (see Section 10.3 "Indications and error messages"

IMPORTANT	
	The duration of power up depends on the volume of the configuration data and can take up to 20 seconds.

8.2 Test notes

8.2.1 Pre-commissioning tests

The purpose of the pre-commissioning tests is to confirm the safety requirements specified in the national/international rules and regulations (EC Conformity). This applies particularly to the safety requirements in the machine directive or work equipment directive.

ATTENTION	
	Ensure that you do not place anybody at risk during initial commissioning of the machine. As a general commissioning concern, always expect that the machine, equipment or the protective device does not yet behave as you have planned.

- ➡ Ensure that there are no persons in the hazardous area during initial commissioning.
- ➡ Check the effectiveness of the protective device mounted to the machine, using all selectable operating modes as specified in the checklist in the annex (see Section 13.1 "Manufacturer's checklist" on page 54).
- ➡ Make sure that the operating personnel of the machine protected by the safety laser scanner are properly instructed by specialist personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine owner.
- ➡ Ensure that the adhesive label "Important information," which is included with the scanner on delivery, is affixed to the machine in a place where it is clearly visible for the operators. Ensure that the operators have the possibility to perform this daily check correctly.
- ➡ The annex to this document includes a checklist for review by the manufacturer and OEM. Use this checklist as a reference prior to commissioning for the first time (see Section 13.1 "Manufacturer's checklist" on page 54).
- ➡ Document the adjustment of the scanner and the results of the testing during initial commissioning in a traceable manner. For this purpose also print out the complete configuration of the scanner (including

protective safety field shapes) and include these with the documentation.

8.2.2 Regular inspection of the protective device by qualified personnel

➡ Check the system following the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device after the first commissioning are detected.

➡ If major changes have been made to the machine or the protective device, or if the safety laser scanner has been modified or repaired, check the equipment again as per the checklist in the annex (see Section 13.1 "Manufacturer's checklist" on page 54).

8.2.3 Daily testing of the protective device by a specialist or authorized personnel

The effectiveness of the protective device must be checked daily by a specialist or by authorized personnel. The test must also be performed if the operating mode is changed.

ATTENTION	
	No further operation if errors occur during the test. If any one of the following points is not met, it is not permitted to continue to work on the machine or operate the vehicle. In this case the installation of the SafeZone multizone safety laser scanner must be checked by specialized personnel (see Section 8.2.2 "Regular inspection of the protective device by qualified personnel" on page 37).

➡ The test must be carried out for the relevant preset monitoring case.

➡ Check the mechanical installation to ensure that all mounting screws are secure and that the SafeZone safety laser scanner is properly aligned.

➡ Check each SafeZone safety laser scanner device for visible changes such as damage, manipulation etc.

➡ Switch on the machine/equipment.

➡ Watch the LEDs on each SafeZone safety laser scanner.

➡ If at least one LED is not permanently lit when the machine/equipment is switched on, it is to be assumed that there is a fault in the machine or equipment. In this case the machine must be shut down immediately and checked by a specialist.

➡ Deliberately obstruct the protective safety field without risk to any personnel while the machine is running in order to test the effectiveness of the entire system.

The LEDs of the SafeZone safety laser scanner device must change from green to red and the hazardous movement must stop immediately.

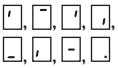
Repeat this test at different points in the danger area and on all SafeZone multizone safety laser scanner devices. If you discover any non-conformance of this function, the machine/equipment must be shut down immediately and checked by a specialist.

➡ For stationary applications, check that the danger area marked out on the floor matches the shape of the protective safety field stored in the SafeZone safety laser scanner and that any gaps are protected by additional protective measures. In the case of mobile applications, check that the moving vehicle actually stops at the field limits which are set in the SafeZone safety laser scanner and listed on the information label in the vehicle or in the configuration protocol. If you discover any non-conformance of this function, the machine/equipment/vehicle must be stopped immediately and checked by a specialist.

8.3 Re-commissioning

If the SafeZone safety laser scanner has previously been commissioned, but the device replaced, the SafeZone safety laser scanner automatically reads the saved configuration from the system connector. In this way acceptance by a specialist is not necessary. However, the test in accordance with the regulations for the daily test must be performed (see Section 8.2.3 "Daily testing of the protective device by a specialist or authorized personnel" on page 37).

When you place a configured SafeZone safety laser scanner (e.g. after replacement of the sensor head) back into operation, the following indications are possible:

Step	Display	Meaning
1		Power-up cycle, testing the 7-segment display. All segments are activated sequentially.
2		Power up cycle, during initial commissioning: Devices in configuration mode
3		Waiting for partner device on the Bus connection (future functionality)
4		Waiting for valid inputs
5	No display	The device is operational.
	Other display	Safety lock activated. Malfunction in external conditions or in the device itself. See Section 10.4 "Errors displayed by the 7-segment display" on page 41.

Display					Meaning
					
l	m	m	m	m	Power-up cycle, step 1
l	l	l	l	m	Power-up cycle, step 2
l	m	l	m	m	The device is operational, object in protective safety field and warning field.
m	m	l	m	l	Or: The device is operational, object in warning field.
m	m	m	m	l	Or: The device is operational, no object in protective safety field and warning field.

l	l	m	m	m	Or: The device is operational, no object in protective safety field and warning field.
Other display					Safety lock activated. Malfunction in the external conditions or in the device itself (see Section 10.3 "Indications and error messages"

Section 9 — Care and maintenance

ATTENTION 	Do not make any repairs to the device. The SafeZone safety laser scanner does not contain any repairable components. For this reason do not open the SafeZone safety laser scanner components and only replace the parts that are described in the following sections as replaceable. Switch the entire machine/system off line. The machine/system could inadvertently start up while you are changing the front screen. As a matter of principle, always isolate the machine from the power supply during all work on the machine and safety laser scanner.

9.1 Cleaning the front screen

The SafeZone safety laser scanner is maintenance-free. The front screen on the safety laser scanner should however be regularly cleaned and also if contaminated:

- Do not use aggressive detergents.
- Do not use abrasive cleaning agents.

IMPORTANT	Static charges cause dust particles to be attracted to the front screen. You can diminish this effect by using an antistatic plastic cleaner.

Cleaning the front screen:

➡ Use a clean and soft brush to remove dust from the front screen.

➡ Next, wipe the front screen with a clean and damp cloth.

9.2 Replacing the front screen

If the front screen is scratched or damaged, you must replace it. Order the replacement front screen from Rockwell (see Section 12.2 "Accessories/ spare parts" on page 53).

IMPORTANT	➡ The front screen on the SafeZone safety laser scanner is an optical part that must not be contaminated or scratched. ➡ The front screen is only allowed to be replaced by specialist personnel in a dust- and dirt-free environment. ➡ Never replace the front screen during operation as dust particles could enter the device. ➡ It is imperative that you avoid contamination of the inside of the front screen, e.g. with fingerprints. ➡ Do not use any additional sealant for sealing the front screen, e.g. silicon, as the vapors produced may damage the optics. ➡ Mount the front screen as per the following instructions to ensure that the housing is sealed to IP65.

