

LMS1xx

LASER MEASUREMENT SENSORS



Described product

LMS1xx

Manufacturer

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Original document

This document is an original document of SICK AG.

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1 About this document

1.1 Information regarding the operating instructions

These operating instructions provide important information on how to handle laser measurement sensors from SICK AG.

Prerequisites for working safely are:

- Adherence to all the specified safety instructions and guidelines.
- Complying with any local work safety regulations and general safety specifications applicable to the use of the laser measurement sensors.

These operating instructions are intended for specialists and electricians.

Important Read these instructions carefully before starting any work on the device to familiarize yourself with the LMS1xx laser measurement sensor and its functions.

The operating instructions are considered a part of the device and must be kept in an accessible location in the immediate vicinity of the LMS1xx at all times, optimally in printed format. 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 operating the machine in which the laser measurement sensor is integrated. For information about this, refer to the operating instructions of the respective machine.

1.2 Scope

These operating instructions are designed to address the technical personnel in regards to safe mounting, electrical installation, commissioning and configuration and maintenance of the following laser measurement sensor variants.

A step-by-setp approach is taken for all tasks.

1.2.1 LMS1xx variants

These operating instructions apply to the following variants:

LMS1xx variant	Range of use/purpose
LMS100	Indoor
LMS111	Outdoor
LMS151/LMS153	Outdoor, with extended functionality
LMS121/LMS122/LMS123/LMS173 Security	Indoor, for object protection systems
LMS131/LMS132/LMS133/LMS141 Core/ LMS141 Prime/LMS182 Security	Outdoor, for object protection systems
LMC121/LMC122/LMC123 VdS	Indoor, for VdS object protection systems
LMC131/LMC132/LMC133 VdS	Semi-Outdoor, for VdS object protection systems

Tab. 1: Variants of the LMS1xx laser measurement sensor



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find further information on these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

Simplified device designation in the document

Below, the LMS1xx laser measurement sensor is referred to in simplified form as "LMS1xx". The exceptions are where distinction between device variants is required because of the technical features or functions are different. In this case the complete type designation (e.g. LMS10x) is used.

1.2.2 Software versions

Software/tool	Function	State
LMS10x/LMS11x/LMS15x	Firmware	From V 1.40
LMS12x/LMS173/LMS13x/ LMS182 LMC12x/LMC13x	Firmware	From V 1.11
LMS14x	Firmware	From V 01.30
LMS10x/LMS11x/LMS15x	Device specific software module for SOPAS ET (device description: *.sdd file)	From V 01.14.00
LMS12x/LMS173/LMS13x/ LMS182	Device specific software module for SOPAS ET (device description: *.sdd file)	From V 01.11.00
LMS14x	Device specific software module for SOPAS ET (device description: *.sdd file)	From V 01.30.00
LMC12x/LMC13x	Device specific software module for SOPAS ET (device description: *.sdd file)	From V 01.00.00
SOPAS ET	Configuration software	From V 02.32 or from V 3.00 (new graphical user interface and functions)

Tab. 2: Software versions

Access to the LMS1xx via the SOPAS ET configuration software is password protected. For details see [section "Interactive configuration using SOPAS ET" on page 84](#).



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

Access to these devices via the SOPAS ET configuration software is described in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

1.3 Depth of information

These operating instructions contain the following information on the LMS1xx:

- Product description
- Transport and storage
- Mounting
- Electrical installation
- Commissioning and configuration
- Maintenance
- Troubleshooting
- Technical data

In addition, an online help is available in the SOPAS ET configuration software supplied; this help provides information on the usage of the software user interface, as well as on the configuration of the LMS1xx.



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find further information on these devices, in particular on installation and mounting, electrical installation, commissioning and configuration, in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.



You will find a detailed description of the different telegrams for the LMS1xx/LMC1xx in the document "Telegram Listing Laser Measurement Sensor", part no.: 8014631, issue in English.

You will find further information on the LMS1xx/LMC1xx, its accessories as well as documents on the online product page.

Please see [section 1.5 "Further information" on page 9](#).

1.4 Explanation of symbols

Warnings in these operating instructions are indicated by symbols. The warnings are introduced by signal words that indicate the extent of the danger.

- These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

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.

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

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

Important Sections marked "Important" provide information about special features of the device.

Explanation Explanations provide background knowledge on technical relationships.

MENU COMMAND This typeface indicates a term in the SOPAS ET user interface.

Terminal output This typeface indicates messages that the LMS1xx outputs via its interfaces.

➤ **Take action ...** Here you must do something. This symbol indicates an instruction to perform an action that contains only one action or actions in warnings where a specific sequence does not need to be followed. Instructions to perform actions that contain several steps in sequence are numbered.



This symbol refers to additionally available documentation.



Software notes show where you can make the appropriate settings and adjustments in the SOPAS ET configuration software.

1.5 Further information

LMS1xx

Important All the documentation available can be found on the online product page at:

➤ <http://www.sick.com/lms1xx>

The following information is available for download there:

- Model-specific online data sheets for device variants, containing technical data, dimensional drawings, and working range diagrams
 - EU declaration of conformity for LMS1xx/LMC1xx product families
 - Dimensional drawings and 3D CAD dimension models in various electronic formats
 - Working range diagrams
 - These “LMS1xx laser measurement sensors“ operating instructions, in English (part no. 8012471) and German (part no. 8012470), and other languages (if applicable)
 - “Laser Measurement Sensor” telegram listing, in English (part no. 8014631)
 - "Laser Measurement Systems of the LMS100 Product Family" product information, in English (part no. 8012468) and German (part no. 8012467), and other languages (if applicable)
 - Publications dealing with accessories
-

LMC12x/LMC13x

Important All the documentation available can be found on the online product page at:

➤ <http://www.sick.com/lmc1xx>

The following information is available for download there:

- Model-specific online data sheets for device variants, containing technical data, dimensional drawings, and working range diagrams
- EU declaration of conformity for LMS1xx/LMC1xx product families
- Dimensional drawings and 3D CAD dimension models in various electronic formats
- Working range diagrams
- These “LMS1xx laser measurement sensors“ operating instructions. In English (part no. 8012471) and German (part no. 8012470), and other languages (if applicable)
- “LMS12x/LMS13x/LMS14x Security“ technical information (installer instructions) as supplement to the operating instructions, in English (part no. 8014487) and German(part no. 8014486), and other languages (if applicable)
- “LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS“ technical information (installer instructions VdS) as supplement to the operating instructions, in English (part no. 8013749) and German (part no. 8013748), and other languages (if applicable)
- Laser Measurement Sensor” telegram listing, in English (part no. 8014631)

- "Laser Measurement Systems of the LMS100 Product Family" product information in English (part no. 8012468) and German (part no. 8012467), and other languages (if applicable)
-

1.6 Customer service

Do not hesitate to contact our customer service should you require any technical information. Please refer to the back page of these operating instructions for your agent's contact details.

Important Before calling, make a note of all type label data such as type code, serial number, etc. to ensure faster processing.

2 For your safety

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

- Please read this chapter carefully before working with the LMS1xx.

2.1 Correct use

The LMS1xx is a non-contact optical distance measurement sensor for stand-alone or network operation. It is suitable for applications in which precise, electro-sensitive measurements of contours and surroundings are required. It is also possible to create systems, for instance, for collision protection, for building surveillance or for access monitoring.

It must be initialized only by qualified personnel and only in industrial environments.

Important The LMS1xx is only allowed to be operated in the ambient temperature range allowed (see [section 10.1 “Data sheet LMS1xx/LMC1xx laser measurement sensor” on page 91](#)).

2.2 Incorrect use

- The LMS1xx does not constitute a safety component according to the EC Machinery Directive (2006/42/EC).
- The LMS1xx is not a device for the protection of people in the context of the related safety standards for machinery.
- The LMS1xx must not be used in explosion hazard areas.
- Any other use that is not described as correct use is prohibited.
- The use of accessories not specifically approved by SICK is at own risk.

2.3 IP technology

NOTICE

SICK uses standard IP technology in its products. The emphasis is placed on availability of products and services.

SICK always assumes the following prerequisites:

- The customer will ensure the integrity and confidentiality of the data and rights affected by the use of the aforementioned products.
 - In all cases, appropriate security measures, such as network separation, firewalls, virus protection, and patch management, is to be taken by the customer on the basis of the situation in question.
-

2.4 Limitation of liability

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

- Failing to observe the operating instructions
- Incorrect use of the device
- Use by untrained personnel
- Unauthorized conversions
- Technical modifications
- Use of unauthorized spare parts, consumables and accessories

With special variants, where optional extras have been ordered, or owing to the latest technical changes, the actual scope of delivery may vary from the features and illustrations shown here.

2.5 Modifications and conversions

NOTICE

Modifications and conversions to the LMS1xx and/or the installation may result in unforeseeable dangers.

In case of any other usage as well as in case of modifications to the LMS1xx, e.g. due to opening the housing during mounting and electrical installation, or to the SICK software, any claims against SICK AG under the warranty will be rendered void.

Before any technical modifications to and expansions of the LMS1xx, the prior written approval of the manufacturer must be obtained.

2.6 Requirements for skilled persons and operating personnel

WARNING

Risk of injury due to insufficient training!

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

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

These operating instructions list the training requirements for the various fields of activity, as follows:

- **Instructed personnel** have been given a briefing by the operator about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnel** have the specialist training, skills, and experience, as well as knowledge of the relevant regulations, to be able to perform tasks delegated to them and to detect any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions to be able to carry out work on electrical systems and to detect any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e. g. Master Electrician). Other relevant regulations applicable in other countries must be observed.

The following qualifications are necessary for the various tasks:

Activities	Qualification
Mounting and maintenance	<ul style="list-style-type: none"> • Basic technical training • Knowledge of the current safety regulations in the workplace
Electrical installation and replacement	<ul style="list-style-type: none"> • Practical electrical training • Knowledge of current electrical safety regulations
Commissioning, operation and configuration	<ul style="list-style-type: none"> • Basic knowledge of the Windows operating system • Basic knowledge of data transmission
Operation of devices in the related application	<ul style="list-style-type: none"> • Knowledge on the use and operation of devices in the related application (e.g. crane, assembly system) • Knowledge on the software and hardware environment in the related application (e.g. crane, assembly system)

Tab. 3: Authorized personnel

2.7 Hazard warnings and operational safety

Please observe the safety notes and the warnings listed here and in other chapters of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.



WARNING

Safety notes

Please observe the following items in order to ensure the correct and safe use of the LMS1xx.

- The notices in these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- When operating the LMS1xx, the national, local and statutory rules and regulations must be observed.
- National/international rules and regulations apply to the installation, commissioning, use and periodic technical inspections of the laser measurement sensor, in particular:
 - the work safety regulations/safety rules
 - other relevant health and safety regulations
- Manufacturers and operators of the machine/system on which the LMS1xx is installed are responsible for obtaining and observing all applicable safety regulations and rules.
- The tests must be carried out by specialist personnel or specially qualified and authorized personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- The operating instructions must be made available to the operator of the system where the LMS1xx is fitted. The operator of the system is to be instructed in the use of the device by specialist personnel and must be instructed to read the operating instructions.

2.7.1 Laser radiation

The LMS1xx operates with a infrared-light laser diode. The laser beam cannot be seen with the human eye.



CAUTION

Laser radiation!

The LMS1xx corresponds to laser class 1 (eye safe) as per EN/IEC 60825-1:2014. Identical laser class for issue EN/IEC 60825-1:2007.

Complies with 21 CFR 1040.10 with the exception of the deviations as per Laser Notice No. 50, Juin, 2007.

- Incorrect usage can result in hazardous exposure to laser radiation.
- Do not open the housing (opening the housing will not switch off the laser).
- Pay attention to the laser safety regulations as per IEC 60825-1 (latest version).

Important No maintenance is necessary to ensure compliance with laser class 1.

Laser power

The laser operates at a wavelength $\lambda = 905$ nm (invisible infrared light). The radiation emitted in normal, appropriate operation is not harmful to the eyes and human skin.

Laser output aperture

The laser output aperture is the window of the optics cover on the.

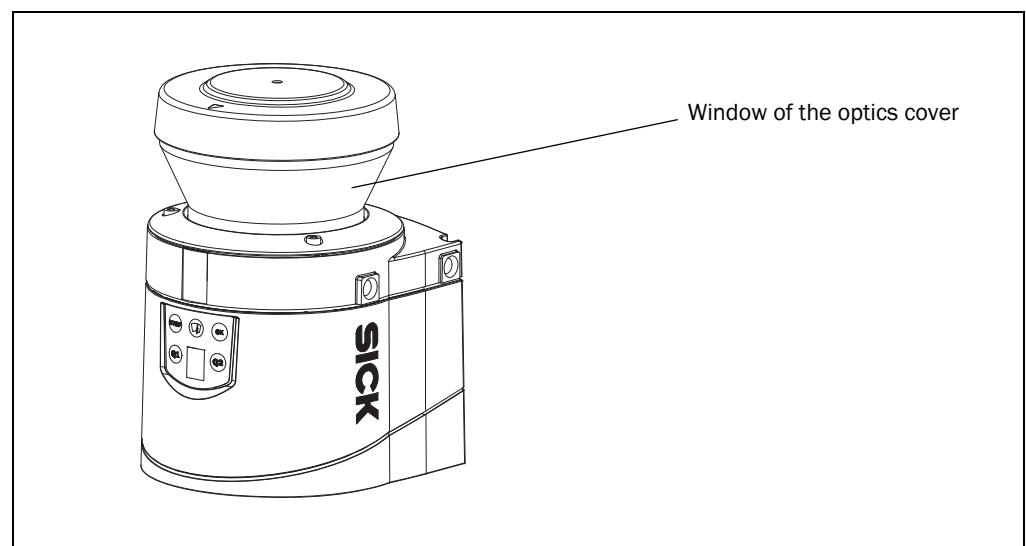


Fig. 1: Laser output aperture

2.7.2 Electrical installation work

NOTICE

- Only authorized specialists are allowed to perform the skilled electrical installation work.
- Only make and disconnect electrical connections when the device is electrically isolated.
- Select and implement wire cross-sections and their correct fuse protection as per the applicable standards.
- Do not open the housing.
- Observe the current safety regulations when working on electrical systems.

2.8 Quick stop and Quick restart

2.8.1 Switching off the LMS1xx

LMS10x/LMS12x/LMS17x:

- Switch off voltage supply (power supply unit)

LMS11x/LMS13x/LMS14x/LMS15x/LMS18x as well as LMC12x/LMC13x:

- Switch off voltage supply (supply unit) or disconnect the M12 supply cable on the device.

The LMS1xx retains configurations parameters stored in the internal, non-volatile memory. Measured values on the data interface are lost.

2.8.2 Switching back on the LMS1xx

LMS10x/LMS12x/LMS17x:

- Switch on voltage supply (power supply unit)

LMS11x/LMS13x/LMS14x/LMS15x/LMS18x as well as LMC12x/LMC13x:

- Switch on voltage supply (supply unit) or re-connect the M12 supply cable on the device.

The LMS1xx re-commences operation with the configurations parameters last saved.

2.9 Environmental protection

The LMS1xx has been designed to minimize environmental impact. It uses only a minimum of power.

2.9.1 Power consumption

LMS1xx variant	Max. power consumption during operation
LMS100/LMS12x/LMS173/LMC12	Sensor: Max. 10 W
LMS111/LMS13x/LMS14x/LMS15x/LMS182/ LMC13x	Sensor: Max. 10 W Heating: Additionally max. 45 W

Tab. 4: LMS1xx variants: Maximum of power consumption

While working, always act in an environmentally responsible manner.

2.10 Repair

NOTICE

Repairs to the LMS1xx are only allowed to be undertaken by trained and authorized service personnel from SICK AG. Any manipulation or modification of the LMS1xx by the customer will invalidate the manufacturer warranty.

3 Product description

This chapter provides information on the special features and properties of the LMS1xx. It describes the construction and the operating principle of the device, in particular the different operating modes.

Please read this chapter before mounting, installing and commissioning the device.

3.1 Delivery

The LMS1xx delivery includes the following components:

Quantity	Components	Comment
1	An LMS1xx laser measurement sensor	Model type depends on order. Outdoor variants: M12-round plug-in connectors equipped with protection caps and plugs made of plastic
1	Type-specific notes on device with electrical circuit diagram for getting started	Is included in the LMS1xx packaging

Tab. 5: Delivery

An overview about the available LMS1xx variants, its accessories and, device documentation is available from the web product page:

➤ <http://www.sick.com/lms1xx>

The configuration software SOPAS ET, the current system prerequisites for the PC, and the instructions for downloading the software and the device description file(s) can be found online at:

➤ http://www.sick.com/SOPAS_ET

[Section 11.1 “Ordering information” on page 104](#) provides an overview of available consumables.

3.2 Device variants

Type	Special features	Heating	Enclosure rating
LMS10x	Indoor variant	No	IP 65
LMS11x	Outdoor variant	Yes	IP 67 ¹⁾
LMS15x	Outdoor version with extended functionality	Yes	IP 67 ¹⁾
LMS12x LMC12x LMS173	Indoor variant, optimized for usage in object protection systems	No	IP 65
LMS13x LMS14x LMS182	Outdoor variant, optimized for usage in object protection systems	Yes	IP 67 ¹⁾
LMC13x	Semi-outdoor variant, optimized for usage in object protection systems	Yes	IP 67 ¹⁾

1) Under the following conditions: the cables plugged into the M12 round plug-in connections must be screwed tight. Any electrical connections that are not being used must be fitted with protective caps or plugs that are screwed tight (as in the delivery condition). The M8 connection on the front is screwed tight.

Tab. 6: Device variants of the LMS1xx

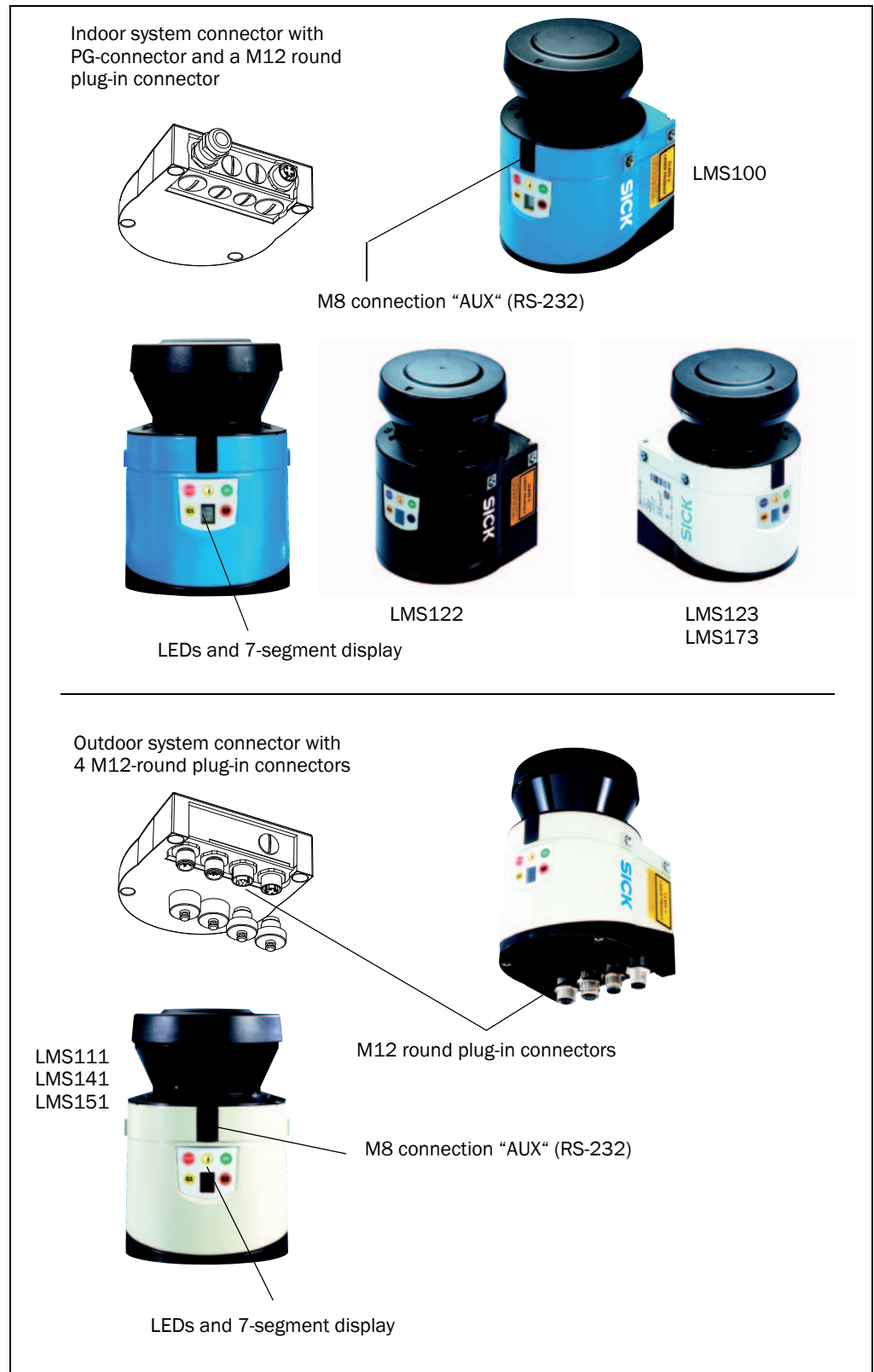


Fig. 2: View of the LMS1xx device variants

3.3 Type code

3.3.1 Marking scheme of LMS variants (without special devices)

LMS a b c - dd e 00

Placeholder	Characteristics	Variant
a	Device family	1: LMS1xx
b	Variant	0: Indoor housing without heating, IP 65 1: Outdoor housing with heating, IP 67 2: Security indoor housing without heating, IP 65 3: Security outdoor housing with heating, IP 67 4: Security outdoor housing with heating, IP 67, scanning range max. 40 m 5: Outdoor housing with heating, IP 67, scanning range max. 50 m 7: Security indoor housing without heating, IP 65, special device 8: Security outdoor housing with heating, IP 67, special device
c	Housing color	0: blue 1: gray 2: black 3: white
dd	Performance	05: Core, with extended ambient temperature range -40 °C ... + 60 °C 10: Standard/Prime 11: VdS certified 15: Standard /Prime, with extended ambient temperature range -40 °C ... + 60 °C
e	Connectivity	0: System connector/PG 1: M12 Standard

Tab. 7: Type code of LMS1xx

Not all possible combinations are available according to the type code.

3.3.2 Marking scheme of LMC variants (without special devices)

LMC a b c - dd e ff

Placeholder	Characteristics	Variant
a	Device family	1: LMC1xx
b	Variant	2: Security indoor housing without heating, IP 65 3: Security outdoor housing with heating, IP 67
c	Housing color	1: gray 2: black 3: white 4: black (sensor) / installation set uncoated
dd	Performance	11: VdS certified
e	Connectivity	0: System connector/PG 1: M12 Standard
ff	Mounting types	00: installation set VdS 1 01: installation set VdS 2

Tab. 8: Type code of LMC1xx

Not all possible combinations are available according to the type code.

3.4 Special features of the LMS1xx

Variant	Special features
All	<ul style="list-style-type: none"> Field of view maximum 270° Resolution of the angular step width: 0.25/0.50° Scanning frequency 25/50 Hz Flexible system configurations Configuration/measured value request using telegrams (command strings) 2 digital switching inputs Data interfaces Ethernet, RS-232, CAN (for the connection of an I/O module) <p>Measured value output (raw data)</p> <ul style="list-style-type: none"> electro-sensitive, active measurement technique measurement of objects with almost any shape measured value output for a second reflection pulse (e.g. in rain or on measurement through a window) <p>Integrated field application</p> <ul style="list-style-type: none"> Up to 10 configurable evaluation fields (depends on LMS1xx variant) Monitoring of the evaluation field contours Switching of the evaluation fields using digital switching inputs Encoder inputs (not for LMS12x/LMS13x/LMS14x) Additional output of the evaluation field (unoccupied or infringed) via switching outputs or telegrams
LMS10x	<ul style="list-style-type: none"> Scanning range up to 20 m with > 13% object remission (18 m with 10% object remission) Indoor housing with protection class IP 65 3 digital switching outputs
LMS11x	<ul style="list-style-type: none"> Scanning range up to 20 m with > 13% object remission (18 m with 10% object remission) Outdoor housing with protection class IP 67 3 digital switching outputs
LMS12x LMS173	<ul style="list-style-type: none"> Scanning range up to 20 m with > 13% object remission (18 m with 10% object remission) Indoor housing with protection class IP 65 Optimized for usage in object protection systems 2 additionally digitale switching inputs Relay switching outputs Digital sabotage output
LMS13x LMS182	Like LMS12x, however <ul style="list-style-type: none"> Outdoor housing with protection class IP 67
LMS14x	Like LMS12x, however <ul style="list-style-type: none"> Scanning range up to 30 m with > 10% object remission Outdoor housing with protection class IP 67 Optimized for usage in object protection systems Relay switching outputs <p>LMS14x Core: the device sends the measured contour values via RS-232/Ethernet only with low refresh rate. The data can only be used for visualization and configuration on the PC.</p>
LMS15x	Like LMS11x, however <ul style="list-style-type: none"> Scanning range up to 50 m with > 75 % object remission (18 m with 10% object remission)

Tab. 9: Special features of the LMS1xx variants



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find further information on the special features of these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English. Please see [section 1.5 "Further information" on page 9](#).

3.5 Controls and status indicators

3.5.1 User interface

In normal operation the LMS1xx fully automatically without the intervention of an operator. The interactive configuration is carried out using the provided SOPAS ET configuration software. The software used for this purpose runs on a PC that is connected to the LMS1xx via one of the interfaces.

Use the graphic scan view in SOPAS ET to verify the generated measured values and to verify the measurement area online. During this process, note that the field evaluation monitor cannot display the data in real-time and therefore does not display all measured values.

3.5.2 Status indicators

The LEDs and the 7-segment display indicate the operational status of the LMS1xx.



Fig. 3: Status indicators






Important On the LMS1xx, along with the standard displays described below, the indication functions of the LEDs and the 7-segment display can be configured in SOPAS ET.
PROJECT TREE, LMS..., PARAMETER, NETWORK/INTERFACES/IOs, DISPLAY.



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find further information on the status indicators of these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English. Please see [section 1.5 "Further information" on page 9](#).

LEDs

Display	Possible cause
	LMS1xx measuring and no error reported
	LMS1xx either not measuring (stopped by user) or measuring with error events
	OFF: no contamination (optics cover) ON: contamination warning Blinking: contamination error
	At least one field is infringed (see section 3.9.3 "Operator for the evaluation cases on the output" on page 45)
	LMS1xx in the teach-in mode

Tab. 10: Meaning of the LEDs of the LMS1xx

Further information see [section 9.2 "Error displays of the LEDs" on page 89](#).

7-segment display

Used for diagnostics on occurring errors or malfunctions (see [section 9.3 "Indications of the 7-segment display" on page 90](#)).

3.6 Operating principle of the LMS1xx

The LMS1xx is an electro-optical laser measurement sensor that electro-sensitively scans the perimeter of its surroundings in a plane with the aid of laser beams. The LMS1xx measures its surroundings in two-dimensional polar coordinates. If a laser beam is incident on an object, the position is determined in the form of distance and direction.

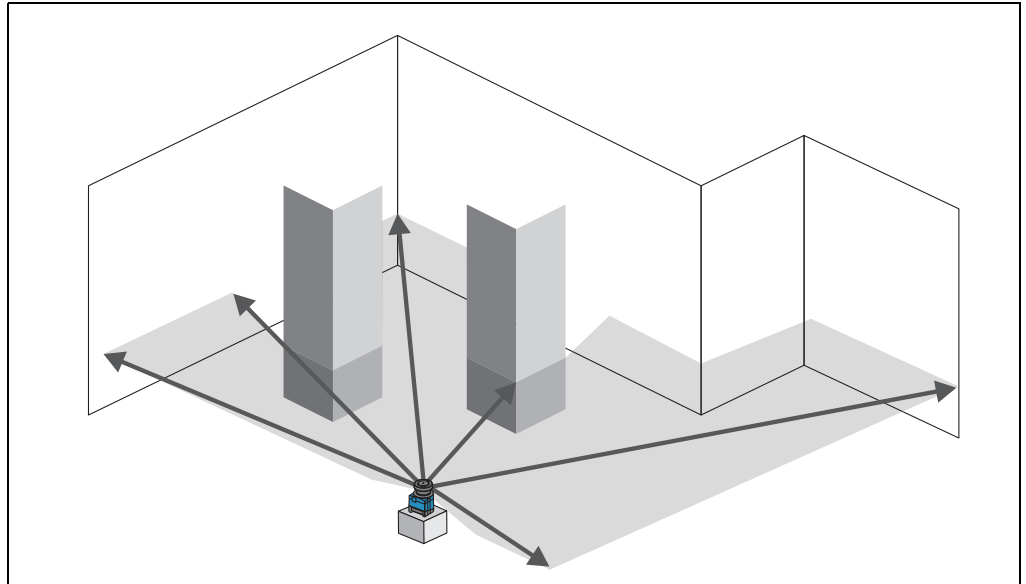


Fig. 4: Measuring principle of the LMS1xx

Scanning takes place in a sector of 270°. The scanning range of the LMS1xx is type-dependent maximum up to 50 m on light, natural surfaces (e.g. a white house wall).

Distance measurement

The LMS1xx emits pulsed laser beams using a laser diode. If such a laser pulse is incident on an object or a person, it is reflected at its surface. The reflection is detected in the receiver of the LMS1xx using a photodiode.

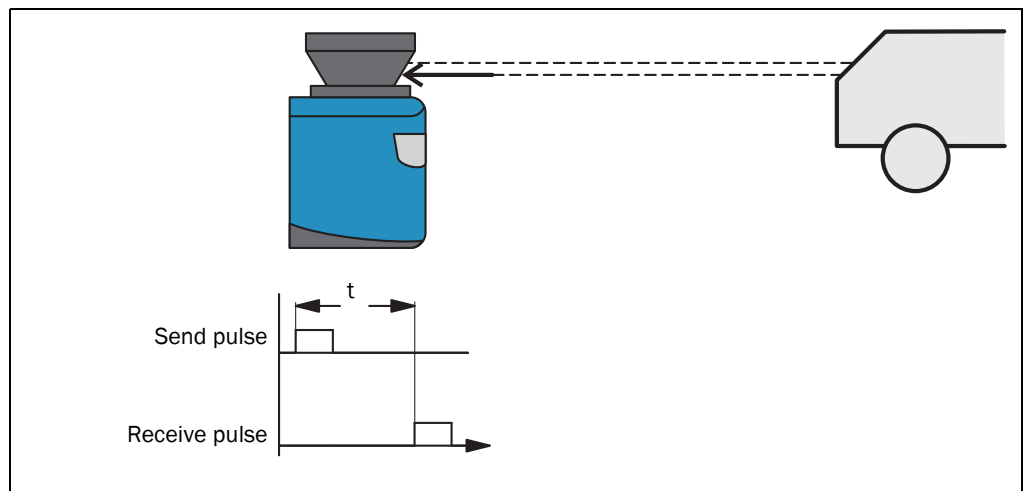


Fig. 5: Principle of operation for pulse propagation time measurement

The distance to the object is calculated from the propagation time that the light requires from emission to reception of the reflection at the sensor. This principle of “pulse propagation time measurement” is used by radar systems in a similar manner (see also [section 3.8.4 “Measured value output for a second reflected pulse” on page 38](#)).

