



OPERATING INSTRUCTIONS

## **Safety Laser Scanner RLS 100**

# **SICK**

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# 1 About this document

Please read this chapter carefully before working with this documentation and the safety laser scanner RLS 100.

## 1.1 The function of this document

This document provides information on the technical properties of the Safety Laser Scanner RLS 100 (Rotating Laser Scanner). You will find information on:

- Safety
- Structure and operation
- Planning
- Maintenance and care

## 1.2 The target group of this document

This document is intended for those persons who constructively integrate the safety laser scanner RLS 100, and commission and operate it as a protective device.

## 1.3 Scope

This document is part of SICK part number 8 009 894 (operating instructions “Safety Laser Scanner RLS 100” in all available languages). You will find this number on the information label on the system.

## 1.4 Depth of information of this document

This document contains all the information necessary for planning, acquisition and maintenance of the safety laser scanner RLS 100. Information is provided on its operating principle, possible uses and mounting.

More detailed information is available from SICK AG directly.

## 1.5 Abbreviations and terms

### 1.5.1 Abbreviations

<b>ESPE</b>	Electro-sensitive protective equipment (e.g. safety laser scanner RLS 100)
<b>CDS</b>	SICK Configuration & Diagnostic Software. With a <b>PC</b> and the <b>CDS</b> , as a user you can define the monitored areas, and define or check the correct configuration of the safety laser scanner RLS 100.  The safety laser scanner RLS 100 uses a reference target fixed to the RLS 100 for self-checking. Any change to this target is interpreted as a system error.
<b>OSSD</b>	Output signal switching device

## 1.5.2 Important terms

Please distinguish between the following terms:

<b>Machine</b>	In these operating instructions, <b>machine</b> is used as a term for the system to be monitored. A dangerous state or a dangerous movement that rules out the presence of persons or objects in the protective field, is involved in the operation of the machine.
<b>Scanning range</b>	The <b>maximum scanning range</b> describes an arc of 300° around the sensor with a radius of max. 7.5 m.
<b>Protective field</b>	The safety area that, when infringed, results in the immediate shut down of the dangerous movement, is termed the <b>protective field</b> . If a person or object enters the <b>protective field</b> the safety laser scanner RLS 100 provides a stop signal to the machine via the <b>OSSD</b> switching outputs.
<b>Protective field size</b>	The <b>maximum protective field size</b> is defined by the distance of the safety laser scanner scanning head to the most distant point of the protective field including the safety supplement.
<b>Monitored areas</b>	<b>Monitored areas</b> is a general term used for <b>protective fields</b> (up to 6 m) and/or <b>warning fields</b> (up to 7.5 m). <b>Monitored areas</b> can have irregular shapes or shapes adapted to the surroundings. The safety laser scanner RLS 100 monitors them continuously by means of individual radial laser beams.
<b>Warning field</b>	The <b>warning field</b> is described as that safety area whose infringement causes an optical or acoustic warning signal. If a person or object enters the <b>warning field</b> the safety laser scanner RLS 100 provides a signal to the monitored machine via the output for <b>warning field</b> .

## 1.6 Symbols used

Some information in this document is given particular emphasis to make it easier to find it quickly.

<b>Recommendation</b>	Recommendations are designed to give you assistance in your decision-making process with respect to a function or a technical measure.
<b>Note</b>	Such notes provide information on special device features.
● Red, ● Yellow, ○ Green	LED symbols describe the state of a diagnostics LED. Examples: ● Red      The red LED is illuminated constantly. ● Yellow    The yellow LED is flashing. ○ Green     The green LED is off.
➤ Take action...	Instructions for taking action are shown by an arrow. Carefully read and follow the instructions for action.



### Warning!

A warning indicates an actual or potential risk or health hazard. They are designed to prevent accidents.

Always read warnings attentively and follow instructions carefully!



Software notes show the location in the CDS (Configuration & Diagnostic Software) where you can make the appropriate settings and adjustments. In the CDS open the menu **View, Dialog boxes** and select the item **File Cards** to go straight to the above dialog fields. Alternatively, the Software Wizard will guide you through the appropriate setting.

**The term “dangerous state”**

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

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

## 2 On safety

This chapter deals with your safety and the safety of the equipment operators.



CAUTION

### **Safety notes**

Please observe the following items in order to ensure the correct and safe use of the safety laser scanner RLS 100.

Prior to commissioning the safety laser scanner RLS 100 for the first time, please read these operating instructions and the user manual for the CDS (Configuration & Diagnostic Software) carefully. Get to know the system and the CDS. Please contact the manufacturer if you have any questions. We would be pleased to provide assistance.

All appropriate legal regulations, the requirements of the trade associations and the instructions of the manufacturer of the machine to be monitored must be observed without fail.

The protective function of the safety laser scanner RLS 100 depends on the correct definition and programming of the **warning field** and **protective field**.

Installation of the safety laser scanner RLS 100, definition and programming of the areas to be monitored and integration in the machine control system may only be carried out by authorised personnel who are appropriately trained.

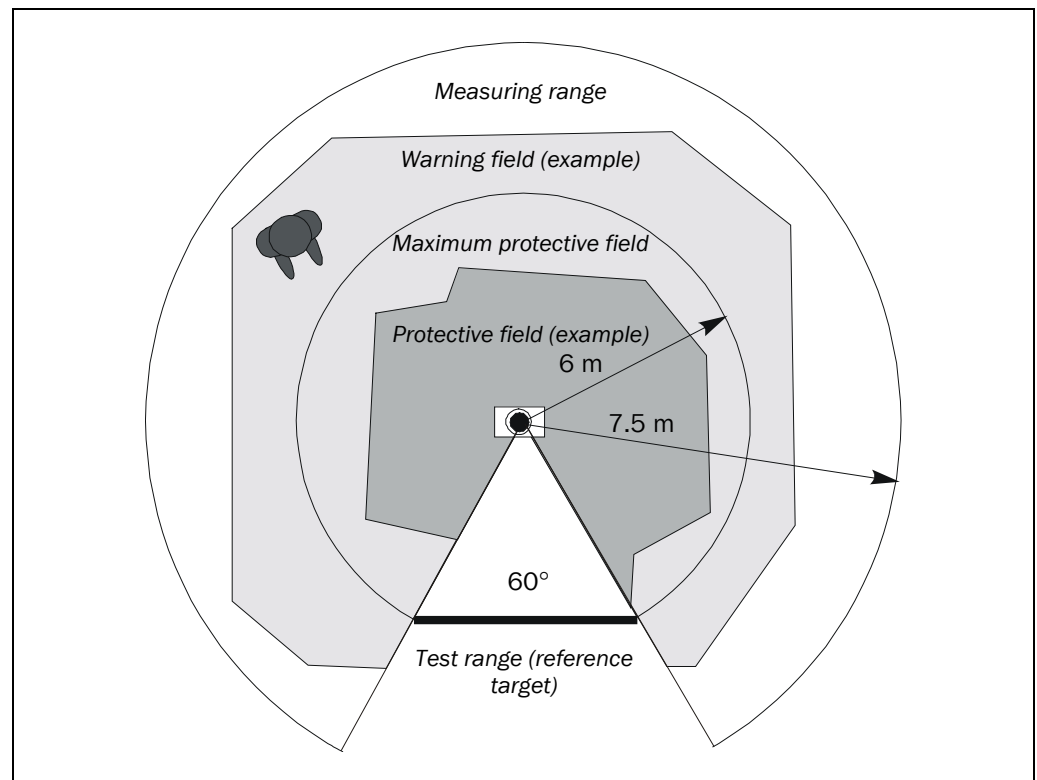
After completing the programming, the arrangement of the protective and warning fields are to be tested on the machine while it is switched on, but **not running**. On this topic see Section 7.2 “Testing the Monitor functions” on page 34.



## 2.1 Use of the device

The safety laser scanner RLS 100 has been developed and approved as a Type 3 electro-sensitive protective equipment according to the IEC/EN 61496-1 standard.

Fig. 1: Schematic diagram of the monitored areas



The safety laser scanner RLS 100 has been designed for industrial use. Its task is to detect access of persons to hazardous areas and stop the dangerous movement of a machine in this area. A signal is triggered as soon as a person or object enters the monitored area:

- If a person or object is present within the **warning field** the safety laser scanner RLS 100 switches a relay contact at the corresponding signal output. This signal can be used for acoustic and optical warnings. Warnings are to indicate that the hazardous area is to be left before the protective field is activated, and the safety laser scanner RLS 100's OSSDs issue a stop signal that would trigger a machine stop.
- If a person or object is present within the **protective field** the safety laser scanner RLS 100 switches two independent relay contacts. These signals must lead to an immediate switching off of the dangerous machine movement.

The CDS (Configuration & Diagnostic Software) is included with the safety laser scanner RLS 100 for the definition and testing of the protective field and warning field.

## 2.2 Correct use of the device

The safety laser scanner RLS 100 may only be used as protective equipment for detecting persons or objects (horizontal protective field). Operation of the device is only permissible according to the technical specifications. All warranty claims against SICK AG are forfeited in the case of any other use, or alterations being made to devices, even as part of their mounting or installation.

## 2.3 General safety information and protective measures



CAUTION

**The safety laser scanner RLS 100 may only be employed for monitoring tasks fulfilling all the following conditions:**

- The safety laser scanner RLS 100 must be able to terminate the dangerous state within a defined time period by triggering the stop signal.
- The safety distance monitored by the safety laser scanner RLS 100 must be smaller than the maximum protective field.
- The maximum value of the machine's stopping time plus the safety laser scanner RLS 100's response time must be calculated so that nobody can gain access to the hazardous point before the dangerous movement has come to a complete stop.



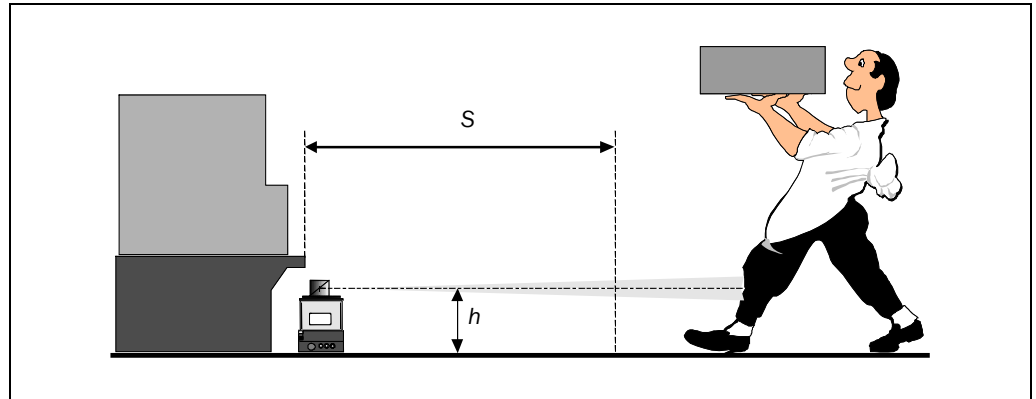
The safety laser scanner RLS 100 is of laser safety class 1. Additional measures for screening the laser radiation are not necessary (eye safe).

**RLS 100**

**2.3.1 Stationary application**

According to Chapter 6.2 of the EN 999 standard the safety distance between the limit of the protective field and the hazardous area of a stationary machine is calculated as follows:

Fig. 2: Calculation of the safety distance for a stationary application



$$S = 1.6 \times (t_1 + t_2) + (1200 - 0.4 h) + ZM$$

Please note:  $1200 - 0.4 h \geq 850$

Here...