Replacement of the front screen:

➡ Disconnect the system connector and remove the SafeZone safety laser scanner.

➡ Take the SafeZone safety laser scanner to a clean place (office, repair shop or similar).

➡ First clean the outside of the SafeZone safety laser scanner. This prevents foreign bodies entering the device when it is opened.

➡ Undo the mounting screws ① to ⑧ for the front screen.

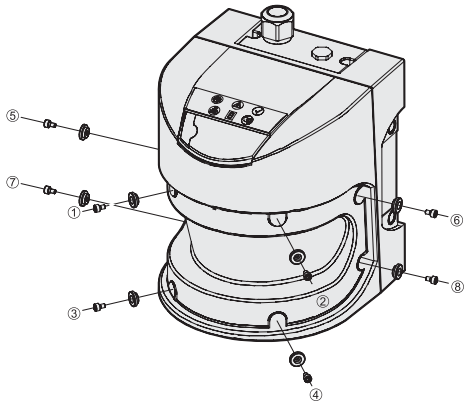


Figure 60: Removing the mounting screws for the front screen

➡ Next, remove the old front screen and the old rubber seal.

➡ Remove any dirt from the seal groove and the mating face on the sensor head. For this purpose if possible use a plastic cleaner that does not leave residues (see Section 12.2 "Accessories/spare parts" on page 53).

Recommendation If necessary smear a thin coating of vaseline in the seal groove. This makes mounting easier.

➡ Insert the new seal ①—starting in the middle. During this process first align the center markings on the sensor head (② and ③) and seal (④ and ⑤).

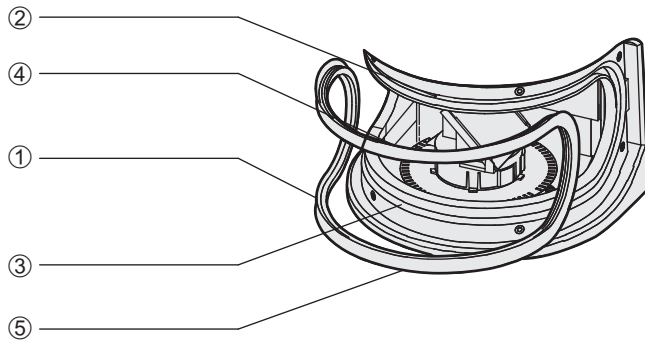


Figure 61: Inserting the rubber seal

IMPORTANT	If the front seal is not inserted correctly, the front screen may be damaged. Do not use any pointed or sharp tools.

➡ First place the seal only lightly in the rounded sections of the seal groove. In this way you will avoid stretching the seal.

➡ Only then press the seal home. The seal should not be stretched on insertion.

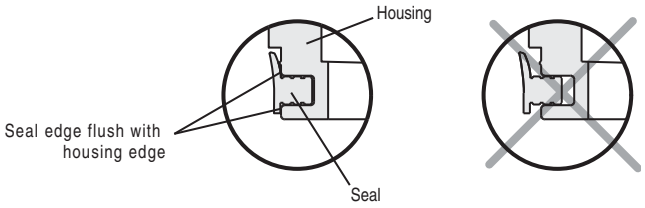


Figure 62: Depth for pressing in the seal

The seal is pressed in far enough when the edge of the seal and the sensor head are flush.

➡ It is necessary to check that the seal is seated evenly all the way around the groove.

➡ Check whether the mirror on the motor is clean and remove any contamination with an optic brush.

➡ Set a torque wrench to 0.7 N•m or 6.2 in•lbf (hand-tight) for the use of installing screws.

➡ Take the new front screen from the packaging.

➡ Remove any remnants of packaging.

➡ Place the front screen on the rubber seal and insert the new mounting screws ① to ④ with spacers (see Figure 61).

➡ Press the front screen on the front of the cover. During this process tighten the front screens ① to ④ to the torque set.

➡ Then insert the rest of the screws ⑤ to ⑧ with spacers (see Figure 61) and tighten using the torque wrench.

ATTENTION	Always perform a front screen calibration with the aid of the SCD software after the replacement of the front screen. The level of contamination is measured continuously during the operation of the SafeZone safety laser scanner. For this purpose the front screen calibration must first be performed; this then serves as a reference for the contamination measurement (status = not contaminated). The front screen calibration may only be performed immediately after the replacement of the front screen.

Device symbol SafeZone multizone safety laser scanner, command Service, Front screen calibration.

The new front screen must be free of contamination at the time of the front screen calibration. The front screen calibration should be performed at room temperature (10...30°C (50...86°F)).

Re-commissioning the SafeZone safety laser scanner:

➡ Re-mount the SafeZone safety laser scanner correctly (see Section 4 "Installation and mounting" on page 18).

➡ Connect the SafeZone safety laser scanner system connector. After power up the SafeZone safety laser scanner automatically reads the saved configuration from the system connector (see Section 8.3 "Re-commissioning" on page 37).

9.3 Replacing the I/O module

IMPORTANT	➡ The I/O module is only allowed to be replaced by specialist personnel in a clean environment. ➡ Mount the I/O module as per the following instructions to ensure that the housing is sealed to IP65.

ATTENTION	While replacing the I/0 module, the equipment may start inadvertently. Switch the entire machine/system off line. As a matter of principle, always isolate the machine from the power supply during all work on the machine and safety laser scanner.

IMPORTANT	When the I/O module is dismantled, advanced electronic components are accessible. Protect these from electrostatic discharge, contamination and moisture.

- If possible use anti-static floor mats and workbench covers.
- When working on the SafeZone safety laser scanner, touch a bare metal surface from time to time to discharge static charging of your body.
- Only remove the components for the SafeZone safety laser scanner from their anti-static packing immediately prior to installation.
- Note that no liability can be accepted for damage caused by electrostatic discharge.

Replacing the I/O module:

- Disconnect the system connector and remove the SafeZone safety laser scanner.
- Take the SafeZone safety laser scanner to a clean place (office, repair shop or similar).
- First clean the outside of the SafeZone safety laser scanner. This prevents foreign bodies entering the device when it is opened.
- Undo the mounting screws for the I/O module.
- Take hold of the I/O module with one hand at the recess for the connector to the system connection.
- With the other hand take hold of the I/O module at the dismantling aid on the underside of the device.
- Pull out the I/O module parallel to the mounting shaft.
- Remove any contamination from the sealing surface and the mating surface for the sensor head. For this purpose if possible use a plastic cleaner that does not leave residues (see Section 12.2 “Accessories/spare parts” on page 53).
- Remove the I/O module from the packaging, ensure that you take adequate ESD protection measures during this process.
- Check the surfaces for cleanliness and the seal for correct seating.
- Insert the I/O module in the mounting shaft parallel to the rear of the sensor head. During this process use the three surrounding sides of the shaft for orientation.
- Guide the I/O module along these surfaces to the connector. During this process slide the I/O module parallel to the rear of the sensor, avoid tilting. The I/O module can be connected without the need to apply force.
- When the I/O module is flat against the rear of the sensor head (distance approx. 1 N•m or 8.9 in•lbf), tighten the screws in stages, diagonally (to 10...12 N•m or 88.5...106 in•lbf).

