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SICK
Sensor Intelligence.

LMS1104C-111031S01

QUICKSTART	en

1 About this document

The purpose of this Quickstart is to allow you to commission the product quickly and easily and to achieve initial measurement results.

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2 Safety information

- Please observe the safety notes and the warnings listed in the publication Safety Notes (part no. 8018793) to reduce the possibility of risks to health and avoid dangerous situations.
- Read these instructions before commissioning the product in order to familiarize yourself with the device and its functions.
- Mounting and electrical installation are to be performed only by qualified technicians.
- Electrical connections between the LiDAR sensor and other devices may only be made when there is no power to the system. Otherwise, the devices may be damaged.
- Wire cross-sections in the supply cable from the customer's power system should be designed in accordance with the applicable standards. Protect the LiDAR sensor with an external 5 A slow-blow fuse at the start of the supply cable, from the perspective of the voltage supply.
- All electric circuits connected to the device must be configured as PELV or SELV circuits (PELV= protective extra-low voltage, SELV = safety extra-low voltage).
- In order to comply with the specified enclosure rating, non-contacted connections must be closed with protective caps.
- Use the device only under permitted ambient conditions (e.g., temperature) (see "Technical specifications").
- Turn the rotatable electrical connections max 270° from end position to end position.
- Opening the screws of the LiDAR sensor housing will invalidate any warranty claims against SICK AG.
- The LiDAR sensor does not constitute personal protection equipment in accordance with the respective applicable safety standards for machines.

2.1 Intended use

The LMS1000 2D LiDAR sensor features 1 scan plane and is designed for the following applications:

- Detection of objects during continuous output of measured data as required.
- Field monitoring of freely defined areas with signaling of field breaches via switching outputs.

It is suitable for applications which demand precise, non-contact optical measuring contours and dimensioning. Typical areas of application include, for example, profile detection in traffic monitoring, access monitoring, pass-through monitoring.

3 Product description

3.1 Scope of delivery

- LiDAR sensor with type designation LMS1104C-111031S01 (see the type label).
- Protective caps included or possibly attached to the device. Without connecting cables and brackets.
- Printed Quickstart (this document): English, German, French
- Safety notes for 2D/3D LiDAR sensors with laser class 1 (multilingual)

3.2 Device structure and dimensions

See Technical data, page 4.

3.3 Connection diagram

ⓘ **NOTE**
The recommended connecting cables and their associated technical data can be found online at:
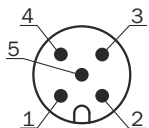**www.sick.com/LMS1000**

PWR connection

Figure 1: Male connector M12, 5-pin, A-coded

Pin assignment for PWR connection

Pin	Identification	Description	Wire color, part number 2095733 [1]
1	Vs	Supply voltage: +10 ... +30 V DC	Brown
2	-	Reserved	White
3	GND	Supply voltage: 0 V	Blue
4	IN8 / OUT8	Digital input 8 / digital output 8	Black
5	-	Reserved	Gray

[1] Information only valid when using the specified open-ended connecting cable which is available as an accessory
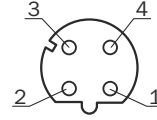
Ethernet connection

Figure 2: M12 female connector, 4-pin, D-coded

Pin assignment for Ethernet connection

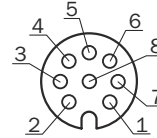| Pin	Identification	Description
1	TX+	Sender+
2	RX+	Receiver+
3	TX-	Sender-
4	RX-	Receiver-

I/O connection

Figure 3: Female connector, M12, 8-pin, A-coded

Pin assignment for I/O connection

Pin	Identification	Description	Wire color, part number 6036155 [1]
1	IN1 / OUT1	Digital input 1 / digital output 1	White
2	IN2 / OUT2	Digital input 2 / digital output 2	Brown
3	IN3 / OUT3	Digital input 3 / digital output 3	Green
4	IN4 / OUT4	Digital input 4 / digital output 4	Yellow
5	IN5 / OUT5	Digital input 5 / digital output 5	Gray
6	IN6 / OUT6	Digital input 6 / digital output 6	Pink
7	GND INx/OUTx	Ground for all digital inputs / outputs	Blue
8	IN7 / OUT7	Digital input 7 / digital output 7	Red

