OPERATING INSTRUCTIONS

LD-LRS

2D LiDAR sensor

SICK
Sensor Intelligence.

Described product

LD-LRS

- LD-LRS3600 (field application and CoLa A/B)
- LD-LRS3601 (raw data measurement sensor with USP and CoLa A/B)
- LD-LRS3611 (raw data measurement sensor with USP, CoLa A/B and extended scanning range)

Manufacturer

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Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Information on the operating instructions

These operating instructions provide important information on how to use devices from SICK AG.

Prerequisites for safe work are:

- Compliance with all safety notes and handling instructions supplied.
- Compliance with local work safety regulations and general safety regulations for device applications

The operating instructions are intended to be used by qualified personnel and electrical specialists.

NOTE
Read these operating instructions carefully to familiarize yourself with the device and its functions before commencing any work.

The operating instructions are an integral part of the product. Store the instructions in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the device is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Explanation of symbols

Warnings and important information in this document are labeled with symbols. Signal words introduce the instructions and indicate the extent of the hazard. To avoid accidents, damage, and personal injury, always comply with the instructions and act carefully.

DANGER
... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING
... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION
... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTICE
... indicates a potentially harmful situation, which may lead to material damage if not prevented.

NOTE
... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

1.3 Further information

More information can be found on the product page.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

The following information is available depending on the product:

- Data sheets
- This document in all available language versions
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Other publications
- Software
- Accessories

2 Safety information

2.1 Intended use

The LD-LRS 2D LiDAR sensor is intended exclusively for use in industrial environments. Radio interference may result when used in residential areas.

The LD-LRS automates ship loading operations when using ship-to-shore cranes. The laser optics system performs non-contact scanning of the container stack and precisely detects all obstacles impeding the loading. The precise measurement data from the LD-LRS is used to determine the profile data of the container stacks.

The profile measurement of the filling condition of bulk material stockpiles can be converted into a 3D model to determine the exact surface structure of the stockpile to control the loading system.

In conjunction with the field application, the LD-LRS can also be used for building safety and security and for monitoring a variety of access zones outdoors.

Possible fields of application

- Container automation: position determination and detection
- Piece goods: measurement of the shape, position and volume of objects
- Crane control: profile measurement, collision protection, position detection and guidance
- Surveying: floor plan surveying, longitudinal and transverse profiles in buildings
- Buildings: object protection, access monitoring, protection of facades and areas (LD-LRS3600 only)

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is not described in this documentation.

2.2 Improper use

Any use outside of the stated areas, in particular use outside of the technical specifications and the requirements for intended use, will be deemed to be incorrect use.

- The device does not constitute a safety component in accordance with the respective applicable safety standards for machines.
- The device must not be used in explosion-hazardous areas, in corrosive environments or under extreme environmental conditions.
- Any use of accessories not specifically approved by SICK AG is at your own risk.

WARNING
Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe the following information:

- Product should be used only in accordance with its intended use.
- All information in the documentation must be strictly observed.
- Shut down the product immediately in case of damage.

2.3 Cybersecurity

Overview

To protect against cybersecurity threats, it is necessary to continuously monitor and maintain a comprehensive cybersecurity concept. A suitable concept consists of organizational, technical, procedural, electronic, and physical levels of defense and considers

suitable measures for different types of risks. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

You will find further information at www.sick.com/psirt, e.g.:

- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

2.4 Limitation of liability

Relevant standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when compiling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Non-adherence to the product documentation (e.g., operating instructions)
- Incorrect use
- Use of untrained staff
- Unauthorized conversions or repair
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

2.5 Modifications and conversions

NOTICE

Modifications and conversions to the device may result in unforeseeable dangers.

Interrupting or modifying the device or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation.

2.6 Requirements for skilled persons and operating personnel

WARNING

Risk of injury due to insufficient training.

Improper handling of the device may result in considerable personal injury and material damage.

- All work must only ever be carried out by the stipulated persons.

The following qualifications are required for various activities:

Table 1: Activities and technical requirements

Activities	Qualification
Mounting, maintenance	▪ Basic practical technical training ▪ Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	▪ Practical electrical training ▪ Knowledge of current electrical safety regulations ▪ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	▪ Basic knowledge of the computer operating system used ▪ Basic knowledge of the design and setup of the described connections and interfaces ▪ Basic knowledge of data transmission

Activities	Qualification
Operation of the device for the particular application	■ Knowledge of the operation and control of the devices in their particular application ■ Knowledge of the software and hardware environment for the particular application

2.7 Operational safety and specific hazards

Please observe the safety notes and the warnings listed here and in other sections of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.

CAUTION
Optical radiation: Class 1 Laser Product

The accessible radiation does not pose a danger when viewed directly for up to 100 seconds. It may pose a danger to the eyes and skin in the event of incorrect use.

- Do not open the housing. Opening the housing may increase the level of risk.
- Current national regulations regarding laser protection must be observed.

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

It is not possible to entirely rule out temporary disorienting optical effects, particularly in conditions of dim lighting. Disorienting optical effects may come in the form of dazzle, flash blindness, afterimages, photosensitive epilepsy, or impairment of color vision, for example.

WARNING
Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- The power supply must be disconnected when attaching and detaching electrical connections.
- The product must only be connected to a voltage supply as set out in the requirements in the operating instructions.
- National and regional regulations must be complied with.
- Safety requirements relating to work on electrical systems must be complied with.

WARNING
Risk of injury and damage caused by potential equalization currents!

Improper grounding can lead to dangerous equipotential bonding currents, which may in turn lead to dangerous voltages on metallic surfaces, such as the housing. Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
- Follow the notes in the operating instructions.
- Install the grounding for the product and the system in accordance with national and regional regulations.

3 Product description

3.1 Scope of delivery

The delivery of the device includes the following components:

Table 2: Scope of delivery

No. of units	Component	Note
1	Device in the version ordered	Depending on version Without connecting cables and brackets
1	Lens cloth	For cleaning the optics cover
1	Printed safety notes, multilingual	Brief information and general safety notes

3.2 Status indicators

Operator interface

The device works fully automatically in normal operation and requires no operator intervention.

The SOPAS ET configuration software allows interactive configuration. For this, the software runs on a computer which is connected to the device with one of the data interfaces.

The graphical scan display in SOPAS ET is used to verify the generated measured values and the measuring range online.

NOTE

Scans in SOPAS ET are not displayed in real time, but at a limited speed. Not all measured values are displayed for this reason.

3.3 Type label

The type label gives information for identification of the device.

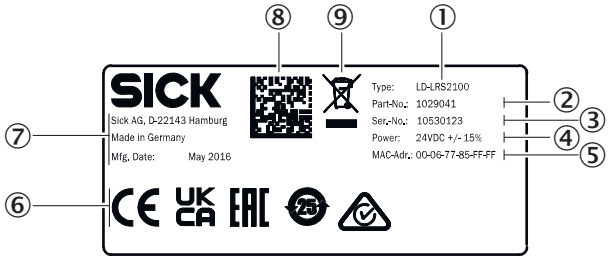


Figure 1: LD-LRS type label (example)

① Type code
② Part number
③ Serial number
④ Voltage supply
⑤ MAC address
⑥ Conformity mark/certification mark
⑦ Manufacturer, place of production, production date
⑧ Data Matrix code with product data and link to product page
⑨ WEEE marking

3.4 Principle of operation

3.4.1 Measurement principle

The device is an optoelectronic LiDAR sensor that contactlessly scans the outline of its surroundings with the help of laser beams. The device measures its surroundings in two-dimensional polar coordinates, relative to its measurement origin. This is marked by a circular indentation in the center of the optics cover. If a laser beam strikes an object, the position of that object is determined in terms of distance and angle.

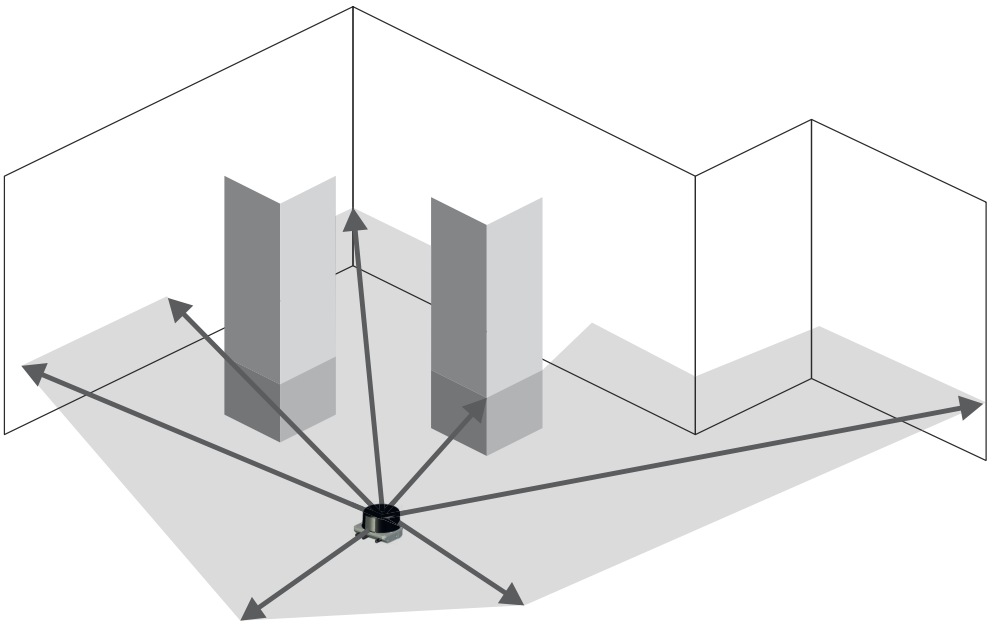
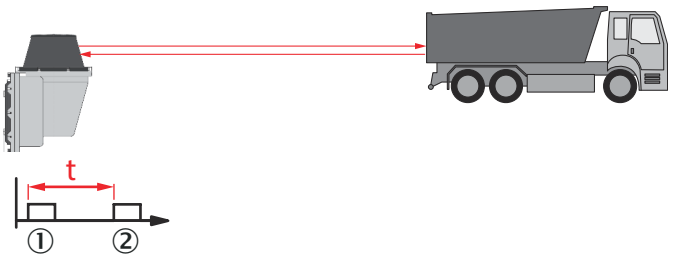


Figure 2: LiDAR sensor with one scan plane

3.4.2 Distance measurement

The device emits beams pulsed by a laser diode. If the laser beam is reflected by an object, the reflected beam is received by the sensor.