Direction measurement

The emitted laser beams are deflected using a mirror and scan the surroundings in a circular manner. The measurements are triggered at regular steps using an angular encoder.

The LMS1xx scans with a scanning frequency of 25 or 50 Hz. During this process, a laser pulse and therefore a measurement is triggered after an angular step of 0.25° or 0.50° .

Influences of object surfaces on the measurement

The signal received from a perfectly diffuse reflecting white surface corresponds to the definition of a remission of 100%. As a result of this definition, the remissions for surfaces that reflect the light bundled (mirrored surfaces, reflectors), are more than 100%.

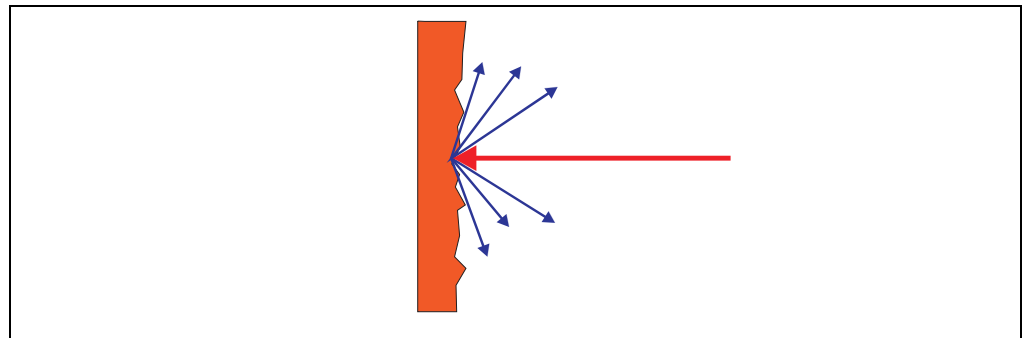


Fig. 6: Reflection of the laser beam at the surface of an object

The majority of surfaces reflect the laser beam diffusely in all directions.

The reflection of the laser beam will vary as a function of the surface's structure and color. Light surfaces reflect the laser beam better than dark surfaces and can be detected by the LMS1xx over larger distances. Bright white plaster reflects approx. 100% of the incident light, black foam rubber approx. 2.4%. On very rough surfaces, part of the energy is lost due to shading. The scanning range of the LMS1xx will be reduced as a result.

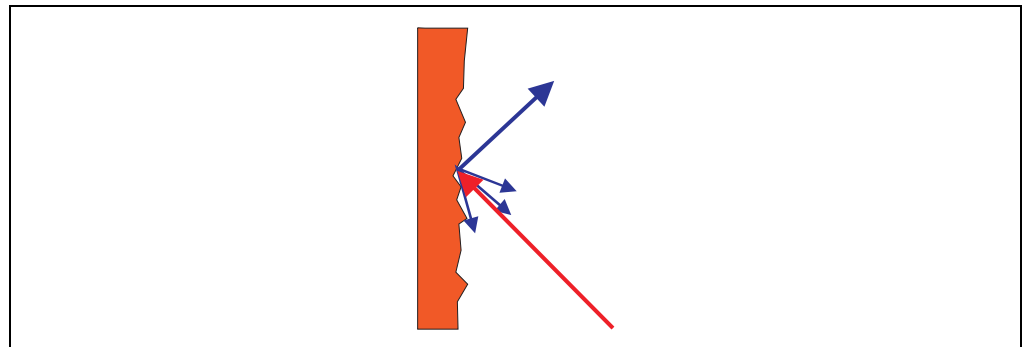


Fig. 7: Reflection angle

The reflection angle is the same as the angle of incidence. If the laser beam is incident perpendicularly on a surface, the energy is optimally reflected ([Fig. 6](#)). If the beam is incident at an angle, a corresponding energy and scanning range loss occurs ([Fig. 7](#)).

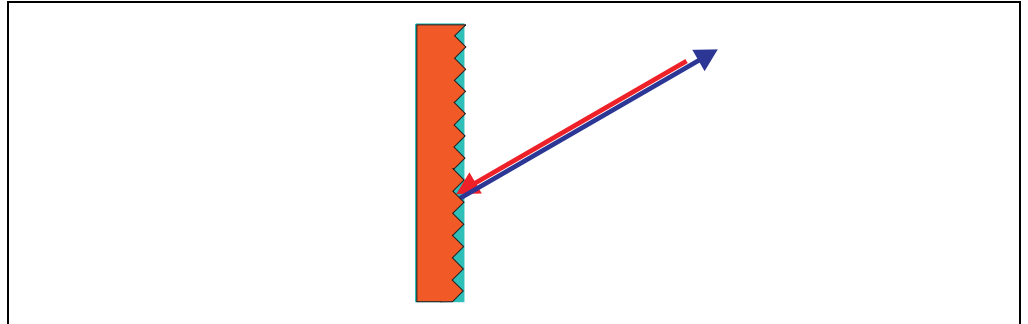


Fig. 8: Degree of reflection

If the reflected energy returned is over 100% (basis: Kodak standard) the incident beam is not reflected diffusely in all directions, but is reflected in a specific direction (Fig. 8). As a result a large portion of the energy emitted can be received by the laser distance measurement device. Plastic reflectors (“cats’ eyes”), reflective tape and triple prisms have these properties.

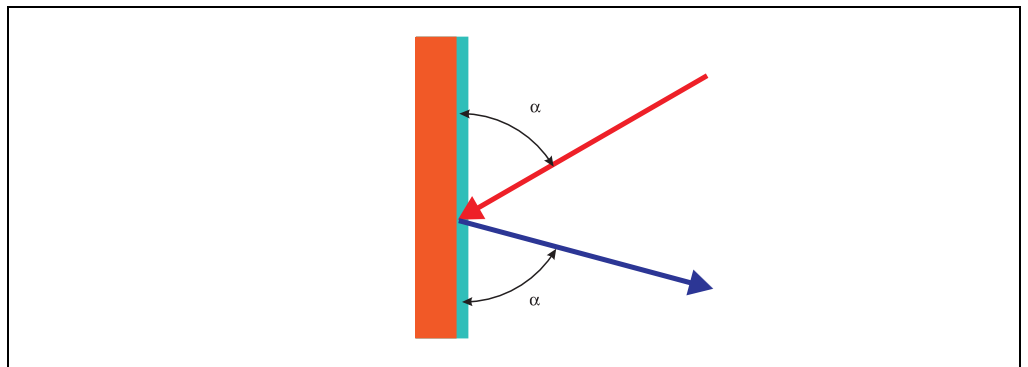


Fig. 9: Mirror surfaces

At mirror surfaces the laser beam is almost entirely deflected (Fig. 9).

Instead of the surface of the mirror, it is possible that the object on which the deflected laser beam is incident may be detected.

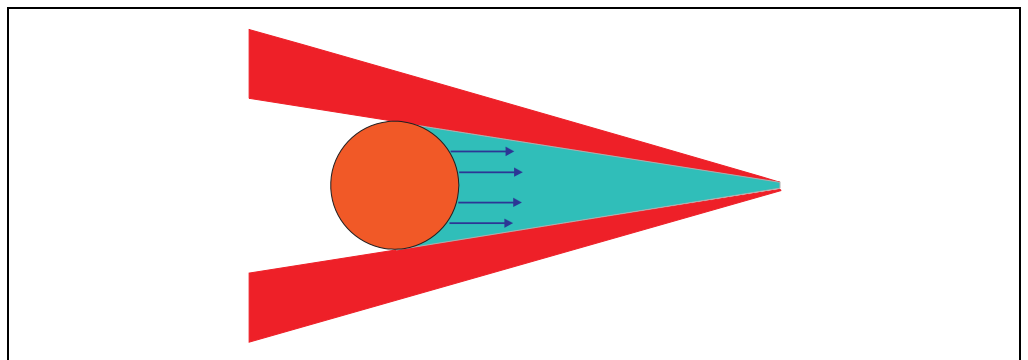


Fig. 10: Object smaller than diameter of the laser beam

Objects that are smaller than the diameter of the laser beam cannot reflect all the energy of the laser light (Fig. 10). The energy in the portion of the laser light that is not reflected is lost. This means that the scanning range is less than would be possible theoretically based on the surface of the object.

3.6.1 Scanning range of the LMS1xx

The scanning range of the LMS1xx is dependent on the remission of the objects to be detected. The better a surface reflects the incident radiation, the greater the scanning range of the LMS1xx. The diagrams in [Fig. 11](#), [Fig. 12](#) and [Fig. 13 on page 27](#) indicate the relationship between remission and detectability for different LMS1xx variants.

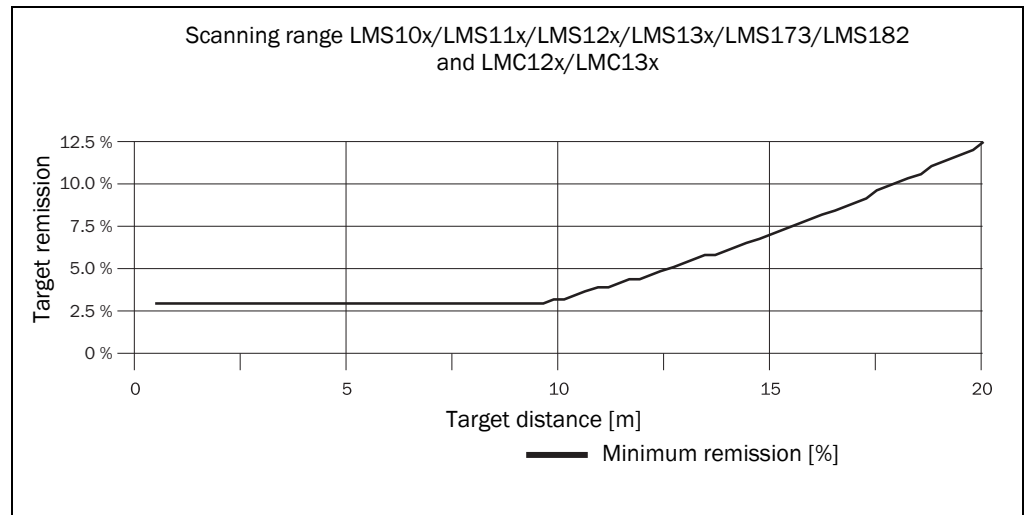


Fig. 11: LMS10x/LMS11x/LMS12x/LMS13x/LMS173/LMS182 and LMC12x/LMC13: Scanning range as a function of the target remission

Up to a distance of 10 m the LMS1xx can detect objects from 3% remission. At a distance of 20 m objects are only detected if they have a remission > 13% ([Fig. 11](#)). The LMS14x only detects objects at a distance up to 16 m from 3% remission ([Fig. 12](#)), the LMS15x only detects objects at a distance up to 10 m from 3% remission ([Fig. 13 on page 27](#)).

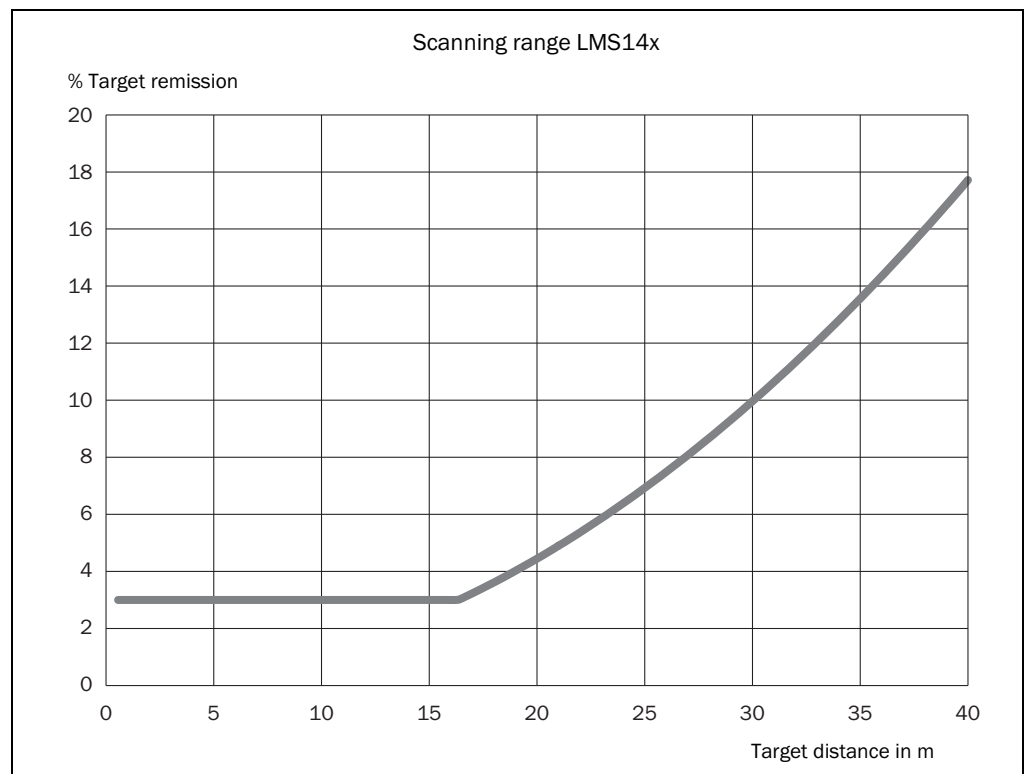


Fig. 12: LMS14x: Scanning range as a function of the target remission

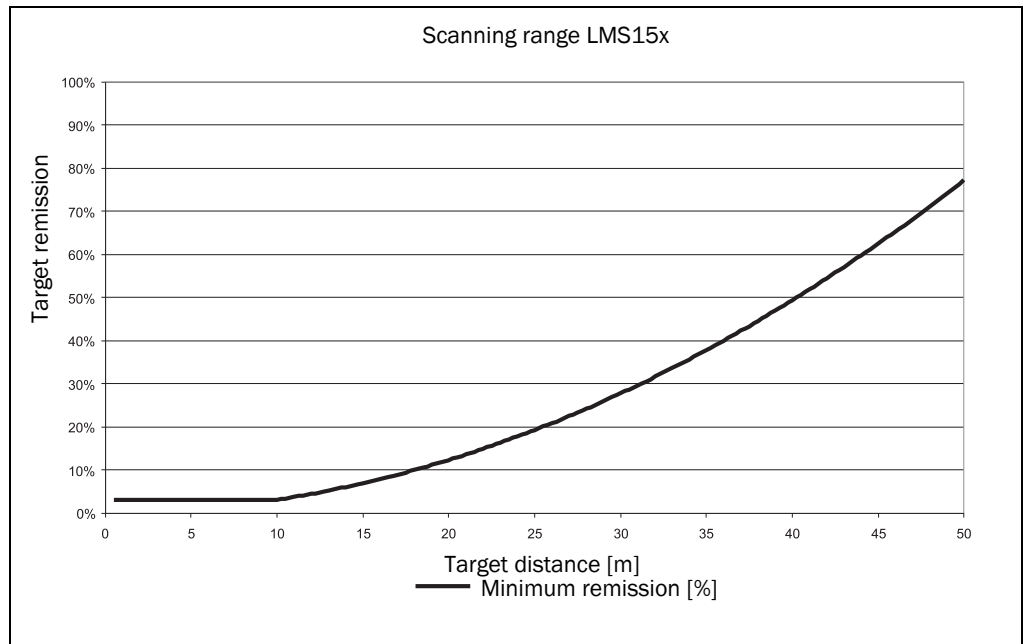


Fig. 13: Scanning range of the LMS15x as a function of the target remission

Important The diagrams in [Fig. 11 on page 26](#), [Fig. 12 on page 26](#) and [Fig. 13](#) are only applicable if no filters are configured.

3.6.2 Beam diameter and distance between measured points

With increasing distance from the LMS1xx the laser beam of the LMS1xx increases in size. As a result the diameter of the measured point on the surface of the object increases.

The distance-dependent diameter of the measured point is the distance (mm (in)) \times 0.015 rad + 8 mm.

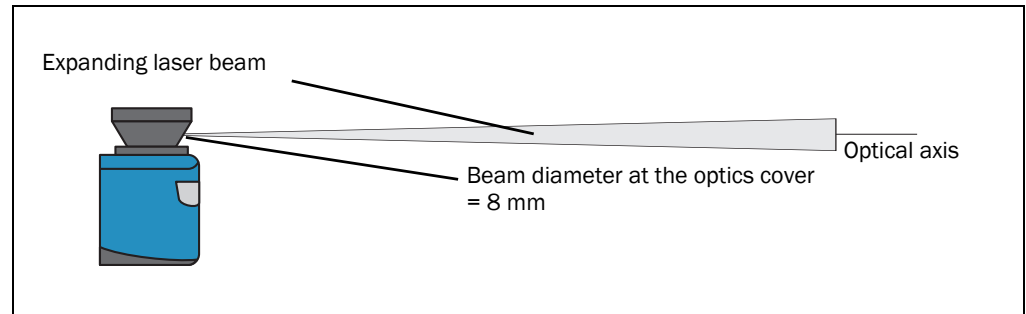


Fig. 14: Beam expansion

With increasing distance from the LMS1xx, the distance between the individual measured points also increases. The distance between the measured points is also dependent on the angular resolution configured. With a coarser resolution, the distance is larger, with a finer resolution the distance is smaller. The distance-dependent spacing between the measured points is the tangent of the angular resolution \times distance.

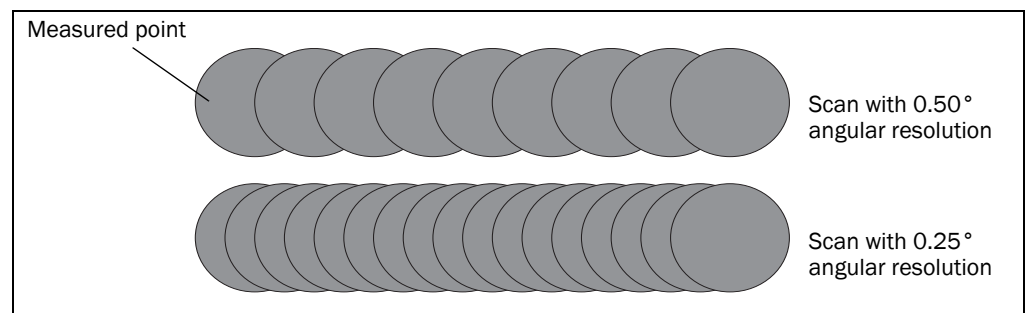


Fig. 15: Schematic layout of the distance between measured points at different angular resolutions

The diagram in [Fig. 16 on page 29](#) shows the beam diameter and the measured point spacing as a function of the distance from the LMS1xx.

Important The beam diameter is always greater than the measured point spacing. As a result full scanning without gaps is ensured.

All LMS1xx variants:

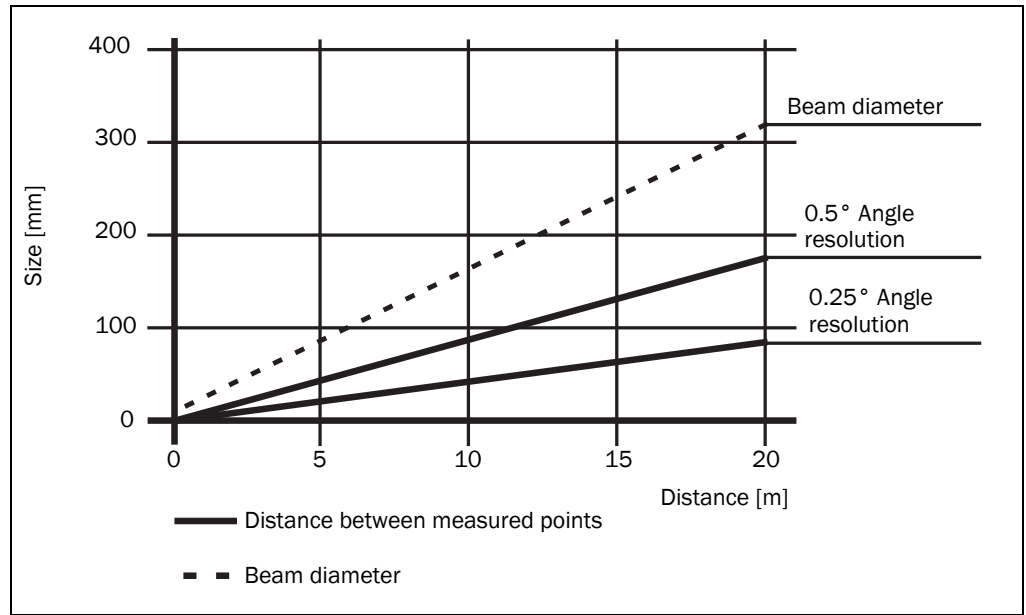


Fig. 16: All LMS1xx variants: Beam diameter and distance between measured points at 0 to 20 m

Example for angular resolution 0.25° in Fig. 16

Distance 10 m

Distance intersection point 10 m gives a distance between the measured points of approx. **40 mm**.

Distance intersection point 10 m with the characteristic curve for the beam diameter gives a beam size of approx. **170 mm**.

Example for angular resolution 0.50° in Fig. 16

Distance 20 m

Distance intersection point 20 m gives a distance between the measured points of approx. **180 mm**.

Distance intersection point 20 m with the characteristic curve for beam diameter gives a beam size of approx. **310 mm**.

LMS14x:

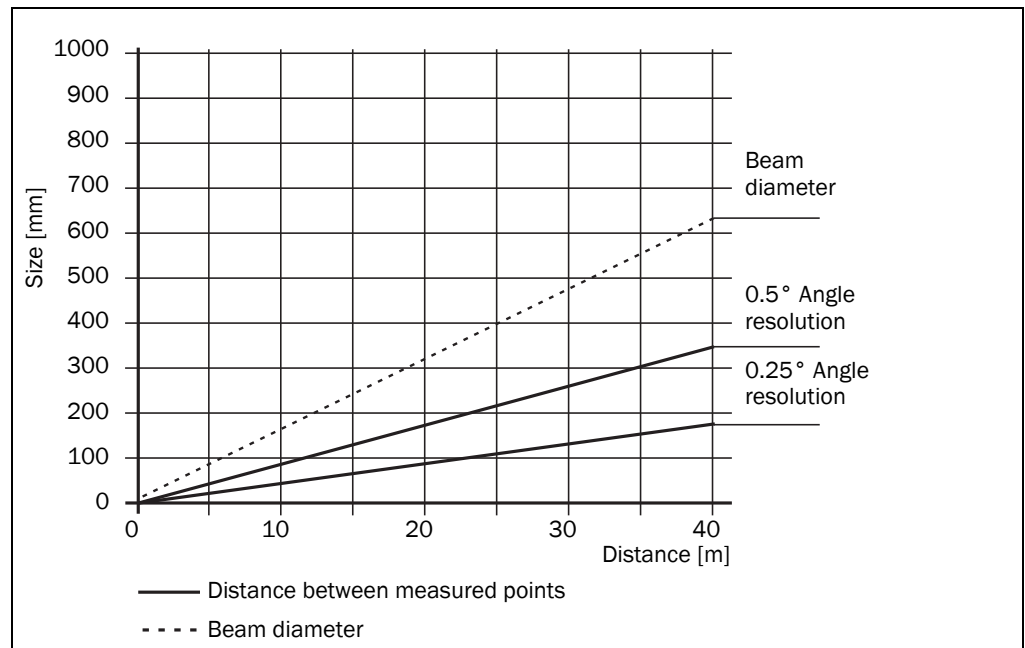


Fig. 17: LMS14x: Beam diameter and distance between measured points at 0 m to 40 m

Example for angular resolution 0,50° in Fig. 17

Distance 40 m

Distance intersection point 40 m gives a distance between the measured points of approx. **350 mm**

Distance intersection point 40 m with the characteristic curve for beam diameter gives a beam size of approx. **608 mm**

LMS15x:

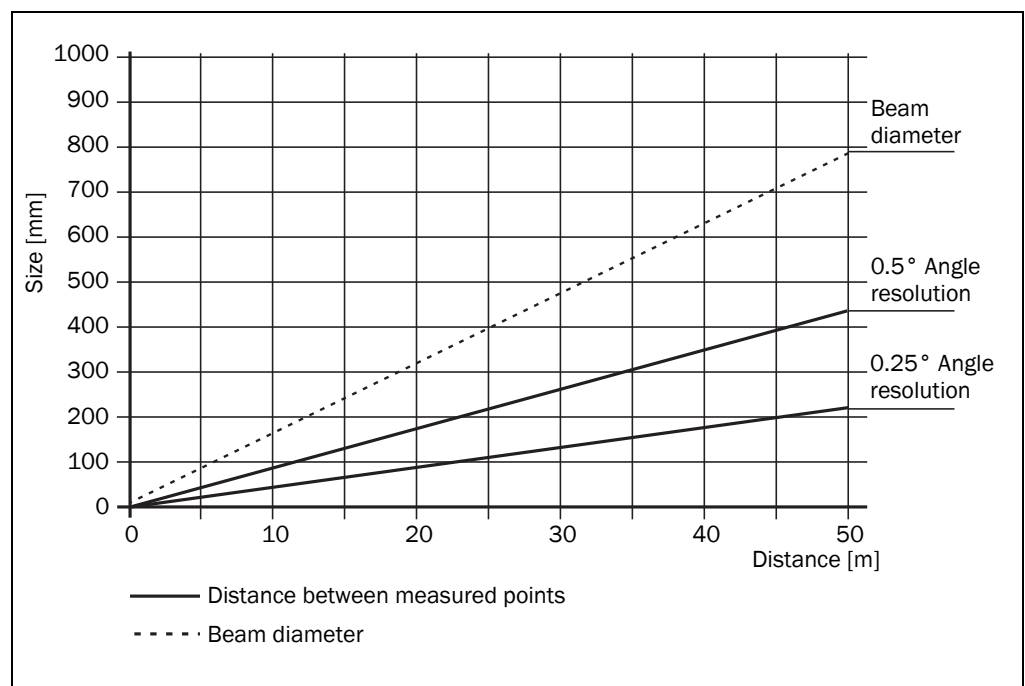


Fig. 18: LMS15x: Beam diameter and distance between measured points at 0 to 50 m

Example for angular resolution 0.50° in Fig. 18 on page 30

Distance 35 m

Distance intersection point 35 m gives a distance between the measured points of approx. **305 mm**.

Distance intersection point 35 m with the characteristic curve for beam diameter gives a beam size of approx. **560 mm**.

3.6.3 Minimum object size

To reliably detect an object, a laser beam must be fully incident on it once. If the beam is partially incident, less energy will be reflected by an object than necessary in some circumstances (see Fig. 10 on page 25).

An object is only reliably fully seen if it is at least as large as the measured point spacing plus the beam diameter.

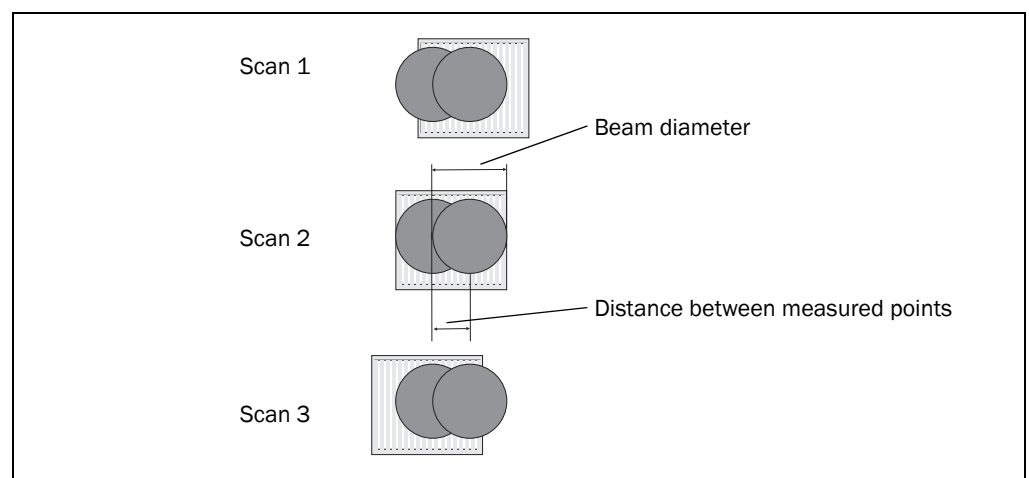


Fig. 19: Minimum object size for detection

In the example in Fig. 19, the beam is fully incident on the object at least once during **each** scan. It will therefore be reliably detected if it has the necessary remission.

How to calculate the minimum object size:

beam diameter + distance between the measured points = minimum object size

- For beam diameter and measured point spacing as a function of the distance from the LMS1xx see the diagram in Fig. 16 on page 29.

Important In particular on the usage of the LMS1xx for measured value output, it is necessary for a reliable measurement that the beam is incident on the object several times. The example shows the minimum size of an object. For a reliable measurement it is important that the beam is incident on the object several times. Therefore an object should be either larger than the minimum object size or the LMS1xx as well as the object should not move.

3.6.4 Contamination measurement

The LMS1xx has an optics cover for protection. This optics cover can become contaminated. The laser beam radiation emitted and received is reduced by the contamination. As a result scanned objects are perceived with a lower remission than they actually have, or no longer measured at all from a certain level of contamination.

For this reason the contamination is measured continuously while the device is in operation. From a certain contamination level, initially a contamination warning is output; if the contamination becomes worse, a contamination error is output and the LMS1xx disables the measurement mode.

Depending on the application in which the LMS1xx is used, you can choose between various strategies for the contamination measurement.



PROJECT TREE, LMS..., PARAMETER, CONTAMINATION MEASUREMENT.

- **Inactive**
No contamination measurement
- **Highly available**
Contamination warning and contamination error are only output on even contamination of the optics cover.
- **Available**
Contamination warning and contamination error are only output on partial contamination of the optics cover.
- **Sensitive**
Contamination warning and contamination error are output even with isolated contamination.