- $S$  = The safety distance in mm
- $t_1$  = The response time of the RLS 100 (see Chapter 11 "Technical data" on page 40)
- $t_2$  = The machine stopping/run-down time (in ms)
- $h$  = Height of protective field above the floor (in mm)  $300 \leq h < 1000$
- 1.6 = The assumed approach speed (in m/s)
- $ZM$  = Maximum measuring error of the RLS 100 (see Chapter 11 "Technical data" on page 40)



**Ensure that the correct mounting height is used!**

When selecting the mounting height ensure that it is not possible to enter the hazardous area from below the protective field.



**The safety laser scanner RLS 100 must be supplemented by further safety devices if one of the following situations applies:**

- A hazardous point can be reached without passing through the monitored areas;
- The area monitored by the safety laser scanner RLS 100 can be reached from above, below or from the side;
- According to EN 999, possible access by crawling below the protective field must be taken into account above the regulation minimum protective field height of 300 mm.

**Example for a stationary application**

Machine width  $M = 2.2 \text{ m} = 2200 \text{ mm}$

Response time of the RLS 100 = 280 ms

The machine stopping/run-down time = 300 ms

Height of protective field above the floor = 0.5 m = 500 mm

Maximum measuring error of the RLS 100 = 350 mm

Protective field width =  $M + \text{safety supplement left and right}$

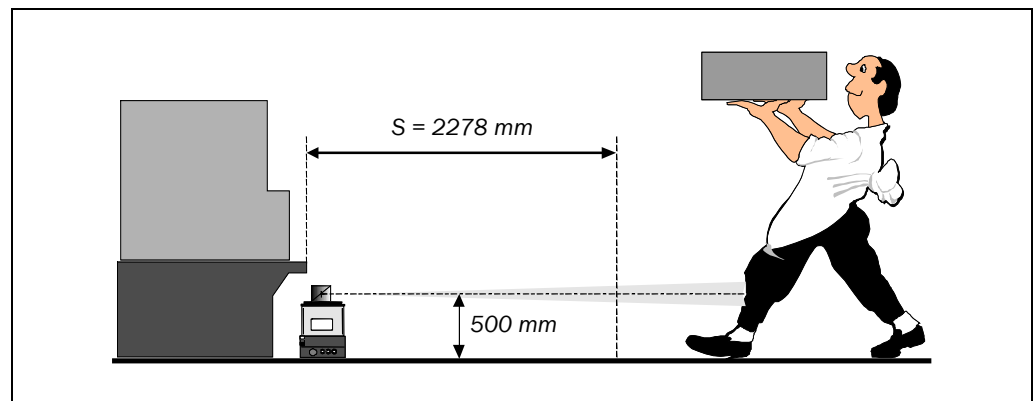
$S = 1.6 \text{ m/s} \times (280 \text{ ms} + 300 \text{ ms}) + (1200 \text{ mm} - 0.4 \times 500 \text{ mm}) + 350 \text{ mm} = 2278 \text{ mm}$

**Protective field width = 2200 mm + 350 mm + 350 mm = 2900 mm**

**Maximum protective field size =  $(S^2 + \frac{1}{2} \text{ protective field width}^2)^{-\frac{1}{2}} = 2700 \text{ mm}$**

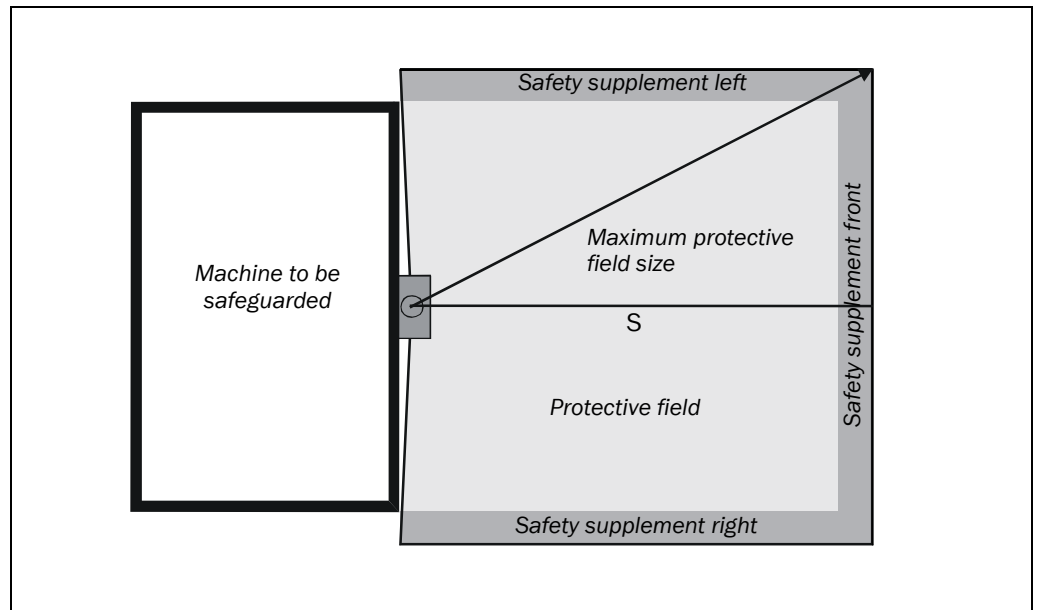
Please note: The example only applies if no access from the side is possible. Access from the side must be prevented either by a wider protective field and/or other measures.

Fig. 3: Example: minimum distance for stationary application



## RLS 100

Fig. 4: Maximum protective field size and safety supplements for stationary applications



Safety supplements are to be determined for maximum protective field sizes.

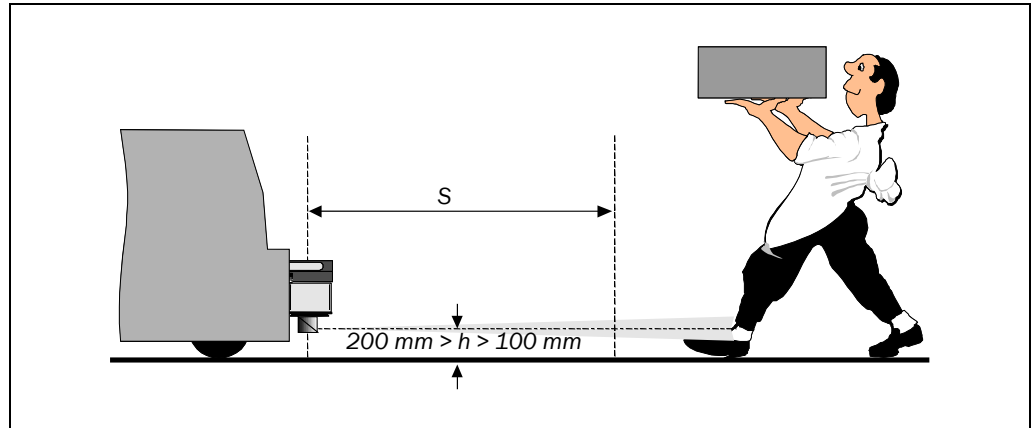
The following applies if the access of persons from behind cannot be hindered by appropriate sizing of the protective field:

- A manual restart interlock must be present in the machine control system (generally necessary).
- The width of the accessible, unmonitored area directly in front of the machine must be smaller than 35 mm for a maximum protective field size of up to 3 m. For larger maximum protective field sizes the distance must be reduced to zero.

### 2.3.2 Application on automated guided vehicles (AGVs)

Taking the regulations for automated guided vehicles (e.g. EN 1525) into account, the minimum distance between the edge of the protective field and the hazardous area of the AGV is calculated as follows:

Fig. 5: Calculating the minimum distance for automated guided vehicles



$$S = 1.1 \times ((V_{\max} \times (t_1 + t_2)) + B) + ZM + F^{1)}$$

Here...

S = Minimum distance in mm = max. stopping distance AGV

$t_1$  = Response time of the RLS 100 (see Chapter 11 "Technical data" on page 40)

$t_2$  = AGV control system reaction time (in ms)

$V_{\max}$  = Maximum speed of the AGV (m/s)

B = Maximum braking path for the AGV (in mm)

ZM = Maximum measuring error of the RLS 100 (see Chapter 11 "Technical data" on page 40)

F = Foot clearance: 150 mm (if AGV floor clearance less than 50 mm)

h = Height of protective field above the floor in mm

1.1 = Safety supplement for possible brake wear



CAUTION

**The safety laser scanner RLS 100 must be supplemented by further safety devices if one of the following situations applies:**

- A hazardous point can be reached without passing through the monitored areas;
- The area monitored by the safety laser scanner RLS 100 can be reached from above, below or from the side.



CAUTION

**Define protective field cover correctly!**

The protective field must cover the entire width of the AGV. The protective field must be increased at the sides by the safety supplements (see Chapter 11 "Technical data" on page 40).

<sup>1)</sup> F only applies when there is no foot clearance according to prEN 1493.

## RLS 100



CAUTION

**Define the protective field correctly where routes bisect each other!**

At “crossroads” where there are “blind spots”, the protective field must have the same configuration as in the direction of motion.

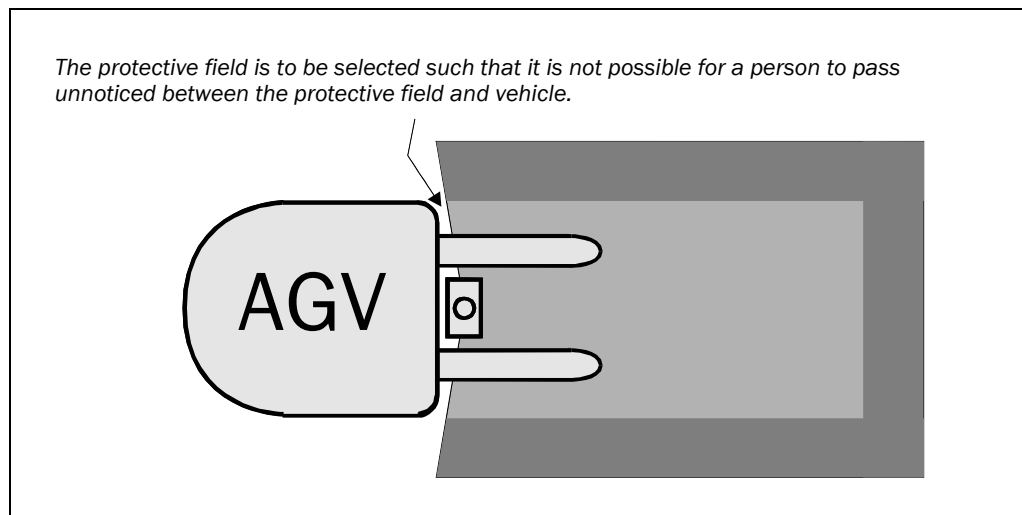


CAUTION

**Avoid undercutting of the protective field!**

The protective field must be configured in such a way that stepping between the protective field and the AGV from behind in the direction of motion (undercutting) is not possible. The safety laser scanner RLS 100 has a maximum scanning angle of 300°.

Fig. 6: Prevent undercutting of the AGV protective field



If it is not possible to prevent undetected personnel standing in front of the AGV by appropriate sizing of the protective field, then there must be a manual restart interlock in the AGV.

The width of the accessible area that is not monitored directly in front of the AGV must be less than 35 mm for a maximum protective field size of up to 3 m. For larger maximum protective field sizes the distance must be reduced to zero.



CAUTION

**Program reactivation delay!**

In case of AGV applications, you must program a reactivation delay for the safety laser scanner RLS 100. The reactivation delay defines the time [ms] after which the relay is reactivated when the monitored field is clear (automatic restart after time).

With automatic restart the restart period must be set to a minimum of 2000 ms.



You can stipulate the reactivation delay independently for the warning field and the protective field. Device symbol **RLS 100**, context menu **Configuration draft, Edit**. The values permitted are between 200 and 5000 ms.