The distance to the object is calculated on the basis of the time that the pulsed light beam requires to be reflected and received by the sensor.



① Emitted pulse

② Receive pulse

3.4.3 Direction measurement

The scanner head rotates at a selectable frequency of 5 to 15 Hz. A laser pulse and thus a distance measurement is triggered continuously after each angle increment.

In interlaced mode, individual scans are taken offset at an angle one to the other with the maximum resolution that is technically possible. Combining the scans externally enables a higher overall resolution to be achieved.

3.4.4 Impact of object surfaces on the measurement

Remission value

Remission is the ability of a material to reflect light. The remission correlates with the amount of laser light emitted by the LiDAR sensor which is reflected by an object (see Lambert's law).

Glossy surfaces have different remissions at the same distance with different angles of impact. In the case of shiny surfaces, maximum remission is achieved when the beam makes vertical impact.

Matt and dull surfaces have diffuse remission. They therefore exhibit similar relative remissions with the same angle of impact regardless of the distance from the zero point.

Table 3: Typical remissions of frequently used materials

Material	Typ. relative remission
Rubber tires (vulcanized, black)	2%
Foam rubber (black)	2.4%
Photographic board (black, matte)	10%
Cardboard (gray)	20%
Wood (untreated fir, soiled)	40%
PVC (gray)	50%
Paper (white, matte)	80%
Plaster (white)	100%
Aluminum (black anodized)	110 ... 150%
Steel (stainless, shiny)	120 ... 150%
Steel (high gloss)	140 ... 200%

Reflection

Most surfaces produce a diffuse reflection of the laser beam in all directions. The structure (smooth or rough), shape (flat or curved), and color (light or dark) of the surface determine how well the laser beam is reflected.

On very rough surfaces, a large proportion of the energy is lost due to absorption. Curved surfaces produce a higher diffusion. Dark surfaces reflect the laser beam worse than light ones (brilliant white plaster reflects approx. 100% of the light, while black foam rubber reflects approx. 2.4%). The aforementioned surface characteristics can reduce the scanning range of the device, in particular for surfaces with low remission values.

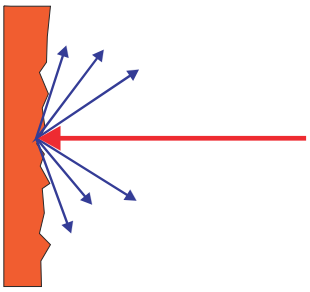


Figure 3: Reflection of light on the surface of the object

Angle of reflection

The angle of reflection corresponds to the angle of incidence. If the laser beam hits a surface at right angles, the energy is optimally reflected. If the laser beam hits a surface at an oblique angle, energy and range are lost accordingly.

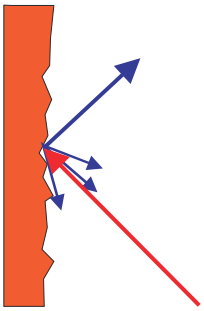


Figure 4: Angle of reflection

Retroreflection

If the reflective energy is greater than 100%, the beam is not reflected diffusely in all directions; instead it is reflected in a targeted way (retroreflection). Thus a large part of the emitted energy can be received by the laser distance measurer. Plastic reflectors (cat's eyes), reflective tape, and triple prisms have these properties.

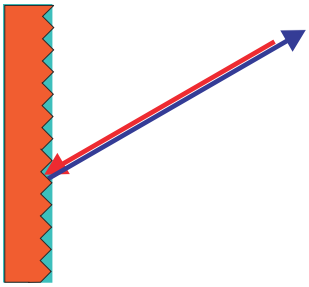


Figure 5: Retroreflection

Reflective surfaces

The laser beam is almost completely deflected on reflective surfaces. This means that an object hit by the deflected beam may be detected instead of the reflective surface.

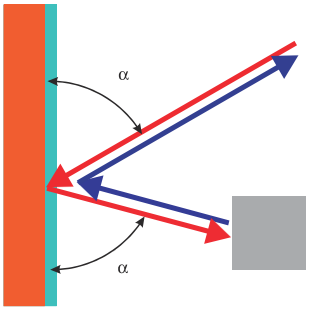


Figure 6: Specular surfaces

Small objects

Objects that are smaller than the diameter of the laser beam cannot reflect the laser light's full energy. The portion of the light beam that does not reach the object is lost. If all of the light reflected to the sensor is insufficient, the object may not be detected.

The portion of the light that does not reach the front object can be reflected by a larger object in the background. If all of the light reflected to the sensor is sufficient, this object is detected. This can lead to a corruption of the measured value.

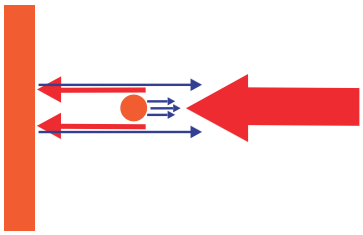


Figure 7: Object smaller than the laser beam diameter

3.4.5 Beam diameter and measuring point distance

As the distance from the device increases, the laser beam expands. As a result, the diameter of the measuring point increases on the surface of the object.

The range-dependent diameter of the measuring point corresponds to the distance (mm) x 0.0028 rad + 40 mm.

Similarly, as the distance from the device increases, the individual measuring points also grow further apart from one another. The distance between the measuring points also depends on the selected angular resolution. The distance is larger with a coarser angular resolution, and smaller with a finer angular resolution.

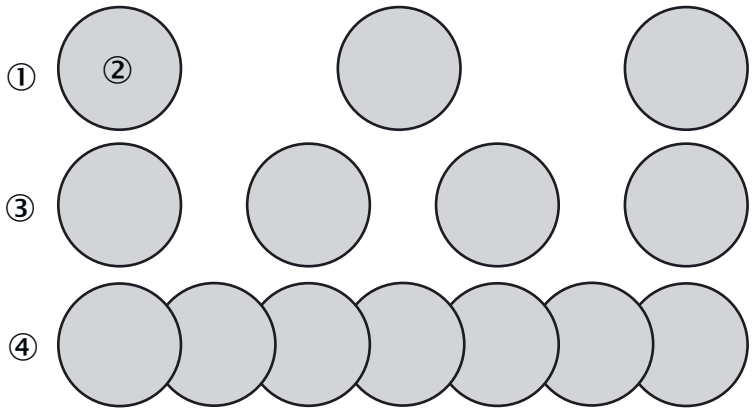


Figure 8: Schematic representation of the measuring point distance at different angular resolutions

① Scan at 0.375°
② Measuring point
③ Scan at 0.25°
④ Scan at 0.125°

The graph in figure 9shows the beam diameter and the measuring point distance depending on the distance to the device.

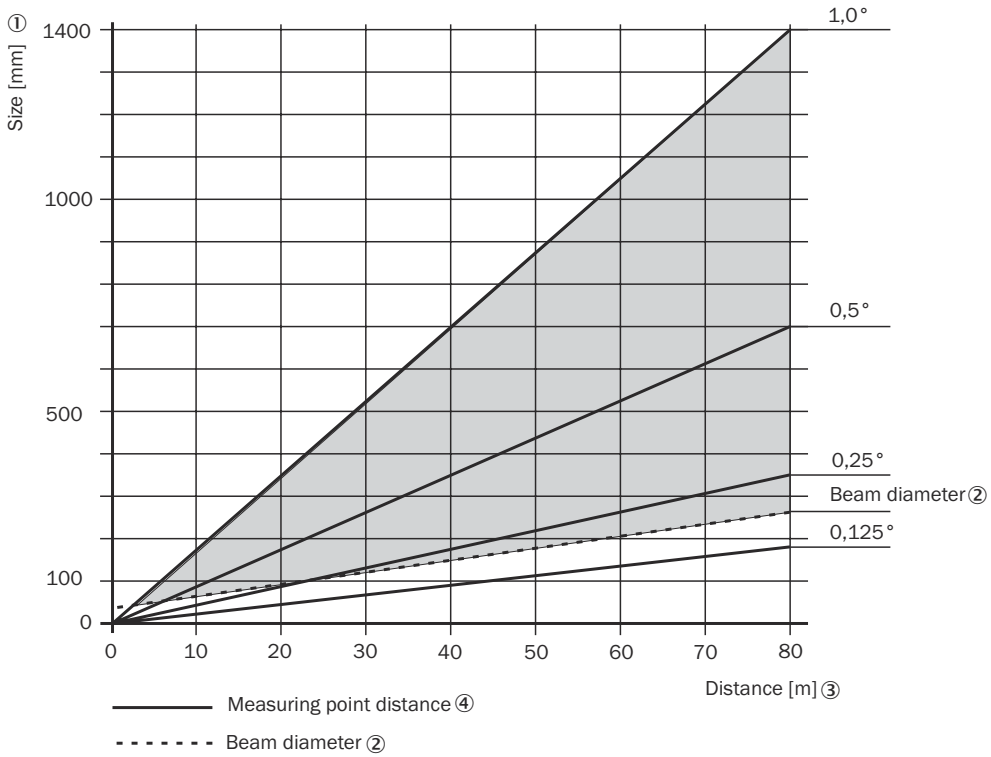


Figure 9: Beam diameter and measuring point distance at 0 to 80 m

① Size [mm]
② Beam diameter
③ Distance [m]
④ Measuring point distance

Reading example for an angular resolution of 0.125° in figure 9

- 60 m distance
- A distance intersection point of 60 m results in a measuring point distance of approx. 130 mm
- For a distance intersection point at 60 m and based on the characteristic curve for beam diameter, the beam expansion is approx. 200 mm
- Result: No gaps in the scan

