

Laser Measurement Systems of the LMS500 Product Family



More than meets the eye.
Compact size for big solutions



Software version described

Software/tool	Function	Status
LMS500-20000	Firmware	V 1.00
LMS511-10100	Firmware	V 1.00
LMS511-20100	Firmware	V 1.00
Device description LMS500-10000	Device specific software module for SOPAS ET	V 01.00.00 or higher
Device description LMS511-10100	Device specific software module for SOPAS ET	V 01.00.00 or higher
Device description LMS511-20100	Device specific software module for SOPAS ET	V 01.00.00 or higher
SOPAS ET	Configuration software	V 02.32 or higher

Software access to the LMS500/511 is password protected. As supplied the following passwords are defined:

User level	Password
Maintenance personnel	main
Authorised client	client

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Version of the operating instructions

The latest version of these operating instructions can be obtained as PDF at www.sick.com.

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Abbreviations

BCC	Block character check
CAN	Controller area network = standardised 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 on the Internet
LED	Light Emitting Diode
LMS	SICK AG laser measurement system
RAM	Random access memory = volatile memory with direct access
ROM	Read-only memory (permanent)
SOPAS ET	SICK OPEN PORTAL for APPLICATION and SYSTEMS Engineering Tool = configuration software for the configuration of the LMS500/511

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1 About this document

Please read this chapter carefully before working with this documentation and the LMS500/511 laser measurement system.

1.1 Function of this document

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

- LMS500-20000 (indoor)
- LMS511-10100 (outdoor), Standard Resolution (SR)
- LMS511-20100 (outdoor), High Resolution (HR)

See device variants in [section 3.2 “Device variants” on page 15](#).

Important In the following the variants are termed “LMS” for short, except in cases where exact differentiation is necessary.

1.2 Target group

The intended audience for this document is people in the following positions:

Activities	Target group
Mounting, electrical installation, maintenance and replacement	Factory electricians and service engineers
Commissioning, operation and configuration	Technicians and engineers

Tab. 1: Target groups of this document

1.3 Depth of information

These operating instructions contain the following information on the LMS:

- product description
- mounting
- electrical installation
- commissioning and configuration
- maintenance
- fault, error diagnosis and troubleshooting
- conformity and approval

Planning and using laser measurement systems such as the LMS also require specific technical skills which are not detailed in this documentation.

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 LMS.

Further information on the LMS is available from SICK AG, Division Auto Ident, and in the Internet at www.sick.com.

1.4 Symbology used

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 LMS 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.

NOTICE

Note!

A note indicates potential hazards that could involve damage or degradation of the functionality of the LMS or other devices.



WARNING

Warning!

A warning indicates an actual or potential hazard. They are designed to help you to prevent accidents.

The safety symbol beside the warning indicates the nature of the risk of accident, e.g. due to electricity. The warning category (DANGER, WARNING, CAUTION) indicates the severity of the hazard.

- Read carefully and follow the warning notices!

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 LMS.

2.1 Authorised personnel

The LMS laser measurement system must be installed, commissioned and serviced only by adequately qualified personnel.

NOTICE

Repairs to the LMS are only allowed to be undertaken by trained and authorised service personnel from SICK AG.

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 • knowledge on the use and operation of devices in the related application (e.g. crane, assembly system)
Commissioning, operation and configuration	<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) • basic knowledge of the Windows operating system • basic knowledge of an HTML browser (e.g. Internet Explorer) • basic knowledge of data transmission

Tab. 2: Authorised personnel

2.2 Correct use

The LMS is an electro-sensitive distance measurement system 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 realise systems, for instance, for collision protection, for building surveillance or for access monitoring.

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

NOTICE

In case of any other usage as well as in case of modifications to the LMS, 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.

The LMS is only allowed to be operated in the ambient temperature range allowed (see [section 9.1 "Data sheet LMS laser measurement system" on page 67](#)).

2.3 General safety notes and protective measures



WARNING

Safety notes

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

- 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 LMS, 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 system, in particular:
 - the work safety regulations/safety rules
 - other relevant health and safety regulations
- Manufacturers and operators of the system on which the LMS 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 authorised 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 LMS 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.
- The LMS is not a device for the protection of people in the context of the related safety standards for machinery.

2.3.1 Electrical installation work

NOTICE

- Only authorised personnel are allowed to perform the 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.

2.3.2 Laser radiation from the laser measurement system



CAUTION

Laser radiation!

The LMS corresponds to laser class 1 (eye safe) as per EN 60825-1 (for publication date see laser warning label on the device). Complies with 21 CFR 1040.10 with the exception of the deviations as per Laser Notice No. 50, June 2007. The laser beam cannot be seen with the human eye.

- 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 output aperture

The laser output aperture is the window of the front screen on the LMS.

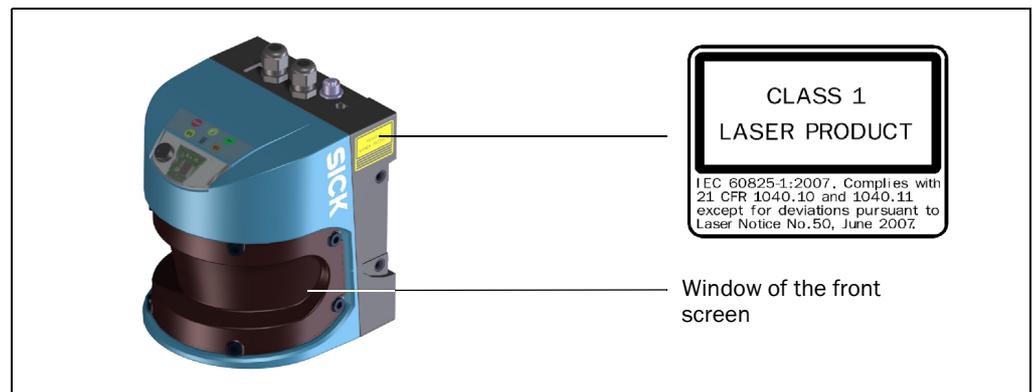


Fig. 1: Laser output aperture of the LMS

Laser power

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

Laser warning label

The laser warning is on the LMS on the right side of the housing.

2.4 Quick stop and Quick restart

2.4.1 Switching off the LMS

- Switch off voltage supply (power supply) for the LMS or disconnect the system plug on the LMS500 or the M12 supply cable on the LMS511.

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

2.4.2 Switching back on the LMS

- Switch on voltage supply (power supply) for the LMS or re-connect the system plug on the LMS500 or the M12 supply cable on the LMS511.

The LMS re-commences operation with the parameters last saved.

2.5 Environmental protection

The LMS has been designed to minimise environmental impact. It uses only a minimum of power.

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

2.5.1 Power consumption

- The LMS500 consumes a maximum of 24 W in operation.
- In addition, the LMS511 draws a maximum of 50 W in cycles for the heating.

2.5.2 Disposal after final de-commissioning

- Always dispose of unserviceable or irreparable devices in compliance with local/national rules and regulations on waste disposal.
- Dispose of all electronic assemblies as hazardous waste. The electronic assemblies are straightforward to dismantle.

Important SICK AG does not accept unusable or irreparable devices that are returned.

3 Product description

This chapter provides information on the special features and properties of the LMS laser measurement system. 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 LMS delivery includes the following components:

Quantity	Components	Comment
1	An LMS laser measurement system	LMS500-10000, LMS511-20100, LMS511-10100, depending on order
1	Device instructions with electrical circuit diagram for getting started	Is included in the LMS packaging
1	CD-ROM "Manuals & Software Auto Ident"	Contents see 3.1.1

Tab. 3: Delivery

[Section 10.3 "Ordering information" on page 95](#) provides an overview of the systems available and the accessories available.

3.1.1 Contents of the CD-ROM

- SOPAS ET configuration software
- operating instructions "LMS500/511 Laser measurement system" in German and English as PDF
- freely available software "Adobe® Reader™"

The latest versions of the publications and programs included on the CD-ROM are also available for download at www.sick.com.

3.2 Device variants

Type	Special features	Range	Heating	Enclosure rating
LMS500-10000	Indoor variant	max. 65 m 26 m @ 10% ¹⁾	Without	IP 65
LMS511-10100	Outdoor variant	max. 65 m 26 m @ 10%	With	IP 67
LMS511-20100	Outdoor variant	max. 65 m 40 m @ 10%	With	IP 67

Tab. 4: Device variants

1) object remission

The LMS comprises four components:

- the housing
- the sensor head with the opto-electronic acquisition system
- the application module, this defines the functionality of the LMS
- the system plug with the configuration memory (the system plug contains all electrical connections)

3.3 Special features of the LMS

Variant	Special features
All	<ul style="list-style-type: none"> • field of view maximum 190° • resolution of the angular step width: 0.167/0.25/0.33/0.5/0.66/1° • rotation frequency 25/35/50/75/100 Hz • flexible system configurations • configuration/measured value request using messages (command strings) • data interfaces Ethernet, RS-232/-422, USB, CAN <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 all reflection pulses (echoes), e.g. in rain or on measurement through a window <p>Integrated field application</p> <ul style="list-style-type: none"> • 10 configurable evaluation fields • monitoring of the evaluation field contours • switching of the evaluation fields using digital inputs • encoder inputs • additional output of the evaluation field (unoccupied or infringed) via digital outputs or messages
LMS500-10000	<ul style="list-style-type: none"> • scanning range up to 65 m (213.25 ft) with > 100% object remission (26 m (85.30 ft) with 10% object remission) • housing with protection class IP 65
LMS511-10100	<ul style="list-style-type: none"> • scanning range up to 65 m (213.25 ft) with > 100% object remission (26 m (85.30 ft) with 10% object remission) • outdoor housing with protection class IP 67
LMS511-20100	<ul style="list-style-type: none"> • scanning range up to 65 m (213.25 ft) with > 100% object remission (40 m (131.23 ft) with 10% object remission) • housing with protection class IP 67

Tab. 5: Special features of the LMS variants

3.4 Controls and status indicators

3.4.1 User interface

In normal operation the laser measurement system operates 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 LMS 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.

3.4.2 Status indicators

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

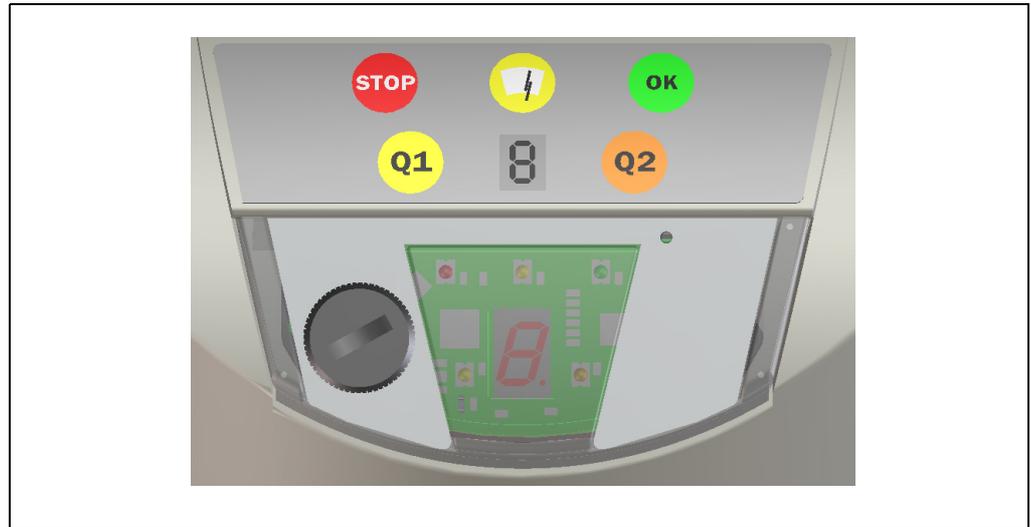


Fig. 2: Status indicators

Important

- On the LMS, 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.