Recommendation The cleaner the application environment, the lower you can set the sensitivity for the contamination measurement. The more exact the measured result must be, the higher you should set the sensitivity of the contamination measurement.

Contamination warning and contamination error are indicated on the LEDs on the LMS1xx (see [section 9.2 “Error displays of the LEDs” on page 89](#)). You can also read these states using telegrams.

Important The LMS14x Core only provides 2 levels when indicating contamination:

- No indication/contamination measurement inactive
 - 80 % contamination warning, 50 % contamination error
-



You will find a detailed description of the different telegrams in the document “Telegram Listing Laser Measurement Sensor”, part no. 8014631, issue in English.

Please see [section 1.5 “Further information” on page 9](#).

A contamination error is also signalled on a digital or external output if this output is configured for the status “Device Ready” (see [section 3.10.3 “Digital switching outputs” on page 45](#)).

Important If you use the “Contour monitoring with blanking” strategy (see [section “Evaluation strategy” on page 42](#)) in the field evaluation application, the contamination measurement should be configured as inactive. If the contamination measurement is active, erroneous detections of contour infringements may occur.

To ensure the reliable operation with deactivated contamination measurement it is recommended to evaluate an external reference contour additional to the measurement data output or detection field. If the LMS1xx is no more detecting the external reference contour, it has to be assumed that there is a significant level of pollution.

3.7 Applications

In principle the LMS1xx can be used for two purposes:

- for the measurement of objects (see [section 3.8 “Measurement of objects” on page 34](#))
- for the detection of objects with evaluation fields (see [section 3.9 “Field application” on page 40](#))

Therefore, the possible applications are very wide-ranging. In particular the following can be stated:

- container loading/handling
- traffic/transport
- robots
- object protection (low false alarm rate)

3.8 Measurement of objects

3.8.1 Basic parameters

The LMS1xx scans with a scanning frequency of 25 or 50 Hz or with an angular resolution of 0.25° or 0.50°. At a higher scanning frequency or a finer angular resolution the LMS1xx supplies more measured values.



PROJECT TREE, LMS..., PARAMETER, BASIC PARAMETERS, areas CURRENT CONFIGURATION and NEW CONFIGURATION.

Important

- The LMS1xx outputs the data after the start of the measurement using the same interface over which the measured values were requested.
- It is only possible to output all measured values of a scan in real-time using the Ethernet interface.

In case of an error, the measured value output is stopped immediately and an error code output that can be evaluated by the application connected. The error code can also be queried via SOPAS ET from the LMS1xx (see [section 9.4 “Detailed error analysis” on page 90](#)).

Important

The LMS14x Core sends the measured contour values via RS-232/Ethernet only with low refresh rate. The data can only be used for visualization or configuration on the PC.

3.8.2 Filter

The LMS1xx has digital filters for the pre-processing and optimization of the measured distance values.

You can configure either a fog filter, a hardware blanking window, an echo filter or a filter for interference suppression.



PROJECT TREE, LMS..., PARAMETER, FILTER.

Fog filter

The fog filter suppresses possible glare due to fog. The LMS1xx becomes less sensitive in the near range (up to approx. 4 m) with the fog filter.

Hardware blanking window

With a blanking window the LMS1xx only supplies measured values from a configured distance. An area in front of the LMS1xx is therefore completely blanked. You can configure a blanking window from 1 to 15 m.

Important A hardware blanking window affects the evaluation fields for the field application (see [section 3.9.2 “Evaluation fields” on page 44](#)):

- Field evaluation is not possible in the area of the blanking window configured.
- Field evaluation is not possible reliably up to 1 m in front of the blanking window configured.
- Field evaluation is possible reliably from 2 m in front of the blanking window configured.

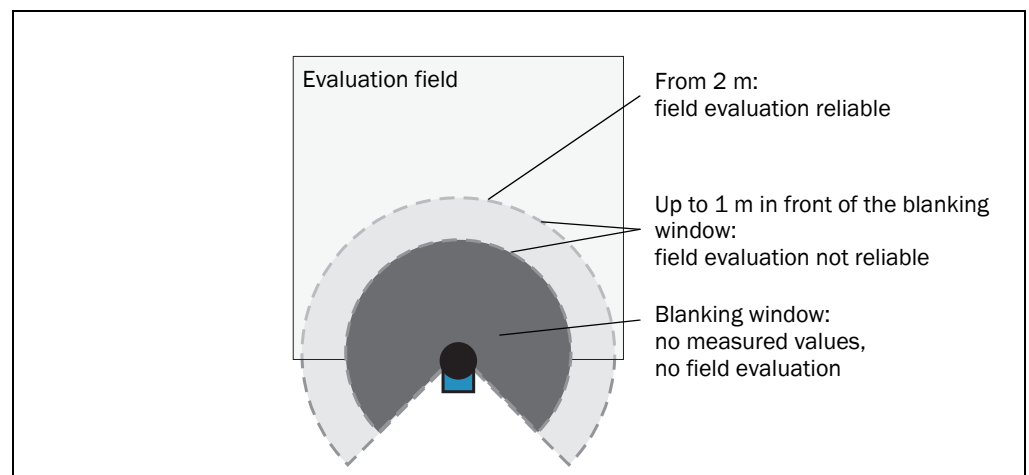


Fig. 20: Effect of the hardware blanking window on the evaluation fields for the field application

Echo filter

If two pulses are reflected by two objects during a measurement (drops of rain or edges etc.), the filter initially filters out the first reflected pulse (echo) (see [section 3.8.4 “Measured value output for a second reflected pulse” on page 38](#)).

Particle filter

The particle filter can be used in dusty surroundings or in case of rain or snow to filter out interference due to particles of dust, rain drops, snow flakes etc.

Important Due to the particle filter, the reaction to an object in the evaluation field or an infringement of the contour is delayed by the time for a scan. The response time set for the pixel evaluation, blanking and contour evaluation strategies is not changed as a result.

Mean filter

The mean filter acts on the measured value output, not on the field application. If the mean filter is active, the mean is formed from the configured number of scans and then output.

The mean filter reduces the scan data output (not a smoothing mean).

3.8.3 Measured value output

For the measured value output, the LMS1xx supplies measured values to one of the interfaces. It is prerequisite for this data output that the LMS1xx is in the measurement mode. There are two ways you can start the measurement mode:

- start via SOPAS ET
PROJECT TREE, LMS..., PARAMETER, BASIC PARAMETERS, area MEASUREMENT
- start via telegram



Recommendation

After the measurement mode is started the LMS1xx needs a little time to reach the status “Ready for measurement”. You should therefore query the status of the LMS1xx using the **sRN STlms** telegram.

Then request measured data by using a telegram on the interface from which you want to receive measured data. There are two possible ways of doing this:

- Exactly one measured value telegram can be requested using the **sRN LMDscandata** telegram – the last scan measured is transferred.
- Measured data can be continuously requested using the **sEN LMDscandata** telegram – measured data are then transferred until the measured value output is stopped using the **sEN LMDscandata** telegram.

Examples of single measured value output

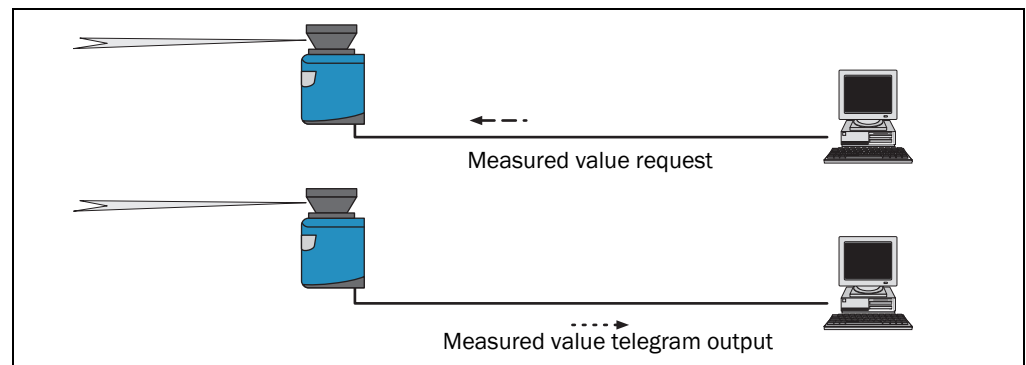


Fig. 21: Measured value telegram request

1. Start measurement

Request

```
<STX>sMN LMCstartmeas<ETX>
```

LMS1xx answer

```
<STX>sAN LMCstartmeas 0<ETX>
```

2. Query measuring status

You must query the status until status 7 (that is ready to measure) is achieved in the reply.

Request

```
<STX>sRN STlms<ETX>
```

LMS1xx answer

```
<STX>sRA STlms 7 0 8 00:00:00 8 01.0 1.06 0 0 0<ETX>
```

Important If the status is less than 7, you must send the request again.
Start the output of measured values for a single scan.

Request

<STX>sRN LMDscandata<ETX>

LMS1xx answer

<STX>sRA LMDscandata [contents]<ETX>

Example of continuous measured value output

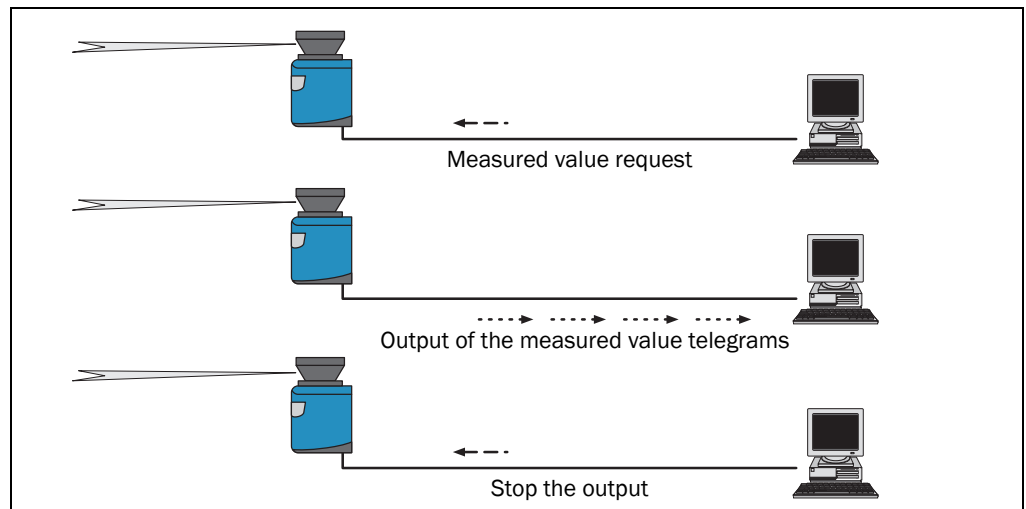


Fig. 22: Continuous measured value output

Recommendation If you are not certain that the scan data can be processed at the speed at which they are output by the LMS1xx, you should only request the scan data for a single scan. The scan counter in the measured value output can be used as an indication that processing is too slow.

1. Start measurement

Request

<STX>sMN LMCstartmeas<ETX>

LMS1xx answer

<STX>sAN LMCstartmeas 0<ETX>

2. Query measuring status

You must query the status until status 7 (that is ready to measure) is achieved in the reply.

Request

<STX>sRN STlms<ETX>

LMS1xx answer

<STX>sRA STlms 7 0 8 00:00:00 8 01.0 1.06 0 0 0<ETX>

If the status is less than 7, you must send the request again.

3. Start continuous measured value output

The scan data are output until measured value output is ended.

Request

```
<STX>sEN LMDscandata 1<ETX>
```

LMS1xx confirmation

```
<STX>sEA LMDscandata 1<ETX>
```

LMS1xx answer

```
<STX>sSN LMDscandata [contents]<ETX>
```

4. Stop continuous measured value output

Request

```
<STX>sEN LMDscandata 0<ETX>
```

LMS1xx confirmation

```
<STX>sEA LMDscandata 0<ETX>
```

3.8.4 Measured value output for a second reflected pulse

The LMS1xx also measures a second reflected pulse, if it is produced, and outputs its measured value in the measured value telegram. A second reflected pulse can be produced, e.g., if the LMS1xx hits a rain drop first. This will reflect part of the energy (1st reflected pulse). The other part of the beam continues to propagate and is reflected by the actual object (2nd reflected pulse).

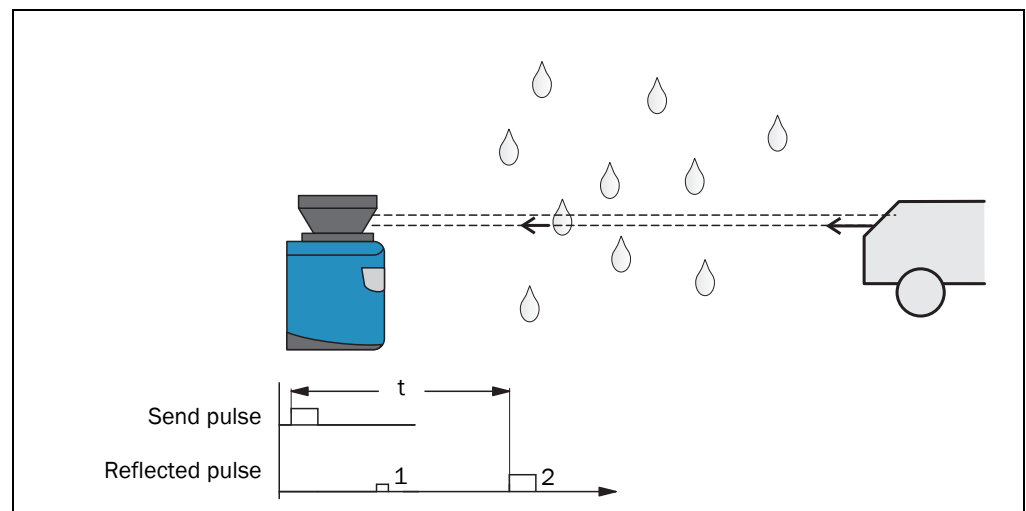


Fig. 23: Principle of operation of the measurement of the second reflected pulse

Important

- The function can only be used in measurement applications, not in the field application.
- The time after the first reflected pulse from which measurement can be performed with full accuracy is dependent on the target that reflected the first reflected pulse.

An application in the host connected can then, for instance, take into account the 2nd reflected pulse for the measurement and ignore the first reflected pulse. In bad weather (rain/snow), this procedure can produce better results or actually make possible special applications such as measurement through a window (e.g. in an ATEX environment).

Measurement through a window

In the case of measurement through a window, various different light reflections may occur. On the one hand due to direct incidence on the window (e.g. due to contamination or scratches), on the other hand due to reflections at the window (that is due to objects behind or beside the LMS1xx). Reflections of objects on the window must be shaded.

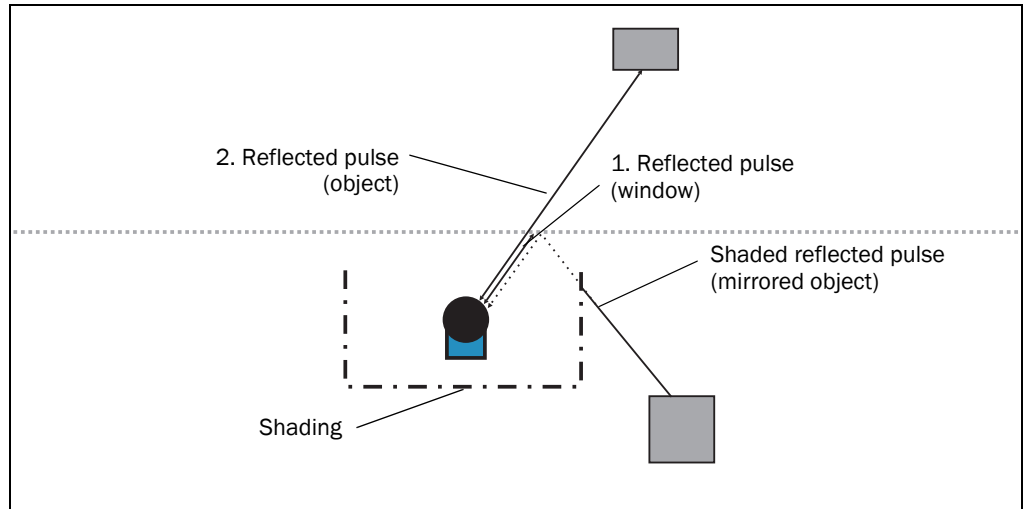


Fig. 24: Shading of reflections

3.9 Field application

With the aid of the integrated field application, the LMS1xx type-dependently evaluates up to 10 evaluation fields within its scan area. Using the field application, you can e.g. implement systems for collision protection, for building surveillance or for access monitoring.

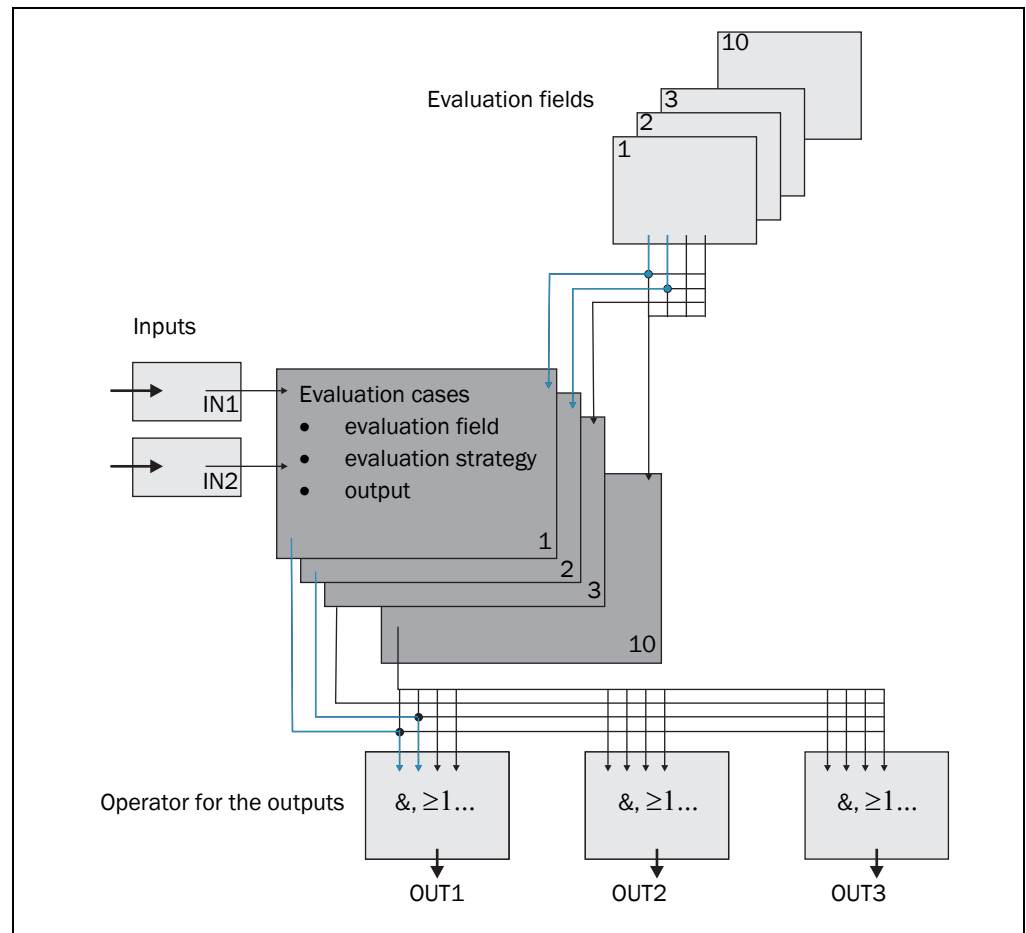


Fig. 25: Principle of the field application

The LMS1xx is adapted to the evaluation situation with the aid of up to ten evaluation cases (type-dependent). In the evaluation case, one of max. ten configurable evaluation fields, an evaluation strategy, an output and in some circumstances a combination of inputs that activate the evaluation case, are selected. An operator is selected for each output; this operator determines the result on the output if more than one evaluation case acts on the output.

In the example in [Fig. 25](#), in evaluation case 1 evaluation field 1 is used, in evaluation case 2 evaluation field 2 is used. Both evaluation cases act on the output OUT1. If an AND operator is used for the results of the evaluation cases, then the output will only switch if both evaluation cases are signalling an event.



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find further information on the field application of these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

3.9.1 Evaluation cases

An evaluation case defines which output field is evaluated in which way and on which output it acts. You can configure up to ten evaluation cases, all configured evaluation cases are active simultaneously.

For each evaluation case you configure in SOPAS ET:

- inputs that activate an evaluation case, if necessary
- the evaluation strategy
- the evaluation field
- the output on which the evaluation case acts
- the response time of the output



PROJECT TREE, LMS..., PARAMETER, EVALUATION CASES.

Inputs

If the evaluation case is not to be permanently active, then you can configure an input combination to activate the evaluation case.

Input 1	Input 2	Evaluation case
Active high	Active high	Evaluation case 1
Active high	Active low	Evaluation case 2
Active low	Active high	Evaluation case 3
Active low	Active low	Evaluation case 4

Tab. 11: Input combination examples LMS10x/LMS11x/LMS15x

Wichtig

An input combination can also be defined for several evaluation cases, e.g. two evaluation cases will then be active simultaneously.



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

You will find the input conditions for these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

Evaluation strategy

In SOPAS ET choose one of four possible evaluation strategies:

- **Pixel evaluation**
The LMS1xx evaluates the entire area of the field, every single beam is considered in the evaluation. If an object enters the field, this result is sent to the related output.
- **Blanking**
The LMS1xx evaluates the entire area of the field. However, using blanking objects of a specific size can be blanked. An object is only detected if it is larger than the blanking configured.
- **Contour**
The LMS1xx evaluates the presence of a contour that must be permanently and completely in the evaluation field. As a result the LMS1xx can detect, e.g., that a door is opening outwards or that the position of the LMS1xx is being changed. Also crawling beneath a vertical evaluation field or the deflection of the laser beam by a mirror can be detected.
Using blanking the lack of part of a contour can be blanked up to a certain size.
- **I/O operator**
Using the I/O operator evaluation strategy you can link the inputs of the LMS1xx with its outputs (see [section 3.10.5 “Logical operators for inputs and outputs” on page 46](#)).

Response time

For the Pixel evaluation, Blanking and Contour evaluation strategies you must define a response time. For the LMS1xx to detect an object using the Pixel evaluation or Blanking evaluation strategy, the object must be detected in one place for at least the duration of the response time. For the Contour evaluation strategy the contour infringement must be detected in one place for at least the duration of the response time.

Obstruction protection

If pixel evaluation is configured, glare may result in it no longer being possible for the LMS1xx to monitor a field. If blanking is configured, small objects in the near range of the LMS1xx can cause large shadows.

If you use evaluation fields at a distance from the LMS1xx, then the object or the object erroneously measured due to glare is outside the evaluation field and will not be detected.

To prevent this situation arising, you can configure the OBSTRUCTION PROTECTION option.

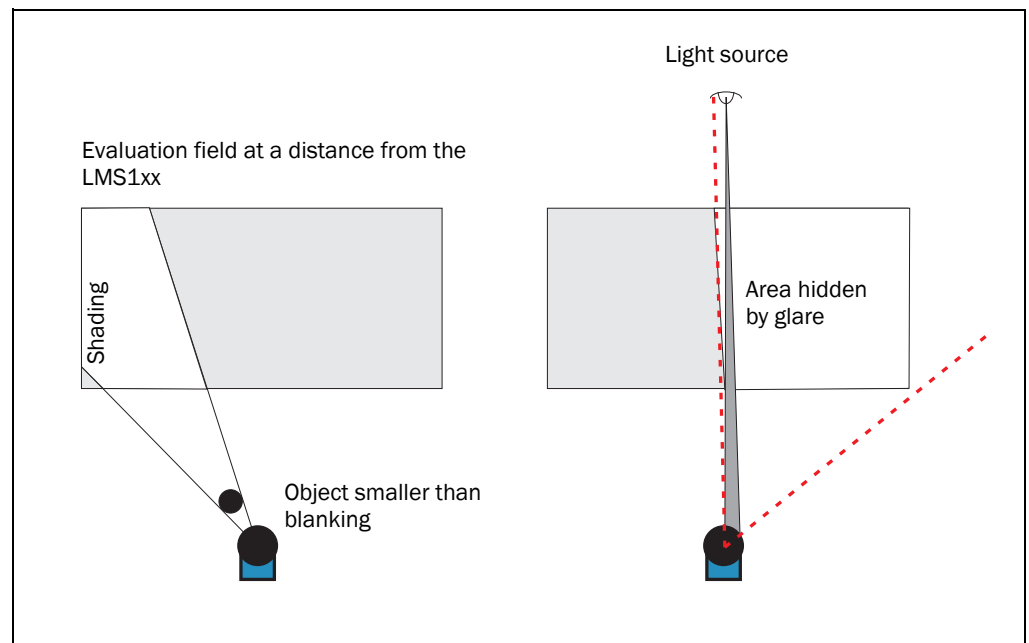


Fig. 26: Protection against tampering due to shading and glare

The Obstruction protection option switches the evaluation field at the following events:

- An object that is smaller than or equal to the blanked object size is in front of the laser output aperture on the LMS1xx for the configured response time for Obstruction protection.
- The LMS1xx is dazzled for longer than the configured response time for Obstruction protection.

Evaluation field

Choose one of the evaluation fields already configured for the evaluation case. Its shape must match the evaluation strategy (see [section 3.9.2 "Evaluation fields" on page 44](#)). If, for instance, you select the evaluation strategy CONTOUR AS REFERENCE, then a contour field must be configured so that the LMS1xx functions correctly.

Output

Choose one of the outputs for the evaluation case. If several evaluation cases act on an output, you must define how the results of the evaluation cases are linked (see [section 3.9.3 "Operator for the evaluation cases on the output" on page 45](#)).

Negating the result

By negating the result the field evaluation is signalled in reverse on the output. The output used is, e.g., then switched if the evaluation field is clear or if the contour is not infringed.

Important Do not confuse the negation of the result with the setting active high/active low for the outputs (see [section 3.9.3 "Operator for the evaluation cases on the output" on page 45](#)).

3.9.2 Evaluation fields

With the aid of the integrated field application, you can configure up to ten evaluation fields. The size and shape of these evaluation fields can be configured almost entirely as required.

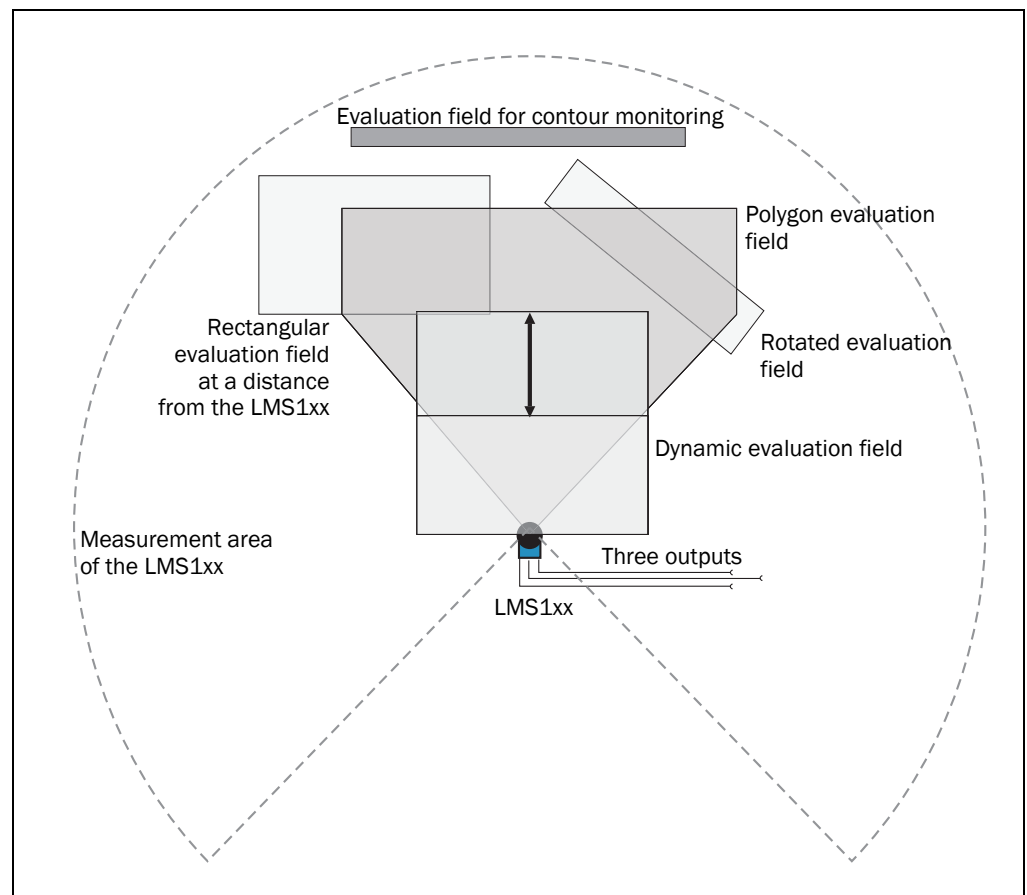


Fig. 27: Examples of different evaluation field shapes

The evaluation fields can be drawn using SOPAS ET to suit the needs of your application. Evaluation fields can have the following shapes:

- Polygon
- Rectangular
- Raching the LMS1xx
- At a distance from the LMS1xx
- LMS10x/LMX11x/LM15x only:
dynamic (the length changes with speed measured using the encoder, see [section 3.10.2 "Encoder inputs" on page 45](#))



You can configure the evaluation fields in SOPAS ET:

PROJECT TREE, LMS..., PARAMETER, EVALUATION FIELDS.

If the area to be monitored changes, then you can re-configure the LMS1xx via software without additional mounting effort.

3.9.3 Operator for the evaluation cases on the output

If several evaluation cases act on an output, you must define how the results of the evaluation cases are linked. The related results can be linked using an AND or an OR operator.



PROJECT TREE, LMS..., PARAMETER, NETWORK/INTERFACES/IOs, DIGITAL OUTPUTS.

The outputs are configured as active high in the pre-setting. You can configure the outputs also as active low.

Resetting an output

By default the outputs are reset immediately. You can configure a delay of up to 10 s (e.g. to activate a horn or to send the output signal to a PLC).

An alternative you can also reset the output using an input. The output is reset only when the allocated input has the configured status.

3.10 Inputs and outputs



You will find information on the design of the outputs of the LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

3.10.1 Digital switching inputs

The LMS1xx has 2 digital switching inputs. These inputs can switch on and off evaluation cases (see [section 3.9.1 "Evaluation cases" on page 41](#)). With the aid of the inputs, the switching outputs on the LMS1xx can also be reset (see [section "Resetting an output" on page 45](#)).