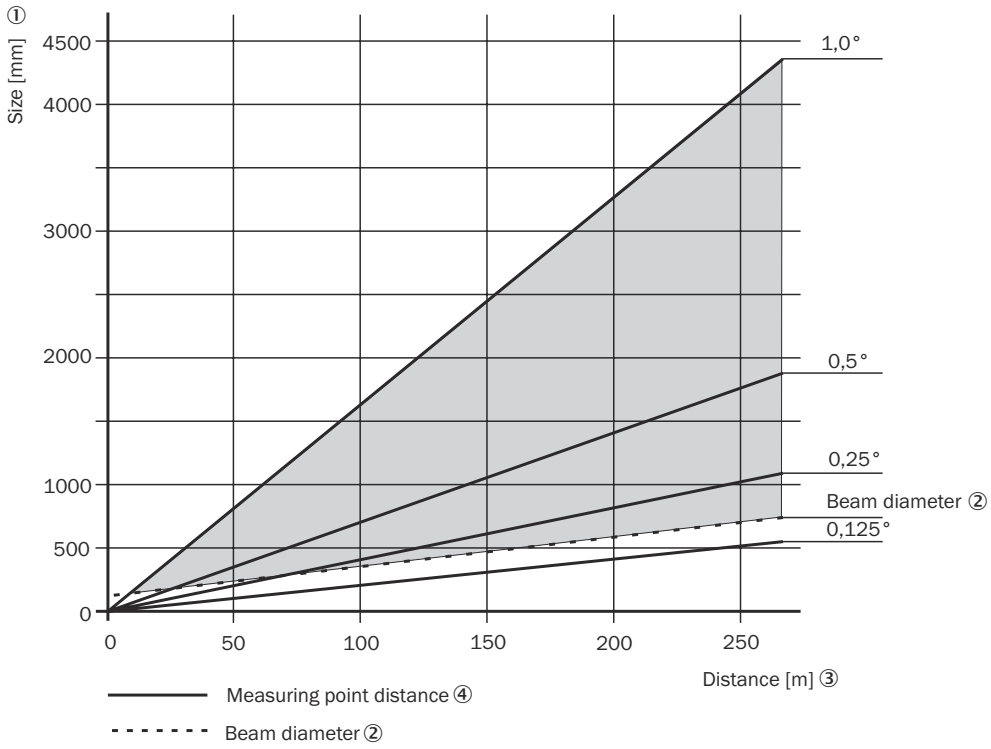


Figure 10: Beam diameter and measuring point distance at 0 to 250 m

① Size [mm]
② Beam diameter
③ Distance [m]
④ Measuring point distance

Reading example for an angular resolution of 0.50° in figure 10

- 150 m distance
- For a distance intersection point at 150 m, the measuring point distance is approx. 1,100 mm
- For a distance intersection point at 150 m and based on the characteristic curve for beam diameter, the beam expansion is approx. 450 mm
- Result: Gaps of approx. 650 mm during scanning, minimum object size >650 mm

3.4.6 Minimum object size

For an object to be detected reliably, it must be hit completely by a laser beam once. If the beam only partially hits, less energy may be reflected from the object see "Principle of operation", page 11.

An object is then reliably hit completely at any time if it is at least as large as the measuring point distance plus the beam diameter.

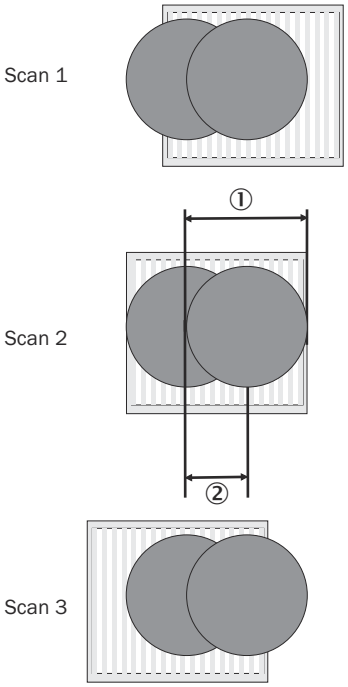


Figure 11: Minimum object size for detection

① Beam diameter

② Measuring point distance

In the example in figure 11, the object is fully hit at least once during each scan. It is therefore reliably detected if it has the necessary remission.

How to calculate the minimum object size:

Beam diameter + measuring point distance = minimum object size

- Beam diameter and measuring point distance as a function of the distance to the device can be seen in the diagram in see figure 9, page 15.

NOTE

For reliable measurement, in particular when using the device to output measured values, the laser needs to hit the object several times. Therefore, the object either needs to be larger than the minimum object size, or both the device and the object must not be moving.

When using the field application, an object usually has to be hit several times in a row to be recognized as interrupting the field.

3.4.7 Maximum and average pulse rate

The scanner head of the device rotates at a selectable frequency of 5 to 12 Hz. A laser pulse and thus a distance measurement is triggered continuously after an angle increment of for example 0.25° (configurable). The faster the scanner head rotates, the faster the output of measured values, and the finer the angular resolution is configured, the more accurate the contour determination.

NOTE

In this case the selected interface of the device and the downstream host must be able to transmit or process that amount of data.

NOTE
The laser diode heats up with each laser pulse. Like all semiconductors, a laser diode is destroyed by excessive temperatures. The pulse rate is therefore limited.

The maximum pulse rate of the laser diode must never exceed 14.4 kHz. The maximum pulse rate is determined by the number of revolutions per second of the head and the angular resolution.

The average pulse rate must not exceed 10.8 kHz. The average pulse rate is determined by the maximum pulse rate and the size of the scan range.

- For a scan range of 360°, the average pulse rate is equal to the maximum pulse rate.
- For a scan range <360°, the average pulse rate is lower than the maximum pulse rate.

Table 4: Examples for the maximum and average pulse rate

	Scan range	Revolutions of the head	Angular resolution	Maximum pulse rate	Average pulse rate	LD-LRS3601/3611	LD-LRS3600
Example 1	360°	15 Hz	1/2°=0.5°	10.8 kHz	10.8 kHz	x	x [1]
Example 2	300°	10 Hz	1/4°=0.25°	12 kHz	10 kHz	x	x
Example 3	300°	5 Hz	1/8°=0.125°	12 kHz	10 kHz	x	x

1) Available for raw data measurement only (field application)

3.4.8 Output of measured values

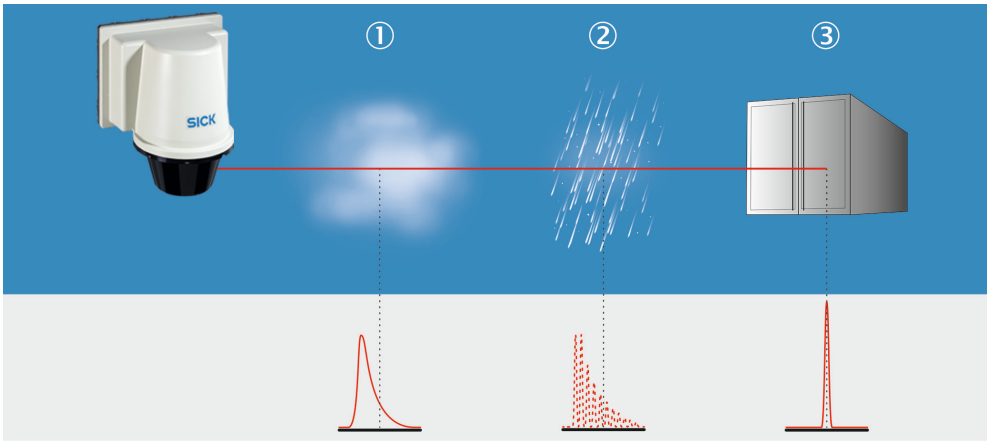
The device outputs the following measured values at its data interfaces:

- Profile of the field of view in two-dimensional polar coordinates
- Content of one revolution (360°): Number of the profile emitted, profile counter, sector numbers, step width, number of points per sector, time stamp for start/end of each sector, direction at the start/end of each sector, value and direction of the distances measured, status

NOTE
It is only possible to output all measured values of a 360° scan in real time using the Ethernet interface.

3.4.9 Multi-echo analysis

The distance between the device and an object is calculated via the time-of-flight of the emitted pulse. The device can evaluate up to three echo signals for each measuring beam to deliver reliable measurement results, even under adverse ambient conditions.



① Fog
② Rain
③ Measuring object

3.4.10 Field application (LD-LRS3600)

The device uses the integrated field application to analyze up to six detection fields within its scan range. You can use the field application to, for example, implement systems for collision protection, object protection, or access monitoring.