LEDs

Display	Possible cause
OK	LMS in operation, no evaluation field is signalling an event
STOP	LMS in operation, at least one evaluation field is signalling an event
⚡	front screen contaminated
Q1	Switching output OUT1 switched (see section 3.8.3 “Operator for the evaluation cases on the output” on page 33)
Q2	Switching output OUT2 switched (see section 3.8.3 “Operator for the evaluation cases on the output” on page 33)

Tab. 6: Meaning of the LEDs

Further information see [section 8.2 “Error displays of the LEDs” on page 65](#).

7-segment display

Used for diagnostics on occurring errors or malfunctions (see [section 8.3 “Indications of the 7-segment display” on page 66](#)).

3.5 Operating principle of the LMS

The LMS is an electro-optical laser measurement system that electro-sensitively scans the perimeter of its surroundings in a plane with the aid of laser beams. The LMS 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.

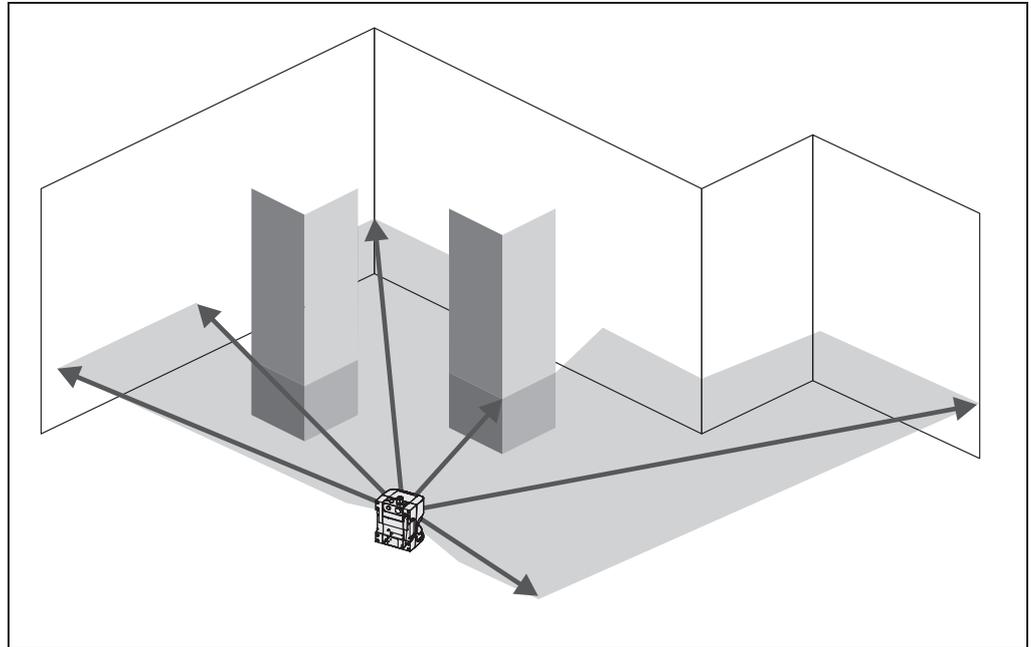


Fig. 3: Measuring principle of the LMS

Scanning takes place in a sector of 190° . The scanning range of the LMS is maximum 65 m (213.25 ft) on light, natural surfaces with an object remission $> 100\%$ (e.g. a white house wall).

Distance measurement

The LMS 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 laser measurement system's receiver using a photodiode.

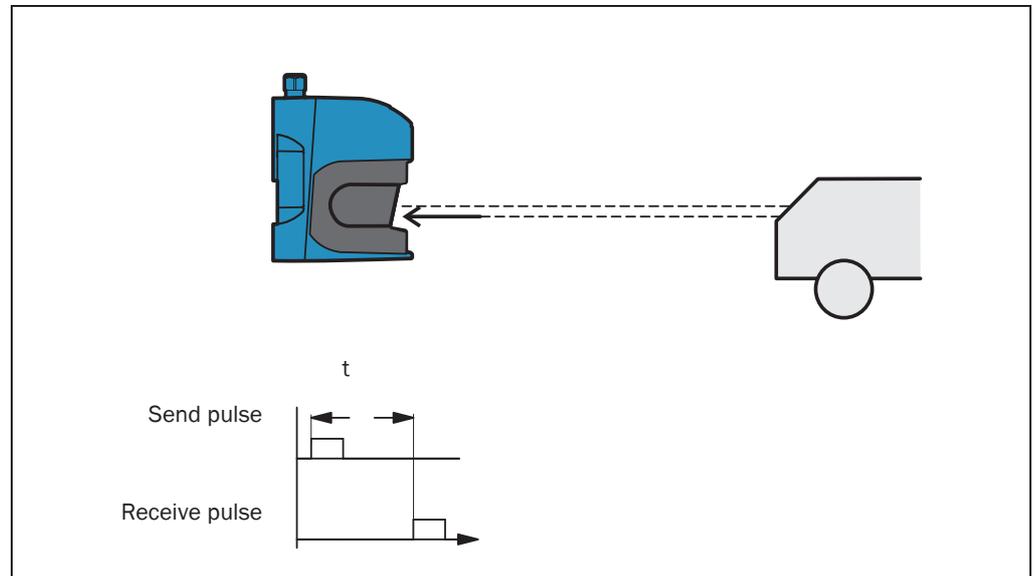


Fig. 4: Principle of operation for pulse propagation time measurement

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 3.7.4 “Measured value output for a 5-echo reflected pulse” on page 29](#)).

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 angular steps using an angular encoder.

The LMS scans with a scanning frequency of 25, 35, 50, 75 or 100 Hz. During this process, a laser pulse and therefore a measurement is triggered after an angular step of 0.167° , 0.25° , 0.33° , 0.5° , 0.66° or 1° .

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%.

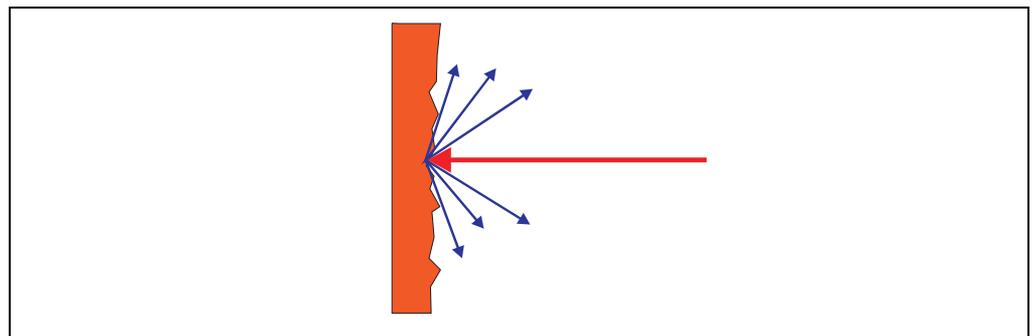


Fig. 5: Reflection of the laser beam at the surface of an object

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 structure and colour. Light surfaces reflect the laser beam better than dark surfaces and can be detected by the LMS over larger distances. Brilliant 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 LMS will be reduced as a result.

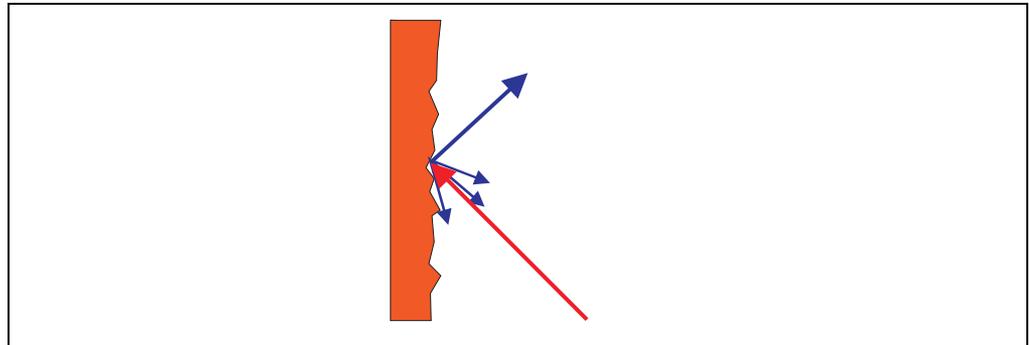


Fig. 6: Reflection angle

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. 5 on page 19](#)). If the beam is incident at an angle, a corresponding energy and scanning range loss is incurred ([Fig. 6 on page 20](#)).

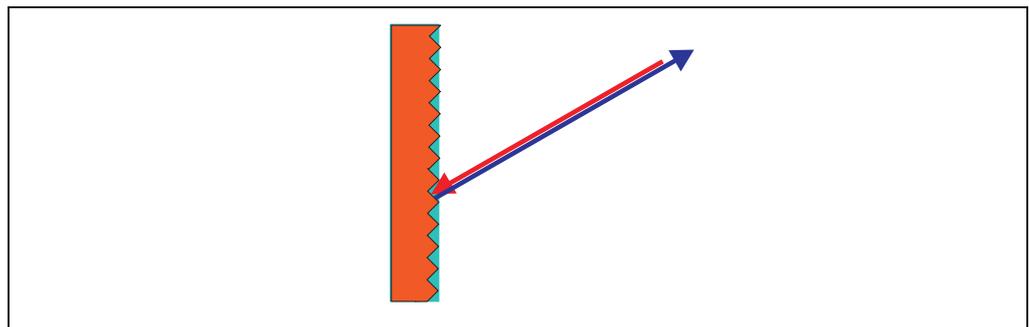


Fig. 7: Degree of reflection

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. 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.

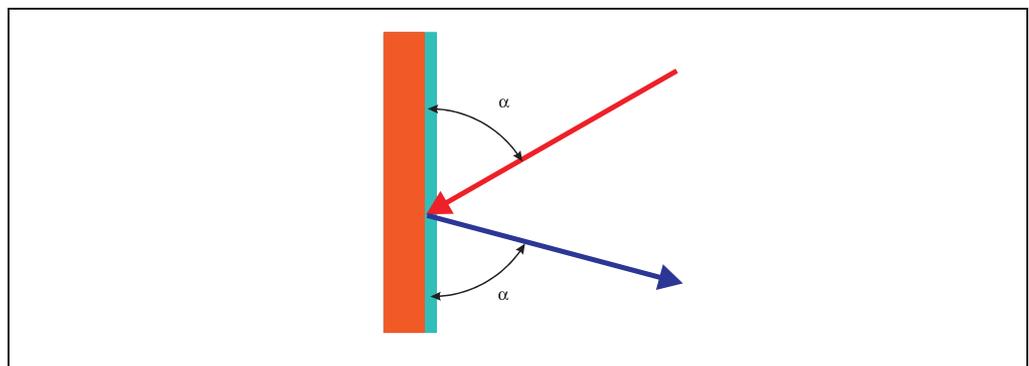


Fig. 8: Mirror surfaces

At mirror surfaces the laser beam is almost entirely deflected ([Fig. 8 on page 20](#)).

