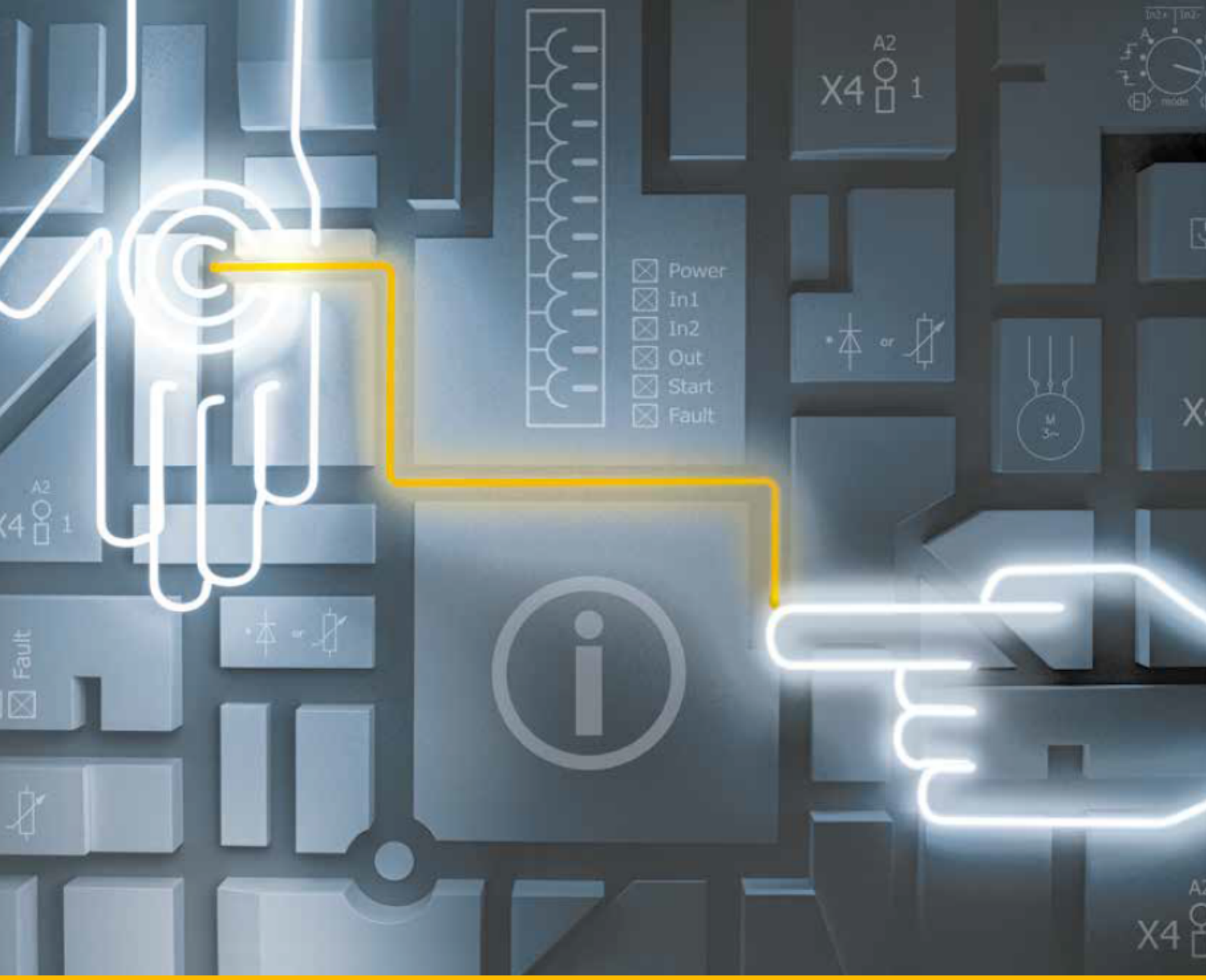


PSEN sc PN 5.5 down/back

PILZ
THE SPIRIT OF SAFETY

Operating Manual-1007024-EN-02
- PSEN sensor technology




This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

1 Introduction

1.1 Validity of documentation

This documentation is valid for the following products from version 1.0. It is valid until new documentation is published.

Product type	Designation in this operating manual
PSEN sc PN 5.5 08 down	PSEN sc PN 5.5. down/back
PSEN sc PN 5.5 08 back	

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product.

1.2 Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

1.3 Definition of symbols

Information that is particularly important is identified as follows:

DANGER!

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

INFORMATION

This gives advice on applications and provides information on special features.

2 Overview

2.1 Device features

Safety laser scanners of the PSEN sc PN 5.5. down/back constitute electrosensitive protective equipment (ESPE type: 3) in accordance with EN 61496-3 for workspaces in which machines, robots, and automated systems might pose a physical danger to their operators.

Product	Male connector	max. number		max. number of configurable		Operating range
		Safety zones	Zone sets	Inputs	Inputs/outputs	
PSEN sc PN 5.5 down/back	8-pin	8	70	1	4	5.5

Product	Male connector	Max. number of zone set switching inputs	
		Connection to a safety controller with test pulses	Connection to a safety controller without test pulses
PSEN sc PN 5.5 down/back	8-pin	2	3

- Configuration
  - Via PROFINET or
  - Configuration with PSENscan PN Configurator

    With teach-in function when creating zones.
- Detection capability: 30 mm, 40 mm, 50 mm, 70 mm, 150 mm
- Connection
  - With 8-pin M12 connector on supply voltage and evaluation device
- LED display and display for status information
- Scan angle: 275°
- Infrared laser beams build up a 2-dimensional protected area
- Separation of the protected area in a safety zone and a warning zone
- Enhanced availability by configurable multiple evaluation
- Muting (2 outputs, 2 inputs)
  - Muting in one direction
  - Muting in two directions
  - Dynamic muting
- Override
- Transferable configuration by saving the configuration in an exchangeable memory module
- Protection against manipulation

  When indications of a manipulation are detected, the SafetyStatusZone of the respective zone set is set to 0. The safety laser scanner therefore switches to the OFF state.

- Rest condition to save energy
- The safety laser scanner can be installed and operated overhead.
  When mounted overhead, the safety laser scanner must be cleaned more frequently.
- Connection to PROFINET

2.2 Device view

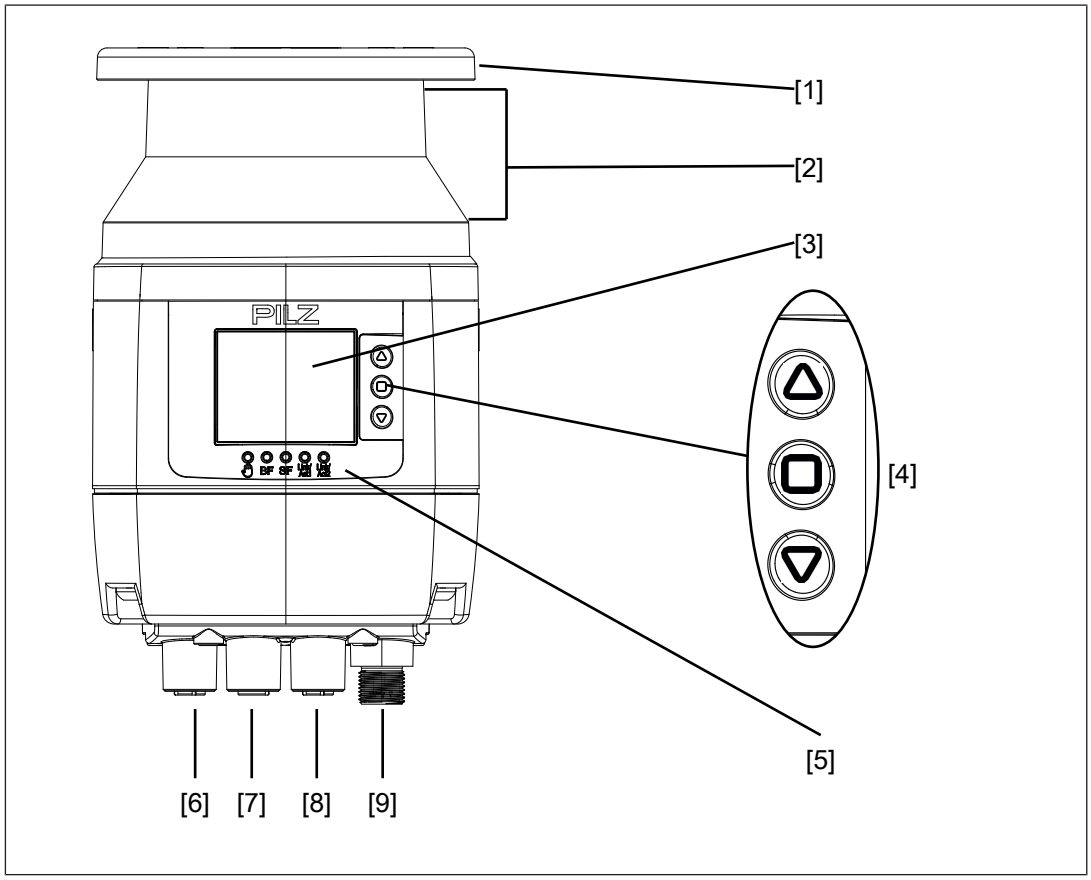


Fig.: PSEN sc PN 5.5 down - Front view

Legend

[1] Metal cover upper side

[2] Front panel (exit laser beams)

[3] Display for device messages

[4] LEDs as status indicator

[5] Buttons for scrolling in the display or to confirm the message in the display

△ Scroll up

□ Confirm message in the display

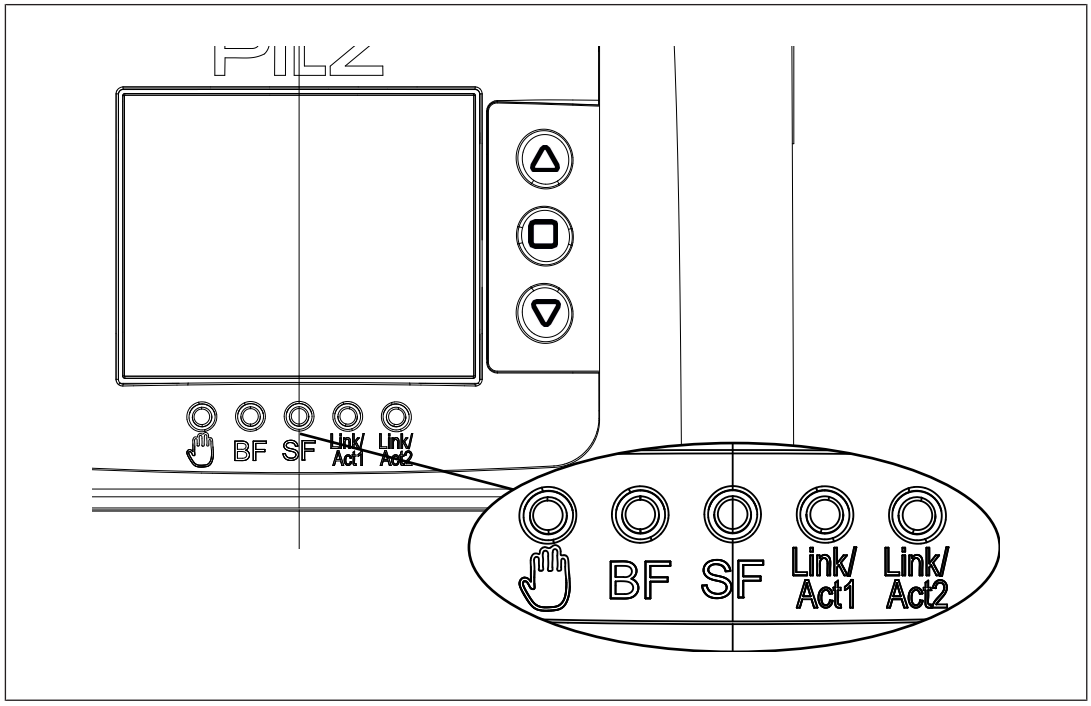
▽ Scroll down

[6] M12 5-pin female connector, D-coded, for connection to configuration PC

[7] M12 5-pin female connector, D-coded, for connection to PROFINET/ PROFIsafe

[8] M12 5-pin female connector, D-coded, for connection to PROFINET/ PROFIsafe

[9] M12 8-pin male connector, A-coded, for connection to an evaluation device and the supply voltage



Legend

- Status of safety zones
- BF Error in PROFINET transfer
- SF System error
- Link/ Act1 Status of fieldbus connection at Port 1:
- Link/ Act2 Status of fieldbus connection at Port 2:

Detailed description of the LEDs:

Symbol	Status	☼ = LED on ● = LED off	Meaning
	Status of safety zone and warning zone	☼ Green	No object detected in a safety zone
		☼ Orange	Object detected in a warning zone
		☼ Red	Object detected in safety zone 1 (or shutdown)

Symbol	Status	= LED on = LED off	Meaning
BF	Interlock	 Off	Error-free operation
		 Red	No data transfer
			No configuration, physical connection is slow or non-existent
SF	System error	 Off	No error
		 Red	DCP signal service is initiated via the bus
		 Red	System error
Link/ Act1	Status of Ethernet connections	 Off	No connection to Ethernet
Link/ Act2		 Green	Connection to Ethernet at Ports FBUS1/FBUS2
		 Yellow	Sends / receives Ethernet frames at Ports FBUS1/FBUS2

3 Safety

3.1 Intended use

The safety laser scanners in the PSEN sc PN 5.5. down/back are electrosensitive protective equipment of ESPE type 3. They are used to protect personnel and systems. The safety laser scanners are designed to

- Safeguard the danger zone,
- Safeguard danger zones of automated guided vehicle systems (AGVS) and
- Guard access within buildings.

The safety laser scanner may only be used for personal protection on machinery if

- the hazardous state can be removed by the safety laser scanner and
- the starting of the machine is controlled by the safety laser scanner and
- the safety assessment prescribes no better detection capability than 30 mm, 40 mm, 50 mm, 70 mm, 150 mm.

The safety level PL d (Cat. 3)/SIL 2 is only achieved if

- The safety outputs must be processed safety-related in 2-channel mode.

The machine or automated guided vehicle system (AGVS) can be restarted using a manual or automatic restart.

- It must not be possible to operate the pushbutton for manual restart from inside the danger zone. The pushbutton must be located at a position from which there is a full, unobstructed view of the danger zone.

Prevent circumvention of the safety zone. This means that other electrosensitive protective equipment and protective measures may be required in addition to the safety laser scanner. These should be determined via a safety assessment based on the specific application range and specific local conditions (e.g. official specifications).

Refer to IEC/TS 62046 to determine other necessary safeguards for securing the danger zone.

Their application must fulfil the site's relevant national regulations (e. g. EN 60204-1, NFPA 79:17-7).

Improper use

The following is deemed improper use in particular:

- Any component, technical or electrical modification to the product,
- Use of the product outside the areas described in this operating manual,
- Use of the product outside the technical details (see chapter entitled Technical Details [📖 127]).

NOTICE

EMC-compliant electrical installation

The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

Foreseeable misuse

- The safety laser scanner may **not** be accessed and may **not** be used as a step.
- The PSEN sc bracket H mounted on the safety laser scanner may **not** be accessed and **not** be used as a step

3.2 Safety regulations

3.2.1 Safety assessment

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

3.2.2 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, decommissioned and maintained by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

- Are familiar with the basic regulations concerning health and safety / accident prevention,
- Have read and understood the information provided in the section entitled Safety
- Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.3 Warranty and liability

All claims to warranty and liability will be rendered invalid if

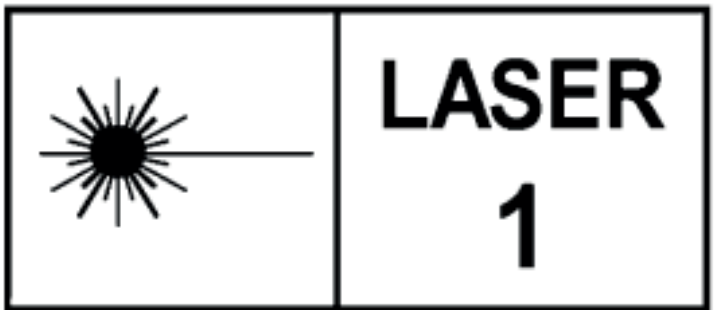
- The product was used contrary to the purpose for which it is intended,
- damage can be attributed to not having followed the guidelines in the operating manual,

- the operating personnel are not suitably qualified, or
- changes of any kind were made that this document does not describe.

3.2.4 Disposal

- In safety-related applications, please comply with the mission time T_M stated in the safety-related characteristic data.
- When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

3.3 For your safety



INFORMATION

Laser radiation of the safety laser scanner

The safety laser scanner of the PSEN sc PN 5.5. down/back corresponds to the laser class 1 in accordance with EN 60825-1. Additional measures to shield the laser beams are not required (eye-safe).

4 Security

To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall industrial security concept that is state of the art.
Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures with care. If necessary, seek advice from Pilz Customer Support.

4.1 Required security measures

- The product is not protected from physical manipulation or from reading of memory contents during physical access. Use appropriate measures to ensure that there is no physical access by unauthorised persons. You should also use security seals so that you can detect any manipulation of the product or interfaces. Installation inside a lockable control cabinet is recommended as a minimum measure.
- The configuration computer that accesses the product has to be protected from attacks by a firewall or other suitable measures. We recommend that a virus scanner is used on this configuration computer and updated regularly.
- Protect the product from unauthorised data exchange via the network by using a firewall or providing other appropriate measures. Only allow the data exchange that's required for the application. Any data exchange that is not required for the application must be prevented by the firewall.

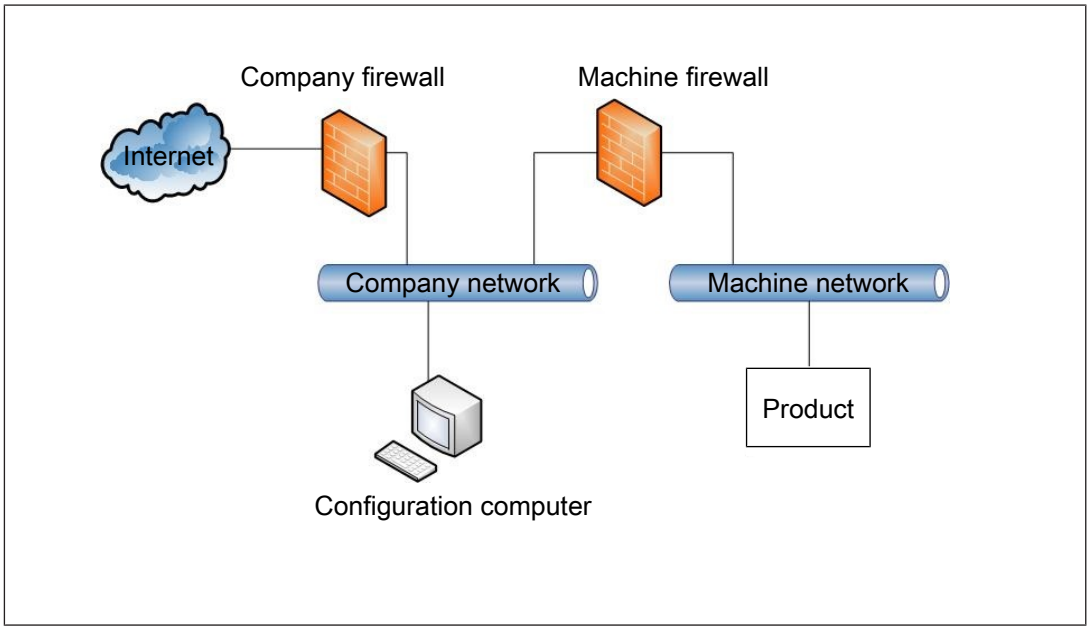


Fig.: Example network topology

- If necessary, protect the configuration computer and the product from unauthorised use by assigning passwords and taking further measures if required. We also recommend that the user logged on to this configuration computer does not have administrator rights.
- Only assign strong passwords and handle the passwords carefully. Be guided by generally accepted guidelines such as NIST 800-63b for example.
- Assign different permissions for the various user groups (e.g. diagnostics - configuration).
- As soon as possible, install firmware updates that Pilz provides for the product.

- Before disposal, the product must be safely decommissioned. To do this, all the data must be deleted from the device.
  - Set the configuration back to its default settings or delete the configuration.
  - Switch off the product.
- Note the network data [📖 131] for risk analysis and the security measures.

5 Function description

5.1 Basic function of the safety laser scanner

The safety laser scanner monitors an area that is covered by the light beam emitted by the safety laser scanner.

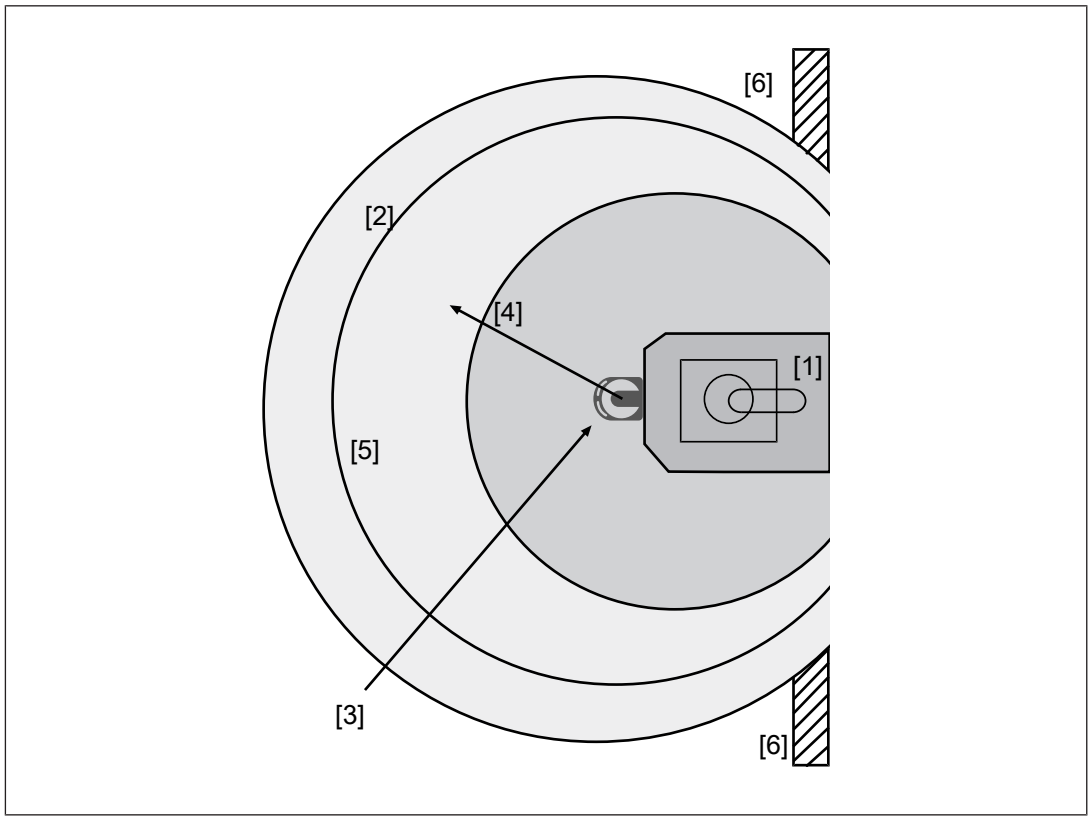


Fig.: Operating principle safety laser scanner

Legend

[1] Danger zone

[2] Area covered by the laser beam

[3] Safety laser scanner

[4] Safety zone

[5] Warning zone

[6] Additional protective equipment for securing the danger zone that is not covered by the safety laser scanner

The monitored area can be divided into a safety zone and a warning zone.

If an object or a person violates the safety zone, the safety outputs switch to the OFF state.

If an object or a person enters the warning zone, a warning output can trigger an action (e.g. switch on indicator light unit).

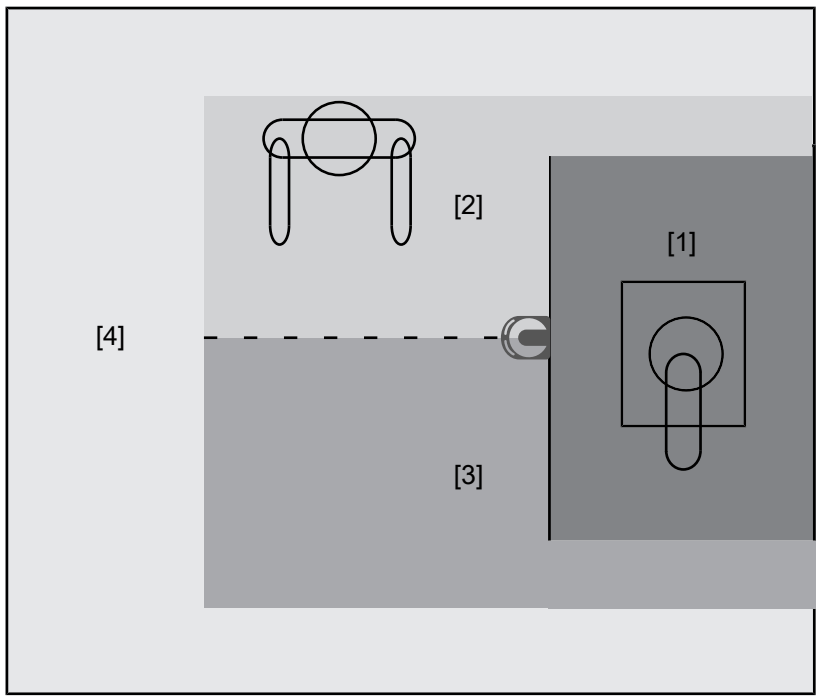
You can specify for each warning output whether activation is to occur when a Low signal or a High signal is present.

If the safety outputs on the safety laser scanner switch to the OFF state, a bit is set in the safe process data (Safety Zone Status, Byte 2, Bits 1-8).

5.2 Stationary and mobile danger zone

You can use the safety laser scanner to monitor a stationary or mobile danger zone, e.g. the environment of a machine that is installed in a fixed position or an area in front of an automated guided vehicle system or a mobile robot.

The monitored area can be divided into subsections, for which monitoring can be activated and deactivated respectively.



Legend

[1] Danger zone

[2] Configured zone 1, monitoring not activated

[3] Configured zone 2, monitoring not activated

[4] Warning zone

If a violation of the safety zone is detected, the safety outputs switch to the OFF state.

If a violation of the warning zone is detected, the actions configured in the PSENscan PN Configurator are carried out. A visual or audible signal can be activated as advance warning.

When using 2 warning zones, different reactions can be configured.

5.2.1 Horizontal application

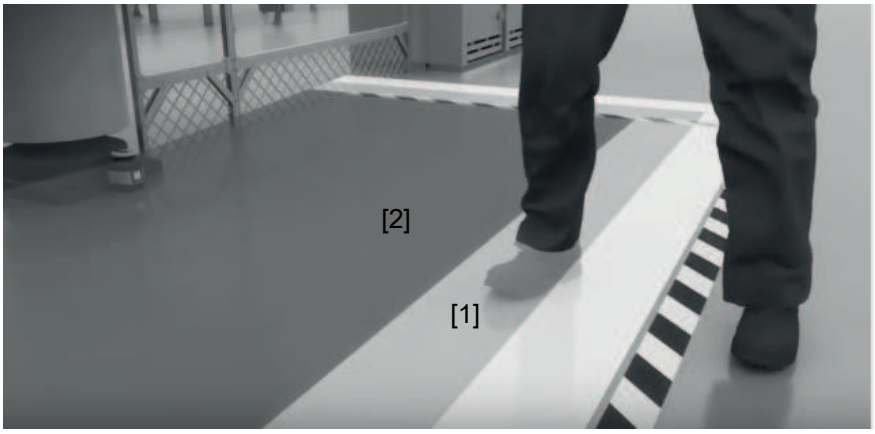


Fig.: Application example PSENscan safety laser scanner - horizontal configuration

Legend

[1] Warning zone

[2] Safety zone

5.2.2 Vertical application

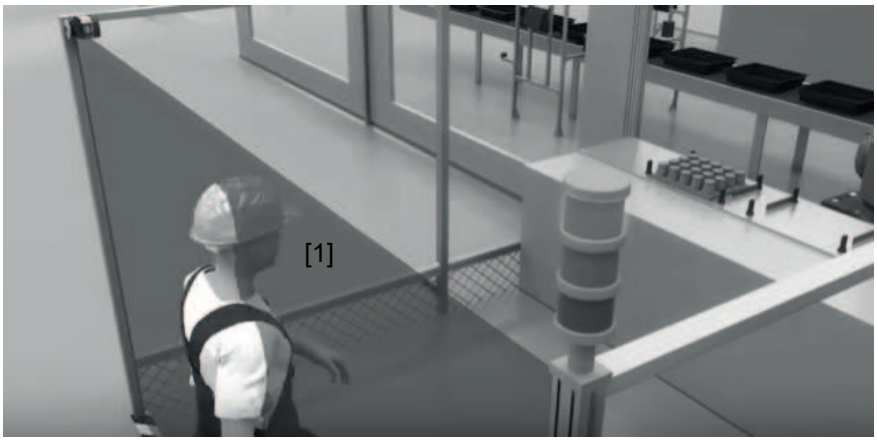


Fig.: Application example PSENscan safety laser scanner - vertical configuration

Legend

[1] Safety zone

5.2.3 Mobile application

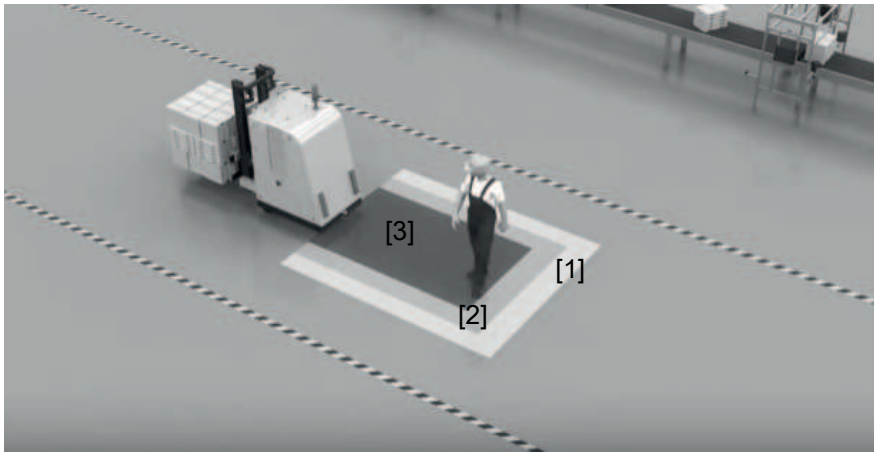


Fig.: Application example PSENscan safety laser scanner - mobile configuration

Legend

[1] Warning zone 1

[2] Warning zone 2

[3] Safety zone

The safety laser scanner scans the area in front of an automated guided vehicle system to prevent collisions. When an object or a person is detected, the safety laser scanner sends a signal to the automated guided vehicle system.

- If the warning zone is violated, an alarm on the automated guided vehicle system can be triggered. The person can leave the route or remove the object from the route.
- When the safety zone is violated, a stop of the automated guided vehicle system is triggered.
- The safety distance is calculated from the danger source, not from the safety laser scanner.

5.3 Reference outline monitoring

For vertical applications, national and international standards recommend monitoring a reference outline.

The reference outline is configured during the first installation of PSEN sc PN 5.5. down/back. The distances measured during configuration are used as reference values for monitoring the reference outline.

If the safety laser scanner is monitored by a safety controller, a dynamic reference outline can be used.

A max. 15 reference points are possible in each zone set. When the zone set is changed, the reference points are also changed.

5.4 Use of zone sets and switching of zone sets

A zone set must include a safety zone and it can include a max. of two warning zones.

Each zone can include any number of geometrical shapes.

Each machine state can be assigned a signal at the control inputs or a combination of signals at the control inputs. Each assignment is assigned a zone set. The zone set is always active whose control input signal/combination of signals is present.

Therefore, a change of signals at the control inputs triggers a change of the active zone set.

When a machine has different operating statuses, a safety laser scanner can be used to monitor several operating statuses.

When using several zone sets, the monitoring of a zone set can be switched to the monitoring of the next zone set. The configurable inputs must be used as switches.

The standard behaviour when switching the zone sets does not provide for an overlap of the zone sets.

- Max. number of inputs that can also be used for switching zone sets
  - PSEN sc PN 5.5. down/back with use the 8-pin connection and connection to a safety controller without test pulses: 3
  - PSEN sc PN 5.5. down/back with use of the 8-pin connection and connection to a safety controller with test pulses (for example a configurable safe small controller PNOZmulti): 2
  - PSEN sc PN 5.5. down/back with use of the 12-pin connection and connection to a safety controller without test pulses: 5
  - PSEN sc PN 5.5. down/back with use of the 12-pin connection and connection to a safety controller with test pulses (for example a configurable safe small controller PNOZmulti): 1
- Max. number of zone sets
  - PSEN sc PN 5.5. down/back with use of 8-pin connection: 3
  - PSEN sc PN 5.5. down/back with use of 12-pin connection: 10

5.5 Automatic and monitored start/restart

Automatic start/restart

When the safety laser scanner is switched on or when the safety zone is re-released, the safety laser scanner starts automatically and the safety outputs switch to the ON state under these conditions:

- Both safety outputs are wired correctly **and**
- No error has occurred **and**
- The safety zone is free.