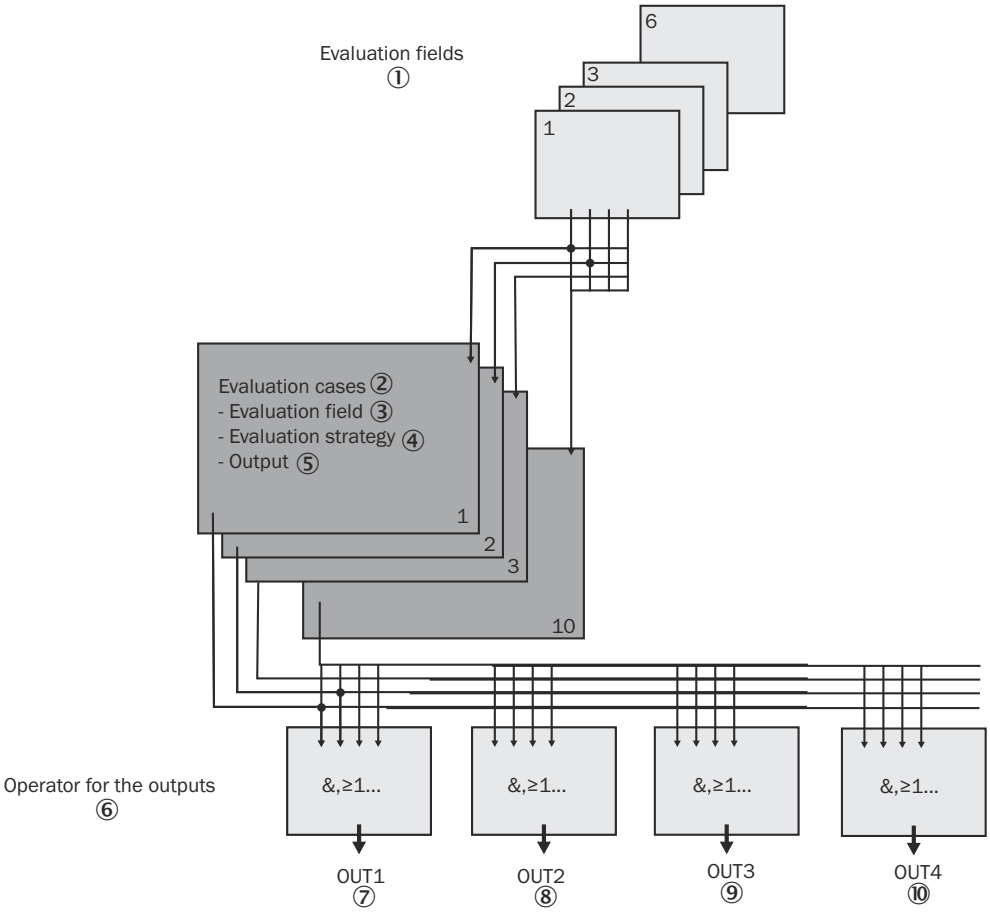


Figure 12: Principle of field application

① Detection fields
② Evaluation cases
③ Detection field
④ Analysis strategy
⑤ Output
⑥ Linking of outputs
⑦ OUT1
⑧ OUT2
⑨ OUT3
⑩ OUT4

The device is adapted to the evaluation scenario with the help of up to ten evaluation cases.

In the evaluation case, one of six configurable detection fields, an evaluation strategy, and an output that activates the evaluation case is selected. For each output, a link is chosen which determines the result of the output if more than one evaluation case affects the output.

In the example in see figure 12, detection field 1 is used in evaluation case 1, and detection field 2 is used in evaluation case 2. Both evaluation cases act on output OUT1. If the results of the evaluation cases are AND-linked, the output only switches when both evaluation cases report an event.

The field application is active when the device is delivered.

NOTE
If you activate or deactivate the field application, the parameter display in SOPAS is adjusted accordingly.

To deactivate the field application of the LD-LRS3600:

- In the **Project tree**, open **LD-LRS36xx**, **Parameters**, **Default**. You can activate or deactivate the field application by selecting **Raw data scan** in the **Application selection** area.

3.4.11 Integration into other controllers

NOTE
Integrating a device into other controllers requires in-depth programming knowledge of controllers. You also need knowledge on exchanging data between a 2D LiDAR sensor and an external computer, for example an industrial PC.

3.4.11.1 Data interfaces

The device has a serial host interface and an Ethernet interface. The device is configured via these interfaces using SOPAS ET. The device also communicates with the external computer via its interfaces.

The default setting for the Ethernet interface

- IP address: 192.168.1.10
- Subnet mask: 255.255.255.0
- TCP/ IP port for SOPAS ET: 2112
- Selectable between CoLa A (ASCII) and CoLa B (binary)

3.4.11.2 Communicating data via telegrams

The device sends telegrams over the interfaces described above to communicate with a connected host. The following functions can be run using telegrams:

- Parameter setting by the host for the configuration of the device
- Parameters and status log querying by the host.
- Requests for contour measurement values by the host, subsequent response from the device

Each telegram comprises a frame and the application data.

NOTE
USP command is available for the LD-LRS3601/3611 only.

A detailed description of the different telegrams can be found in telegram listing no. 8016687 and 8016855 on the product page.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

Frame and coding of the telegrams

The payload varies depending on the coding.

Table 5: Frame of the telegrams when using ASCII coding (CoLa-A)

	Frame	Telegram	Frame
Designation	STX	Payload	ETX
Length (Byte)	1	≤ 60 kB	1
Description	Start of text character	ASCII coded	End of text character

3.4.11.3 Digital output

The device has a digital output which is used to synchronize the internal clock of the device and that of the external computer. Depending on the synchronization method, the output provides a 10 ms pulse or a pulse dependent on the rotational frequency (see "Synchronization of the external clock and device clock", page 22). The pulse is output depending on the synchronization method.

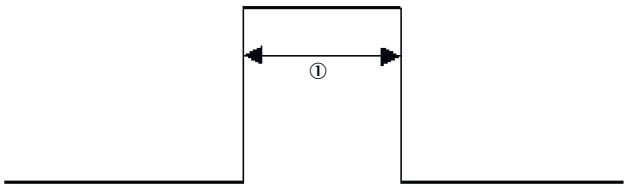


Figure 13: Synchronization pulse

① min. 10 ms

3.4.11.4 Synchronization of the external clock and device clock

For precise control, the contour data of the device and the calculations in the external computer must be synchronized as accurately as possible in time.

The measurement data from the device is provided with the internal time stamp. The internal time stamp in the device is a 32-bit counter which increases in increments of 1 every 1 ms.

There are three ways to synchronize the internal time of the device with the system time of the controller:

- Via telegram: The computer queries the internal time of the device using a telegram. The device writes its internal time in a telegram and sends this to the computer. Sending can happen with a delay time of up to a few milliseconds, which results in some uncertainty.
- Via **Timer Read** telegram: The computer retrieves the internal time of the device using a telegram. The hardware output provides a pulse of at least 10 ms once the internal time stamp is written in the telegram. If the telegram is then received by the computer, this can add the delta between the pulse and receipt to the time entered in the telegram. As a result, the external computer can determine the actual time in the device.

- Via index (pulse at hardware output): The device outputs a signal depending on the scanner head position. . This signal is used, for example, to synchronize scans with the position of a swivel device for 3D measurement.

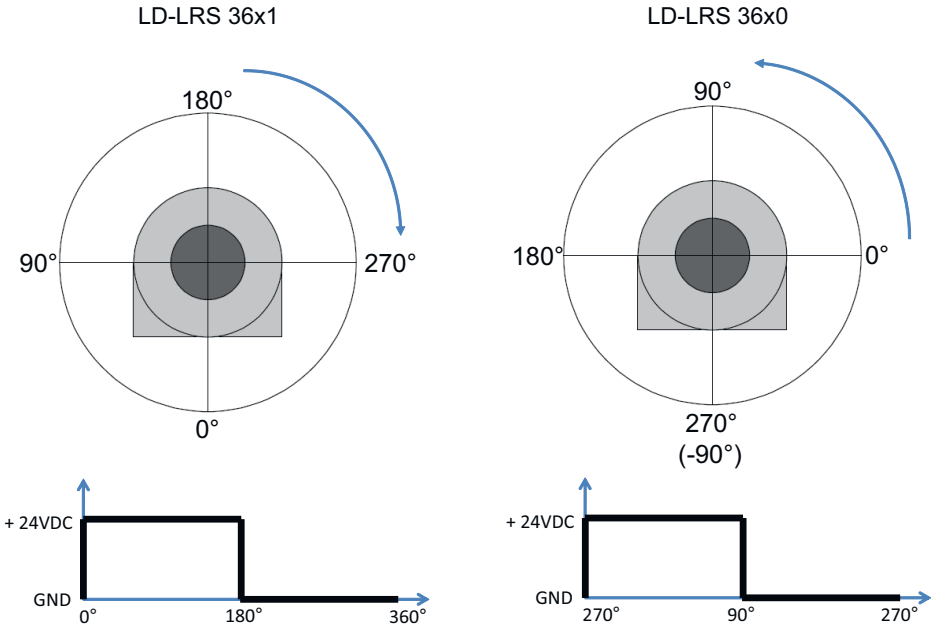


Figure 14: Pulse at the head position

NOTE
Program the controller to respond to the leading edge of the output pulse.

3.4.11.5 Distance between the device and the object/surface to be measured

The laser beam expands with increasing distance from the device.

With recessed installation of the device, it is important to consider how the laser beam expands as the distance increases in order to avoid incorrect measurements. If the device is mounted in an unfavorable position, depending on the distance, this could therefore mean that objects in the scanning area are detected constantly as they are hit by the laser beam.