[1] Information only valid when using the specified open-ended connecting cable which is available as an accessory
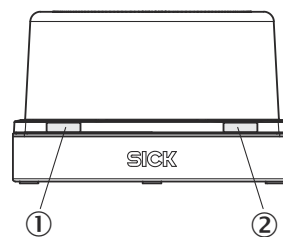
3.4 Status indicators

Figure 4: Status indicators

① LED1
② LED2

LED1 (color)	LED2 (color)	Description
● (Red)	● (Red)	Startup, parameterization, firmware update, correctable errors
-	-	Off
● (Green)	● (Yellow)	Field breached
● (Green)	● (Green)	Field free
☀ (Red)	☀ (Red)	Fatal error
● (Green)	● (Green)	On / Ready for operation
☀ (Green)	☀ (Green)	Standby
☀ (Green)	☀ (Green)	Save energy
● (Green)	● (Yellow)	Restart after time; input

LED1 (color)	LED2 (color)	Description
☀ (Yellow)	● (Green)	Contamination warning
☀ (Yellow)	☀ (Red)	Contamination error
☀ (Yellow)	☀ (Yellow)	EasyTeach / teach-in
● (Green) ● (Yellow) ● (Red)	● (Green) ● (Yellow) ● (Red)	Identifying the device

● = illuminated; ☀ = flashing

1. Alternating

4 Mounting

- The device should be as free from shock and vibration as possible during operation.
- Protect the sensor from direct sunlight.
- In applications with temperatures near the maximum ambient operating temperature, fasten the device firmly on a metal holder with the optional bracket to conduct heat away from the device.
1. Mount the LiDAR sensor on a prepared bracket.
2. Align the horizontal 0° axis of the LiDAR sensor's field of view with the center of the area to be monitored. The marking on the lid of the optics cover serves as a bearing alignment aid.

5 Electrical installation

1. Connect the communication interface (Ethernet, 4-pin M12 female connector) of the LiDAR sensor directly to the PC.
2. Switch on the PC.
3. Supply the LiDAR sensor with voltage (5-pin M12 male connector, supply voltage 10 ... 30 V).
✓ After successful initialization, the two status LEDs light up green. The device is ready for use.

6 Configuration without computer

6.1 Field evaluation

Configuration is performed by teaching in (EasyTeach) of the surrounding contour in order to automatically generate a field with any shape, including more complex shapes. In the as-delivered configuration, the teach-in phase is activated and deactivated using the wiring for input IN4.

Preparing EasyTeach

- Remove all objects that will not permanently be in the field of view in monitoring mode later on.
- Distance yourself sufficiently from the device during the teach-in phase and do not enter the monitored area, so that you are not detected as part of the field contour.

Teaching in the field contour

- The device forms the field from the surrounding contour with a negative offset of 100 mm.
- The field shape to be formed can be defined by pacing out the limits during the teach-in phase. It is important to make sure that the person can always be unequivocally detected.
- The device stores the shortest value measured during the teach-in phase as a field limit for each angle.
- Note: A parameter upload is required in order to display the newly taught-in field contour in SOPAS.
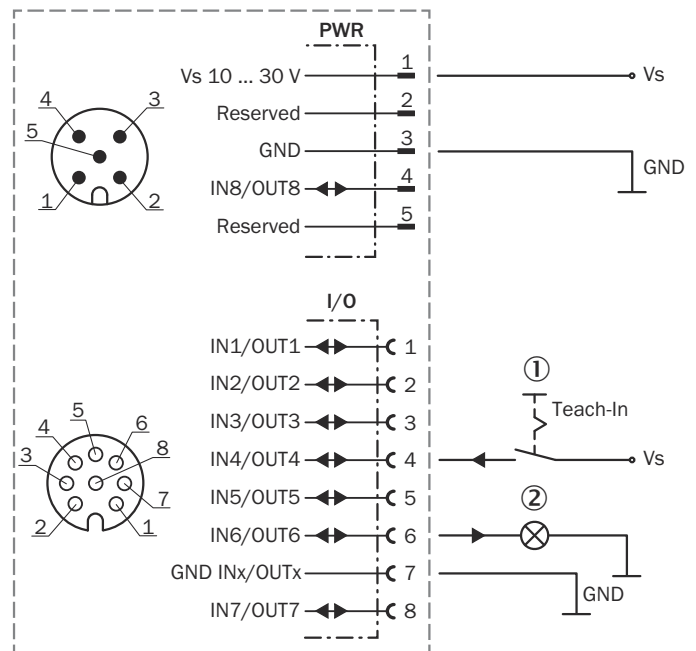1. Install the device.
2. Carry out the EasyTeach wiring.