If the safety zone is violated, the safety outputs switch to the OFF state.

Monitored manual start/restart

During operation, the safety outputs switch to the ON state under these conditions:

- Both safety outputs are wired correctly **and**
- No error has occurred **and**

- The safety zone is free **and**
- At least 80 ms have elapsed since switching to the OFF state **and**
- The start button has been operated and then released again for a min. 0.5 s and a max. 4.5 s. The start occurs with a falling edge.

  If the start button was operated for a shorter or longer period, no start occurs.

It is not possible to use start/restart to bring a safety laser scanner to normal operation when it has been in an error state.

When the error has been rectified, a reset is required.

5.6 Manual restart

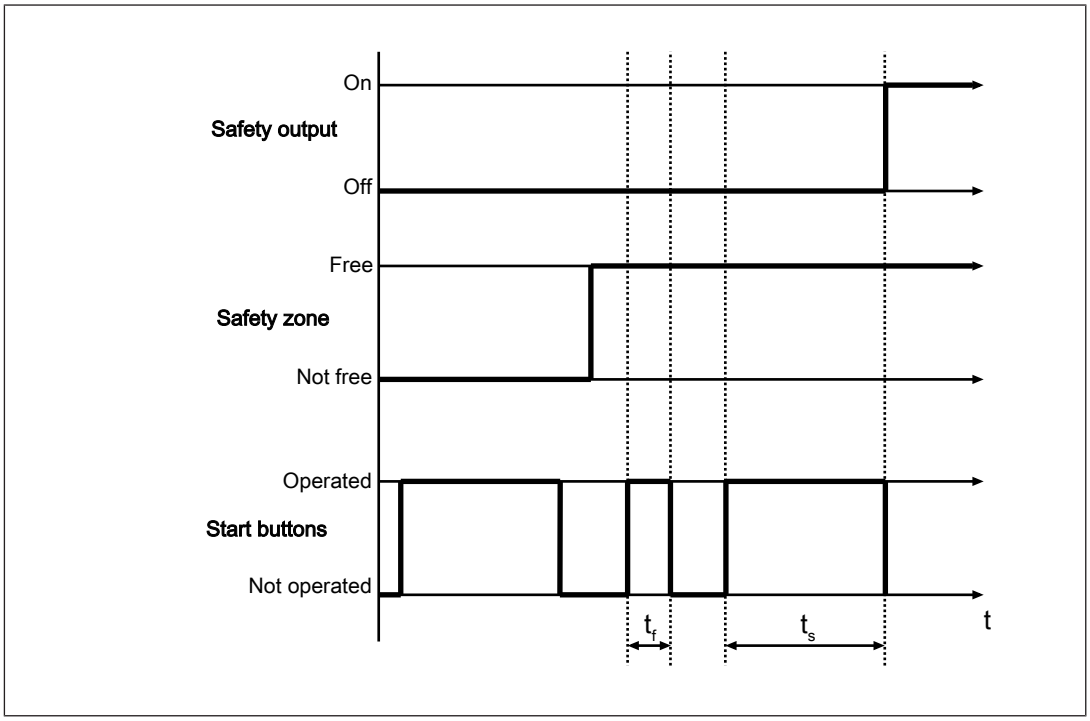


Fig.: Timing diagram for manual restart

Legend

t_f Start button pressed for < 0.5 s, no manual reset triggered

t_s Start button pressed for 0.5 s to 5 s, manual restart is triggered

With the manual restart it is not possible to bring a safety laser scanner to normal operation when it was in an error state, and whose error is rectified.

5.7 Reset

With the reset function, the safety laser scanner can be set to normal operation when the safety laser scanner is in an error state, and the error was rectified.

The reset pushbutton has to be connected to the reset input.

To trigger a reset, the reset pushbutton has to be pressed for at least 500 ms.

Automatic reset

With the automatic reset function the safety laser scanner is set to normal operation when the safety laser scanner was in an error state, and the error was rectified.

When the function of the automatic reset is activated, there is an attempt to restore normal operation automatically 10 seconds after an error state is determined.

The automatic reset function is permanently deactivated if the PSEN sc PN 5.5. down/back switches to an error state more than 5 times within 15 minutes with an INTFx or INPUTCF2 error.

The PSEN sc PN 5.5. down/back must be switched off and then on again.

Reset without restarting the network connection

This function is only available in the safety controller via the process data.

The safety laser scanner switches from an error state to normal operation without switching the supply voltage off and on again. The safety laser scanner's network connection is maintained and the safety laser scanner can be addressed from the network.

It is only possible to reset without restarting the network connection if the bit for Reset safety laser scanner without resetting the network (Byte 6, Bit 0) after a change 0-1-0 is 1 for the duration of t >T_min_reset (T_min_reset = 1).

Reset with restart of network connection

This function is only available in the safety controller via the process data.

The safety laser scanner switches from an error state to normal operation without switching the supply voltage off and on again. The network connection of the safety laser scanner is interrupted. The function is comparable with switching the supply voltage off and then on again.

It is only possible to reset with a restart of the network connection if the bit for Reset safety laser scanner without resetting the network (Byte 6, Bit 1) after a change 0-1-0 is 1 for the duration of t >T_min_reset (T_min_reset = 1).

5.8 Coding against interference

Safety laser scanners that can influence each other can be operated in the same room when beam coding of the safety laser scanner is set up.

For this, each laser scanner must be assigned a code during configuration (***configure detection capability***).

Four codes can be selected.

The selected code extends the response time per measurement cycle of the safety laser scanner.

For the four codes there are the following response time extensions per measurement cycle.

Code	Response time per measurement cycle
0	94 ms
1	95 ms
2	96 ms
3	97 ms

5.9 Alarms

- Window cleaning

  CLEANW2 is shown on the display of the safety laser scanner. The front panel must be cleaned to prevent the safety laser scanner switching to the error state.

- Safety laser scanner error

  Safety laser scanner in error state.

5.10 Wave

With the wave function, a safety laser scanner that is to be configured in a network can be identified more easily from its position.

When starting the automatic search for a safety laser scanner in a network the wave button can be selected.

The device found registers with the flashing message  in the display.

5.11 Rest condition

In a rest condition the functions of the safety laser scanner are deactivated to save energy.

This enables the use of the safety laser scanner with a supply voltage by battery (e.g. in an automated guided vehicle system).

In a rest condition no safety or warning zones are monitored.

The safety laser scanner is still available for the operation and it can be switched back to normal operation, if necessary.

5.12 Muting

Muting is the temporary, automatic suspension of a safety function. This suspension is triggered via muting sensors, which are connected to the configurable inputs and detect an object under defined conditions.

The muting function can be used to suspend the safety function of the safety laser scanner during operation, subject to special operating conditions.

- Example of a special operating condition:

  Material is transported into the safety zone on a conveyor and the safety function is overridden for the time it takes the material to pass through.

Muting is suitable when, under certain operating conditions, an object is permitted to pass through the danger zone but a person is not.

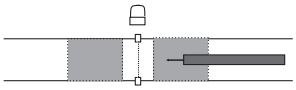
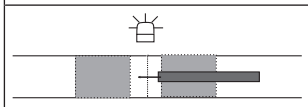
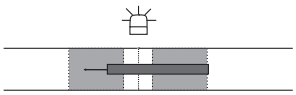
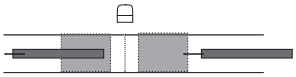
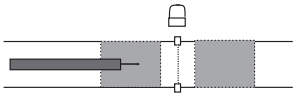
CAUTION!

Risk of injury due to loss of the safety function

In muting status, the safety outputs continue to be in the ON state. The connected machine remains in operation and represents a potential hazard.

– Prevent the possibility of access to the danger zone during muting.

Sequence for T-muting cycle when material passes from the right-hand side

Phase in the muting cycle	Explanation
	Material has already passed the first muting sensor and is being transported on the conveyor in the direction of the second muting sensor, muting lamp off.
	Material on the conveyor passes the second muting sensor (max. 4 s after the first sensor was passed). Muting lamp flashes, signalling the muting status.
	Material on the conveyor passes the PSEN sc PN 5.5. down/back and the first muting sensor on the output side, muting lamp flashes, signalling the muting status.
	Material has left the area of the first muting sensor on the output side, muting lamp is off, muting status is ended. The next piece of material arrives at the first muting sensor.
	If material is transported from the left-hand side, the cycle is reversed. The output side becomes the input side and the flow starts with the second muting sensor on the output side.

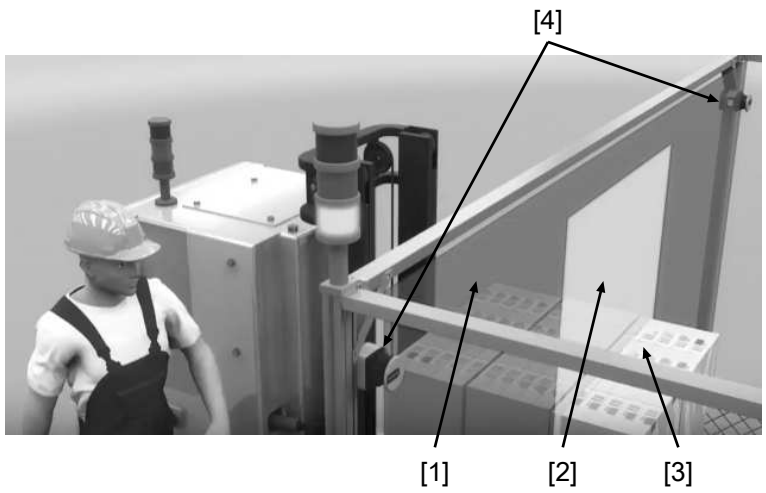
Identification of the conveyed material (pallets, vehicles...) must be guaranteed with all

- Material dimensions and
- Conveyor speeds

that are intended to arise during operation.

- When the muting state of the safety laser scanner is detected, the safety laser scanner triggers the configured actions for the muting state (e.g. switch on warning lamp or warning sound).
- Two muting areas can be created in a safety zone.
- Muting can be used in various versions.
  - L muting: Only for removing material from the danger zone
  - T muting: Transport of material in two directions
  - Dynamic muting: Available for L muting and T muting

    In addition to the conditions for L muting and T muting, activation and deactivation of the muting state can be controlled by the connected safety controller.



Legend

[1] Safety zone

[2] Muting zone

[3] Transported material

[4] Safety laser scanner

5.13 Override

With the override function, a machine can be restarted even though the safety zone is violated by material.

The aim is to clear the danger zone of any material that may have accumulated due to an error in the operating cycle.

If there is a pallet in the safety zone, for example, and the conveyor can no longer be switched on because the safety outputs of the safety laser scanner have switched to the OFF state (because the safety zone is not free), the accumulated material cannot be transported away from the zone.

Activating the override function allows intervention and enables the conveyor to be restarted.

The override function can be activated for the first two safety outputs if muting is activated for these safety outputs.

Condition for the override function

The override function can be started when the following conditions are met:

- The safety laser scanner is in a safe condition
- At least one muting sensor is active

Automatic ending of override function

The override function is ended automatically when one of the following conditions is met:

- Muting timeout has elapsed
- The conditions necessary for activation are no longer present.

- Max. duration of override function has elapsed: After 120 s, the safety laser scanner switches back to its normal operating state.
- No muting sensor is active
- Safety zone is not violated

5.14 Multiple evaluation

When multiple evaluation is active, an object must be scanned several times in succession before the safety laser scanner switches the safety outputs to the OFF state. This reduces the probability that insects, welding sparks or other particles lead to a shutdown of a plant.

If a multiple evaluation of 4 is configured, for example, an object must be detected four times in succession in the safety zone for the safety laser scanner to switch the safety outputs to the OFF state.

With a multiple evaluation > 2 an allowance has to be made to the response time. The height of the allowance (see Calculation of the overall response time [41]) results from the value of the multiple evaluation and the valid response time (see Technical details [127]).

5.15 Restore configuration (Fast Replacement)

If you experience problems with the configuration, a failed firmware update or any other situation in which the system is no longer functional, it may be necessary to reset the system by restoring a different configuration (=Fast Replacement).

With this function, a configuration can be adopted for further systems and therefore simplify the configuration of further systems.

Typical situations for restoring a configuration:

- Configuration of further systems with a similar design
- Interruption of the supply voltage during the firmware update
- Forgotten password
- Incorrect configuration of the IP address

5.16 Report generation

A report can be created for each configuration on the safety laser scanner.

A report includes all the settings that are valid for a configuration.

A report must be checked for correctness and it can be saved as PDF and printed to a connected printer.

5.17 Protection against manipulation

The safety laser scanner permanently monitors the environment to detect manipulations in the workspace or on the safety laser scanner.

Possible consequences of manipulations:

- Loss of the safety function,
- Reduced performance,

- Operational malfunctions.

If there are indications of a manipulation, the safety outputs switch to the OFF state.

is shown in the display of the safety laser scanner.

If required, monitoring of the environment can be set in the PSENscan PN Configurator in the ***Configure detection capability*** window.

- Monitoring can be completely deactivated.

  Select ***Manipulation protection*** = ***Deactivated***.

- Activation of the OFF state can be delayed.

  Select ***Activation delay [s]*** to activate the OFF state after the configured time has elapsed, starting from the moment at which the condition is met.

  Manipulation protection remains activated.

WARNING!

Loss of safety function due to deactivation of manipulation protection

Depending on the application, serious injury or death may result.

By deactivating manipulation protection, manipulations that lead to the loss of the safety function may remain undetected.

- Carry out a safety assessment each time manipulation protection is modified.

- The OFF state of the safety outputs is activated within the configured delay time when the following condition is met:
  - With at least 700 consecutive light beams from the safety laser scanner, the return signal (echo) that is received is of insufficient strength. The area covered by the light beams corresponds to at least a sector of 70° width.
- The ON state of the safety outputs is reactivated 120 ms after the condition is no longer met for at least 50 consecutive light beams from the 70° wide sector. The light beams must cover an area of at least 5° width.

Situations that may lead to activation of the OFF state as a result of monitoring:

- Up to a maximum working distance of 50 m there are no objects on a part of the scanning area.
- In the danger zone covered by the light beams of the safety laser scanner there are objects. Due to their low diffuse reflectivity they do no produce a sufficiently strong return signal (echo).

  Examples:
  - Objects with a diffuse reflectivity of 1.8 % may not be detected at a distance of > 8 m
  - Objects with a diffuse reflectivity of 18 % may not be detected at a distance of > 22 m
- The front screen of a safety laser scanner is concealed within the detection limit area (by a cloth, for example); the area covered by the laser beams will be partly or completely obscured.

- In the area covered by light beams there are reflective areas that are positioned in a way that the incoming light beams from the receive area of the safety laser scanner are deflected.

5.18 Output of measured data

The data measured by the safety laser scanner is provided for further processing in other applications.

Further information for measured data processing:

- Description of the measured data that is generated: PSENscan_UDP_Communication_Shortform-1005879_EN-01

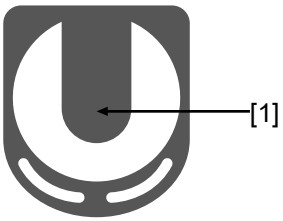
  (Download from www.pilz.com)
- ROS packages: https://github.com/PilzDE/psen_scan_v2

6 Project configuration

6.1 Maintaining the safety distance

6.1.1 General

- The minimum distance from the start of the area protected by the safety laser scanner to the dangerous machine component should be such that the operator cannot reach the danger zone until the movement of the dangerous machine component has stopped.
- All distance specifications and measured values refer to the mirror's rotation axis [1].



Influencing factors in accordance with EN ISO 13855

- Overall response time of the safety laser scanner

  Time between the safety laser scanner responding to an event and the safety outputs changing to the OFF state (see Calculating the overall response time [📖 41]).
- Machine's stopping time

  Time between the safety outputs changing to the OFF state and the hazardous machine movement stopping (including the reaction time of the connected evaluation device).

- Approach speed

  The speed with which the object to be detected is nearing the danger zone in mm/s
- Direction of approach
  - Orthogonal = vertical application

    The object to be detected approaches the danger zone at a right angle to the danger zone.
  - Horizontal = horizontal application

    The object to be detected approaches the danger zone in parallel to the danger zone.
- Reflection of the ambient light
- Prevent stepping behind/circumvention of the protective equipment and, if necessary, the resulting additions
  - Height of the scan plane
  - Detection capability
  - Switchover times

The general formula for calculating the minimum distance in accordance with EN ISO 13855 is:

S= (K * T) + C

S Minimum distance in mm, measured from the start of the safety zone to the danger source

K Approach speed at which the object (body) to be detected is nearing the danger zone in mm/s

T Overall time from the occurrence of a safety zone violation to the complete stop of the machine
The value is separated for the calculation in t1 and t2, with $T = t_1 + t_2$.

C Addition depending on the height of the scan plane, the detection capability, the ambient light and if necessary, additions for the installation on automated guided vehicle systems

6.1.2 Horizontal application with stationary danger zone

A horizontal application has been achieved when the safety laser scanner is aligned at an angle of max. 30° with the floor level.

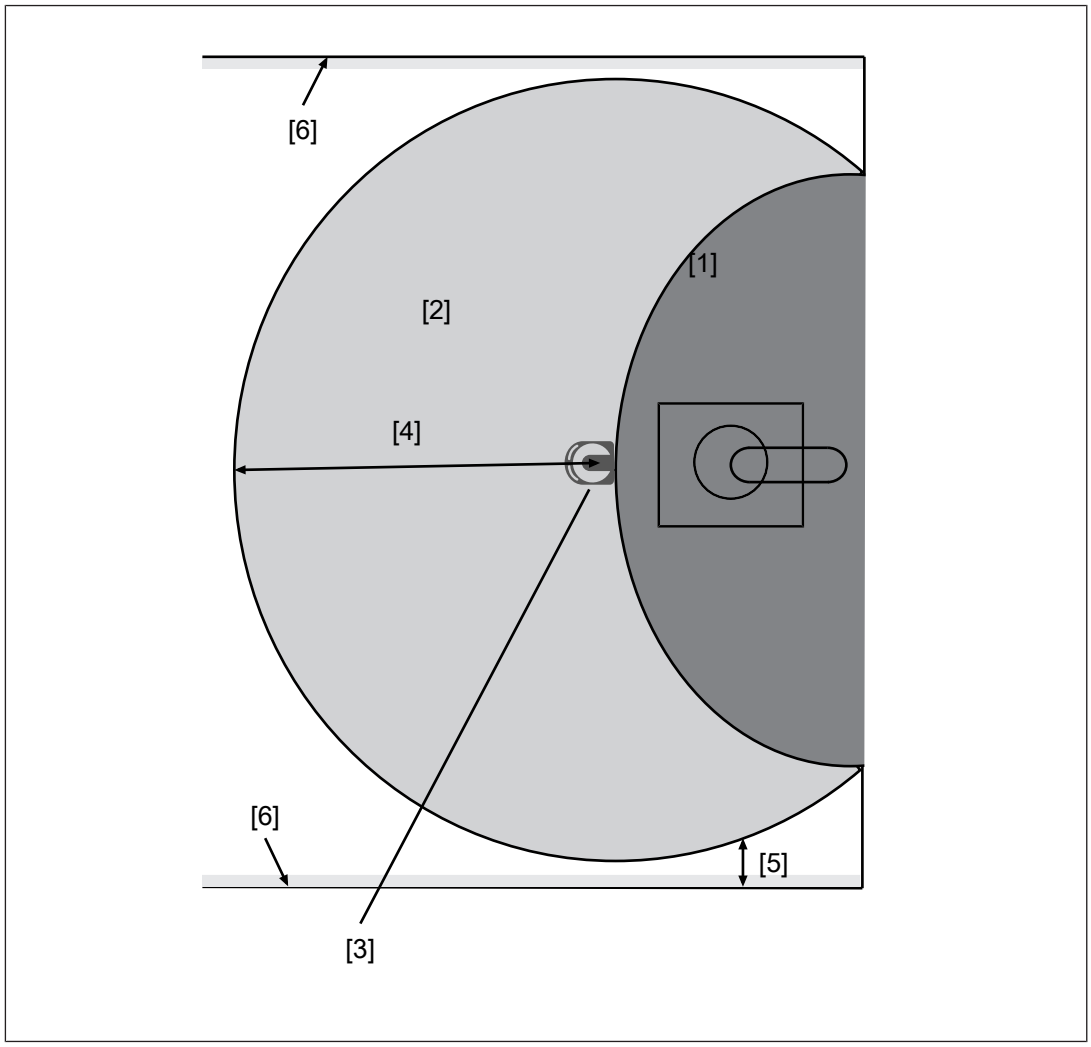


Fig.: Schematic representation minimum distance from the start of the protected area to the danger zone

Legend

[1] Danger zone

[2] Area covered by the laser beam

[3] Safety laser scanner

[4] Minimum distance to the danger zone (corresponds max. to the operating range of the safety laser scanner)

[5] Safety allowance Z_T for the distance from fixed objects or walls

[6] Wall

The following applies for these applications:

$$S = K * (t_1 + t_2) + Z_T + Z_R + C$$

Icon	Meaning
S	Minimum distance in mm, measured from the start of the safety zone to the danger source
K	Approach speed with which the object to be detected is nearing the danger zone in mm/s K = 1600 mm/s when S > 500 mm K = 2000 mm/s when S ≤ 500 mm
t_1	Overall response time of the safety laser scanner in seconds (see Calculation of the overall response time [📖 41]) Time between the violation of a safety zone and the signal change at the safety outputs on the safety laser scanner
t_2	Machine's stopping time in seconds The time required for the machine to stop after the signal change at the safety outputs
Z_T	General safety allowance Standard value in the calculation and the teach-in function = 100 mm, (see distance from walls [📖 51])
Z_R	Allowance when installing near intense light sources or reflective surfaces (see Distance to intense light sources and to reflective surfaces [📖 49])
C	Additional distance depending on the height of the scanning plane

Determining the additional distance C depending on the height of the scanning plane and the detection capability (see EN ISO 13855)

C = (1200 -0.4H)

Note:

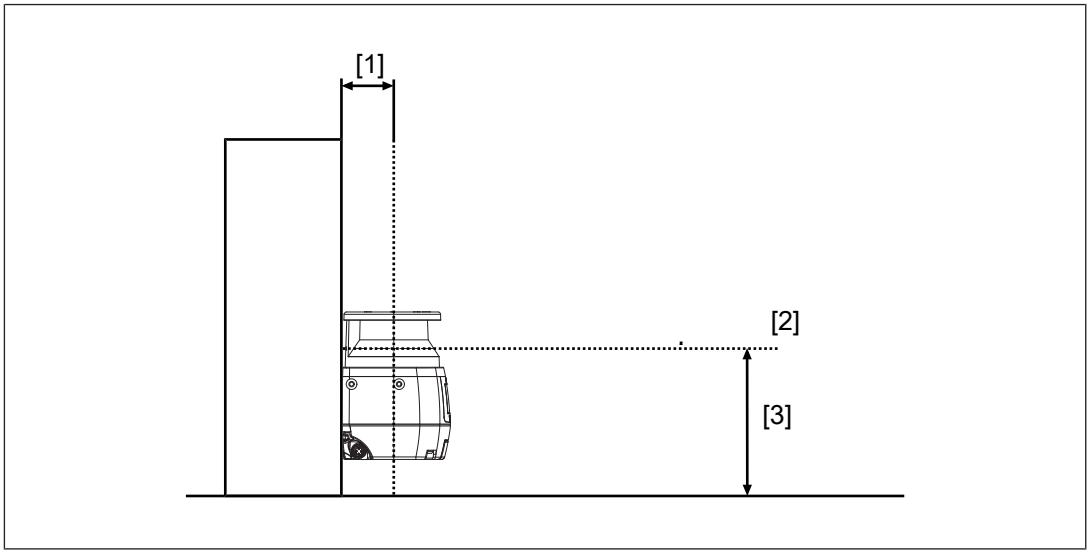
- Permitted height H of the scanning plane
  - Max. 1000 mm
  - Min. h = 15(d-50) for d ≥ 70 mm

    The height H must not be less than 0.

    d = Resolution (see Technical details [📖 127])
  - If the height of the scanning plane is specified, the lowest permitted resolution d_r can be calculated.

    d_r = H/15 + 50

    d_r = lowest permitted resolution
- When the safety laser scanner is to be placed at a height of H > 300 mm, there is a risk of creeping underneath the safety zone. This is to be taken into account in the risk assessment, and if required additional protective measures must be taken.



Legend

[1] Opening between the origin of the laser beam of the safety laser scanner and the mounting area

[2] Scanning plane

[3] Height H between scanning plane and base area

CAUTION!

Risk of injury due to insufficient safeguard

Reaching into the opening between safety laser scanner and mounting area can lead to injuries.

– Prevent reaching into the opening by using a suitable safeguard.

6.1.3 Horizontal application with automated guided vehicle systems

The following applies for these applications:

$$S = S_{Br} + (T_{RtV} + t_1) * V_{maxAGVS} + Z_T + Z_R + Z_F + Z_B$$

Icon	Meaning
S	Minimum distance in mm, measured from the start of the safety zone to the danger source
S_{Br}	Braking distance of the automated guided vehicle system (AGVS) (see Technical details of the AGVS)
T_{RtV}	Response time of the vehicle control system (see Technical details of the vehicle control system)
t_1	Overall response time of the safety laser scanner in seconds (see Calculation of the overall response time [📖 41]) Time between the violation of a safety zone and the signal change at the safety outputs on the safety laser scanner
$V_{maxAGVS}$	Max. approach speed of the automated guided vehicle system (AGVS)

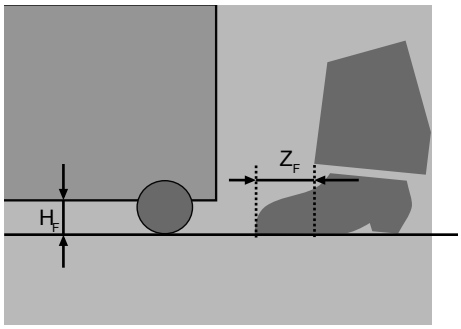
Icon	Meaning
Z_T	General safety allowance Standard value in the calculation and the teach-in function = 100 mm, (see distance from walls [📖 51])
Z_R	Allowance when installing near intense light sources or reflective surfaces (see Distance to intense light sources and to reflective surfaces [📖 49])
Z_F	Allowance for missing ground clearance (length of a foot)
Z_B	Allowance for decreasing braking power of the automated guided vehicle system (AGVS) in mm (10 % of braking distance S_{Br})

Note:

- Height of the scan plane

  Pilz recommends a scan plane height of 15 cm.

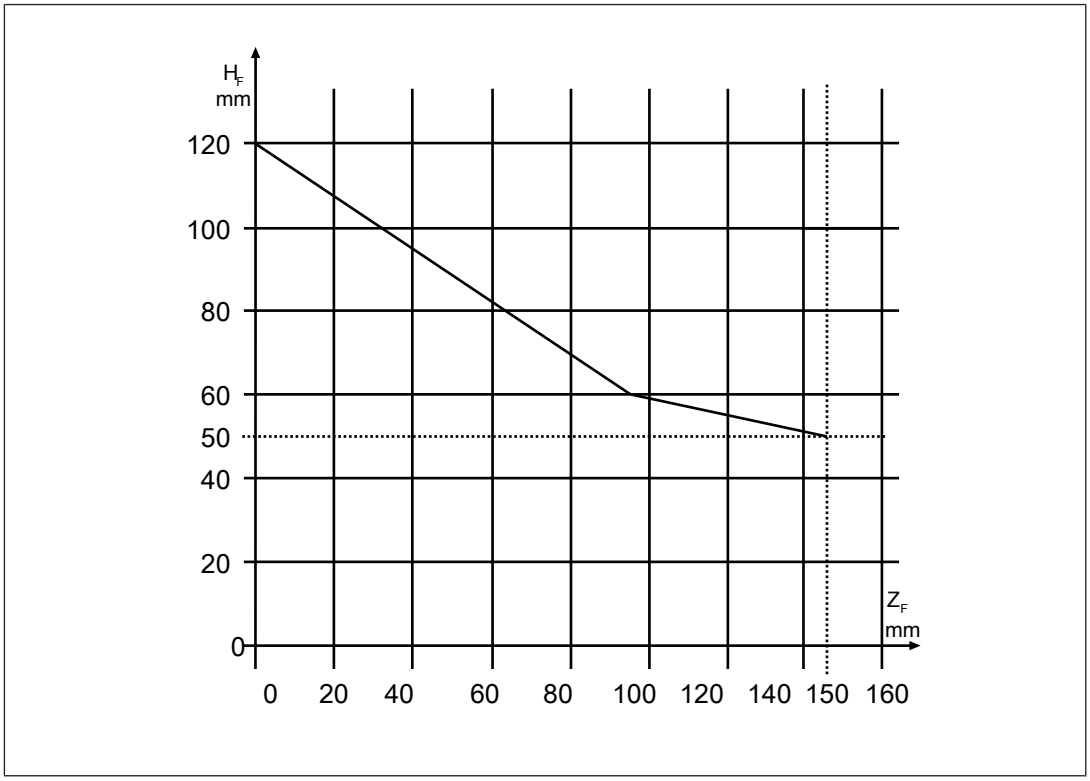
  A person lying on the floor is detected. A lower height would lead to reduced availability because of the increased dust formation on the floor.



Legend

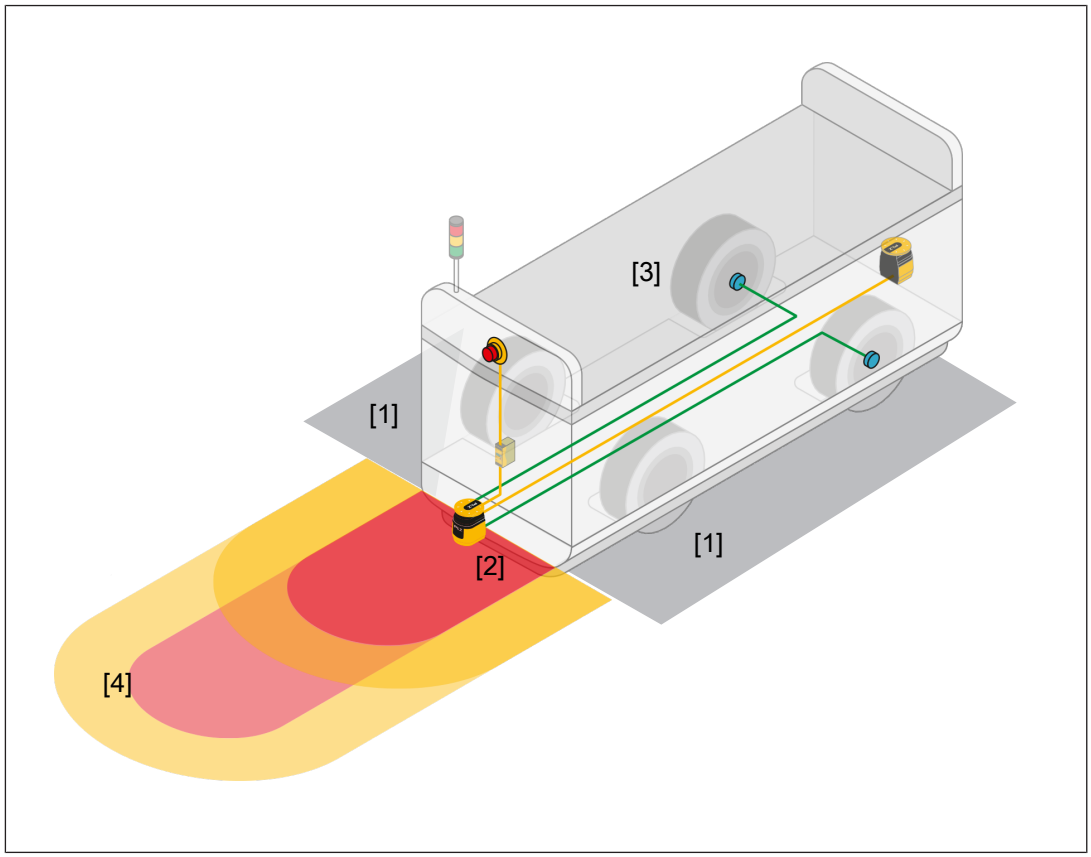
Z_F Allowance for missing ground clearance (length of a foot)

H_F Distance of the vehicle underside to the ground



- If required, prevent access to dead zones on the sides of the automated guided vehicle system through additional safeguards.

  If this is not possible, the speed of the automated guided vehicle system must be limited to 0.3 m/s.