Re-commissioning the SafeZone safety laser scanner:

- Correctly re-mount the SafeZone safety laser scanner (see Section 4 “Installation and mounting” on page 18).
- Connect the SafeZone safety laser scanner system connector.

  After power up the SafeZone safety laser scanner automatically reads the saved configuration from the system connector (see Section 8.3 “Re-commissioning” on page 37).

Section 10 — Diagnostics

This section describes how to identify and remedy errors and malfunctions during the operation of the safety laser scanner.

10.1 In the event of faults or errors

ATTENTION	
	If a fault or error is observed, cease operation if the cause of the malfunction has not been clearly identified. Stop the machine, the system or the vehicle if you cannot clearly identify or allocate the error and if you cannot safely remedy the malfunction.

10.2 Rockwell Automation Support

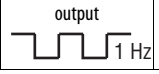
If you cannot remedy an error with the help of the information provided in this section, please contact your local Rockwell representative or technical support.

10.3 Indications and error messages

This section describes the meaning of the indications and error messages and how you can respond. You will find a description of the indicators in Section 3.5 “Indicators and outputs” on page 17, the connections for the outputs in Section 5.1 “System connection” on page 31.

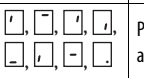
Display	Output Level	Possible Cause
STOP ●	At the OSSDs	Object in the protective safety field, OSSDs deactivated
✓ ●	At the OSSDs	Protective safety field unoccupied, OSSDs activated
⚠ ●	At the warning field output	Object in warning field

Display	Output Level	Possible Cause	Remedying the Error
STOP ○ ✓ ○	OSSDs	No operating voltage, or voltage too low	➡ Check the voltage supply and activate, if necessary.
○	Error/contamination	No error	
○	Application diagnostic output	No supply voltage	➡ Check the voltage supply and activate, if necessary.
●	Application diagnostic output	Front screen contaminated, operation not	➡ Clean the front screen.

	Application diagnostic output 	Front screen contaminated, still in operation	➡ Clean the front screen.
	At the Res_Req output 	Reset required	➡ Operate the control switch for restarting or resetting.

10.4 Errors displayed by the 7-segment display

This section explains the meaning of the error displays on the 7-segment display and how to respond to the messages. You will find a description of the positions and symbols on the SafeZone multizone safety laser scanner in Section 3.5 “Indicators and outputs” on page 17.

Display	Possible Cause	Remedying the Error
	Power-up cycle~all segments are activated sequentially.	No error
	Park mode (see Section “Park mode” on page 16); the OSSDs are deactivated, the laser is shutdown.	No error. Readiness for operation is restored by switching to another monitoring case.
	Object in protective safety field	No error. Status indication eases system testing on the use of simultaneous protective safety fields or in master/slave operation (if the OSSDs on the slave are not used in master/slave operation, then as required in the standard, a protective safety field infringement is not signalled via the red LED on the slave).
	Object in the simultaneous protective safety field or the contour as reference function has triggered	
	Initializing the device	➡ The display goes off automatically when the SafeZone safety laser scanner is initialized If display  does not go off: ➡ Check the cabling. ➡ Check the system configuration with the aid of the SCD software. Re-transfer the corrected configuration to the SafeZone safety laser scanner.
	Waiting for valid input signal	➡ The display goes off automatically when an input signal is present that corresponds to a configured monitoring case. If display does not go off: ➡ Check the cabling. ➡ Check the configuration of the system using the SCD software. Re-transfer the corrected configuration to the SafeZone safety laser scanner.
	Waiting for configuration or configuration not complete	➡ The display goes off automatically once the configuration has been successfully transferred. If display does not go off: ➡ Check the configuration of the system using the SCD software. Re-transfer the corrected configuration to the SafeZone safety laser scanner.
 or	EDM error	➡ Check whether the contactors are stuck or incorrectly wired and rectify any error. ➡ If is displayed: Switch the device off and back on again.
	Error in control switch for restarting or resetting	➡ Check the functionality of the control switch. The button may be defective or stuck. ➡ Check the wiring of the control switch for short-circuit to 24V.

Display	Possible Cause	Remedying the Error
	Sensor head faulty	➡ Send the sensor head to the manufacturer for repair.
	I/O module faulty	➡ Send the I/O module to the manufacturer for repair.
	Configuration memory in the system connector faulty	➡ Send the system connector to the manufacturer for repair.
	Overcurrent on OSSD connection 1	➡ Check the switching element connected. Replace, if necessary. ➡ Check the wiring for short-circuit to 0V.
	Short-circuit to 24V at OSSD connection 1	➡ Check the wiring for short-circuit to 24V.
	Short-circuit to 0V at OSSD connection 1	➡ Check the wiring for short-circuit to 0V.
	Overcurrent on OSSD connection 2	➡ Check the switching element connected. Replace, if necessary. ➡ Check the wiring for short-circuit to 0V.
	Short-circuit to 24V at OSSD connection 2	➡ Check the wiring for short-circuit to 24V.
	Short-circuit to 0V at OSSD connection 2	➡ Check the wiring for short-circuit to 0V.

F. ↻ 7	Short-circuit between OSSD connection 1 and 2	➡ Check the wiring and rectify the error.
F. ↻ 9	General OSSD wiring error	➡ Check the complete wiring of the OSSDs.
1. ↻ 1.	The SafeZone safety laser scanner is receiving no measured values within a range of at least 90° (measuring range maximum 49 m), it thus is not detecting any obstacles such as e.g. building walls.	➡ For the correct function of the safety laser scanner, always ensure that measured values are received within a range of 90°; this range can be moved as required within the scan range.
1. ↻ 2.	Device is saturated by infrared light	➡ Check whether the SafeZone safety laser scanner is being saturated by an external light source, e.g. headlight, infrared light sources, stroboscopic light, sun etc. If necessary, re-mount the device.
1. ↻ 3	Temperature error. The operating temperature of the SafeZone safety laser scanner has exceeded the permissible range.	➡ Check whether the SafeZone safety laser scanner is operated as per the permissible ambient conditions.
L. ↻ 2.	Invalid configuration of the EDM	➡ Verify that the machine-side EDM is connected correctly.
L. ↻ 9.	There is a short-circuit between the input for the control switch for restarting or resetting and another input or output.	➡ Check the wiring for short-circuits.
n. ↻ 1.	Input signal for an undefined monitoring case.	➡ Check the path of the vehicle. Or:
n. ↻ 2.	Incorrect sequence on switching the monitoring cases	➡ Check the work process on the machine or equipment monitored. ➡ If necessary, check the configuration of the monitoring cases with the aid of the SCD software.
n. ↻ 3	Incorrect operation of the control inputs	➡ Check the operation of the digital control inputs.
u. ↻ 1. … 6.	Channel 1 to 6 of the contamination measurement soiled	➡ Clean the front screen.
u. ↻ 7	No front screen fitted or saturation by infrared light of the contamination measurement	➡ Refit the new front screen (then perform front screen calibration). If at any time of the error a front screen was fitted: ➡ Check whether the SafeZone safety laser scanner is being saturated by an external light source, e.g. headlight, infrared light source, stroboscopic light, sun etc.
y. ↻ 3	I/O module does not match the configuration saved or vice-versa.	➡ Check whether the correct I/O module has been used, and replace if necessary.