**Example for application on AGVs**

AGV<sub>width</sub> = 1.6 m = 1600 mm

Response time of the RLS 100 = 280 ms

AGV control system reaction time = 300 ms

Maximum speed of the AGV = 1 m/s

Maximum braking distance for the AGV = 0.3 m = 300 mm

Maximum measuring error of the RLS 100 = 250 mm

F unnecessary: the AGV has foot clearance

Safety supplement for possible brake wear = 1.1

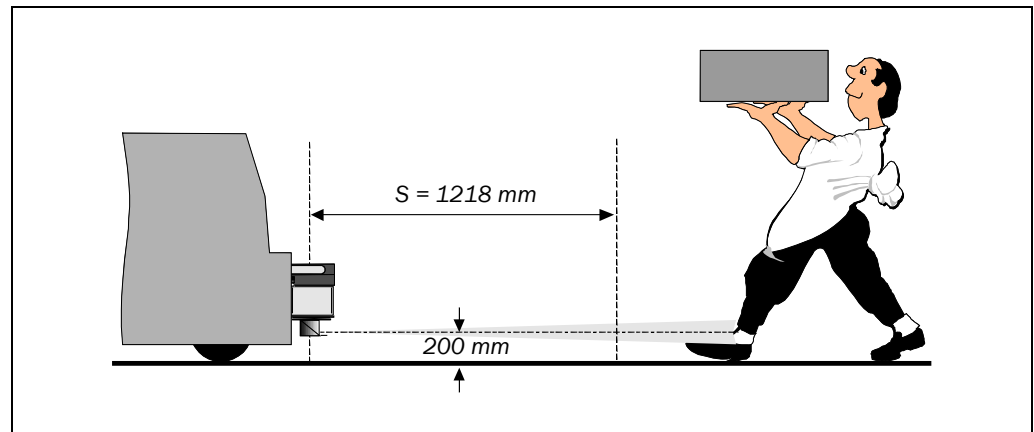
Protective field width = AGV<sub>width</sub> + safety supplement left and right

**$S = 1.1 \times ((1 \text{ m/s} \times (280 \text{ ms} + 300 \text{ ms})) + 300 \text{ mm}) + 250 \text{ mm} = 1218 \text{ mm}$**

**Protective field width = 1600 mm + 250 mm + 250 mm = 2100 mm**

**Maximum protective field size =  $(S^2 + \frac{1}{2} \text{ protective field width}^2)^{-\frac{1}{2}} = 1608 \text{ mm}$**

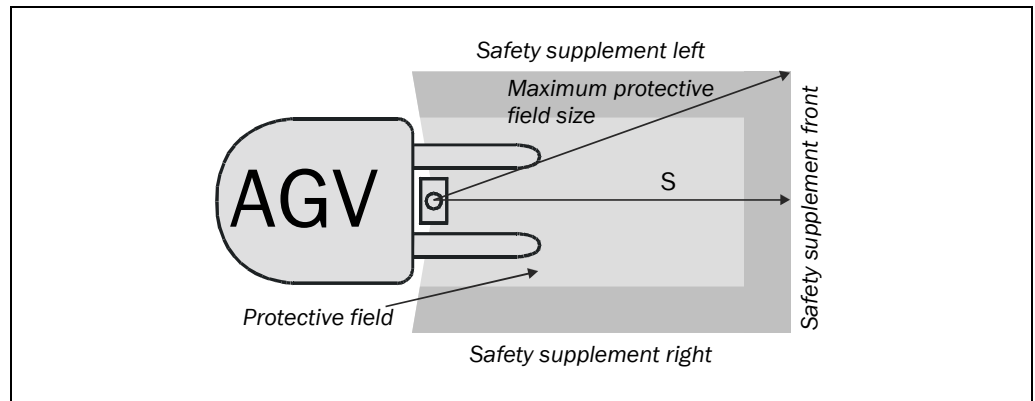
Fig. 7: Example: minimum distance for automated guided vehicles





**RLS 100**

Fig. 8: Maximum protective field size and safety supplements for AGVs



## 2.4 Protection of the environment

The safety laser scanner RLS 100 is constructed in such a way that it adversely affects the environment as little as possible. It emits and contains no environmentally damaging substances and requires only a minimum of energy and resources.

At work, always act in an environmentally responsible manner. For this reason please note the following information on disposal.

### Disposal

- Always dispose of unusable or irreparable devices according to the particular waste disposal regulations applicable in the country of use.

### Please note

We would be pleased to be of assistance to you on the disposal of these devices. Contact us.

## 3 Product description

### 3.1 Construction of the device

The sensor of the safety laser scanner RLS 100 is housed in a robust aluminium housing. The housing is protected against water spray according to IP 65 (only applicable if the connection sockets are equipped with plugs or covers).



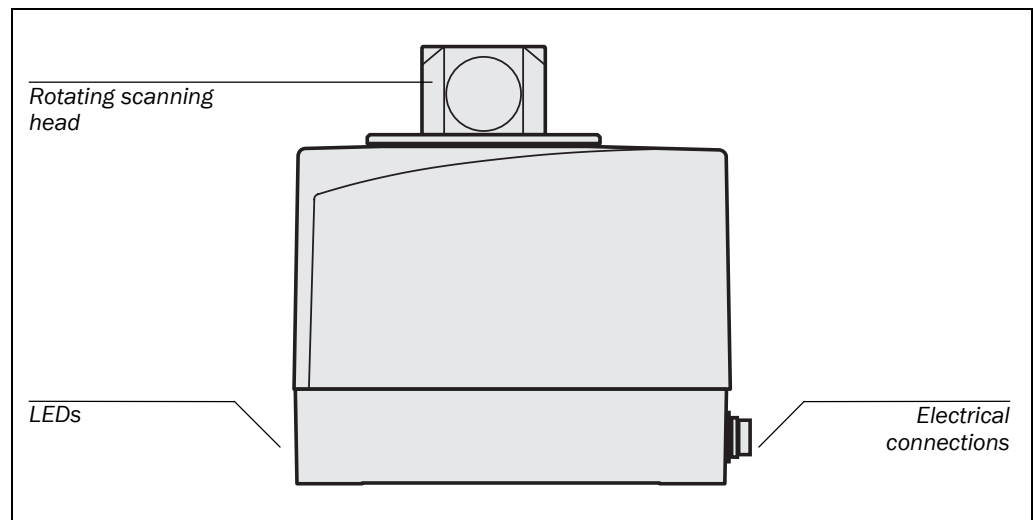
CAUTION

#### Do not damage seals!

The housing screws are sealed. Any damage to seals leads to forfeiting of the manufacturer's warranty.

The deflecting mirror and laser optics are located on the top of the housing in a rotating housing component. The laser transmitter and receiver use the same lens. This complex co-axial construction prevents angular error resulting from separate transmitter and receiver optics.

Fig. 9: Construction of the safety laser scanner RLS 100



The invisible laser beams emitted conform to laser safety class 1. The measurement area begins immediately in front of the optics.



CAUTION

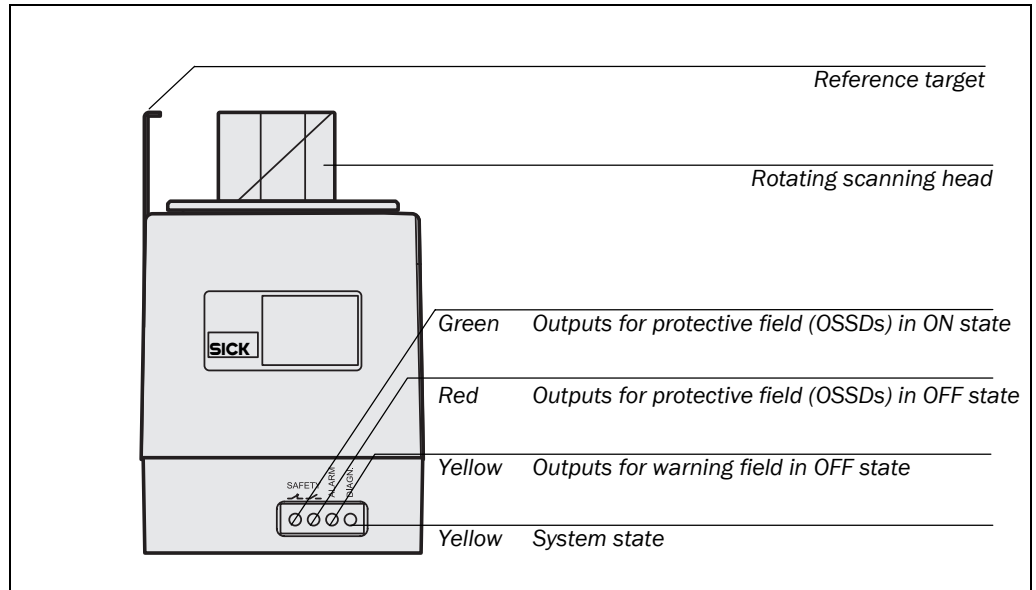
#### Do not mount the device at eye level!

Fix the safety laser scanner RLS 100 such that the measuring beam is not at eye level during use.

## RLS 100

There are four LEDs on the side of the housing showing the state of the system:

Fig. 10: LEDs on the safety laser scanner RLS 100



Tab. 1: Status of the LEDs for the safety laser scanner RLS 100

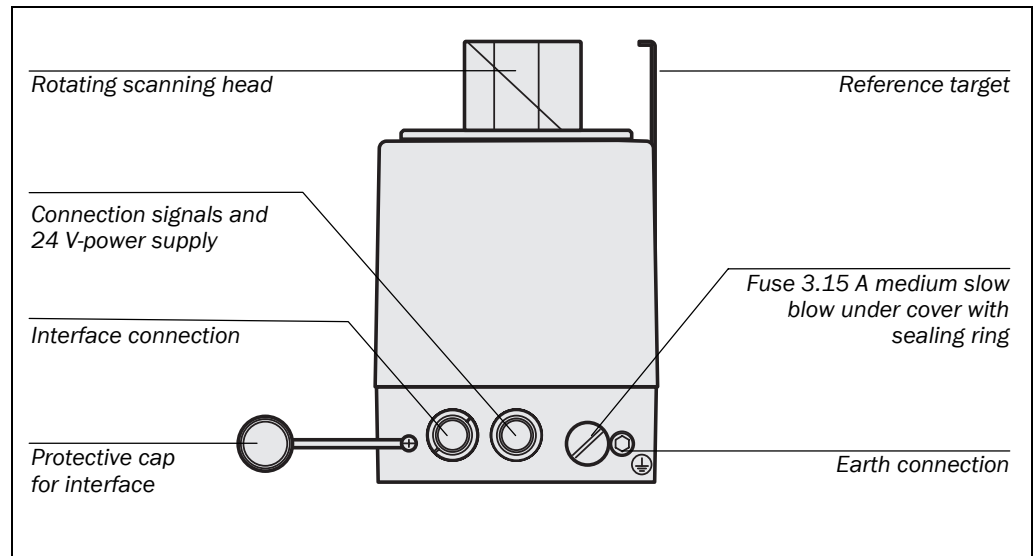
LED indication				Meaning
Green	Red	Yellow	Yellow	
○	○	○	○	Device switched off
●	●	●	●	Test LEDs for 1 sec. after Power On <sup>2)</sup>
●	○	○	○	The system is ready for operation, the outputs for protective field (OSSDs) and for warning field are in an ON state
○	●		○	Outputs for protective field (OSSDs) in OFF state
		●	○	Outputs for warning field in OFF state
○	●	●	● <sup>3)</sup>	System error

<sup>2)</sup> The system state LED lights up during the start-up test after Power On. During the last 5 seconds before operational readiness is achieved and the release of the outputs for protective field (OSSDs) this LED blinks at 2 Hz.