Figure 5: Wiring for EasyTeach (example)

① Teach-in via an external signaling device such as a pushbutton, at input IN4/OUT4 in this example.
② Feedback for object detection; At output IN6/OUT6 in this example

3. Set the EasyTeach input signal to start the teach-in phase (active high).
4. Define the field (e.g., using the existing surrounding contour or by pacing out the field).
5. Remove the EasyTeach input signal to end the teach-in phase (active high).
6. Thoroughly check correct detection of the field borders by performing a functional check in which For this purpose, deliberately induce object detections.

7 Configuration with computer

The SOPAS ET configuration software (from Version 3.3.3) is used as standard to display the surrounding contour (measuring line) recorded by the LiDAR sensor, as well as diagnostic information in the event of an error.

7.1 Installing and starting the configuration software

1. Download and install the latest version of the SOPAS ET configuration software, as well as the current device description files (*.sdd): **www.sick.com**. 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.
2. Start the "SOPAS ET" program option after completing the installation. Path: **Start** > **Programs** > **SICK** > **SOPAS ET Engineering Tool** > **SOPAS**.
✓ SOPAS ET automatically starts searching for connected devices and displays connected devices in the **Device search** window.
3. Select the appropriate LiDAR sensor from the list of available devices:
   ○ LMS1xxx Use (port 2111) to configure the device.
   ○ LMS1xxx Use (port 2112) to view only measured data.
   If necessary, install an updated device description file for the device.
4. Click on 🔲 **Add** to establish communication.
✓ SOPAS ET establishes communication with the LiDAR sensor, loads its current device description (parameters), and displays it in the **New Project** window.
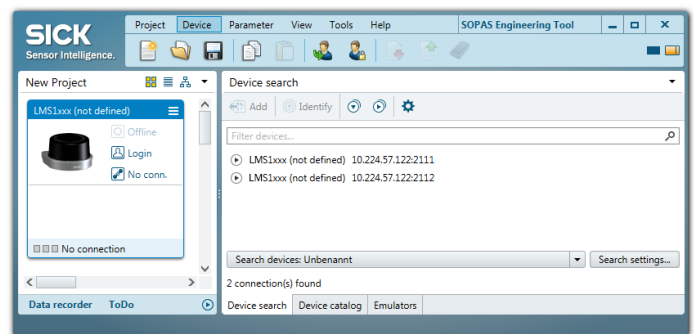

Figure 6: SOPAS ET: main window

7.2 Logging into the device

1. In the project window, click 🔲 **Login** to establish communication.
2. Select `Autorisierter Kunde` as the **as user level** and enter the **password** `client` . Click the **Login** button.

7.3 Output of measured values via terminal program

Example commands for output of measured values

If the LiDAR sensor receives one of the two example commands by telegram through the Ethernet interface, it will start the output of measured values through this data interface.

The detailed structure of the output telegram as well as the flow of requirements and outputs is described in the "Measurement output telegram" chapter in the Telegram listing publication (English, no. 8014631).