IMPORTANT	If you have problems during troubleshooting, contact Rockwell Automation support. Keep a copy of the print out of the results of the diagnostics at hand.

10.5 Extended diagnostics

The SCD software supplied with the device includes extended diagnostic options. It allows you to narrow down the problem if the error is non-specific or if you experience usage downtime problems. Detailed information to be found:

- In the online help function of the SCD software.
- In the user manual for the SCD software.

Section 11 — Technical specifications

11.1 Characteristics

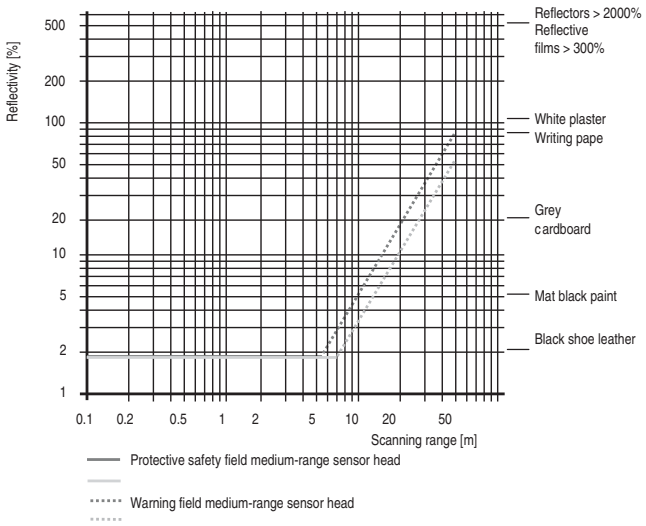


Figure 63: Diagram of scanning ranges for various reflectances

11.2 OSSD response times

The total response time of your application is dependent on...

- The basic response time at the related resolution and the maximum protective safety field range.
- The multiple sampling used.
- The OSSDs used.

Calculation of the total response time T_S: $T_S = t_B + T_{MFA}$

Where...

$_B$ = tB= Basic response time

T_{MFA} = Supplement due to multiple sampling > 2

d = Resolutions of the SafeZone safety laser scanner (mm)

Basic response time for various resolutions

The following basic response times apply for the internal OSSDs with standard multiple sampling of 2 without taking into account the switching time for the monitoring cases.

Table 23: Response time with a resolution of 30 mm (hand detection)

Maximum Possible Protective Safety Field Size	Basic Response Time
1.90 m	60 ms
2.80 m	120 ms

Table 24: Response time with a resolution of 40 mm (hand detection)

Maximum Possible Protective Safety Field Size	Basic Response Time
2.60 m	60 ms
3.80 m	120 ms

Table 25: Response time with a resolution of 50 mm (leg detection, stationary)

Maximum Possible Protective Safety Field Size	Basic Response Time
3.30 m	60 ms
4.80 m	120 ms

Table 26: Response time with a resolution of 70 mm (leg detection, mobile)

Maximum Possible Protective Safety Field Size	Basic Response Time
4.70 m	60 ms
5.00 m	120 ms

Table 27: Response time with a resolution of 150 mm (body detection)

Maximum Possible Protective Safety Field Size	Basic Response Time
5.00 m	60 ms
5.00 m	120 ms

Multiple sampling

The SafeZone safety laser scanner is always set to a minimum of two times multiple sampling. From a multiple sampling of three you must add a supplement to the response time. The related supplement is dependent on the basic response time and the multiple sampling.

Table 28: Supplements for multiple sampling

Multiple Sampling	Basic Response Time 60 ms	Basic Response Time 120 ms
3 times	30 ms	60 ms
4 times	60 ms	120 ms
5 times	90 ms	180 ms
6 times	120 ms	240 ms
7 times	150 ms	300 ms
8 times	180 ms	360 ms
9 times	210 ms	420 ms
10 times	240 ms	480 ms
11 times	270 ms	540 ms
12 times	300 ms	600 ms
13 times	330 ms	660 ms
14 times	360 ms	720 ms
15 times	390 ms	780 ms
16 times	420 ms	840 ms

11.3 Timing behavior of the OSSDs

The SafeZone safety laser scanner tests the OSSDs immediately after switching on and then at regular intervals. For this purpose the SafeZone safety laser scanner briefly switches off both OSSDs (for 300 µs) and checks whether the channels are electrically isolated during this period.

IMPORTANT	Ensure that the input electronics on your machine or equipment do not react to this test pulse and therefore shut down the machine or equipment.

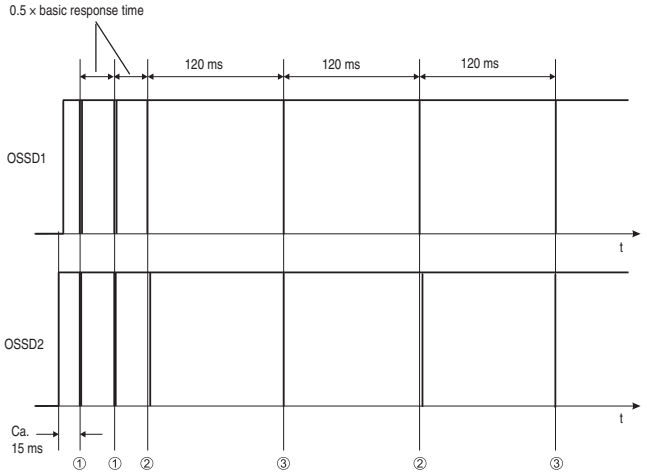


Figure 64: Diagram of the test pulse at the OSSDs

Approx. 15 ms after the switch on of the OSSDs, the SafeZone safety laser scanner performs the first voltage test ① and then after a half basic response time (see "Basic response time for various resolutions" on page 43) performs a second voltage test ①.

After a further half basic response time of the SafeZone safety laser scanner there is a shut-down test ②, 120 ms later a further voltage test ③. Then the SafeZone safety laser scanner performs a shut-down test and a voltage test alternately at an interval of 120 ms. Figure 66, Figure 67 and Figure 68 show the pulse durations for the individual tests.