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

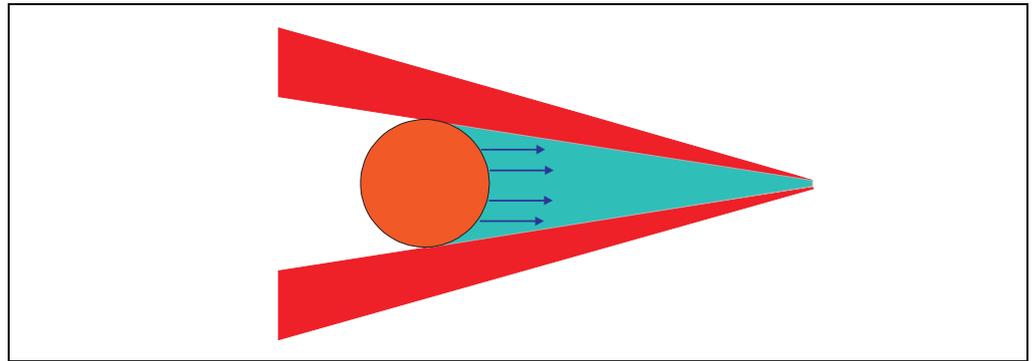


Fig. 9: Object smaller than diameter of the laser beam

Objects that are smaller than the diameter of the laser beam cannot reflect all the energy of the laser light ([Fig. 9 on page 21](#)). 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.

3.5.1 Scanning range of the LMS

The scanning range of the LMS 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 LMS. The diagrams in [Fig. 10](#) indicate the relationship between remission and detectability.

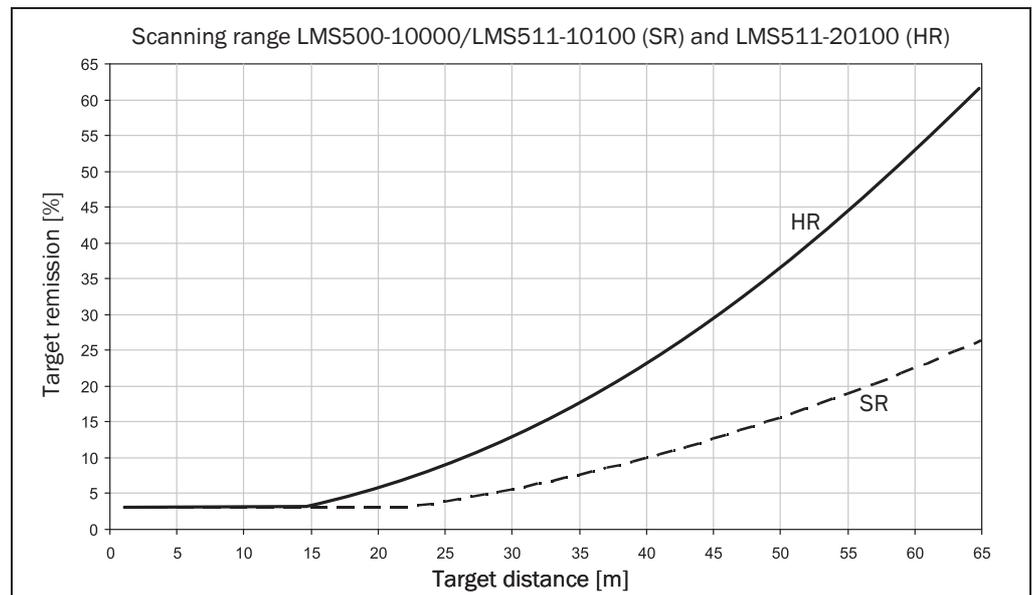


Fig. 10: Scanning range of the LMS as a function of the target remission

Up to a distance of 10 m (32.81 ft) the LMS can detect objects from 3% remission. At a distance of 65 m (213.25 ft) objects are only detected if they have a remission > 100%.

Important The diagram in [Fig. 10](#) is only applicable if no filters are configured.

3.5.2 Beam diameter and distance between measured points

With increasing distance from the LMS the laser beam of the LMS 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) \times 0.0046 rad (HR) or 0.011 rad (SR) + 13 mm.

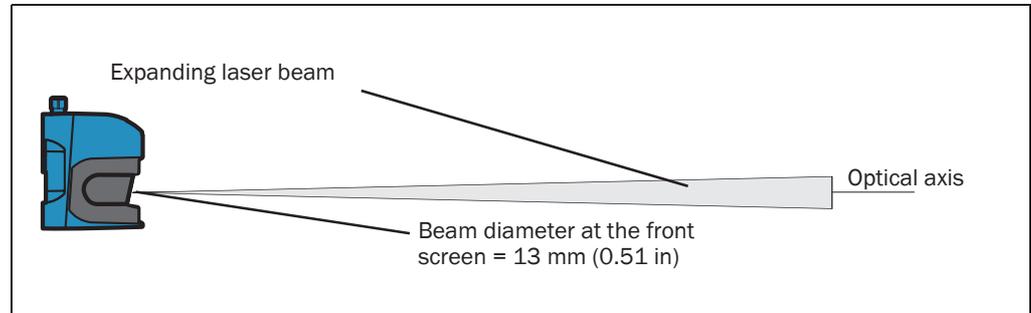


Fig. 11: Beam expansion

With increasing distance from the LMS, 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

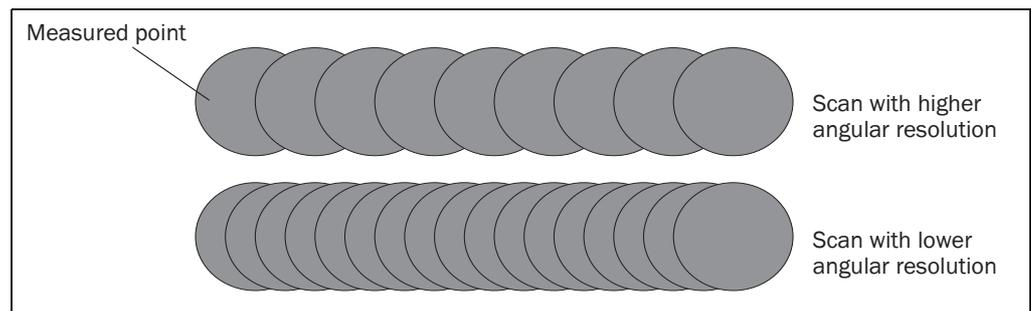


Fig. 12: Schematic layout of the distance between measured points at different angular resolutions

The diagram in [Fig. 13](#) shows the beam diameter and the measured point spacing as a function of the distance from the LMS.

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

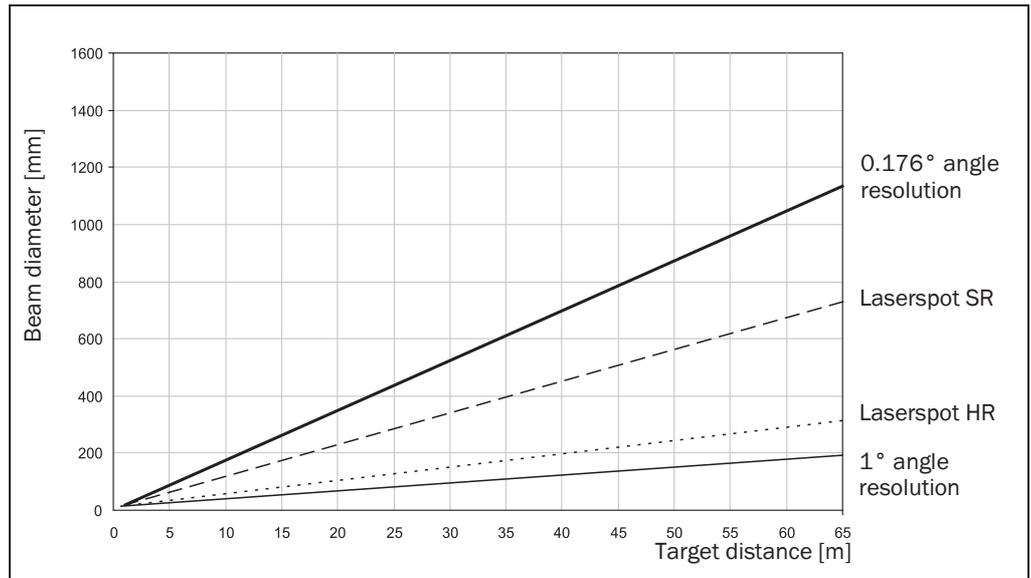


Fig. 13: Beam diameter and distance between measured points of LMS500 at 0 to 65 m (0 to 213.25 ft)

Example for angular resolution 0.167° (HR) in Fig. 13

Distance 35 m (114.83 ft)

Distance intersection point 30 m (98.42 ft) gives a distance between the measured points of approx. **87 mm (3.43 in)**

Distance intersection point 30 m (98.42 ft) with the characteristic curve for beam diameter gives a beam size of approx. **150 mm (5.91 in) (HR) or 342 mm (13.46 in) (SR)**

3.5.3 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. 9 on page 21).

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

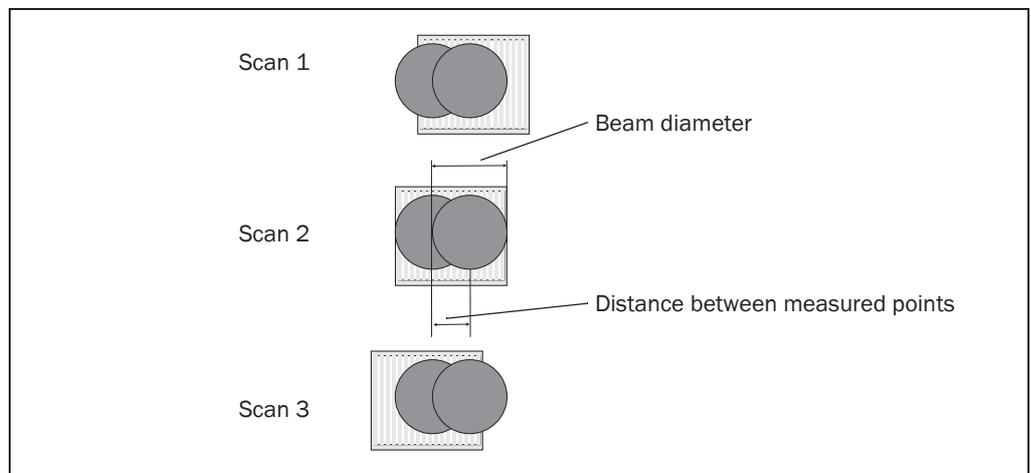


Fig. 14: Minimum object size for detection

In the example in [Fig. 14](#), 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 LMS see the diagram in [Fig. 13](#).