Request for output of measured values:

Telegram structure: sRN LMDscandata

Telegram part	Description	Variable type	Length (byte)	Value range
Command type	Request (SOPAS read by name)	string	3	sRN
Command	Request data	string	11	LMDscandata

Example: sRN LMDscandata

Telegram type	Command
ASCII	`<STX>sRN{SPC}LMDscandata<ETX>`
HEX	02 73 52 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 03
Binary	02 02 02 02 00 00 00 0F 73 52 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 05

Request for continuous output of measured values:

Telegram structure: sEN LMDscandata measurement start/stop

Telegram part	Description	Variable type	Length (byte)	Value range
Command type	Request (SOPAS event by name)	string	3	sEN
Command	Request data	string	11	LMDscandata
StartStop measurement		Enum8	1	0: Stop output of measured values 1: Start output of measured values

Example: sEN LMDscandata

Telegram type	Command
ASCII	`<STX>sEN{SPC}LMDscandata{SPC}1<ETX>`
HEX	02 73 45 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 20 31 03
Binary	02 02 02 02 00 00 00 11 73 45 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 20 01 33

Note:

For the content of the response telegram for the measured value request, see the telegram listing (no. 8014631) under Send Data Permanently in Chapter 4. The telegram consists of one part with information on the configuration of the device and the time stamp, one part with measured data, and a status part with information on the device status and the statuses of the inputs/outputs.

After starting the measurement mode, the device needs some time to reach status 1 ("ready"). You should therefore query the status of the device using the **sRN SCdevicestate** telegram.

Then request measured data via telegram at the data interface from which you want to receive measured data. This can be achieved in two ways:

- The request of exactly one measured value with the **sRN LMDscandata** telegram – the last measured scan is transmitted.
- Continuous request of measured data with the **sEN LMDscandata 1** telegram – measured data is transmitted until the output of measured values is stopped with the **sEN LMDscandata 0** telegram.

Activating the output of the measured values in SOPAS on a test basis:

1. Start the terminal emulator: **Tools** menu > **Terminal**.
2. In the dialog window in the **Connections** menu, select the **Create new connection** function.
3. In the connection wizard, select the communication interface (**Ethernet**) and connection settings (default IP address: 192.168.0.1) and establish the connection (**Finish** button).
4. Enter in the input line one of the two example telegrams from the annex as they appear (automatically framed by **STX** and **ETX** when sending in the default setting). Pay attention to blank characters in the string.
5. Use the 📩 button to transmit the telegram to the LiDAR sensor.
✓ The LiDAR sensor responds by providing the data as a one-off or continuously in the display area of the terminal emulator.
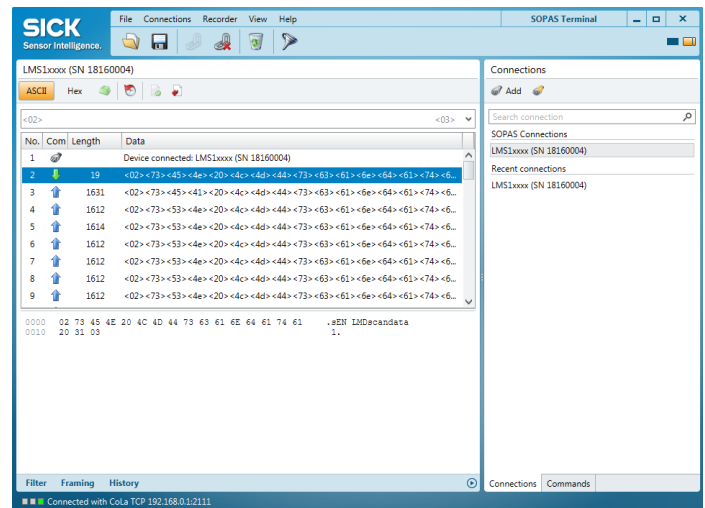
Data output format of the measured values

The data output format per scan is comprised of the configuration information, measured values, radial distance, RSSI, , device and status information, and time stamp.

In the default settings, the distance is output as a measured value (in mm).

To output the reflectance values in the telegram: Open the device window (**Device> Open** menu) and, in the **Distance measurement** view, select the **RSSI** check box under **Output data format**.