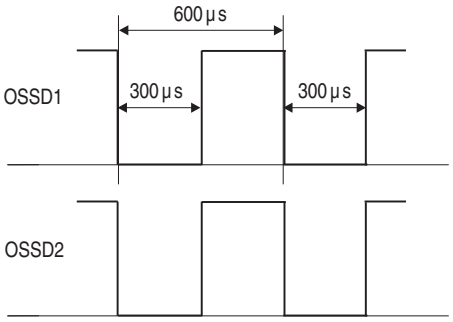


Figure 65: Voltage test after switching on the OSSDs

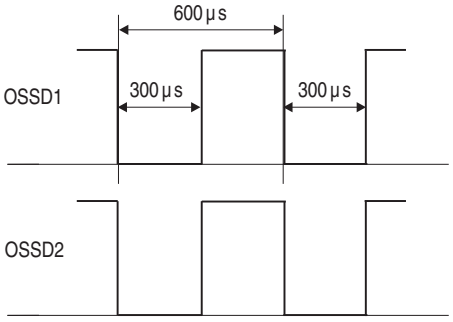


Figure 66: Figure 66: Shut-down test

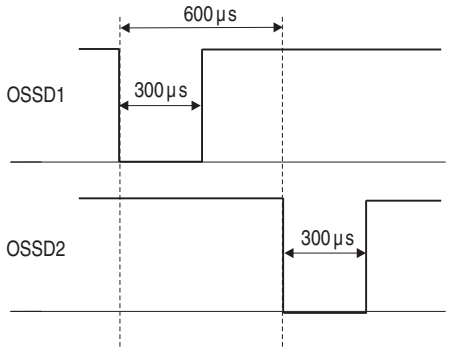


Figure 67: Voltage Test

11.4 Data sheet

	Minimum	Typical	Maximum
General Data			
Laser protection class	Laser class I (21 CFR 1040, 10 and 1040.11, DIN EN 60825:2001)		
Enclosure rating	IP65 (EN 60529)		
Protection class according to DIN VDE 0106, DIN EN 50178	II		
Type according to IEC/EN 61496, part 3	3		
Functional safety programmable electronic system (IEC/EN 61508)	SIL 2		
PFD - probability of failure on demand (minimum requirement = 1E-2)		4.46E-3	
Operating temperature range	-10°C		+50°C
Storage temperature range	-25°C		+70°C max. 24 h
Humidity (taking into account the operating temperature range)	IEC/EN 61496-1, section 5.1.2 and 5.4.2, as well as IEC 61496-3, section 5.4.2		
Vibration	IEC/EN 61496-1, section 5.1.2 and 5.4.4.1, as well as IEC 61496-3, section 5.4.4.2		
Frequency range	10 Hz		150 Hz
Amplitude	0.35 mm or 5 g		
Shock resistance			
Single shock	15 g, 11 ms according to EN 60068-2-27 10 g, 16 ms according to IEC/EN 61496-1, section 5.1.2 and 5.4.4.2, as well as IEC 61 496-3, section 5.4.4.2		
Sender	Pulsed laser diode		
Wavelength	880 nm	905 nm	935 nm
Divergence of the collimated beam		2.5 mrad	
Pulse duration			3.1 ns
Average output power			562 µW
Size of light spot at the front screen		12 mm	
Size of light spot at 4.0 m scanning range		23 mm	
Size of light spot at 5.0 m scanning range		27 mm	
Housing			
Material	Aluminium die-cast		
Color	RAL 1021		
Front screen			
Material	Polycarbonate		
Surface finish	Outside with scratch-resistant coating		
System connector	ESD protected		
Dimensions SafeZone multizone safety laser scanner)①			
Height			185 mm
Width			155 mm
Depth			160 mm
Total weight		3.3 kg	

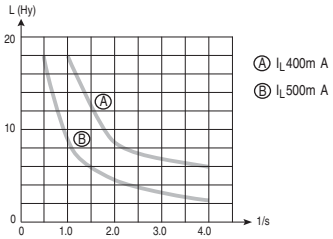
	Minimum	Typical	Maximum
Functional Data			
Protective safety field of the sensor head with 4.0 m scanning range at 120 ms response time At 30 mm resolution At 40 mm resolution At 50 mm resolution At 70 mm resolution At 150 mm resolution			 2.80 m 3.80 m 4.00 m 4.00 m 4.00 m
Protective safety field of the sensor head with 4.0 m scanning range at 60 ms response time At 30 mm resolution At 40 mm resolution At 50 mm resolution At 70 mm resolution At 150 mm resolution			 1.90 m 2.60 m 4.00 m 4.00 m 4.00 m
Protective safety field of the sensor head with 5 m scanning range at 120 ms response time At 30 mm resolution At 40 mm resolution At 50 mm resolution At 70 mm resolution At 150 mm resolution			 2.80 m 3.80 m 4,80 m 5 m 5 m
Protective safety field of the sensor head with 5 m scanning range at 60 ms response time At 30 mm resolution At 40 mm resolution At 50 mm resolution At 70 mm resolution At 150 mm resolution			 1.90 m 2.60 m 3.30 m 4,70 m 5 m
Scan angle			190° (-5° to 185°)
Reflectivity	1.8%		Several 1000% (Reflectors)
Resolution	30, 40, 50, 70, 150 mm		
Angular resolution	0.50°		0.25°
Protective safety field supplement generally necessary			100 mm
Supplement for retroreflectors in scan plane at a distance of less than 1 m to the protective safety field boundary protective safety field boundary			200 mm
Measurement error for measured data error output up to 5.0 m and 1.8% reflectivity Systematic error Statistical error at 1 σ Statistical error at 2 σ Statistical error at 3 σ Statistical error at 4 σ		 ±5 mm ±24 mm ±43 mm ±62 mm ±80 mm	
Evenness of the scan field at 5.0 m			±70 mm
Distance from mirror axis of rotation (zero point on the X and Y axis) to the rear of the device the device	93 mm		
Distance between center of the scan plane and the bottom edge of the housing	63 mm		
Warning field		Approx. 20②	49 m
Distance measuring range			49 m
Number of multiple samplings (configurable via SCD)	2		16
Power up time		9 s	20 s
Restart after (configurable)	2 s		60 s

	Minimum	Typical	Maximum
Electrical Data			
Electrical connection	Plug-in connection housing with screw terminal connections		
Technical data, screw terminals			
Cross-section of rigid cores	0.14mm^2		1.5 mm^2
Cross-section of flexible cores③	0.14 mm^2		1.0 mm^2
American Wire Gauge (AWG)	26		16
Insulation stripping length for the cores		5 mm	
Screw tightening torque	0.22 nm		0.25 nm
Cable length for power supply tolerance ±10%			
For cable cross-section 1 mm^2			50 m
For cable cross-section 0.5 mm^2			25 m
For cable cross-section 0.25 mm^2			12 m
Cable length for power supply tolerance ±5%			
For cable cross-section 1 mm^2			60 m
For cable cross-section 0.5 mm^2			30 m
For cable cross-section 0.25 mm^2			15 m
Cable length for power supply tolerance ±1%			
For cable cross-section 1 mm^2			70 m
For cable cross-section 0.5 mm^2			35 m
For cable cross-section 0.25 mm^2			17 m
Supply voltage (SELV) The voltage supply must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204. Suitable power supplies are available from Rockwell Automation Automation	16.8V	24V	28.8V
Permissible residual ripple④			±5%
Switch on current⑤			2 A
Operating current at 24 V without output load			0.8 A
Operating current with max. output load			2.3 A
Power consumption without output load			19 W
Power consumption with maximum output load			55 W
Input for control switch for restarting or resetting			
Input resistance when HIGH		2 k Ω	
Voltage for HIGH	11V	24V	28.8V
Voltage for LOW	-3V	0V	5V
Input capacitance		15 nF	
Static input current	6 mA		15 mA
Input EDM			
Input resistance when HIGH		2 k Ω	
Voltage for HIGH	11V	24V	28.8V
Voltage for LOW	-3V	0V	5V
Input capacitance		15 nF	
Static input current	6 mA		15 mA