3.10.2 Encoder inputs

The LMS10x/LMS11x/LMS15x has 2 digital inputs for an encoder.

With the aid of the encoder pulses, the size of so-called dynamic fields can be changed, e.g., for speed-dependent vehicle monitoring. The length of a dynamic field changes with the speed measured, e.g. using an encoder.



PROJECT TREE, LMS..., PARAMETER, INCREMENT CONFIGURATION.

When stationary ($V = 0$ m/s) the evaluation field is the same size as the basic field configured. The size increases continuously with increasing speed up to the largest physical size for the field at the configured maximum speed.

3.10.3 Digital switching outputs

The LMS10x/LMS11x/LMS15x has three digital switching outputs.

The outputs can be used as digital switching outputs to ground, as floating outputs or as resistance monitored outputs (see [section 6.4.5 "Wiring of switching inputs and outputs on the LMS1xx" on page 77](#)).

For each output you configure whether it is switched by the field evaluation application or via SOPAS ET telegrams, or whether it is used to signal the device is ready.



PROJECT TREE, LMS..., PARAMETER, NETWORK/INTERFACES/IOs, DIGITAL OUTPUTS.

If an output is switched by the field evaluation application, the LMS1xx can signal evaluation field infringements or contour infringements. For this purpose, configure in SOPAS ET which evaluation case is to act on which output.

3.10.4 External switching outputs

A CAN module (part no. 6038825) can be supplied to expand the switching outputs. With this module additional external switching outputs are made available.

The external switching outputs have the same functionality as the digital switching outputs on the LMS1xx.



PROJECT TREE, LMS..., PARAMETER, NETWORK/INTERFACES/IOs, EXTERNAL OUTPUTS.

3.10.5 Logical operators for inputs and outputs

With the aid of an evaluation case the inputs and outputs on several LMS1xx can be linked together (see [section 3.9.1 "Evaluation cases" on page 41](#)).

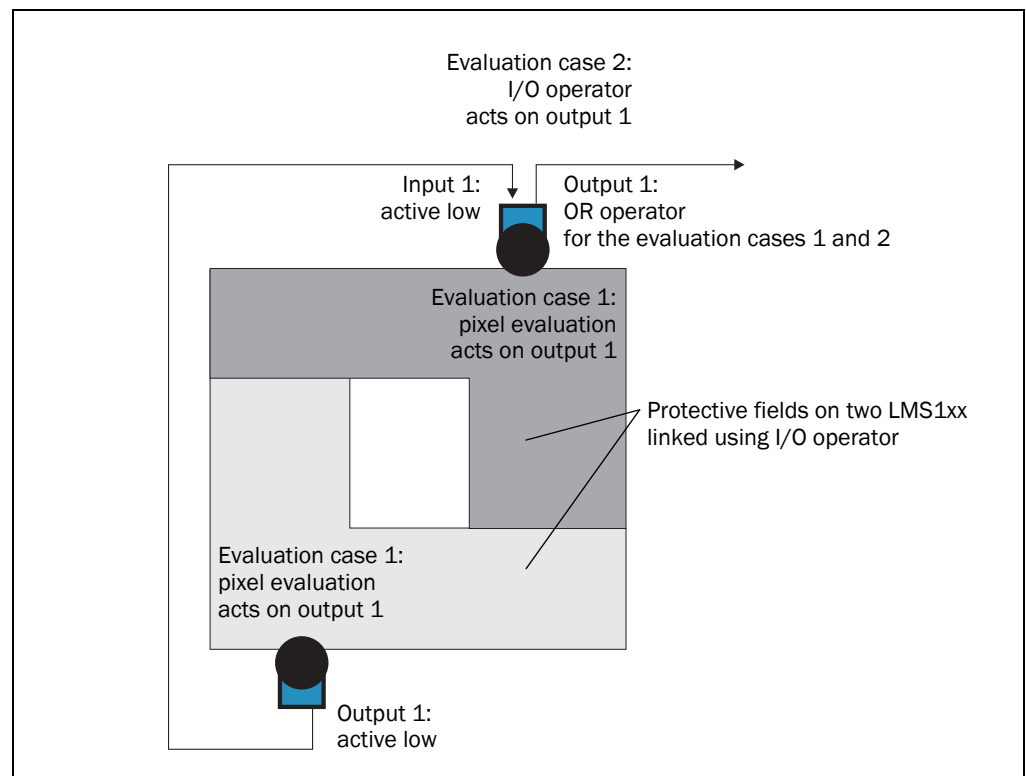


Fig. 28: Logical operators for inputs and outputs

In the example output 1 on the LMS1xx at the bottom is connected to input 1 on the LMS1xx at the top. An evaluation field infringement is therefore signalled at the input on the LMS1xx at the top. This LMS1xx links the input to output 1 in its evaluation case 2. At the same time, evaluation case 1 also acts on the LMS1xx at the top and its output 1. Using the OR operator for the two results, evaluation field infringements on both LMS1xx are signalled on output 1 on the LMS1xx at the top.

3.11 Data interfaces

The LMS1xx has different data interfaces for the configuration and the transmission of measured values.

- Important**
- It is only possible to output all measured values of a scan in real-time using the Ethernet interface.
 - The data transmission rate of the RS-232 interfaces is limited. Therefore these interfaces are not suitable for transmitting scan data in real time.

3.11.1 Ethernet interface

The Ethernet interface has a data transmission rate of 10/100 MBit. The interface is a TCP/IP interface. Full duplex and half duplex are supported.

The Ethernet interface allows the configuration of the LMS1xx as well as the output of measured values.

The factory setting for the Ethernet interface is as follows:

- IP address: 192.168.0.1
- subnet mask: 255.255.255.0
- TCP port: 2111 and 2112



If necessary, adjust the TCP/IP configuration for the Ethernet interface to enable a connected PC (client) to communicate with the LMS1xx via Ethernet: PROJECT TREE, LMS..., NETWORK/INTERFACES/IOS, ETHERNET.

- Important**
- If you change the parameters for the Ethernet interface over the Ethernet interface, you must first save the data in non-volatile memory in the LMS1xx and then restart the LMS1xx. For this purpose there is the RESTART button in SOPAS ET.

You will find a description of the electrical interface in [section 6.2 "Connections of the LMS1xx" on page 66](#).

3.11.2 CAN

The CAN interface supports data transmissions between 10 Bit/s and 1 Mbit/s.

For data communication via CAN you must configure the LMS1xx so that it can communicate with the host:



PROJECT TREE, LMS..., NETWORK/INTERFACES/IOS, CAN.

The following interface parameters can be configured:

- baud rate of the CAN bus
- ID of the LMS1xx in CAN

3.11.3 Serial host interface

Important The LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS variants have no serial host interface.



The serial host interface is an RS-232 interface. The host interface permits the configuration of the LMS1xx and only limited measured value output.

The interface parameters are freely configurable:

PROJECT TREE, LMS..., NETWORK/INTERFACES/IOs, SERIAL, area SERIAL HOST INTERFACE.

The factory setting for the host interface is as follows:

- 57,600 Baud
- 8 data bits
- 1 stop bit
- no parity

Important If you change the parameters for the host interface over the host interface, the connection to the device will be lost. You must then scan for the LMS1xx again in SOPAS ET (see [section 7.3.5 “Performing scan” on page 83](#)).

You will find a description of the electrical interface in [section 6.2 “Connections of the LMS1xx” on page 66](#).

3.11.4 Serial auxiliary interface

The serial auxiliary interface is an RS-232 interface. The auxiliary interface permits the configuration of the LMS1xx.



The interface parameters are freely configurable:

PROJECT TREE, LMS..., NETWORK/INTERFACES/IOs, SERIAL, area SERIAL AUXILIARY INTERFACE.

The factory setting for the auxiliary interface is as follows:

- 57,600 Baud
- 8 data bits
- 1 stop bit
- no parity

Important If you change the parameters for the auxiliary interface over the auxiliary interface, the connection to the device will be lost. You must then scan for the LMS1xx again in SOPAS ET (see [section 7.3.5 “Performing scan” on page 83](#)).

You will find a description of the electrical interface in [section 6.2 “Connections of the LMS1xx” on page 66](#).

3.12 Data communication using telegrams

The LMS1xx sends telegrams over the interfaces described above to communicate with a connected host. The following functions can be run using telegrams:

- request for measured values by the host and subsequent output of the measured values by the LMS1xx
- parameter setting by the host for the configuration of the LMS1xx
- parameters and status log querying by the host

The telegrams each comprise a frame (see [section 3.12.1 “Frame and coding for the telegrams” on page 49](#)) and the data.



You will find a detailed description of the different telegrams in the document “Telegram Listing Laser Measurement Sensor”, part no.: 8014631, issue in English.

Please see [section 1.5 “Further information” on page 9](#).

3.12.1 Frame and coding for the telegrams

The data frame varies depending on the coding.

Telegrams with ASCII coding

	Frame	Telegram	Frame
Code	STX	Data	ETX
Length (byte)	1	≤ 30 kB	1
Description	Start of text character	ASCII coded. The length is dependent on the previous send telegram.	End of text character

Tab. 12: Frame for the telegrams with ASCII coding



The frame for the serial host interface can be configured in SOPAS ET: PROJECT TREE, LMS..., INTERFACES, SERIAL, area SERIAL HOST INTERFACE.

In this way, for example, you can use two stop bytes (e.g. to end telegrams with CR/LF).

Telegrams with binary coding

	Frame				Telegram	Frame	
Code	STX	STX	STX	STX	Data	Checksum	
Length (byte)	1	1	1	1	Telegram length	1	
Description	Start of text character				Length of the data without CS	Binary encoded. The length is dependent on the previous send telegram.	See “Calculation of the checksum” further below

Tab. 13: Frame for the telegrams with binary coding

Calculation of the checksum

The checksum is calculated using an XOR operator for every byte of the data, that is without the frame.

3.13 Planning

3.13.1 LMS1xx system requirements

For commissioning and operating the LMS1xx, the following are required:

LMS1xx variant	Supply voltage ¹⁾	Required power drain of power supply unit
LMS10x/LMS11x/LMS15x	Sensor: DC 10.8 V ... 30 V	Typ. 10 W
LMS12x/LMS13x/LMS14x/LMS173/ LMS182 as well as LMC12x/LMC13x	Sensor: DC 9 V ... 30 V	Typ. 10 W
LMS11x/LMS13x/LMS15x/LMS182/ LMC13x	Heating: DC 24 V ± 20 %	Heating: Additionally typical 40 W
LMS14x	Heating: DC 24 V -10 %/+20 %	Heating: Additionally typical 40 W
1) per IEC 60364-4-41 (VDE 0100, part 410)		

Tab. 14: Required power supply voltages and power drains

See also [Chapter 10.1 "Data sheet LMS1xx/LMC1xx laser measurement sensor" on page 91](#).

Protection of Supply Cables

To ensure protection against short-circuits or overload in the supply cables from the customer's power system, the lead cross sections used have to be selected and protected according to the national standards.

Depending on the power supply concept, the LMS1xx must be protected using the following fuse(s) in the supplying circuit(s) at the start of the supply cable(s):

- Separate power supply voltages for sensor and heating**
 The sensor consumes the maximum current at the lowest permissible supply voltage for the device compared to the heating.
 Recommended fuses: sensor: 2 A slow-blow, heating 2 A slow-blow
- Collective power supply voltage for sensor and heating**
 The heating consumes the maximum current at the highest permissible collective supply voltage for the device compared to the sensor.
 Recommended fuse for sensor incl. heating: 4 A slow-blow

Data interface RS-232 and Ethernet (see also [section 6.3.3 "Boundary conditions for the data interfaces" on page 72](#))

Device disconnecter – installation of a switch in the supply cable

A switch, emergency stop switch, or similar, must be installed in the supply cable to the device in order to reliably disconnect the device from the supply voltage in the event of a fault. If the sensor and heater are supplied by separate supply voltages, both supply cables must be routed via the switch.

Internet The configuration software SOPAS ET, the current system prerequisites for the PC, and the instructions for downloading of the software and the device description file(s) can be found online at:

➤ http://www.sick.com/SOPAS_ET

3.13.2 Mounting requirements

The LMS1xx must be mounted as follows:

- Robust
- As far as possible without shocks
- As far as possible without vibration

Mounting kits

The following mounting kits are available:

- Mounting kit 1a: mounting bracket for mounting at the rear on wall or machine (see [Fig. 65 on page 101](#))
- Mounting kit 1b: mounting bracket for mounting at the rear on wall or machine, with protection for the optics cover (see [Fig. 66 on page 101](#))
- Mounting kit 2: mounting bracket, only in conjunction with mounting bracket 1a or 1b, cross-wise adjustment possible (see [Fig. 67 on page 102](#))
- Mounting kit 3: mounting plate, only in conjunction with mounting bracket 2, length-wise adjustment possible (see [Fig. 68 on page 102](#))

As an alternative you can use a strong stable mounting bracket that provides adjustable alignment of the LMS1xx in the X- and Y axis. The LMS1xx weighs approx. 1.1 kg.

NOTICE

Risk to damage due to overheating!

Mount the LMS1xx such that it is not exposed to direct sunlight (if necessary fit canopy). In this way an inadmissible increase in the temperature inside the sensor is avoided.

3.13.3 Distance between LMS1xx and the object/surface to be monitored

The laser beam diverges with increasing distance from the LMS1xx. In the scan area the floor or a wall may then be continuously detected, as the laser beam is incident on it.

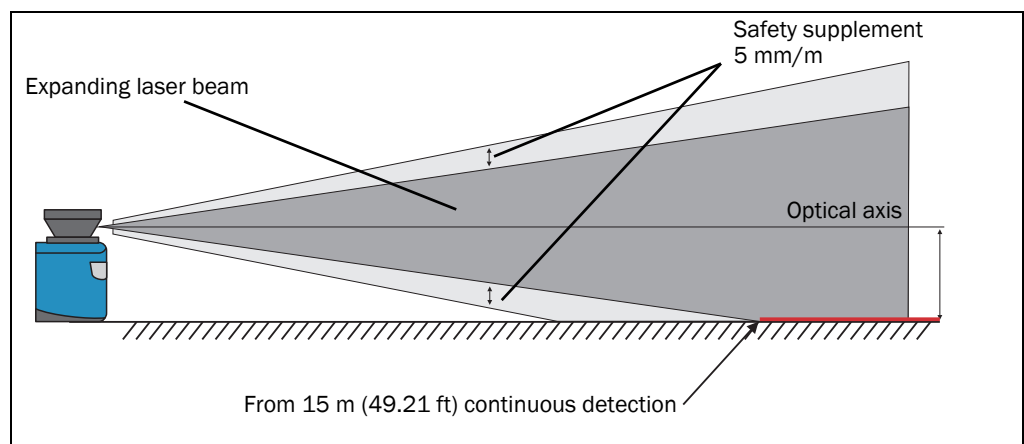


Fig. 29: Increase in the size of the beam and safety supplement

The optical axis is used as the reference plane for the distance to be maintained from the floor or the wall; on a vertically mounted LMS1xx this axis is approx. 116 mm above the bottom edge of the housing.

The distance-dependent increase in the size of the beam can be calculated using the formula:

$$\text{beam diameter} = (\text{distance (mm)} \times 0.015 \text{ rad}) + 8 \text{ mm}$$

The following table shows a few values as examples:

Distance	5 m	10 m	15 m	20 m	40 m	50 m
Beam diameter	83 mm	158 mm	233 mm	308 mm	608 mm	758 mm

Tab. 15: Beam diameter at different distances from the LMS1xx

For the assessment of whether the laser beam can be incident on an object or the wall, the distance of half the beam diameter from the optical axis is used.

Recommendation Take into account a safety supplement of approx. 5 mm per meter.

3.13.4 Heating

A separate source of power is required for the heating in the LMS11x, LMS15x and LMS182 as well as the LMS13x/LMS14x and LMC13x (supply voltage DC 24 V, minimum output power 50 W).

The heating starts to heat at an internal temperature below 10 °C It then operates for at least three seconds. If the temperature is always around 10 °C then the heating will often operate for a short time.

Temperature in the LMS1xx	Behaviour of the device/heating
T > 0 °C	The device starts
T < 0 °C	Heating is active until the device will start
	During operation: The device continues to operate, a telegram is output indicating that the temperature has dropped below the operating temperature

Tab. 16: Behaviour of device and heating, depending on the inner temperature

Important The minimum operating ambient temperature of -30 °C respectively -40 °C (LMS14x) is guaranteed for a wind speed of 0 m/s. Based on experience, operation with a wind speed of up to 0.5 m/s is possible. At higher wind speed the heat from the heating is removed from the device too quickly.

4 Transport and storage

4.1 Transport

For your own safety, please read and observe the following notes:

NOTICE

Damage to the LMS1xx due to improper transport!

- Package the device so that it is protected against collision and humidity.
- Recommendation: use the original packaging for optimal protection.
- Transport should be performed by trained specialist staff only.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Transport inspection

Upon receipt, please 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.

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

4.3 Storage

Store the LMS1xx under the following conditions:

- Recommendation: use the original packaging.
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- To ensure that any residual moisture present can escape, do not store the device in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage ambient temperature range:
All variants except LMS14x: -30 °C to $+70\text{ °C}$ ($+70\text{ °C}$ maximum 24 h)
LMS14x: -40 °C to $+70\text{ °C}$ ($+70\text{ °C}$ maximum 24 h)
- Relative humidity: max. 95%, non-condensing.
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

NOTICE

Claims under the warranty rendered void!

The housing screws of the LMS1xx are sealed. Claims under the warranty against SICK AG will be rendered void if the seals are damaged or the device opened. The housing is only allowed to be opened by authorized service personnel.

5.1 Overview of the mounting steps

- Select a mounting location for the LMS1xx
- Mounting and adjusting the LMS1xx

5.2 Preparations for mounting

5.2.1 Components to be mounted

- An LMS1xx (weight approx. 1.1 kg)

5.2.2 Material and accessories necessary

- Optional mounting kit or mounting kits with mounting material (not included)
or
- Optional weather protection hood with mounting kit (not included)
or
- As an alternative if a fixing bracket is provided by the user
 - Stable mounting bracket that provides adjustable alignment of the LMS1xx in the X and Y axis
 - 4 M6 screws for the LMS1xx, screw length dependent on the wall thickness of the mounting bracket used

5.2.3 Necessary tools

- 4 M6 screws for mounting the SICK fixing bracket on the support, screw length as a function of the wall thickness of the support
- Tool set

5.2.4 Select mounting location

NOTICE

Risk of dysfunction due to overheating or dazzle!

Direct sunlight can increase in the temperature inside the LMS1xx in an inadmissible way.

- Mount the LMS1xx such that it is not exposed to direct sunlight (if necessary fit canopy).
- To avoid a dazzle by the device itself, do not install the device with view of glass or stainless steel surfaces.

5.3 Mounting steps

NOTICE

Special features to note during mounting:

- Mount the LMS1xx such that it is protected from moisture, dirt and damage.
- Ensure that the entire field of view of the LMS1xx is not restricted.
- Mount the LMS1xx such that the indicators are easy to see.
- Always mount the LMS1xx so that there is still enough space for mounting and removing the system connector.
- Avoid excessive shock and vibration loading on the LMS1xx.
- In applications with heavy vibration, prevent the fixing screws from coming loose by using screw locking devices (see [section 10.1 "Data sheet LMS1xx/LMC1xx laser measurement sensor" on page 91](#)).
- Regularly check the tightness of the fixing screws.
- Pay attention to the maximum torque of the M5 fixing screws on the LMS1xx of max. 5.9 Nm.

The LMS1xx can be fastened in the following ways:

Mounting	Remark	For mounting see ...
Direct mounting	Without mounting kit	Fig. 30 on page 57
With mounting kit 1a (part no. 2034324) or kit 1b (part no. 2034325)		Fig. 31 on page 58 and Fig. 32 on page 58
With mounting kit 2 (part no. 2039302) and kit 3 (part no. 2039303)	Only in conjunction with mounting kit 1a or 1b	Fig. 33 on page 59
With weather protection hood 190° (part no. 2046459)	+ standard mounting kit (part no. 2046025)	Fig. 34 on page 60 Fig. 36 on page 61
	+ quick-action mounting kit (part no. 2046989)	Fig. 37 on page 61
With weather protection hood 270° (part no. 2046458)	+ standard mounting kit (part no. 2046025)	Fig. 35 on page 60 Fig. 36 on page 61
	+ quick-action mounting kit (part no. 2046989)	Fig. 37 on page 61

Tab. 17: Mounting options for the LMS1xx

**LMC12x/LMC13x VdS:**

You will find information on the mounting kit VdS 1 or mounting kit VdS 2 in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

5.3.1 Direct mounting

The LMS1xx has two M5 × 8 threaded holes on the rear. Using them you can mount the LMS1xx directly on the intended mounting surface. To avoid a possible tendency to vibrate, the reference surface on the rear can be used as the third mounting point (1).

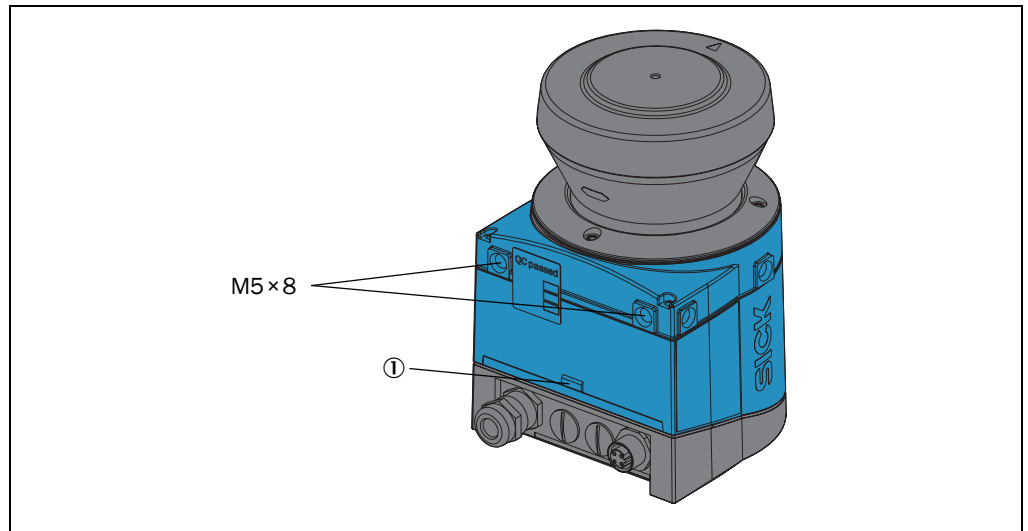


Fig. 30: Direct mounting

Important During mounting, please observe the dimensional drawings (see [section 10.3.1 "Dimensional drawing LMS10x/LMS12x/LMS173/LMC12x" on page 99](#)).

5.3.2 Mounting with mounting kit 1a or 1b

Using mounting kit 1 you can mount the LMS1xx on a mounting surface (wall, machine). The mounting kit is available as mounting kit 1a without protection device for the optics cover and as mounting kit 1b with protection device for the optics cover.

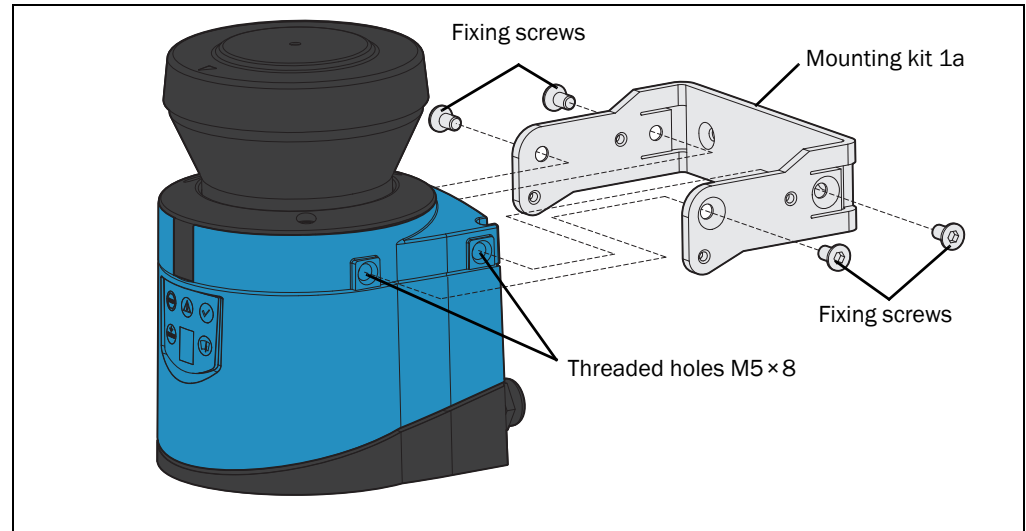


Fig. 31: Mounting with mounting kit 1a (part no. 2034324)

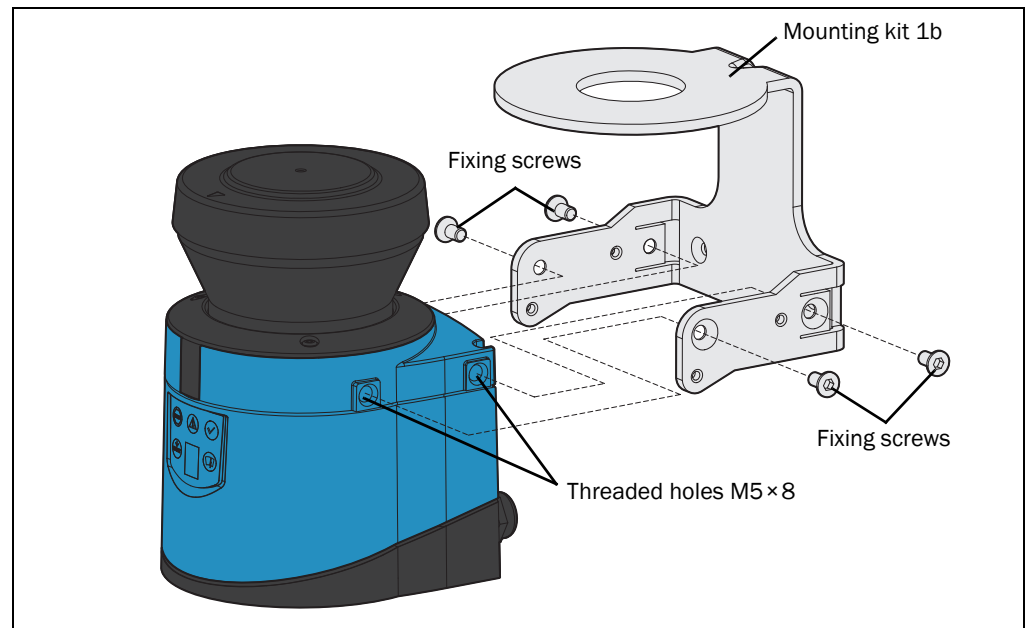


Fig. 32: Mounting with mounting kit 1b (part no. 2034325)

1. Mount mounting kit 1a or 1b on the mounting surface.
2. Then mount the LMS1xx on the mounting kit 1a or 1b.

Important During mounting, please observe the dimensional drawings (see [section 10.3.3](#) “*Dimensional drawings mounting kits*” on page 101).

5.3.3 Mounting with mounting kit 2 and 3

With the aid of mounting kits 2 and 3 (only in conjunction with mounting kit 1a or 1b) you can align the LMS1xx in two planes. The maximum adjustment angle is $\pm 11^\circ$ in both planes.

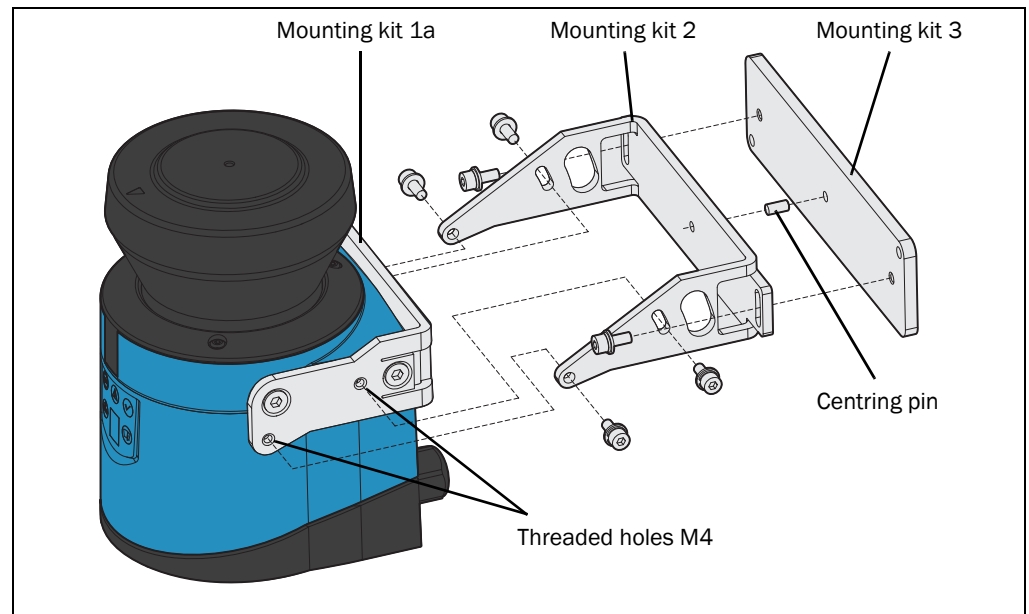


Fig. 33: Mounting with mounting kit 2 (part no. 2039302) and kit 3 (part no. 2039303)

1. Mount mounting kit 1a or 1b to the LMS1xx.
2. Mount the mounting kit 3 on the mounting surface.
3. Fit the centring pin (4 mm) in the central hole on mounting bracket 3.
4. Fit mounting kit 2 to mounting kit 3 and mount it using two fixing screws M4 × 10.
5. Then mount the LMS1xx on mounting kit 2 with the aid of the threaded holes in mounting kit 1a.
6. Adjust the LMS1xx longitudinally and transversely and then tighten the six fixing screws on the mounting kits.

Important During mounting, please observe the dimensional drawings (see [section 10.3.3](#) “*Dimensional drawings mounting kits*” on page 101).

5.3.4 Mounting the LMS11x/LMS13x/LMS14x/LMS15x/LMS182 with weather protection hood

To protect the LMS11x/LMS13x/LMS14x/LMS15x/LMS182 from glare and precipitation when used outside, two weather protection hoods are available.

- The weather protection hood 190° provides a field of view of 190° and practically flat mounting on the application.
- The weather protection hood 270° provides a larger field of view of 270°, but not flat mounting on the application.