<sup>3)</sup> On this topic see Section 10.2 "LED indications" on page 39.

There are two connection sockets on the opposite side of the housing labelled **Interface** and **24 V DC/signal**. The appropriate plugs are supplied with the safety laser scanner.

Fig. 11: Housing connection side



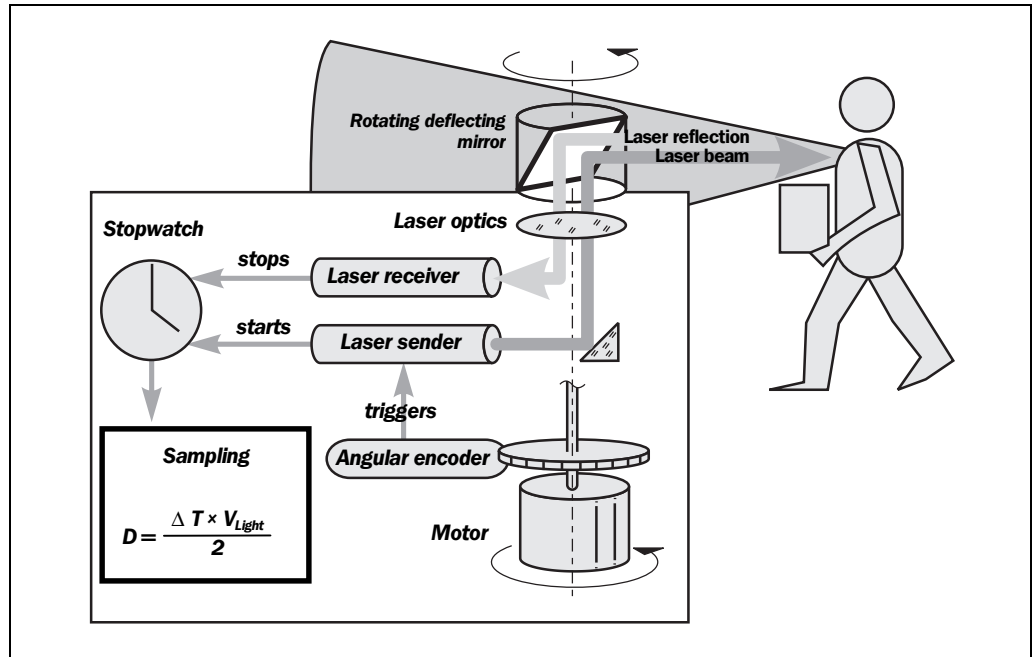
- Interface**  
 Communication with the computer or restart. At this connection an RS 232 interface is available.
- 24 V DC/signal**  
 For connecting the power supply, the two outputs for protective field, OSSD1 and OSSD2, and the output for warning field.

### 3.2 Operating principles of the device

#### Measurement principle

The safety laser scanner RLS 100 emits pulsed laser beams throughout a complete 360° with the help of a rotating mirror. The light pulses are reflected diffusely from objects in the vicinity and received by a photodiode in the sensor. The safety laser scanner RLS 100 derives the distance to the object from the propagation time that the light requires from emission to reception of the reflection at the sensor.

Fig. 12: Schematic diagram of safety laser scanner RLS 100 operating principle



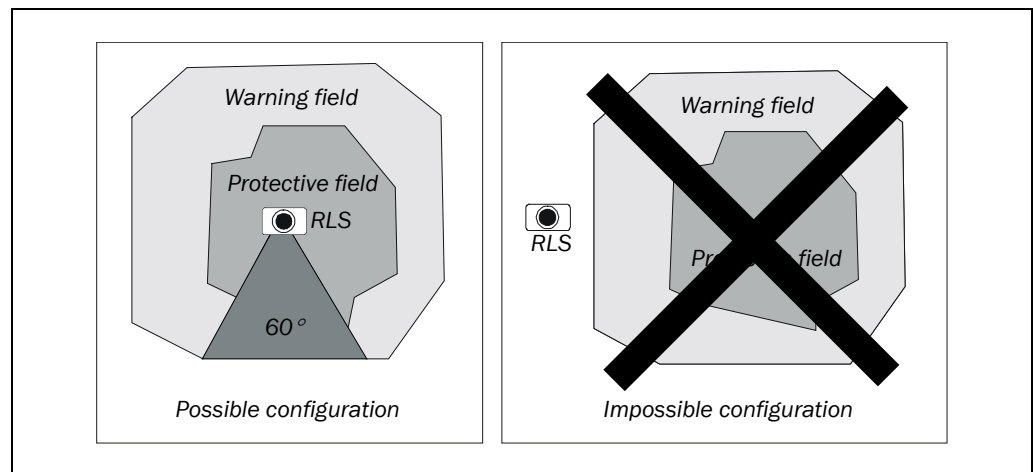
The direction of each individual measurement beam is determined with the help of an angular encoder.

The measurement data for distance and direction can be called up by a computer via the interface.

### Monitoring of protective field and warning field

Two distance limit values, representing the warning field and protective field, can be defined for each measurement beam with the help of the CDS. During monitoring the safety laser scanner RLS 100 compares the measured object distance with defined limit values.

Fig. 13: Configuration of monitored areas



The tables of distance limit values are determined with a computer and laid down in the safety laser scanner RLS 100. The warning and protective field limits can be of any shape and ideally adapted to the surroundings. The safety laser scanner RLS 100 must therefore be within the limits of both the warning field and the protective field.

### Self-testing

Comprehensive internal tests run continuously within the safety laser scanner RLS 100. This ensures the system's high level of operational reliability. All basic components are either present in duplicate or are monitored by testing logics that operate independently.

The so-called reference or test target is an important constituent of the self-testing systems. This involves a stationary target firmly mounted on the safety laser scanner RLS 100, detected on each rotation. Any alteration in the measurement value indicates a system error and leads to an error state.

While monitoring, the safety laser scanner RLS 100 checks that it is functioning correctly. The system sensitivity of the device is monitored through the measurement of the light reflected from the reference target. Contamination of the optics or the reference target can thus lead to the system analysis: **Device insensitive/reference target error** (LED indicators). In such a case, clean the device optics as well as the reference target as per the instructions given in Section 9 "Maintenance and care" on page 38.

# 4 Installation and mounting

## 4.1 Operating conditions

Please note the following points before using the device:

- The device is only for use in predominantly enclosed areas.
- The safety laser scanner RLS 100 is protected against water spray according to IP 65 and operates within a temperature range of 0 to 50 °C. Protect the system from moisture and temperatures that are outside the temperature range.
- Protect the safety laser scanner RLS 100 from continuous direct sunlight.
- To prevent condensation do not expose the safety laser scanner RLS 100 to rapidly changing temperatures.
- Do not expose the safety laser scanner RLS 100 to aggressive chemicals (detergents).
- Glass panes or reflective surfaces are not reliably detected by the safety laser scanner RLS 100 as objects.
- The safety laser scanner RLS 100 only detects objects that are visible from its location and not covered up.
- Rain, snow, dust and smoke are detected as “objects” and may trigger **warning field** or **protective field** states.

## 4.2 Mounting the device



CAUTION

### **Observe the machine manufacturer's safety regulations!**

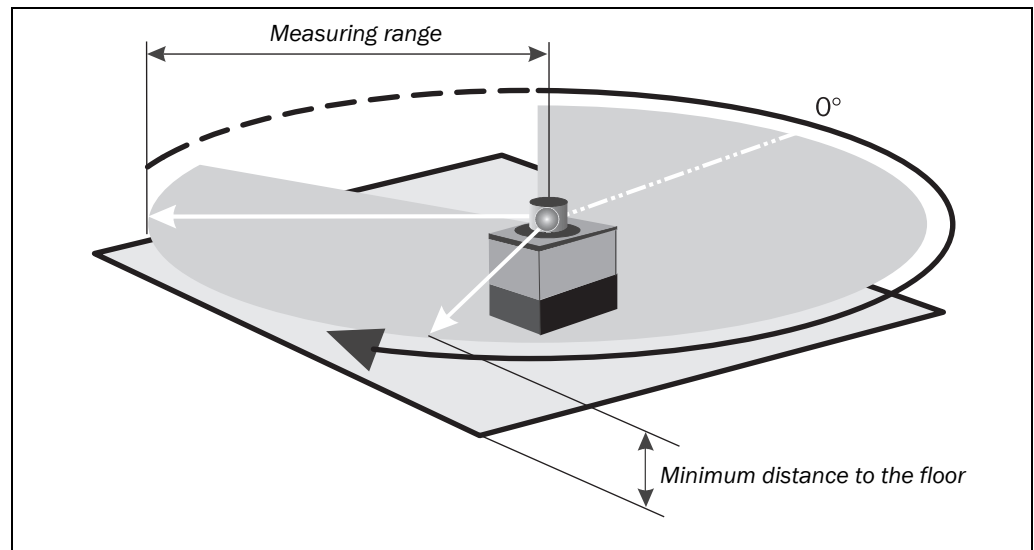
It is essential that the safety instructions for working on the machine, defined by the machine manufacturer, are observed when mounting the safety laser scanner RLS 100.

Mounting of the safety laser scanner RLS 100 may only be carried out by qualified personnel.

The safety laser scanner RLS 100 can be mounted in any orientation (standing, hanging, lying).

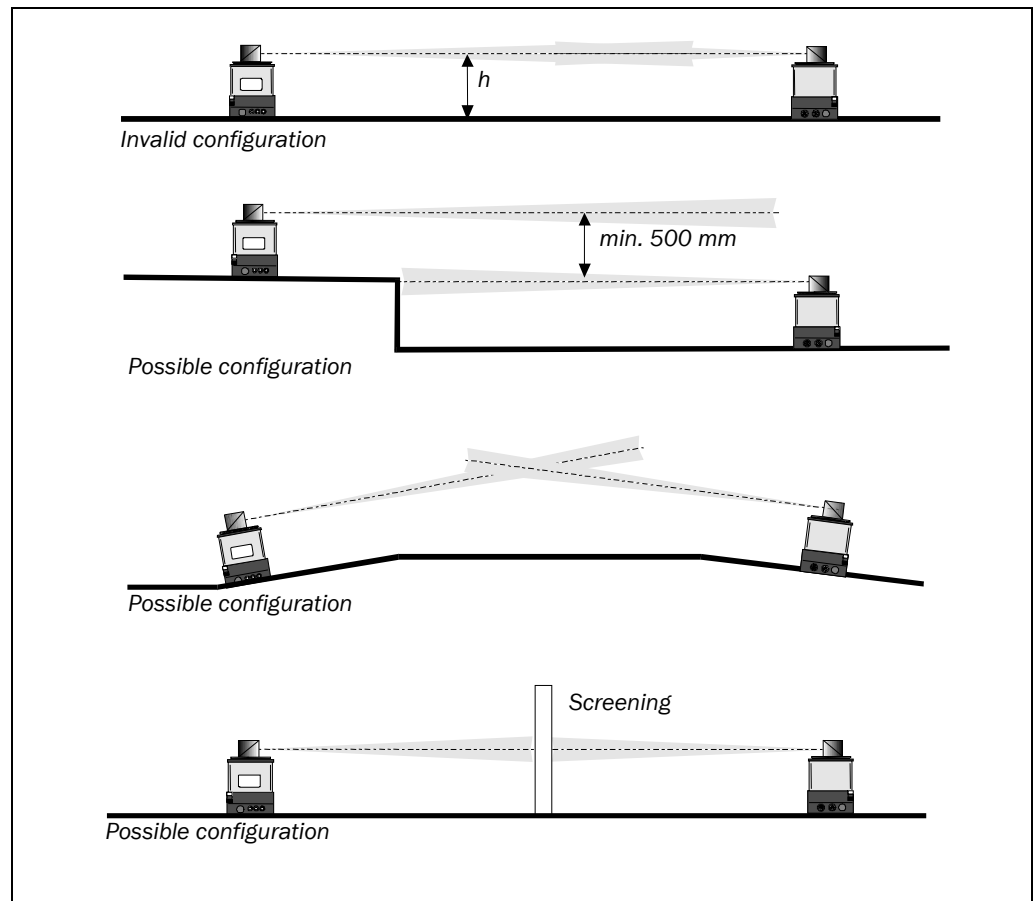
**Note** The emitted laser beam has a divergence of  $1^\circ$ . This means that it is essential that during mounting a minimum distance of 100 mm to the floor must be maintained.