	Minimum	Typical	Maximum
Static control input			
Input resistance when HIGH		2 kΩ	
Voltage for HIGH	11V	24V	28.8V
Voltage for LOW	-3V	0V	5V
Input capacitance		15 nF	
Static input current	6 mA		15 mA
Input frequency (max. switching sequence or frequency)	1/(multiple sampling + 1) x scan time x 2		
OSSDs			
Output signal switching device pair	2 PNP semiconductors, short-circuit protected⑥, cross-circuit monitored		
HIGH switching voltage at 500 mA	U_V - 2.7V		U_V
Switching voltage LOW	0V	0V	3.5V
Source switching current	6 mA	0.2 A	0.5 A
Leakage current⑦			250 µA
Load inductance⑧			2.2 H
Load capacity			2.2 µF at 50 Ω
Switching sequence (without switching and without simultaneous monitoring)	Depending on load inductance		
Permissible cable resistance⑨			2.5 Ω
Test pulse width⑩		230 µs	300 µs
Test frequency		120 ms	
Switching time of the OSSDs from red to green		120 ms	
Time offset on switching the OSSDs between OSSD2 and OSSD1		1.3 ms	2 ms
Application diagnostic outputs warning field, contamination of the front screen/ error, reset necessary			
HIGH switching voltage at 200 mA	U_V - 3.3V		U_V
Source switching current		100 mA	200 mA
Current limiting (after 5 ms at 25°C)	600 mA		920 mA
Power up delay		1.4 ms	2 ms
Switch off delay		0.7 ms	2 ms
Configuration and diagnostics interface			
Communication protocol	RS-232 (proprietary)		
Transmission speed	9600 baud 19 200 baud 38 400 baud		
Cable length at 9600 baud and 0.25-mm^2 cables			15 m
Galvanic de-coupling	No		
Output TxD HIGH	5V		15V
Output TxD LOW	-15V		-5V
Voltage range RxD	-15V		15V
Switching threshold RxD LOW	-15V		0.4V
Switching threshold RxD HIGH	2.4V		15V

	Minimum	Typical	Maximum
Short-circuit current at TxD	-60 mA		60 mA
Max. voltage level at RxD	-11V		11V
Max. voltage level at TxD	-11V		11V
Data interface			
Communication protocol	RS-422 (proprietary)		
Transmission speed (selectable)	19 200 baud 38 400 baud 125 kbaud 250 kbaud 500 kbaud		
Cable length at 500 kbaud and 0.25-mm^2 cables			100 m
Galvanic de-coupling	Yes		
Differential output voltage at the sender (between TxD+ and TxD-) with 50 ~ load	±2V		±5V
Differential input threshold at the receiver (between RxD+ and RxD-)	±0.2 V		
Short-circuit current at TxD+, TxD	-250 mA		250 mA
Max. voltage level at TxD+, TxD	-29 V		29V
Max. voltage level at RxD+, RxD	-29 V		29V
Terminating resistance	115 Ω	120 Ω	125 Ω
Type of connecting cable	Twisted pairs with copper braid screen		
Characteristic impedance of the connecting cable	80 Ω	100 Ω	115 Ω
Cable cross-section of the connecting cable	0.25 mm^2		0.6 mm^2

① Without projection of cable fittings with system connector mounted.
② For objects with 20% reflectivity.
③ Core terminating sleeves are not required.
④ The absolute voltage level must not drop below the specified minimum voltage.
⑤ The load currents for the input capacitors are not taken into account.
⑥ Applies to the voltage range between U_V and 0V.
⑦ In the case of a fault (the 0V cable is open circuit) the leakage current flows through the OSSD cable as a maximum. The downstream controller must detect this status as LOW. An FPLC (fail-safe programmable logic controller) must detect this status.
⑧ The maximum rated load inductance is higher with lower switching sequence.



⑨ Make sure to limit the individual line core resistance to the downstream controller to this value to ensure that a short-circuit between the outputs is safely detected (also note EN 60 204-1).
⑩ When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test pulses do not result in deactivation.