Important

- In particular on the usage of the LMS 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 LMS as well as the object should not move.

3.5.4 Contamination measurement

The LMS has an front screen for protection. This front screen 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. For a certain level of contamination, first a contamination warning is output; if the contamination becomes worse, a contamination error is output and the LMS stops taking measurements.

Depending on the application in which the LMS 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 front screen.
- available
Contamination warning and contamination error are only output on partial contamination of the front screen.
- 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 LMS (see [section 8.2 “Error displays of the LEDs” on page 65](#)). You can also read these states using messages (see [section 10.2.6 “Read contamination level” on page 86](#) and [section 10.2.4 “Read scan data” on page 80](#)).

A contamination error is also signalled on a digital or external output if this output is configured for the status “Device Ready” (see [section 3.9.2 “Digital switching outputs” on page 34](#)).

Important If you use the “Contour monitoring with blanking” strategy (see [section “Evaluation strategy” on page 31](#)) 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.

3.6 Applications

In principle the LMS can be used for two purposes:

- for the measurement of objects (see [section 3.7 “Measurement of objects” on page 25](#))
- for the detection of objects with evaluation fields (see [section 3.8 “Field application” on page 30](#))

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

- container loading/handling/positioning
- traffic/transport
- robots
- object/building protection (low false alarm rate)
- anti-collision
- navigation
- mapping

3.7 Measurement of objects

3.7.1 Basic parameters

The LMS scans with a scanning frequency of 25 up to 100 Hz or with an angular resolution of 0.167° up to 1°. At a higher scanning frequency or a finer angular resolution the LMS supplies more measured values.



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

Important

- The LMS 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 LMS (see [section 8.4 “Detailed error analysis” on page 66](#)).

3.7.2 Filter

The LMS has digital filters for the pre-processing and optimisation of the measured distance values.

You can configure either a fog filter, a hardware blanking window, an n-pulse-to-1-pulse filter or a filter for interference suppression.

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



Fog filter

The fog filter suppresses possible glare due to fog. The LMS becomes less sensitive in the near range (up to approx. 7 m (22.97 ft)) with the fog filter.

Global filter

If echo pulses are reflected by several objects during a measurement (incident on drops of rain, glass surfaces, edges etc.) with a maximum of up to five echoes, the Global filter can be selected to give out only the first echo, all echoes or the last echo received (see [section 3.7.4 “Measured value output for a 5-echo reflected pulse” on page 29](#)).

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

- The particle filter is an application filter. It acts on the field application, not on the measured value output.
- 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).

3.7.3 Measured value output

For the measured value output, the LMS supplies measured values to one of the interfaces. It is prerequisite for this data output that the LMS 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 message (see [section 10.2.1 “Start measurement” on page 77](#))



Recommendation

After the measurement mode is started the LMS needs a little time to reach the status “Ready for measurement”. You should therefore query the status of the LMS using the sRN STlms message (see [section 10.2.3 “Query status” on page 79](#)).

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

- Exactly one measured value message can be requested using the sRN LMDscandata message – the last scan measured is transferred (see [section 10.2.4 “Read scan data” on page 80](#)).
- Measured data can be continuously requested using the sEN LMDscandata message – measured data are then transferred until the measured value output is stopped using the sEN LMDscandata message (see [section 10.2.4 “Read scan data” on page 80](#)).

Example of single measured value output

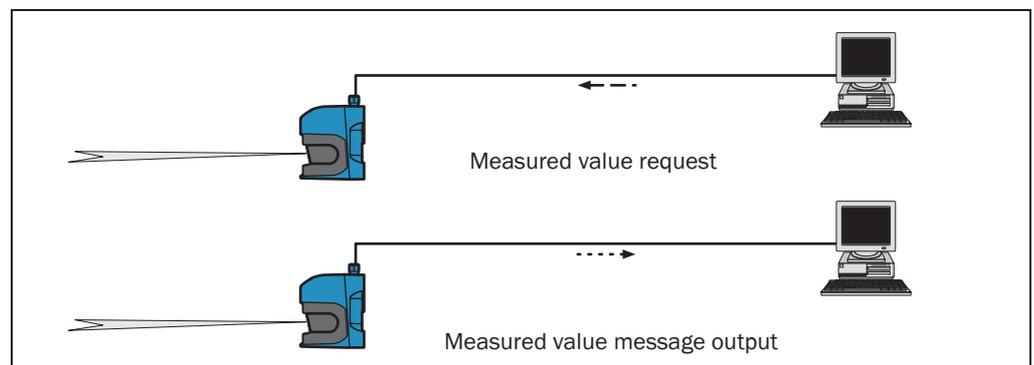


Fig. 15: Measured value message request

1. Start measurement

Request

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

LMS 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>
```

LMS 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>
```

LMS answer

```
<STX>sRA LMDscandata [contents see section 10.2.4 "Read scan data" on page 80]<ETX>
```

Example of continuous measured value output

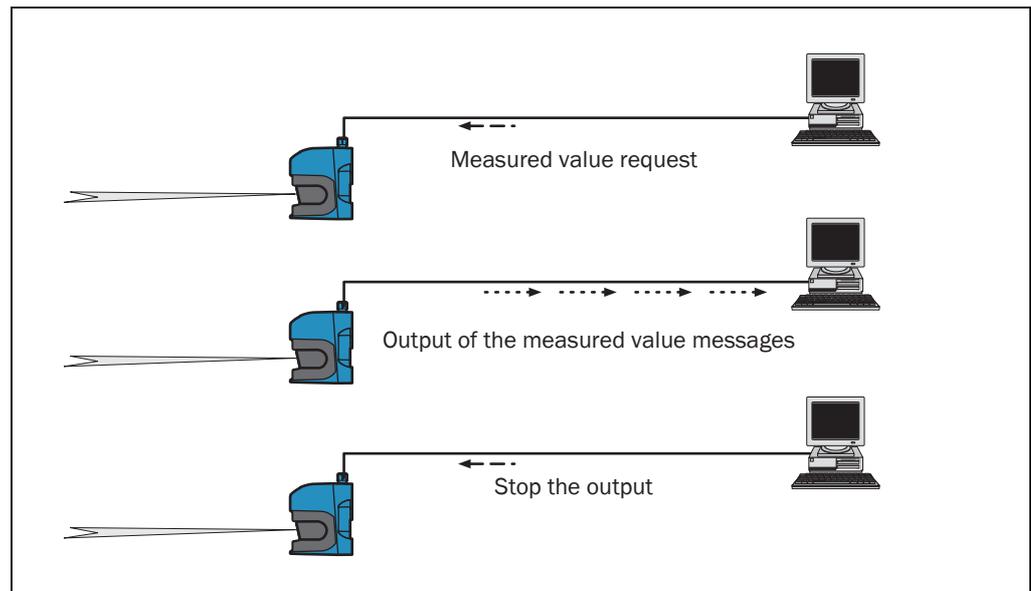


Fig. 16: Continuous measured value output

Recommendation If you are not certain that the scan data can be processed at the speed at which they are output by the LMS, 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 (see [section 10.2.4 "Read scan data" on page 80](#)).

1. Start measurement

Request

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

LMS 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>
```

LMS 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>
```

LMS confirmation

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

LMS answer

```
<STX>sSN LMDscandata [contents see section 10.2.4 "Read scan data" on page 80]<ETX>
```

4. Stop continuous measured value output

Request

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

LMS confirmation

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

3.7.4 Measured value output for a 5-echo reflected pulse

The LMS500 Series can measure up to 5 reflected pulses (echoes). The measured values can be output in the measured value message or used in the field application according to the Global Filter settings (see [section 3.7.2 "Filter" on page 25](#)). Several echoes can be produced, e.g. if the LMS sender pulse hits several rain drops, fog, glass, etc. These conditions can reflect part of the energy hence creating reflected pulses or echoes. Most of the sending pulse energy will continue to propagate and will eventually reflect against the actual target object. This final pulse could be up to 5 received echoes.

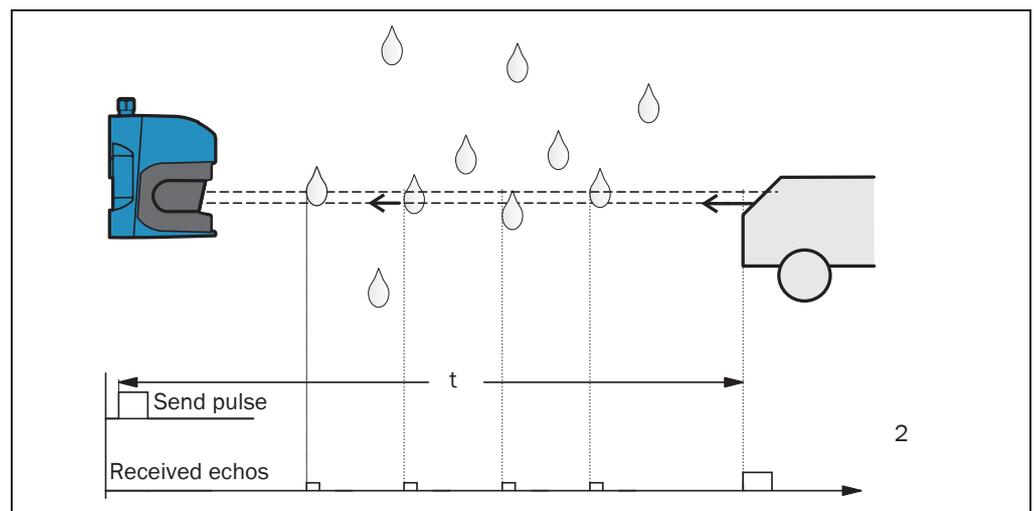


Fig. 17: Principle of operation of the measurement of the fifth received echo

If the Global Filter is set to First Echo, the LMS500 will only take the first echo into account and ignore all following echoes.

With All Echoes the scanner will receive up to 5 echoes. It will display all of them in the SOPAS monitor function and output all the 5 echo values received in the measured value message (no values will be displayed as 0). The Last Echo will also receive up to 5 echoes however it will only display the last echo received, ignoring any previous echoes, and output in the measured value message as only one value.

In bad weather conditions (rain/snow/fog), this filter can produce better results or actually make possible special applications such as measurement through a window.

In such applications a slight inclination of the glass of scanner is recommended to avoid any direct reflections (mirror effect).

3.8 Field application

With the aid of the integrated field application, the LMS 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.