Legend

[1] Dead zones at the sides of the automated guided vehicle system

[2] Safety laser scanner

[3] Automated guided vehicle system

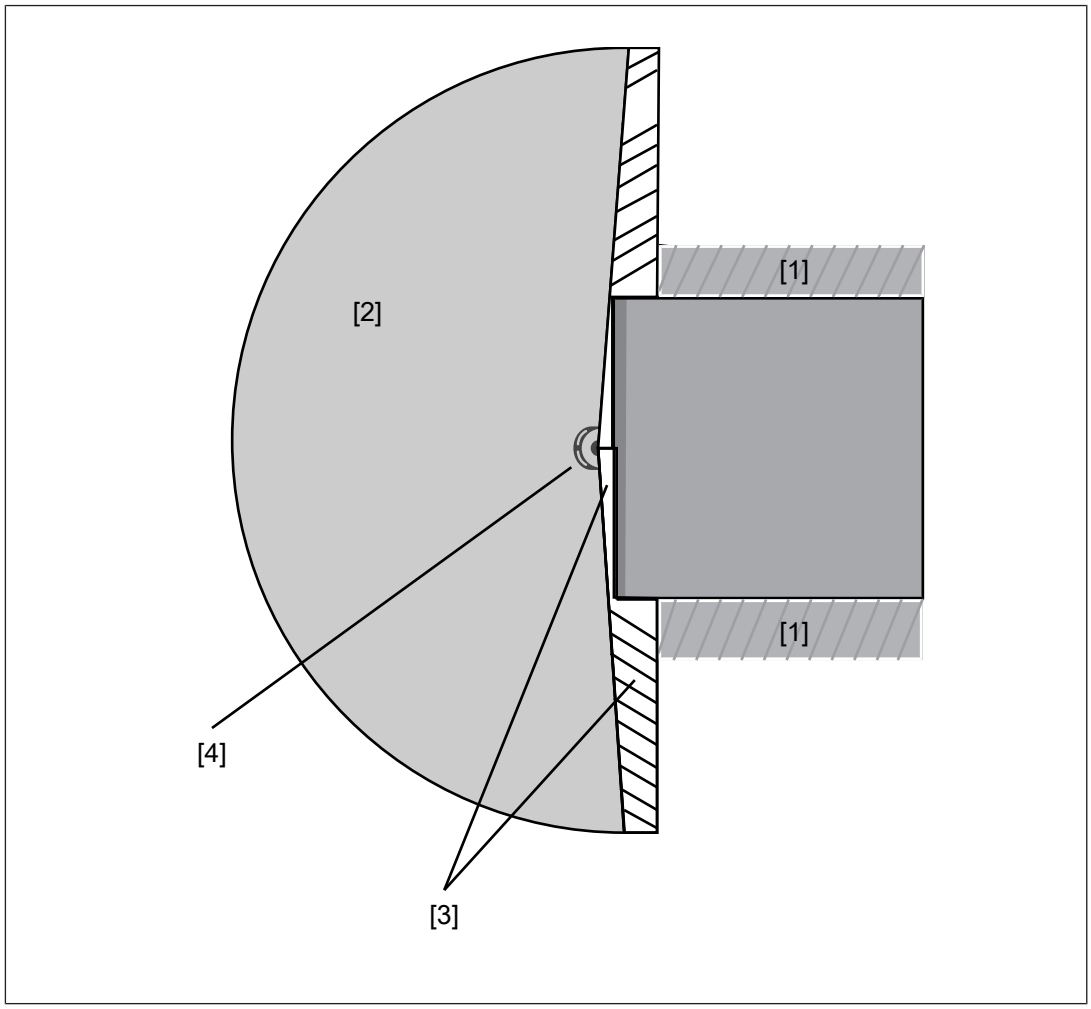
[4] Area covered by the laser beam

CAUTION!

Risk of injury due to insufficient safeguard

Reaching into the opening between safety laser scanner and mounting area can lead to injuries.

– Prevent reaching into the opening by using a suitable safeguard.



Legend

[1] Danger zone with fence

[2] Safeguarded area

[3] Not safeguarded area - safeguard against stepping behind

[4] Safety laser scanner

6.1.4 Vertical application

A vertical application is given when the safety laser scanner is aligned at an angle of over ± 30° with the floor level.

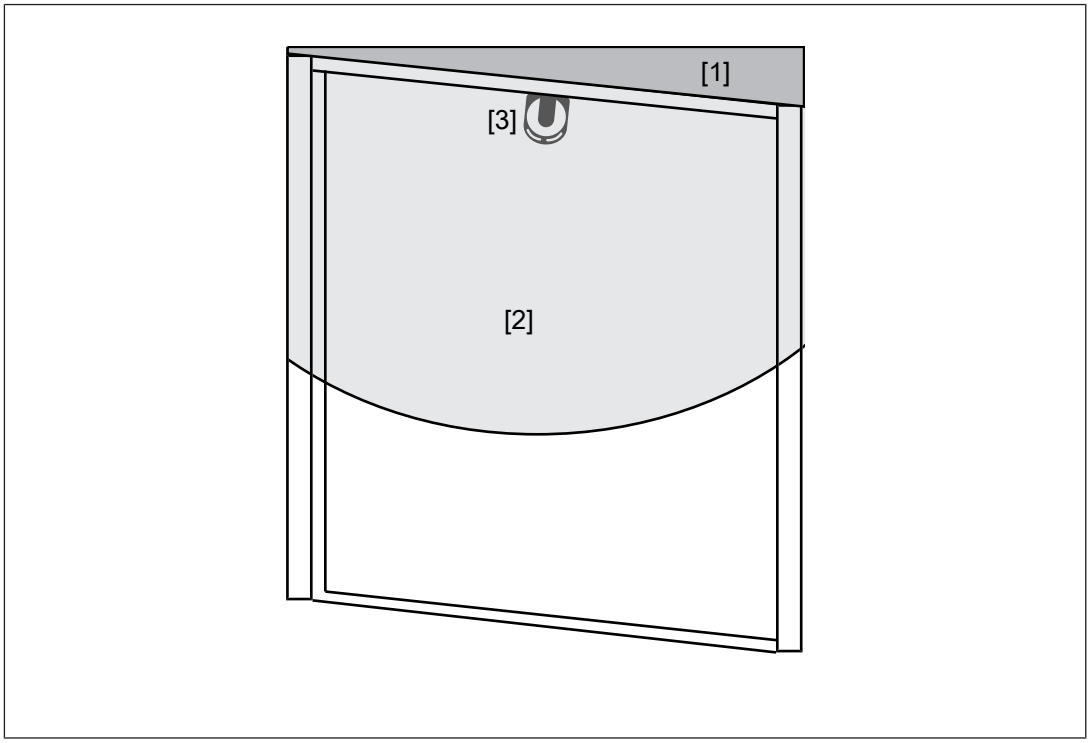


Fig.: Schematic representation of a vertical application on a passage

Legend

[1] Danger zone

[2] Area covered by the laser beam

[3] Safety laser scanner

The following applies for these applications:

$S = K * (t_1 + t_2) + 8 * (d-14\ mm)$

Icon	Meaning
S	Minimum distance in mm, measured from the start of the safety zone to the danger source
K	Approach speed with which the object to be detected is nearing the danger zone in mm/s K = 1600 mm/s when S > 500 mm K = 2000 mm/s when S ≤ 500 mm
t_1	Overall response time of the safety laser scanner in seconds (see Calculation of the overall response time [📖 41]) Time between the violation of a safety zone and the signal change at the safety outputs on the safety laser scanner
t_2	Machine's stopping time in seconds The time required for the machine to stop after the signal change at the safety outputs
d	Resolution (see Technical details [📖 127])

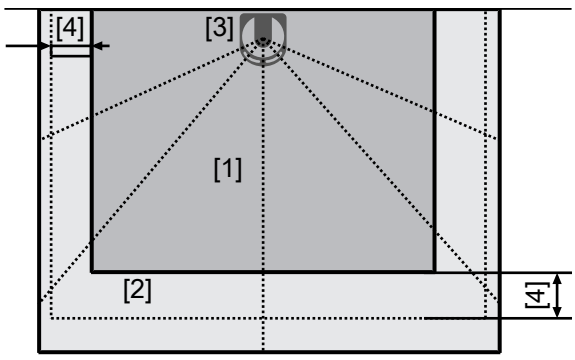
Safety distance	Use this value
S ≤ 100 mm	S = 100 mm
100 mm < S ≤ 500 mm	established value for S
S > 500 mm	S = 1600 mm/s * T+ 8 * (d-14 mm) New value for S > 500 mm => use the recalculated value New value for S ≤ 500 mm => use 500 mm

6.1.4.1 Detect body parts

If the safety laser scanner is used to detect body parts, a physical limit must be monitored in vertical applications. This monitoring is performed by comparison between a reference distance and the distance currently measured by the safety laser scanner.

Limit points are determined during the installation of the safety laser scanner. The distance between these limit points and the safety laser scanner forms the reference distance.

The detection capability of the safety laser scanner required for this must be between 30 mm and 70 mm.



Legend

[1] Danger zone

[2] Area covered by the laser beam

[3] Safety laser scanner

[4] Tolerance zone

If a limit point overlaps with the limit of the protected zone, the tolerance zone in mm must no exceed half of the selected detection capability. If this is exceeded, the zone must be protected by an additional safety device.

6.2 Calculation of the overall response time

The overall response time results from the response time t1 (see Technical details [📖 127]), plus an allowance of 30 ms $t_{multiple}$ for each scan > 2.

In a multiple evaluation = 3 the allowance is $T_{multiple}$ = 30 ms.

Each further increase of the multiple evaluation by 1 increases the allowance $T_{multiple}$ by 30 ms.

6.3 Switching of zone sets

For each zone set, a unique combination of signals must be defined at the control inputs. To prevent unintended switching of the monitored zone sets, two consecutive zone sets must differ in at least two positions in the assigned signals at the control inputs.

In the PSENscan PN Configurator the automatic assignment ensures a difference in exactly two positions.

Pilz recommends that the automatic assignment by the PSENscan PN Configurator is used.

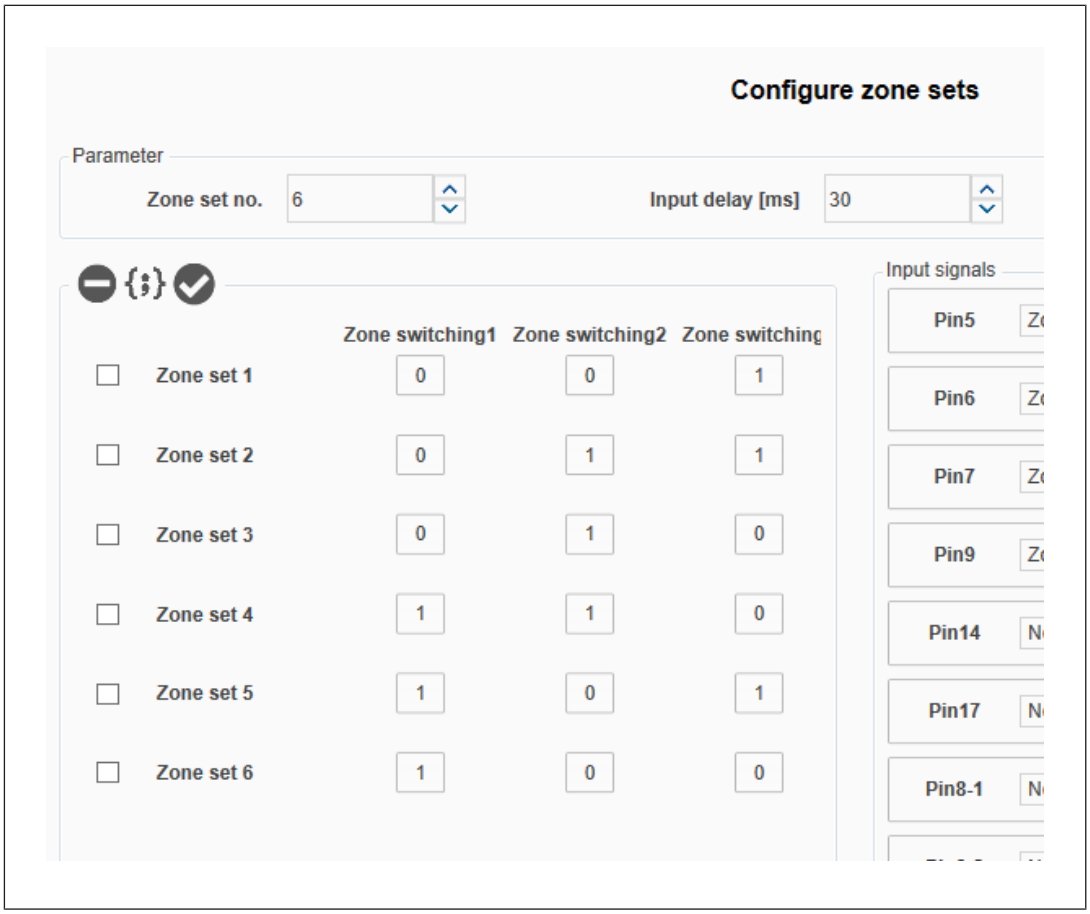


Fig.: Example for the automatic coding of 6 zone sets by the PSENscan PN Configurator to ensure the differentiation to the next monitoring case (Hamming code)

Note:

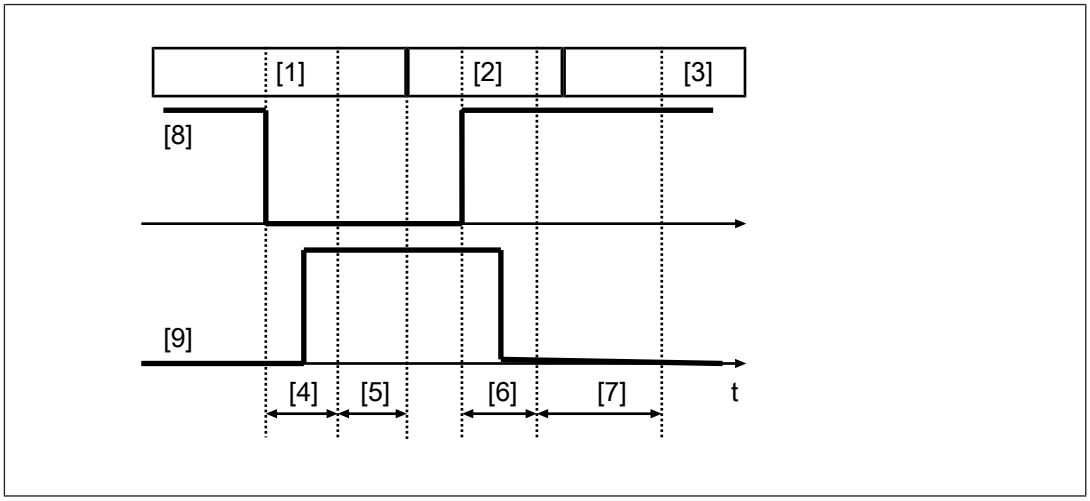
NOTICE

Malfunctions arising from switching over too early.

Switching from one zone set to another takes approx. 60 ms. The next switchover must not occur until the 60 ms has elapsed.

Ensure that there is a period of min. 60 ms between two switchovers (see diagram).

Within this time, ensure that interference does not influence the inputs and that there is no unintended change of state.



Legend

[1] Zone set 1 is monitored

[2] Zone set 2 is monitored

[3] Zone set 1 is monitored again

[4] Input delay

[5] Processing time for switchover

- Firmware version from 3.1.5: 60 ms
- Firmware version < 3.1.5: 250 ms

[6] Input delay for the next switchover

[7] Processing time for the second switchover

[8] Input1

[9] Input2

When a configuration is started, no zone sets are active. WAITING CONF is shown on the safety laser scanner display until a configuration has been completed. The safety laser scanner waits for the zone switching number value (Byte 1, Bit 7) from the controller.

If more than one zone set is configured, the sequence control can be activated or deactivated.

- Activated

  Switching from zone set x to zone set y is only permissible if y differs from x by max. 1 (y = x + 1 or y = x – 1).

  When an attempt is made to switch to a different zone set, the safety laser scanner switches to an error state and the error INPUTCF3 is displayed on the safety laser scanner.

  When the last configured zone set is reached, the next zone set is the first configured one. If the number of the zone set is 0, the safety laser scanner switches to an error state and the error INPUTCF2 is displayed on the safety laser scanner.

- Deactivated

  When switching the zone sets, the permissibility is not checked.

Procedure:

1. Configure at least two zone sets.

2. Specify whether or not the sequence control is to be activated.
3. Make sure that the controller you are using can perform dynamic switching without using an invalid zone set.

6.4 Monitoring of reference outlines

An outline within the area covered by the laser beams can be defined and monitored as a reference outline in the PSENscan PN Configurator.

The outline must be outside the safety zone and it consists of at least 3 and a max. of 15 reference points.

If PSEN sc PN 5.5. down/back detects a change in the outline, the safety laser scanner switches the safety outputs to the OFF state. A change in a tolerance range that can be set in the PSENscan PN Configurator is accepted.

For vertical applications, national and international standards recommend monitoring a reference outline.

The reference outline is configured during the first installation of PSEN sc PN 5.5. down/back. The distances measured during configuration are used as reference values for monitoring the reference outline.

Monitoring of reference outlines is used to detect any changes or changes to the environment of the safety laser scanner.

- Changes to the installation position of the safety laser scanner due to vibration
- Changes of the safety laser scanner due to manipulation
- Changes of an additional protective equipment

Applications of a reference outline for protecting moveable constructions

If the reference points are set to the position of a moveable construction, such as a gate for example, the safety laser scanner switches the safety outputs to the OFF state when the position of the gate changes.

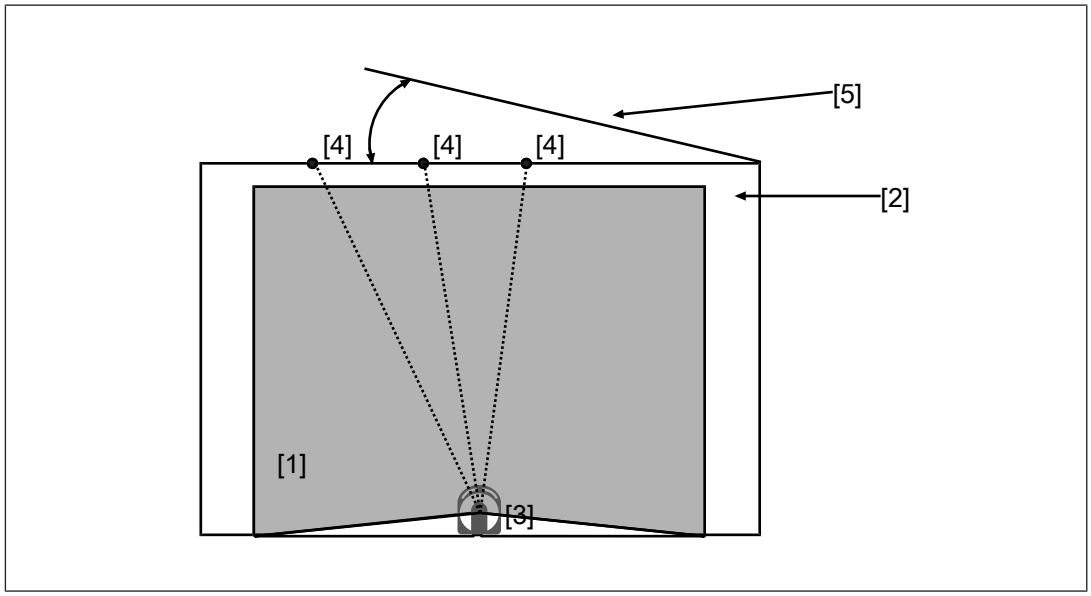


Fig.: Using a reference outline for protecting a moveable construction

Legend

[1] Danger zone

[2] Area covered by the safety laser scanner

[3] Safety laser scanner

[4] Reference points

[5] Moveable construction that is protected by the reference points

Applications of a reference outline for protecting additional protective equipment

If the reference points are set to the positions of additional safeguards, such as mechanical barriers for example, the safety laser scanner switches the safety outputs to the OFF state when one of the marked positions changes.

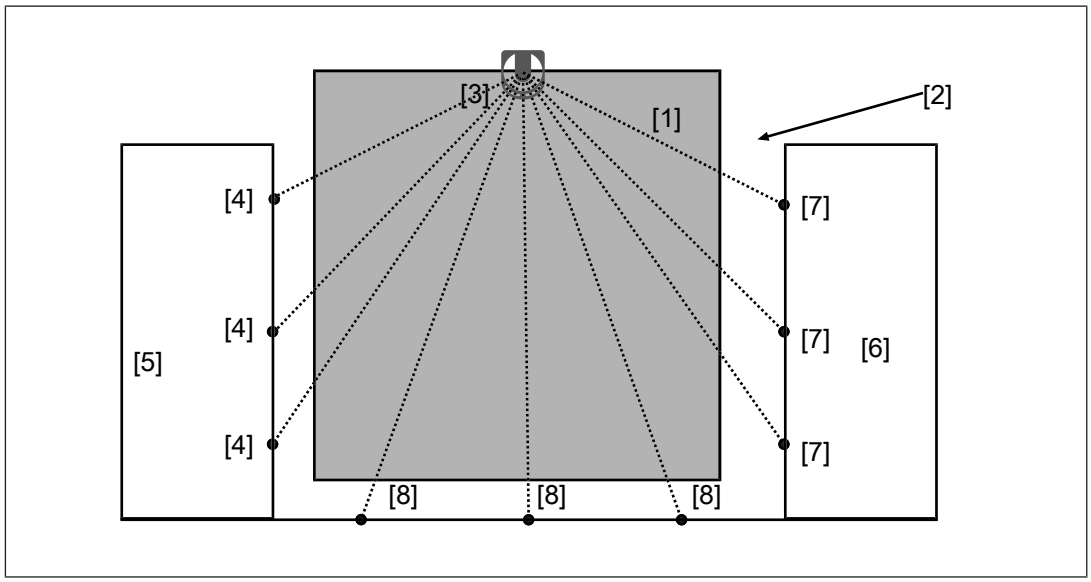


Fig.: Using a reference outline for protecting additional protective equipment

Legend

[1] Danger zone
[2] Area covered by the safety laser scanner
[3] Safety laser scanner
[4] Reference points at protective equipment 1
[5] Additional protective equipment 1 that is protected by the reference points
[6] Additional protective equipment 2 that is protected by reference points
[7] Reference points at protective equipment 2
[8] Reference points on the floor

Process data from the safety laser scanner to the safety controller

Reference outline status

- The reference outline status is 0 when all the reference points in a zone set are within the defined tolerance.

  The reference outline status is 1 when at least one reference point in a zone set is outside the defined tolerance. In this case, the safety zone status in the process data is set to 0.

Reference point activation status

- The reference point activation status is 0 when there are no reference points in the active zone set.

  The reference point activation status is 1 when reference points are configured in the active zone set.

6.5 Operating range to detection capability

Note the change of range depending on the selected **detection capability.**

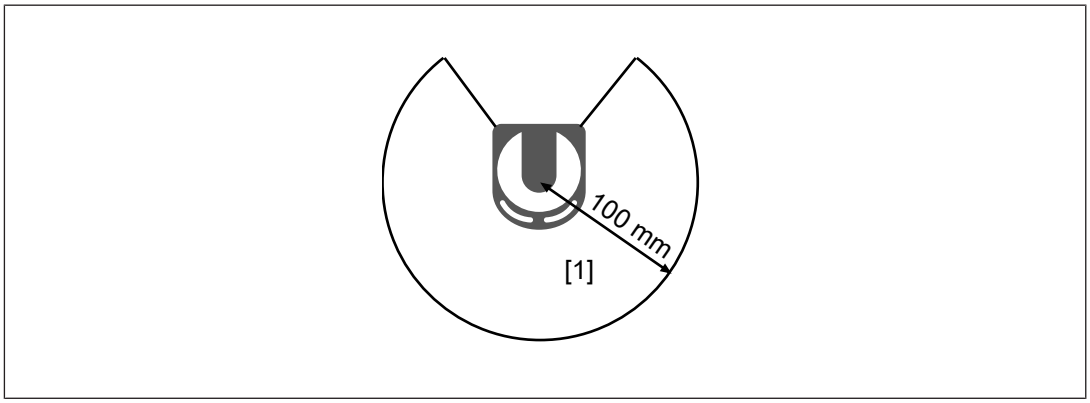
Detection capability	Max. operating range in m
	sc x 5.5
30	2.5
40	3.0
50	4.0
70	5.5
150	5.5

6.6 Area with limited detection capability

In the area of max. 100 mm before the laser scanner there is an areas with limited detection capability.

Note:

- Ensure that the area is not part of the danger zone.
- Install the safety laser scanner so that no objects can enter the zone with limited detection capability.



Legend

[1] Area with limited detection capability

6.7 Installation of several adjacent safety laser scanners

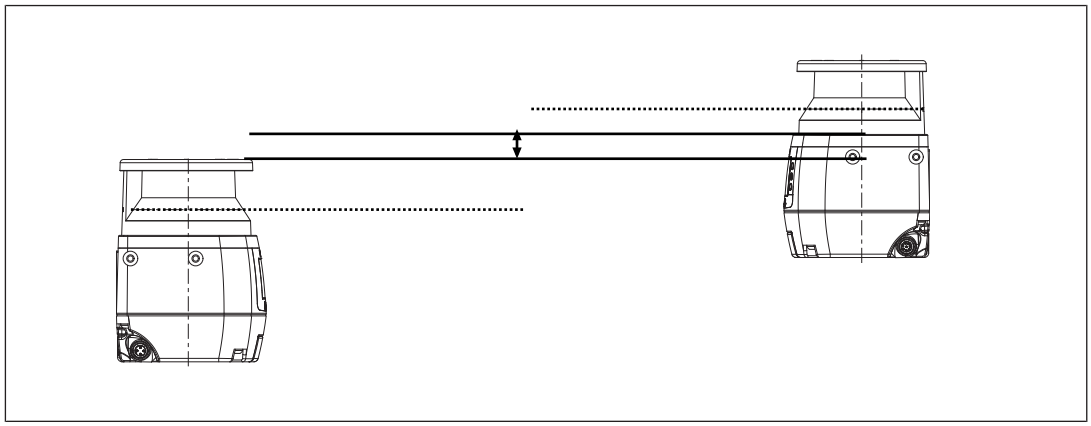
When safety laser scanners must be installed in an area, it must be ensured that the safety laser scanners do not influence each other.

This can be achieved in two ways:

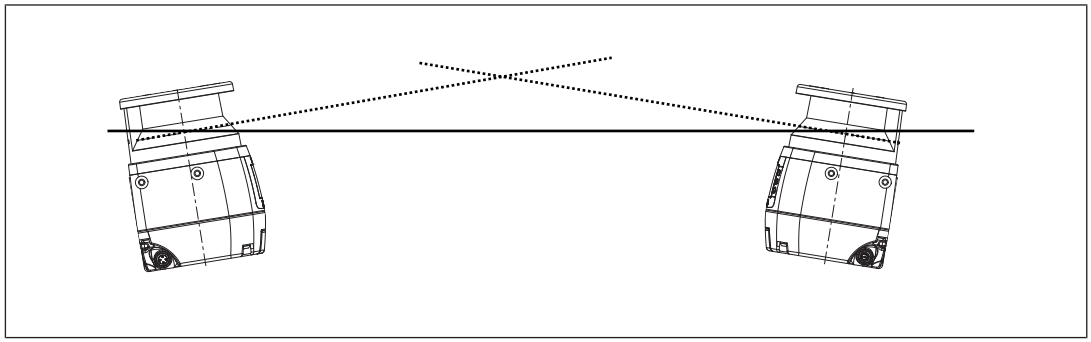
With coding [📖 24]: Define different codes for the individual safety laser scanners in the detection capability configuration,

Without coding: Install safety laser scanner at various heights or inclinations.

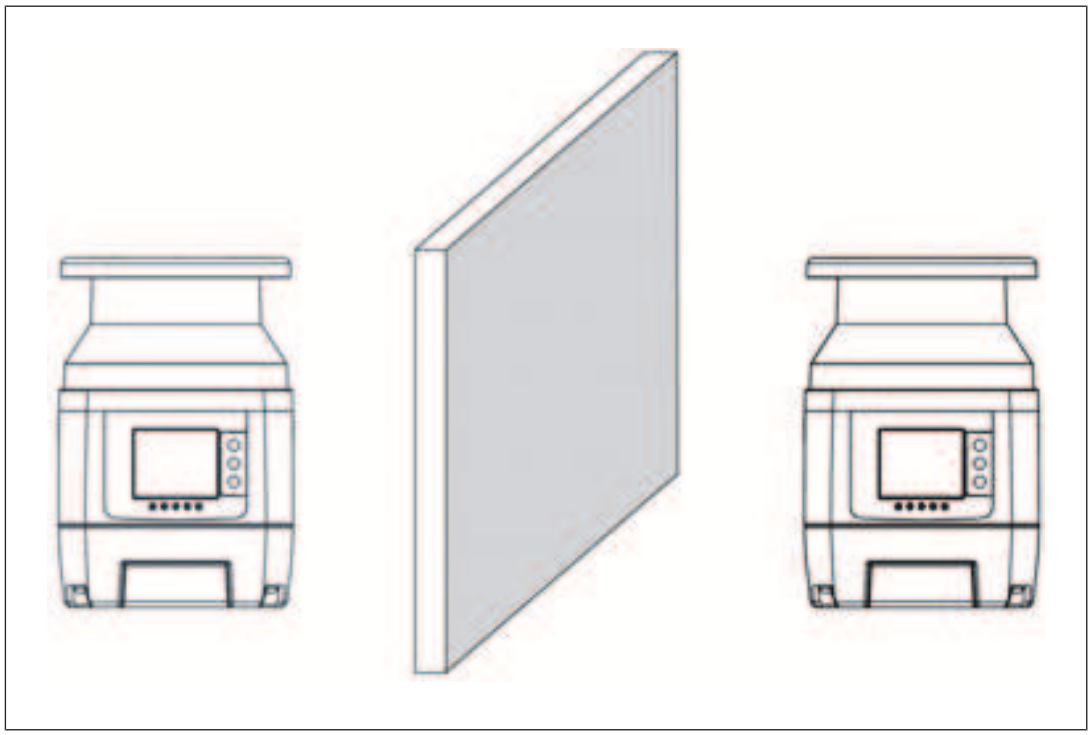
- Change the height of the safety laser scanners



▶ Change the inclination of the safety laser scanners.



▶ Place an opaque object between the safety laser scanners



6.8 Dust filtration

The safety laser scanner has a dust filtration function. This changes the sensitivity of the safety laser scanner, and the availability in dusty environments can be improved.

There are two levels:

- Low for clean environments/low dust formation
- High for contaminated environments/strong dust formation

The default setting is low.

Depending on the degree of dust filtering, it is necessary to consider an allowance for calculating the safety distance when installing the safety laser scanner near intense light sources or reflective surfaces (see Distance to intense light sources and to reflective surfaces [📖 49]).

6.9 Ambient conditions

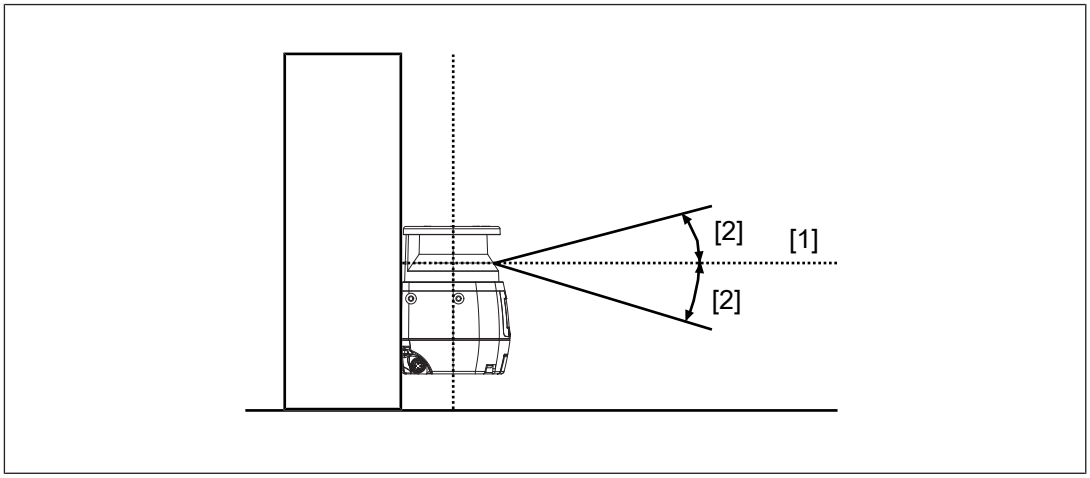
- Information given in the Technical details [📖 127] must be followed.
- If there is a highly reflective background within a distance of 2.5 m from the safety zone perimeter (e.g. a shiny metallic surface), errors in the calculation of the exact distance to the detected object may occur.
  - Reduce the reflection of the background or remove the background **or**
  - add the allowance Z_R to the minimum safety distance (see Distance to intense light sources and to reflective surfaces [📖 49]).
- Avoid strong electromagnetic interference when operating the safety laser scanner.
- When operating the safety laser scanner, avoid strong smoke, mist, and dust formation that would reduce the safety laser scanner's operating range or lead to switching to the OFF state.
- In the safety laser scanner's overall scanning plane, avoid fixed objects that impede monitoring of the safety zone.

6.10 Distance to intense light sources and to reflective surfaces

Minimum distance to especially intense or flashing light sources

Pilz recommends that the safety laser scanner is not installed near particularly intense or flashing light sources (e.g. flash units).