11.5 Dimensional drawings

11.5.1 SafeZone safety laser scanner

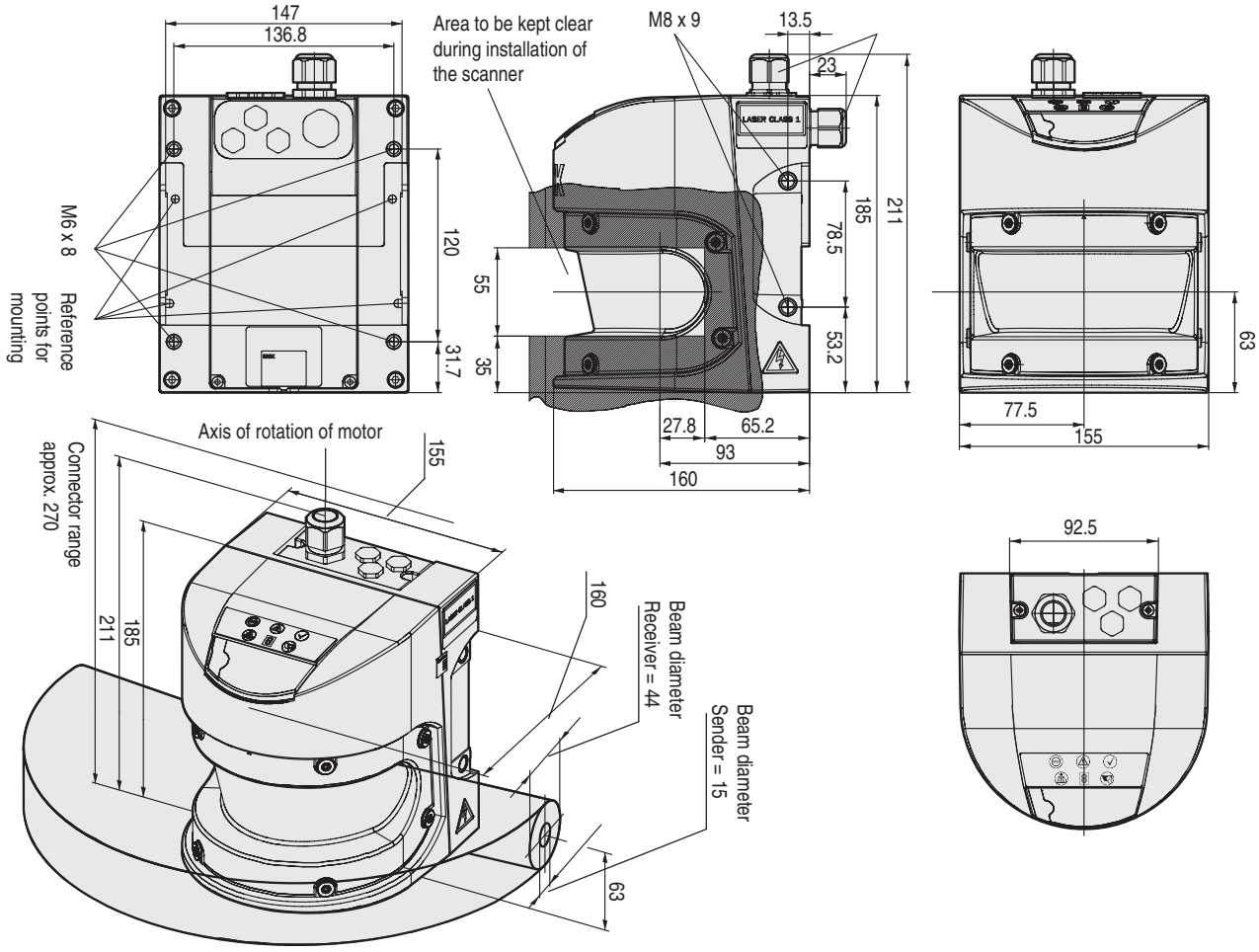


Figure 68: Dimensional drawing SafeZone safety laser scanner (mm)

11.5.2 Mounting kits

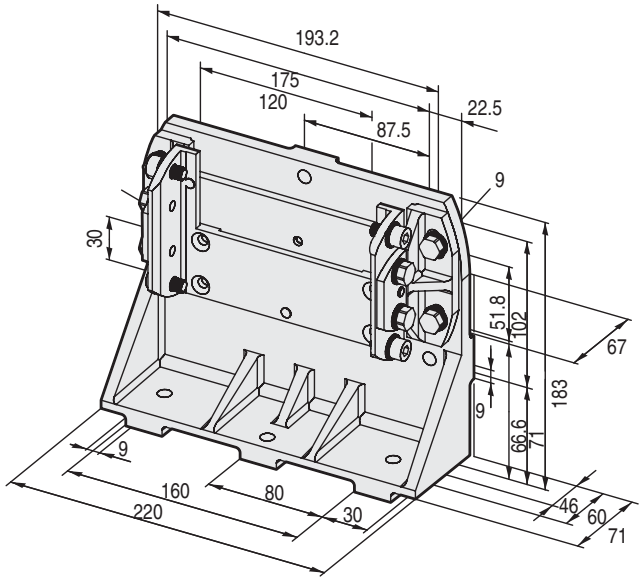


Figure 69: Dimensional drawing, mounting kit 1, 2 and 3 (mm)

11.5.3 Scan plane origin

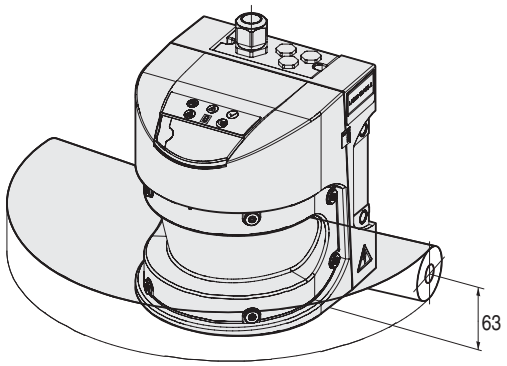


Figure 70: Dimensional drawing of the scan plane (mm)

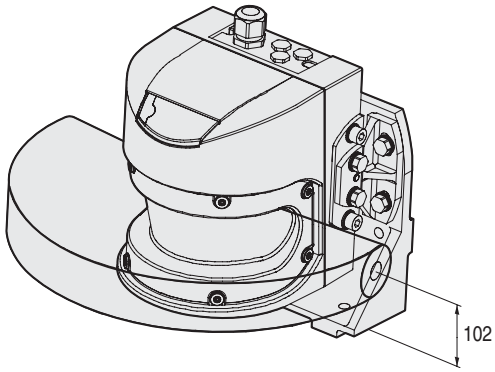


Figure 71: Dimensional drawing of the scan plane with mounting kit 3 (mm)

Section 12 — Ordering Information

The SafeZone multizone system is made up of the following components:

442L-SFZNSZ	Scan head and I/O module — singlezone
442L-SFZNMZ	Scan head and I/O module — multizone
442L-CSFZNMZ-X	Prewired 13 conductor cable to SafeZone multizone memory module X is either 5 m, 10 m or 20 m
442L-ACRS232	RS232 configuration cable, two meters long or
442L-ACRS232-8	Eight meter RS232 configuration cable

12.1 Delivery

- Sensor head with I/O module mounted 442L-SFZNMZ (multizone) or 442L-SFZNSZ (Singlezone)
- Operating instructions and SCD software CD
- Adhesive label “Important information”

IMPORTANT	System connector not in the scope of delivery.

System plug without cable and pre-assembled system plug are available from Rockwell Automation.

12.2 Accessories and replacement parts

Table 30: Catalog numbers

Description		Catalog Number
	Mounting Kit 1: Mounting bracket for direct mounting at the rear on wall or machine. No adjustment facility.	**442L-AMBSFZNMZ1**
	Mounting Kit 2: Bracket only in conjunction with mounting kit 1. Mounting at the rear on wall or machine. Longitudinal and cross-wise adjustment possible.	**442L-AMBSFZNMZ2**
	Mounting Kit 3: Bracket only in conjunction with mounting kit 1 and 2. Mounting at the rear or below on wall, floor or machine. Longitudinal and cross-wise adjustment possible.	**442L-AMBSFZNMZ3**
	3.0 Amp power supply	**1606-XLP72E**
	USB to serial port adaptor cable	**9000USBS**
	100 meter cable spool 13 conductor	**442L-C13GD-S100**
	Replacement front screen kit	**442L-SFZNMZW**
	Scan head - 4 m	**442L-SFZNSZ-SM-A**
	Scan head - 5 m	**442L-SFZNMZ-M-B**
	I/O module — SafeZone singlezone (1 set)	**442L-SFZNSZFMA**
	I/O module — SafeZone multizone (4 sets)	**442L-SFZNMZ-FMB**
	Unwired memory module	**442L-SFZNMZ-MEMA**

Section 13 — Annex

13.1 Manufacturer's checklist

Checklist for the manufacturer/installer for installing electro-sensitive protective equipment (ESPE)

Details about the points listed below must be present at least during initial commissioning~they are, however, dependent on the respective application, the specifications of which are to be controlled by the manufacturer/installer.