Fig. 14: Minimum distance to the floor



**Note** When installing several safety laser scanners, mounting must be carried out in such a way that there cannot be any mutual interference:

Fig. 15: Mounting several safety laser scanners



You require the following aids for mounting the device:

- 4 bolts M4×10 for fastening to a horizontal surface
- 4 washers and locking washers
- If necessary, a spirit level for ensuring level mounting



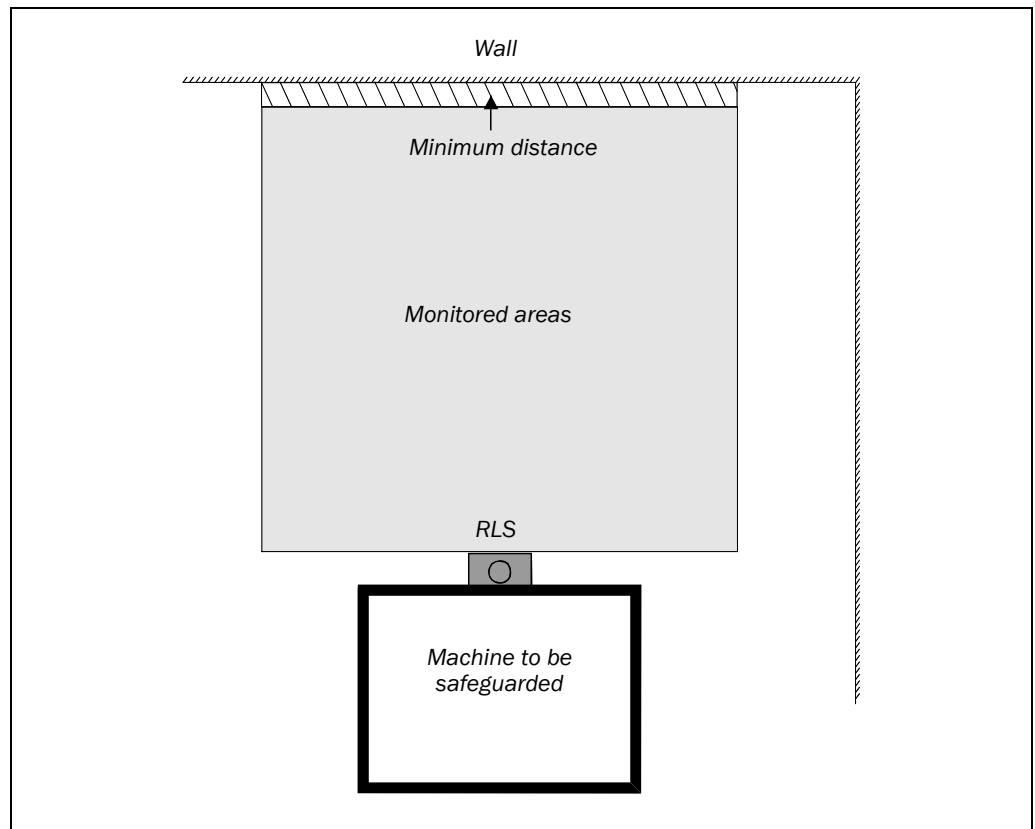
**RLS 100****Fit safety laser scanner RLS 100 to machine:**

1. Switch off the machine and check that you are not taking any risks!
2. Turn the mounting screws with the washers and locking washers in place and tighten them up finger tight.
3. When attaching to non-mobile machines it is recommended that the spirit level is used in two axes to ensure level mounting.
4. Tighten the attachment screws.

**4.3 Minimum distance from objects**

When mounting in front of a wall, for reasons of availability the programmed monitored areas may not be closer than 25 cm to the wall.

*Fig. 16: Minimum distance of the area monitored by the safety laser scanner RLS 100 from surrounding objects*



## 5 Electrical installation

### 5.1 Integrating the safety laser scanner RLS 100's outputs into the machine control system

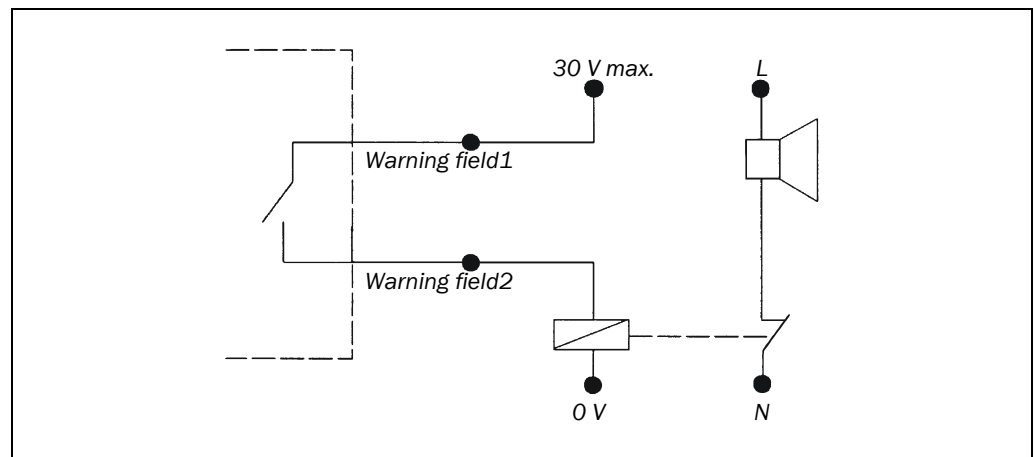


#### Connection only by qualified personnel!

Connection of the safety laser scanner RLS 100 to the machine may only be carried out by appropriately qualified personnel.

These persons must have all the information provided by the suppliers of the machine.

Fig. 17: Example of integration of the warning field signal



Three potential-free switching outputs are available for connection to the machine for **warning field** and **protective field** states. The outputs are designed as N. O. contacts.

#### Switching output for warning field

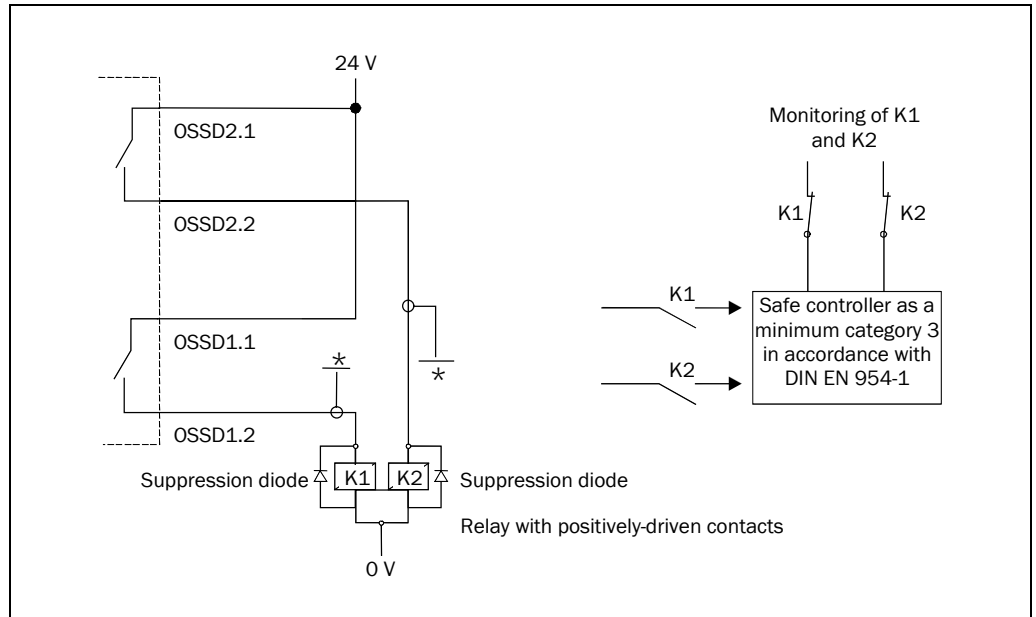
The switching output for **warning field** can be used for the output of a warning signal. The switching output for **warning field** is opened when the warning field is activated or there is a safety laser scanner RLS 100 fault.

If an object is again removed from the warning field, its switching output closes after an adjustable time from 200 to 5000 ms (reactivation delay).

The switching output for **warning field** can be switched with a maximum of 30 Volts and is internally fuse-protected with 2 Amps.

## RLS 100

Fig. 18: Example of integration of the OSSD switching outputs. The wiring is to be laid down in such a way that it is protected against mechanical effects.  
 \* = screen to rule out cross-circuits



### OSSD switching outputs

The OSSD switching outputs can be used as emergency stop trips in the system controller. The OSSD switching outputs are open if

- the protective field has been activated
- or
- the safety laser scanner RLS 100 has a fault.

The switching output closes after a programmable time of between 200 and 5000 ms (re-activation delay), assuming that there is no system fault.



You can stipulate the reactivation delay independently for the warning field and the protective field. Device symbol **RLS 100**, context menu **Configuration draft, Edit**.

The **OSSD1** and **OSSD2** outputs can be wired with a maximum of 30 Volts and are internally fuse-protected with 2 Amps.

## 5.2 Connecting the power supply and signal cables



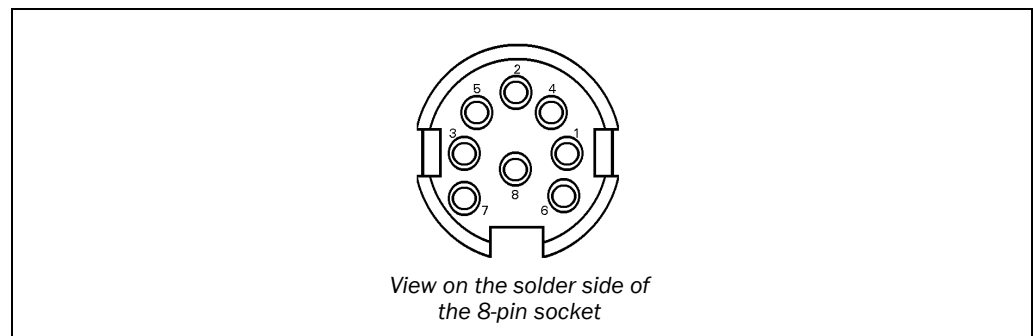
CAUTION

**Electrical work is only to be carried out by appropriately trained electrical specialists!**

Electrical connection of the power supply and connection of the signal cables for the **warning field, OSSD1 and OSSD2** take place together via the middle socket on the right-hand side of the housing. The correct connection plug is supplied with the RLS. You will need the following tools for electrical connection:

- 1 open-ended spanner AF16
- 1 fine soldering iron
- 1 hot-air gun
- shrink-tubing appropriate for the connection wires used

Fig. 19: Plug allocation for connection of the power supply and the signal cables