You will find detailed dimensions in [section 10.3.4 “Dimensional drawings weather protection hoods” on page 103](#).

Important The LMC12x and the LMC13x cannot be fastened with a weather protection hood.

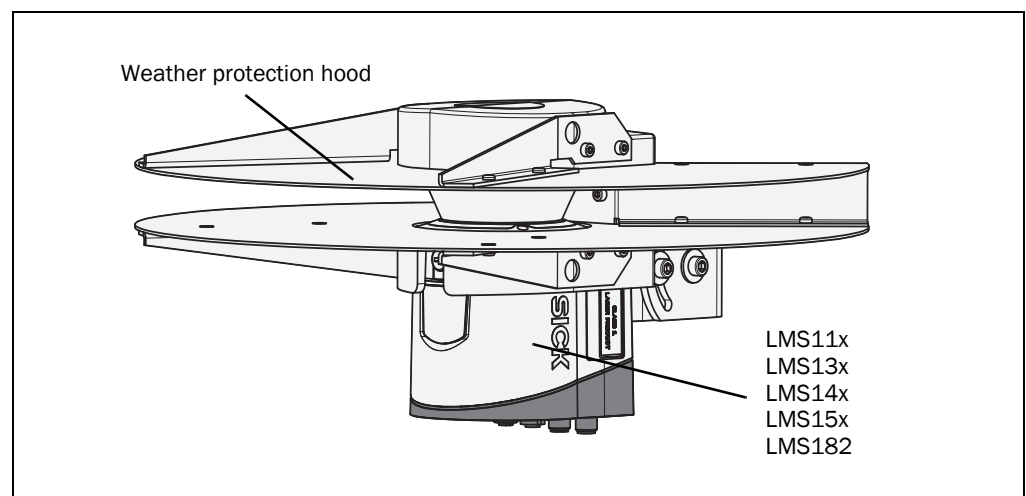


Fig. 34: Weather protection hood 190° (part no. 2046459)

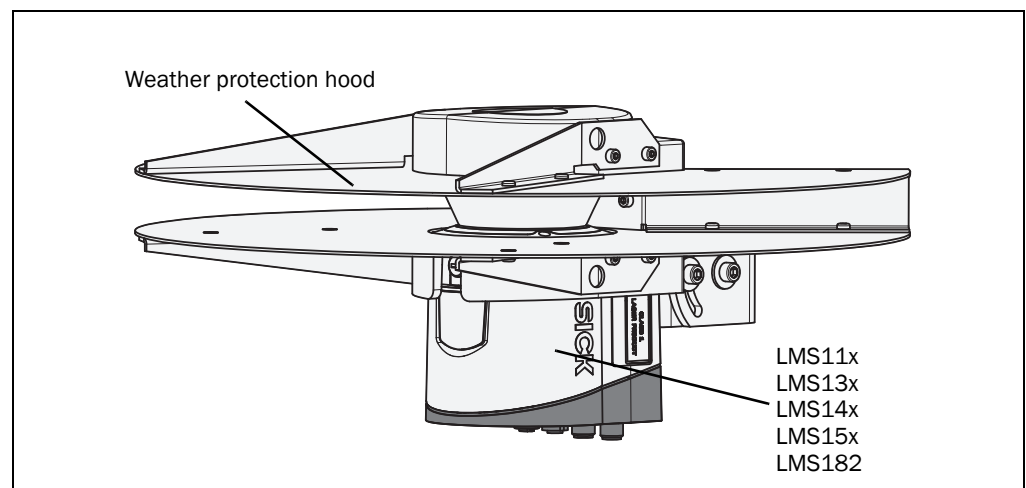


Fig. 35: Weather protection hood 270° (part no. 2046458)

How to mount the weather protection hood on the LMS11x/LMS13x/LMS14x/LMS15x/LMS182:

1. Put the weather protection hood 190° or 270° over the LMS11x/LMS13x/LMS14x/LMS15x/LMS182.
2. Mount the weather protection hood on the LMS11x/LMS13x/LMS14x/LMS15x/LMS182 using three M5 × 15 countersunk head screws (included with the delivery of the weather protection hood).

For this purpose you will find on the weather protection hood two holes with 90° countersink on the rear and one hole with 90° countersink on the right.

Mounting kits for the weather protection hood

Using the mounting kits for the weather protection hood you can align the LMS11x/LMS13x/LMS14x/LMS15x/LMS182 in two planes. The maximum adjustment angle is $\pm 22.5^\circ$ in both planes.

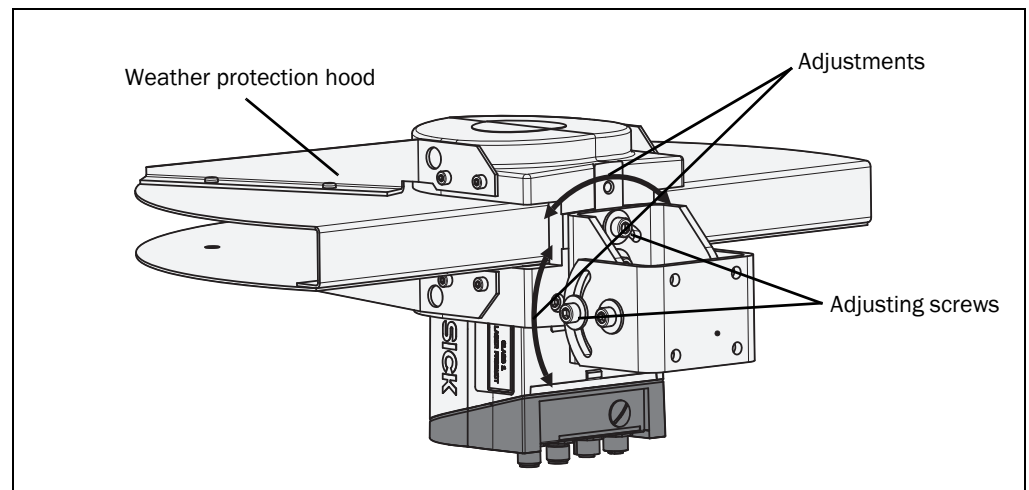


Fig. 36: Standard mounting kit (part no. 2046025) for the weather protection hood

The quick-action mounting kit for the weather protection hood permits the quick replacement of the LMS11x/LMS13x/LMS14x/LMS15x/LMS182, without the need to adjust the new device.

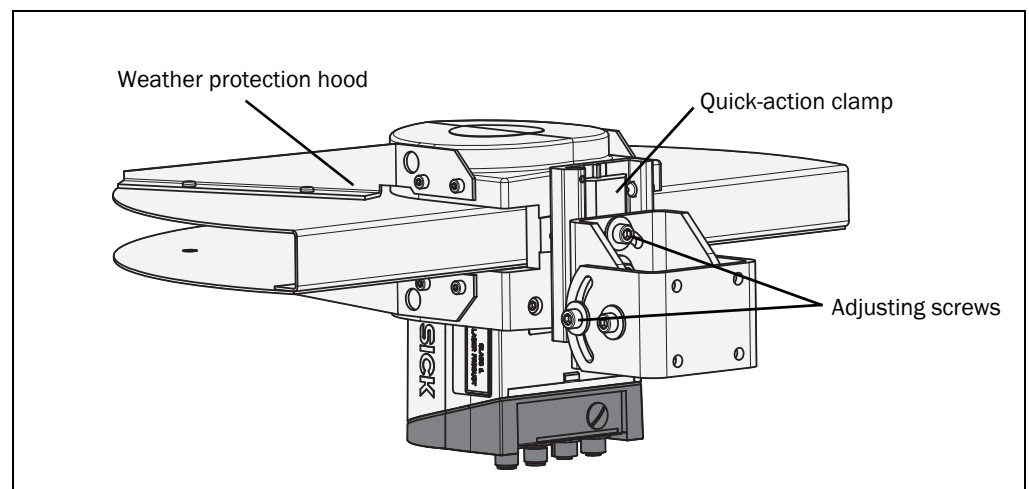


Fig. 37: Quick-action mounting kit (part no. 2046989) for the weather protection hood

5.3.5 Using multiple LMS1xx

NOTICE

Risk of interference on the LMS1xx!

Sources with a wavelength of 905 nm may cause interference if they act directly on the LMS1xx.

The LMS1xx is so designed that mutual interference between several LMS1xx is unlikely. To completely exclude erroneous switching, we recommend mounting the laser measurement sensors as shown in the following examples.

Use mounting kits 1 to 3 to adjust the LMS1xx to different angles.

Correct placement of several LMS1xx

Arrange or shield several LMS1xx such that the laser beam cannot be received by a different LMS1xx.

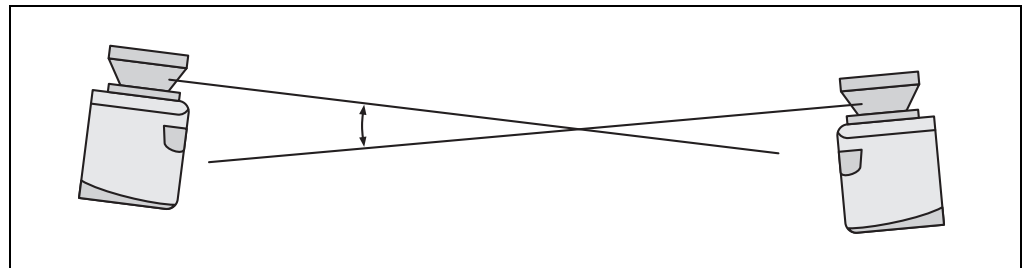


Fig. 38: Placement of two LMS1xx opposed to each other

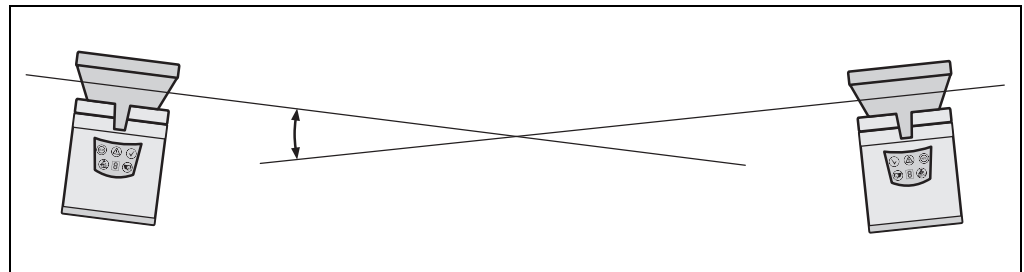


Fig. 39: Crosswise placement of two LMS1xx

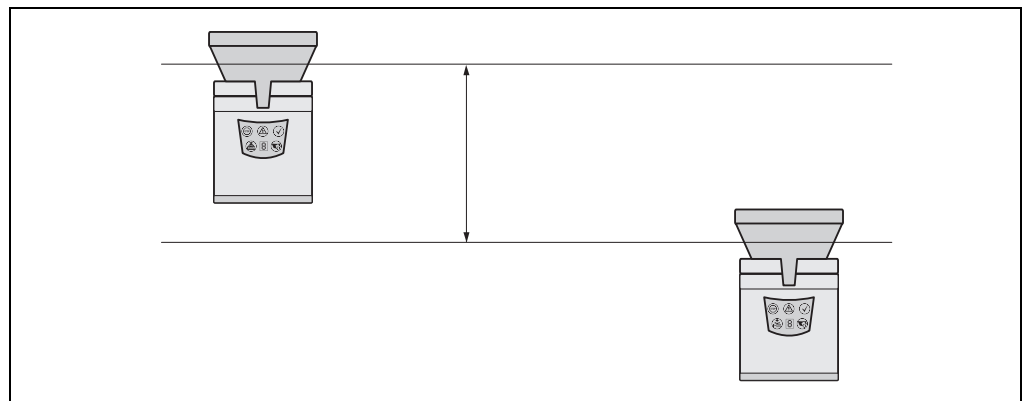


Fig. 40: Placement of two LMS1xx with parallel offset

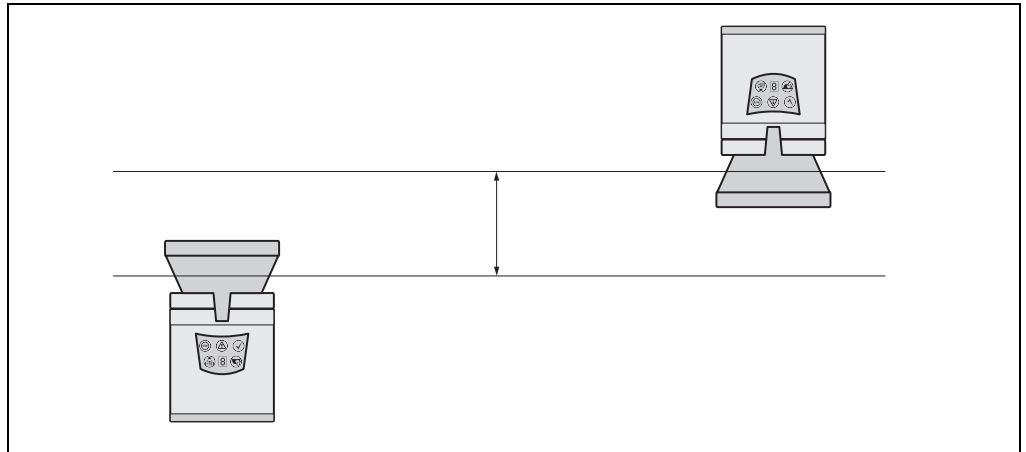


Fig. 41: Placement of two LMS1xx with parallel offset, one of these upside down

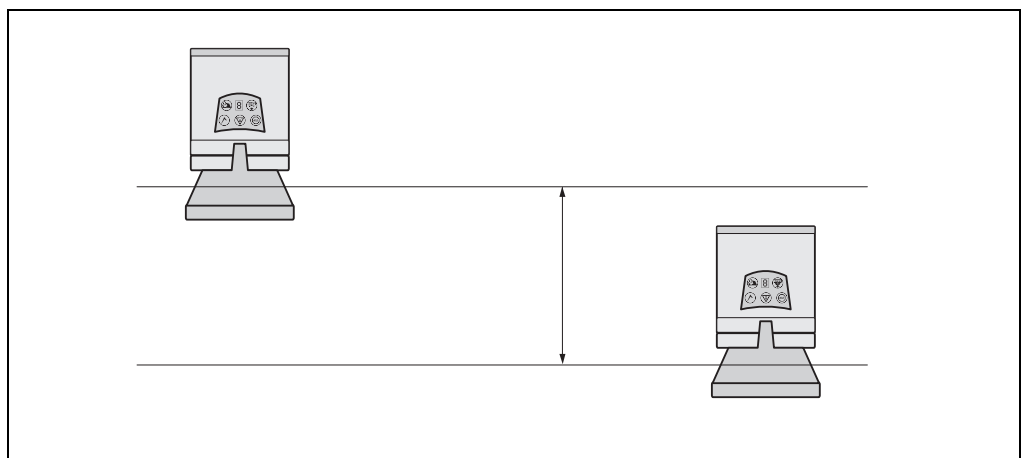


Fig. 42: Placement of two LMS1xx upside down, parallel offset

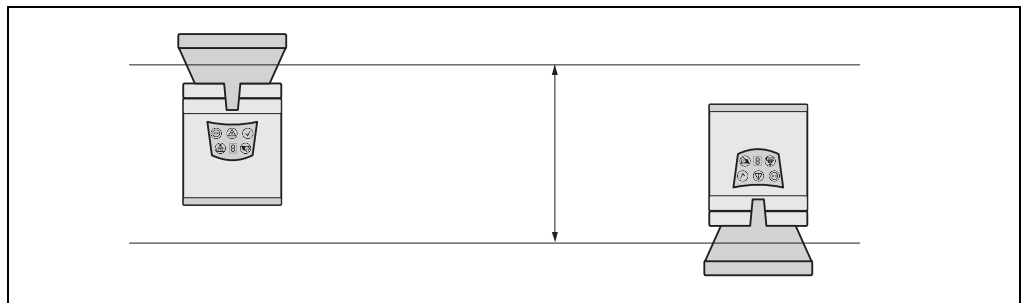


Fig. 43: Placement of two LMS1xx with parallel offset, one of these upside down

5.4 Dismantling the LMS1xx

1. Switch off the supply voltage.
2. Loosen and remove the connection cables.
3. Undo the mounting screws for the LMS1xx to the mounting bracket and remove the device.

Important On final decommissioning, please observe the disposal requirements in [section 8.3.1 "Disposal" on page 88](#) for environmentally correct disposal.

6 Electrical installation

NOTICE

Only authorized personnel are allowed to perform the electrical installation work.

- Do not open the housing of the device.
Only on LMS10x/LMS12x/LMS173 (indoor variants), remove temporarily the system connector on the bottom of the device for connecting cable leads to the terminal blocks.
- Observe the current safety regulations when working on electrical systems.

Switch the entire machine/system offline!

The machine/system could inadvertently start up while you are connecting the device.

- Ensure that the entire machine/system is disconnected during the electrical installation.

6.1 Overview of the installation steps

- Wire switching outputs (application-dependent).
- Temporarily connect PC (configuration).
- Wire data interface for operation.
- Connect the supply voltage to the LMS1xx

6.2 Connections of the LMS1xx



LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection):

You will find information on the connections of these devices in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

Depending on the variant, the LMS1xx has different connections:

LMS1xx variant	Electrical connections
LMS10x, LMS12x, LMS173 and LMC12x	Removable system connector with: - PG7 cable entry ¹⁾ on the rear side - 2 screw type terminal blocks, 17-pole inside of the connector Additionally one multi-pin M12 round plug-in connection (female connector) ¹⁾ ,
LMS11x, LMS13x, LMS14x, LMS15x, LMS182 and LMC13x	Four multi-pin M12 round plug-in connections (female connectors, male connectors)
All devices	Front of device: one M8 round plug-in connection (serial AUX interface) ²⁾

1) You can move the PG7 cable entry and the round plug-in connection (both independent from each other) from the rear to the underside of the system connector (see [Fig. 63 on page 99](#)).

2) This interface is only used for configuration and is not allowed to be permanently connected

Tab. 18: Overview about electrical connections of LMS1xx

6.2.1 Connections of the LMS10x

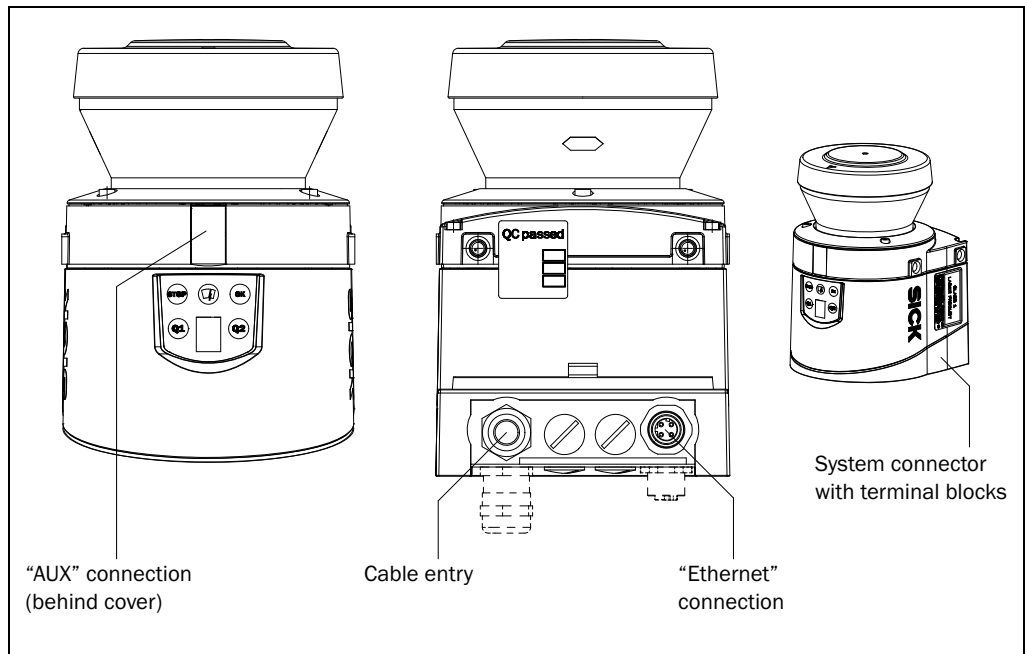


Fig. 44: LMS10x: Position of the electrical connections

NOTICE

Destruction of the device!

Connecting the sensor incorrectly can lead to the destruction of the device.

- Connect the supply voltage for the sensor correctly. Reverse connection is not permitted.

	Terminal	Signal	Function
	1	Reserved	Do not use!
	2	Reserved	Do not use!
	3	RxD HOST	Receiver RS-232 (host interface)
	4	Reserved	Do not use!
	5	Reserved	Do not use!
	6	IN1	Switching input 1
	7	GND IN1	Ground switching input 1
	8	IN2	Switching input 2
	9	GND IN2	Ground switching input 2
	10	INC1 A	Input encoder 1, contact A
	11	INC1 B	Input encoder 1, contact B
	12	GND INC1	Ground encoder 1
	13	OUT1 A	Switching output 1, contact A
	14	OUT1 B	Switching output 1, contact B
	15	OUT1 R	Switching output 1, resistor monitored
	16	OUT2 A	Switching output 2, contact A
	17	OUT2 B	Switching output 2, contact B
	18	GND	Ground Sensor
	19	V _S	Power Supply Sensor
	20	TxD HOST	Transmitter RS-232 (host interface)
	21	Reserved	Do not use!
	22	GND RS/CAN	Ground RS-232/CAN
	23	CAN H	CAN bus high
	24	CAN L	CAN bus low
	25	V _S CAN ¹⁾	Power supply CAN bus
	26	GND RS/CAN	Ground RS-232/CAN
	27	CAN H	CAN bus high
	28	CAN L	CAN bus low
	29	V _S CAN ¹⁾	Power Supply CAN bus
	30	OUT3 R	Switching output 3, resistor monitored
	31	OUT3 B	Switching output 3, contact B
	32	OUT3 A	Switching output 3, contact A
	33	OUT2 R	Switching output 2, resistor monitored
	34	Shield	Housing/shield

Tab. 19: LMS10x: Terminal assignments (2 x terminal blocks, 17-pole)

1) DC 24 V

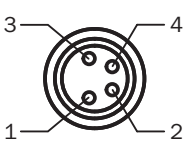
Important The OUT1 B, OUT2 B and OUT3 B connections are internally connected to each other.

“Ethernet” connection

	Pin	Signal	Function
	1	TX+	Transmitter+
	2	RX+	Receiver+
	3	TX-	Transmitter-
4	RX-	Receiver-	

Tab. 20: LMS10x: Pin assignment of the “Ethernet” connection (4-pin M12 female connector, D-coded)

“AUX” connection

	Pin	Signal	Function
	1	Reserved	Do not use!
	2	RxD AUX	Receiver RS-232 (auxiliary interface)
	3	GND RS	Ground RS-232
4	TxD AUX	Transmitter RS-232 (auxiliary interface)	

Tab. 21: LMS10x: Pin assignment of the “AUX” connection (4-pin M8 female connector)

6.2.2 Connections of the LMS11x and LMS15x

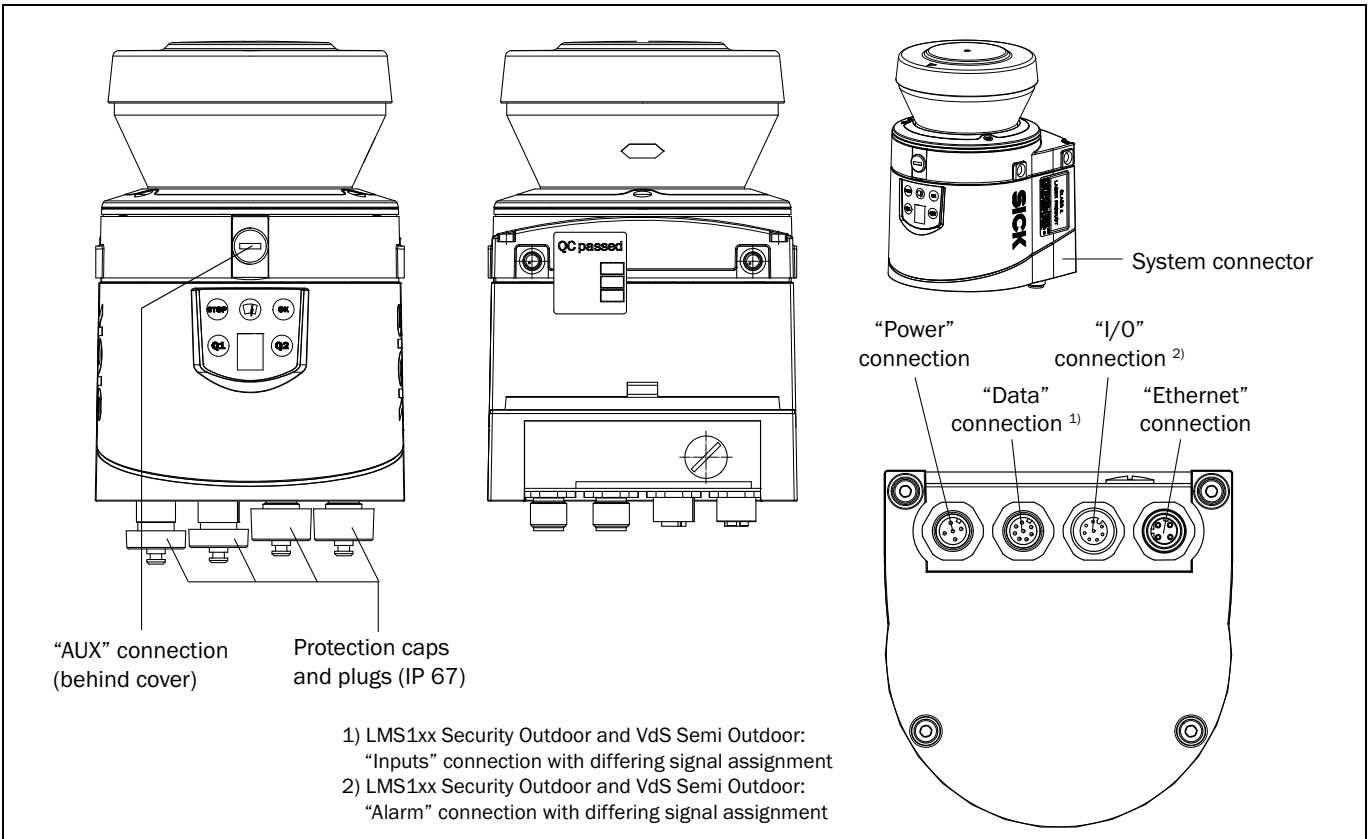


Fig. 45: LMS11x/LMS15x: Position of the electrical connections

“Power” connection

NOTICE

Destruction of the device!

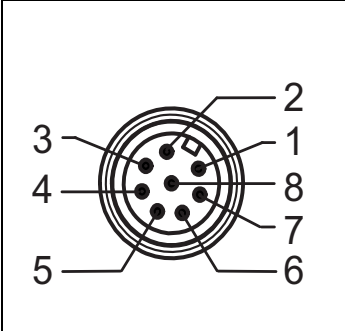
Connecting the sensor incorrectly can lead to the destruction of the device.

- Connect the supply voltage for the sensor correctly. Reverse connection is not permitted.

	Pin	Signal	Function
	1	V _S	Power Supply Sensor
	2	V _S heat.	Power Supply Heating
	3	GND	Ground Sensor
	4	Reserved	Do not use!
	5	GND heat.	Ground Heating

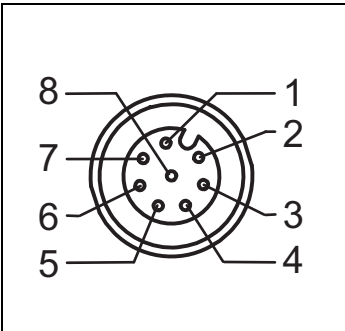
Tab. 22: LMS11x/LMS15x: Pin assignment of the “Power” connection (5-pin M12 male connector, A-coded)

“Data/Input” connection

	Pin	Signal	Function
	1	RxD HOST	Receiver RS-232 (Host interface)
	2	TxD HOST	Transmitter RS-232 (Host interface)
	3	CAN H	CAN bus high
	4	CAN L	CAN bus low
	5	GND RS/CAN	Ground RS-232/CAN
	6	IN1	Switching input 1
	7	IN2	Switching input 2
	8	GND IN 1/IN2	Ground switching input 1 and 2

Tab. 23: LMS11x/LMS15x: Pin assignment of the “Data/Input” connection (8-pin M12 male connector, A-coded)

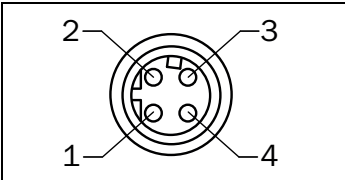
“I/O” connection

	Pin	Signal	Function
	1	INC1 A	Input encoder 1, contact A
	2	INC1 B	Input encoder 1, contact B
	3	GND INC1	Ground encoder 1
	4	OUT1 A	Switching output 1, contact A
	5	OUT2 A	Switching output 2, contact A
	6	OUT3 A	Switching output 3, contact A
	7	OUT1...3 B	Switching output 1 .. 3, contacts B
	8	OUT1...3 R	Switching output 1 .. 3, resistor monitored

Tab. 24: LMS11x/LMS15x: Pin assignment of the “I/O” connection (8-pin M12 female connector, A-coded)

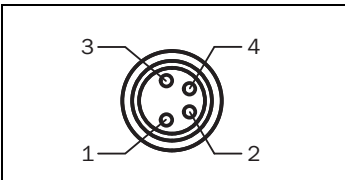
Important The OUT1 B, OUT2 B and OUT3 B connections are internally connected to each other.

“Ethernet” connection

	Pin	Signal	Function
	1	TX+	Transmitter+
	2	RX+	Receiver+
	3	TX-	Transmitter-
	4	RX-	Receiver-

Tab. 25: LMS11x/LMS15x: Pin assignment of the “Ethernet” connection (4-pin M12 female connector, D-coded)

“AUX” connection

	Pin	Signal	Function
	1	Reserved	Do not use!
	2	RxD AUX	Receiver RS-232 (auxiliary interface)
	3	GND RS	Ground RS-232
	4	TxD AUX	Transmitter RS-232 (auxiliary interface)

Tab. 26: LMS11x/LMS15x: Pin assignment of the “AUX” connection (4-pin M8 female connector)

6.3 Preparing the electrical installation

6.3.1 Supply voltage

For commissioning and operating the LMS1xx, type-dependent the following power supply voltages as per IEC 60364-4-41 as well as power drains of the custom-specific power supply unit are required:

Device	Power supply voltage	Power drain
LMS10x LMS11x LMS15x	DC 10.8 V ... 30 V	LMS100: Typical 10 W LMS111: Typical 55 W with maximum heating performance LMS151: Typical 55 W with maximum heating performance
LMS12x LMC12x LMS13x LMS14x LMS173 LMS182 LMC13x	DC 9 V ... 30 V	LMS12x: Typical 10 W LMC12x: Typical 10W LMS13x: Typical 55 W with maximum heating performance LMS141: Typical 55 W with maximum heating performance LMS173: Typical 10 W LMS182: Typical 55 W with maximum heating performance LMC13x: Typical 55 W with maximum heating performance

Tab. 27: Power supply voltages and power consumptions of LMS1xx

For recommended fuse values, please see [Section "Protection of Supply Cables" on page 50](#).