IMPORTANT	This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

Have the safety rules and regulations been observed in compliance with the directives/ standards applicable to the machine	Yes	❒	No	❒
Are the applied directives and standards listed in the declaration of conformity?	Yes	❒	No	❒
Does the protective device comply with the required control category?	Yes	❒	No	❒
Is the access to the hazardous area/hazardous point only possible through the protective safety field of the ESPE?	Yes	❒	No	❒
Have measures been taken to prevent and monitor unauthorized presence in the hazardous area when safeguarding hazardous areas/hazardous points (mechanical point-of-operation guarding), and have these been secured against removal?	Yes	❒	No	❒
Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching below, above or behind the ESPE?	Yes	❒	No	❒
Has the maximum stopping and/or run-down time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?	Yes	❒	No	❒
Has the ESPE been mounted such that the required safety distance from the nearest hazardous point has been achieved?	Yes	❒	No	❒
Are the ESPE devices correctly mounted and secured against manipulation after adjustment?	Yes	❒	No	❒
Are the required protective measures against electric shock in effect (protection class)?	Yes	❒	No	❒
Is the control switch for resetting the protective device (ESPE) or restarting the machine present and correctly installed?	Yes	❒	No	❒
Are the outputs of the ESPE (OSSDs) integrated in compliance with the required control category and does the integration comply with the circuit diagrams?	Yes	❒	No	❒
Has the protective function been checked in compliance with the test notes of this documentation?	Yes	❒	No	❒
Are the given protective functions effective at every setting of the operating mode selector switch?	Yes	❒	No	❒
Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?	Yes	❒	No	❒
Is the ESPE effective over the entire period of the dangerous state?	Yes	❒	No	❒
Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device?	Yes	❒	No	❒
Has the information label "Important Information" for the daily check been attached so that it is easily visible for the operator?	Yes	❒	No	❒

IMPORTANT	This checklist does not replace the initial commissioning, nor the regular inspection by specialist personnel.

13.2 Glossary

AOPDDR Active opto-electronic protective device responsive to diffuse reflection (e.g. SafeZone safety laser scanner, see also IEC/EN 61496-3)

Control Input, static The monitoring cases are switched using the control inputs. The SafeZone safety laser scanner has one static control input.

External device monitoring (EDM) A means by which the electro-sensitive protective equipment (ESPE) monitors the state of control devices which are external to the ESPE.

Field set Protective safety field and warning field form a pair, the so-called field set.

I/O module Defines the functionality of the SafeZone safety laser scanner.

Monitoring case A field set (if necessary a simultaneous field set) is allocated to a monitoring case. Monitoring case switching is performed using the control inputs. In this way the SafeZone safety laser scanner can be adapted to the operating mode of the machine or equipment that it monitors.

OSSD The OSSD output is the switching output on the SafeZone safety laser scanner. This is a semiconductor output and is periodically tested for correct function. The SafeZone safety laser scanner has two OSSD outputs that operate in parallel; for safety reasons these must be evaluated using two channels.

Protective safety field The protective safety field secures the hazardous area on a machine or vehicle. As soon as the safety laser scanner detects an object in the protective safety field, it switches the OSSDs to the off status and thus initiates the shutdown of the machine or stop of the vehicle.

Reflectivity Reflection of luminance. A measure of the reflectivity is the reflectance defined as the ratio of the luminance reflected from a surface in the measuring direction and the luminance of a completely matt white surface (white standard).

Resolution The minimum size of an object that is acquired by the protective device and is guaranteed by the manufacturer

Restart interlock The restart interlock is a protective device. In certain situations it prevents the machine from automatically restarting. This applies, e.g., after the scanner function has triggered during a dangerous machine state, after a change to the operating mode or the method of activation of the machine, or after the change to the start control device on the machine.

Sensor head Contains the opto-electronic acquisition system.

System plug Contains the configuration memory and all electrical connections. In this way the SafeZone safety laser scanner can be easily replaced. After re-commissioning the configuration is loaded from the system plug; the SafeZone multizone safety laser scanner is then, normally, ready for use.

Warning field The warning field is a field with a radius of 49 m. Using this field larger areas can be controlled and simple switching functions (e.g. warning functions) triggered. The warning field is not allowed to be used for tasks related to the protection of people.

EC Declaration of Conformity

The undersigned, representing the manufacturer	*and the authorised representative established within the Community*
Rockwell Automation, Inc.	***Rockwell Automation BV***
2 Executive Drive	***Rivium 1e Straat, 23***
Chelmsford, MA 01824	***2909 LE Capelle aan den IJssel***
USA	***Netherlands***
Herewith declare that the Products:	***Safezone Safety Laser Scanner***
Product identification (brand and catalogue number/part number):	***Allen-Bradley / GuardMaster 442L-SFZ Series*** ***(reference the attached list of catalogue numbers)***
Product Safety Function:	***Safezone 442L-SFZ Series safety laser scanners are active opto-electronic protection devices responsive to diffuse reflection (AOPDDR). These scanners are non-contact safety devices and can be used in applications up to Safety Category 3/PL d (EN ISO 13849-1) and SIL2/SIL CL2 (EN 61508 / EN 62061).***

are in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

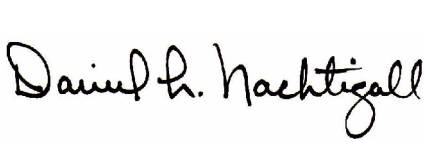
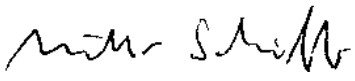
2006/42/EC	*Machinery Directive*
2004/108/EC	*EMC Directive*

and that the standards and/or technical specifications referenced below have been applied:

EN 61496-1:2004 + A1:2008	*Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*
IEC 61496-3:2008	*Safety of machinery – Electro-sensitive protective equipment – Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*
EN ISO 13849-1:2008	*Safety of Machinery – Safety related parts of control systems – Part 1: General principles for design*
EN 62061:2005	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN 61508 Parts 1-7:1998-2000	*Functional safety of electrical/electronic/programmable electronic safety-related systems*
EN 60204-1:2006	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*
EN 50178:1997	*Electronic equipment for use in power installations*
EN 61000-6-2:2005	*Electromagnetic compatibility – Part 6-2: Generic standards – Immunity for industrial environments*
EN 61000-6-4:2007	*Electromagnetic compatibility – Part 6-4: Generic standards – Emission standard for industrial environments*

Conformance of a type sample with the regulations from the EC Machinery Directive has been certified by:

TÜV Rheinland Industrie Service GmbH	*EC Type Examination*
Alboinstrasse 56	*Registration No: 01/205/0616/09*
12103 Berlin, Germany	*Report No: 968/M177.01/09*

Manufacturer:	*Authorised Representative in the Community:*
	
Signature	***Signature***
Name: *Daniel L. Nachtigall*	*Name:* *Viktor Schiffer*
Position: *Supv – Product Certification Engineering*	*Position:* *Engineering Manager*
Date: *26-Jun-2011*	*Date:* *08-Jul-2011*

Document Control Number: SEN-0354-D-EN 1/2

Catalogue number	*Series* ❶	*Description*
445L-SFZNSZ		*Safezone single-zone safety laser scanner*
445L-SFZNMZ		*Safezone multi-zone safety laser scanner*

❶ If no series number is given, then all series are covered.

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Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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