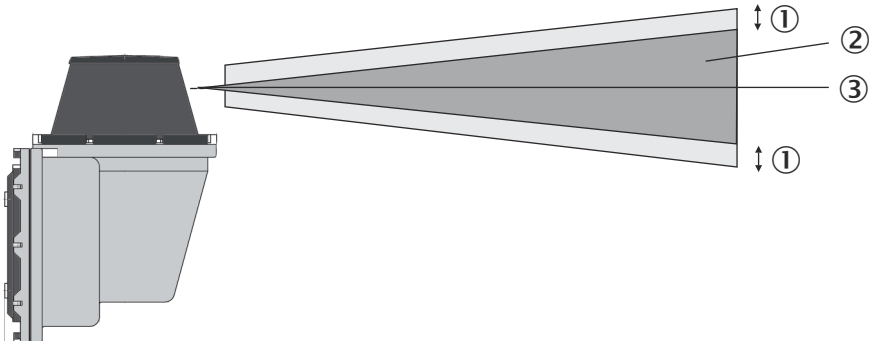


Figure 15: Beam expansion and supplement

① Supplement 5 mm/m
② Expanded laser beam
③ Optical axis

The distance-dependent beam expansion can be calculated using the formula: Beam diameter = (distance (mm) × 2.8 mrad) + 40 mm [1].

The following table shows some example values:

Table 6: Beam diameter at different distances from the device

Distance [m]	5	10	15	20	25	30	40	50	60	70
Beam diameter [mm]	54	68	82	96	120	124	152	180	208	236

When assessing whether the laser beam can hit an object or the wall, the distance from the half beam diameter to the optical axis is used.

NOTE
Take into account a supplement of approx. 5 mm per meter at the top and bottom.

1) Due to the sender lens.

4 Transport and storage

4.1 Transport

NOTICE
Damage due to improper transport!

- The product must be packaged with protection against shock and damp.
- Recommendation: Use the original packaging.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Unpacking

- To protect the device against condensation, allow it to equilibrate with the ambient temperature before unpacking if necessary.
- Handle the device with care and protect it from mechanical damage.

4.3 Transport inspection

Immediately upon receipt in Goods-in, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

NOTE
Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.4 Storage

- Electrical connections are provided with a protective cap.
- Do not store outdoors.
- Store in a place protected from moisture and dust.
- Recommendation: Use the original packaging.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 41.
- Relative humidity: see "Technical data", page 41.
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Mounting instructions

- Observe the technical data.
- Protect the sensor from direct sunlight.
- To prevent condensation, avoid exposing the device to rapid changes in temperature.
- The mounting site has to be designed for the weight of the device.
- Avoid having shiny or reflective surfaces in the scanning range, e.g., stainless steel, aluminum, glass, reflectors, or surfaces with these types of coatings.
- Protect the device from moisture, contamination, and damage.
- Make sure that the status indicator is clearly visible.
- Do not subject the device to excessive shock or vibrations. In systems subjected to heavy vibrations, secure the fixing screws with screw-locking devices.

5.2 Mounting the device

NOTE
So that precipitation (rain, fog, etc.) can drain away more effectively and/or to reduce dustfall, mount the device upside down (optics cover down) and with the connectors facing downward.

1. Mount the device in a suitably prepared bracket using the fixing holes provided (see "Mechanics/Electronics", page 42). Mounting brackets are available as accessories, "Accessories", page 45.
2. Make the electrical connection. Attach and tighten the tension-free cable, see "Overview of the installation steps", page 30.
3. Align the vertical center line of the field of view of the device with the center of the area to be monitored. The marking on the upper side of the optics cover serves as a bearing alignment aid.
4. Switch on the supply voltage.
5. Perform a fine adjustment using a test target and, if necessary, use the alignment aid.

5.3 Mounting multiple devices

NOTICE RISK OF INTERFERENCE FROM OTHER DEVICES!
Radiation sources with a wavelength of 905 nm can cause interference if they affect the device directly.

The device has been designed to minimize the probability of mutual interference, including between different LiDAR sensors. To rule out even the slightest effects on the measurement accuracy, the devices should be arranged such the laser beams are not received by another device.

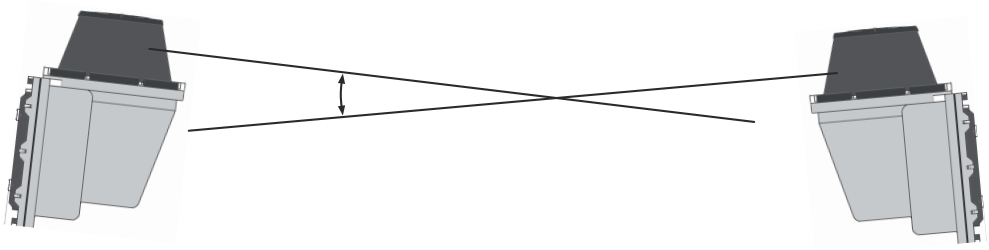


Figure 16: Arrangement for 2 devices

6 Electrical installation

6.1 Wiring instructions

NOTE

Pre-assembled cables can be found on the product page.

The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

NOTICE

Faults during operation and defects in the device or the system

Incorrect wiring may result in operational faults and defects.

- Follow the wiring notes precisely.

All circuits connected to the device must be configured as SELV or PELV circuits. SELV = safety extra-low voltage, PELV = protective extra-low voltage.

Connect the connecting cables in a de-energized state. Do not switch on the supply voltage until installation is complete and all connecting cables are connected to the device and control.

Wire cross-sections in the supply cable from the customer's power system must be implemented in accordance with the applicable standards.

6.2 Prerequisites for safe operation of the device

WARNING

Risk of injury and damage caused by electrical current!

As a result of equipotential bonding currents between the device and other grounded devices in the system, faulty grounding of the device can give rise to the following dangers and faults:

- Dangerous voltages are applied to the metal housings.
- Devices will behave incorrectly or be destroyed.
- Cable shielding will be damaged by overheating and cause cable fires.

Remedial measures

- Only skilled electricians should be permitted to carry out work on the electrical system.
- If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
- Ensure that the ground potential is the same at all grounding points.
- Where local conditions do not meet the requirements for a safe earthing method, take appropriate measures. For example, ensure low-impedance and current-carrying equipotential bonding.

The device is connected to the peripheral devices (any local trigger sensor(s), system controller) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the device.

The device can be grounded through the cable shield or through a blind tapped hole in the housing, for example.

If the peripheral devices have metal housings and the cable shields are also in contact with their housings, it is assumed that all devices involved in the installation have the **same ground potential**.

This is achieved by complying with the following conditions:

- Mounting the devices on conductive metal surfaces
- Correctly grounding the devices and metal surfaces in the system
- If necessary: low-impedance and current-carrying equipotential bonding between areas with different ground potentials

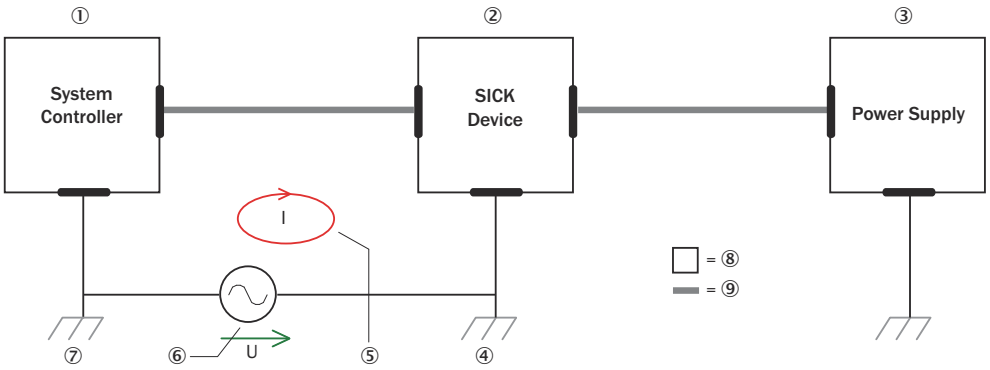


Figure 17: Example: Occurrence of equipotential bonding currents in the system configuration

① System controller
② Device
③ Voltage supply
④ Grounding point 2
⑤ Closed current loop with equalizing currents via cable shield
⑥ Ground potential difference
⑦ Grounding point 1
⑧ Metal housing
⑨ Shielded electrical cable

If these conditions are not fulfilled, equipotential bonding currents can flow along the cable shielding between the devices due to differing ground potentials and cause the hazards specified. This is, for example, possible in cases where there are devices within a widely distributed system covering several buildings.

Remedial measures

The most common solution to prevent equipotential bonding currents on cable shields is to ensure low-impedance and current-carrying equipotential bonding. If this equipotential bonding is not possible, the following solution approaches serve as a suggestion.

NOTICE

We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be complied with and that the safe operation of the device data interfaces can no longer be guaranteed.

Measures for widely distributed system installations

On widely distributed system installations with correspondingly large potential differences, the setting up of local islands and connecting them using commercially available **electro-optical signal isolators** is recommended. This measure achieves a high degree of resistance to electromagnetic interference.

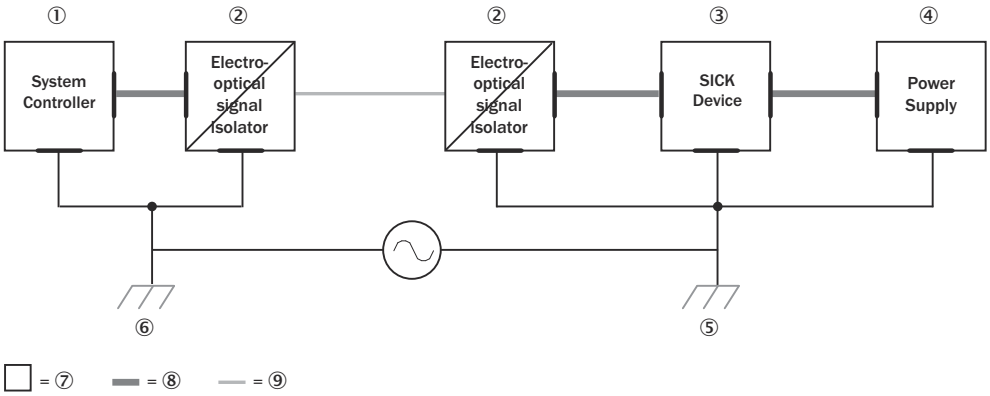


Figure 18: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

① System controller
② Electro-optical signal isolator
③ Device
④ Voltage supply
⑤ Grounding point 2
⑥ Grounding point 1
⑦ Metal housing
⑧ Shielded electrical cable
⑨ Optical fiber

The use of electro-optical signal isolators between the islands isolates the ground loop. Within the islands, a stable equipotential bonding prevents equalizing currents on the cable shields.