Tab. 2: Plug allocation for connection of the power supply and the signal cables

Pin	Signal	Explanation	Colour	Marking
1	24 V	24 V DC supply	Brown	+
2	GND24	Ground	Blue	-
3	OSSD2.1	Relay contact for protective field 2.1	White	S2
4	OSSD2.2	Relay contact for protective field 2.2	Grey	S2
5	OSSD1.1	Relay contact for protective field 1.1	Black	S1
6	OSSD1.2	Relay contact for protective field 1.2	Green	S1
7	Warning field1.1	Relay contact for warning field 1.1	Red	A
8	Warning field1.2	Relay contact for warning field 1.2	Pink	A
	FE	Functional earth (shield)	Black	FE

**RLS 100****Connecting the power supply to the safety laser scanner RLS 100:**

1. Wiring is to be protected.
  2. Turn off the machine and make sure that you are not exposed to any danger.
  3. Avoid short-circuits.
  4. Prepare the connection cable:
    - number of wires: 8
    - outside diameter: 5 ... 8 mm
    - wire cross-section: 0.50 ... 0.75 mm<sup>2</sup>
    - maximum cable length (0.5 mm<sup>2</sup> cross-section of wire): 20 m
    - use screened cable
  5. Cable cross-section for functional earthing/ground 1 ... 2 mm<sup>2</sup>
  6. Prepare the power supply:
    - operating voltage for the safety laser scanner RLS 100: 24 V DC ± 25 %
    - power consumption in operation: typically 750 mA at 24 V DC (switch on current: 2 A for 100 ms)
  7. Open and prepare the 8-pin Binder type cable plug supplied:
    - feed the cable through the crocodile clip and spring collar
    - screw the clip for cable strain relief tight
  8. Push an approx. 2 cm long piece of shrink-tubing onto each wire.
  9. Solder the signal and power supply wires to the plug as shown in Fig. 18.
  10. Push the shrink-tubing over the soldered contacts and shrink it with hot air.
- Note** Soldering, and insulation of the individual contacts with the shrink-tubing, must be carried out with great care to prevent the risk of short-circuits.
11. Attach the plug as described in the manufacturer's mounting instructions:
    - screw sheath onto socket insert
    - push crocodile clip up to sheath and tighten screw
    - push threaded ring onto the sheath until the springs snap in
  12. Connect the plug to the safety laser scanner RLS 100's 24 V DC/signal socket and tighten the screw.
  13. Connect safety laser scanner RLS 100 and computer.
  14. Switch on safety laser scanner RLS 100.
  15. The prismatic head starts to rotate. After a few seconds the system state LED goes out and the safety laser scanner RLS 100 is ready for configuration of the areas to be monitored.

- Notes**
- On connecting the safety laser scanner RLS 100 it is imperative to ensure that the earth is connected correctly. The safety laser scanner RLS 100 must be provided with a safety insulating transformer according to IEC 742. This also applies for the charging devices for vehicle batteries, if charging is to take place on the vehicle.
  - For stationary applications, the safety laser scanner RLS 100 must be **earthed** (earth connection see Section 3.1 “Construction of the device” on page 18).
  - The **functional earth** is to be connected with ground potential for installation on transport vehicles. For applications with battery-powered vehicles a DC voltage transformer must be connected in series before the safety laser scanner RLS 100. On request, please consider a relevant protection against “low dump” (voltage drop).

Fig. 20: Example of the power supply and grounding of stationary applications

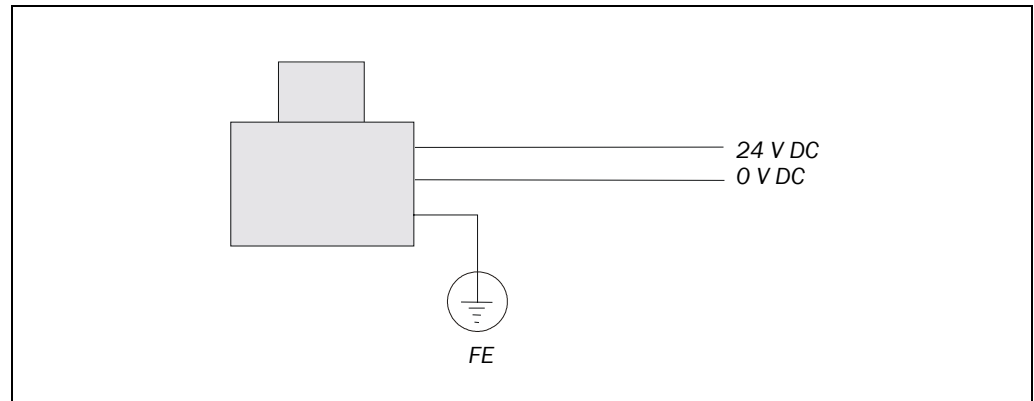
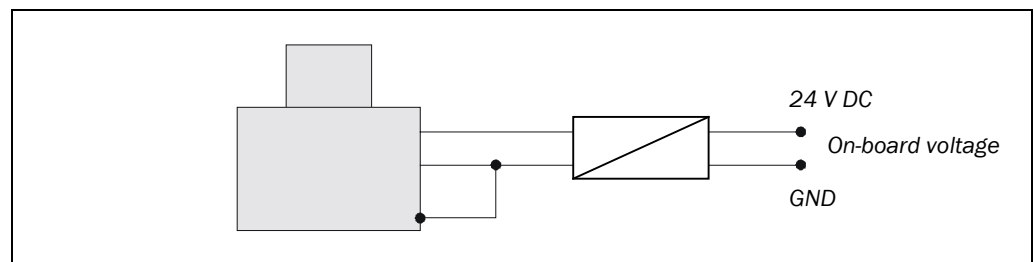


Fig. 21: Example of the power supply and grounding on a transport vehicle



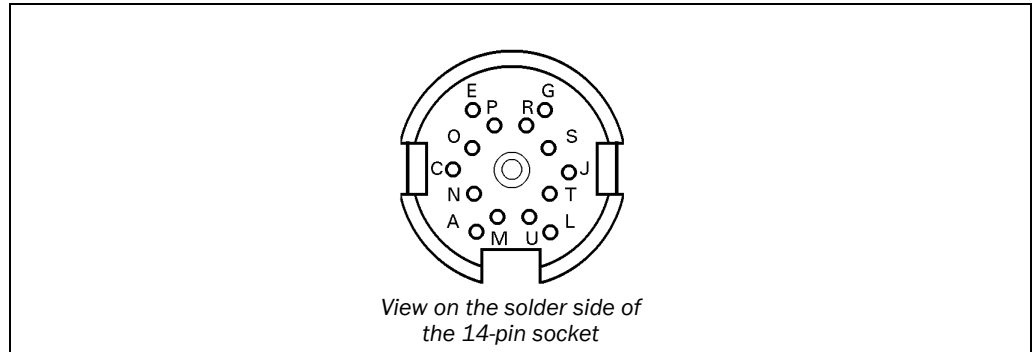
## 5.3 Connecting the data cables

Data cables with 9-pin D-sub plugs are available as accessories from SICK AG as standard connection to a computer.

You will require the following parts and tools if you have to prepare your own cable:

- 1 open-ended spanner AF16
- 1 fine soldering iron
- 1 hot-air gun
- shrink-tubing appropriate for the connection wires used
- 1 14-pin cable plug, Binder type

Fig. 22: Pin assignments for the connection of the data cables



Tab. 3: Pin assignments for the connection of the data cables

Pin	Signal	Explanation	Direction	Level
A	GND	Ground, RS 232	—	—
C	RTS	RS 232: Ready to send	Output	24 V
E	CTS	RS 232: Clear to send	Input	24 V
G	TxD	RS 232: Transmit data	Output	24 V
J	RxD	RS 232: Receive data	Input	24 V
L	—	Do not connect!	—	—
M	RES	Reset (active LOW)	Input	24 V
N	—	Do not connect!	—	—
O	—	Do not connect!	—	—
P	—	Do not connect!	—	—
R	—	Do not connect!	—	—
S	—	Do not connect!	—	—
T	—	Do not connect!	—	—
U	—	Do not connect!	—	—

**Connecting the data cables of the computer to the safety laser scanner RLS 100:**

1. Prevent short-circuits and switch off the safety laser scanner RLS 100 and the computer.
2. Prepare the data cable:
  - number of wires for RS 232: 5
  - outside diameter: 5 ... 8 mm
  - wire cross-section: 0.14 ... 0.75 mm<sup>2</sup>
  - maximum length of wire: 15 m
  - use screened cable if there are strong interfering fields!
3. Open and prepare the 14-pin Binder type cable plug:
  - feed the cable through the crocodile clip and spring collar
  - screw the clip for cable strain relief tight
4. Push an approx. 2 cm long piece of shrink-tubing onto each wire.
5. Solder the data cables of the RS 232 link in the plug as shown in the wiring diagram.
6. Push the shrink-tubing over the soldered contacts and shrink it with hot air.
7. Attach the plug:
  - screw sheath onto socket insert
  - push crocodile clip up to sheath and tighten screw
  - push threaded ring onto the sheath until the springs snap in
8. Connect plug to safety laser scanner RLS 100's **interface** socket and screw tight.
9. The device only conforms to enclosure rating IP 65 if the interface socket is provided with a plug, or covered using a cap.



# 6 Configuration

## 6.1 Delivery status

No protective field or warning field is defined in the safety laser scanner RLS 100 as supplied. The relay reactivation delay is set to the standard value of 200 ms. Prior to commissioning, the safety laser scanner RLS 100 must be configured for the planned application with the aid of the CDS (Configuration & Diagnostic Software) supplied.

## 6.2 Preparing the configuration

### How to prepare the configuration:

- Make sure that the safety laser scanner RLS 100 has been properly mounted and that the electrical connections are correct and in place.
- Plan all settings necessary (warning field, protective field, reactivation delay, etc.).
- To configure the safety laser scanner RLS 100, you need:
  - CDS (Configuration & Diagnostic Software) on CD-ROM
  - User manual for CDS on CD-ROM
  - PC/Notebook with Windows 9x/NT 4/2000 Professional/XP and a serial interface (RS 232). (PC/notebook not included)
  - Connecting cable for the connection between PC and safety laser scanner RLS 100 (connecting cable not included)
- To configure the device, please read the user manual for the CDS (Configuration & Diagnostic Software) and use the online help in the programme.

# 7 Commissioning

## 7.1 Access authorisation

Access to the safety laser scanner RLS 100 is password protected.

- The password is **RLS1** on delivery.
- The user (Safety Officer) must ensure that the password is only known by authorised persons.

### Recommendation

It is recommended that the **RLS1** password is replaced by a new password that you select.



Device symbol **RLS 100**, context menu **Access rights, Change password...**

- It is possible to select the Monitor function on the PC and edit protective fields **without** a password, but it is not possible to **change** the protective field or parameters without it.
- **Using** password it is possible to change the protective field and parameters.

## 7.2 Testing the Monitor functions

After you have defined the monitored areas with the CDS you must check and accept the installation. For this purpose proceed in two steps:

- First check the definition of the protective field with a computer connected and document the test.
- Then connect the machine and repeat the test.

### Check definition of the protective field and document:

- Insert a dark test object with a diameter of about 70 mm from all sides into the protective field. Check every section of the protective field limit.

The green LED must go out and the red LED on the front of the safety laser scanner RLS 100 must light up.

### Checking installation of the safety system to the machine:

- When you are sure that the definition of the protective field is correct, connect the safety laser scanner RLS 100 signal cables to the machine control system. Repeat the test with the machine switched on but not running. Check as far as possible the behaviour of the protective device.
- Also check the behaviour when the safety laser scanner RLS 100 is switched off.
- Switch on the machine. Carefully insert an object, e.g. a box, into the monitored areas. Observe the machine's reaction.
- Prepare a report.