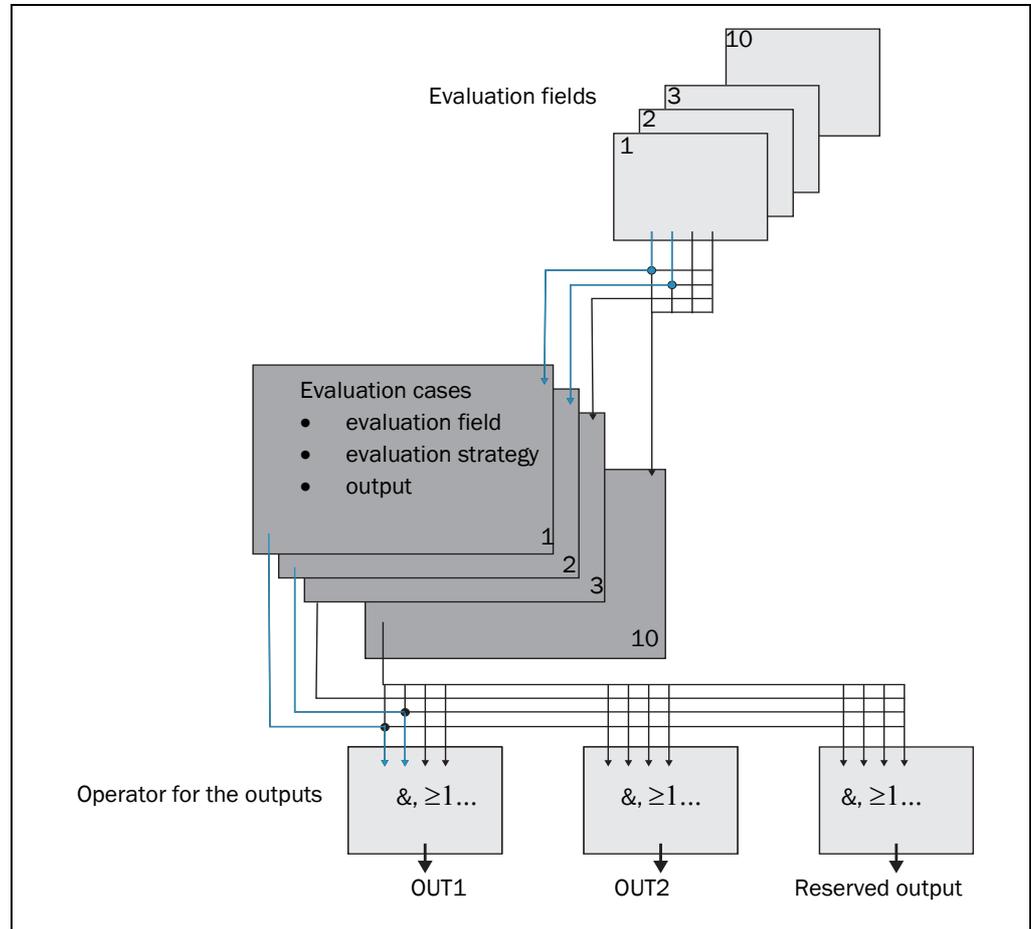


Fig. 18: Principle of the field application

The LMS is adapted to the evaluation situation with the aid of up to ten evaluation cases. In the evaluation case, one of 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. 18](#), 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.

3.8.1 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.



Evaluation strategy

In SOPAS ET choose one of four possible evaluation strategies:

- pixel evaluation
The LMS 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 LMS 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 LMS evaluates the presence of a contour that must be permanently and completely in the evaluation field. As a result the LMS can detect, e.g., that a door is opening outwards or that the position of the LMS 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 LMS with its outputs (see [section 3.9.4 “Logical operators for inputs and outputs” on page 35](#)).

Response time

For the Pixel evaluation, Blanking and Contour evaluation strategies you must define a response time. For the LMS 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.

Manipulation prevention

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

If you use evaluation fields at a distance from the LMS, 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 TAMPER PROTECTION option.

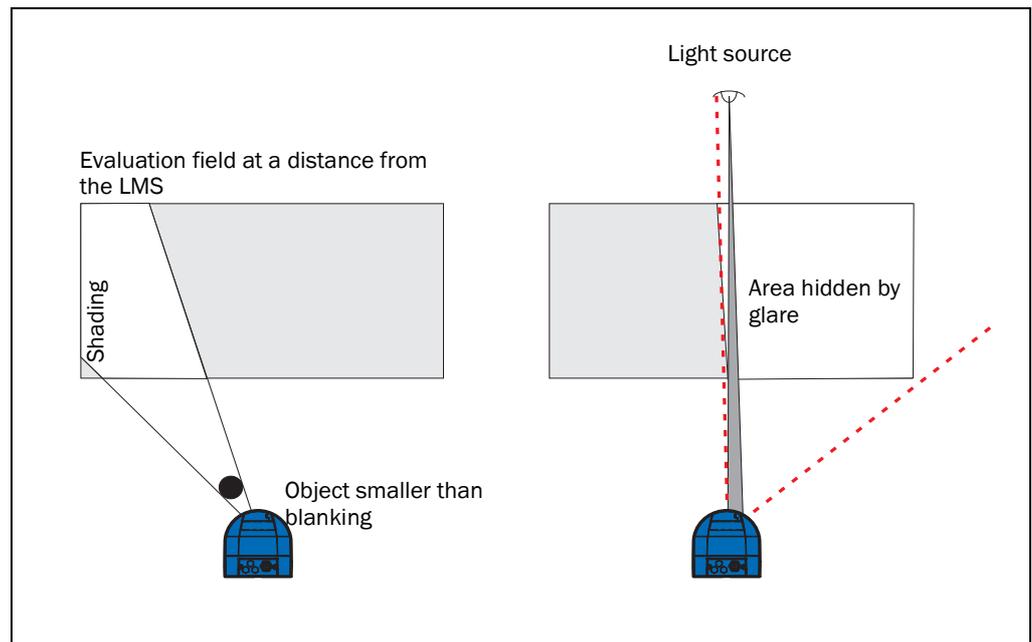


Fig. 19: Protection against tampering due to shading and glare

The Manipulation prevention option switches the evaluation field if ...

- an object that is smaller than or equal to the blanked object size is in front of the laser output aperture on the LMS for the configured response time for Manipulation prevention.
- the LMS is dazzled for longer than the configured response time for Manipulation prevention.

Evaluation field

Choose one of the evaluation fields already configured for the evaluation case. Its shape must match the evaluation strategy (see [section 3.8.2 "Evaluation fields" on page 33](#)).

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 3.8.3 "Operator for the evaluation cases on the output" on page 33](#)).

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 3.8.3 "Operator for the evaluation cases on the output" on page 33](#)).

3.8.2 Evaluation fields

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

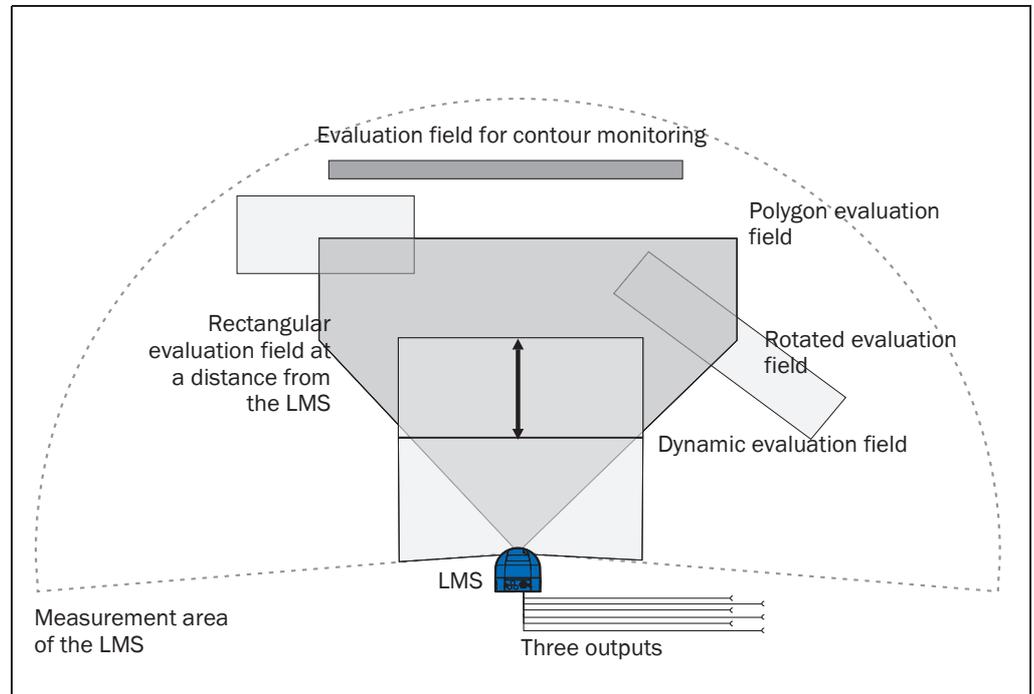


Fig. 20: Examples of different evaluation field shapes

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
- reaching the LMS
- at a distance from the LMS
- dynamic (the length changes with speed measured using the encoder, see [section 3.9.1 "Encoder inputs" on page 34](#))



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 LMS via software without additional mounting effort.

3.8.3 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).

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

3.9 Inputs and outputs

3.9.1 Encoder inputs

The LMS500/511 has 2 encoder inputs (IN3 and IN4).

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 maximum speed.

3.9.2 Digital switching outputs

The LMS500/511 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 5.4.5 “Wiring of inputs and outputs on the LMS” on page 55](#)).

For each output you configure whether it is switched by the field evaluation application or via SOPAS ET messages, 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 LMS can signal evaluation field infringements or contour infringements. For this purpose, configure in SOPAS ET which evaluation case is to act on which output.

3.9.3 Synchronisation of several LMS500/511

Optical interference between two or more LMS can occur if they have to be installed within the same scanning plane (see [section 4.3.6 “Using multiple LMS laser measurement systems” on page 45](#)).

Several LMS can be synchronised to avoid this type of interference. Through the SOPAS software an LMS can be set to be Master only via Output 6 (master synchronisation) and connected to a second LMS through Input 4 (slave synchronisation).

Using the Synchronisation Phase value in the SOPAS software each Master-Slave link can be differentiated.

3.9.4 Logical operators for inputs and outputs

With the aid of an evaluation case the inputs and outputs on several LMS can be linked together (see [section 3.8.1 "Evaluation cases" on page 31](#)).