When especially intense or flashing light sources are near the safety laser scanner (area of +/- 5° to the scanning plane, see figure), an allowance has to be considered when calculating the safety distance.



Legend

[1] Scan plane

[2] Area of +/- 5° to the scan plane

Minimum distance from reflective surfaces

- Pilz recommends that reflective surfaces with a distance of 3 m to the safety zone are removed.

  If this is not possible, the allowance Z_R must be considered when calculating the safety distance.

  (The recommendation was determined with a background reflection of 300 $\frac{cd}{m^2 * lx}$. For highly reflective backgrounds an additional safety assessment is required, taking into account the reflective background. This may result in a higher allowance.)
- Objects that may be influenced by safety laser scanners through ambient light, must not be placed within the opening angle of the laser beam.

Allowance Z_R with distances below the recommended minimum distances to intense light sources or reflective surfaces

If the recommended distances cannot be met, the allowance Z_R must be considered when calculating the safety distance [📖 31].

The value for the allowance Z_R depends on the selected level of the dust filter.

- Z_R = 87 mm for dust filter level = low
- Z_R = 200 mm for dust filter level = high

INFORMATION

Determining of the allowance when the safety laser scanner has to be installed near particularly intense or flashing light sources and a reflective background.

Use the higher value of the relevant allowances.

6.11 Distance from walls

The edges of the safety zone must have a distance of 40 mm to walls or fixed objects on all sides.

With this value, the function of the safety laser scanner is ensured. Depending on the reflective conditions of the walls or objects, higher allowances may be necessary (see Distance to intense light sources and to reflective surfaces [📖 49]).

INFORMATION

Standard value used for the teach-in function for the distance from walls

The teach-in function on the PSENscan PN Configurator uses a standard value of 100 mm. The value can be changed.

6.12 Planning of safety and warning zones and zone sets

- Specify the location and the size of the safety zone and the warning zone in accordance with the safety assessment.
- Specify in what situations the switching operation of the zone sets are to take place.

Number of zones	Number of required outputs on the safety controller
4-6	4
7-10	5
11-20	6
21-35	7
36-70	8

mx. number of zones			Required outputs on PSEN sc PN 5.5. down/back
Safety zone	Warning zone	Muting zone	
1	2 (optional)	1 (optional)	2 safe outputs 2 standard outputs
2	1 (optional)	1 (optional)	4 safe outputs 1 standard outputs
3	-	1 (optional)	6 safe outputs

6.13 Switchover time with zone selection

WARNING!

Loss of the safety function by switching the monitoring too late

Depending on the application, serious injury or death may result.

Switching the monitoring of zone sets too late results in the loss of the safety function. There may be people in the safety zone before switching.

– Use switching of monitoring in time or overlapping zone sets to ensure that no person is in the safety zone when this area changes to a danger zone.

The zone selection is performed by signals that are present at the control inputs. A maximum switchover time (input delay in the PSENscan PN Configurator) is defined for the switching process. For this time, not permitted signals may be present at the entrances to the zone selection. After the switchover time has elapsed, a valid code for a zone must be present at the inputs for zone selection. The switchover time can be adjusted in increments of 30 ms, and it must be adapted to the performance of the control system.

Select the time where the safety controller can switch an input in a defined way.

▶ Avoid switchover times that are too short.

– Firmware version from 3.1.5: Avoid switchover times <= 90 ms (processing time + min. input delay) for switching between two zone sets.

– Firmware version < 3.1.5: Avoid switchover times <= 280 ms (processing time + min. input delay) for switching between two zone sets.

6.14 Muting

6.14.1 General

CAUTION!

Risk of injury due to loss of the safety function

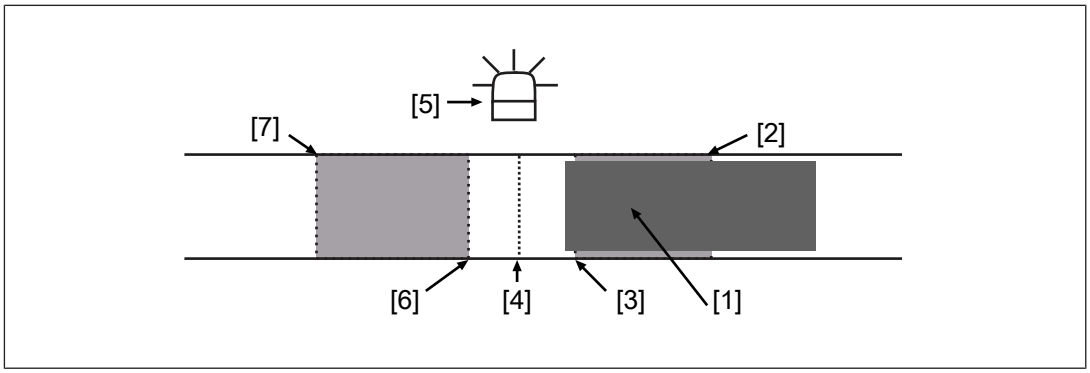
In muting status, the safety outputs continue to be in the ON state. The connected machine remains in operation and represents a potential hazard.

– Prevent the possibility of access to the danger zone during muting.

Muting means a temporary suspension of the safety function. For this reason, the muting function must have a time restriction. When the muting sensors are activated and the muting status begins, an internal clock is started. If the muting sensors are still active after 10 minutes (status when delivered), the muting status is cancelled and the safety laser scanner grid switches to a safe condition.

Time monitoring for the muting function can be set in the PSENscan PN Configurator.

Example of a muting cycle when material passes from the right-hand side



Legend

[1] Conveyed material on conveyor

[2] First muting sensor on the input side of the conveyor, connected to configurable input ***Muting 11***

[3] Second muting sensor on the input side of the conveyor, connected to configurable input ***Muting 12***

[4] PSEN sc PN 5.5. down/back

[5] Muting lamp

[6] First muting sensor on the output side of the conveyor, connected to configurable input ***Muting 11***

[7] Second muting sensor on the output side of the conveyor, connected to configurable input ***Muting 12***

- Inform staff of the
  - hazard potential from the muting function,
  - absence of protection during muting.
- Mark the area that is protected by the safety laser scanner.
- The two muting areas cannot be activated simultaneously.
- Muting cannot be activated if the safety laser scanner is in a safe state (LED lights up red, object detected in the safety zone).
- Different conveyor speeds in the area of a PSEN sc PN 5.5. down/back should be prevented.
- The first muting sensor on the input side and the first muting sensor on the output side must be connected to the configurable input ***Muting 11***.

  The second muting sensor on the input side and the second muting sensor on the output side must be connected to the configurable input ***Muting 12***.
- The muting state is shown by the muting lamp and in the display of PSEN sc PN 5.5. down/back.

  The muting lamp must be connected to the PSEN sc PN 5.5. down/back and positioned so that the muting lamp is clearly visible form the whole danger zone.

- Use a muting lamp with an LED lamp and a max. current consumption of 250 mA.

- Indicate clearly visible near the protected area that there is no protection when the muting lamp is lit.
- The muting sensors have to positioned in a way that the muting area cannot be reached while muting is active.

6.14.2 Muting in two directions

- The muting status occurs
  - If the signal at the second muting input ***Muting 12*** switches to High after muting input ***Muting 11*** has also switched to high (or muting input ***Muting 11*** switches to High after muting input ***Muting 12***) **and**
  - The delay between the two signal changes is within the configurable range ***Muting activation delay [ms].*** The max. delay can be configured for between 1 and 16 seconds.
- The muting state is ended
  - When the configured time is reached **or**
  - When the signal at one of the two muting inputs switches to low **and**
  - the internal delay of max. 30 ms has elapsed.

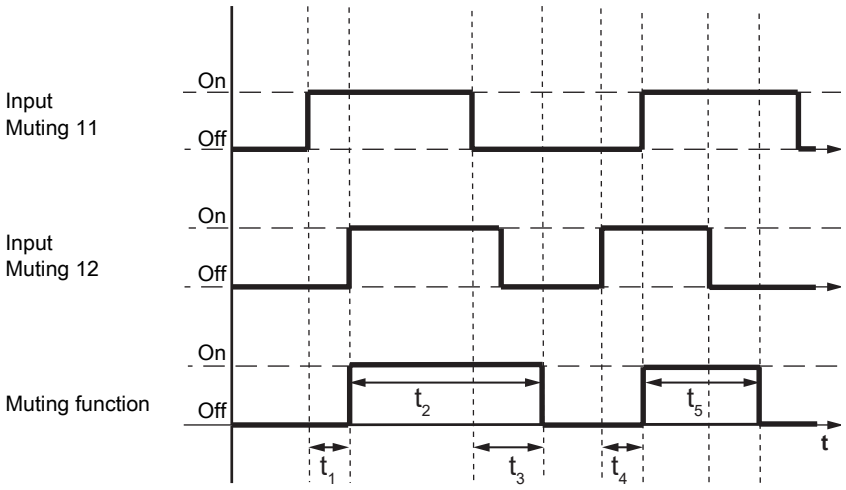


Fig.: Timing diagram T-muting

Legend

t_1 Delay between ***Muting 11*** and ***Muting 12*** (configurable from 1-16 s)

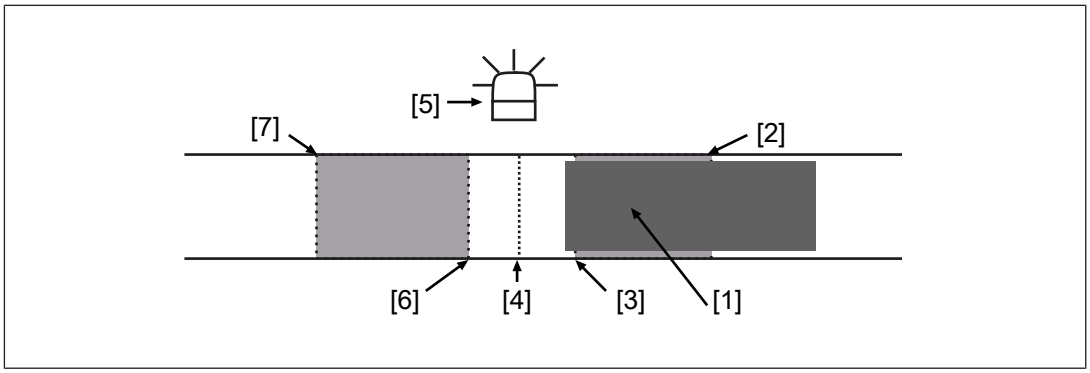
t_2 Duration of the muting state (max. up to the configured timeout)

t_3 Internal delay before the muting state is ended (max. 30 ms)

t_4 Delay between ***Muting 11*** and ***Muting 12*** (configurable from 1-16 s)

t_5 Duration of the muting state (max. up to the configured timeout)

Sequence for T-muting cycle when material passes from the right-hand side



Legend

[1] Conveyed material on conveyor

[2] First muting sensor on the input side, connected to ***Muting 11***

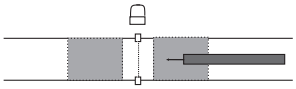
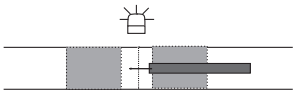
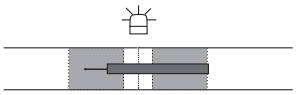
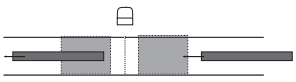
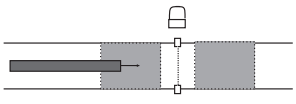
[3] Second muting sensor on the input side, connected to ***Muting 12***

[4] PSEN sc PN 5.5. down/back

[5] Muting lamp

[6] First muting sensor on the output side, connected to ***Muting 11***

[7] Second muting sensor on the output side, connected to ***Muting 12***

Phase in the muting cycle	Explanation
	Material has already passed the first muting sensor and is being transported on the conveyor in the direction of the second muting sensor, muting lamp off.
	Material on the conveyor passes the second muting sensor (max. 4 s after the first sensor was passed). Muting lamp flashes, signalling the muting status.
	Material on the conveyor passes the PSEN sc PN 5.5. down/back and the first muting sensor on the output side, muting lamp flashes, signalling the muting status.
	Material has left the area of the first muting sensor on the output side, muting lamp is off, muting status is ended. The next piece of material arrives at the first muting sensor.
	If material is transported from the left-hand side, the cycle is reversed. The output side becomes the input side and the flow starts with the second muting sensor on the output side.

Please note the following distances and times when installing the safety laser scanner and using the muting function:

$D_{MutingOff}$ = Distance between muting sensor A1 and muting sensor A2 and between muting sensor B1 and muting sensor B2

- $D_{MutingOff} < L$
  - L = Length of the object that triggers the muting state as it passes the muting sensors

D_{A-B} = Max. distance between muting sensor A1 and muting sensor B1 and between muting sensor A2 and muting sensor B2

- $D_{A-B} = V * t_1 * 100$
  - V = Conveyor speed of the transported material in m/s
  - t_1 = Delay between Muting 11 and Muting 12

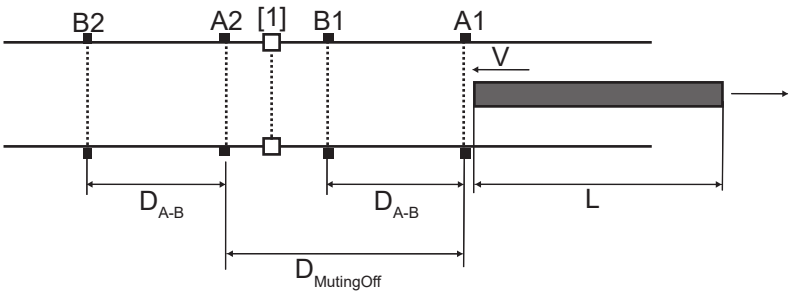


Fig.: Distances between muting sensors - 4 muting sensors

Legend

[1] Safety laser scanner

A1 First muting sensor on the input side, connected to ***Muting 11***

B1 Second muting sensor on the input side, connected to ***Muting 12***

A2 First muting sensor on the output side, connected to ***Muting 11***

B2 Second muting sensor on the output side, connected to ***Muting 12***

L Length of the object that triggers the muting state as it passes the muting sensors

V Speed at which the object is moving

D_{A-B} Distance between the muting sensors A1 and B1, and between A2 and B2

$D_{MutingOff}$ Distance between muting sensor A1 and muting sensor A2

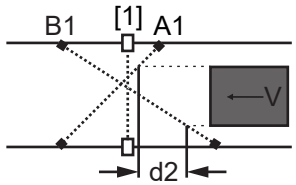


Fig.: Distances between muting sensors - Cross muting

Legend

[1] Safety laser scanner

A1 First muting sensor on the input side, connected to ***Muting 11***

B1 Second muting sensor on the input side, connected to ***Muting 12***

d2 Distance that the object covers from the first muting sensor A1 to the second muting sensor B2 in max. 4 s

V Speed at which the object is moving

6.14.3 Muting in one direction

NOTICE

Faulty application of L-muting

– Only use L-muting to remove material from the danger zone.

- The muting status occurs
  - If the signal at the second muting input ***Muting 12*** switches to High after muting input ***Muting 11*** has also switched to high (or muting input ***Muting 11*** switches to High after muting input ***Muting 12***) **and**
  - The delay between the two signal changes is within the configurable range ***Muting activation delay [ms].*** The max. delay can be configured for between 1 and 16 seconds.
- The muting state is ended
  - When the configured time is reached **or**
  - after a multiple of the delay between the activation of the two muting sensors. The ***Factor activation delay*** can be selected between 2 and 16.

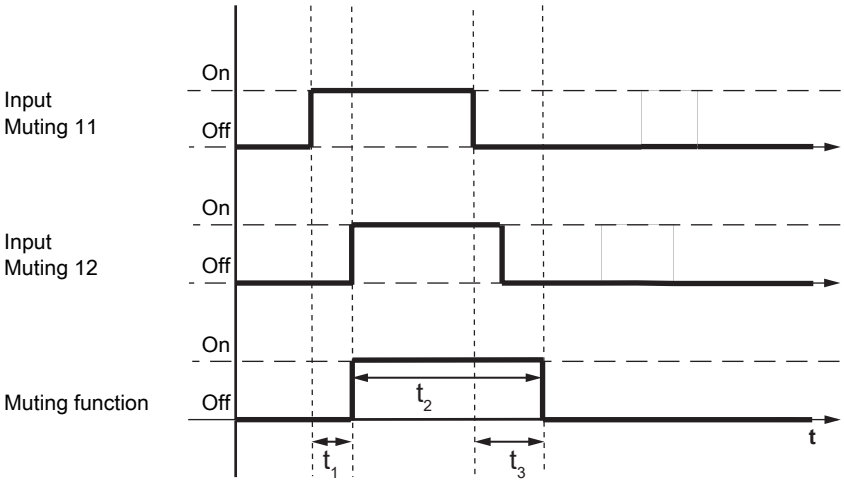


Fig.: Timing diagram L-muting

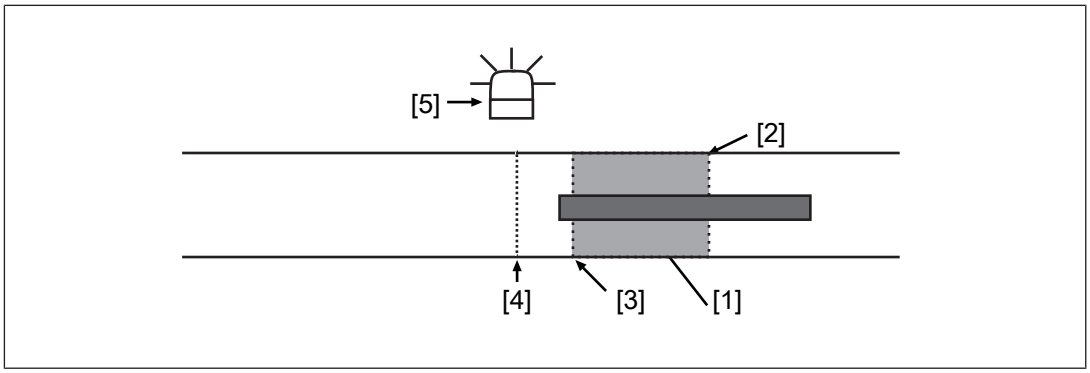
Legend

t_1 Delay between ***Muting 11*** and ***Muting 12*** (configurable from 1-16 s)

t_2 Duration of the muting state (max. up to the configured timeout)

t_3 Internal delay before the muting state is ended (max. 30 ms)

Sequence of an L-muting cycle in accordance with flow of material



Legend

[1] Material is taken away from the danger zone

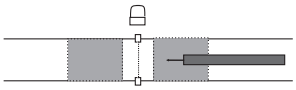
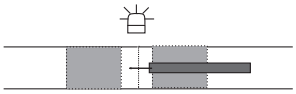
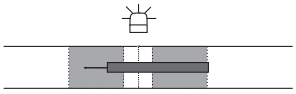
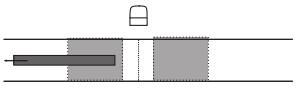
[2] First muting sensor on the input side, connected to ***Muting 11***

[3] Second muting sensor on the input side, connected to ***Muting 12***

[4] PSEN sc PN 5.5. down/back

[5] Muting lamp

Please note the following distances and times when installing the safety laser scanner and using the muting function:

Phase in the muting cycle	Explanation
	Material has already passed the first muting sensor and is being transported in the direction of the second muting sensor, muting lamp off.
	Material passes the second muting sensor (max. 4 s after the first sensor was passed). Muting lamp flashes, signalling the muting status.
	Material passes the PSEN sc PN 5.5. down/back and the first muting sensor on the output side, muting lamp flashes, signalling the muting status.
	Material has left the area of the first muting sensor on the output side, muting lamp is off, muting status is ended.

Muting in one direction

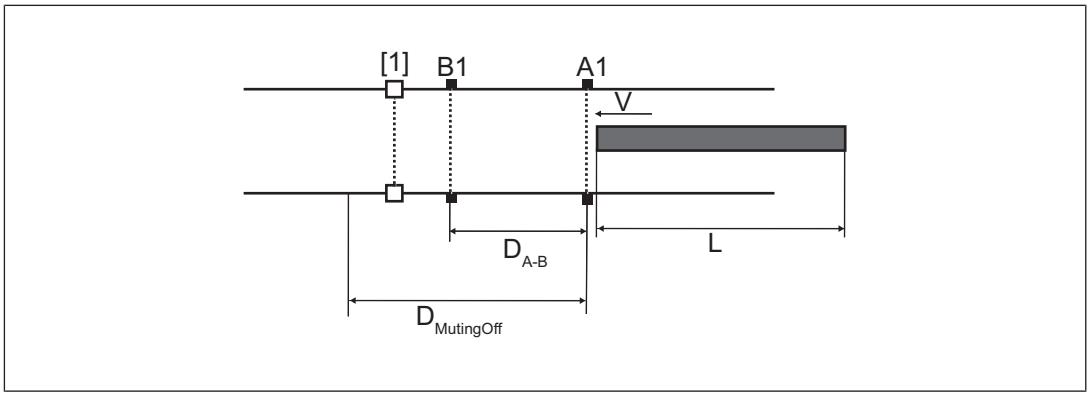


Fig.: Distances between muting sensors - 2 muting sensors

Legend

[1] Safety laser scanner

A1 First muting sensor on the input side, connected to ***Muting 11***

B1 Second muting sensor on the input side, connected to ***Muting 12***

L Length of the object that triggers the muting state as it passes the muting sensors

V Speed at which the object is moving

D_{A-B} Distance between the muting sensors A1 and B1

$D_{MutingOff}$ Distance between muting sensor A1 and the position from which the muting function is turned off again

6.14.4 Dynamic muting

When ***Activate muting*** is selected for an input, muting can be activated and deactivated dynamically.

- Conditions for the occurrence of muting
  - one of the configurable inputs/outputs is connected to a safety controller and it receives a high signal from there when muting is activated.
  - When configuring the inputs, ***Activate muting*** is configured for this input in the PSENscan PN Configurator
  - the first sensor has detected conveyed material and the second sensor also detected it max. 4 s afterwards

6.15 Override

The override function can be used for the three types according to the timing diagrams.

- Single-channel pulses
- Activation is edge-triggered
- Activation is signal-triggered (only when using the 12-pin connection)

The Override function can only be activated when the input signals are controlled in accordance with the timing diagrams.

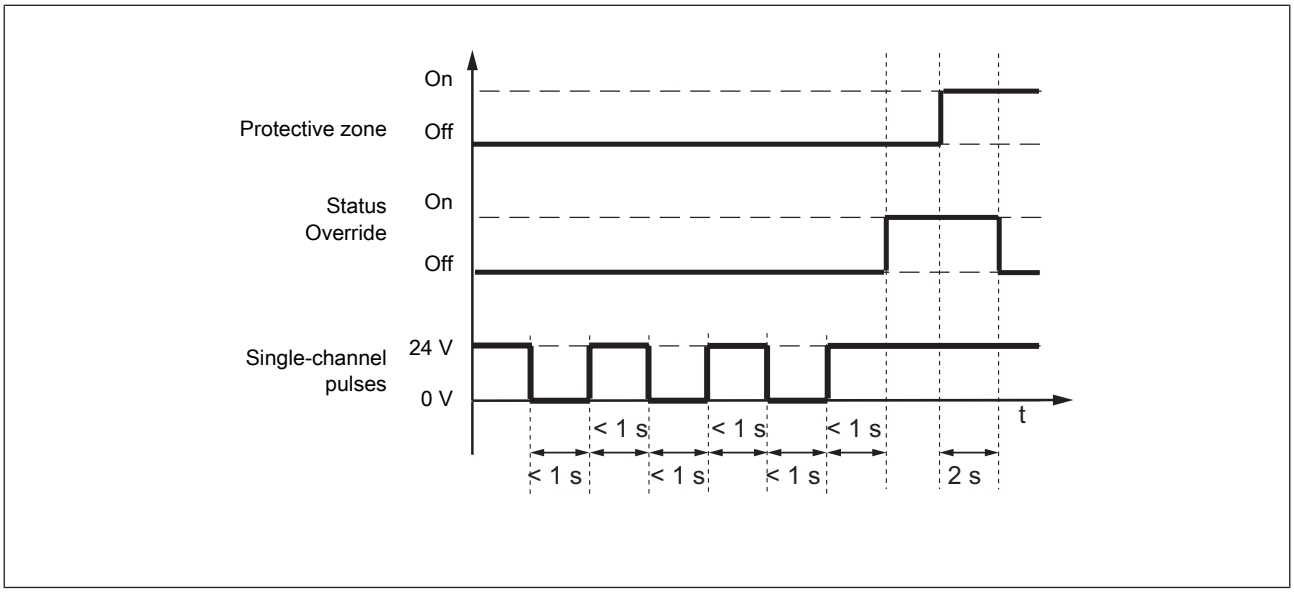


Fig.: Timing diagram for override function single-channel pulses

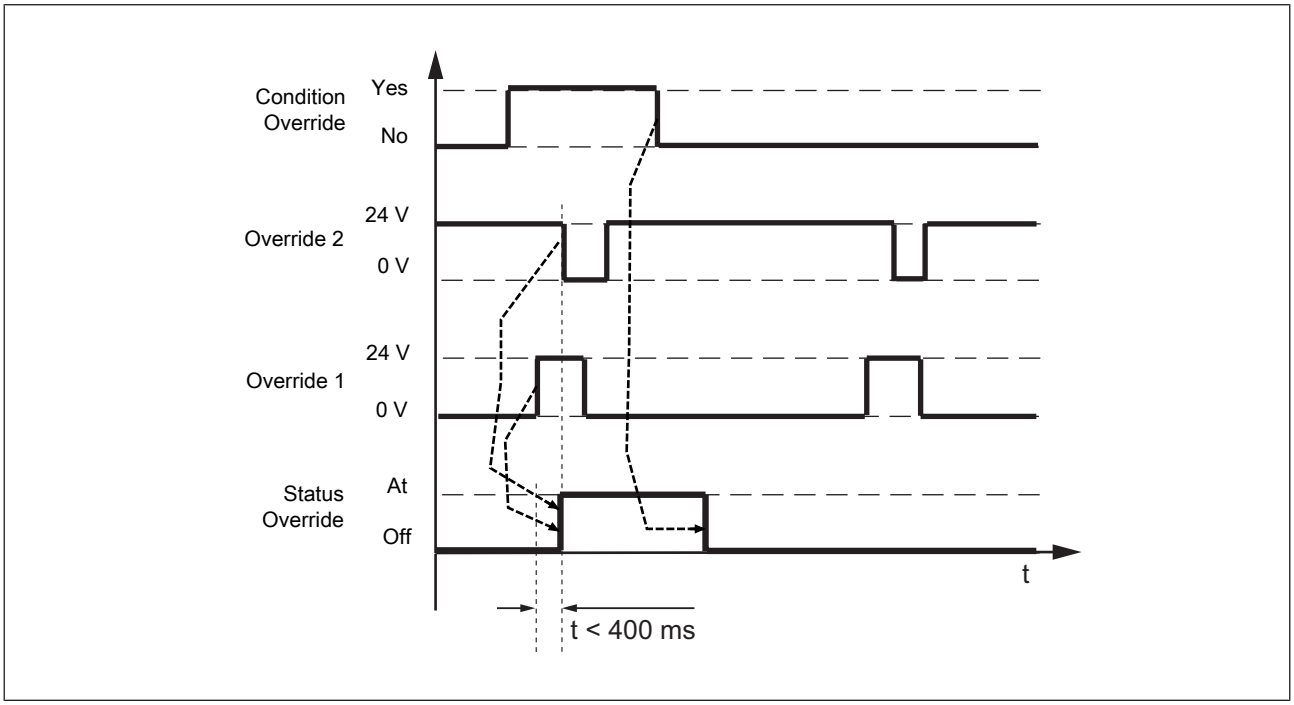


Fig.: Timing diagram for override function edge-triggered

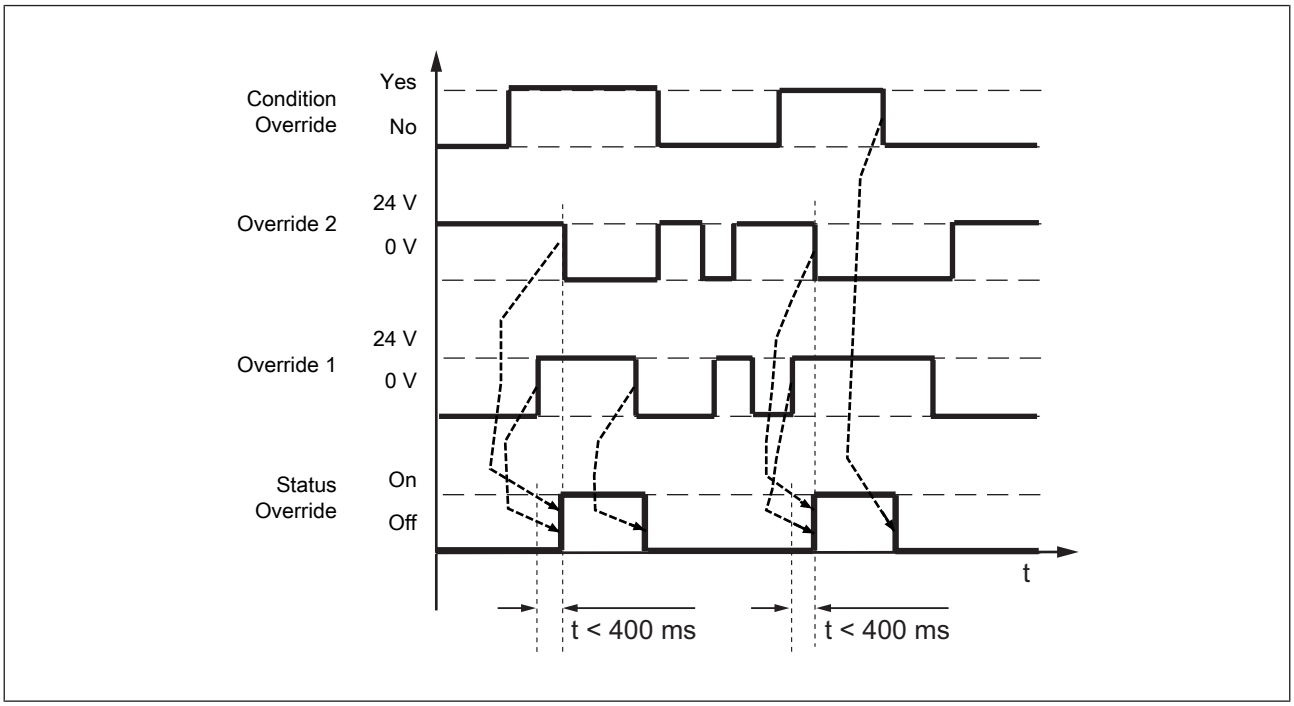


Fig.: Timing diagram for override function signal-triggered

6.16 Rest condition

The safety laser scanner can only be switched to the rest condition, when

- more than one zone set is configured
- no safety or warning zones are configured in the relevant zone set.

The settings in a configuration remain saved.

Forms drawn in a configuration are deleted when the rest condition is activated.

During the rest condition, the following actions are not possible:

- Changes to the configuration
- Update firmware
- Changes of network settings (e.g. IP address)

Maximum power consumption of the safety laser scanner in normal operation and in the rest state

Product type	Consumption in normal operation (without load)	Consumption in rest state
PSEN sc PN 5.5. down/back	300 mA	200mA

6.17 PROFINET configuration

6.17.1 General

- PSEN sc PN 5.5. down/back is suitable for use in these network topologies:
  - Star
  - Line
  - Tree
  - Ring
- The data can be assigned in various ways:
  - In the PSENscan PN Configurator in the *PROFINET/PROFIsafe configuration*
  - With a configuration software for PROFINET networks
  - With a PROFINET controller

6.17.2 Addresses

- The safety laser scanner needs two IP addresses.
  - One for the configuration of the safety laser scanner
  - One for the ports FBUS1/FBUS2
- The safety laser scanner needs a PROFINET name and an F-address.

F-parameters	Description	Value range
F_Source_Address	Code name of F-host, unique address of the controller	1 … 65534
F_Destination_Address	Code name of F-(sub)module, unique address of the safety laser scanner in combination with the F_Source_Address. F_Destination_Address must match the address that was stated when the safety laser scanner was configured.	1 … 65534
F_Watchdog_Time	Watchdog time (monitored time) for cyclical data. The watchdog time must be long enough to tolerate short delays in transmission. This time influences the response time of the overall system and is therefore safety-related.	
F_SIL (F_Prm_Flag1)	Safety Integrity Level (SIL) configured for the safety laser scanner.	SIL 1 SIL 2 No details
F_CRC_Length (F_Prm_Flag1)	Length of the CRC2 key. Depends on the process image you are using.	3 octets (PROFIsafe v2.4) 4 octets (PROFIsafe v2.6)
F_Par_Version (F_Prm_Flag2)	PROFIsafe operating mode (cannot be changed)	1

F-parameters	Description	Value range
F_Block_ID (F_Prm_Flag2)	Type identification for parameters	0 (No F_iPar_CRC) 1 (F_iPar_CRC)
F_iPar_CRC	Check sum of the configuration stored in the device. The value is identical to the IM_Signature (I&M4).	4 octets

6.17.3 Configuration in PROFINET

- To enable the safety laser scanner to be used in PROFINET
  - A device file (GSDML) for the safety laser scanner must be imported into the PROFINET controller
  - The safety laser scanner must be added to the project and connected to the controller
  - A PROFINET name must be assigned for the safety laser scanner
  - The PROFIsafe parameters must be set in the submodule.