Measures for small system installations

For smaller installations with only slight potential differences, insulated mounting of the device and peripheral devices may be an adequate solution.

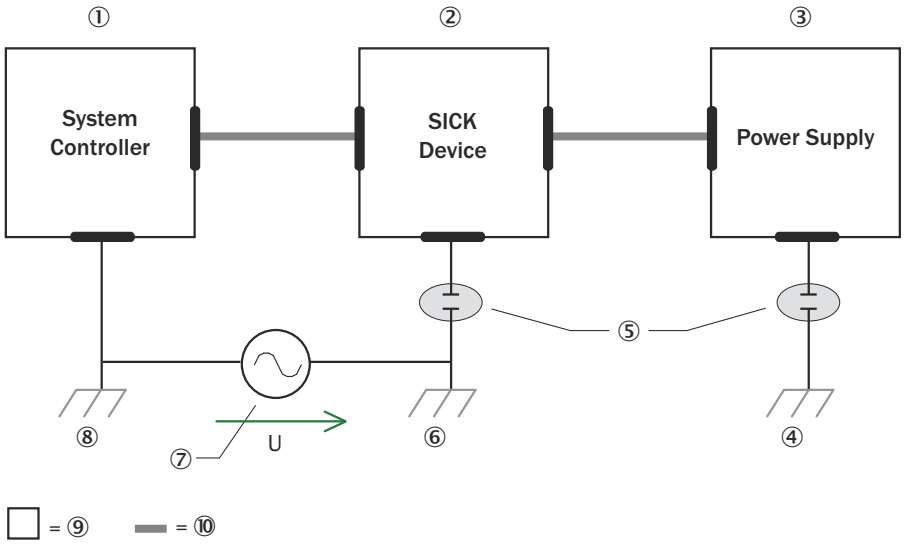


Figure 19: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

① System controller
② Device
③ Voltage supply
④ Grounding point 3
⑤ Insulated mounting
⑥ Grounding point 2
⑦ Ground potential difference
⑧ Grounding point 1
⑨ Metal housing
⑩ Shielded electrical cable

Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.

NOTICE

The voltage supply for the device and the connected peripheral devices must also guarantee the required level of insulation.

Under certain circumstances, a tangible potential can develop between the insulated metal housings and the local ground potential.

6.3 Overview of the installation steps

1. Wire the digital outputs (application-dependent).
2. Connect the computer temporarily (configuration).
3. Wire the data interface for operation.
4. Set up the voltage supply for the device.

6.4 Connection diagram

NOTE

The recommended connecting cables and their associated technical data can be found on the online product page.

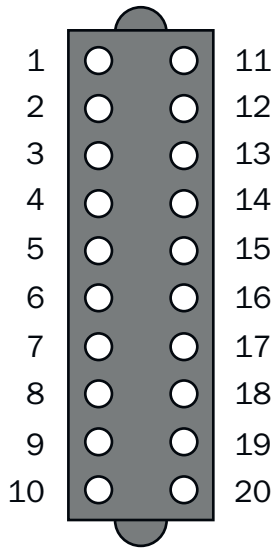
The call is made via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

Connection in the terminal block

Table 7: Terminal assignment of the "Power" connection

Male/female connector	Contact	Short form	Signal description
 *Figure 20: 1 x terminal strip, 20-pin*	01	DC 24V_HZG	Heating supply voltage
	02	DC +24 V	Supply voltage for electronics
	03	OUT1	Digital input 1
	04	OUT3	Digital input 3
	05	–	Reserved
	06	TD-	Sender RS-422 -
	07	TD+	Sender RS-422 +
	08	–	–
	09	TPOP	Sender Ethernet OUT +
	10	TPON	Sender Ethernet OUT -
	11	GND_HZG	Ground heating
	12	GND	Ground for electronics
	13	OUT2	Digital input 2
	14	OUT4	Digital input 4
	15	GND_Data	Ground for data interfaces
	16	RD-	Receiver RS-422 -
	17	RD+	Receiver RS-422 +
	18	–	–
	19	TPIP	Receiver Ethernet IN +
	20	TPIN	Receiver Ethernet IN -
	Housing	–	Shielding

7 Commissioning

7.1 Overview of the commissioning steps

1. Install the SOPAS ET configuration software.
2. Establish communication with the device.
3. Create an application-specific parameter set with SOPAS ET and save it permanently in the non-volatile device memory and on the computer.
4. Test the device for correct functioning.

7.2 SOPAS ET configuration software

The interactive configuration is performed using the SOPAS Engineering Tool (SOPAS ET) software. You can use this configuration software to parameterize and test the measuring properties, evaluation behavior, and output properties of the system as required. The configuration data are stored and archived as a parameter set (project file) on the computer.

NOTE
The most up-to-date version of the SOPAS ET software can be downloaded from www.sick.com/SOPAS_ET. The respective system requirements for installing SOPAS ET are also specified there.

Downloading and installing SOPAS ET

1. Start computer.
2. Download and install the latest version of the SOPAS ET configuration software, as well as current device description files (*.sdd) for the device variant from the online product page for the software by following the instructions provided there.
3. In this case, select the “Complete” option as suggested by the installation wizard. Administrator rights may be required on the computer to install the software.
4. When the installation is finished, start the **SOPAS ET** program option. Path: Start > Programs > SICK > SOPAS ET Engineering Tool > SOPAS.
5. Establish a connection between SOPAS ET and the device. In order to do this, select the desired communication interface for searching in the connection wizard. (Default Ethernet address: IP address: 192.168.0.1, subnet mask: 255.255.255.0).

✓ SOPAS ET establishes communication with the device and loads the associated device description file.

SOPAS ET default settings

Table 8: SOPAS ET default settings

Parameters	Value
Program interface language	English (you must restart the software after making any changes)
Units of length	Metric
Download the parameters to the device	Immediately after a change, temporarily in the RAM of the device
Upload the parameters from the device	Automated after online switching
Window arrangement	3 (project tree, help, working area)
Serial communication	COM1: 115,200 Bd, 8 data bits, no parity, 1 stop bit

7.3 Establishing communication with the device

NOTE
To communicate via Ethernet TCP/IP, the TCP/IP protocol on the computer must be active.

When connecting a PC/host, please adhere to the following order:

1. Connect the computer to the device with a data cable.
2. Switch on computer.
3. Switch on supply voltage of the device.

✓ The device performs a self-test and initializes itself.

Connecting data interfaces

Connect the device to the computer via one of the following data interfaces:

- Ethernet
- RS-422

Starting SOPAS ET and calling up scan assistant

1. Start SOPAS ET.
2. In the main window under **Scan Assistant**, click on the **Configuration** button.

✓ The **Scan Assistant** dialog window appears.

Configuring the Ethernet connection

NOTE
Deactivate all programs on your computer to access Ethernet or TCP/IP.

1. In the **Scan Assistant** dialog box under **Internet Protocol, IP Communication**, select the **Activate IP Communication** and **Use Auto-IP** checkbox.
2. In the **Auto IP Setting** dialog window.
3. Click the **Search for sensors** button to check whether the device is reachable.
   If the status is not reachable, mark the device and follow instructions 5.-7. If the status is REACHABLE, click OK to close the dialog window then start the network scan
4. Click the **Change settings** button.
5. Increase the IP address in the **Network adapter of the PC** field by one digit and enter it in the **Use the following IP settings** field, e.g.:
   - IP address under **Network adapter of the PC** = 169.192.88.120
   - IP address under **Use the following IP setting** = 169.192.88.121.
6. Confirm the settings in the **Scan Assistant** dialog window by clicking **OK**.

✓ The **Scan Assistant** dialog window closes.

Configuring serial connection

1. In the **Scan Assistant** dialog box under **Serial Connection**, **Standard Protocol**, select the **Activate Serial Communication** checkbox.
2. Click the **Advanced...** button.
3. Under **Cola dialect**, select the **ASCII** option.
4. Select the following **PORT Settings**: 8 data bits, no parity, 1 stop bit.
5. Confirm the settings with **OK**.

✓ The **Advanced Scan Settings** dialog window is closed.

6. Confirm the settings in the **Scan Assistant** dialog window by clicking **OK**.

✓ The **Scan Assistant** dialog window closes.

Performing a scan

1. In the **Scan Assistant** dialog window, click the **Start Scan** button.
2. Select the listed devices and confirm by clicking **Add Device.**

✓ The connection is used to search for connected devices. SOPAS ET adds the devices found to the project tree and loads the current parameter set to the device via upload.

7.4 Initial commissioning

The device is adjusted to the situation on site using the SOPAS ET configuration software. To do this, SOPAS ET creates an application-specific parameter set of parameter values. For this purpose, the parameter set can first be loaded from the device (upload, initial commissioning: factory default setting). Or it is created independently, either based on the factory default settings or as a modification of an already existing parameter set of the device of the same type and firmware version.

The parameter set is then loaded into the device (download). This either happens immediately (**Download immediately** option in SOPAS ET) or manually (**Download all parameters to the device** command in SOPAS ET).