7.4 Measured value display and configuration via start window

▶ Open start window: **Device> Open** menu.
✓ The **Start** view with information on the **device**, **device status**, and the graphic **scan display** opens.
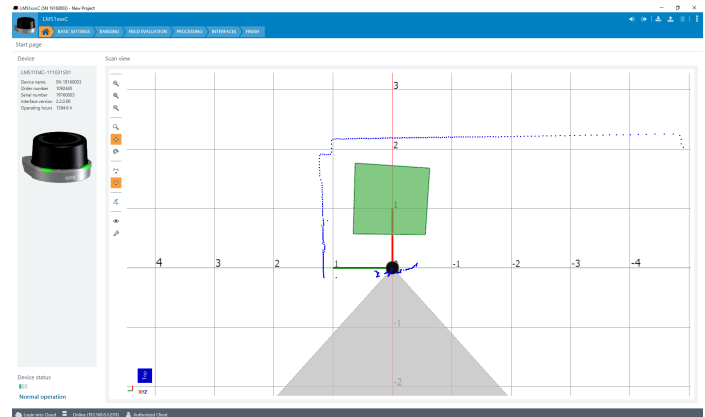

Figure 7: SOPAS ET: Start window

7.5 Selecting the application

1. Open the **Application** view.
2. Select **Field evaluation** or **Measurement data output**.

7.6 Field evaluation

Creating a new evaluation
▶ Click the 🔩 button.

Entering evaluation parameters
▶ Click the ✏ button and enter evaluation parameters.

Inserting field points
1. Click the 🔩 button.
2. Insert field points by clicking.
3. Double-click to close the field.

Editing field points

The Edit field points tool (🔩) can be used to customize the field geometry with the assistance of the mouse pointer. Alternatively, the field vertices can also be customized by entering the coordinate values in the Field coordinates mask.

Function	Procedure
Scale field	Drag square red handle.
Rotate field	Drag round black handle.
Customize field shape	Drag square green handle.
Add field vertices	Double-click in required position.
Remove field vertex	Click to select the square green handle and press the [del] key.
Delete field	Press the [del] key without first selecting a green handle.

Important information about fields

It is possible to define up to 10 fields and 10 evaluations.

7.7 Configuring interfaces

Settings for using the multifunctional I/Os can be made in the **Interfaces** area. In addition, the current status and saved function of the input/output are displayed.

The multifunctional I/Os are switchable and can therefore each be used as either a digital input or output. The factory settings are as follows: multifunctional I/Os 1-4 preset as inputs and multifunctional I/Os 5-8 preset as outputs.

The inputs may switch on, switch off, and switch over analysis cases, for example. The inputs can also be used to activate other functions, such as EasyTeach or measurement data output triggering.

The outputs can be used as digital switching outputs, for example to ground (PNP) (depending on the device type). For each output, it is necessary to define whether it is to be switched by the field evaluation application or by means of SOPAS ET telegrams, or whether it is being used to signal device readiness. If the field evaluation application is being used to switch an output, the sensor may signal evaluation field breaches or contour breaches. In SOPAS ET, you can configure which evaluation affects which output.

7.8 Some useful functions

🔍 button: Resets scan display to default view.

⠿ And ⌁ button: Displays measured values as points or lines.

🔄 button: Freely rotates scan display.

🔷 perspective cube: Changes perspective of the laser scanner.

7.9 Configuring the device

1. Set the desired configuration data in the **Basic settings** and **Interfaces** views (buttons under the menu bar).
2. Finally, permanently save the configuration in the **Finish** view:
   ° Click the **Save permanent** button to save the parameter set in the device.
   ° Click the **Export...** button to save the parameter set on the computer.

8 Technical data

8.1 Features

Measurement principle	HDDM+
Application	Outdoor
Light source	Infrared (wavelength 850 nm, max. output power 1.26 W, pulse duration 3.5 ns, average power 4.0 mW)
Laser class	Laser class 1 (EN/IEC 60825-1:2014, EN/IEC 60825-1:2007) Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.
Horizontal aperture angle	275°
Scan field flatness	Conical error: ± 0.6° Tilt: ± 0.6°
Scanning frequency	150 Hz, 4 x 37.5 Hz
Angular resolution	0.75°, 0.1875° (interlaced mode), 0.375° (interlaced mode)
Heating	self-heating
Working range	0.2 m ... 64 m
Scanning range with 10% remission	16 m
Scanning range with 90% remission	30 m
Spot divergence	10.4 mrad x 26.2 mrad
Light spot size at front screen	7 mm rounded
Number of echoes evaluated	3