6.17.4 Process data

The cyclical transfer of data between the safety controller and the safety laser scanner takes place via the process image. The safety laser scanner provides I&M parameters and alarms.

You can choose from these process images (***F-I/O data*** in the window ***PROFINET/ Profisafe configuration***):

- 12 Bytes (Input/Output) – Default setting
- 7 Bytes (Input/Output)
- 12 Bytes (Output)
- 7 Bytes (Output).

Input/Output refers to the perspective of the safety laser scanner. The output of the process image is sent from the safety laser scanner to the safety controller. The input of the process image is sent from the safety controller to the safety laser scanner.

The process images differ in these criteria.

- Version of the PROFIsafe specification (2.4 or 2.6.1)
- Length of the process image (12 Bytes or 7 Bytes)
- With or without test of the F_iPar_CRC

Process images with a length of 7 Bytes cover all functions. Process images with a length of 12 Bytes will cover additional functions in future versions.

A link to the submodule used is created in the GSDML file for all F-I/O data in a configuration:

- 12 Bytes (Input/Output) supports PROFIsafe V2.6.1 I/O modules and PROFIsafe V2.4 I/O modules:
  - Submodule 12Byte In/Out PROFIsafe V2.6.1 (Submodule Ident Number =0x00000011).

  - Submodule 12Byte In/Out PROFIsafe V2.6.1 iParCRC (Submodule Ident Number =0x00000012).
  - Submodule 12Byte In/Out PROFIsafe V2.4 (Submodule Ident Number =0x00000013).
  - Submodule 12Byte In/Out PROFIsafe V2.4 iParCRC (Submodule Ident Number =0x00000014).
- 7 Bytes (Input/Output) supports PROFIsafe V2.6.1 I/O modules and PROFIsafe V2.4 I/O modules:
  - Submodule 7Byte In/Out PROFIsafe V2.6.1 (Submodule Ident Number =0x00000015).
  - Submodule 7Byte In/Out PROFIsafe V2.6.1 iParCRC (Submodule Ident Number =0x00000016).
  - Submodule 7Byte In/Out PROFIsafe V2.4 (Submodule Ident Number =0x00000017).
  - Submodule 7Byte In/Out PROFIsafe V2.4 iParCRC (Submodule Ident Number =0x00000018).
- 12 Bytes (Output) supports PROFINET non-safety-related I/O modules:
  - Submodule 12Byte Input non-safety-related PNIO data (Submodule Ident Number =0x00000021)
- 7 Bytes (SLS Output) supports PROFINET non-safety-related I/O modules:
  - Submodule 7Byte Input non-safety-related PNIO data (Submodule Ident Number =0x00000022).

Process data output (from the safety controller to the safety laser scanner) – 7 Bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved				Switch to rest state	Stop event report	Re-served	Wave
1	Switching zone number							
2	Restart of safety zone number 1 … 8 (according to the number of safety zones, for manual restart)							
3	Re-served	Muting activation zone (max. 4, depending on the configuration)						
4	Re-served	Override activation zone (max. 4, depending on the configuration)						
5	Reserved							
6	Reserved						Reset with net-work	Reset without network

Process data input (from safety laser scanner to safety controller) - 7 Bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Event report status	Device status	Manipulation protection warning status	Manipulation protection status	Rest state status	Reference outline status	Violation error	Violation warning
1	Switching zone number							
2	Status safety zone number 1 … 8 (according to the number of safety zones, for manual restart)							
3	Status restart interlock 1 … 8 (according to the number of safety zones, for manual restart)							
4	Reserved	Override activation zone (max. 4, depending on the configuration)						
5	Reserved	Override status zone (max. 4, depending on the configuration)						
6	Reference outline activation status	Warning status zone 1 … 8 (max. 8, depending on the configuration)						

Process data output (from the safety controller to the safety laser scanner) – 12 Bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved				Switch to rest state	Stop event report	Reserved	Wave
1	Switching zone number							
2	Reserved							
3	Reserved							
4	Restart of safety zone number 1 … 8 (according to the number of safety zones, for manual restart)							
5	Reserved							
6	Reserved	Muting activation zone (max. 4, depending on the configuration)						
7	Reserved							
8	Reserved	Override activation zone (max. 4, depending on the configuration)						
9	Reserved							
10	Reserved							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11	Reserved						Reset with network	Reset without network

Process data input (from safety laser scanner to safety controller) – 12 Bytes

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Event report status	Device status	Manipulation protection warning status	Manipulation protection status	Rest state status	Reference outline status	Violation error	Violation warning
1	Zone switching number							
2	Status safety zone number 1 … 8 (according to the number of safety zones, for manual restart)							
3	Reserved							
4	Status restart interlock 1 … 8 (according to the number of safety zones, for manual restart)							
5	Reserved							
6	Reserved	Muting status zone (max. 4, depending on the configuration)						
7	Reserved							
8	Reserved	Override status zone (max. 4, depending on the configuration)						
9	Reserved							
10	Reference outline activation status	Warning zone (max. 7, depending on the configuration)						
11	Reserved							

Detailed information

From the safety controller to the safety laser scanner

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
0.0	Wave	Additional function	Bool	Wave function for easier identification of a safety laser scanner	0 = Deactivate wave 1 = Activate wave	No
0.2	Stop event report	Additional function	Bool	Stop recording of events	0 = Activate recording (default value) 1 = Deactivate recording (events are not recorded, events already saved are retained)	No
0.3	Rest state	Safety function	Bool	Energy saving mode	0 = Deactivate rest state (default value) 1 = Activate rest state (1 for the duration of min. 1 s)	No
1.x (x = 0 … 7)	Zone set switching	Safety function	USINT	Active zone set is stated	0 = Do not activate zone set (default value) 1 … 70 = Number of zone set	Yes

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
2.x (x = 0 … 7)	Restart safety zone 0 … 7	Safety function	Bool	Restart safety zone after interlock (if there are no objects in the safety zone)	0 = No restart (default value) 0-1-0= Restart safety zone of zone set (Duration1 T_min_restart < t < T_max_restart) 1 = Ignored	Yes
3.x (x = 0 … 6)	Muting activation zone (max. 4, depending on the configuration)	Safety function	Bool	Activation of muting function for safety zone of zone set	0 = No activation (default value) 0-1 = Activation of muting (Duration1 t > T_min_muting)	Yes
4.x (x = 0 … 6)	Activation of override zone (max. 4, depending on the configuration)	Safety function	Bool	Activation of override for safety zone of zone set	0 = No activation (default value) 0-1 = Activation of override (Duration1 t > T_min_override)	Yes
6.0	Reset safety laser scanner without resetting network	Safety function	Bool	Reset safety laser scanner without stopping the network	0 = No reset (default value) 0-1-0 = Reset (Duration1 t > T_min_reset) 1 = Ignored	Yes

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
	Reset safety laser scanner with network reset	Safety function	Bool	Reset safety laser scanner and stop network	0 = No reset (default value) 0-1-0 = Reset (Duration1 t > T_min_reset) 1 = Ignored	Yes

From safety laser scanner to safety controller

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
0.0	Dirt on window	Safety function	Bool	Status of front panel. If there is evidence of dirt, the safety laser scanner switches to an error state.	0 = No dirt 1 = Error due to dirt	Yes
0.2	Reference points status	Safety function	Bool	Status of monitored reference points in the active zone set.	0 = No change 1 = At least one reference point is outside the tolerance.	Yes
0.3	Rest state	Safety function	Bool	Status of rest state	0 = Rest state deactivated (default value) 1 = Rest state activated (1 for the duration of min. 1 s)	No

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
0.4	Manipulation protection status	Safety function	Bool	Status of manipulation protection	0 = Manipulation protection activated 1 = Manipulation protection deactivated	Yes
0.5	Manipulation protection warning status	Safety function	Bool		0 = Manipulation protection warning activated 1 = Manipulation protection warning deactivated (not standard-compliant)	Yes
0.6	Device status	Diagnostics	Bool		0 = Normal operation 1 = Interlock	No
0.7	Event report status	Additional information	Bool	Status of recorded events	0 = Event recording activated 1 = Event recording deactivated	No
1.x (x = 0 … 7)	Zone set switching	Safety function	USINT	Active zone set is stated	0 = No zone set activated (default value) 1 … 70 = Number of zone set	Yes

Byte.Bit	Name	Application	Data type	Description	Value range	Safety-related
2.x (x = 0 … 7)	Restart safety zone 0 … 7	Safety function	Bool	Restart safety zone after interlock (if there are no objects in the safety zone)	0 = No restart (default value) 0-1-0= Restart safety zone of zone set (Duration1 T_min_restart < t < T_max_restart) 1 = Ignored	Yes
3.x (x = 0 … 6)	Muting activation zone (max. 4, depending on the configuration)	Safety function	Bool	Activation of muting function for safety zone of zone set	0 = No activation (default value) 0-1 = Activation of muting (for the duration t > T_min_muting)	Yes
4.x (x = 0 … 6)	Activation of override zone (max. 4, depending on the configuration)	Safety function	Bool	Activation of override for safety zone of zone set	0 = No activation (default value) 0-1 = Activation of override (for the duration t > T_min_override)	Yes
6.x (x = 0 … 6)	Warning zone x status	Additional information	Bool	Status of warning zone x in the active zone set	0 = Violation of warning zone 1 = No violation	No
6.8	Reference point activation	Additional information	Bool	Status of reference point activation in the active zone set	0 = No reference points configured in the zone set 1 = Reference points configured in the zone set	No

7 Wiring

7.1 General guidelines

- Information given in the Technical details [📖 127] must be followed.
- Do not lay the connecting cable near or in contact with cables that carry high or highly volatile currents.
- Use separate cables to connect the wires to the inputs and outputs of different safety laser scanners or safety switches.
- For supply voltage, use only PELV/SELV power supplies that have a voltage buffer in accordance with EN 60204-1.
- The protection type (see Technical details [📖 127]) can only be achieved by using the Pilz connection leads available as an accessory.
- Connection to evaluation devices
  - Use the cables listed in the order reference (see Order references for accessories [📖 132]) or equivalent cables.
  - The terminals for connection to the evaluation device must be kept in a lockable control cabinet. This prevents unauthorised modifications.
- When shielded cables are used, the shield must be placed at one end.
- Ensure compliance with permissible cable bending radii (see Technical details [📖 127]).
- Do not connect outputs with test pulses to the inputs on the safety laser scanner.

7.2 Connector pin assignment

Product	Male connector	max. number		max. number of configurable		Operating range
		Safety zones	Zone sets	Inputs	Inputs/outputs	
PSEN sc PN 5.5 down/back	8-pin	8	70	1	4	5.5

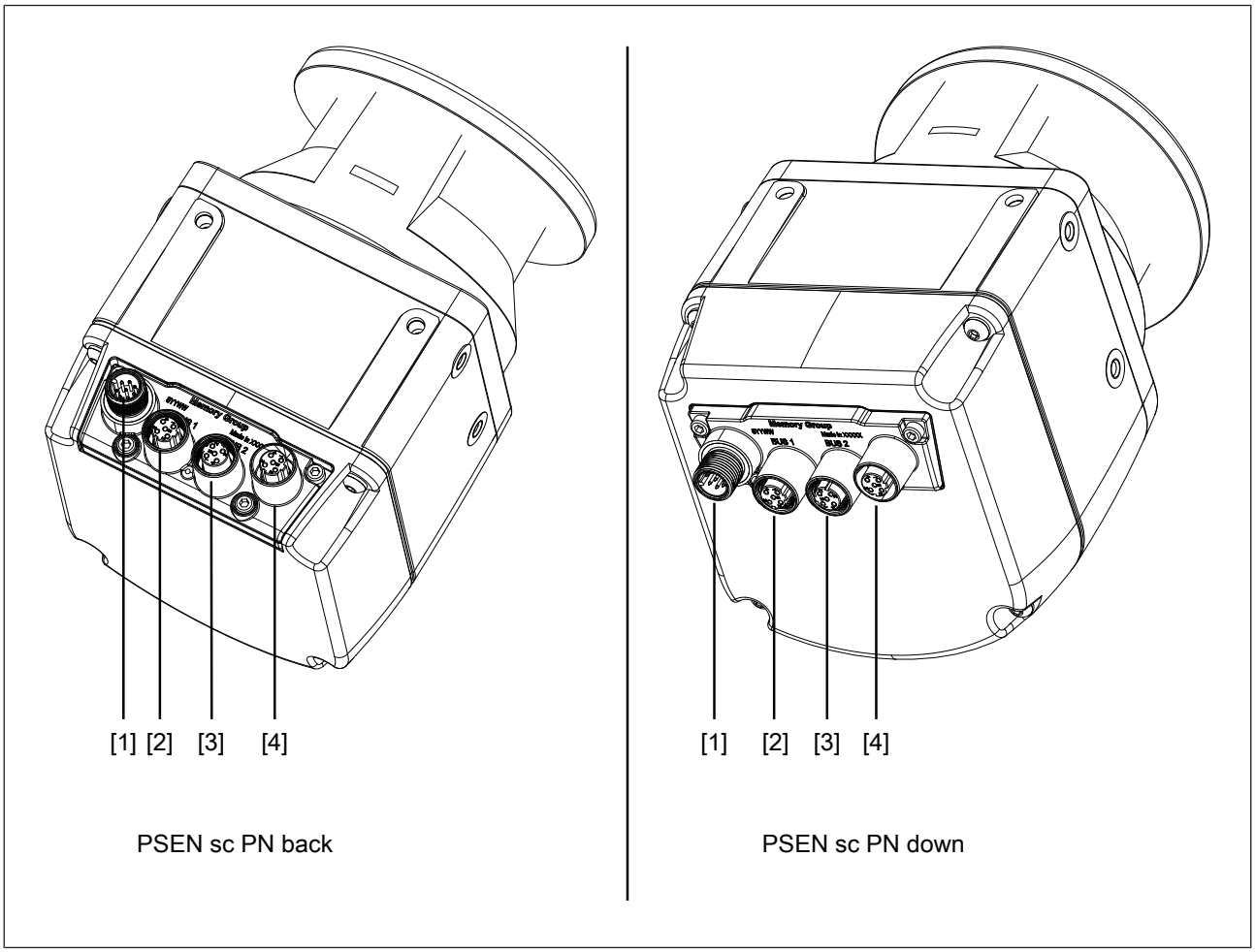


Fig.: Rear view with connectors

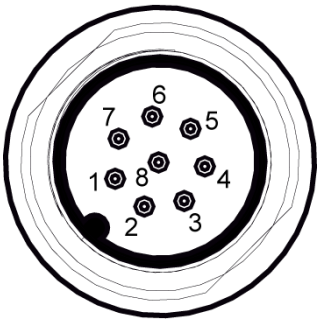
Legend

[1] M12 8-pin male connector, A-coded, for connection to a safety controller and the supply voltage

[2] M12 4-pin female connector, D-coded, for connection to PROFINET

[3] M12 4-pin female connector, D-coded, for connection to PROFINET

[4] M12 8-pin female connector, D-coded, for connection to configuration PC

Male connector	Supply voltage		
	Pin	Colour	Application
8-pin 	2	Brown	24 VDC
	7	Blue	0 VDC
	8	Red	Functional earth

The safety laser scanner PSEN sc PN 5.5. down/back has four PINs that can be configured as an input or output, and one PIN that can be configured as an input.

The configuration can be carried out in the PSENscan PN Configurator. To do this, ***activate Configuration via inputs*** in the ***Configure zone sets*** window.

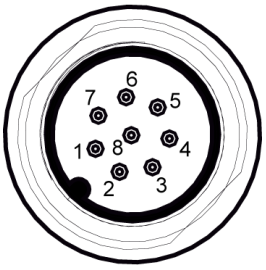
The configuration can also be carried out in PROFINET. To do this, ***deactivate Configuration via inputs*** in the ***Configure zone sets*** window.

All four configurable inputs and outputs can be assigned one of the following functions:

- Reset
- Restart safety zone 1
- Alarm 1 or 2
- Activation of override for safety zone 1 (single-channel pulse)
- Activation of override 11 or 12 for safety zone 1 (signal)
- Activation of override 11 or 12 for safety zone 1 (edge)
- Muting 11 or 12 (automatic deactivation of safety status for safety zone 1)

The configurable input can be assigned one of the following functions:

- Muting lamp for safety zone 1
- Alarm 1 or 2
- Status override for safety zone 1

Male connector	Configurable inputs and outputs		
	Pin	Colour	Application
8-pin 	3	Green	Input
	4	Yellow	Input/output
	1	White	Input/output
	5	Grey	Input/output
	6	Pink	Input/output

Male connector	Connection to PROFINET		
	Pin	Type	Application
4-pin 	1	TX+	Send data
	2	RX+	Receive data
	3	TX-	Send data
	4	RX-	Receive data

7.3 Wiring of the configurations

The wiring must match the specifications in the PSENscan PN Configurator.

When an existing configuration is transferred to the safety laser scanner, the configurable inputs/outputs must be wired in accordance with this configuration.

The safety laser scanner PSEN sc PN 5.5. down/back is configured in the PSENscan PN Configurator on a configuration PC.

7.4 Connection to the PSENscan PN Configurator

Note:

- Ensure that the PSENscan PN Configurator software is installed on the configuration PC.

  We recommend that you always use the latest version (download from www.pilz.com)
- Ensure that the safety laser scanner is switched off when creating a connection to the configuration PC.

100BaseTX cable

Bit rate	100 MBit/s
Max. segment length	100 m
Medium	STP (shielded twisted pair) *1 2 pairs Category 5 *2
Connection	4-pin M12 male connector /4-pin RJ45 male connector
Topology	Point-to-point/hub (hub, switch)

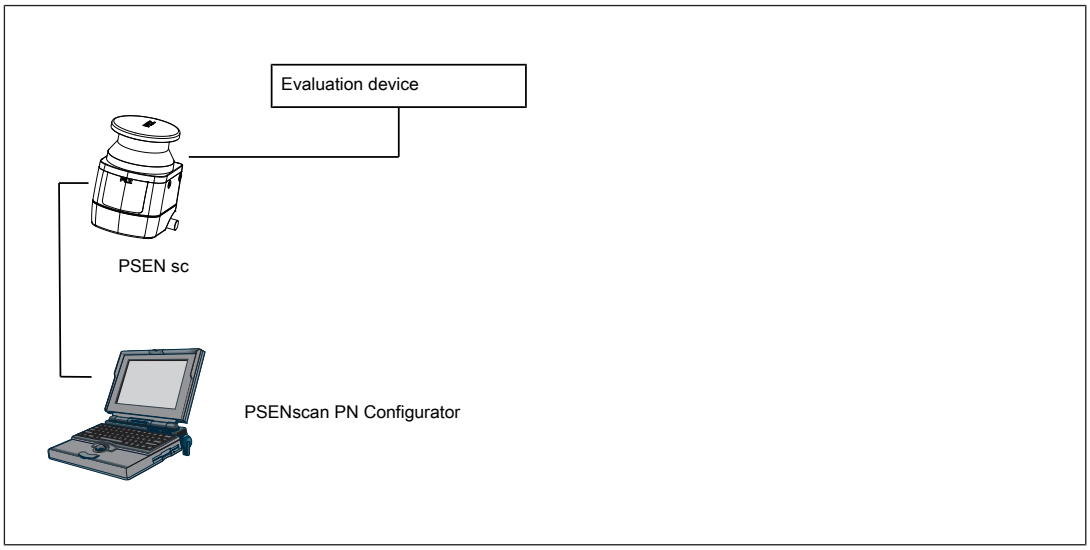
*1

For use in an industrial environment, Pilz recommends double-shielded twisted pair cables (S/STP). Only **shielded RJ45 connectors** should be used.

*2

Twisted pair cables (TP cable) consist of twisted core-pairs. Twisted pair cables are divided into categories in accordance with their electrical features (attenuation, cross-talk). **Category 5 cables are specified** for transferring data with Pilz Ethernet interfaces.

TP cables for Ethernet applications generally have an impedance level of 100 Ohm.



Procedure:

1. Use a 4-pin cable (see Order references [📖 132]) to connect the configuration PC to the safety laser scanner.
2. Connect the safety laser scanners to the supply voltage.

   Use an 8-pin cable (see Order references [📖 132]).
3. Switch the safety laser scanner on.
4. Configure the safety laser scanner in the [📖 89] PSENscan PN Configurator.

7.5 Connections for muting sensors

Wire the muting sensors as shown in the following diagrams.

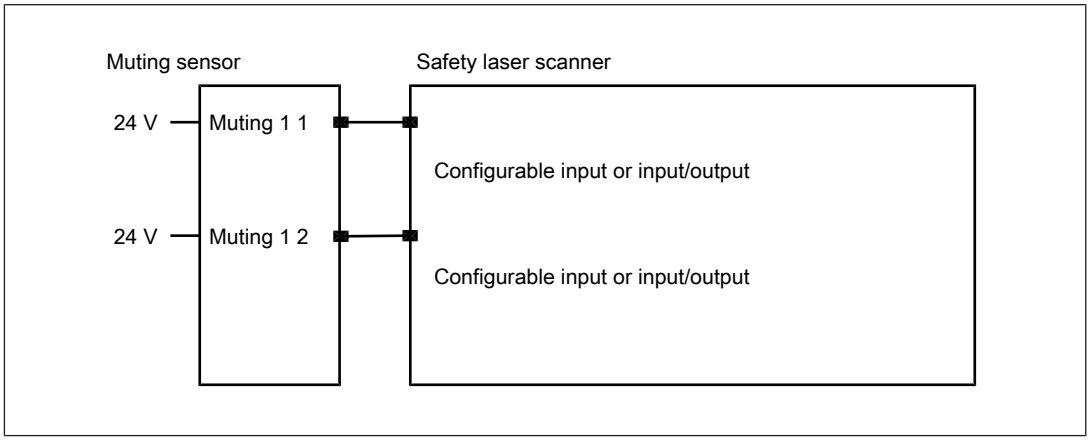


Fig.: Wiring of 2 muting sensors on the PSEN sc PN 5.5. down/back

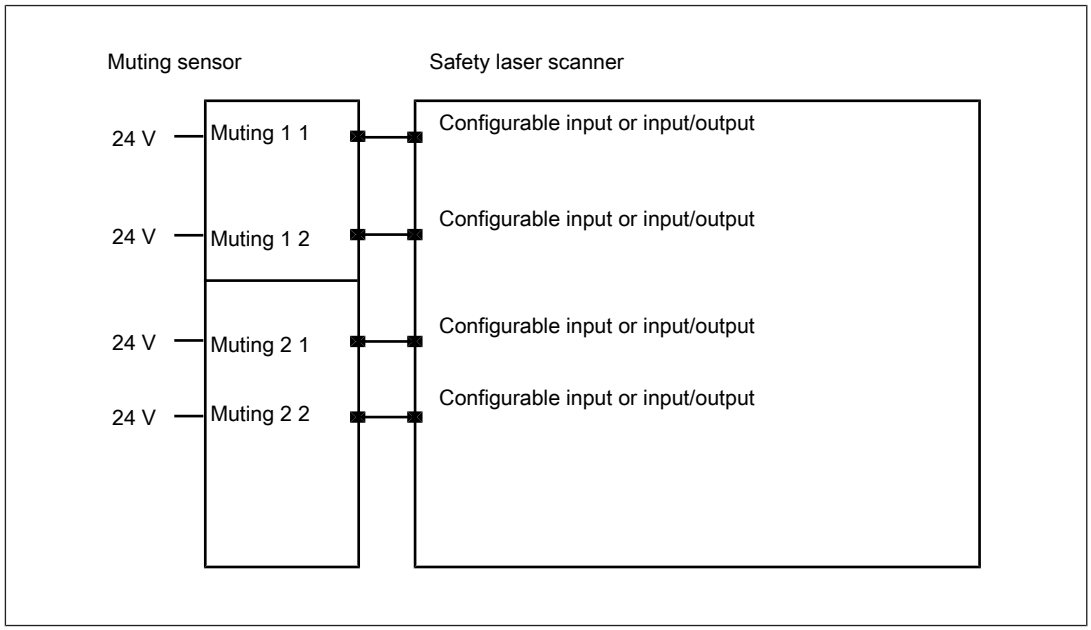
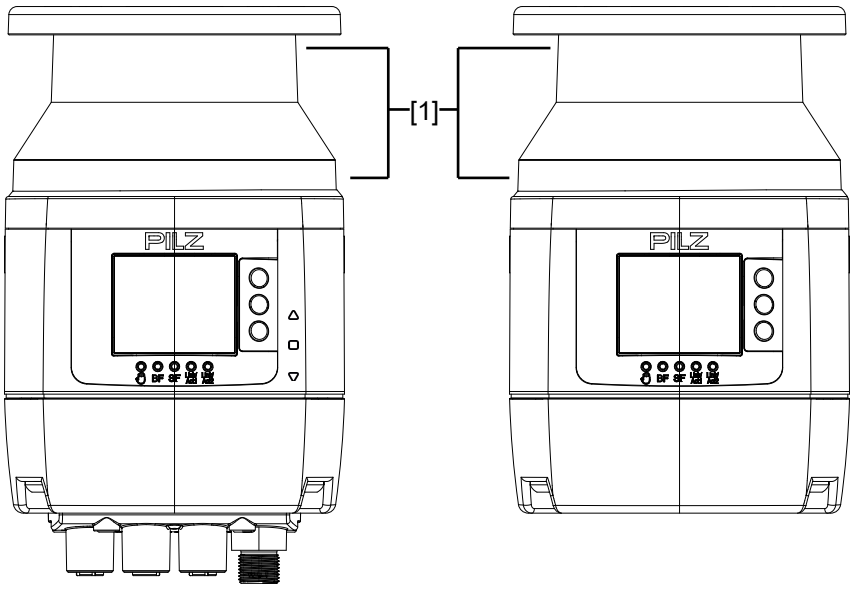


Fig.: Wiring of 4 muting sensors on the PSEN sc PN 5.5. down/back

8 Installation and alignment

8.1 Important information

- Ensure that the front panel of the safety laser scanner is not covered by a wall or any other surface (see diagram). Note the distance from walls [📖 51].



PSEN sc PN down PSEN sc PN down

Legend

[1] Front panel (exit laser beams)

8.2 Installation options

The safety laser scanner can be installed in various ways.

- Installation directly on to mounting surface [📖 78] (overhead also possible)
- Installation of the protective bracket PSEN sc bracket H on the safety laser scanner [📖 80] (overhead also possible)

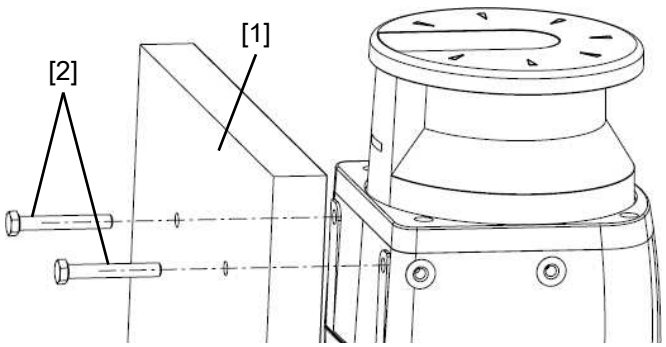
  (Prerequisite for the following installation options)
- Floor installation [📖 81]
- Installation for inclination to the side or upwards and downwards [📖 83]
- Installation for inclination upwards and downwards [📖 85]

8.3 Installation directly on to mounting surface

For direct installation of the safety laser scanner on the mounting surface, two threaded holes are provided at the rear of the safety laser scanner.

Note:

- With direct installation of the safety laser scanner at the mounting surface, the safety laser scanner cannot be inclined to the side or to the top/bottom.
- To fix the safety laser scanner, use M5 screws for a max. screw depth of 10 mm.



Legend

[1] Mounting surface

[2] M5 screws

Prerequisites

- Mounting surface with 2 through-holes for screws M5x10 mm, distance 73 mm horizontally towards each other for fixing the bracket of the safety laser scanner.
- The mounting surface has to be accessible from both sides for installation.

Procedure:

1. Turn the safety laser scanner when the safety laser scanner is to be operated with the top side down.

NOTICE

Dirt on the front panel of the safety laser scanner due to overhead operation

In the event of dirt on the front panel of the safety laser scanner, the safety laser scanner switches to an error state. Overhead operation results in more dirt on the front screen of the safety laser scanner.

– Arrange for more frequent cleaning of the safety laser scanner if it is operated overhead. The display shows  if cleaning is required.

2. Use two M5 screws to fix the safety laser scanner to the mounting surface. Tighten the screws to 3 Nm.

8.4 Installation of the protective bracket PSEN sc bracket H at the safety laser scanner

For easy and flexible installation of the safety laser scanner, the safety laser scanner is fixed to a protective bracket PSEN sc bracket H (see Order reference accessories [132]). The protective bracket protects the safety laser scanner against damage by falling objects.

With this protective bracket, the safety laser scanner can be used in both brackets PSEN sc bracket PR (for inclination to the side or upwards and downwards) or PSEN sc bracket P (for inclination upwards and downwards) (see Order reference: Accessories [132]).

1. Turn the safety laser scanner when the safety laser scanner is to be operated with the top side down.

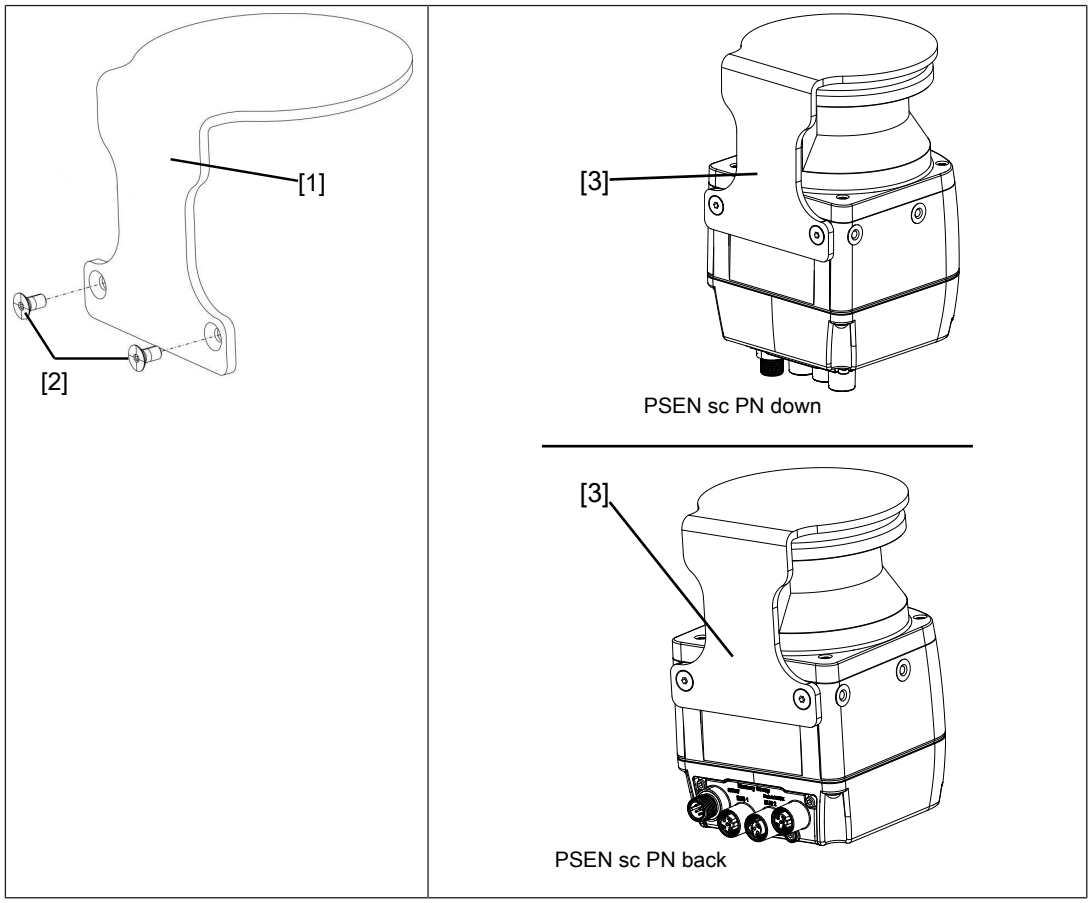
NOTICE

Dirt on the front panel of the safety laser scanner due to overhead operation

In the event of dirt on the front panel of the safety laser scanner, the safety laser scanner switches to an error state. Overhead operation results in more dirt on the front screen of the safety laser scanner.

– Arrange for more frequent cleaning of the safety laser scanner if it is operated overhead. The display shows  if cleaning is required.

2. Fix the PSEN sc bracket H at the rear of the safety laser scanner with two M5 screws and tighten both screws with 3 Nm.