WARNING

Use safety transformer

The output circuit of the power supply must be safely electrically isolated from the input circuit, this feature is normally provided by a safety transformer in accordance with IEC 742 (VDE 0551).

6.3.2 Wire cross-sections

- Wire all connections with copper cables!
- Use the following wire cross-sections:

Connection of	Wire cross-sections
Power supply voltage	At least 0.25 mm ² , if local power supply (power supply unit) in the immediate vicinity
	At least 1.0 mm ² at maximum cable length of 20 m, if connection is made to an existing DC 24 V power supply
Switching outputs	At least 0.25 mm ² , maximum cable length 50 m with 0.5 mm ²
Data interfaces	At least 0.25 mm ²

Tab. 28: Required wire cross-sections

See also [Section 10.1 "Data sheet LMS1xx/LMC1xx laser measurement sensor" on page 91](#).

For the LMS10x the outside diameter of the common cable must be a maximum of 9 mm due to the PG7 cable entry.

Important If you use flexible connecting cables with stranded wire to connect to the terminals on the LMS10x/LMS12x/LMS173, you must **not** use any ferrules.

6.3.3 Boundary conditions for the data interfaces

The table below shows the recommended maximum length of cable as a function of the data transmission rate selected.

Interface type	Transmission rate	Maximum cable length
RS-232	115,200 Bd	10 m
CAN bus ¹⁾	1 MBit/s	40 m

Tab. 29: Maximum cable lengths for the data interfaces

1) With appropriate cable termination, termination in accordance with related specification.

Important

- Use screened cable (twisted-pair) with at least 0.25 mm².
- To prevent interference, do not lay data cable in parallel with power supply and motor cables over a long run, e.g. in cable ducts.

6.4 Perform electrical installation on the LMS1xx



CAUTION

- Lay all cables such that there is no risk of tripping and all cables are protected against damage.

6.4.1 Equipment

- Tool set
- Digital multimeter (current/voltage measurement)

6.4.2 Connecting the AUX or the Ethernet interface to the PC

Pre-assembled cables are available to configure the LMS1xx via the serial auxiliary interface or via the Ethernet interface.

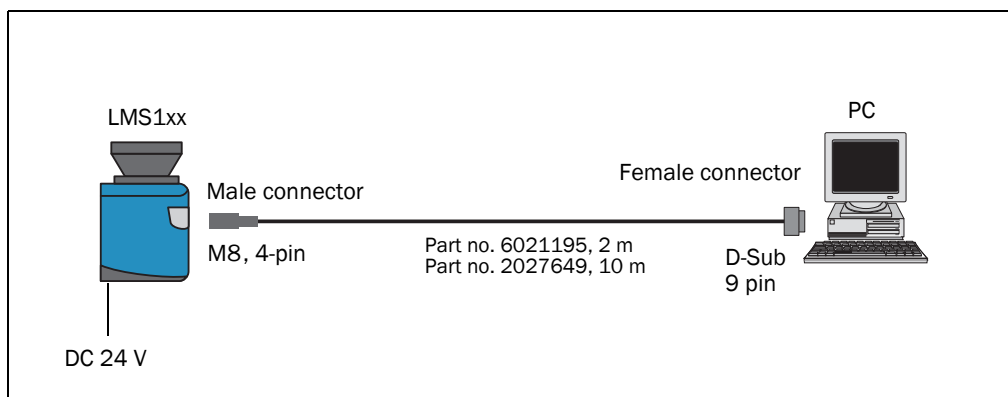


Fig. 46: Connecting the auxiliary interface (RS-232) to the PC

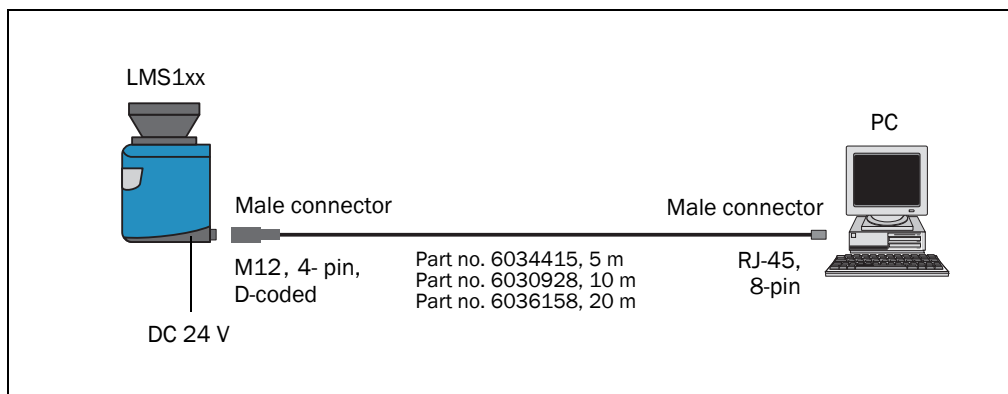


Fig. 47: Connecting the Ethernet interface to the PC

6.4.3 LMS10x/LMS12x/LMS173/LMC12x: Wiring the system connector

NOTICE

Reduced enclosure rating!

If the system connector is removed, the LMS10x/LMS12x/LMS173/LMC12x are no longer compliant with the enclosure rating IP 65.

- To prevent damage due to the entry of moisture and dirt, only open the system connector in dry, clean surroundings.
- If necessary, pre-wire and fit the system connector in suitable surroundings.

Prerequisites on the device for enclosure rating IP 65

- The system connector is plugged on the device, its four screws are tightened.
- The cable in the PG7 cable entry has a suitable outside diameter and is fixed by the lock nut.
- The cable plugged into the M12 round plug-in connection (Ethernet) is screwed tight. If the connection is not used, it must be fitted with a protective plug that is screwed tight (as in the delivery condition).
- The black rubber plate of the auxiliary interface on the front is closed and must be flush mounted on the housing.

1. Ensure the power supply to which the LMS1xx is connected is switched off.
2. Remove system connector on the underside of the device. For this purpose undo the four fixing screws ([Fig. 10.3.1 on page 99](#)) and pull the system connector carefully off the device perpendicular to the base.
3. The PG7 cable entry (metal) has an earth connection to the device. If a screened connecting cable is used, as necessary connect the screen braid on the cable to the cable entry. For this purpose, shorten the screen braid as appropriate before assembling the cable entry and fit over the plastic insert for the cable entry.
4. Undo fitting for the PG7 cable entry.
5. Pull the cable for power supply voltage, switching outputs and data interface (RS-232) with maximum outside diameter \varnothing 5.6 mm through the plastic insert for the PG7 cable entry.
6. Connect electrically isolated wires without draw to the terminal block regarding the terminal assignment ([Tab. 19 on page 67](#)).
7. If necessary, connect screen braid on the cable to the cable entry.
8. Fit PG7 cable entry fitting and tighten.
9. Carefully re-fit the system connector to the LMS1xx.
10. Tighten the fixing screws for the system connector.

6.4.4 LMS11x/LMS13x/LMS15x/LMS182/LMC13x: Wiring the M12 round plug-in connectors

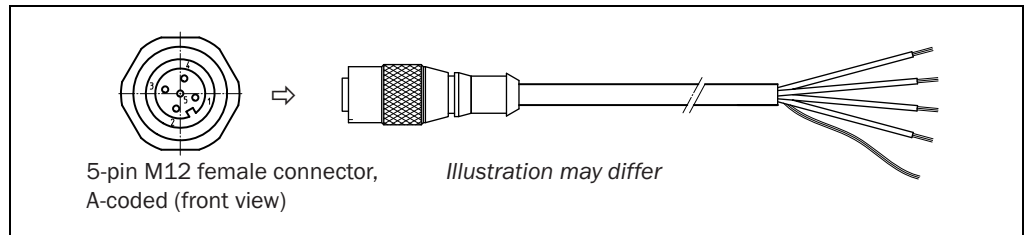
NOTICE

Prerequisites on the device for enclosure rating IP 67

- The device is only connected on the M12 plug-in connectors provided for this purpose.
- The cables and the M12 plug-in connectors are compliant with enclosure rating IP 67.
- The cables plugged into the M12 round plug-in connections must be screwed tight. Any electrical connections that are not being used must be fitted with protective caps or plugs that are screwed tight (as in the delivery condition).
- The black rubber plate of the auxiliary interface on the front is closed and must be flush mounted on the housing. The round cover is screwed tight.

Optional, pre-assembled cables are available as accessories for the connection to the round M12 round plug-in connectors. These comprise the round plug-in connector and 5 m, 10 m or 20 m (cable with flying leads).

Connecting the power supply voltage to the LMS11x/LMS13x/LMS15x/LMS182/LMC13x
 Adapter cables part no. 6036159 (5 m), part no. 6036160 (10 m), part no. 6036161 (20 m).



Pin	Signal	Function	Color of lead
1	V _S	Power Supply Sensor	Brown
2	V _S heat.	Power Supply Heating	White
3	GND	Ground Sensor	Blue or yellow
4	Reserved	Do not use!	-
5	GND heat.	Ground Heating	Black or green

Tab. 30: Pin assignments and lead color assignments of cables no. 6036159, no. 6036160, no. 6036161

NOTICE

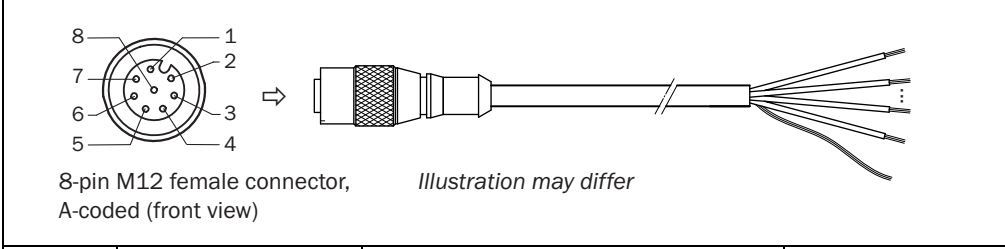
Destruction of the device!

Connecting the sensor incorrectly can lead to the destruction of the device.

- Connect the supply voltage for the sensor correctly. Reverse connection is not permitted.

Connecting the „Data“ connection (RS-232) on the LMS11x/LMS15x/LMS182

Adapter cables part no. 6036153 (5 m), part no. 6028420 (10 m), part no. 6036154 (20 m)



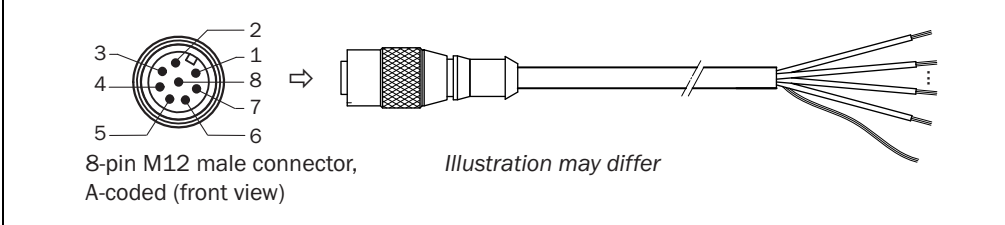
8-pin M12 female connector, A-coded (front view) *Illustration may differ*

Pin	Signal	Function	Color of lead
1	RxD HOST	Receiver RS-232 (Host interface)	White
2	TxD HOST	Transmitter RS-232 (Host interface)	Brown
3	CAN H	CAN bus high	Green
4	CAN L	CAN bus low	Yellow
5	GND RS/CAN	Ground RS-232/CAN	Gray
6	IN1	Switching input 1	Pink
7	IN2	Switching input 2	Blue
8	GND IN 1/IN2	Ground switching input 1 und 2	Red

Tab. 31: Pin assignments and lead color assignments of cables no. 6036153, no. 6028420, no. 6036154

Connecting the „I/O“ connection on the LMS11x/LMS13x/LMS15x/LMS182/LMC13x

Adapter cables part no. 6036155 (5 m), part no. 6036156 (10 m), part no. 6036157 (20 m)



8-pin M12 male connector, A-coded (front view) *Illustration may differ*

Pin	Signal	Function	Color of lead
1	INC1 A	Input encoder 1, contact A	White
2	INC1 B	Input encoder 1, contact B	Brown
3	GND INC1	Ground encoder 1	Green
4	OUT1 A	Switching input 1, contact A	Yellow
5	OUT2 A	Switching input 2, contact A	Gray
6	OUT3 A	Switching input 3, contact A	Pink
7	OUT1...3 B	Switching input 1 .. 3, contacts B	Blue
8	OUT1...3 R	Switching input 1 .. 3, resistor monitored	Red

Tab. 32: Pin assignments and lead color assignments of cables no. 6036155, no. 6036156, no. 6036157

Important The OUT1 B, OUT2 B and OUT3 B connections are internally connected to each other.

6.4.5 Wiring of switching inputs and outputs on the LMS1xx

Connecting switching inputs referred to a potential (power supply voltage)

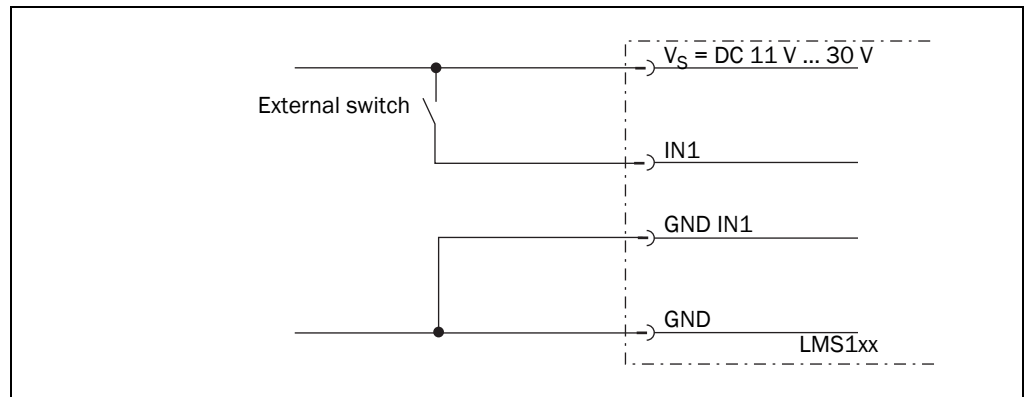


Fig. 48: Connecting switching input, e.g. IN1, referred to a potential

Important The switching inputs require a switching voltage of at least DC 11 V. For this reason the supply voltage must be at least DC 11 V.

Connecting switching inputs as floating

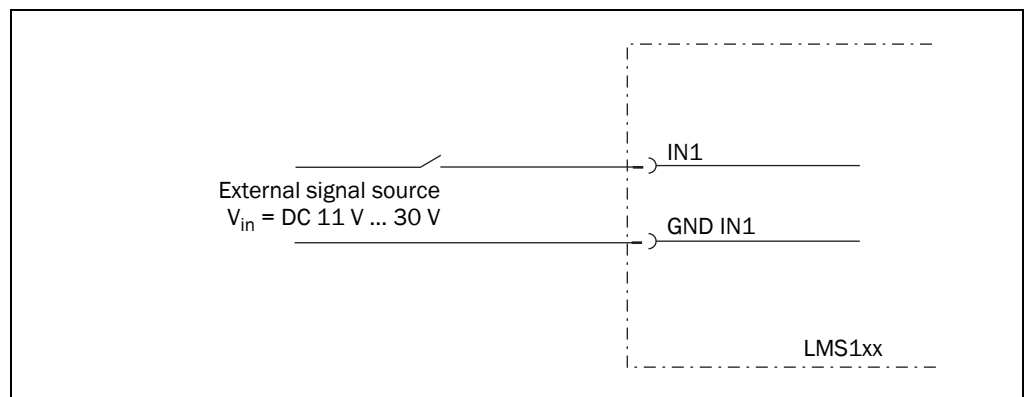


Fig. 49: Connecting switching input, e.g. IN1, as floating

Wiring encoder inputs

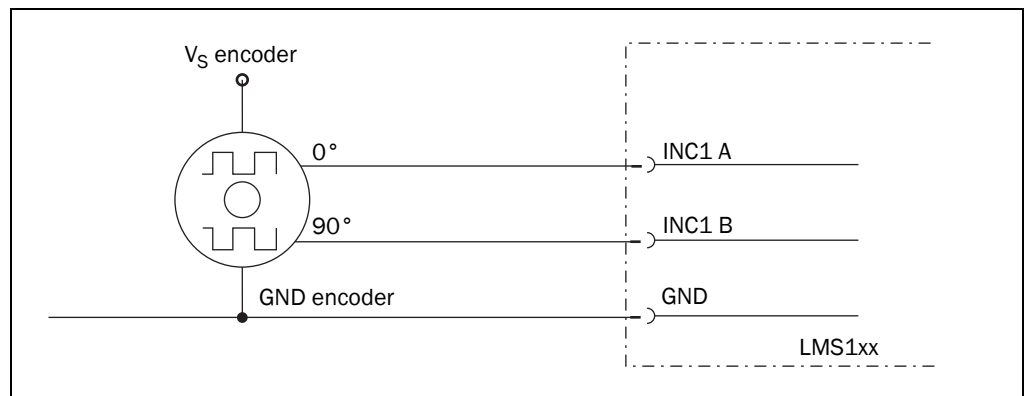


Fig. 50: Wiring encoder inputs

Connection of the switching outputs of the LMS10x/LMS11x/LMS15x to a PLC, non-floating

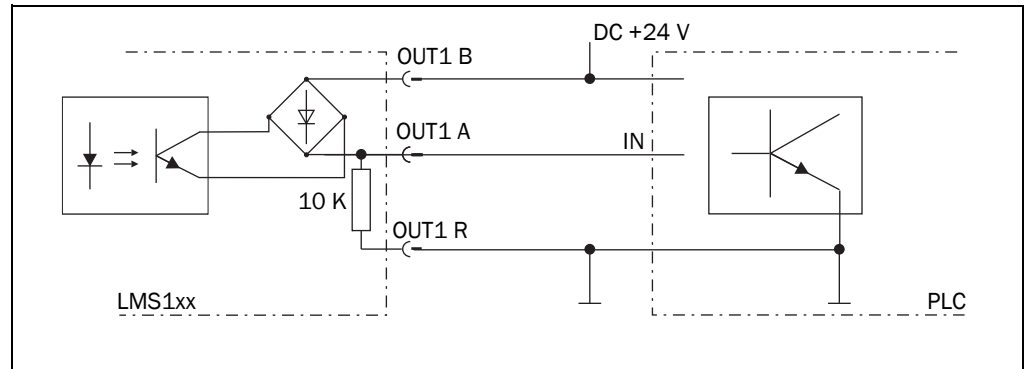


Fig. 51: Connection of the switching outputs, e.g. OUT1, to a PLC, non-floating (active high)

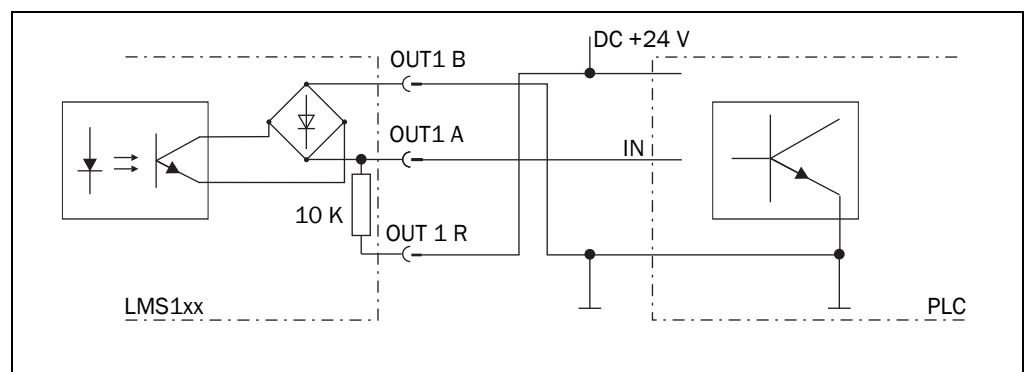


Fig. 52: Connection of the switching outputs, e.g. OUT1, to a PLC, non-floating (active low)

Connection of the switching outputs of the LMS10x/LMS11x/LMS15x to a PLC, floating

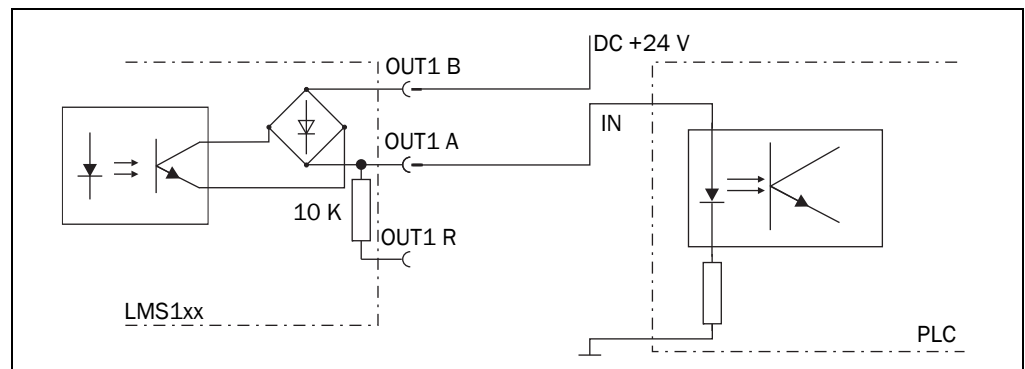


Fig. 53: Connection of the switching outputs, e.g. OUT1, to a PLC, floating (active high)

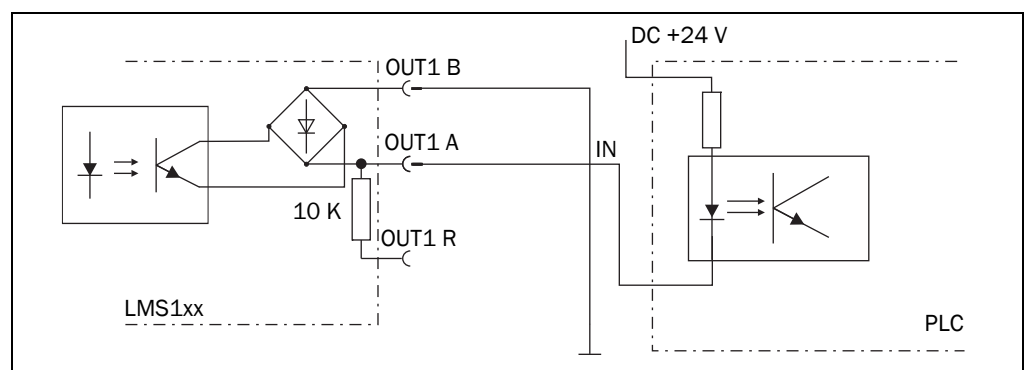


Fig. 54: Connection of the switching outputs, e.g. OUT1, to a PLC, floating (active low)



Connection to an object protection system

LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS

You will find information on connecting these devices to an object protection system in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

Wiring CAN-interface

To wire the CAN interface a screened "twisted-pair" cable is required. The terminator of $120\ \Omega$ must be connected.

- Pay attention to max. cable length as per [section 6.3.3 "Boundary conditions for the data interfaces" on page 72](#).

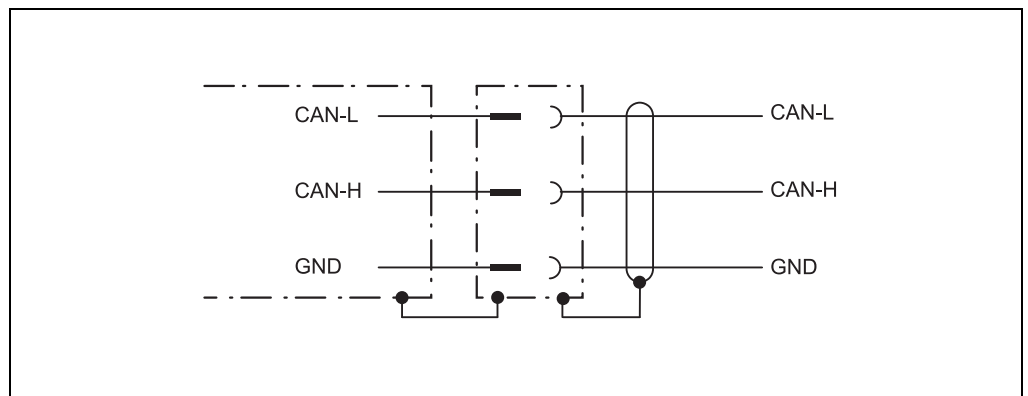


Fig. 55: Wiring CAN- interface

Wiring RS-232 interface

A shielded cable is required for the wiring of the RS-232 interface.

- Pay attention to max. cable length as per [section 6.3.3 "Boundary conditions for the data interfaces" on page 72](#).

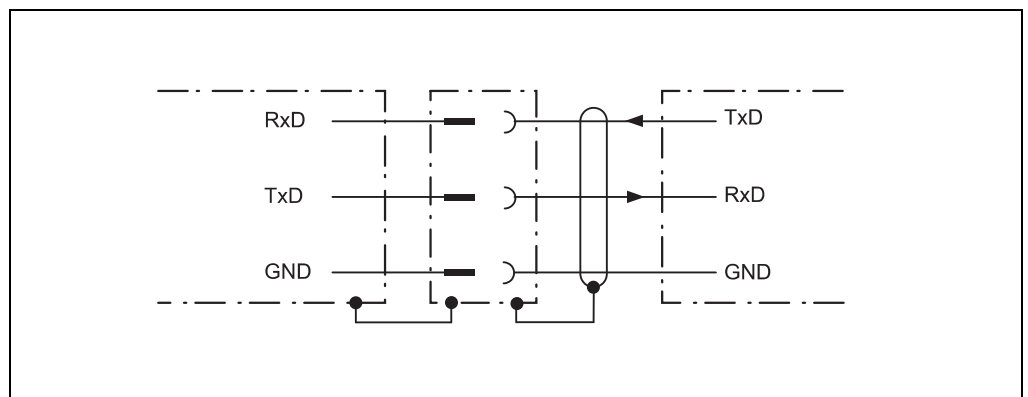


Fig. 56: Wiring RS-232 interface

7 Commissioning and configuration



WARNING

Danger due to incorrect commissioning and configuration!

No Commissioning without a thorough check by qualified personnel!

Before you operate a system equipped with the LMS1xx for the first time, make sure that the system is first checked and released by qualified personnel. On this issue, observe the notes in chapter *chapter 2 “For your safety” on page 11*.

Commissioning, configuration and diagnostics are undertaken using the SOPAS ET configuration software.

7.1 Overview of the commissioning steps

- Install SOPAS ET configuration software
- Establish communication with the LMS1xx
- Create a custom parameter set using SOPAS ET and save in non-volatile memory in the LMS1xx as well as in a file on the PC due to a saving concept.
- Test LMS1xx for correct function

7.2 SOPAS ET configuration software

The interactive configuration is carried out using SOPAS ET. Using this configuration software, you can configure and test the measurement properties, the analysis behaviour and the output properties of the system as required. The configuration data can be saved as a parameter set (project file) on the PC and archived.

Help for the program user interface as well as for the different options can be found in SOPAS ET:

- menu HELP, HELP F1: comprehensive online help for the program interface and the different options
- HELP window (on the bottom left in the program user interface): context sensitive help for the visible dialog
- tool tips: Move the mouse pointer over an input field. A short text (“tool tip”) with information about valid entries appears.

Primary functions are:

- selection of the menu language (German/English)
- establishment of the communication with the LMS1xx
- password-protected configuration with different operating levels
- system diagnostics

7.2.1 System requirements for SOPAS ET

The configuration software SOPAS ET, the current system prerequisites for the PC, and the instructions for downloading the software and the device description file(s) can be found online at:

- http://www.sick.com/SOPAS_ET

7.2.2 Download and installation of SOPAS ET

1. Start PC.
2. Download and install the latest version of the SOPAS ET configuration software, as well as current device description file (*.sdd) for the LMS1xx 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 install wizard. Administrator rights may be required on the PC to install the software
4. Start the “SOPAS ET” program option after completing the installation. Path: Start > Programs > SICK > SOPAS ET Engineering Tool > SOPAS.
5. Establish a connection between SOPAS ET and LMS1xx via the wizard which opens automatically. To do so, under the devices available depending on the connected communication interface, e.g. Ethernet, select the LMS1xx. (Default Ethernet address: IP address: 192.168.0.1, Subnet mask: 255.255.255.0).
SOPAS ET establishes communication with the LMS1xx and loads the associated device description file for the LMS1xx.

7.2.3 SOPAS ET default setting

Parameter	Value
Language for the user interface	English (the software must be re-started after a change)
Units of length	Metric
User group (operating level)	Machine operator
Download of the parameters to the LMS1xx	Immediate on change, temporary in the LMS1xx RAM
Upload of the parameters from the LMS1xx	After switching online, automatic
Window layout	3 (project tree, help, working area)
Serial communication	COM1: 9600 Bd/19200 Bd, 8 data bits, no parity, 1 stop bit

Tab. 33: SOPAS ET default setting

7.3 Establish communication with the LMS1xx

Important For communication via Ethernet TCP/IP, the TCP/IP protocol must be active on the PC.

1. Switch on the PC.
2. Connect the PC to the LMS1xx using data cable.
3. Switch on the supply voltage for the LMS1xx.
The LMS1xx performs a self-test and initializes itself.

7.3.1 Connect the data interfaces

➤ Connect PC and LMS1xx together as per table.

Data interface	Comment
Ethernet	Connect the PC to the LMS1xx using the Ethernet cable (see Fig. 47 on page 73)

Or:

RS-232	Connect the PC (serial interface) to the LMS1xx (see Fig. 46 on page 73)
--------	---

Tab. 34: Connect the data interfaces

7.3.2 Starting SOPAS ET and opening the scan assistant

1. Start SOPAS ET.
By default SOPAS ET opens the program window with the English user interface.
2. To change the language setting, in the start dialog box click CANCEL and using the menu TOOLS, OPTIONS change the language for the user interface to GERMAN/DEUTSCH.
3. If the language setting has been modified, quit SOPAS ET and re-start.
4. In the dialog box, choose the option CREATE NEW PROJECT and confirm with OK.
5. In the main window in SCAN ASSISTANT click the CONFIGURATION button.
The SCAN ASSISTANT dialog box appears.