Working range diagram
Scanning range in m

Figure 8: Working area diagram, top view
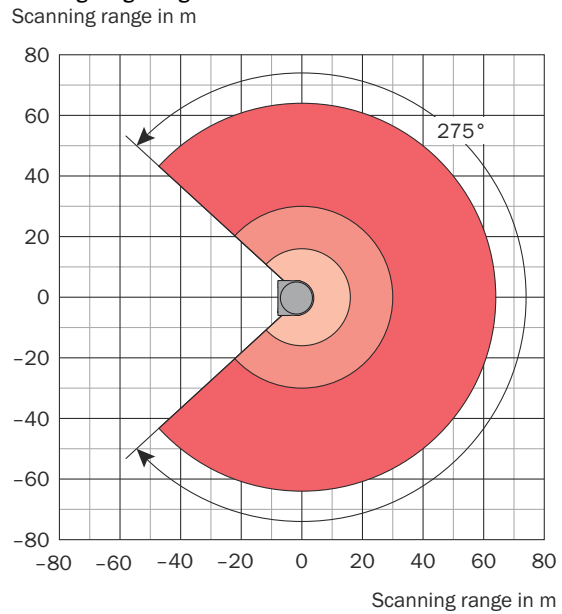
■ Scanning range max. 64 m

■ Scanning range for objects up to 90 % remission 30 m

■ Scanning range for objects up to 10 % Remission 16 m

8.2 Mechanics/electronics

Connection type	3 x M12 round connectors with swivel connector
Supply voltage	10 V DC ... 30 V DC
Permissible residual ripple	±5%
Power consumption	P_{typ} = 18 W P_{start} = 35 W for 5 s (motor start-up) P_{max} = 42 W (with full specified current at all outputs)
Housing	ALSi12 Optics cover: PC
Housing color	Gray (RAL 7042)
Enclosure rating	IP65 (IEC 60529:1989+AMD1:1999+AMD2:2013) IP67 (IEC 60529:1989+AMD1:1999+AMD2:2013)
Protection class	III (IEC 61140:2016-11)
Electrical safety	IEC 61010-1:2010-06
Weight	1.2 kg
Dimensions (L x W x H)	151.9 mm x 150 mm x 92.5 mm
Encoder input frequency	not available
Maximum output current	max. 100 mA per output

[1]   e.g., 30 V*100 mA = 3 W

8.3 Dimensional drawing

LMS1000 device structure and dimensions, dimensions in mm: **A**

8.4 Performance

Scan/frame rate	55000 ... 165000 measuring points/second
Response time	7 ms
Systematic error	± 60 mm Temperature drift: typically ± 0.5 mm/K
Statistical error	≤ 30 mm
Integrated application	Integrated field evaluation with flexible fields, data output
Number of field sets	Up to 10 fields
Simultaneous analysis cases	Up to 10 analyses
Filters	Fog filter, particle filter, mean filter, median filter, edge filter, echo filter

[1]   Depends on the object size and selected filter settings.

8.5 Interfaces

| Ethernet	✓, TCP/ IP, UDP/ IP Function: HOST, OPC, NTP Measured data output (distance, RSSI) Data transmission rate: 10/100 Mbit/s
digital inputs/outputs	I/O (8 (multiport))

Output data	Contamination indication, IMU (secondary sensor data)
Optical indicators	2 LEDs
Configuration software	SOPAS ET, web server (display)

8.6 Ambient data

Object remission	2% ... > 1,000% (reflector)
Electromagnetic compatibility (EMC)	EN 61000-6-2:2005 EN 61000-6-3:2007+A1:2011

Vibration resistance	EN 60068-2-6:2007
Shock resistance	EN 60068-2-27:2008
Ambient operating temperature	-30 °C ... +50 °C
Storage temperature	-40 °C ... +75 °C
Operating and storage air humidity	Max 90% air humidity (non-condensing)
Ambient light immunity	80 klx