Legend

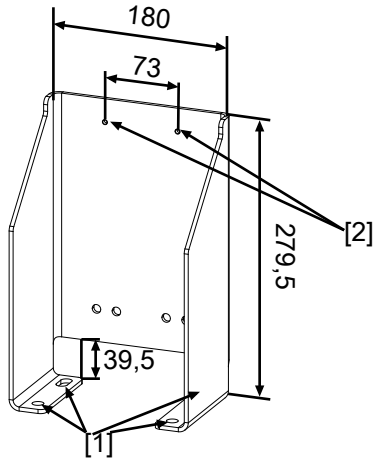
[1] PSEN sc bracket H (protective bracket for safety laser scanner)
[2] M5 screws for fixing the PSEN sc bracket H at the safety laser scanner
[3] PSEN sc bracket H installed at the safety laser scanner

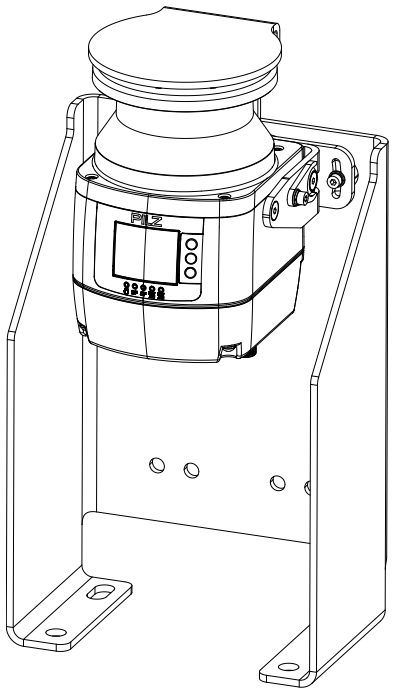
8.5 Installation on the floor

Prerequisites

- The protective bracket PSEN sc bracket H must already be attached to the safety laser scanner (see Installation of the protective bracket PSEN sc bracket H on the safety laser scanner [80]).
- PSEN sc bracket P or PSEN sc bracket PR (see Order references [132])

Procedure:





[1]	Drill holes for attachment to floor	PSEN sc PN with PSEN sc bracket PR mounted on PSEN sc bracket F (model shown is PSEN sc PN down)
[2]	Through holes for attaching the PSEN sc bracket P or PSEN sc bracket PR to PSEN sc bracket F	

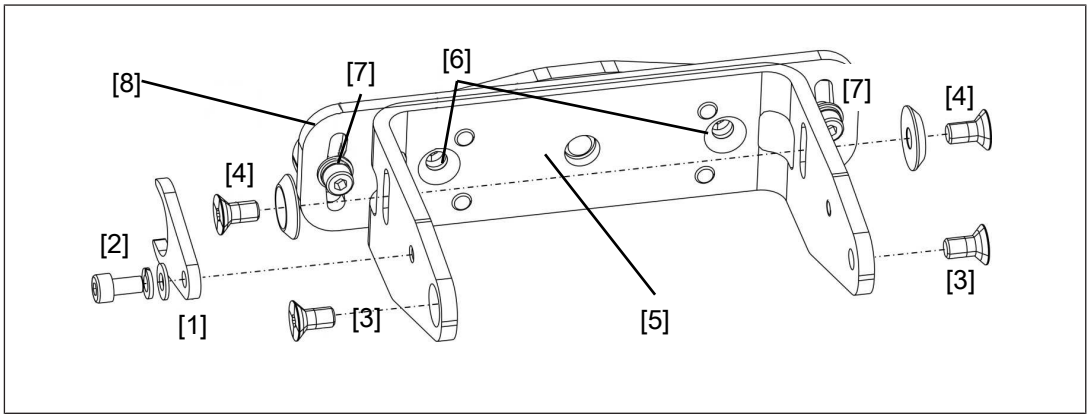
1. Fix PSEN sc bracket F with the fixing screws to the floor and tighten the fixing screws alternately and evenly with 3 Nm.
2. Fix PSEN sc bracket PR or PSEN sc bracket P with the fixing screws to PSEN sc bracket F and tighten the fixing screws alternately and evenly with 3 Nm.
3. Fix the adjusting disc for angle of inclination [1] with the set screws and washers [2] on the PSEN sc bracket P (right or left).
4. Align the middle of the adjusting disc for angle of inclination [1] with the center of the fixing for the safety laser scanner [3] and tighten the set screw for the adjusting disc for angle of inclination [2] with 2,5 Nm.
5. Insert the safety laser scanner in PSEN sc bracket PR or PSEN sc bracket P with the bracket PSEN sc bracket H to the top and fix the safety laser scanner with the screws [3] and [4]. Tighten all four screws to 3 Nm.
6. Set the angle of inclination of the safety laser scanner, if necessary. [📖 86]
7. Set the side inclination of the safety laser scanner, if necessary [📖 86].

8.6 Installation for inclination to the side or upwards and downwards

- The setting of the angle of inclination of the safety laser scanner is not changed when exchanging the safety laser scanner.

Prerequisites

- PSEN sc bracket PR (see Order references [📖 132])
- Mounting surface with 2 drill holes, 10 mm deep, distance 73 mm horizontally to each other for attaching the PSEN sc bracket PR
- The protective bracket PSEN sc bracket H must already be attached to the safety laser scanner (see Installation of the protective bracket PSEN sc bracket H on the safety laser scanner [📖 80]).



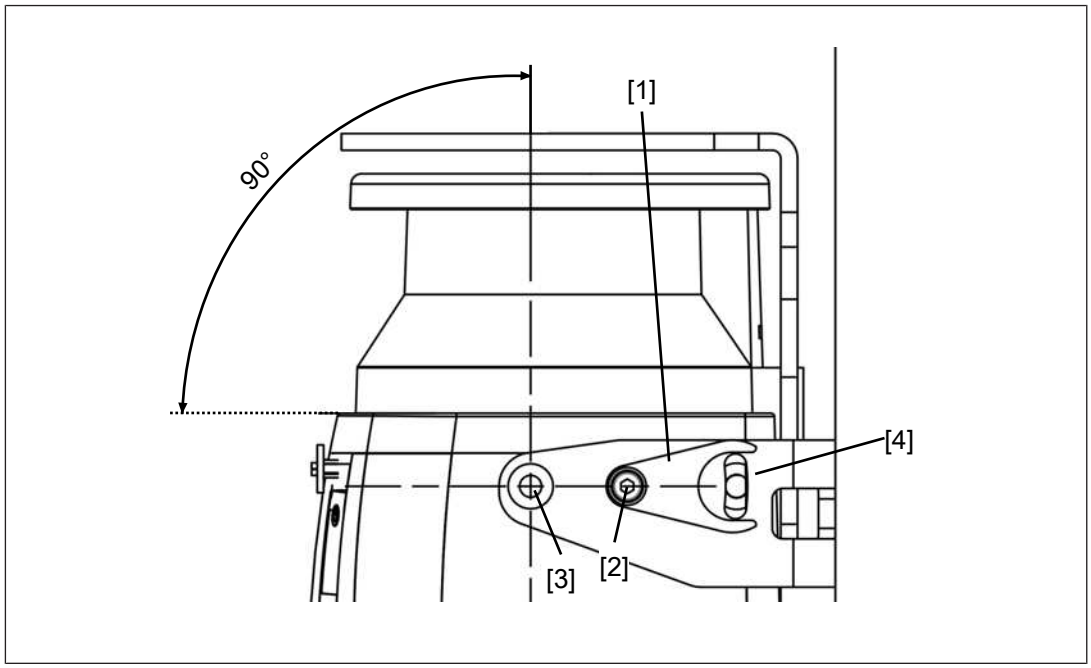
Legend

[1] Adjusting disc for angle of inclination
[2] Set screw for adjusting disc for angle of inclination
[3] Fixing screws for safety laser scanner
[4] Fine adjustment screws for the incline of the safety laser scanner
[5] Front part of the PSEN sc bracket PR
[6] Fixing screws for fixing to the mounting surface
[7] Roll angle fine adjustment screws
[8] Rear part of the PSEN sc bracket PR

Procedure:

1. Loosen the roll angle fine adjustment screws [7] of PSEN sc bracket PR slightly, if required, and align the front part [5] of PSEN sc bracket PR to the rear part [8].

   The bracket is pre-assembled.
2. Fix PSEN sc bracket PR with the fixing screws [6] to the mounting surface and tighten the fixing screws [6] alternately and evenly with 3 Nm.
3. Fix the adjusting disc for angle of inclination [1] with the set screws and washers [2] on the PSEN sc bracket PR (right or left).
4. Align the middle of the adjusting disc for angle of inclination [1] with the center of the fixing for the safety laser scanner [3] and tighten the set screw for the adjusting disc for angle of inclination [2] with 2,5 Nm.



Legend

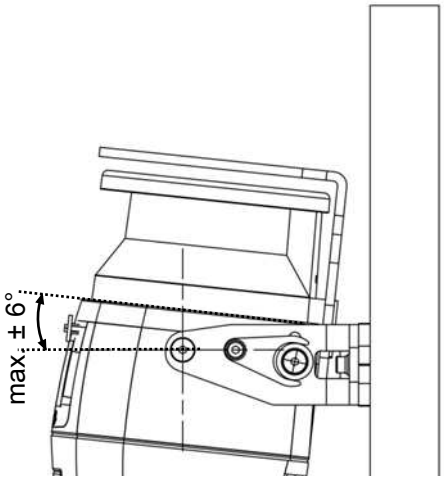
[1] Adjusting disc for angle of inclination

[2] Set screw for the adjusting disc for angle of inclination

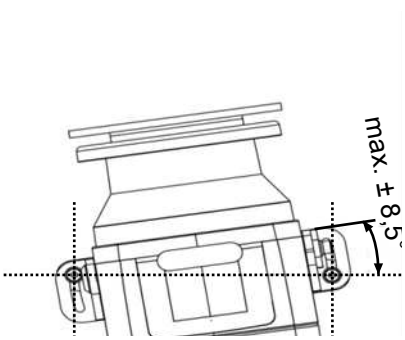
[3] Fixing screws for safety laser scanner

[4] Fine adjustment screws for the incline of the safety laser scanner

5. Insert the safety laser scanner in PSEN sc bracket PR with the bracket PSEN sc bracket H to the top and fix the safety laser scanner with the screws [3] and [4]. Tighten all four screws to 3 Nm.



Inclination upwards/downwards



Inclination to the side (roll)

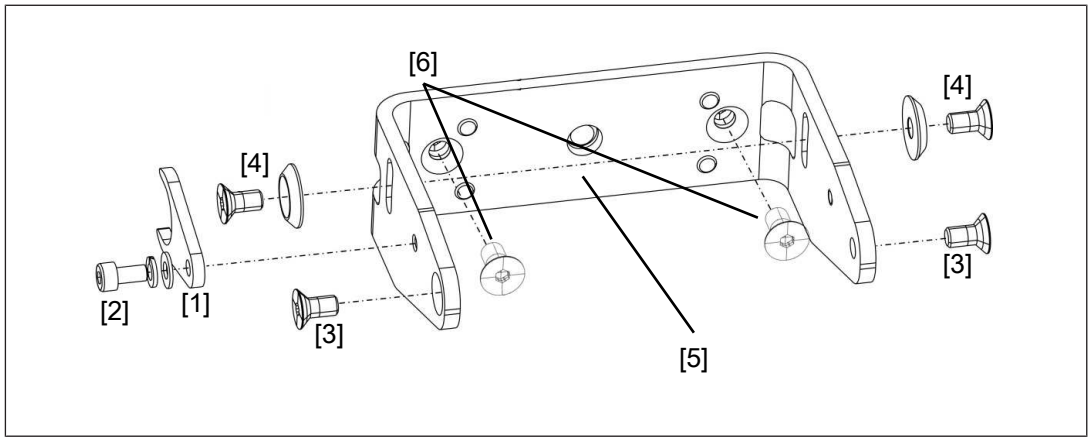
8.7 Installation for inclination upwards and downwards

- The setting of the angle of inclination of the safety laser scanner is not changed when exchanging the safety laser scanner.

Prerequisites

- PSEN sc bracket P (see Order references [📖 132])
- Mounting surface with 2 drill holes, 10 mm deep, distance 73 mm horizontally to each other for attaching the PSEN sc bracket P
- The protective bracket PSEN sc bracket H must already be attached to the safety laser scanner (see Installation of the protective bracket PSEN sc bracket H on the safety laser scanner [📖 80]).

Procedure:



Legend

[1] Adjusting disc for angle of inclination
[2] Set screw for adjusting disc for angle of inclination
[3] Fixing screws for safety laser scanner
[4] Fine adjustment screws for the incline of the safety laser scanner
[5] PSEN sc bracket P
[6] Fixing screws for fixing to the mounting surface

Procedure:

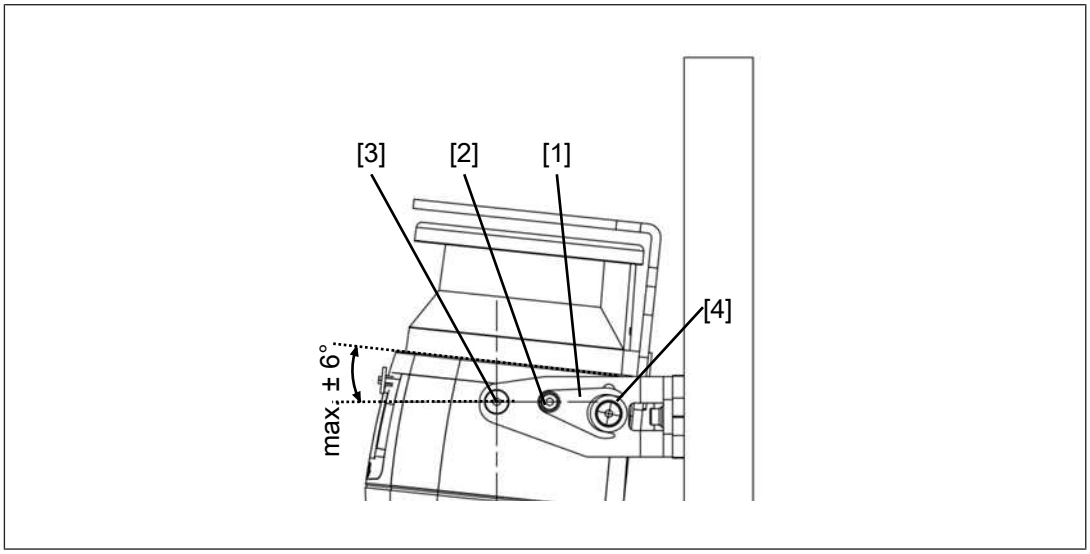
1. Fix PSEN sc bracket P with the fixing screws [6] to the mounting surface and tighten the fixing screws [6] alternately and evenly with 3 Nm.
2. Fix the adjusting disc for angle of inclination [1] with the set screws and washers [2] on the PSEN sc bracket P (right or left).
3. Align the middle of the adjusting disc for angle of inclination [1] with the center of the fixing for the safety laser scanner [3] and tighten the set screw for the adjusting disc for angle of inclination [2] with 2,5 Nm.

8.8 Set the angle of inclination of the safety laser scanner

Procedure:

1. Change the inclination of the safety laser scanner within the permitted range of ± 6°.

   If necessary, loosen the fixing screws for the safety laser scanner [3], the fine adjustment screws for the inclination of the safety laser scanner [4] and the set screw for the adjusting disc for angle of inclination [2].



Legend

[1]	Adjusting disc for angle of inclination
[2]	Set screw for adjusting disc for angle of inclination
[3]	Fixing screws for safety laser scanner
[4]	Fine adjustment screws for the incline of the safety laser scanner

2. Tighten the fixing screws for the safety laser scanner [3] with 3 Nm. Tighten the fine adjustment screws for the inclination of the safety laser scanner [4].
3. Tighten the set screw for the adjusting disc for angle of inclination [2] with 2,5 Nm.

8.9 Set the side inclination of the safety laser scanner

Prerequisites

- The bracket PSEN sc bracket PR has to be installed at the mounting surface.

Procedure:

1. Change the side inclination of the safety laser scanner within the permitted range of ± 8.5°.

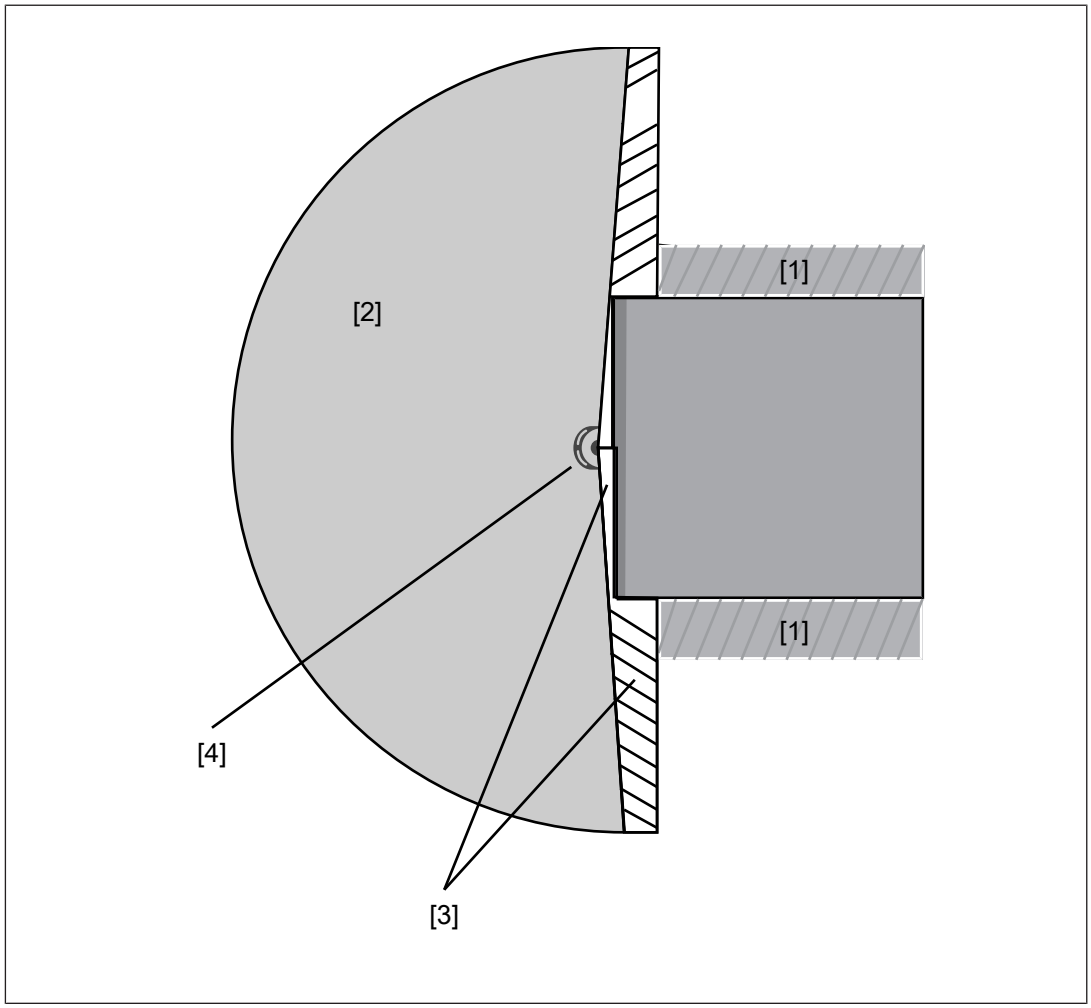
   If necessary, loosen the roll angle fine adjustment screws [7] (see diagram Installation for inclination to the side or upwards and downwards [83]).
2. Tighten up the roll angle fine adjustment screws [7] (see diagram Installation for inclination to the side or upwards and downwards [83]) to 2,5 Nm.

8.10 Measures to safeguard unsecured areas

When installing the PSEN sc PN 5.5. down/back areas may result that are not detected by the safety laser scanner.

If required, install additional protective devices to safeguard the danger zone.

Prevent stepping behind



Legend

[1] Danger zone with fence

[2] Safeguarded area

[3] Not safeguarded area - safeguard against stepping behind

[4] Safety laser scanner

Prevent creeping underneath

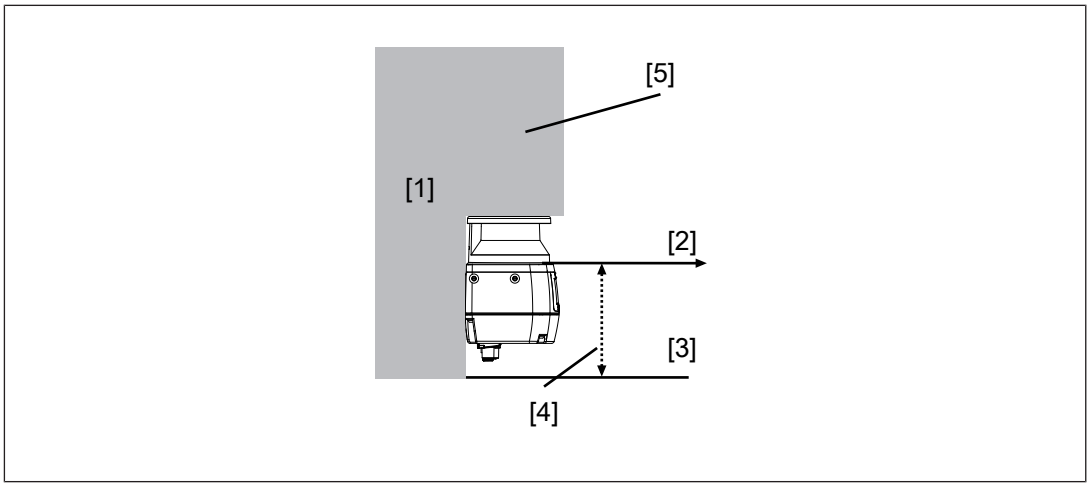


Fig.: Installation of the safety laser scanner positioned to prevent crawling underneath (model illustrated: PSEN sc PN down)

Legend

[1] Mounting surface

[2] Scan plane

[3] Base area

[4] Safeguard area against creeping underneath

[5] Edge at the mounting surface

9 PSENscan PN Configurator

9.1 Basics

The PSENscan PN Configurator is a graphic tool

- For configuration of the safety laser scanners of the PSEN sc PN 5.5. down/back,
- For incorporation of the safety laser scanner into a network,
- For monitoring the safety laser scanners in the network,
- For creating reports,
- For management of passwords on the safety laser scanner PSEN sc PN 5.5. down/back,

9.2 Installation

9.2.1 System requirements

Operating system:	Windows 7, 10 or XP (32 Bit and 64 Bit)
Processor:	Pentium 4, 2 GHz 3 GHz recommended
RAM:	min. 2 GB
Available hard drive space:	approx. 70 MB
Graphics card:	Min. 1024 x 768 pixel resolution, 65536 colours For optimum performance of the system, a current graphics card with 3D acceleration should be used, and the 3D acceleration should be activated.
To view the documentation:	Adobe Acrobat Reader, from Version 7.1.0
Interfaces:	A free 100 Mbps Ethernet interface for data transfer to the safety laser scanner
Access rights:	Network access for PSENscan PN Configurator, ***Private*** profile

9.2.2 Install PSENscan PN Configurator

Procedure:

1. Download the software PSENscan PN Configurator from the download area on the Pilz homepage at http://www.pilz.com/support/downloads/.
2. Double-click on the unpacked file.

   The software PSENscan PN Configurator is installed.

   The installer will guide you through the installation.
3. Create the device with the same IP address in the LAN.

   The device must be known in the LAN before it can be connected.

INFORMATION

To ensure that PSENscan PN Configurator functions correctly, the files and directories in the installation directory of PSENscan PN Configurator must not be modified manually once installed (e.g. with the Windows Explorer or a text editor).

9.2.3 Ethernet Connections

9.2.3.1 Factory default settings for the IP addresses

The factory-set default of the IP address of the safety laser scanner: 192.168.0.10.

INFORMATION

Use the correct IP address

A second IP address has been set up for internal functions of the safety laser scanner. This address always follows directly after the IP address specified in the network settings.

Example: First address = 192.168.0.10, second address = 192.168.0.11

– Ensure that the subsequent IP address is not used by any other network subscriber.

9.2.3.2 Create firewall rule

A firewall or any other security mechanisms on the PC and network may prevent the PSENscan PN Configurator from communicating correctly with the connected device. In this case it is necessary to adjust the security settings and firewall settings.

Firewalls allow access to explicitly registered programs.

PSENscan PN Configurator must have access to the ***Private*** profile.

9.2.3.3 Connect automatically

The PSENscan PN Configurator offers the option to automatically search for a device available in the network.

1. Select ***Device -> Search device***.

   The network is searched for connected devices of the PSEN sc PN 5.5. down/back.

   Connected devices of the PSEN sc PN 5.5. down/back are listed under ***Network environment***.

   To locate the PSEN sc PN 5.5. down/back, click on  . The wave symbol is shown on the display of the selected PSEN sc PN 5.5. down/back.

2. Double-click on the safety laser scanner found in the ***Network environment***.

The safety laser scanner is displayed in the workspace with IP address, firmware version and status information.

On a safety laser scanner with a connected subscriber unit or several subscriber units, all safety laser scanners are displayed as an arrangement.

3. Select ***Settings -> Change network settings***.

   Enter the password for the safety laser scanner (the factory-set default setting for the password is ***admin***).

4. Enter the network data for connecting to the network and click ***OK***.
5. The safety laser scanner switches to the OFF state. Click ***OK*** to continue.
6. The safety laser scanner is displayed automatically with an updated IP address.
7. Double-click on the device to Create a new configuration [📖 94].

9.3 Download configuration to device

You can use the ***Download configuration to device*** function to download the configuration in the PSENscan PN Configurator to a connected device. Once the configuration test has been completed, the new configuration in the connected device can be accepted or rejected.

Load configuration

1. Make sure that the ***Download configuration*** work window shows a report, listing the differences between the existing configuration on the connected device and the configuration in the PSENscan PN Configurator.

   The configuration on the connected device is labelled DEV.

   The configuration in the PSENscan PN Configurator is labelled GUI.

2. Check the whole report to ensure it is correct.
3. Click on ***Download***.

   The configuration in the PSENscan PN Configurator is downloaded to the connected device. The connected device goes offline as the configuration is downloaded. The configuration settings are not available again until after the configuration is ***accepted*** or ***rejected***.

4. Select ***Monitoring*** and test the downloaded configuration.
5. Select ***Download configuration*** and ***Accept*** or ***Reject*** the downloaded configuration:

- Click ***Accept*** to activate the downloaded configuration in the connected device and reject the existing configuration on the connected device.
- Click ***Reject*** to reject the downloaded configuration in the connected device and continue to use the existing configuration on the connected device. The downloaded configuration in the connected device will be deleted.

9.4 Create backup copy of a configuration

For restoring an existing configuration (see Restore configuration [📖 112]) you need a backup copy of this configuration.

Procedure:

- Select Project -> Save.

  The dialogue box for saving is opened. Please enter a name for the MIB file.

  The MIB file includes all the data for configuration.

9.5 Change password

Prerequisites

- There is a connection to the safety laser scanner.

Procedure:

1. In the PSENscan PN Configurator***, select Device -> Settings -> Change access rights and password.***

   Enter the current password and click OK.

2. Enter the new password twice and select the access rights for the password.

   Enter the new password in the field ***New password***. Repeat the password in the field ***Check new password***. Select the access rights for the password and confirm with ***OK***.

9.6 Reset password

Prerequisites

- There is a connection to the safety laser scanner.

Procedure:

1. In the PSENscan PN Configurator***, select Device -> Settings -> Reset password.***

   Take down the counter shown and the serial number of the safety laser scanner. Do **not** close the window if you have not yet received a new password.

2. For resetting the password, please contact Pilz.

   Name the counter shown and the serial number of the safety laser scanner.

   You will receive a new password.

3. Enter any text in the ***Reset password*** window and click ***OK***.

   You can access the safety laser scanner again.

10 First commissioning

10.1 Requirements for commissioning

Note:

- Ensure that the window of the safety laser scanner is clean, intact and without fingerprints.

CAUTION!

Deterioration in the detection of safety zone violations

If the safety laser scanner is commissioned under deviating conditions, there may be a deterioration in the detection of safety zones violations.

10.2 System connection

- Ensure that the safety laser scanner is connected to a safe PROFINET/PROFIsafe controller.

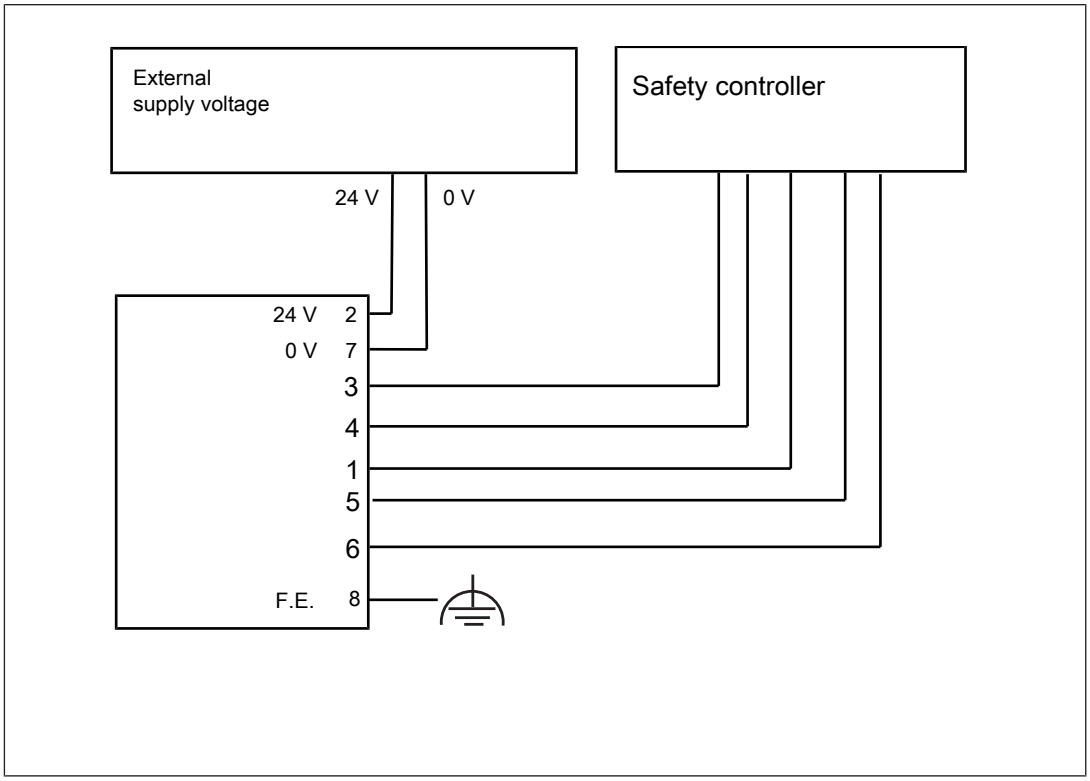


Fig.: Dual-channel connection of the safety laser scanner with 8-pin male connector to a safe controller

10.3 Configuration of zones

Note:

When these inputs/outputs are used, a pin has to be assigned for each used input or output.

- Outputs
  - – Alarm 1 (cleaning of front panel)
  - – Alarm 2 (safety laser scanner in error state)
- Inputs
  - – Manual restart
  - – Muting (per sensor one pin)
  - – Activation override
  - – Override mode = Edge or signal

For simultaneous monitoring of several zones and the switching of monitoring of zone sets, the configurable inputs of the safety laser scanner must be configured appropriately.

- Configuration of a static zone set

  No configurable inputs are required.
- Configuration of two zone sets

  Configure two configurable inputs.

10.3.1 Example for a 8-pin connection

Example settings in the PSENscan PN Configurator for a safety laser scanner with 8-pin connection: vertical application with reference outline monitoring, configuration via inputs activated, 1 zone set, 1 warning zone, automatic restart, sequence control deactivated, dynamic muting in one direction, manipulation protection is active

Prerequisites

- The safety laser scanner is already connected to the 8-pin male connector.

Procedure:

1. From the start page, select ***Create new configuration***.

   The ***Device selection*** window is displayed with a tab for ***Online*** and ***Overview of all types.***
2. Select the connected device from ***Overview of all types***. Double-click the device.

   The device is displayed in the work window and it can be configured***.***
3. In ***Application***, select the ***VERTICAL*** application.

   Configuration

   You can enter a title for the configuration in ***Configuration Name***.

   You can enter the name of the person who created the configuration under ***Author***.

   You can describe the configuration in detail under ***Description***.

   The ***Configurator version*** is entered by the system and cannot be changed.

   The ***Check sum*** is entered by the system and cannot be changed.

The ***Creation date*** is entered by the system and cannot be changed.

Device name

You can enter a title for the connected device under ***Device Name***.

Click on the arrow ›. The next window ***Configure outputs*** is opened.

4. Select ***Warning zone*** = ***1***.

   Select ***Muting*** = ***Activated***.

   Select ***Configuration via inputs*** = ***Activate*** for safety zone 1.

5. Select ***Automatic reset*** = ***Activated*** for this safety laser scanner. An automatic reset occurs if an error state is detected.