**RLS 100**

Before accepting the system take the following points into consideration:

- Use the test to ensure that no dangerous state can be set in motion as long as an object is present in the hazardous area.
- Ensure that the dangerous state or the dangerous movement comes to a stop before any part of a person's body can reach the hazardous point. When defining the protective field, take the machine stopping/run-down time and the safety laser scanner RLS 100's response time into account.
- Ensure that the safety laser scanner RLS 100 and other protective devices monitor all access points to the hazardous areas.
- Check that the safety laser scanner RLS 100 is firmly mounted. Check that the system doesn't move under normal operating conditions and that its position cannot be changed.
- Train the machine operating personnel in how the safety laser scanner RLS 100 operates. Explain its design and how to use the system (LEDs, faults).

### 7.3 Regular examinations

**CAUTION****Carry out regular tests!**

Daily tests can be carried out by the machine's operating personnel.

The six-monthly maintenance (see below) and testing of the monitored areas may only be carried out by authorised Safety Officers.

**Daily tests**

- Check the state and installation of the safety laser scanner RLS 100 for any changes. If in doubt switch off the safety laser scanner RLS 100 and immediately inform the Safety Officer.
- Keep the optics clean. Only use a soft brush or optical cloth for cleaning the optics.
- Check the surroundings for changes (e.g. structural alterations) that may have taken place since configuration.

**Six-monthly tests**

- Check the definition of the protective field at least every six months.
- Follow the regulation procedure described in Section 7.2 "Testing the Monitor functions" on page 34.

## 8 Transport and storage

### 8.1 Transporting the safety laser scanner RLS 100

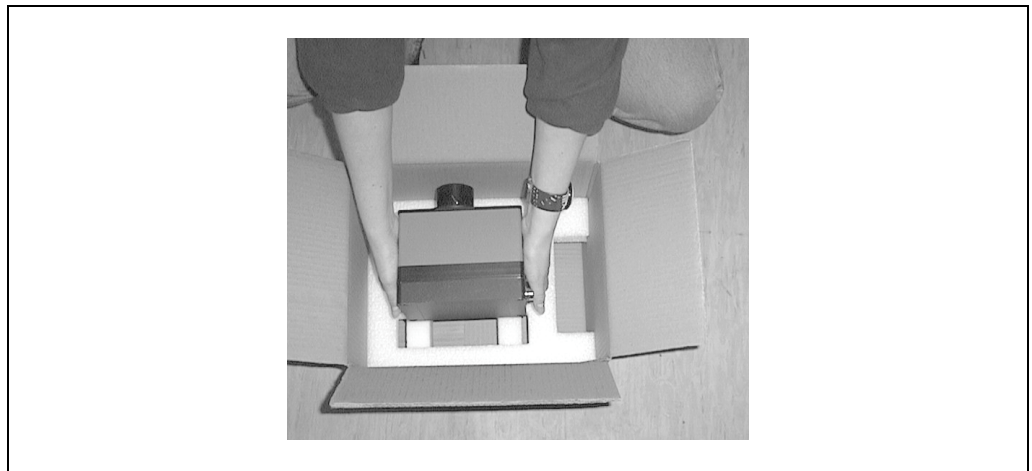
Adhere to the following instructions when transporting the safety laser scanner RLS 100:

- Notes**
1. Remove all plugs to prevent buckling of the cable.
  2. Fix rotating parts with adhesive tape to prevent scratching of the optics.
  3. Do not allow any mechanical loads to affect the rotating parts.
  4. Use the original packaging.

**This is how you pack the safety laser scanner in its original packaging:**

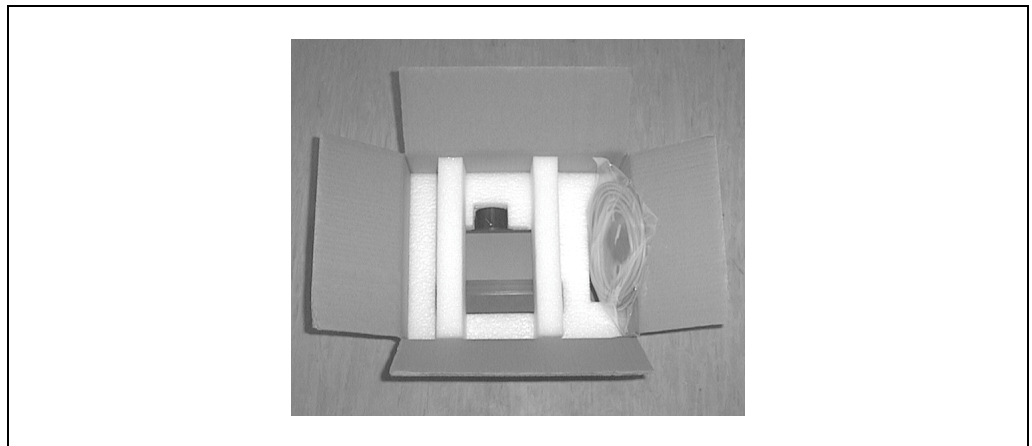
1. Place the lower membrane cushion upright in the box and lay the safety laser scanner RLS 100 on it on its side.

*Fig. 23: Place RLS 100 on its side in the original packaging*



2. Place the upper membrane cushion on top of the safety laser scanner RLS 100.

*Fig. 24: Place the upper membrane cushion on top of the RLS 100*



**RLS 100**

Fig. 25: Put the accessories in the original packaging

3. Finally, place the accessories in the box.



4. Before sending the package label it clearly: "Sensitive measurement device – fragile!"

## 8.2 Storage

Adhere to the following instructions when storing the safety laser scanner RLS 100:

- Notes**
- Carefully dry the system before storage. Condensation can damage optical parts.
  - Do not store the system in closed airtight containers, so that any remaining dampness can evaporate. If possible, use the original packaging.
  - Store with an air humidity of 5 to 85 % (without condensation)
  - Storage temperature -20 to +70 °C

## 9 Maintenance and care

The safety laser scanner RLS 100 requires no maintenance apart from the regular examinations already mentioned. No adjustments or calibration are necessary.

Please observe the following general instructions for handling the safety laser scanner RLS 100:

- Notes**
- You should clean the beam exit (prism) of the scanning head as soon as there is evidence of visible contamination, so that the sensor operates without error. Do not touch the prism directly when cleaning. Use a plastic cleaner with a soft optical cloth to clean the prism. Never use rough cloths or aggressive detergents such as acetone.
  - Clean the safety laser scanner RLS 100's housing with a soft, damp cloth. Do not use aggressive detergents.
  - Protect the safety laser scanner RLS 100 from continuous direct sunlight.
  - Do not expose the safety laser scanner RLS 100 to rapid temperature changes to prevent the formation of condensation.
  - Never open the safety laser scanner RLS 100! The system does not contain any components that can be repaired or maintained by the operator.
  - If errors occur or you have difficulty using the safety laser scanner RLS 100, SICK's Customer Service would be pleased to be of assistance.
- Moreover, SICK offers Installation and Commissioning Service packages. Our Customer Service will provide further assistance if required.

# 10 Troubleshooting

## 10.1 Correcting faults

**All the LEDs are off and the laser optics are not rotating:**

- Power supply 18 ... 30 V (24 V ± 25 %) present?
- Fuse intact?
- Plug correctly mounted on the safety laser scanner RLS 100 and tightly connected?
- Plug cables with correct polarity?

**Green LED for “System OK” does not light up, OSSDs and warning field are active**

- Clean optics (see Section 7.3 “Regular examinations” on page 35).
- Check power supply for high current.
- Connect the computer and display the CDS diagnostics.



Device symbol **RLS 100**, context menu **Diagnostics, Display**.

- If you cannot solve the problem, please send the safety laser scanner RLS 100 to SICK’s Customer Service.

**Objects within the monitored areas are not detected:**

- Is the yellow LED for **system state** lit or blinking?
  - **Yes:** the safety laser scanner RLS 100 has found an error: Check optics.
  - **No:** With the aid of the computer and the CDS, check the definitions for the protective and warning field.



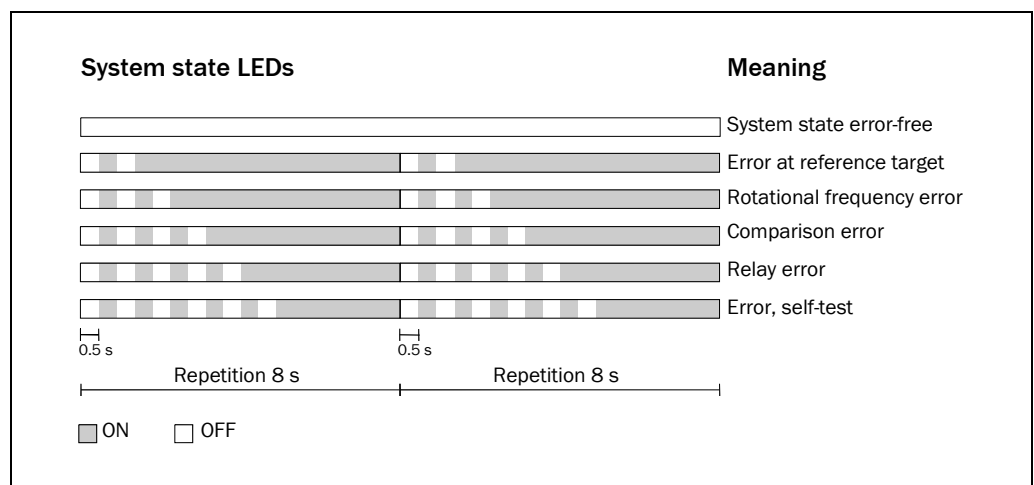
Device symbol **RLS 100**, context menu **Configuration draft, Edit monitored areas**.

**Objects are reported within the monitored areas without actually existing:**

- Check the surroundings for changes (e.g. structural alterations) that may have taken place since configuration.
- Rain, snow, smoke and dust could be the cause of the spurious object detection!

## 10.2 LED indications

Fig. 26: The system state LED indications



# 11 Technical data

## 11.1 Data sheet

Tab. 4: Technical data for the safety laser scanner RLS 100

### Safety classes

Safety category	Type 3 ESPE acc. to EN 61496-1 error-proof acc. to EN 61496-1
Laser protection class	IEC 825 Laser Class 1

### Characteristic data for the safety laser scanner RLS 100

Measurement and tolerance range	0 to 7.5 m
Range for a safe detection of the "nominal leg" <sup>4)</sup>	0 to 6 m (incl. safety supplement)
Protective field response time	280 ms
Maximum angle	300°

### Laser and angular measurement

Laser diode	Avalanche Photo Diode
Wavelength	905 nm
Laser protection class	1 (IEC 825)
Pulse frequency	5.76 KHz + 5 %
Scanning frequency	8 Hz + 5 %
Scanning angle	300°
Angle encoder resolution	360×4 increments
Point resolution	0.5°

### Optics (co-axial transmitter and receiver optics)

Laser beam divergence	15 mrad
Focal length	30 mm
Lens diameter	30 mm

### Power supply

Operating voltage	24 V DC ± 25 % (via a safety insulating transformer acc. to IEC 742, see section 5.2 "Connecting the power supply and signal cables" on page 28).
Current uptake	Approx. 1 A at 24 V DC
Switch on current	2 A for 100 ms
Power consumption	24 W total

<sup>4)</sup> Definition of the "nominal leg": black cylinder with 70 mm diameter and 1.8% reflectivity. This corresponds approximately to a leg in child's clothing made of black corduroy.



**RLS 100**

Tab. 4: Technical data for the safety laser scanner RLS 100 (contd.)