NOTE

After completing configuration, the changed parameter set must be permanently stored in the non-volatile memory of the device. As part of a backup concept for the created parameter values, we recommend saving the parameter set as a project file (*.sopas file with configuration data) on the computer for archival purposes.

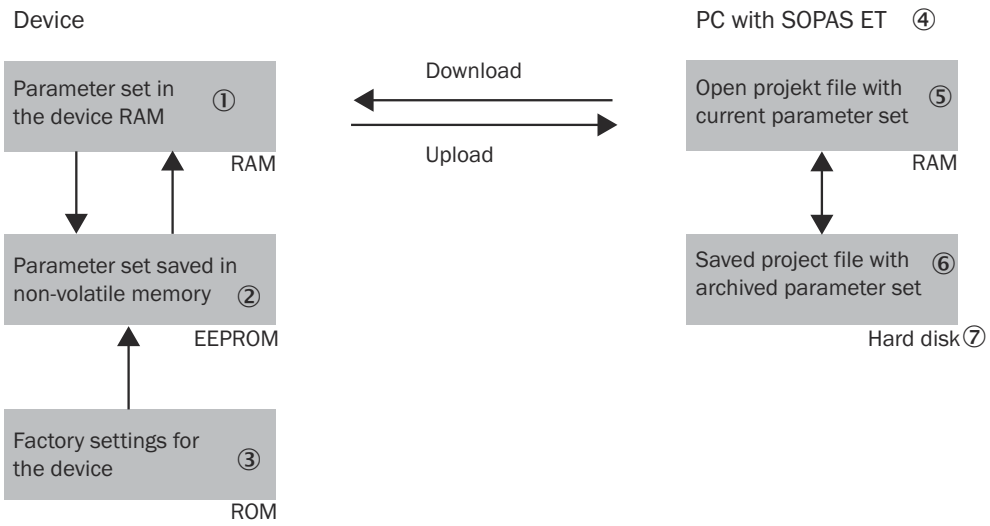


Figure 21: Data storage principle

① Parameter set in the working memory of the device
② Permanently saved parameter set
③ Factory-set pre-settings of the device
④ Computer with SOPAS ET
⑤ Opened project file with current parameter set
⑥ Saved project file with archived parameter set (*.spr)
⑦ Hard drive

Device configuration

You can configure the device in two ways:

- Interactively using SOPAS ET. This section describes the interactive configuration.
- Using configuration telegrams, see "Communicating data via telegrams", page 21.

Interactive configuration with SOPAS ET

All configurable parameters of the device are collected together in a corresponding device description (.sdd file) for SOPAS ET. You can access these parameters via the project tree for the device description.

A content-sensitive explanation of each of the parameters is available directly next to the parameter via the **?** button or in the online help (**F1** key). The **Parameter Info** display window lists the valid range of values and the default setting (right-click when the pointer is located over the parameter).

NOTE

Software access to the device is protected by user levels and passwords. After successfully configuring the device, you should change the passwords so they can fulfill their protective function.

Table 9: Passwords

User levels	Password
Maintenance	`main`
Authorized Client	`client`
Service	`servicelevel`
Operator	–

NOTE

Change the passwords during initial commissioning to protect your device.

A higher user level can change the password of a lower user level.

NOTE

If the password for the Service user level has been lost: see "Resetting the password for the Service user level", page 39.

Use the project tree in SOPAS ET to configure the necessary parameters for your application.

NOTICE

Loss of configuration data in the connected device

1. Do not switch off the voltage supply during the configuration of the device. Otherwise all parameters not yet saved permanently will be lost.

1. In the **Options** menu, select the **Log into device** command and log in as an **Authorized Client** using the password `client`.
2. Configure the device for the required application using the parameters in SOPAS ET. Help on using the program user interface as well as for the different options can be found in SOPAS ET.

Resetting the configuration

NOTE

To reset the device to the delivery condition, use the **Factory defaults** option in SOPAS ET.

7.5 Connecting and performing a test measurement

Use the graphic scan view in SOPAS ET to verify the generated measured values and the measuring range online.

1. In the project tree, select **LD-LRS36xx...**, **Monitor**, **Scan view pro**.
2. Compare the measurement line with the required result.

NOTE

- The **Pro scan display** in the **Monitor** depends on the available processing power of the computer and is not a real time display. For this reason not all measured values are displayed. The same restriction also applies to saving the displayed measured values in a file.
- The monitor displays the measured values unfiltered, i.e. the effect of filters cannot be checked using the monitor.

3. After successful completion of the test measurement, save the configuration permanently in the device: Menu **LD-LRS36xx**, **Parameters**, **Save permanently**.

8 Maintenance

8.1 Maintenance plan

NOTE
No maintenance is required to ensure compliance with the laser class.

Table 10: Maintenance plan

Maintenance work	Interval	To be carried out by
Check device and connecting cables for damage at regular intervals.	Depends on ambient conditions and climate.	Specialist
Clean housing and optics cover.	Depends on ambient conditions and climate.	Specialist
Check the screw connections and plug connectors.	Depends on the place of use, ambient conditions or operating requirements. Recommended: At least every 6 months.	Specialist
Check the mounting accessories and vibration dampers used.	Depends on the place of use, ambient conditions or operating requirements. Recommended: At least every 6 months.	Specialist
Check that all unused connections are sealed with protective caps.	Depends on ambient conditions and climate. Recommended: At least every 6 months.	Specialist

8.2 Cleaning

NOTICE
Equipment damage due to improper cleaning.
Improper cleaning may result in equipment damage.

- Only use recommended cleaning agents and tools.
- Never use sharp objects for cleaning.

► Clean the optics cover at regular intervals and in the event of contamination with a lint-free lens cloth (part number 4003353) and plastic cleaning agent (part number 5600006). Rinse off coarse dirt first with water. The cleaning interval essentially depends on the ambient conditions.

NOTICE
If the optics cover is scratched or damaged (cracked, broken), it must be replaced. Contact SICK Support to arrange this.

- If the optics cover is cracked or broken, take the device out of operation immediately for safety reasons and have it repaired by SICK.

9 Troubleshooting

9.1 General faults, warnings, and errors

Possible faults and corrective actions are described in the table below for troubleshooting. In the case of faults that cannot be rectified using the information below, please contact the SICK Service department. To find your agency, see the final page of this document.

NOTE
Before calling, make a note of all type label data such as type designation, serial number, etc., to ensure faster assistance.

NOTE
If the device detects a device error during the self-test or during operation, it returns an error code. The error code can be read and evaluated using telegrams (see Telegram Listing, No. 8014631).

NOTE
You can use the monitor to view the measurement data, the detected reflectors, and the position of the device. SOPAS: **Project tree**, **LD-LRS**, **Monitor**, **Scan view**.

Table 11: Troubleshooting questions and replies

Question / status	Response / remedial actions
SOPAS ET cannot communicate with the device.	**Supply voltage not switched on** • Check the supply voltage. • Check whether supply cables are fixed correctly in the connector plug. • Check whether the cables are poled correctly. • Increase the wire cross-section. • Disconnect the supply voltage and reconnect. If the red LED is still lit, inform SICK Service. • Check the supply voltage. • Check whether supply cables are fixed correctly in the connector plug. • Check whether the cables are poled correctly. • Increase the wire cross-section. • Disconnect the supply voltage and reconnect. If the red LED is still lit, inform SICK Service.
	Computer not connected • Connect the computer to the device (use a suitable data cable for the type of interface).
	Incorrect interface selected • Select the interface in SOPAS ET according to the connection made on the computer.
	Another application on the computer is already accessing the interface • Check the assignment of the interface; if necessary end the application accessing the interface.
	Sequence not observed when switching on the device 1. Switch on computer. 2. Connect the computer to the device. 3. Switch on the device.

Question / status	Response / remedial actions
Measurements in close range without objects present.	Carefully clean the optics cover with a soft, lint-free cloth. If the optics cover is scratched, contact SICK service.
The device does not detect objects that are present.	Check whether the scanner head is clean and dry.
The device does not transmit a measurement result.	Check the wiring.
Frequent CRC errors via the RS-422 interface.	Data transmission is time-critical: Increase the baud rate.

9.1.1 Resetting the password for the Service user level

If you have forgotten the password of the **Service** user level, you can reset it with the assistance of SICK.

NOTE

The responsible SICK sales company or the responsible SICK service partner carefully checks each code request to reset the password. A risk of deception by third parties nevertheless exists. The operating entity should therefore take suitable security measures.

The operating entity should also take suitable measures to limit, as best as possible, access to the product. This includes, in particular, physical access as well as access to the software interfaces of the product.

Requesting an unlock code

1. Open SOPAS ET.
2. Open the device window.
3. Open the device name > **Password** > **Reset Service password**.

✓ The **Reset password** window appears.

4. Enter the relevant data.

   NOTE | Do not press **Generate** if an unlock code has already been requested from SICK. Only press this button if a new device code is required when inquiring again.

5. Click **Generate e-mail with data**.

✓ Your SICK subsidiary will create the unlock code based on the information provided and send it to you.
The code is only valid once for the reset process. You can close the window by clicking on the **x** without interrupting the reset process. If you select **Cancel** or enter an incorrect code several times, the current reset process is terminated. The requested code is no longer valid. The process must be restarted.

6. Wait for the unlock code: The dialog box can be closed and the device switched off.

Entering the unlock code

Prerequisite

- SICK has sent an unlock code.

1. Open SOPAS ET.
2. Open the device window.
3. Open the device name > **Password** > **Reset Service password**.

✓ The **Reset password** window appears.

4. Click **Next**.
5. Enter the code sent by SICK.

6. Click **Ok**.
✓ Password has been reset to the default password `servicelevel`. Parameters are not changed.

Assigning a new password for the Service user level

1. Open SOPAS ET.
2. Log on to the device with the **Service** user level and the default password `servicelevel`.
3. Open the device name > **Password** > **Change password**.
4. Assign the new password for the **Service** user level.