6. Click on the arrow ›. The next window ***Configure zone sets*** is opened.

   Zone set = 1 is already selected.

   Select ***Sequence control*** = ***Activated***

   Click on the arrow ›. The next window ***Configuration of inputs*** is opened.

7. Select ***Automatic*** for ***Restart*** and define the ***Recovery time*** (min. 200 ms, max. 60000 ms).

   Select ***Muting type*** and define the value for ***Muting activation delay [ms]***.

   For ***Muting type*** = ***L-Muting***, a factor can be defined to increase the activation delay.

   If necessary, define a value for time monitoring of the muting function (***Time exceeded [min] (0 = no time exceeded)***)

   In ***Input wiring***, select the PINs to which the muting sensors are connected.

8. Click on the arrow ›. The next window ***Configure detection capability*** is opened.

9. Under ***Beam coding***, select the code that is to be assigned to this safety laser scanner.

   The response time of the safety laser scanner is increased in accordance with the respective Increased response time per measurement cycle [📖 24] and is shown with the new value.

10. Under ***Multiple evaluation***, define the number of consecutive scans needed for detection for each configured safety zone and warning zone.
    Increasing the number of consecutive scans increases the response time of the safety laser scanner.

11. Select the ***detection capability [mm]*** for this safety laser scanner. Define the value for each configured ***Safety zone*** and for each ***Warning zone***.

12. Select ***Dust filter level*** (level 1 = low, level 3 = high).
    A higher level of dust filtering requires a longer safety distance.

WARNING!

Loss of safety function due to a safety distance that is too low

Depending on the application, serious injury or death may result.

- Depending on the degree of dust filtering, it is necessary to consider an allowance for calculating the safety distance when installing the safety laser scanner near intense light sources or reflective surfaces into account (see Distance to intense light sources and to reflective surfaces [📖 49]).
  - When calculating the safety distance, ensure that the allowance is considered depending on the dust filtering.
  - Ensure that the new safety distance fulfils the specifications of the safety assessment.

13. In ***Destination address F*** enter the address ***F_Destination_Address***.

    Select the desired process image in ***F-I/O data***.

    PROFINET settings

    You can enter a unique title for the safety laser scanner under ***PROFINET name***. The name cannot be used for any other device in the PROFINET network. Permitted characters: Lower case letters, numerals, periods, hyphens.

    Identification & Maintenance

    Identification number (function tag in the display of the safety laser scanner)

    Location (location tag in the display of the safety laser scanner)

    Installation date (installation date in the display of the safety laser scanner)

    Identification number of the tool (? in the display of the safety laser scanner)

    The PROFINET settings can be read by the safety laser scanner or transferred to the safety laser scanner.

    Changed values only go into effect after restarting the safety laser scanner.

    Factory alarms

    Specify which alarms should be transferred from the safety laser scanner to the safety controller. The following is already selected in the default setting: ***System error***, ***Configuration error*** and ***Maintenance request***.

    Click on the arrow › . The next window ***Configure outputs*** is opened.

14. Click on the arrow › . The next window ***Configure zones*** is opened.

    Create the zones using the symbols in the tool bar on the right-hand side.

15. In the selection of zones, select ***Safety***, select a shape and create the required shape.

    The shape is displayed as the first zone in the selected safety zone.

16. Select the muting zone for the safety zone that was just created.

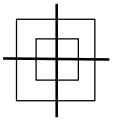
    A warning is shown. With each change of safety zone, all the assigned muting zones are deleted. Click ***OK***.

17. Select whether the muting zone is to cover the whole safety zone.

    The muting zone can still be changed at a later stage, however, not beyond the limits of the safety zone.

    Click ***Yes***: The created muting zone covers the whole safety zone.

    Click ***No***: No muting zone is created. Select a shape and manually create a muting zone.

18. Click on  .

    Specify at least 3 (max. 15) reference points. Specify a max. permitted tolerance for each reference point. ***Tol -*** is the tolerance for the side that faces the safety laser scanner, ***Tol +*** is the tolerance for the side that is facing away from the safety laser scanner.

19. Switch the display in the work window to a live image by clicking on  .

    Check the safety function of the safety laser scanner as indicated under Inspection [📖 98].

    Each time the test piece enters the safety zone, the safety outputs must switch to the OFF state and the status of the safety outputs in the Monitoring work window must show the violation of the safety zone.

    The safety outputs must switch to the OFF state each time a reference point changes beyond the tolerance range, and the status of the safety outputs in the Monitoring work window must show the change in the reference points.

20. Select ***Download configuration to device,*** to transfer the configuration to the device.

    Click ***Accept*** to activate the downloaded configuration in the connected device and reject the existing configuration on the connected device.

    Save the report in PDF format.

    Click ***Reject*** to reject the downloaded configuration in the connected device and continue to use the existing configuration on the connected device. The downloaded configuration in the connected device will be deleted.

10.4 Testing

Before finally commissioning the safety laser scanner after the installation and alignment, final inspections must be carried out.

INFORMATION

This inspection may only be carried out by qualified personnel.

Check safety function of the safety laser scanner

Procedure:

As a test piece, use an opaque object with a height of at least 300 mm and a diameter that corresponds to the selected detection capability.

- Move the test piece at various points along the limits of the safety zone into the safety zone:

  The safety outputs must switch to the OFF state each time the test piece enters the safety zone.
- Switch off the safety laser scanner.

  Both safety outputs must switch automatically to the OFF state. The machine in the monitored danger zone is switched off and cannot be started.
- Behaviour when the safety zone is free again

  Remove the test piece from the safety zone.

  – Automatic restart

    The safety laser scanner starts automatically and the safety outputs switch to the ON state.

  – Manual restart

    The safety outputs remain in the OFF state and only switch to the ON state when the start button has been operated and then released again for a min. 0.5 s and a max. 5 s.

Supplementary test step for vertical applications

Change the position of the reference points beyond the tolerance range of the reference points:

The safety outputs must switch to the OFF state each time a reference point changes beyond the tolerance range.

Check ambient conditions and installation

- Correct alignment and fixing
  Check that the fixing screws of the safety laser scanner are firmly seated.
- Safety distance

  The safety distance must comply with the requirements in Maintaining the safety distance [📖 31].

- Circumventing the safety zone
  The hazardous area must be secured so that it is impossible to access by circumventing the safety zone.
- Safety zone perimeters
  The safety zone perimeters (see Project configuration [31]) must completely secure the danger zone, making it inaccessible.
- Position of the pushbutton for manual restart

  It must not be possible to operate the pushbutton for manual restart from inside the danger zone. The pushbutton must be located at a position from which there is a full, unobstructed view of the danger zone.
- Response time and stopping time must fulfil the requirements in Maintaining the safety distance [31].

  Ensure that the safety laser scanner's response time and the machine's stopping time fulfil the requirements Maintaining the safety distance.
- Intense or flashing light sources in the vicinity

  The allowance Z_R for particularly intense or flashing light sources near the safety laser scanner (range of +/- 5° to the scan plane or highly reflective background within a distance of 2.5 m to the safety zone perimeter) has been considered when calculating the safety distance (see Distance to intense light sources [49]).
- Ambient conditions

  Please observe the environmental conditions [49].
- Check the safety laser scanner’s front panel.
  - Scratched front panel: Exchange the PSEN sc head. [119]
  - Dirty front panel: Clean the front panel [116].

Create backup copy of a configuration

- After successfully checking the installation and configuration of the safety laser scanner, create a backup copy of the configuration.

Procedure:

- Select Project -> Save.

  The dialogue box for saving is opened. Please enter a name for the MIB file.

  The MIB file includes all the data for configuration.

11 Operation

11.1 Display of the monitoring status

Icon		Status	Description/measure
Valid configuration	Configuration not yet accepted		
		Device is switched on and operational	
		Warning zone has been violated	A violation of the warning zone has been detected. The configured action for a violation of the warning zone has been triggered. The area of violation is marked outside the semicircle with the yellow beams.
		Safety zone has been violated	A violation of the safety zone has been detected. The safety outputs are in the OFF state. The area of violation is marked outside the semicircle with the red beams.
		Change detected in the reference outline	A violation of the reference outline has been detected. The area of change is marked outside the semicircle with the blue beams. Check the cause for the change and eliminate the cause or adapt the reference outline.

11.2 Display during normal operation

Message in the display		Status	Description/measure
Icon	Text		
	ALIGN SW REQ	The firmware of the device must be updated. The safety outputs are in the OFF state.	Update the firmware [📖 116].
	CLEANW2	The font panel of the safety laser scanner is contaminated and it must be cleaned to ensure normal operation.	Arrange for the front panel to be cleaned soon. Clean front panel [📖 115]

Message in the display		Status	Description/measure
Icon	Text		
	DLDNC	Download of a configuration or a report	A configuration or a report is downloaded.
	INPUTCF1	Faulty input	Faulty input, e.g. wrong number of inputs that are used for switching the zone sets.
		Error in the configuration or wiring.	Check that the wiring [📖 72] and the configuration [📖 94] match.
		The status of the network is checked	The status of the safety laser scanner in the network is checked.
	ITLOCK1	Safety laser scanner in interlock condition	The safety laser scanner is in interlock condition. Normal operation is possible only after a successful restart of the safety laser scanner.
	NOCONF	No configuration available	No configuration for the safety laser scanner could be found.
	MUTING	Muting on safety output 1 is active. The safety outputs are in the ON state.	
	OVERRIDE	Override is active.	

11.3 Diagnostic information

11.3.1 Error

Message in the display		Error/cause	Description/measure
Icon	Text		
	BKP FAILED	Creating a backup copy of a configuration has failed.	▸ Restart the process of creating a backup copy [📖 99] or ▸ Create a new configuration in the PSENscan PN Configurator.

Message in the display		Error/cause	Description/measure
Icon	Text		
	CLEANW1	The front panel of the safety laser scanner must be cleaned.	Clean front panel
	DEVICE EMPTY	No configuration is stored in the safety laser scanner.	▸ Create a new configuration in the PSENscan PN Configurator **or** ▸ Restore a configuration from the memory module [📖 112].
	FBus Params	Error in the parameters of the PROFIsafe configuration (e.g. addresses).	Check and correct the PROFIsafe configuration.
	FBus Trans	Error in the PROFIsafe transfer (e.g. time exceeded or inconsistent data).	
	INPUTCF1	Faulty input	Faulty input, e.g. wrong number of inputs that are used for switching the zone sets.
		Error in the configuration or wiring.	Check that the wiring [📖 72] and the configuration [📖 94] match.
	INPUTCF2	Configuration error.	In the configuration, check the configured state transitions and switching operations. Ensure that no pulses with a length of > 850 µs are connected to the inputs of the safety laser scanner.
		The automatic reset function has been permanently deactivated.	Perform a Reset of the safety laser scanner [📖 113].
	INPUTCF3	Sequence error when switching zone sets.	In the configuration, check and correct check the configured switching of zone sets.
	INTF1	An error occurred during the system test. Internal communication error.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.

Message in the display		Error/cause	Description/measure
Icon	Text		
	INTF2	An error occurred during the system test. Internal communication integrity test failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF3	An error occurred during the system test. Micro integrity test failure – RAM Test.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF4	An error occurred during the system test. Micro integrity test failure – ROM Test	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF5	An error occurred during the system test. Micro integrity test failure - internal peripheral Test (Safety relevant).	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF7	An error occurred during the system test. Micro integrity test failure - Function and operation test.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.

Message in the display		Error/cause	Description/measure
Icon	Text		
	INTF8	An error occurred during the system test. Micro integrity test failure - Coherence check Up/Uw.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF9	An error occurred during the system test. Micro integrity test failure - Program Coherence check CRC failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF10	An error occurred during the system test. Micro-FPGA integrity test failure - Diagnostic test failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF11	An error occurred during the system test. FPGA integrity test failure - Internal self test failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF12	An error occurred during the system test. FPGA power supply supervisor failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.

Message in the display		Error/cause	Description/measure
Icon	Text		
	INTF13	An error occurred during the system test. Measurement integrity test failure - Internal target coherence test.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF14	An error occurred during the system test. Temperature measurement integrity check - Coherence comparison of sensors.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF15	An error occurred during the system test. Rotational speed coherence test failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF16	An error occurred during the system test. Dust detector integrity failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF17	An error occurred during the system test. Power supervisory failure.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.

Message in the display		Error/cause	Description/measure
Icon	Text		
	INTF18	An error occurred during the system test.	Perform a Reset of the safety laser scanner [📖 113]. Avoid external influences (using filtered supply voltage, shielded cables). If the error persists, please contact Pilz.
	INTF20	An error occurred during the system test.	Perform a reset of the safety laser scanner [📖 113]. If the error persists, please contact Pilz.
	MG EMPTY	No configuration is stored in the memory module.	▸ Create a new configuration in the PSENscan PN Configurator **or** ▸ Restore a configuration [📖 112].
	MG FAILURE	The memory module is faulty or not compatible with the current configuration.	▸ Create a new configuration in the PSENscan PN Configurator **or** ▸ Restore a configuration **or** ▸ Switch off the safety laser scanner and replace the memory module with a new one.
	MG NO MATCHING	The memory module is not compatible with the current configuration.	Switch off the safety laser scanner and replace the memory module with a compatible module.
	RES FAILED	Restoring a configuration has failed.	▸ Restore a configuration [📖 112] or ▸ Create a new configuration in the PSENscan PN Configurator.

11.3.2 Warnings

Message in the display		Error/cause	Description/measure
Icon	Text		
	BOOTF	An error has occurred when starting the system.	Perform a reset of the safety laser scanner [📖 113]. If the error persists, please contact Pilz.
	INTF6	An error occurred during the system test.	Perform a reset of the safety laser scanner [📖 113]. If the error persists, please contact Pilz.

Message in the display		Error/cause	Description/measure
Icon	Text		
	EXTTEMP	The ambient temperature is outside the temperature range indicated in the Technical details.	Ensure that the ambient temperature is in the temperature range specified in the Technical details [📖 127].
	OVERTEMP	The temperature of the safety laser scanner is outside the permitted temperature range.	Ensure that the temperature of the safety laser scanner is within the temperature range specified in the Technical details [📖 127].
	HIGH REFL-BKG	The reflection of the background is too strong.	Reduce the background reflection or increase the safety distance (see Distance to intense light sources and to reflective surfaces [📖 49]).

11.3.3 Information

Message in the display		Error/cause	Description/measure
Icon	Text		
		The wave function is activated.	The symbol flashes. Select the safety laser scanner in the PSENscan PN Configurator and configure it.
	ANTITAM-PERING	Protection against manipulation has been activated.	
	BKP DONE	The backup copy of a configuration was completed successfully.	
	BKP IN PRO-GRESS	The backup copy of a configuration is created.	Wait until the backup copy was created successfully.
	CFG NO MATCHING	The configuration stored in the safety laser scanner does not match the configuration in the memory module.	Follow the instructions in Restore configuration [📖 112].
	CHECK MAS-TER	A PSEN sc head is exchanged.	
	CLEANW2	The font panel of the safety laser scanner is contaminated and it must be cleaned to ensure normal operation.	Arrange for the front panel to be cleaned soon. Clean front panel [📖 115]

Message in the display		Error/cause	Description/measure
Icon	Text		
	COMMIT ON FIELD	A PSEN sc head was exchanged. The subsequent recommissioning must be confirmed.	Confirm the recommissioning of the safety laser scanner.
	DLDNC	Download of a configuration or a report	A configuration or a report is downloaded.
	DLDNF	A new firmware version is downloaded.	
	INCOHERENCE	The configuration stored in the safety laser scanner does not match the configuration in the memory module.	Create a new configuration in the PSENscan PN Configurator.
	ITLOCK1	Safety laser scanner must be restarted	Perform a reset of the safety laser scanner [📖 113].
	MUTING ERR	Could not activate muting because the specifications for activating the muting sensors were not met.	
	MUT TIMEOUT	Muting has elapsed (timeout).	
	OVERRIDE ERR	Could not activate override because the specifications for activation were not met.	
	OVR TIMEOUT	Override has elapsed.	
	RES ABORT	The user can cancel the restoring of the configuration. If the restore operation is cancelled, it can be performed again or a new configuration can be created in the PSENscan PN Configurator.	Follow the instructions in Restore configuration [📖 112].
	RES IN PROGRESS	The configuration in the safety laser scanner is changed to the configuration in the memory module.	Wait until the change of the configuration is complete.

Message in the display		Error/cause	Description/measure
Icon	Text		
	RES SHUT-OFF	The rest condition of the safety laser scanner has been deactivated.	
	RES VALIDA-TION	The restoring of the configuration in the safety laser scanner is checked. After the check is complete, you must confirm whether the restore was successful.	Wait until the check of the configura-tion is complete. Follow the instructions in Restore configuration [📖 112].
	RESTORE DONE	The configuration was restored suc-cessfully.	
	SHUT-OFF	The rest condition of the safety laser scanner has been activated.	
	WAITING CONF	The safety laser scanner waits for a configuration (e.g. after restoring a configuration).	Configure the safety laser scanner (see Configuration of zones [📖 94]).
	WR FAILED	Calibration of the new PSEN sc has failed.	Start the calibration of the new PSEN sc head again or exchange the PSEN sc head [📖 119].

11.3.4 Log file

A series of events is stored in a log file.

The file is saved in the memory module and synchronously also in the safety laser scanner.

- Events at the safety outputs (violations of the safety zone)
- Events at the inputs for muting and override
- Error
- Updates (firmware, configurations etc.)
- Restoring of configurations
- Current configuration of zone sets
- Exchange of PSEN sc head

The log file is saved in csv format.

An entry is created in the log file for each logged event.

Format of the entries:

<Date> <Time> <Event type <Details on the event>

Example of a mistake:

10-Sep-20 5:24:30 PM;FAULT;FAULT INPUTCF2

Create log file

Procedure:

1. Select ***Device -> Search device***.

   The network is searched for connected PSEN sc PN 5.5. down/back.

   Connected PSEN sc PN 5.5. down/back are listed under ***Network environment***.

   Select the safety laser scanner for which you want to log the events.

2. Select ***Device -> Read from device -> Open protocol file in PSENscan memory.***

   The requirement must be confirmed by entering the password. The safety laser scanner switches to ***Out of operation.*** Click OK to continue.

   Select the directory in which the file is to be saved.

3. The safety laser scanner display is dark. A red LED is lit.

4. When creating the log file is finished, a message is output. Click OK to continue.

   The safety laser scanner switches to ***In operation.***

5. You can now open the log file.

   In Windows explorer, switch to the directory you selected when saving the log file and open the log file on a text editor.

11.4 Text messages in the display

With the buttons under the display of PSEN sc PN 5.5. down/back you can navigate in the message in the display.

	Confirm message in the display and open the next menu level or exit the last menu level
	Scroll down
	Scroll up

The LC display shows information and navigates the menu with the sections Information, Setting and Exit.

Information

Menu item	Menu second level	Meaning
Hardware		Device-specific displays
	Device name	The name of PSEN sc PN 5.5. down/back is displayed.
	Product name	The product type of PSEN sc PN 5.5. down/back is displayed.
	Order number	The order number of PSEN sc PN 5.5. down/back is displayed.
	Serial number	The serial number of PSEN sc PN 5.5. down/back is displayed.

Menu item	Menu second level	Meaning
	Firmware version	The firmware version of PSEN sc PN 5.5. down/back is displayed.
	Device Lifetime (h)	The current operating time of PSEN sc PN 5.5. down/back in hours is displayed
Configuration		Configuration-specific displays
	Configuration name	The name under which the configuration has been saved in the PSENscan PN Configurator is displayed.
	Check sum	The check sum is displayed that was created when saving the configuration.
	Last saved date	Date of last modification of the project
	IP address	The first IP address of the PSEN sc PN 5.5. down/back is displayed.
	MAC address	The MAC address of the PSEN sc PN 5.5. down/back is displayed.

Setting

Menu item	Menu second level	Meaning
Display settings		
	Rotate	The display is rotated.
Reset PSENscan		Confirming starts a reset of the PSEN sc PN 5.5. down/back.

FBus Params

Menu item	Menu second level
	Profi Params
	MAC address
	IP address
	Subnet Mask
	F-Dest Address
	PROFINET Name
	I&M Params
	Vendor ID
	Order ID
	Function Tag
	Location Tag
	Installation Date
	Signature

Exit

Exit menu in the display.

11.5 Restore configuration

Prerequisites

- The memory module is installed correctly.
- The pin assignment must be compatible with the data in the memory module.
- The correct configuration for the application is ready on the memory module.

One of the following conditions must be met.

- The MIB files in PSEN sc PN 5.5. down/back and in the memory module are different.
- The topologies in PSEN sc PN 5.5. down/backand in the memory module are different.
- The serial numbers saved in PSEN sc PN 5.5. down/back and in the memory module are different.

Procedure:

1. Switch the safety laser scanner on.

   The system checks whether the conditions are met. When the conditions are met, restoring of the configuration is started.

2. The process for restoring the configuration will vary, depending on the type of difference between the memory module and safety laser scanner.

   Serial numbers different: CFG NO MATCHING is shown on the display. Continue by selecting the data to be restored.

   Topology or MIB files different: WAITING CONF is shown on the display. Continue the configuration in the PSENscan PN Configurator.

3. Use the buttons on the display to select the data to be used for restore.

   Display:

   Restore cfg: The configuration in the memory module is used. Confirm the selection with ***Confirm*** and the configuration is copied from the memory module to the safety laser scanner. Continue checking the configuration.

   cfg from GUI: The new configuration created in the PSENscan PN Configurator is used. Confirm your selection with ***Confirm*** and continue with Create new configuration in the PSENscan PN Configurator.

4. Display: ***Confirm*** / ***Cancel***

   Confirm your entry with ***Confirm***

5. Checking the configuration

   Display:

   RES FAILED. Could not copy the configuration successfully. Continue by selecting the data for the restoring.

   RUN TEST MODE: Select ***Enter Test*** on the display. Test operation starts. Continue with accept or reject configuration.

6. Accept or reject configuration

   Test operation is complete.

Select ***Validate conf*** to accept the configuration. The safety laser scanner is ready for operation again.

Select ***Reject conf*** to reject the configuration. Continue by selecting the data for the restoring.

7. Create new configuration in the PSENscan PN Configurator

   Display: WAITING CONF

   Configure the safety laser scanner in the PSENscan PN Configurator.

11.6 Reset

With the reset function, the safety laser scanner can be set to normal operation when the safety laser scanner is in an error state, and the error was rectified.

Procedure:

Hold the reset pushbutton down for at least 500 s.

11.7 Activate rest condition

Prerequisites

- At least two zone sets are configured.
- No safety or warning zones are configured in the respective zone set.

Procedure:

1. Select the Configure zone sets window.

   Select ***Rest condition*** = ***Activated***.

2. The display of the safety laser scanner shows for 30 seconds that the rest condition is started.

   Then the display switches to the energy saving mode and the LEDs will go out.

11.8 Deactivate rest condition

Procedure:

1. Select the Configure zone sets window.

   Select ***Rest condition*** = ***Deactivated***.

2. After approx. 30 seconds the safety laser scanner is again in normal operation.

   The display and the LEDs of the safety laser scanner show normal operation.

11.9 Monitoring and simulation

The ***Simulation*** function makes it possible to simulate data from the fieldbus protocol without a controller.

- Data that are sent by the safety laser scanner can be monitored.
- Data can be sent to the safety laser scanner in the same manner as from a PROFINET controller.

The function should only be used for testing and simulating the configuration.

Use of the function is not recommended if the safety laser scanner is connected to a controller.

Prerequisites

- There is a connection to the safety laser scanner.

The following displays are possible:

- Status of the safety zone (

/ 

)
- Assignment of the pins to cable colours and functions
- Display of objects in the safety zone and warning zones
- All detected errors
- Surrounding space that is captured by the safety laser scanner (real-time)
- Configured parameters
- Test mode

  For the activation of the simulation, set the ***Test mode*** slide control to ***ON***. If a configuration has not yet been accepted, the ***Test mode*** slide control is always set to ***ON.*** The test mode cannot be deactivated.
- Input process data

  The process image selected in the configuration (7 bytes or 12 bytes) is shown. For each bit, the current value is shown that was sent by the controller to the safety laser scanner.
- Output process data

  The process image selected in the configuration (7 bytes or 12 bytes) is shown. For each bit, the current value is shown that was sent by the safety laser scanner to the controller.
- Changeable input data

  The bytes of the input process data that can be edited are shown in hexadecimal.
- Colour assignment

  The bits are shown in a coloured frame. The colour assignment includes a list of which colour is assigned to the bit contents (zone set switching, interlock, safety zone, warning zone, muting, override, reserved, not configured, standard).

12 Cleaning, checks and maintenance

12.1 Cleaning

The font panel and the underside of the metal cover on the upper side of the safety laser scanner need to be cleaned regularly. The frequency depends on the environmental conditions.

- When mounted overhead, the safety laser scanner must be cleaned more frequently.

INFORMATION

Reduced availability by improper cleaning agents

Improper cleaning agents can damage the front screen and lead to faulty shutdowns.

– Use only the cleaning agents specified.

Contact Pilz and exchange the PSEN sc head [📖 119] if the front panel is scratched.

Contamination	Cleaning
Finger marks	Dampen PSEN sc cloth with PSEN sc cleaner (see order reference [📖 132]) and clean the front panel in one go without rubbing
Sticking particles	Dampen PSEN sc cloth with PSEN sc cleaner (see order reference [📖 132]) and clean the front panel in one go without rubbing
Loose, non-chafing particles	▸ Vacuum or gently blow away the particles without touching ▸ Remove particles using PSEN sc cloth in one go without rubbing
Loose, chafing particles	1. Vacuum or gently blow away the particles without touching 2. Remove particles using PSEN sc cloth in one go without rubbing
Oil drops	Dampen PSEN sc cloth with PSEN sc cleaner (see order reference [📖 132]) and clean the front panel in one go without rubbing
Statically charged particles	1. Vacuum particles without touching 2. Dampen PSEN sc cloth with PSEN sc cleaner (see order reference [📖 132]) and clean the front panel in one go without rubbing

12.2 Checks

12.2.1 Regular check

Regular checks can bring to light changes to the plant/machine, safeguards and ambient conditions.

Pilz recommends that the safety laser scanner be checked every six months.

- Check the safety laser scanner's front panel:
  - Scratched front panel: Exchange the PSEN sc head [📖 119].
  - Dirty front panel: Clean the front panel [📖 115].

    In a particularly dirty environment, the front panel should be checked for dirt more frequently.
- Ensure there are no fixed objects in the safety zone.
- Check the tightness of the safety laser scanner.

  All screws must be tightened to the torque specified in the Technical details [📖 127].
- Check the safety function of the safety laser scanner (see Check the safety function of the safety laser scanner [📖 98]).

12.2.2 Check after plant/machine modification

Check the safety laser scanner each time the plant/machine is modified. Changing the safety laser scanner or swapping components of the safety laser scanner should also be regarded as a modification.
You **must** comply with the requirements of the applicable national regulations.

INFORMATION

This inspection may only be carried out by qualified personnel.

The Appendix contains a Checklist which should help you perform the safety check.

12.3 Maintenance

12.3.1 Update firmware

The firmware of the safety laser scanner can be updated.

The update is started in the PSENscan PN Configurator.

Prerequisites

- You have the authorisation to update the firmware.
- The current firmware is available on the configuration PC.

  A current firmware can be provided by the Technical Support. Please contact Pilz.

Procedure:

1. Select a device under ***Network environment***.

The following information is shown in the work window:

Device type

Configuration

Firmware version

Device status

Device IP address

2. Select ***Device -> Firmware update***.

   Enter the password and log on to the safety laser scanner.

3. Click on ***Select*** and, in the directory in which the current firmware is saved, select the package that is to be loaded.

   A report showing information on the selected package is displayed in the ***Firmware update*** work window.

4. Click on ***Download*** under ***Load configuration*** to load the selected package.

   The safety laser scanner switches to offline while the package is being loaded.

5. Switch to the offline check mode when the firmware was loaded successfully. Create a configuration and check the new firmware version.

   Perform a complete reset of the safety laser scanner. [📖 98]

6. Click ***Accept,*** when the firmware works correctly or ***Reject,*** when the firmware does not work correctly.

12.3.2 Exchange of a memory module

When exchanging a memory module, you can use a memory module without saved configuration or a memory module where a configuration is already saved. This configuration can be restored for use in the safety laser scanner.

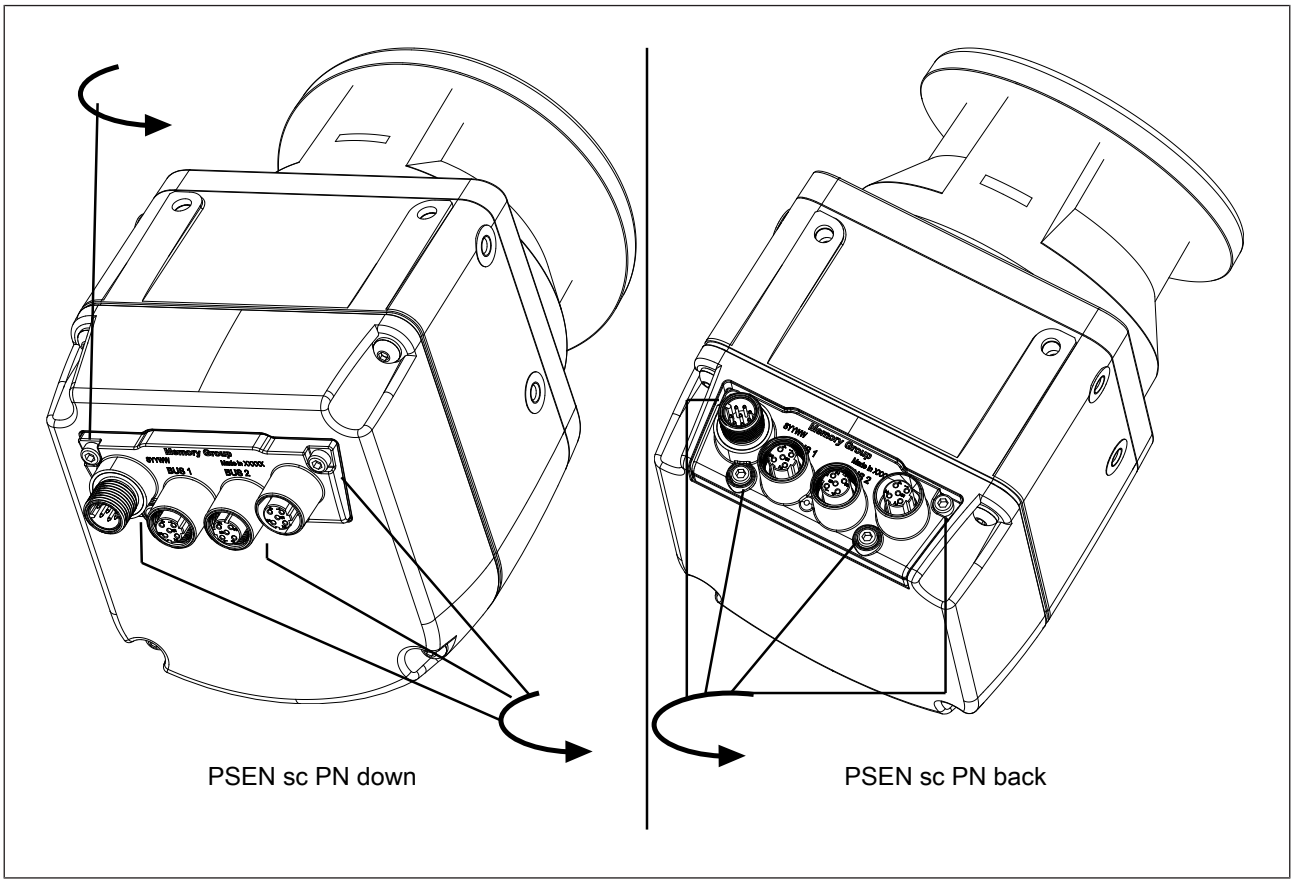
Prerequisites

The memory module must already be disconnected from the supply voltage.

Procedure:

1. Switch off the safety laser scanner.
2. Turn the safety laser scanner PSEN sc PN 5.5. down/back for better access to the memory module.
3. Disconnect all cables from the connectors.
4. Loosen the M3 screws [1] of the memory module and pull out the memory module.

   The screws are secured against loss and they cannot be removed.



Legend

[1] M3 screws for attaching the memory module

5. Insert the new memory module into the safety laser scanner.
6. Screw the memory module with ?.
7. Reconnect the supply voltage, safety controller and PROFINET.

   Use two 8-pin cables and two 4-pin cables (see Order references [📖 132]).
8. Switch the safety laser scanner on.

   The system checks whether the conditions are met. When the conditions are met, restoring of the configuration is started.
9. The process for restoring the configuration will vary, depending on the type of difference between the memory module and PSEN sc PN 5.5. down/back.

   Serial numbers different: CFG NO MATCHING is shown on the display of the master unit. Continue by selecting the data to be restored.

   Topology or MIB files different: WAITING CONF is shown on the display of the master unit. Continue the configuration in the PSENscan PN Configurator.
10. Use the buttons on the display of the master unit to select the data to be used for restoring.