**Housing and environmental resistance**

Material	Aluminium
Enclosure rating	IP 65
Length	168 mm
Width	108 mm
Height	176 mm
Weight	Ca. 3.0 kg
Operating temperature	0 ... 50 °C
Storage temperature	-20 ... 70 °C

**Interfaces**

Data interfaces to computer	RS 232: 9600 baud, 8 data bits, 1 stop bit, no parity
Signal outputs for warning field, OSSD1, OSSD2	Potential-free relay outputs, max. 2 A, max. 30 V, purely Ohmic load, number of operations 2 million

**Cable plug**

Interface connection	14-pin, Binder type
24 V DC/signal connection	8-pin, Binder type

**11.2 Device accuracy and safety supplements**

The accuracy of the device depends on distance. Accuracy is as follows:

Tab. 5: Accuracy of the RLS 100 in relation to distance

Distance up to	Safety supplement
2 metres <sup>5)</sup>	25 cm
3 metres <sup>5)</sup>	35 cm
4 metres <sup>5)</sup>	45 cm
5 metres <sup>5)</sup>	55 cm
6 metres <sup>5)</sup>	70 cm

All possible influences, and particularly the reflective properties of the materials that could come into question and all background effects, have been taken into consideration in these tolerances.

Please note that when programming the device the safety supplement must be calculated in.

<sup>5)</sup> All distance figures include safety supplement.

# 12 Order data

## 12.1 Delivery

The precise order description for the RLS 100 is:

**Safety laser scanner RLS 100, part number 6 022 627**

The following components are supplied as constituents of the safety laser scanner RLS 100 package:

- Safety laser scanner RLS 100
- Technical documentation with configuration software
- Bolt set 1 (fastening to the underside of the safety laser scanner RLS 100):
  - 4 bolts M4 × 10
  - 4 washers
  - 4 locking washers
- Cable for power supply and switching signals
- Plastic cap for the interface socket
- Packing instructions
- Packaging box

## 12.2 Accessories

Independent of the number of safety laser scanners that you want to use you will need at least one

- RS 232 cable for the connection to the computer (part number: 6 024 723)

# 13 Appendix

## 13.1 Dimensional drawings, safety laser scanner RLS 100

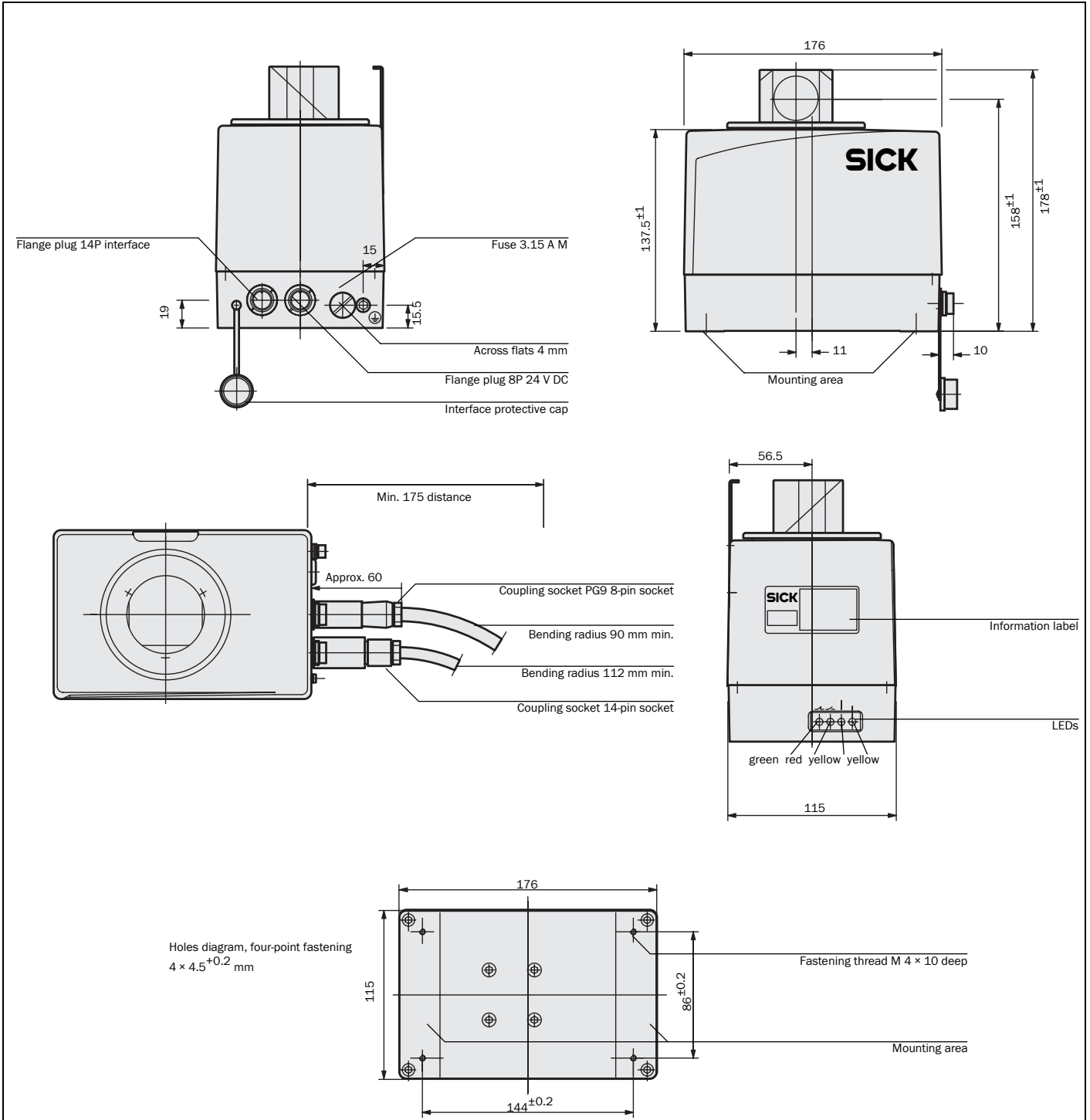


Fig. 27: Dimensional drawings, safety laser scanner RLS 100 (mm)

## 13.2 Standards and directives

The most important standards and directives, valid for the use of opto-electronic protective devices in Europe, are listed below. Further regulations may be of importance to you, depending on the type of use. Information on further device-specific standards can be obtained from the responsible authorities or from your trade association.

If the machine or vehicle is to be operated in a country that does not belong to the European Union, we recommend that you contact the plant operator or local authorities.

### **On the application and installation of protective equipment**

- The Machinery Directive 98/37/EC
- Safety of machinery – Basic concepts, general principles for design (EN 292)
- The safety of integrated production systems (DIN EN 1921)
- Safety of machinery – Electrical machine equipment – Part 1: General requirements (EN 60204)
- Safety of machinery – Safety distances to prevent danger zones being reached by the upper limbs (EN 294)
- Safety requirements for robots (EN 775)
- Safety rules for electro-sensitive protective equipment on power-driven equipment (ZH 1/597)
- Safety of machinery – The positioning of protective equipment in respect of approach speeds of parts of the human body (EN 999)
- Safety of machinery – Principles for risk assessment (EN 1050)

### **On the construction and equipping of protective equipment**

- Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements (IEC/EN 61496-1 as well as based on IEC/EN 61496-3)
- Basic safety considerations for MCR safety systems (DIN V 19250)
- Safety of machinery – Electrical equipment of machines – Part 1: General requirements (EN 60204)
- Safety of machinery – Safety-related parts of control systems – General principles for design (EN 954)

Please request our brochure on this topic “Safe machinery with opto-electronic protection”.

### 13.3 Declaration of conformity

# SICK

## EC Declaration of Conformity

In Compliance with the EC Machine Directive 98/37/EG and EMC 89/336/EWG

We hereby declare that the devices  
of the product family RLS100-...

are safety components for a machine constructed as per the EC directive 98/37/EEC art. 1 para. 2. This declaration will lose its validity if any modification to a device used in the plant is made without prior consultation.

We employ a quality system certified by the DQS (German Quality Assurance Society), No. 462, as per ISO 9001 and have therefore observed the regulations in accordance with module H as well as the following EC directives and EN standards during development and production:

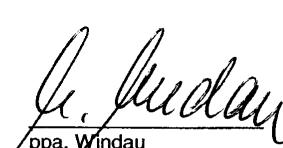
- |                                     |  |   |                        |
|-------------------------------------|--|---|------------------------|
| 1. <b>EC directives</b>             | EC machine directive 98/37/EEC, as per 91/368/EEC, 93/68/EEC, 93/44/EEC<br>EC EMC directive 89/336/EEC as per 92/31/EEC, 93/68/EEC, 93/465/EEC |   |                        |
| 2. <b>Harmonized standards used</b> | EN 50081-2<br>EN 61496-1   | Emitted interference, industry<br>Safety of mach., active opto-electronic protective devices (AOPD) | Ed. 93-08<br>Ed. 97-12 |

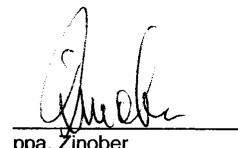
3. **Test result**

The CE mark was affixed to the appliance in conformance with directive 89/336/EEC and 93/68/EEC.

Conformance of a type sample belonging to the above-mentioned product family with the regulations from the listed EC directives has been certified by:

Waldkirch/Br., 30.10.02

  
ppa. Windau  
(Manager Marketing & Sales  
Division Safety Systems)

  
ppa. Zinöber  
(Manager Production  
Division Safety Systems)

The declaration certifies conformance with the listed directives, but does not guarantee product characteristics. The safety instructions contained in the product documentation must be observed.

**Mat. No.: 9 063 835**

8 006 440 0439 BK BK II - 16566

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Aufsichtsrat: Gisela Sick (Ehrevorsitzende) • Volker Reiche (Vorsitzender)  
Vorstand: Anne-Kathrin Deutrich (Sprecherin) • Dr. Robert Bauer • Jens Höhne  
Sitz: Waldkirch i. Br. • Handelsregister: Emmendingen HRB 355 W

## 13.4 Checklist for the manufacturer

# SICK

### Check list for the manufacturer/OEM for the installation of electro-sensitive protective equipment (ESPE).

The details on the items listed below must be available at the latest when the system is commissioned for the first time, depending, however, on the various applications the requirements of which must be reviewed by the manufacturer/OEM.

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

- |   |                              |                             |
|---|------------------------------|-----------------------------|
| 1. Have the safety rules and regulations been observed in compliance with the directives/standards applicable to the machine?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 2. Are the applied directives and standards listed in the declaration of conformity?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 3. Does the protective device comply with the required control category?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 4. Is the access to the hazardous area/ hazardous point only possible through the protective field of the ESPE?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 5. Have appropriate measures been taken to prevent (mechanical point-of-operation guarding) or monitor unprotected presence in the hazardous area when protecting a hazardous area/hazardous point and have these been secured against removal? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 6. Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching below, above or around the ESPE?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 7. Has the maximum shutdown and/or stopping/run-down time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 8. Has the ESPE been mounted such that the required safety distance from the nearest hazardous point has been achieved?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 9. Are the ESPE devices properly mounted and secured against manipulation after adjustment?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 10. Are the required protective measures against electric shock in effect (protection class)?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 11. Is the command unit for resetting the protective equipment (ESPE) or restarting the machine present and correctly installed?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 12. Are the outputs of the ESPE (OSSDs) integrated in compliance with the required control category and does the integration comply with the circuit diagrams?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 13. Has the protective function been checked in compliance with the test notes of this documentation?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 14. Are the given protective functions effective at every setting of the operating mode selector switch?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 15. Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 16. Is the ESPE effective over the entire period of the dangerous state?  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 17. Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device?   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

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

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