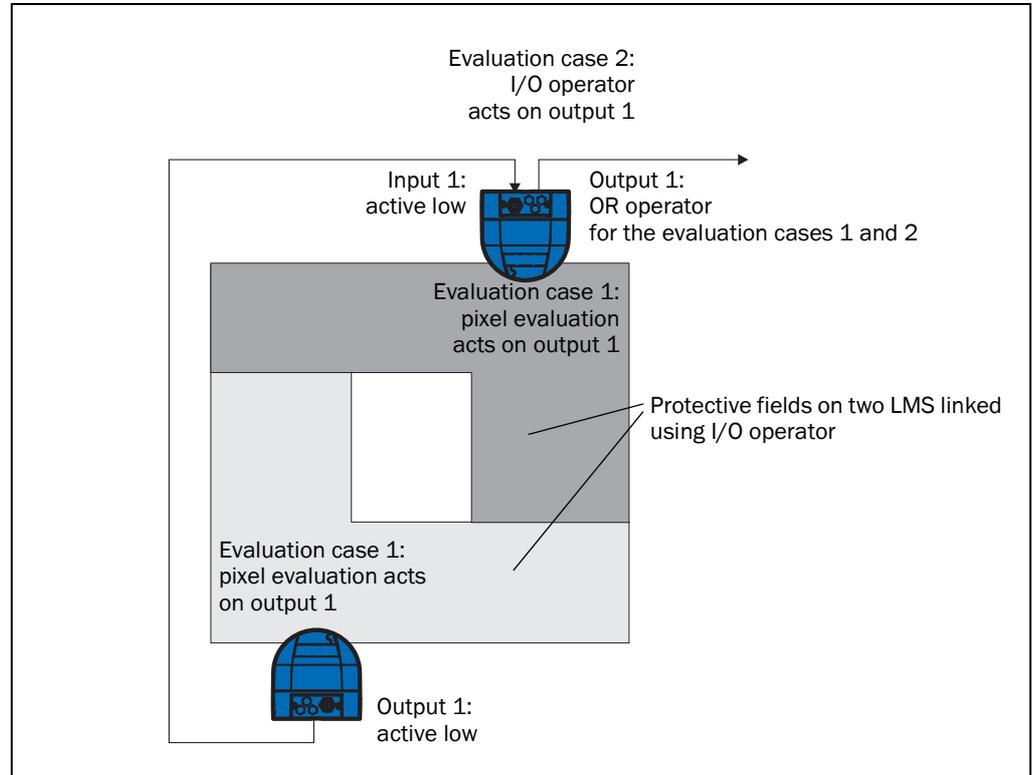


Fig. 21: Logical operators for inputs and outputs

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

3.10 Data interfaces

The LMS 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/RS-422 interfaces is limited. Therefore these interfaces are not suitable for transmitting scan data in real time.

3.10.1 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 LMS 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



If necessary, adjust the TCP/IP configuration for the Ethernet interface to enable a connected PC (client) to communicate with the LMS 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 LMS and then restart the LMS. For this purpose there is the RESTART button in SOPAS_ET.

You will find a description of the electrical interface in [section 5.2 “Connections of the LMS” on page 47](#).

3.10.2 Serial host interface

The serial host interface is an RS-232/RS-422 interface. The host interface permits the configuration of the LMS 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 LMS again in SOPAS ET (see [section 6.3.5 “Performing scan” on page 60](#)).

You will find a description of the electrical interface in [section 5.2 “Connections of the LMS” on page 47](#).

3.10.3 USB auxiliary interface

The mini-USB auxiliary interface permits the configuration of the LMS.

The USB driver provided in the LMS CD must be loaded first.

Parameters can be changed via USB while the scanner is connected to another interface such as RS or Ethernet to a host. Only the last changes saved in the configuration, either via USB, RS or Ethernet, will be permanent.

3.11 Data communication using messages

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

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

The messages each comprise a frame (see [section 3.11.1 “Frame and coding for the messages” on page 37](#)) and the data.

A detailed description of the different messages can be found in the annex (see [section 10.2 “Messages” on page 76](#)).

3.11.1 Frame and coding for the messages

The data frame varies depending on the coding.

Messages with ASCII coding

	Frame	Message	Frame
Code	STX	Data (see section 10.2 “Messages” on page 76)	ETX
Length (byte)	1	≤ 30 kB	1
Description	Start of text character	ASCII coded. The length is dependent on the previous send message.	End of text character

Tab. 7: Frame for the messages 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 messages with CR/LF).

Messages with binary coding

	Frame				Message	Frame	
Code	STX	STX	STX	STX	Message length	Data (see section 10.2 “Messages” on page 76)	Checksum
Length (byte)	1	1	1	1	4	≤ 2,495	1
Description	Start of text character				Length of the data without CS	Binary encoded. The length is dependent on the previous send message.	See “Calculation of the checksum” further below

Tab. 8: Frame for the messages 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.

3.12 Planning

3.12.1 LMS system requirements

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

- LMS500: Supply voltage DC 19.2 ... 28.8 V, generated as per IEC 60364-4-41 (VDE 0100, part 410), output power minimum 24 W
- LMS511: Supply voltage DC 19.2 ... 28.8 V, generated as per IEC 60364-4-41 (VDE 0100, part 410), output power minimum 24 W.
Supply voltage for the heating DC 24 V, output power minimum 50 W (cyclic)
- Data interface RS-232/RS-422, Ethernet and USB (optional, in case several LMS are connected together in a network)
- PC with operating system Windows 2000™, Windows XP™ or Windows Vista™ (see also [section 6.2.1 "System requirements for SOPAS ET" on page 58](#))

3.12.2 Mounting requirements

The LMS must be mounted as follows:

- robust
- as far as possible without shocks
- as far as possible without vibration
- protected from direct sunlight and heat sources

Mounting kits

The following mounting kits are available:

- mounting kit 1: mounting bracket for mounting at the rear on wall or machine (see [Fig. 49 on page 72](#))
- mounting kit 2: mounting bracket, only in conjunction with mounting bracket 1, cross-wise adjustment possible (see [Fig. 50 on page 73](#))
- mounting kit 3: mounting plate, only in conjunction with mounting bracket 1 and 2, length-wise adjustment possible (see [Fig. 51 on page 74](#))
- mounting with the Heavy Duty mounting bracket (see [Fig. 51 on page 74](#))

NOTICE

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

4 Mounting

NOTICE

Do not open the housing of the LMS. If the housing is opened, any warranty claims against SICK AG will be rendered void.

4.1 Overview of the mounting steps

- select a mounting location for the LMS
- mounting and adjusting the LMS

4.2 Preparations for mounting

4.2.1 Components to be mounted

- an LMS, weight approx. 3.7 kg (8.15 lb)

4.2.2 Material and accessories necessary

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

4.2.3 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

4.2.4 Select mounting location

NOTICE

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

Avoid installing with view of glass or stainless steel surfaces.

4.3 Mounting steps

NOTICE

Special features to note during mounting:

- Mount the LMS such that it is protected from moisture, dirt, damage and direct sunlight.
- Ensure that the entire field of view of the LMS is not restricted.
- Mount the laser measurement system such that the indicators are easy to see.
- Always mount the LMS so that there is still enough space for mounting and removing the system plug.
- Avoid excessive shock and vibration loading on the laser measurement system.
- On applications that suffer from heavy vibration, prevent the fixing screws from coming loose using screw locking devices (see [section 9.1 "Data sheet LMS laser measurement system" on page 67](#)).
- Regularly check the tightness of the fixing screws.
- Pay attention to the maximum torque for the fixing screws on the LMS:
 - M6 on rear = max. 12 Nm
 - M8 on side = max. 16 Nm

The LMS can be fastened in the following ways:

- direct mounting without mounting kit
- mounting with mounting kit 1
- mounting with mounting kit 2 (only in conjunction with mounting kit 1)
- mounting with mounting kit 3 (only in conjunction with mounting kits 1 and 2)

4.3.1 Direct mounting

The LMS has four M6×8 threaded holes on the rear. Using them you can mount the LMS directly on the intended mounting surface.

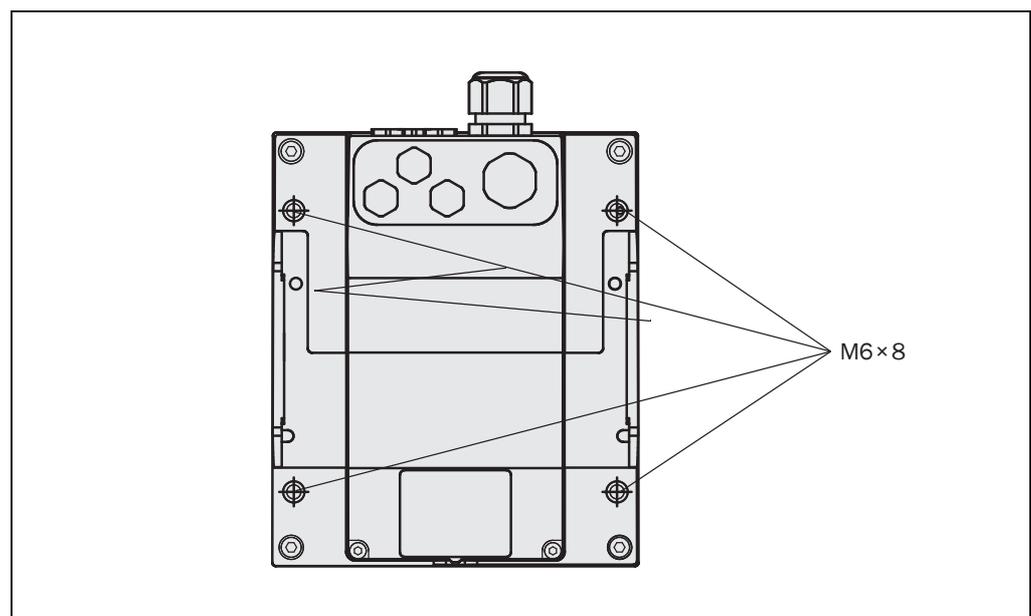


Fig. 22: Direct mounting

Important During mounting, please observe the dimensional drawings (see [section 9.2.1](#) “*Dimensional drawing LMS500*” on page 70).

4.3.2 Mounting with mounting kit 1

With the aid of mounting kit 1 you can mount the LMS on a mounting surface (wall, machine).

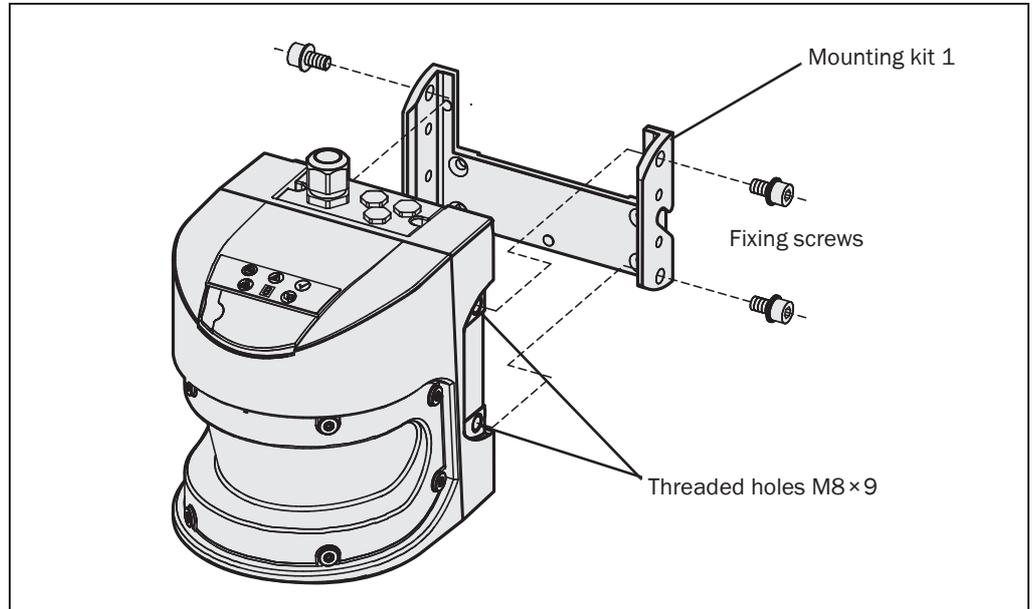


Fig. 23: Mounting with mounting kit 1

1. Mount mounting kit 1 on the mounting surface.
2. Then mount the LMS on the mounting kit 1.

Important During mounting, please observe the dimensional drawings (see [section 9.2.3](#) “*Dimensional drawings, mounting kits*” on page 72).