    Display master unit:

    Restore cfg: The configuration in the memory module is used. Confirm the selection with ***Confirm*** and the configuration is copied from the memory module into the PSEN sc PN 5.5. down/back. Continue checking the configuration.

cfg from GUI: The new configuration created in the PSENscan PN Configurator is used. Confirm your selection with ***Confirm*** and continue with Create new configuration in the PSENscan PN Configurator.

11. Display master unit: ***Confirm*** / ***Cancel***

    Display subscriber unit: CHECK MASTER

    Confirm your entry with ***Confirm***

12. Checking the configuration

    Display master unit: RES FAILED. Could not copy the configuration successfully. Continue by selecting the data for the restoring.

    Display master unit: RUN TEST MODE

    On the display of the master unit, select ***Enter Test***. Test operation starts. Continue with accept or reject configuration.

13. Accept or reject configuration

    Test operation is complete.

    Select ***Validate conf*** to accept the configuration. The safety laser scanner is ready for operation again.

    Select ***Reject conf*** to reject the configuration. Continue by selecting the data for the restoring.

14. Create new configuration in the PSENscan PN Configurator

    Display master unit: WAITING CONF

    Display subscriber unit: CHECK MASTER

    Configure the safety laser scanner in the PSENscan PN Configurator.

12.3.3 Exchange PSEN sc head

NOTICE

Error exchanging the PSEN sc head

If PSEN sc head is incorrectly installed, this may lead to a not suitable behaviour of the safety laser scanner.

Prerequisites

- In the serial number of the safety laser scanner (see Identification [📖 136]) at least 2021 is specified as year of manufacture.

  The serial number has the format XYYM#####.

  YY must be ≥ 21.
- A firmware version 3.1.1 or newer is installed on the device.
- The exchange of PSEN sc head is done only by qualified personnel
- The machine in the danger zone is switched off and protected against switching on again.
- The new PSEN sc head is dry and dust-free

- Safety laser scanner is dry and dust-free
- Exchange of the PSEN sc head takes place in a controlled and pollutant-free environment
  - Temperature between 18 and 30° C
  - Relative humidity < 80%
- Within a radius of 275° around the safety laser scanner an area of 2 m must remain free.
- Ensure that the front screen of the new PSEN sc head is not damaged when the PSEN sc head is installed.
- Use clean, thin gloves to install the PSEN sc head.
- Do not touch the front screen.
- During installation, hold the PSEN sc head by the metal cover on the upper side of the PSEN sc head.
- Required tool: Hexagon socket torque wrench 2.5 mm with long shaft

Procedure:

1. Check the scope of delivery of the new PSEN sc head.

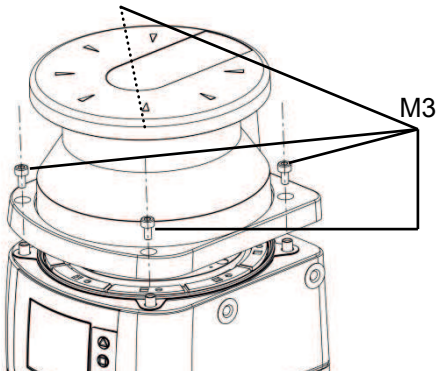
   Content of the package:

   1 new PSEN sc head

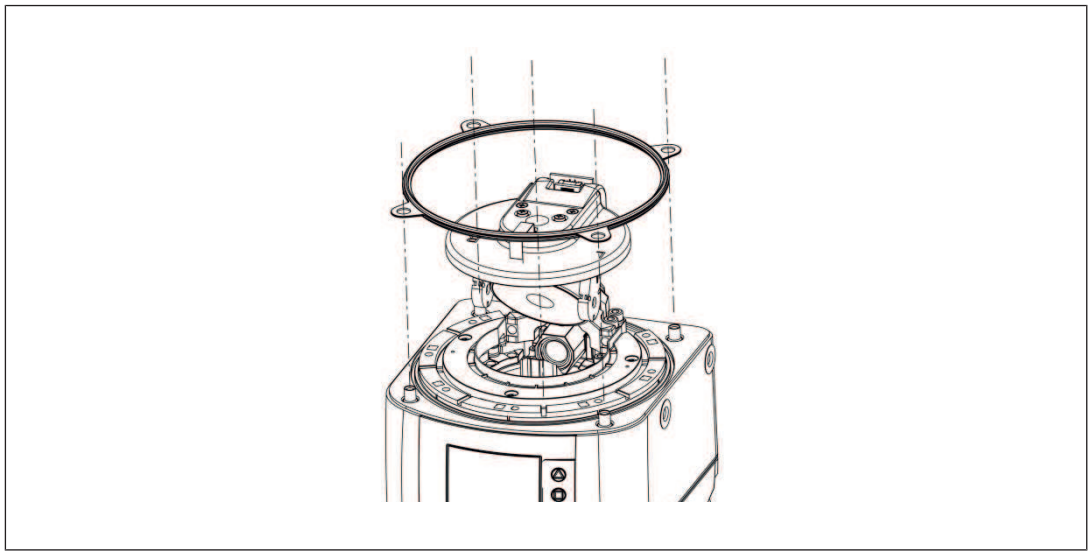
   1 seal

   4 M3 screws

2. Undo the four M3 screws on the PSEN sc head (see figure) and remove the PSEN sc head vertically upwards (see figures).



3. Replace the old seal with the new seal. Ensure that the new seal is seated correctly in the seal seat.



4. Check whether the interior of the safety laser scanner is free from contaminations.

   Use dry compressed air for cleaning, if necessary.

5. Place the new PSEN sc head carefully on the lower part of the safety laser scanner.

   Make sure that the new PSEN sc head is horizontally on the base of the safety laser scanner.

6. Fix the PSEN sc head with the four M3 screws and tighten the screws with 0.6 Nm.
7. Install the safety laser scanner again as it was before the removal of PSEN sc head.

   Note the previous installation position, the wiring and the configuration of the safety laser scanner.

8. Switch the safety laser scanner on.
9. Establish a connection to the safety laser scanner in the PSENscan PN Configurator.
10. In the PSENscan PN Configurator, select ***Device -> Exchange PSEN sc head.***

    Enter the password for the safety laser scanner and follow the instructions for the procedure.

11. Select the device with the exchanged PSEN sc head and enter the serial number of the new PSEN sc head.
12. Calibration of the new PSEN sc starts.

    The safety laser scanner switches to offline and then into a state for checking the safety laser scanner. A warning is displayed.

13. The calibration of the new PSEN sc head is complete and it must be assessed.
14. Check the safety function of the safety laser scanner with a detection capability of 40 mm at a distance of 1 m to the safety laser scanner over the complete scanning area of 275° (see Check the safety function of the safety laser scanner [📖 98]).
15. Switch off the safety laser scanner.
16. The safety outputs of the safety laser scanner switch to the OFF state.

    Make sure that the danger zone cannot be used.

17. Switch the safety laser scanner on.
18. Click ***Reject*** or ***Accept*** to complete the calibration.

Click ***Accept*** to activate the downloaded configuration in the connected device and reject the existing configuration on the connected device.

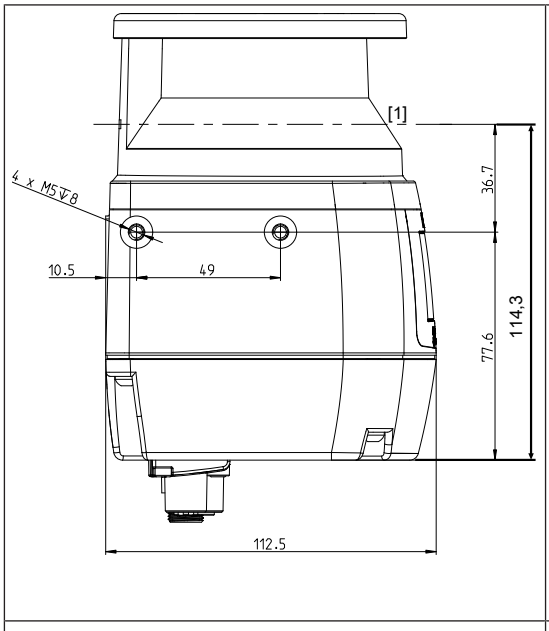
Click ***Reject*** to reject the downloaded configuration in the connected device and continue to use the existing configuration on the connected device. The downloaded configuration in the connected device will be deleted.

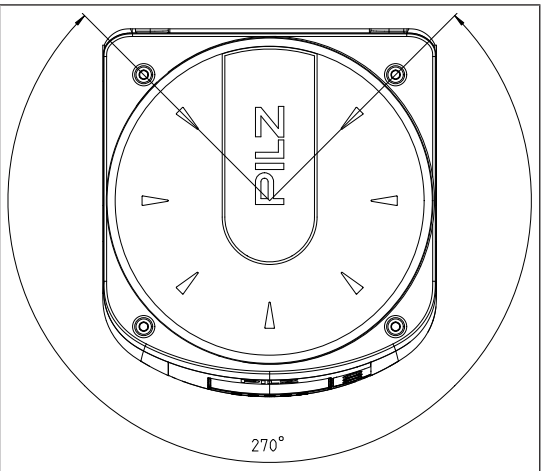
19. The display of the safety laser scanner shows: COMMIT ON FIELD
20. In the PSENscan PN Configurator, select ***Device -> Exchange PSEN sc head.***

    Confirm the exchange of the PSEN sc head with ***Done***.

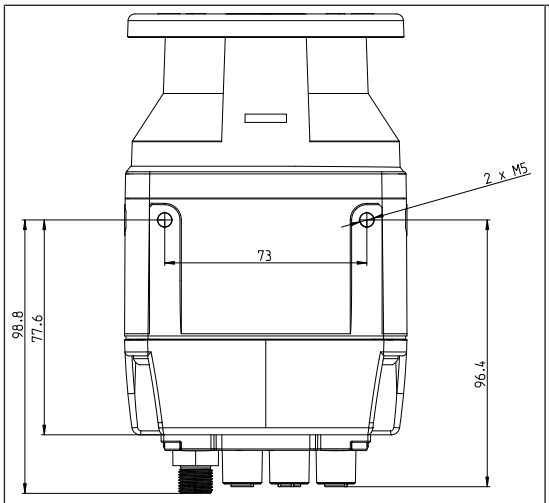
13 Dimensions

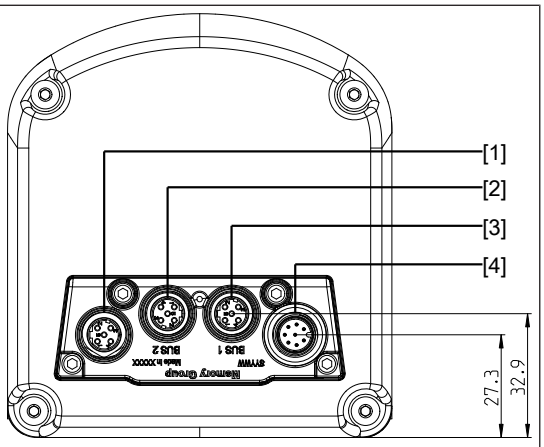
PSEN sc PN5.5 down – Order no. 6D000035





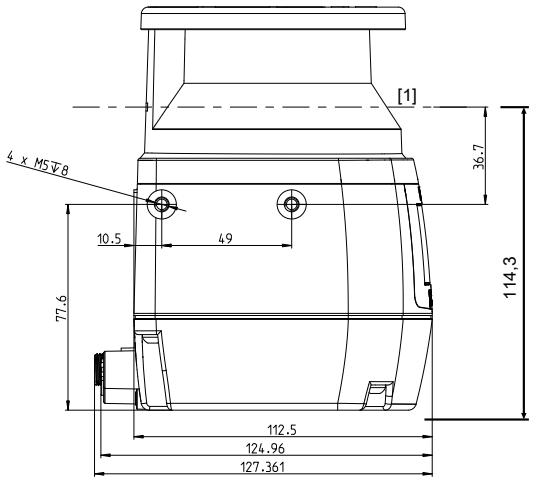
Side view		Plan view
[1]	Scan plane	

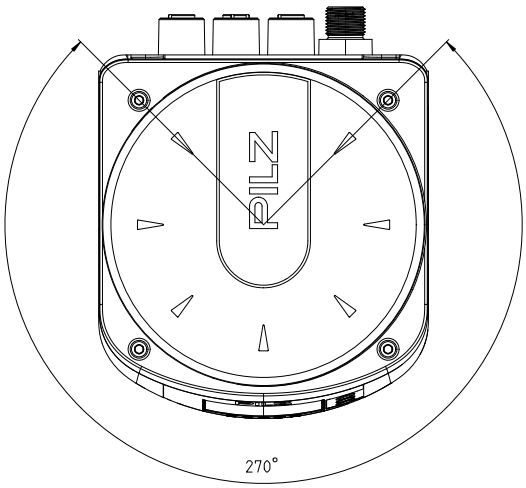




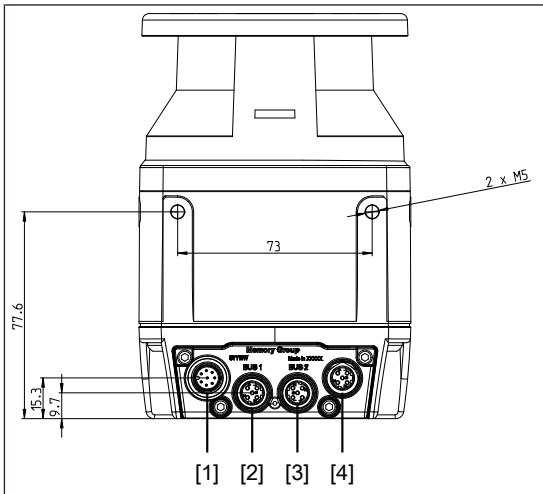
Rear view	View from below	
	[1]	M12 5-pin female connector, D-coded
	[2]	M12 5-pin female connector, D-coded
	[3]	M12 5-pin female connector, D-coded
	[4]	M12 8-pin male connector, A-coded

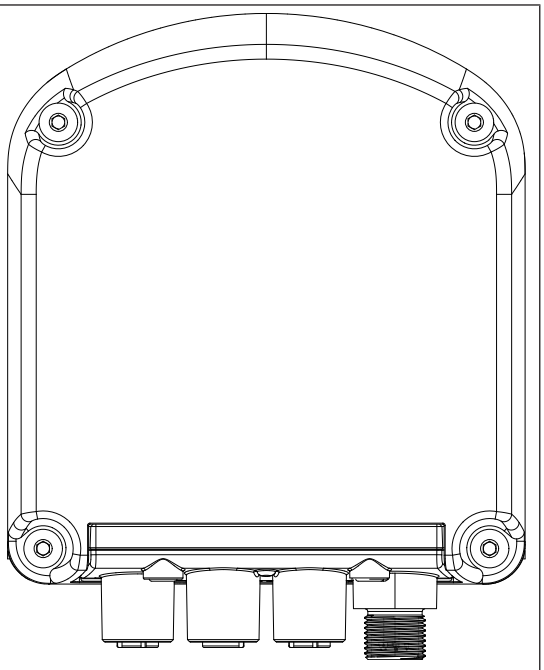
PSEN sc PN5.5 back - Order no. 6D000036





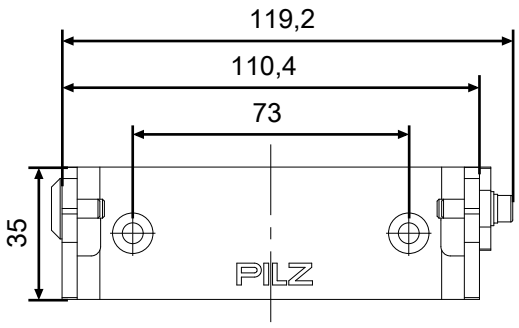
Side view		Plan view
[1]	Scan plane	



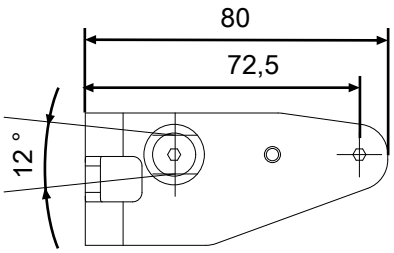


Rear view		View from below
[1]	M12 8-pin female connector, A-coded	
[2]	M12 5-pin female connector, D-coded	
[3]	M12 5-pin female connector, D-coded	
[4]	M12 5-pin male connector, D-coded	

PSEN sc bracket P

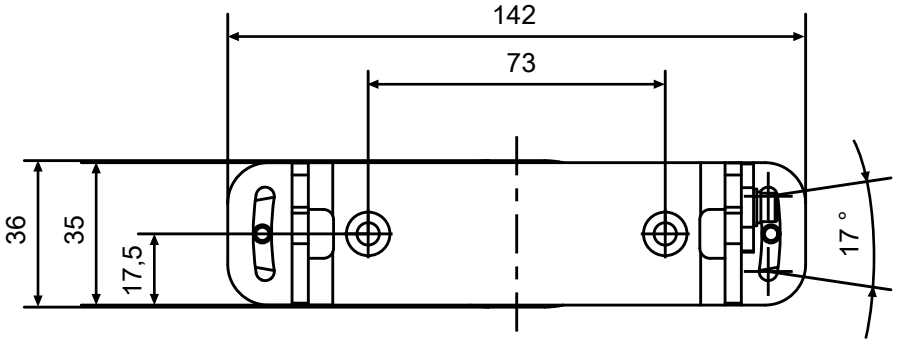


Front view

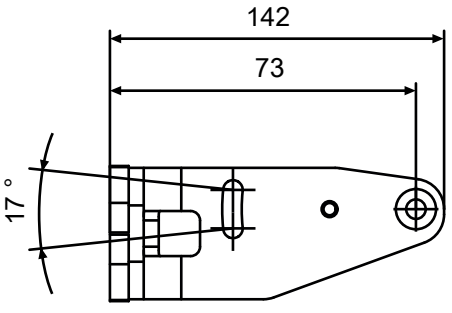


Side view

PSEN sc bracket PR

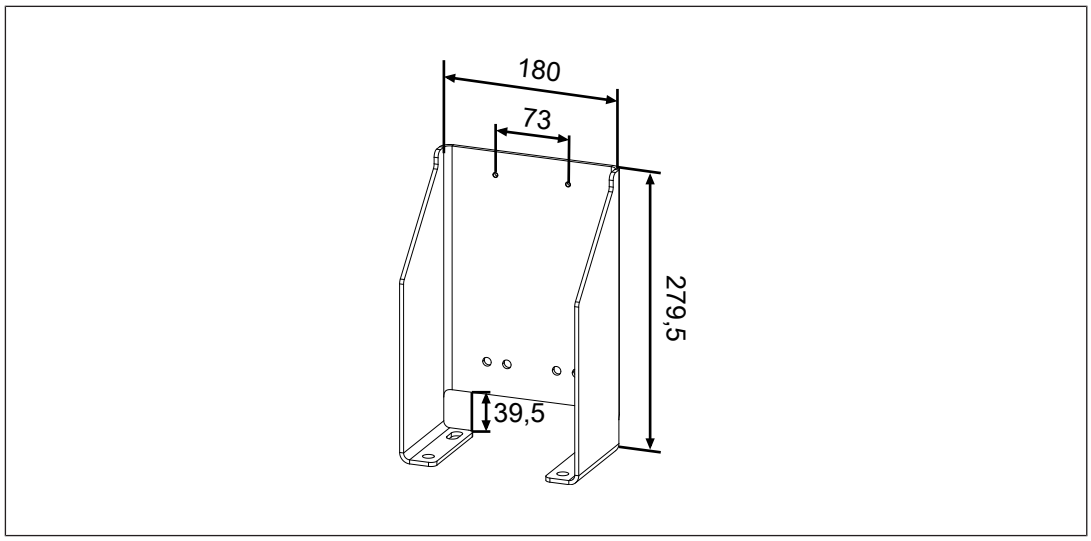


Front view



Side view

PSEN sc bracket F



14 Technical details order no. 6D000035-6D000036

Where standards are undated, the 2019-07 valid editions apply.

General	6D000035	6D000036
Certifications	**CE, TÜV, UKCA, cULus Listed**	**CE, TÜV, UKCA, cULus Listed**
ESPE type	**3**	**3**
Product type	**PROFIsafe/PROFINET IO Device**	**PROFIsafe/PROFINET IO Device**
Sensor's mode of operation	**Optical**	**Optical**
Resolution		
Operating range	**5,5 m**	**5,5 m**
Resolutions	**30 mm, 40 mm, 50 mm, 70 mm, 150 mm**	**30 mm, 40 mm, 50 mm, 70 mm, 150 mm**
Number of zone sets that can be switched	**70**	**70**
Operating range		
Warning zone	**19 m/resolution 30 mm, 22 m/resolution 40 mm, 23 m/resolution 50 mm, 40 m/resolution 150 mm, 40 m/resolution 70 mm**	**19 m/resolution 30 mm, 22 m/resolution 40 mm, 23 m/resolution 50 mm, 40 m/resolution 150 mm, 40 m/resolution 70 mm**
Safety zone	**2.50 m/resolution 30 mm, 3 m/resolution 40 mm, 4 m/resolution 50 mm, 5.5 m/resolution 150 mm, 5.5 m/resolution 70 mm**	**2.50 m/resolution 30 mm, 3 m/resolution 40 mm, 4 m/resolution 50 mm, 5.5 m/resolution 150 mm, 5.5 m/resolution 70 mm**
Number of simultaneously monitored safety zones	**8**	**8**
Number of simultaneously monitored zones	**8**	**8**
Number of zone configurations	**70**	**70**
Electrical data	**6D000035**	**6D000036**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-30 %/+20 %**	**-30 %/+20 %**
Output of external power supply (DC)	**8,5 W**	**8,5 W**
Residual ripple DC	**5 %**	**5 %**
Max. inductive load per output	**2 H**	**2 H**
Protection class	**3**	**3**
Optical data	**6D000035**	**6D000036**
Diameter light spot on front plate	**8 mm**	**8 mm**
Used wavelength range	**905 nm**	**905 nm**
Laser class (DIN EN 60825-1)	**1**	**1**
Scan area	**275°**	**275°**
Max. opening angle scanner	**0,12°**	**0,12°**
Angle resolution	**0,1°**	**0,1°**

Optical data	6D000035	6D000036
Max. number of multiple evaluations	16	16
Detectable remission area	1,8 - 1.000 %	1,8 - 1.000 %
Pulse duration	3 ns	3 ns
Typical output power laser	8 mW	8 mW
Inputs	**6D000035**	**6D000036**
Number of configurable inputs	5	5
Number of configurable inputs/outputs	4	4
Signal level at g0 h	< 5 V	< 5 V
Signal level at "1"	> 12 V	> 12 V
Voltage at inputs	24 V	24 V
Current per input	2 mA	2 mA
Semiconductor outputs	**6D000035**	**6D000036**
Quantity	8	8
Function	Safety output	Safety output
Number of configurable outputs	1	1
Number of configurable inputs/outputs	4	4
Residual current at "0" signal	< 700 µA	< 700 µA
Output voltage at "1" signal	17,2 V	17,2 V
Output voltage at "0" signal	0 V	0 V
Max. output current at rated voltage	300 mA	300 mA
Max. capacitive load	2,2 µF	2,2 µF
Ethernet interface	**6D000035**	**6D000036**
Connection type	M12x1, 4-pin, D-code	M12x1, 4-pin, D-code
Transmission rate	100 MBit/s	100 MBit/s
Times	**6D000035**	**6D000036**
Switch-on delay		
after UB is applied	35 s	35 s
Increased response time per measurement cycle	30 ms	30 ms
Response time t1	94 ms	94 ms
Rotation time	42 ms	42 ms
Environmental data	**6D000035**	**6D000036**
Ambient temperature		
Temperature range	-10 - 50 °C	-10 - 50 °C
Storage temperature		
Temperature range	-20 - 70 °C	-20 - 70 °C
Climatic suitability		
Humidity	max. 95 %	max. 95 %
Condensation during operation	Not permitted	Not permitted
Max. operating height above SL	2000 m	2000 m

Environmental data	6D000035	6D000036
Vibration		
in accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Shock stress		
in accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**
Number of shocks	**1000**	**1000**
Acceleration	**10g**	**10g**
Duration	**16 ms**	**16 ms**
Protection type		
Housing	**IP65**	**IP65**
Deviation from ideal flatness of the scan field at max. operating range	**50 mm**	**50 mm**
Mechanical data	**6D000035**	**6D000036**
Distance scanning plane to top edge	**37,7 mm**	**37,7 mm**
Distance mirror rotational axis to the rear	**52,5 mm**	**52,5 mm**
Connection type	**2x M12, 5-pin male connector, M12, 8-pin male connector**	**2x M12, 5-pin male connector, M12, 8-pin male connector**
Material		
Housing	**Aluminium**	**Aluminium**
Top	**PC**	**PC**
Front screen	**PMMA**	**PMMA**
Max. torque setting		
Fixing screw	**3 Nm**	**3 Nm**
Adjusting screw for angle of inclination	**2,5 Nm**	**2,5 Nm**
Dimensions		
Height	**152 mm**	**152 mm**
Width	**102 mm**	**102 mm**
Depth	**112,5 mm**	**112,5 mm**
Weight	**1.400 g**	**1.400 g**

15 Safety characteristic data

NOTICE

You must comply with the safety characteristic data in order to achieve the required safety level for your plant/machine.

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN IEC 62061 SIL CL/max. SIL	EN IEC 62061 61508 PFH [1/h]	EN/IEC 61511 61508 SIL	EN/IEC 61511 61508 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL d	Cat. 3	SIL 2	2,26E-08	–	–	20

Explanatory notes for the safety-related characteristic data:

- T_M is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN/IEC 61508-6 and EN/IEC 61511 and as the proof test interval and mission time in accordance with EN IEC 62061

All the units used within a safety function must be considered when calculating the safety characteristic data.

INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the products used and may differ from these.

16 Network data

Interface	Protocol	Direction	Transport log	Port no.	Can be de-activated	Description
User interface	Proprietary	Out	UDP	2000	no	Monitoring
User interface	Proprietary	In/out	UDP	3000	no	Receive command
User interface	Proprietary	In/out	UDP	4088	no	Find device in network
User interface	Proprietary	In/out	UDP	12000	no	Poll configur-ation data Information for data ex-change

17 Order reference

17.1 System

Product type	Features	Order no.
PSEN sc PN 5.5 08 down	PROFINET IO DEVICE with PROFIsafe, 30 mm, 40 mm, 50 mm, 70 mm, 150 mm detection capability, muting, partial muting, override, EDM, restart application in accordance with EN ISO 61496-3, vertical applications, max. 15 dynamic reference markers, measured data output (UDP), fast replacement due to exchangeable memory module on the bottom, window exchangeable, ROS & C++ interface available, 5.5 m safety zone, max. 8 safety/warning zones in parallel, extended connection options (I/O), 70 configurable zone sets.	6D000035
PSEN sc PN 5.5 08 back	PROFINET IO DEVICE with PROFIsafe, 30 mm, 40 mm, 50 mm, 70 mm, 150 mm detection capability, muting, partial muting, override, EDM, restart application in accordance with EN ISO 61496-3, vertical applications, max. 15 dynamic reference markers, measured data output (UDP), fast replacement due to exchangeable memory module on the rear, window exchangeable, ROS & C++ interface available, 5.5 m safety zone, max. 8 safety/warning zones in parallel, extended connection options (I/O), 70 configurable zone sets.	6D000036

17.2 Accessories

Product type	Features	Order no.
PSEN sc memory fbus	Exchangeable memory module 08-12 for fast replacement safety laser scanner	6D000037
PSEN sc head	Exchangeable head for a safety laser scanner with window, for PSEN sc L/M/S from delivered firmware version 3.1.3	6D000007
PSEN sc cleaner	Antistatic cleaning agent	6D000008
PSEN sc cloth	Cleaning cloth	6D000009

Installation material

Product type	Features	Order no.
PSEN sc bracket P R	Mounting bracket for setting the tilt of the angle of inclination and the roll angle	6D000002
PSEN sc bracket P	Mounting bracket for setting the tilt of the angle of inclination	6D000003
PSEN sc bracket C	Mounting bracket for corner mounting	6D000011
PSEN sc bracket F	Mounting bracket for floor mounting	6D000010
PSEN sc bracket H	Accessory for protection of the head part	6D000004

Muting

Product type	Features	Order no.
PIT si2.1 LED muting lamp	LED signal lamp for muting mode	620015

17.2.1 Cable

M12, 8-pin, unshielded

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN cable axial M12 8-pole 3m	3 m	M12, 8-pin female connector, straight			540319
PSEN cable axial M12 8-pole 5m	5 m	M12, 8-pin female connector, straight			540320
PSEN cable axial M12 8-pole 10m	10 m	M12, 8-pin female connector, straight			540321
PSEN cable M12-8sf, 20m	20 m	M12, 8-pin female connector, straight			540333
PSEN cable axial M12 8-pole 30m	30 m	M12, 8-pin female connector, straight			540326

M12, 8-pin, shielded

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN op cable axial M12 8-p. shield. 3m	3 m	M12, 8-pin female connector, straight			630313
PSEN op cable axial M12 8-p. shield. 5m	5 m	M12, 8-pin female connector, straight			630314
PSEN op cable axial M12 8-p. shield. 10m	10 m	M12, 8-pin female connector, straight			630315
PSEN op cable axial M12 8-p. shield. 30m	30 m	M12, 8-pin female connector, straight			630328
PSEN op cable axial M12 8-p. shield. 50m	50 m	M12, 8-pin female connector, straight			630368
PSEN op cable angle M12 8-p. shield. 3m	3 m	M12, 8-pin female connector, angled			630316

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN op cable angle M12 8-p. shield. 5m	5 m	M12, 8-pin female connector, angled			630317
PSEN op cable angle M12 8-p. shield. 10m	10 m	M12, 8-pin female connector, angled			630318
PSEN op cable angle M12 8-p. shield. 30m	30 m	M12, 8-pin female connector, angled			630329
PSEN op cable angle M12 8-p. shield. 50m	50 m	M12, 8-pin female connector, angled			630369

For configuration only, unshielded

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN op Ethernet cable 1m	1 m	M12, 4-pin male connector, straight	4-pin RJ45 male connector, straight		631071
PSEN op Ethernet cable 3m	3 m	M12, 4-pin male connector, straight	4-pin RJ45 male connector, straight		631072
PSEN op Ethernet cable 10m	10 m	M12, 4-pin male connector, straight	4-pin RJ45 male connector, straight		631073

Configuration and output of measured data, shielded

Product type	Features	Order no.
Cable/PN/ RJ45-4SM/ M12-4SMX/D/003/ Q324/GN	Connection for PROFINET, CAT5e, shielded, RJ45 on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 3 m	C1000001
Cable/PN/ RJ45-4SM/ M12-4SMX/D/005/ Q324/GN	Connection for PROFINET, CAT5e, shielded, RJ45 on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 5 m	C1000002
Cable/PN/ RJ45-4SM/ M12-4SMX/D/010/ Q324/GN	Connection for PROFINET, CAT5e, shielded, RJ45 on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 10 m	C1000003
Cable/PN/ RJ45-4SM/ M12-4SMX/D/020/ Q324/GN	Connection for PROFINET, CAT5e, shielded, RJ45 on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 20 m	C1000004
Cable/PN/ M12-4SMX/ M12-4SMX/D/0,5/ Q324/GN	Connection for PROFINET, CAT5e, shielded, 4-pin M12 male connector, straight, D-coded on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 0.5 m	C1000005

Product type	Features	Order no.
Cable/PN/ M12-4SMX/ M12-4SMX/D/003/ Q324/GN	Connection for PROFINET, CAT5e, shielded, 4-pin M12 male connector, straight, D-coded on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 3 m	C1000006
Cable/PN/ M12-4SMX/ M12-4SMX/D/005/ Q324/GN	Connection for PROFINET, CAT5e, shielded, 4-pin M12 male connector, straight, D-coded on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 5 m	C1000007
Cable/PN/ M12-4SMX/ M12-4SMX/D/010/ Q324/GN	Connection for PROFINET, CAT5e, shielded, 4-pin M12 male connector, straight, D-coded on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 10 m	C1000008
Cable/PN/ M12-4SMX/ M12-4SMX/D/020/ Q324/GN	Connection for PROFINET, CAT5e, shielded, 4-pin M12 male connector, straight, D-coded on 4-pin M12 male connector, straight, D-coded, conductor cross section: 4 x 0.34 mm2, cable length: 20 m	C1000009

18 Identification

The safety laser scanner's year and month of manufacture is encoded within its serial number.

The serial number is a 9-digit code.

X YY M #####

Legend

X	Internal designation (any letter)		
YY	Year of manufacture	16 = 2016	
		17 = 2017	
		18 = 2018	
		19 = 2019	
		…	
		30 = 2030	
M	Month of manufacture	A = January	G = July
		B = February	H = August
		C = March	I = September
		D = April	L = October
		E = May	M = November
		F = June	N = December
#####	Consecutive number within the month		

19 EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC on machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.
Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

20 UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.
The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

Representative: Pilz Automation Technology, Pilz House, Little Colliers Field, Corby, Northamptonshire, NN18 8TJ United Kingdom, eMail: mail@pilz.co.uk

Support

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1007024-EN-02, 2025-07 Printed in Germany