7.3.3 Configuring the serial connection

1. In the SCAN ASSISTANT dialog box, under SERIAL CONNECTION, STANDARD PROTOCOL, activate the ACTIVATE SERIAL COMMUNICATION checkbox.
2. Click ADVANCED... button.
3. In COLA DIALECT choose the BINARY option.
4. Choose following PORT SETTINGS: 8 data bits, no parity, 1 stop bit.
5. Confirm the settings with OK.
The ADVANCED SCAN SETTINGS dialog box is closed.
6. Confirm the settings in the SCAN ASSISTANT dialog box with OK.
The SCAN ASSISTANT dialog box is closed.

7.3.4 Configuring the Ethernet connection

Important Deactivate all programs on your PC/notebook that access Ethernet or TCP/IP.

1. In the SCAN ASSISTANT dialog, under INTERNET PROTOCOL, IP COMMUNICATION, select the ACTIVATE IP COMMUNICATION checkbox and the USE AUTOIP checkbox.
2. Confirm the settings in the SCAN ASSISTANT dialog box with OK.
The SCAN ASSISTANT dialog box is closed.

7.3.5 Performing scan

1. In the SCAN ASSISTANT dialog box, click on the START SCAN button.
2. Choose devices listed and accept using ADD DEVICE.
A scan is performed for devices connected via the connection. SOPAS ET adds the devices found to the project tree and uploads the actual parameter set from the device.

Important If it is not possible to establish a connection, pay attention to the following notes for Windows XP (the settings are similar for other operating systems). To make changes to the operating system, in general you will need administrator rights on the PC.

NOTICE

Please document or save the original settings before you make changes to the system settings.

All liability for any faults and damage due to changes to system settings (e.g. to the IP address) is excluded.

- Ensure that any “Secure Clients” etc. on your PC/notebook that monitor access are deactivated while the parameters are configured. Check the settings using the START MENU, SETTINGS, NETWORK CONNECTIONS, LOCAL AREA CONNECTION. In the LOCAL AREA CONNECTION STATUS dialog box click PROPERTIES.

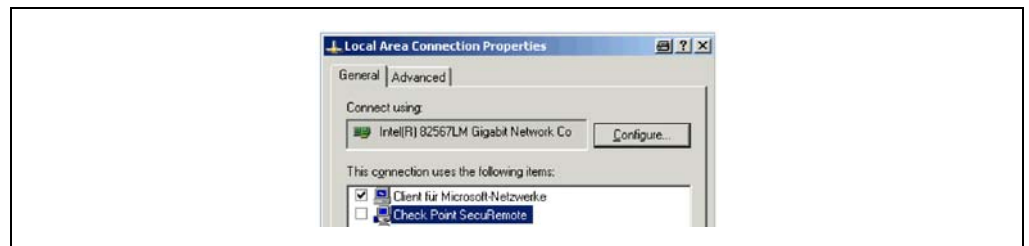


Fig. 57: Local Area Connection Properties in Windows XP

- Ensure that the IP address of your PC/notebook is correct. LMS1xx and notebook must not have the same IP address.

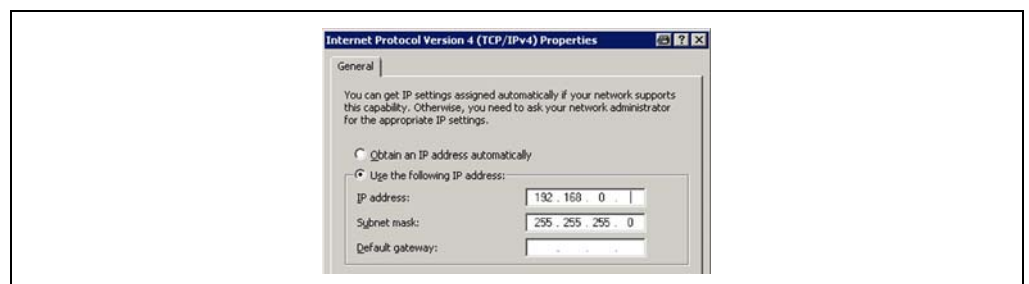


Fig. 58: IP address in Windows XP

- Proxy servers should be disabled or an exception entered for the IP address.

7.4 Initial commissioning

The LMS1xx is adapted to the local measurement or detection situation using SOPAS ET. For this purpose a custom parameter set is created using SOPAS ET. The parameter set can either be loaded initially from the device (upload) or it can be prepared independently.

The parameter set is then loaded into the LMS1xx (download). This action is performed either immediately (SOPAS ET option IMMEDIATE DOWNLOAD) or manually (SOPAS ET command DOWNLOAD ALL PARAMETERS TO THE DEVICE).

Important Once the configuration has been completed, the parameter set must be saved in non-volatile memory in the LMS1xx. In addition, the parameter set has to be saved as a project file (*.spr file with configuration data) on the PC and archived.

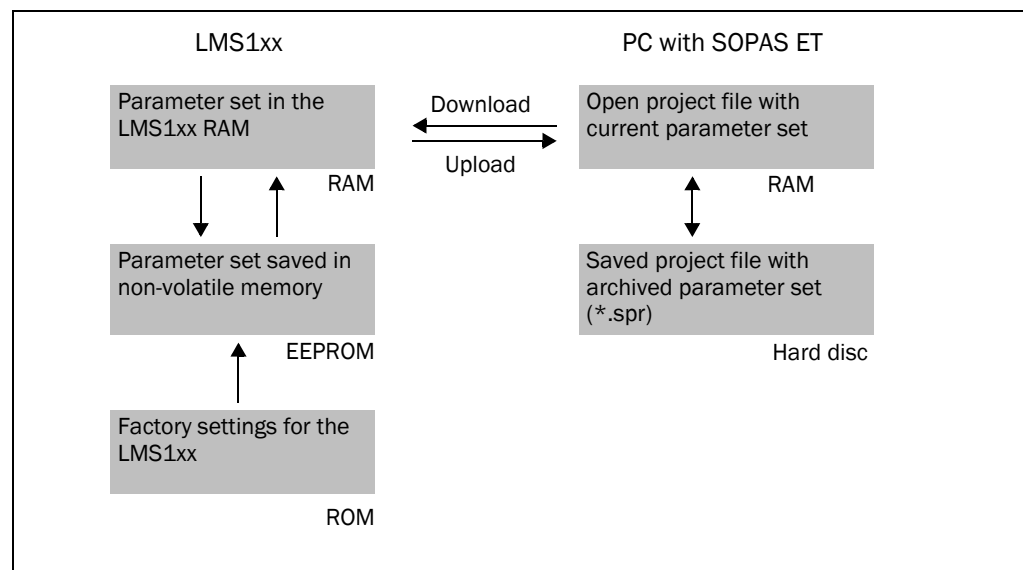


Fig. 59: Principle of data storage

7.4.1 Configuring the LMS1xx

You can configure the LMS1xx in two ways:

- Interactively using SOPAS ET
This section describes the interactive configuration.
- Using configuration telegrams
On this subject please read [section 3.12 “Data communication using telegrams” on page 49](#).

Interactive configuration using SOPAS ET

All parameters that can be configured for the LMS1xx are type-dependently combined into a corresponding device description (sdd-file) for SOPAS ET. You can open this file using the device description project tree.

The function of each parameter is explained in a context-sensitive online help (F1 key). The valid range of values and the default are listed in the PARAMETER INFO window (right mouse button when the pointer is positioned over the parameter).

Important Software access to the LMS1xx is password protected. Following completion of the configuration, you should change the password so that it can perform its protective function.

In the default delivery status the following passwords are defined:

User level	Password
Maintenance personnel	main
Authorized client	client

Tab. 35: Passwords for LMS10x/11x/15x/LMS173/LMS182

LMS12x/LMS13x/LMS14x Security and LMC12x/LMC13x VdS (object protection)

Access to these devices via the SOPAS ET configuration software is described in the document "Technical Information (installer instructions VdS)", part no.: 8013749, issue in English.

Please see [section 1.5 "Further information" on page 9](#).

A password is not defined for the Operator user level as supplied.

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



NOTICE

Risk of losing the configuration parameters!

Switching off the voltage supply of the LMS1xx during configuration causes all parameters already configured to be lost in the volatile memory of the device.

- Do not switch off the voltage supply during configuration!

1. From the OPTIONS menu select the LOGIN DEVICE command and log in to the system using the password "client" as AUTHORIZED CLIENT.
2. Configure the LMS1xx for the required application with the aid of the parameters in SOPAS ET.



Help for the program user interface as well as for the different options can be found in SOPAS ET.

Expert mode or Quickstart

For the LMS12x a Quickstart configuration mode is available with the aid of which the parameters for the LMS12x can be easily configured for the needs of object protection.

For the LMS10x/LMS11x/LMS15x only the Expert mode is available. The Expert mode can also be used for the LMS12x.

Resetting configuration

Recommendation To reset the LMS1xx to the default delivery status, you should first export the device data to a file from a device that is in the default delivery status. You can then subsequently load these device data into an already configured device to reset its configuration to the default delivery status.

7.5 Connection and test measurement



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

1. In the project tree, choose LMS..., MONITOR, SCAN VIEW.
2. In order to start the measurement, click on PLAY.
3. Compare the measurement line with the desired result.

Important

- The SCAN VIEW in the MONITOR is dependent on the available computing power of the PC and is **not** output in real-time. For this reason not all measured values are displayed. The same limitation also applies when saving measured values displayed in a file.
 - The monitor displays the measured values **unfiltered**, i.e. the action of filters can **not** be checked with the aid of the monitor.
4. After completing the test measurement successfully, save the configuration permanently to the LMS1xx: menu LMS..., PARAMETER, SAVE PERMANENT.

8 Maintenance

NOTICE

Claims under the warranty rendered void!

The housing screws of the LMS1xx are sealed. Claims under the warranty against SICK AG will be rendered void if the seals are damaged or the device opened. The housing is only allowed to be opened by authorized service personnel.

8.1 Maintenance during operation

8.1.1 Cleaning the optics cover

The LMS1xx is largely maintenance-free. The optics cover on the LMS1xx should however be cleaned regularly and if it is contaminated.

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

Important Static charges can cause dust particles to be attracted to the optics cover.

You can diminish this effect by using the anti-static plastic cleaner (SICK part no. 5600006) and the SICK lens cloth (part no. 4003353) (see [section 11.1.1 “Consumables” on page 104](#)).

How to clean the optics cover:

1. Use a clean and soft brush to remove dust from the optics cover.
2. Wipe the view window of the optics cover with a clean and damp cloth.

8.2 Exchanging an LMS1xx

Incorrect or damaged LMS1xx have to removed and resealed with either new or repaired LMS1xx of the same type.

As all external cable connections end in the system connector or in the round plug-in connectors, it is not necessary to re-install the device electrically on a device replacement. The replacement unit of the same type can then be simply connected.

If the LMS1xx is to be replaced, proceed as follows:

1. Switch off the voltage supply for the LMS1xx.
2. **LMS10x/LMS12x/LMS17x:**
Loosen and remove the system connector on the bottom of the device.
LMS11x/LMS13x/LMS14x/LMS15x/LMS18x:
Loosen and remove all connection cables from the LMS1xx.
3. Mount the replacement device (see [chapter 5 “Mounting” on page 55](#)).
4. **LMS10x/LMS12x/LMS17x:**
Plug and fix the system connector on the bottom of the replacement device.
LMS11x/LMS13x/LMS14x/LMS15x/LMS18x:
Connect all connection cables to the replacement device and fix them.
5. Configure the replacement device (see [chapter 7 “Commissioning and configuration” on page 80](#)).

8.2.1 Returns

- Only return devices after consultation with the SICK Support.

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

- Details of a contact person
- A description of the application
- A description of the fault that occurred

8.3 Decommissioning

8.3.1 Disposal

The design of the LMS1xx allows for its separation as recyclable secondary raw materials and hazardous waste (electronic scrap).

Important **Danger to the environment due to improper disposal of the LMS1xx:**

Disposing of LMS1xx improperly may cause damage to the environment.

- Always observe the valid national regulations on environmental protection.
- Following correct disassembly, pass on any commercially viable disassembled components for recycling. Separate materials as far as possible by type.

SICK AG is not currently able to take back devices that can no longer be used.

9 Troubleshooting

NOTICE

Claims under the warranty rendered void!

The housing screws of the LMS1xx are sealed. Claims under the warranty against SICK AG will be rendered void if the seals are damaged or the device opened. The housing is only allowed to be opened by authorized service personnel.

This chapter describes how to identify and rectify errors and malfunctions of the LMS1xx.

9.1 In the event of faults or errors








WARNING

Cease operation if the cause of the malfunction has not been clearly identified!

Stop the machine/system if you cannot clearly identify or allocate the error and if you cannot safely rectify the malfunction.

9.2 Error displays of the LEDs

Important On the LMS12x the status indicators are switched off so that as far as possible it cannot be seen that the device is part of an object protection system. In the practice check mode they are switched on.

Display	Possible cause	Rectification of the error
 and  off	No operating voltage, or voltage too low	➤ Check the voltage supply and activate, if necessary.
 illuminated	Optics cover contaminated, still in operation	➤ Clean the optics cover.
 flashes with 1 Hz	Optics cover contaminated, no operation	➤ Clean the optics cover.
 flashes with 4 Hz	System error	➤ Pay attention to the error display of the 7-segment display or carry out a diagnostics with the aid of SOPAS ET. ➤ Switch the device off and back on again.

Tab. 36: Error displays of the LEDs

9.3 Indications of the 7-segment display

Display	Possible cause	Rectification of the error
, , ...	No error	Device in measurement mode
	IDLE mode, the outputs are in the OFF state, the laser is switched off.	No error. If the criteria for the IDLE mode are withdrawn, readiness for operation is re-established.
	Motor starts	No error
	LMS1xx faulty	➤ Send the LMS1xx to the manufacturer for repair.

Tab. 37: Indications of the 7-segment display

9.4 Detailed error analysis

The LMS1xx outputs occurring errors in various ways. Errors are output in stages and always permit detailed analysis:

- Communication errors can occur on the transfer of telegrams to the LMS1xx. The LMS1xx then returns an error code.
- In case of status errors occurring during a scan, error codes are written to a status log.

9.4.1 Field evaluation monitor

Using the field evaluation monitor, you can analyse whether and how evaluation fields are infringed and how the outputs on the LMS1xx behave.

PROJECT TREE, LMS..., MONITOR, FIELD EVALUATION MONITOR.



9.4.2 Field evaluation logging

Using the field evaluation logging you can log, save and subsequently play back the operation of LMS1xx. It is used for diagnostics over extended periods and for the analysis of malfunctions or for the optimization of processes.

PROJECT TREE, LMS..., MONITOR, FIELD EVALUATION LOGGING.



9.5 SICK Support

If an error cannot be eliminated, it is possible that the LMS1xx is defective.

The LMS1xx cannot be repaired by the user, meaning that it is not possible to re-establish functions after a failure cannot be repaired by the user, meaning that it is not possible to re-establish functions after a failure. Interrupting or modifying the LMS1xx will invalidate any warranty claims against SICK AG.

However, the LMS1xx can be rapidly replaced by the user, see [section 8.2 “Exchanging an LMS1xx” on page 87](#).

- If an error occurs which cannot be eliminated, please contact SICK Support. Please refer to the back page of these operating instructions for your agent's contact details.

Important Before calling, make a note of all type label data such as type code, serial number, etc. to ensure faster processing.

10 Technical specifications

10.1 Data sheet LMS1xx/LMC1xx laser measurement sensor

	Minimum	Typical	Maximum
Functional data			
Scan angle			270°
Scanning frequency	25 Hz		50 Hz
Remission	3 %		Several 1,000 % ¹⁾ (reflectors)
Angular resolution			
With 25 Hz	0.25°		0.5°
With 50 Hz		0.5°	
Measuring error 1. Reflected pulse ²⁾ – All variants except LMS14x Security			
Systematic error		±30 mm	±50 mm
Temperature drift	0 mm/°C		0.32 mm/°C
Statistical error (1 σ)		12 mm	20 mm
Measuring error 1. Reflected pulse ³⁾ – LMS14x Security			
Systematic error		±30 mm	±50 mm
Temperature drift	0 mm/°C		0.32 mm/°C
Statistical error (1 σ) (0.5 m ... 10 m)		12 mm	
Statistical error (1 σ) (10 m ... 20 m)		20 mm	
Statistical error (1 σ) (20 m ... 40 m)		35 mm	50 mm
Immunity to external light		40 klx	
Evenness of the scan field (25 Hz)			
Cone		±0.5°	±1°
Inclination		±1°	±2°
Distance from mirror axis of rotation (zero point on the X and Y axis) to the rear of the device		55 mm	
Distance between centre of the scan plane and the bottom edge of the housing		116 mm	
Distance measuring range (operating range)			
LMS10x/LMS11x LMS12x/LMS13x/LMS173/LMS182 Security LMC12x/LMC13x VdS	0.5 m		20 m
LMS14x Security	0.5 m		40 m
LMS15x	0.5 m		50 m
Hardware blanking window	0 m		15 m
Step width		1 m	
Power-up delay			60 s
Of a configured device		15 s	
Configurable restart after	2 s		60 s
Numbers of evaluation fields			
LMS10x/LMS11x/LMS15x LMS12x/LMS13x/LMS173/LMS182 Security LMC12x/LMC13x VdS			10
LMS14x Core Security			4
LMS14x Prime Security			10

Tab. 38: Data sheet LMS1xx/LMC1xx

	Minimum	Typical	Maximum
General data			
Laser class	Laser class 1 according IEC 60825-1:2014		
Enclosure rating	As per EN 60529 (1991-10); A1 (2002-02)		
LMS10x LMS12x/LMS173 Security LMC12x VdS	IP 65		
LMS11x/LMS15x LMS13x/LMS14x/LMS182 Security LMC13x VdS	IP 67 ⁴⁾		
Protection class	III as per EN 50178 (1997-10)		
EMC test	As per EN 61000-6-2 (2005-08), EN 61000-6-3 (2007-01)/A1 (2011-03)		
Electrical safety	As per EN 50178 (1997-10)		
Operating ambient temperature range			
LMS10x LMS12x/LMS173 Security LMC12x VdS	0 °C		+50 °C
LMS11x/LMS15x LMS13x/LMS182 Security LMC13x VdS	-30 °C		+50 °C
LMS14x Security	-40 °C		+60 °C
LMC12x VdS with mounting kit 1	-30 °C		+45 °C
LMC12x VdS with mounting kit 2	-30 °C		+50 °C
Storage ambient temperature range			
All variants except LMS14x Security	-30 °C		+70 °C max. 24 h
LMS14x Security	-40 °C		+70 °C max. 24 h
Humidity (taking into account the operating ambient temperature range)	DIN EN 60068-2-61, Procedure 1		
Vibration resistance	As per EN 60068-2-6 (1995-04)		
Frequency range	10 Hz		150 Hz
Amplitude	5 g RMS		
Shock resistance			
As per EN 60068-2-27 (1993-03), EN 60068-2-29 (1993-04)			
Single shock	15 g, 11 ms		
Continuous shock	10 g, 16 ms		
Installation height	< 5,000 m above sea level		
Sender			
Pulsed laser diode			
Wave length	895 nm	905 nm	915 nm
Divergence of the collimated beam (solid angle)		15 mrad	
Light spot size at the optics cover		8 mm	
Light spot size at 18 m scanning range		300 mm	
Housing			
Material	GD-ALSI12 3.2582.05		
Alloy	Excellent weather resistance as per DIN EN 106:1988, plate 3		
Color LMS10x	RAL 5012 (blue)		
Color LMS1x1	RAL 7032 (gray)		
Color LMS1x2	RAL 9005 (black)		

Tab. 38: Data sheet LMS1xx/LMC1xx (cont.)

LMS1xx Laser Measurement Sensors

	Minimum	Typical	Maximum
Color LMS1x3	RAL 9003 (white)		
Optics cover			
Material	Polycarbonate		
Surface finish	Outside with scratch-resistant coating		
System connector (LMS10x/LMS12x/LMS173 Security)			
Material	GD-ALSI12 3.2582.05		
Color	RAL 9005 (black)		
Cable entry (LMS10x/LMS12x/LMS173 Security)	PG7		
Material	Stainless steel/plastic		
Dimensions ⁵⁾			
Height			
LMS10x LMS12x/LMS173 Security LMC12x VdS			152 mm
LMS11x/LMS15x LMS13x/LMS14x/LMS182 Security LMC13x VdS			162 mm
Width			102 mm
Depth			106 mm
Total weight (without connection cables)		1.1 kg	

Electrical data (Typical values: Apply to DC 24 V supply voltage unless otherwise stated)

Power Supply Sensor, SELV or PELV as per IEC 60364-4-41 (2005-12)			
LMS10x/LMS11x/LMS15x LMS14x Security	10.8 V ⁶⁾	24 V	30 V
LMS12x/LMS13x/LMS14x/LMS173/LMS182 Security LMC12x/LMC13x VdS	9 V ⁷⁾	24 V	30 V
Permissible residual ripple			±5%
Power Supply Heating, SELV or PELV as per IEC 60364-4-41 (2005-12)			
LMS11x/LMS15x LMS182/LMS13x Security LMC13x VdS	19.2 V	24 V	28.8 V
LMS14x Security	21.6 V	24 V	28.8 V
All variants			
Switch on current			2 A
Operating current Sensor		0.33 A	0.4 A at DC 24 V 1.0 A at DC 9 V
Power consumption Sensor		8 W	10 W
LMS11x/LMS15x, LMS13x/LMS14x/LMS182 Security as well as LMC13x VdS			
Power consumption Heating		35 W	45 W
Operating current (Sensor + Heating) with max. heating performance		1.8 A	2.6 A
Power consumption (Sensor + Heating) with max. heating performance		43 W	55 W

Tab. 38: Data sheet LMS1xx/LMC1xx (cont.)

	Minimum	Typical	Maximum
Electrical connection			
LMS10x LMS12x Security LMC12x VdS	Removable system connector with 2 screw terminal blocks 1 x M12 round plug-in connector 1 x M8 round plug-in connector		
LMS11x/LMS15x LMS13x/LMS14x Security LMC13x VdS	4 x M12 round plug-in connectors 1 x M8 round plug-in connector		
Technical specifications, screw terminals			
Cross-section of rigid cores (American Wire Gauge – AWG)	0.14 mm ² (approx. 26 AWG)		1.5 mm ² (approx. 16 AWG)
Cross-section of flexible cores (American Wire Gauge – AWG)	0.14 mm ² (approx. 26 AWG)		1.0 mm ² (approx. 18 AWG)
Insulation stripping length for the cores		5 mm	
Screw tightening torque	0.22 Nm		0.3 Nm
Cable lengths			
For power supply Sensor at DC 24 V			
With 1 mm ² wire cross-section (approx. 18 AWG)			220 m
With 0.5 mm ² wire cross-section (approx. 22 AWG)			110 m
With 0.25 mm ² wire cross-section (approx. 24 AWG)			50 m
For power supply heating at DC 24 V (all variants with heating except LMS14x Security)			
With 1 mm ² wire cross-section (approx. 18 AWG)			45 m
With 0.5 mm ² wire cross-section (approx. 22 AWG)			20 m
With 0.25 mm ² wire cross-section (approx. 24 AWG)			10 m
For power supply heating at DC 24 V (LMS14x Security)			
With 1 mm ² wire cross-section (approx. 18 AWG)			24 m
With 0.5 mm ² wire cross-section (approx. 22 AWG)			12 m
With 0.25 mm ² wire cross-section (approx. 24 AWG)			6 m
For power supply sensor at DC 12 V (all variants)			
With 1 mm ² wire cross-section (approx. 18 AWG)			20 m
With 0.5 mm ² wire cross-section (approx. 22 AWG)			10 m
With 0.25 mm ² wire cross-section (approx. 24 AWG)			5 m
Switching inputs			
Number	2		
Input resistance on HIGH		2 kΩ	
Voltage for HIGH	11 V	24 V	30 V
Voltage for LOW	-30 V	0 V	5 V
Input capacity		15 nF	
Static input current	6 mA	12 mA	15 mA

Tab. 38: Data sheet LMS1xx/LMC1xx (cont.)

LMS1xx Laser Measurement Sensors

	Minimum	Typical	Maximum
Dynamic control inputs (LMS10x/LMS11x/LMS15x)			
Number	2		
Input resistance on HIGH		2 k Ω	
Voltage for HIGH	11 V	24 V	30 V
Voltage for LOW	-30 V	0 V	5 V
Input capacity		1 nF	
Static input current	6 mA	15 mA	20 mA
Duty cycle (Ti/T)		0.5	
Input frequency			100 kHz
Current load per incremental encoder		50 mA	100 mA
Velocity range that can be sampled			
Forward	From +100 mm/s to +20,000 mm/s		
Backward	From -10 mm/s to -20,000 mm/s		
Incremental encoders that can be evaluated			
Type	Two-channel rotary encoder with 90° phase offset		
Supply voltage	$V_S - 3 V$		V_S
Outputs required on the incremental encoders	Push/pull		
Pulse frequency			100 kHz
Number of pulses per cm	50		
Cable length (shielded)			10 m
Digital switching outputs (LMS10x/LMS11x/LMS15x)			
Number	3		
Voltage drop load		2 V	
Maximum switching current			140 mA
Current limiting (after 5 ms at 25 °C)	100 mA		200 mA
Power-up delay	Negligible		
Switch off time		0.8 ms	2 ms
Relay switching outputs (semiconductor relay/MOSFET) LMS12x/LMS13x/LMS173/LMS182 Security LMC12x/LMC13x VdS			
Number	2		
Switching voltage			DC/AC 40 V
Switching current			0.5 A
Contact resistance		0.34 Ω	0.7 V
Output capacitance			220 pF
Dielectric strength of input/output			1500 VAC
Power-up delay		1.3 ms	0.1 ms
Switch off time		0.1 ms	0.5 ms

Tab. 38: Data sheet LMS1xx/LMC1xx (cont.)

	Minimum	Typical	Maximum
Serial auxiliary interface			
Communication protocol	RS-232 (proprietary)		
Transmission speed	9.6 kBd	57.6 kBd	115.2 kBd
Serial host interface			
Communication protocol	RS-232 (proprietary)		
Transmission speed (selectable)	9.6 kBd	57.6 kBd	115.2 kBd
Cable length at 38,400 kBd and wire cross-section 0.25 mm ² (approx. 24 AWG)			15 m
Galvanic de-coupling	Yes		
Wire cross-section of the connecting cable (American Wire Gauge – AWG)			0.25 mm ² (approx. 24 AWG)
Ethernet	10/100 MBit/s		
CAN	20 kBit/s, 500 kBit/s, 1 MBit/s		

Tab. 38: Data sheet LMS1xx/LMC1xx (cont.)