4.3.3 Mounting with mounting kit 2

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

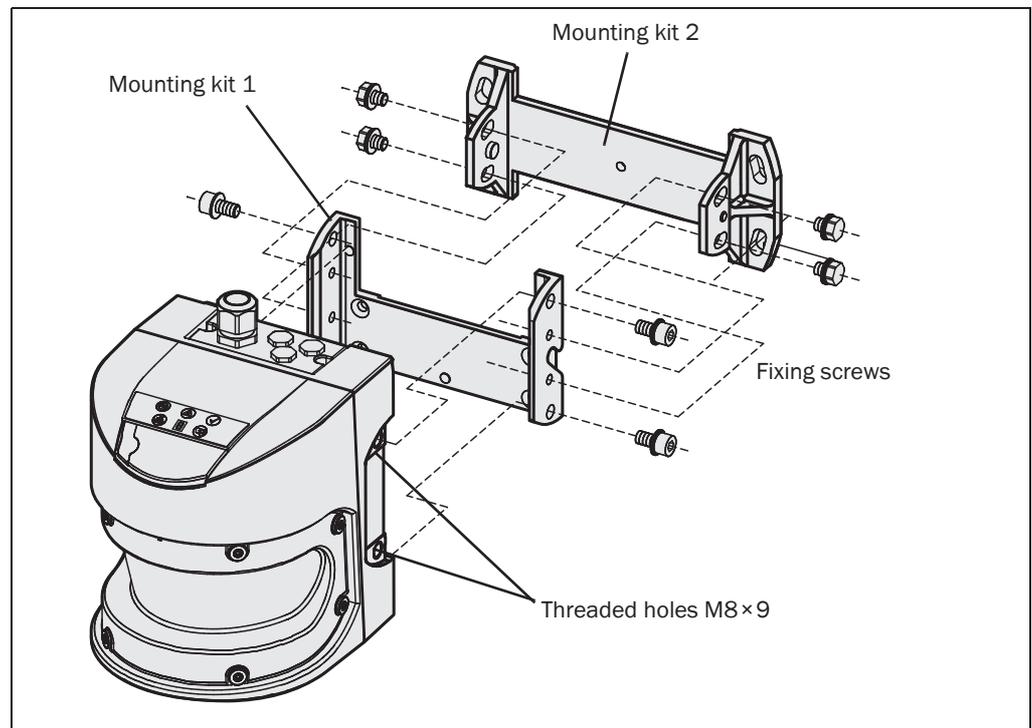


Fig. 24: Mounting with mounting kit 2 and 3

1. Mount the mounting kit 2 on the mounting surface.
2. Then mount mounting kit 1 on mounting kit 2.
3. Then mount the LMS on mounting kit 1.
4. Adjust the LMS longitudinally and cross-wise.

Important During mounting, please observe the dimensional drawings (see [section 9.2.3 “Dimensional drawings, mounting kits” on page 72](#)).

4.3.4 Mounting with mounting kit 3

With the aid of mounting kit 3 (only in conjunction with mounting kits 1 and 2) you can mount the LMS500/511 such that the scan plane is parallel to the mounting surface. This enables stable floor mounting or ensures that mounting kit 2 remains precisely adjustable cross-wise on uneven wall surfaces.

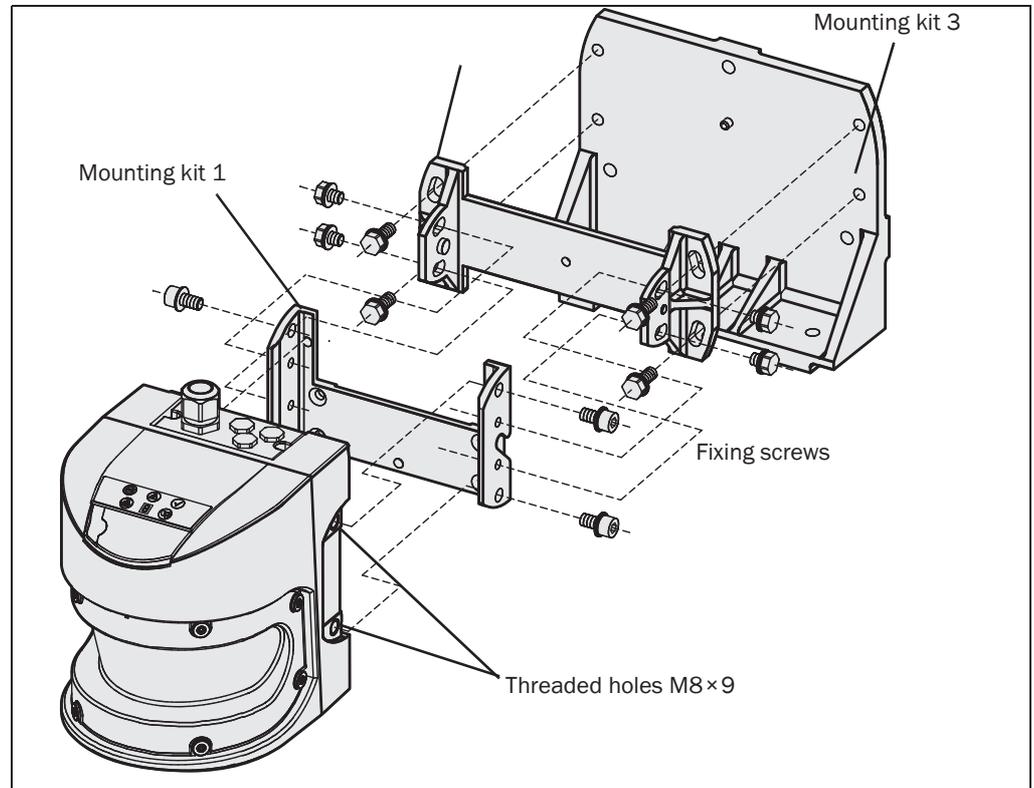


Fig. 25: Mounting with mounting kit 2 and 3

1. Mount mounting kit 3 on the mounting surface.
2. Then mount mounting kit 2 on mounting kit 3.
3. Then mount mounting kit 1 on mounting kit 2.
4. Finally mount the LMS on mounting kit 1.
5. Adjust the LMS longitudinally and cross-wise.

Important During mounting, please observe the dimensional drawings (see [section 9.2.3 "Dimensional drawings, mounting kits" on page 72](#)).

4.3.5 Mounting the LMS500/511 with weather protection hood

To protect the LMS500/511 from glare, precipitation and direct sunlight when used outside, a weather protection hood is available.

The weather protection hood can be mounted on the LMS500/511 in two different positions depending on the orientation of the scanner.

You will find detailed dimensions in [section 9.2.4 “Dimensional drawings, weather protection hoods” on page 75](#).

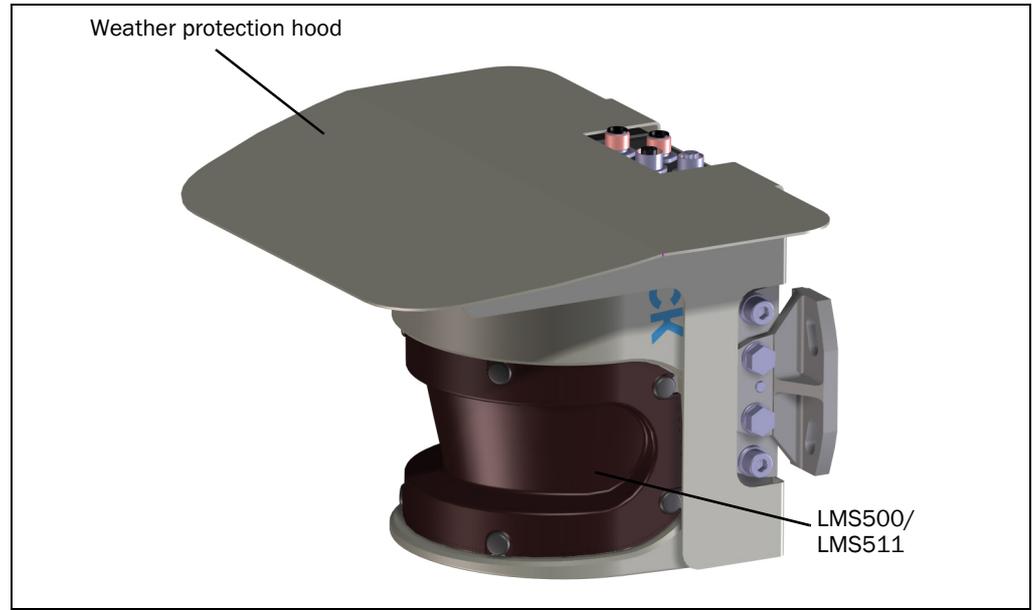


Fig. 26: Weather protection hood, upright orientation of the scanner

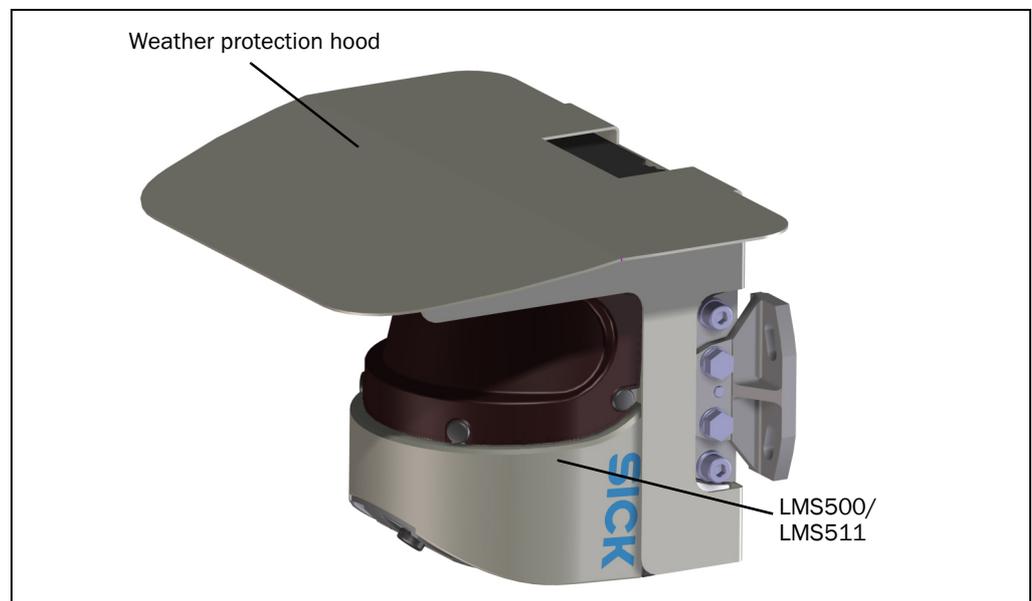


Fig. 27: Weather protection hood, upside down orientation of the scanner

4.3.6 Using multiple LMS laser measurement systems

NOTICE

Risk of interference on the LMS!