9.2 Repairs

Repair work on the device may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the device by the customer will invalidate any warranty claims against SICK AG.

9.3 Returns

► Only send in devices after consulting with SICK Service.
► The device must be sent in the original packaging or an equivalent padded packaging.

NOTE
To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of the contact person
- Description of the application
- Description of the fault that occurred

9.4 Disposal

If a device can no longer be used, dispose of it in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. Do not dispose of the product along with household waste.

NOTICE
Danger to the environment due to improper disposal of the device.
Disposing of devices improperly may cause damage to the environment.
Therefore, observe the following information:

- Always observe the national regulations on environmental protection.
- Separate the recyclable materials by type and place them in recycling containers.

10 Technical data

NOTE

The relevant online product page for your product, including technical data, dimensional drawing, and connection diagrams, can be downloaded, saved, and printed from the Internet.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

Please note: This documentation may contain further technical data.

10.1 Features

Application	Outdoor
Light source	Infrared (wavelength 905 nm; max. output power 1.26 W; pulse duration 3.5 ns; average power 4.0 mW)
Laser class	Laser class 1 (EN 60825-1:2014+A11:2021, IEC 60825-1:2014) Complies with 21 CFR 1040.10 and 1040.11 except for the listed tolerances in the document “Laser Notice No. 50", dated June 24, 2007.
Horizontal aperture angle	360°
Scanning frequency	5 Hz ... 15 Hz
Angular resolution	0.125°, 0.1875°, 0.25°, 0.375°, 0.5°, 0.75°, 1°, Interlaced: 0.0625°
Heating	Yes
Working range	2.5 m ... 250 m (LD-LRS3600/LD-LRS3601) 5 m ... 250 m (LD-LRS3611)
Scanning range for 10 % remission factor	80 m (LD-LRS3600/LD-LRS3601) 120 m (LD-LRS3611)
Scanning range for at 90% remission	250 m
Beam divergence	2.8 mrad
Pulse rate	Max. 14.4 kHz (max. 12 kHz over 360°)

Working range diagram

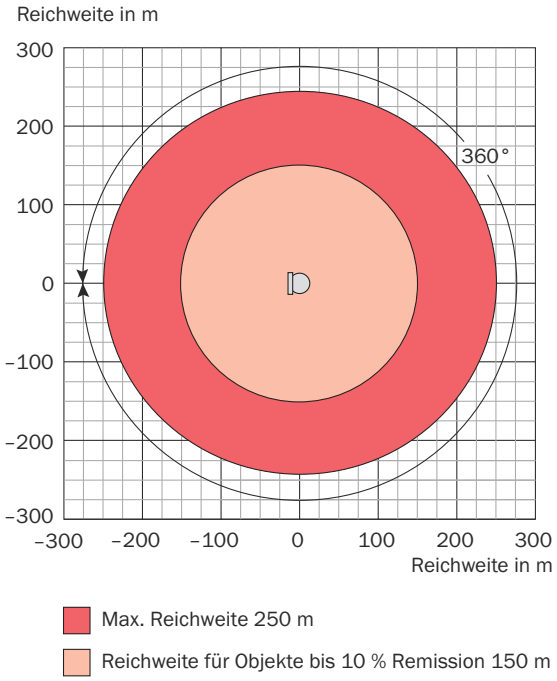


Figure 22: Working area diagram, top view

10.2 Mechanics/Electronics

Electrical connection	1 x 20-pin Harting connector
Supply voltage	24 V DC ± 15%
Digital outputs	**LD-LRS3600** • 4x (OUT1 to OUT4) semiconductor output high-active • 12 W max. load per output (0.5 A at 24 V DC) • 18 W max. total output load (0.75 A at 24 V DC) **LD-LRS3601/LD-LRS3611** • 1 x (OUT1 for synchronization) • Semiconductor output high-active • 12 W max. load (0.5 A at 24 V DC)
Permissible residual ripple	6 V
Power consumption	Typical ≤ 36 W (1.5 A) + 140 W heating Start-up phase briefly max. 2.1 A
Housing	PUR-IHS (polyurethane integral skin foam) optics cover: PC
Housing color	Grey (RAL 7042)
Enclosure rating	IP67 (EN 60529 (1991-10); A1 (2002-02))
Protection class	III (IEC 61140:2002-03)
Electrical safety	IEC 61010-1:2010-06
Weight	9.1 kg
Dimensions (L x W x H)	250 mm x 350 mm x 391.1 mm

10.3 Performance

Detectable object shape	Almost any

Systematic error [1]	± 38 mm up to 80 m ± 63 mm from 80 m Temperature drift: typ. ± 0.6 mm/K
Statistical error [1]	≤ 30 mm (at 20 ... 90% remission)
Measurement resolution	1/256 m up to 250 m in the USP interface; 4 mm to 250 m (CoLa-A/B)
Integrated application (LD-LRS3600 only)	Field evaluation
Number of field sets (LD-LRS3600 only)	6
Simultaneous evaluation cases (LD-LRS3600 only)	10

1) Typical value; actual value depends on ambient conditions

10.4 Interfaces

Ethernet	TCP/ IP Data transmission rate: 100 Mbit/s **Protocols:** • CoLa-A/B (port 2112) • CoLa-A (port 2111) • ID-LRS3611 only: USP (port 49152)
Serial	RS-422 Data transmission rate: 19,200 baud ... 115,200 baud Data format: Variable, default: 8 data bits, 1 stop bit, no parity Protocol: CoLa-A
Optical displays	None
Digital outputs	4
Configuration software	SOPAS ET, web server (display only)

10.5 Dimensional drawing

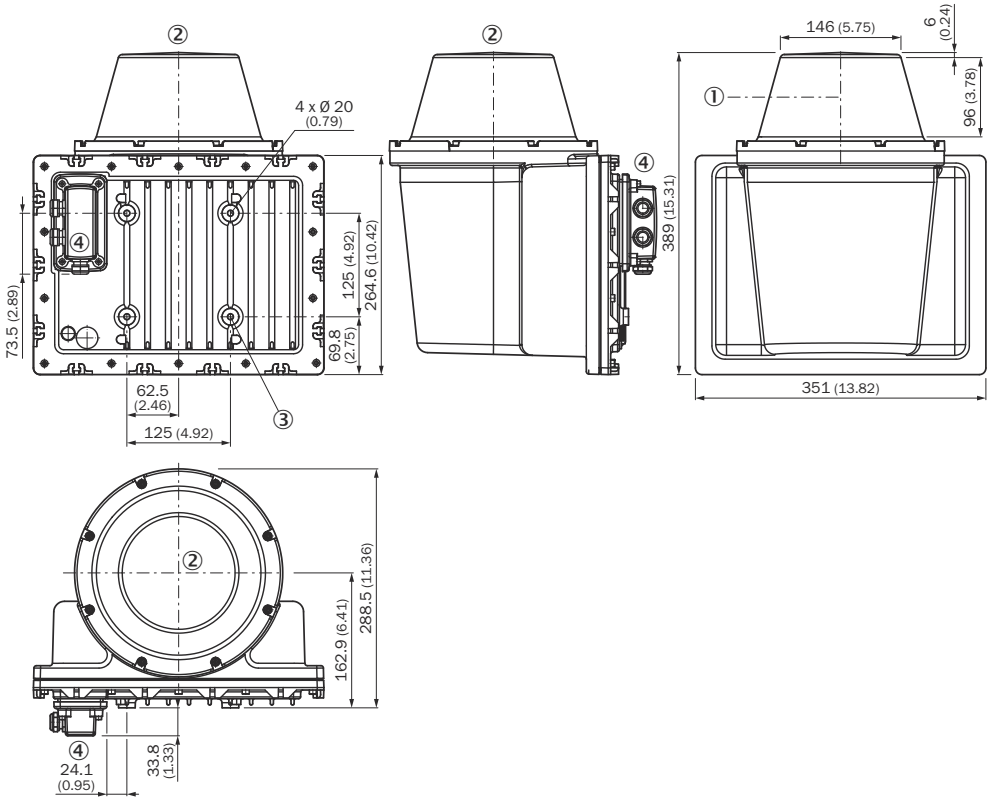


Figure 23: Device dimensions, dimensions in mm (inch), decimal separator: point

① Optical axis
② Device zero point
③ Fixing hole (M6x9)
④ 20-pin Harting connector (RS-232/Ethernet/supply voltage)

10.6 Ambient data

Remission factor	2% ... 1,000% (reflector)
Electromagnetic compatibility (EMC)	EN 61000-6-2:2005-08 EN 61000-6-4:2007-01 EN 61000-6-4:2007-01+A1:2011-02
Vibration resistance	According to EN 60068-2-6:2007, Table 2c (frequency range 10 ... 150 Hz, amplitude 0.35 mm or 5 g)
Shock resistance	EN 60068-2-27:2008
Ambient operating temperature	-25 °C ... +50 °C
Storage temperature	-25 °C ... +80 °C
Operating and storage air humidity	Max. 85% relative humidity (non-condensing)
Ambient light immunity	80 klx

11 Accessories

NOTE

On the product page you will find accessories and, if applicable, related installation information for your product.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

Support Portal

NOTE

In the SICK Support Portal (supportportal.sick.com, registration required) you will find, besides useful service and support information for your product, further detailed information on the available accessories and their use.

12 Annex

12.1 Declarations of conformity and certificates

You can download declarations of conformity and certificates via the product page.

The page can be accessed via the **SICK Product ID: pid.sick.com/{P/N}/{S/N}**

{P/N} corresponds to the part number of the product, see type label.

{S/N} corresponds to the serial number of the product, see type label (if indicated).

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