- 1) Corresponds to Diamond Grade 3000X™ (approx. 1,250 cd/lx × m²).
- 2) The time after the first reflected pulse from which measurement can be performed with full accuracy is dependent on the target that reflected the first reflected pulse.
- 3) The time after the first reflected pulse from which measurement can be performed with full accuracy is dependent on the target that reflected the first reflected pulse.
- 4) Under the following conditions: the cables plugged into the M12 round plug-in connections must be screwed tight. Any electrical connections that are not being used must be fitted with protective caps or plugs that are screwed tight (as in the delivery condition). The M8 connection on the front is screwed tight.
- 5) Without fixing screws and projection of cable glands with system connector mounted.
- 6) If the switching inputs are used, the minimum switching voltage is at least DC 11 V
- 7) If the switching inputs are used, the minimum switching voltage is at least DC 11 V

10.2 Operating range diagrams

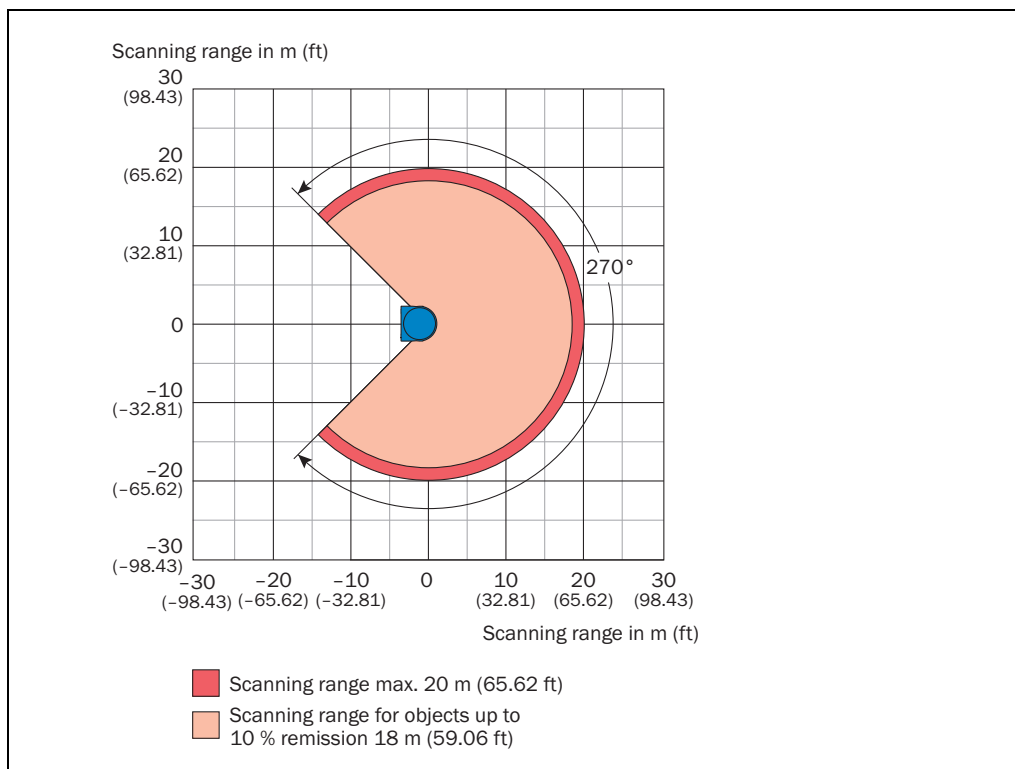


Fig. 60: Operating range LMS10x,/LMS11x/LMS12x/LMS13/LMC12x/LMC13x/LMS17x/LMS18x

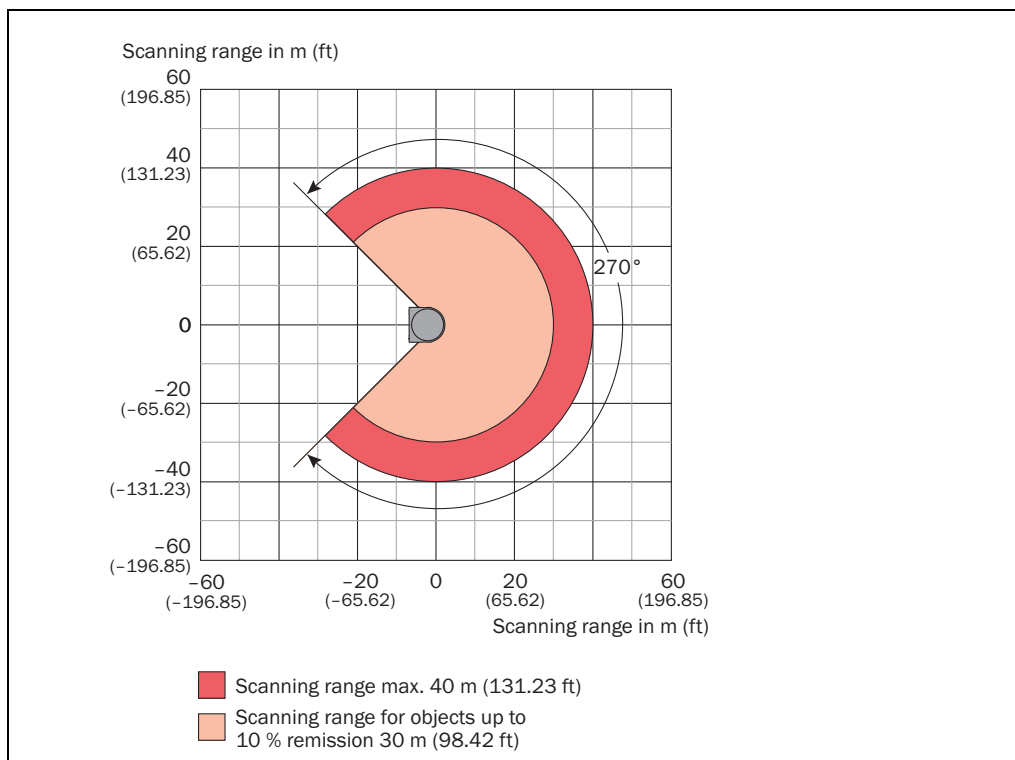


Fig. 61: Operating range LMS14x Security

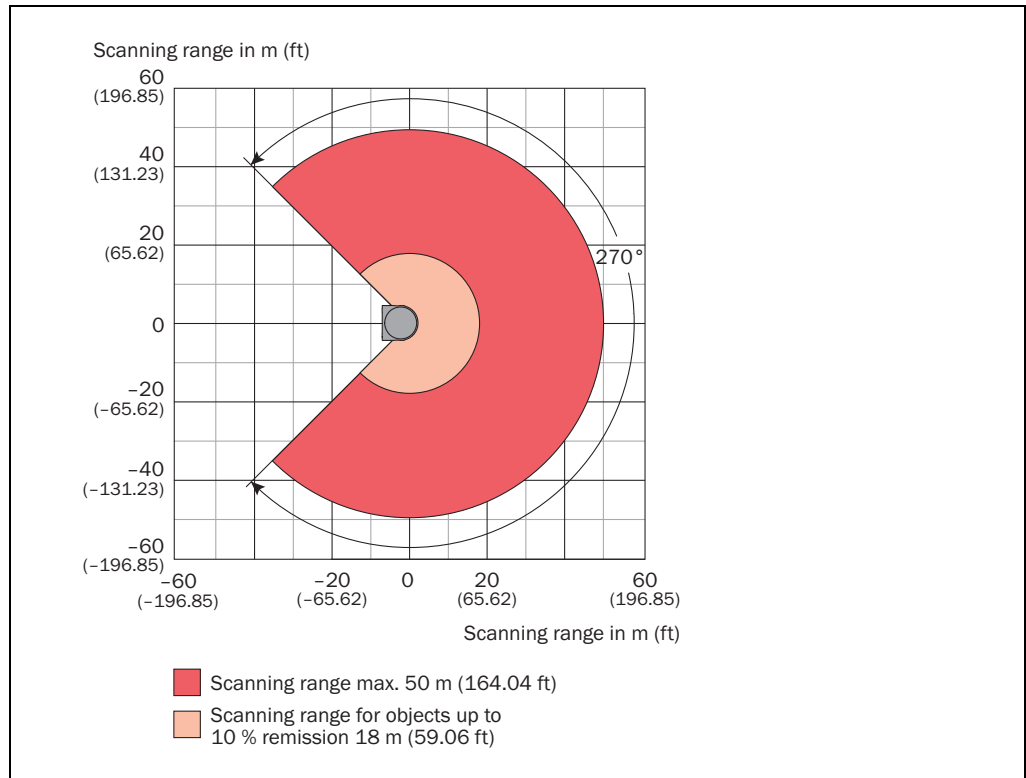


Fig. 62: Operating range LMS15x

10.3 Dimensional drawings

10.3.1 Dimensional drawing LMS10x/LMS12x/LMS173/LMC12x

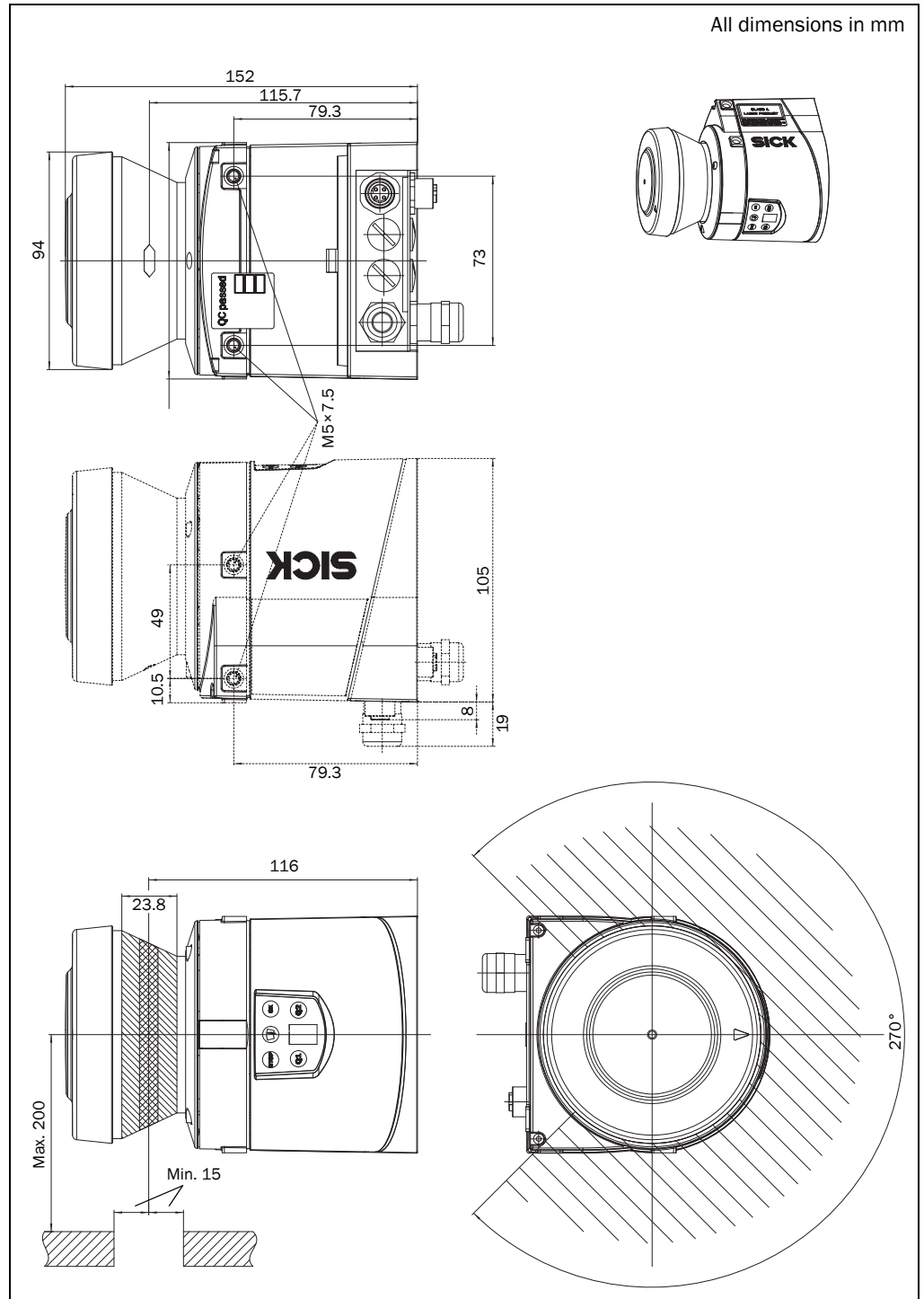


Fig. 63: Dimensional drawing LMS10x/LMS12x/LMS173/LMC12x

10.3.2 Dimensional drawing LMS11x/LMS13x/LMS14x/LMS15x/LMS182/LMC13x

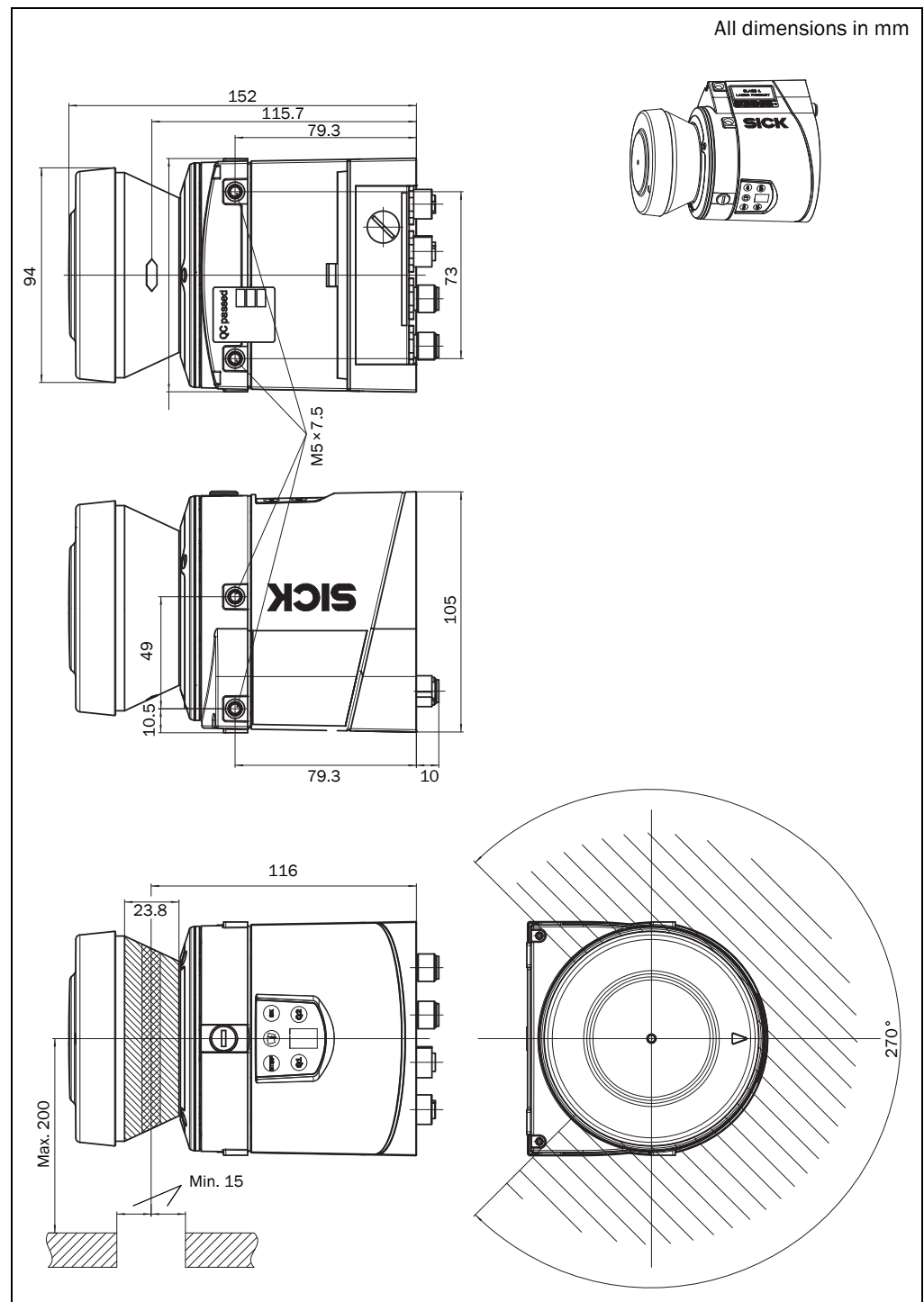


Fig. 64: Dimensional drawing LMS11x/LMS13x/LMS14x/LMS15x/LMS182/LMC13x

10.3.3 Dimensional drawings mounting kits

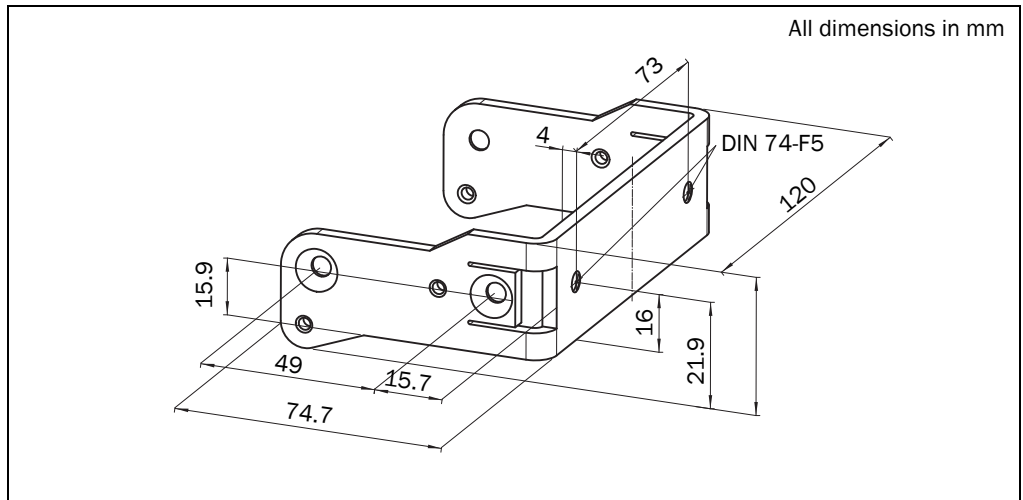


Fig. 65: Dimensional drawing mounting kit 1a (part no. 2034324)

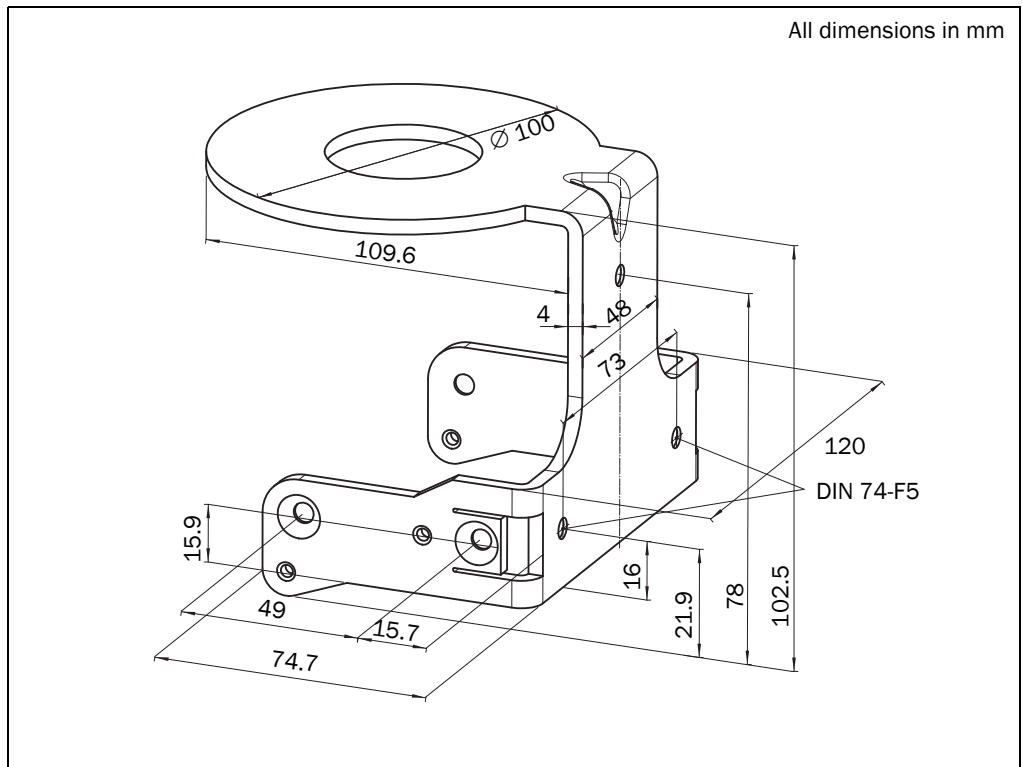


Fig. 66: Dimensional drawing mounting kit 1b (part no. 2034325)

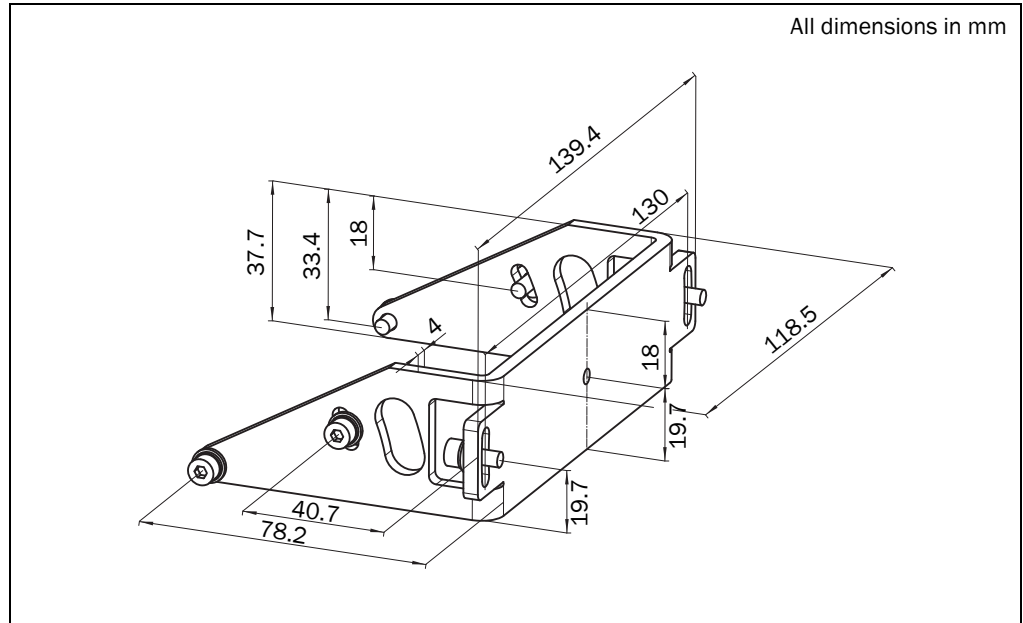


Fig. 67: Dimensional drawing mounting kit 2 (part no. 2039302)

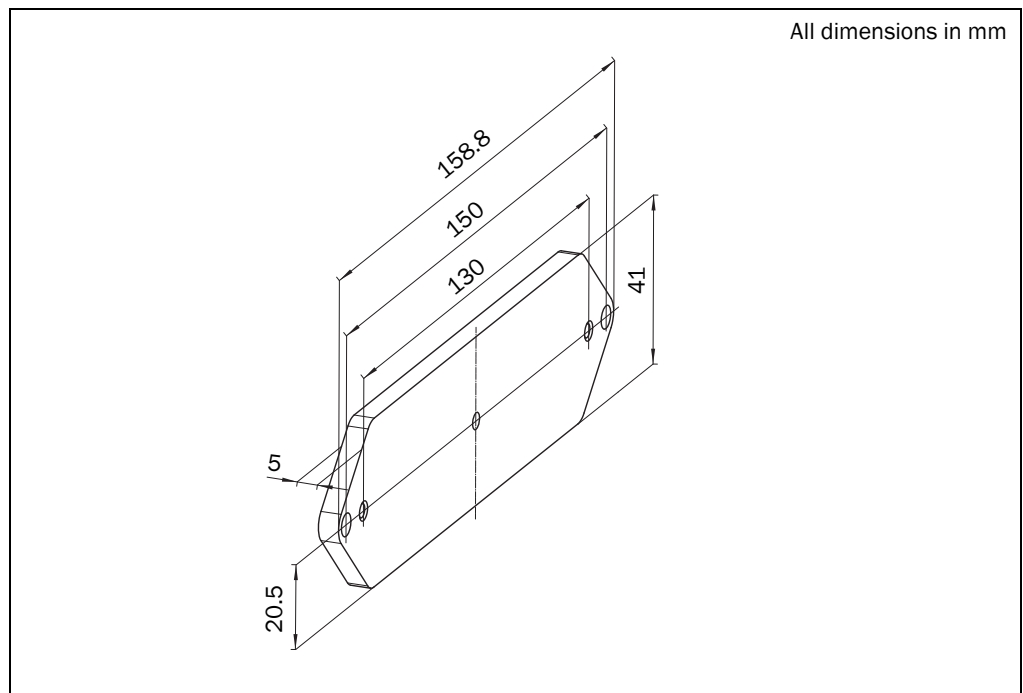


Fig. 68: Dimensional drawing mounting kit 3 (part no. 2039303)

10.3.4 Dimensional drawings weather protection hoods

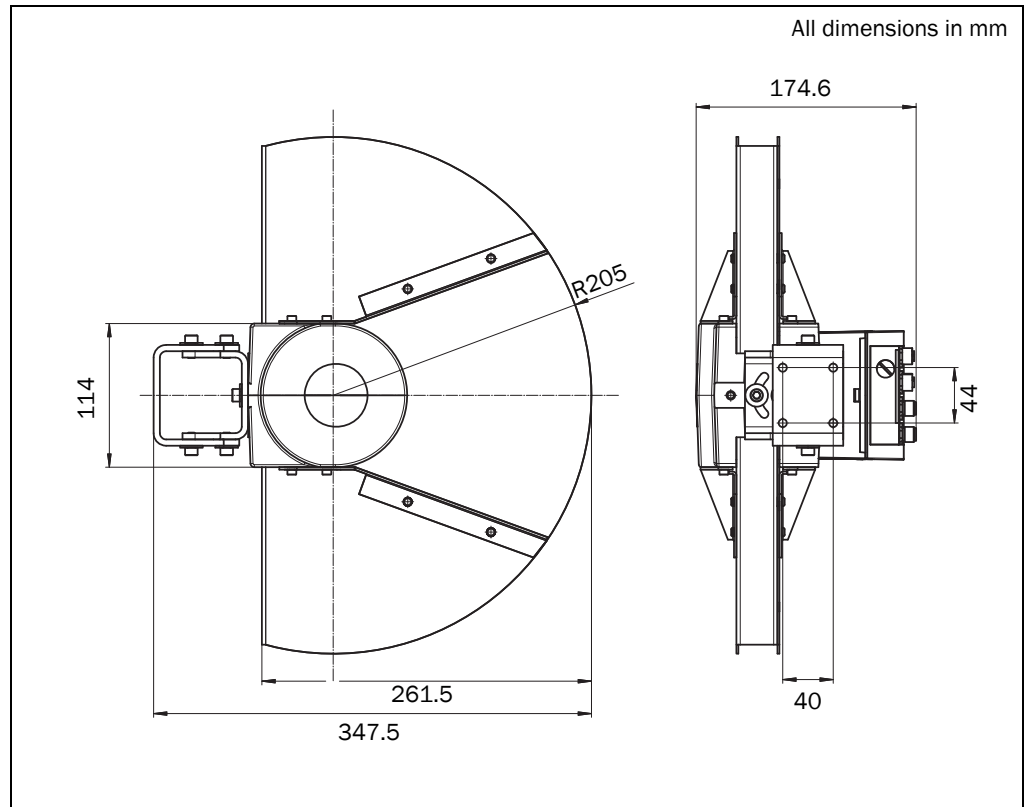


Fig. 69: Dimensional drawing weather protection hood 190° (part no. 2046459)

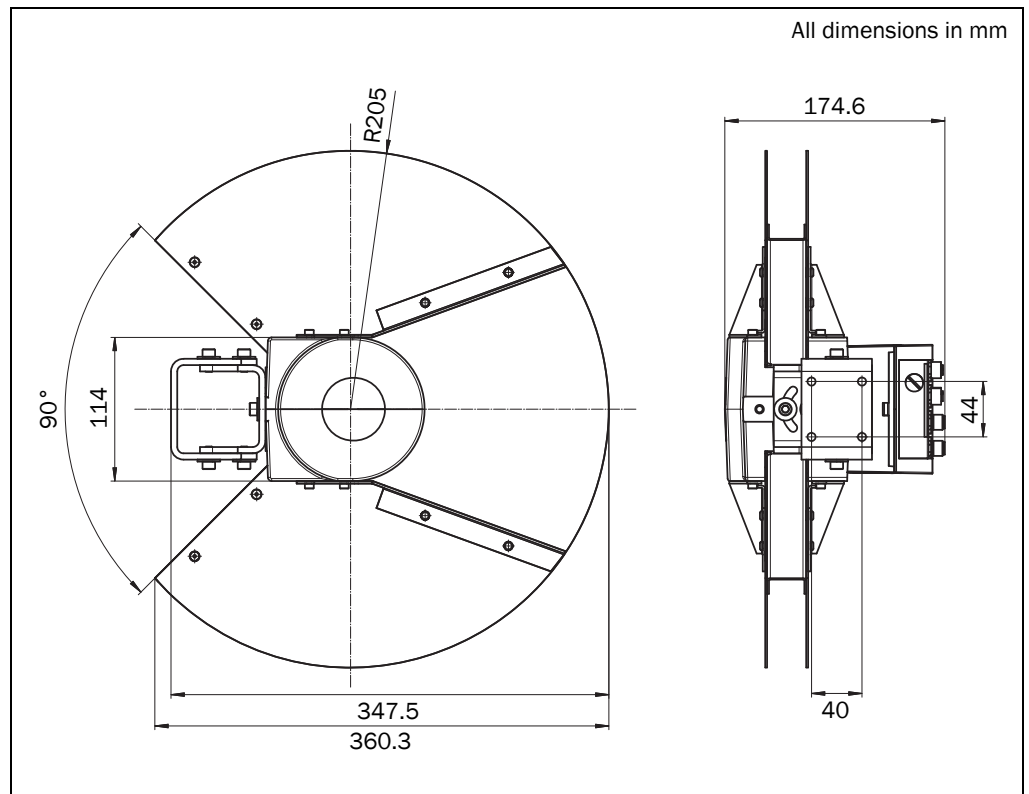


Fig. 70: Dimensional drawing weather protection hood 270° (part no. 2046458)

11 Annex

11.1 Ordering information

Ordering information about the LMS1xx and its optional accessories is available from the following web product page:

➤ <http://www.sick.com/lms1xx>

11.1.1 Consumables

Part number	Type	Description
4003353	Lens cloth	Special cloth for correctly cleaning the window
5600006	Plastic detergent	Antistatic, mild detergent solution

Tab. 39: Consumables

11.2 EU declaration of conformity

The EU declaration of conformity of the LMS1xx with the listed available device variants (according to the type code) and the fulfilled standards is available in PDF format from the following product web page:

➤ <http://www.sick.com/lms1xx>

11.3 Glossary

Download

Transmission of the parameter set that has been modified offline in the SOPAS ET configuration software from the PC to the LMS1xx. SOPAS ET transmits either always a complete copy to the memory (RAM) of the LMS1xx (menu COMMUNICATION, DOWNLOAD ALL PARAMETERS TO DEVICE) or only the parameter that has just been edited (menu COMMUNICATION, DOWNLOAD MODIFIED PARAMETERS TO DEVICE). With the menu LMS, PARAMETER, SAVE PERMANENT, the parameter set is saved permanently in the EEPROM of the LMS1xx.

Field of view α

Angle that defines the limits to which the laser beam is deflected by the polygon mirror wheel. A v-shaped area is formed radially in the scan direction in front of the laser output aperture; this area must contain the objects to be measured.

Parameter set

Data set using which the functions implemented in the LMS1xx are initialized and activated. Is transmitted from the LMS1xx to SOPAS ET and in the reverse direction using UPLOAD or DOWNLOAD respectively.

Remission

Remission is the quality of reflection at a surface. The basis is the Kodak standard, known worldwide in, among other areas, photography.

Scan

A scan encompasses all measured values determined referred to the scanning angle and the speed of rotation of the mirror.

SOPAS ET

Configuration software, used for the offline configuration (adaptation to the read situation on-site) and the online operation of the LMS1xx in dialog mode.

Upload

Transmission of the parameter set from the LMS1xx to the PC into the SOPAS ET configuration software. The values for the parameters are displayed on the file cards of the configuration software. Prerequisite for the modification of the current parameter set.

11.4 Abbreviations

ATEX	Atmosphère explosible = synonym for explosion protection
BCC	Block character check
CAN	Controller area network = standardized fieldbus system with message-based protocol for exchanging data
CoLa	Communication Language = proprietary SOPAS ET communication language (ASCII = CoLa-A or Binary = CoLa-B)
CS	Checksum
EEPROM	Electrically erasable programmable read-only memory
HTML	Hypertext markup language = page description language in the Internet
LED	Light emitting diode
LMC	SICK AG laser measurement sensor VdS certified
LMS	SICK AG laser measurement sensor
RAM	Random access memory = volatile memory with direct access
ROM	Read-only memory (permanent)
sdd	SOPAS device driver = device description file for SOPAS ET
SOPAS ET	SICK OPEN PORTAL for APPLICATION and SYSTEMS ENGINEERING TOOL = configuration software for the configuration of the LMS1xx/LMC1xx
VdS	Formerly “Verband der Sachversicherer e.V.” – in 1997 the technical departments of the former organization were transferred to VdS Schadenverhütung GmbH. This is a subsidiary of the Gesamtverband der Deutschen Versicherungswirtschaft e.V. (GDV = association of German insurers)
VSÖ	Verband der Sicherheitsunternehmen Österreichs (= Association of Austrian Security Companies)

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