A
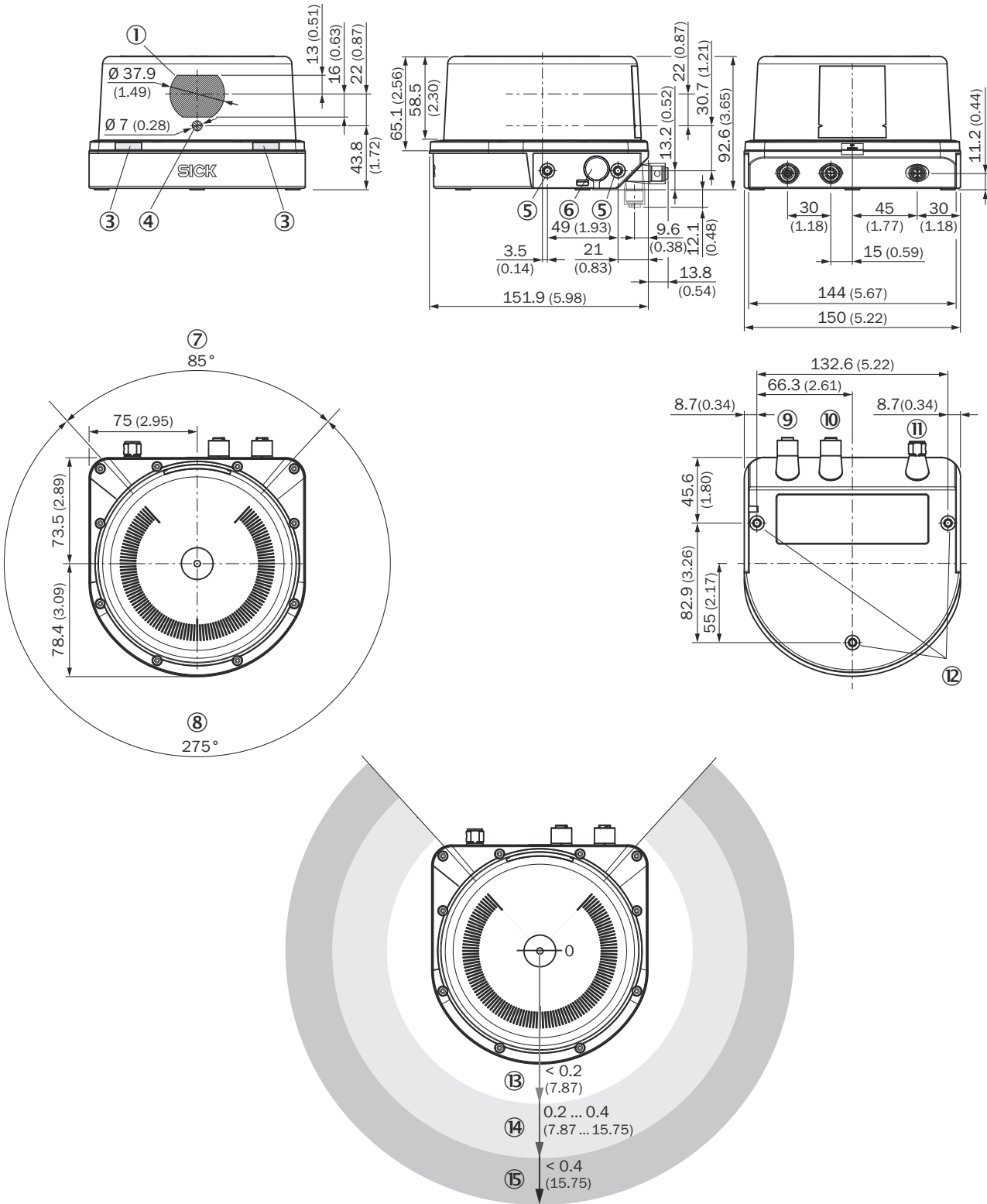
①   Receiver
②   -
③   Status LEDs
④   Sender
⑤   M5x7.5 fixing holes
⑥   Pressure compensation element
⑦   Blind spot
⑧   Field of view
⑨   Ethernet connection
⑩   I/O connection
⑪   PWR connection (supply voltage)
⑫   M5x7.5 fixing holes
⑬   Close range (no detection or measurement possible)
⑭   Detection area
≙   Measuring range