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

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

Use mounting kits 1 to 3 to adjust the laser measurement systems to different angles.

Correct placement of several LMS

Illustration of the LMS500 have to be inserted on the following figures

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

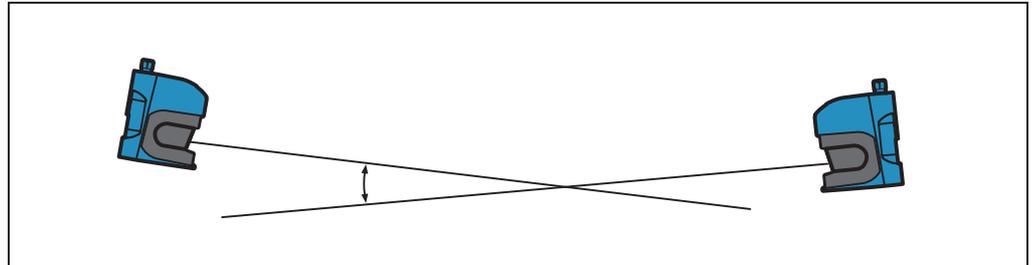


Fig. 28: Placement of two LMS opposed to each other

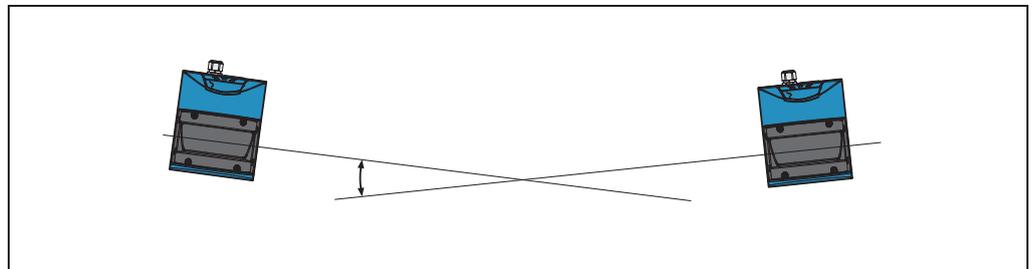


Fig. 29: Crosswise placement of two LMS

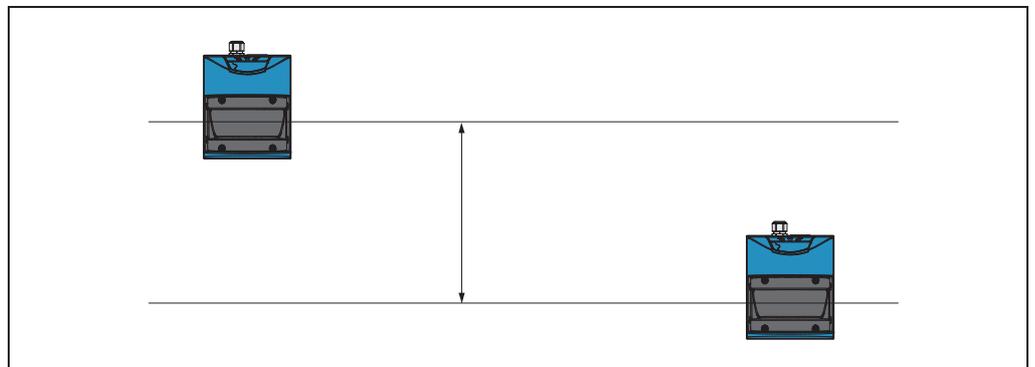


Fig. 30: Placement of two LMS with parallel offset

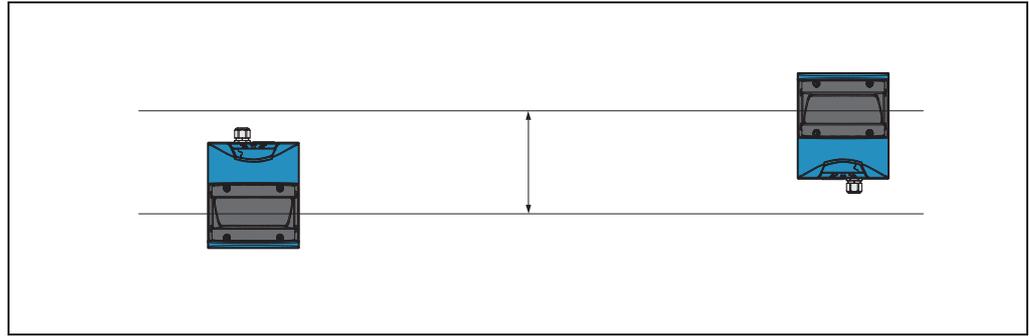


Fig. 31: Placement of two LMS with parallel offset, one of these upside down

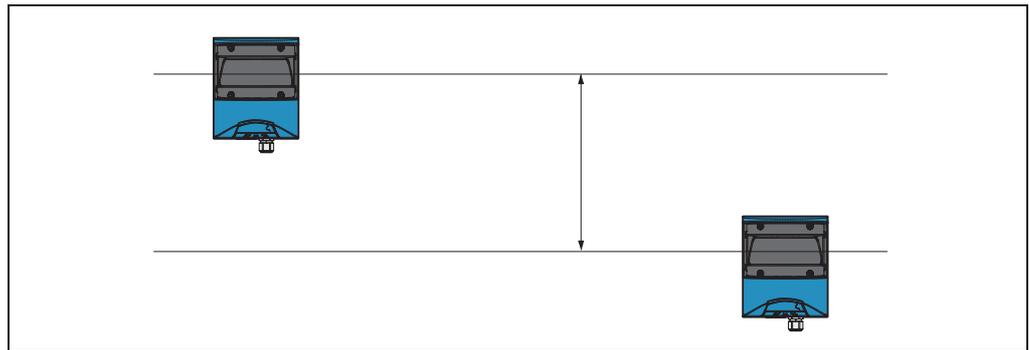


Fig. 32: Placement of two LMS upside down, parallel offset

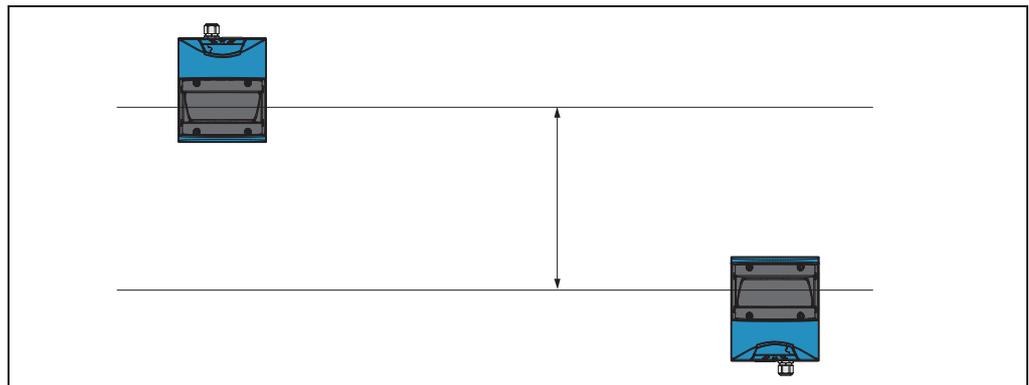


Fig. 33: Placement of two LMS with parallel offset, one of these upside down

4.4 Dismanteling the system

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

Important On final decommissioning, please observe the disposal requirements in [section 2.5.2](#) *“Disposal after final de-commissioning”* on page 14 for environmentally correct disposal.

5 Electrical installation

NOTICE

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

- Do not open the housing.
- 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.

5.1 Overview of the installation steps

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

5.2 Connections of the LMS

Depending on the variant, the LMS has different connections:

- The LMS500 has a removable system plug. This has a M16 screw type cable entry on the rear. The connections are made to the screw type terminal in the system plug. In addition these variants have a round M12 plug connector for the connection to Ethernet.

You can move the M16 cable entry and the round plug connector from the rear to the underside of the system plug (see [section 9.2.1 "Dimensional drawing LMS500" on page 70](#)).

- The LMS511 has four multipin round M12 plug connectors. The connections are made to the related plug or sockets.
- All variants have a mini USB connector on the front of the unit for the connection to the USB interface on a PC.

Important

- This interface is only used for configuration and is not allowed to be permanently connected.
- Install the USB driver provided on the CD-ROM before connecting the device to the PC.

5.2.1 Connections of the LMS500

Terminal	Signal	Function
1	24 V SYS	Supply voltage LMS
2	GND SYS	Ground LMS
3	24 V EXT	
4	GND EXT	
5	OUT 1	Digital output 1
6	OUT 2	Digital output 2
7	OUT 3	Digital output 3
8	OUT 4	Digital output 4
9	OUT 5	Digital output 5
10	OUT 6	Digital output 6
11	CAN H	CAN-BUS High
12	GND CAN HST	Ground CAN host
13	CAN L	CAN-BUS Low
14	SHIELD	Shield
15	Reserved	Do not use!
16	Reserved	Do not use!
17	IN3	Digital input 3
18	IN4	Digital input 4
19	IN34EXT	
20	IN12EXT	
21	IN1	Digital input 1
22	IN2	Digital input 2
23	RTS TDP	
24	TXD TDN	
25	GND CAN HST	Ground CAN host
26	RXD RDN	
27	CTS RDP	
28	SHIELD	Shield

Tab. 9: Terminal assignment of the LMS500

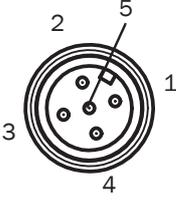
"Ethernet" connection M12×4, socket

Pin	Signal	Function
1	Ethernet_TX+	Ethernet interface
2	Ethernet_RX+	Ethernet interface
3	Ethernet_TX-	Ethernet interface
4	Ethernet_RX-	Ethernet interface

Tab. 10: Pin assignment of the "Ethernet" connection on the LMS500

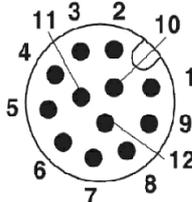
5.2.2 Connections of the LMS511

“Power” connection M12×5, plug

	Pin	Signal	Function
	1	V _S	LMS supply voltage
	2	V _S heat.	Supply voltage for the heating
	3	GND	Ground
	4	-	Not assigned
5	GND heat.	Ground heating	

Tab. 11: Pin assignment of the “Power” connection on the LMS511

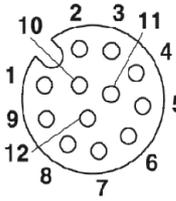
Communication connection M12×12, plug

	Pin	Signal	Function
	1 ¹⁾	V _{CC} Out 1+2	
	2	RS422 RxD-	Serial RS-422 host interface (receiver)
	3 ¹⁾	Out 1	
	4	RS422 CAN GND	Ground Serial RS-422 and CAN
	5 ¹⁾	Out 2	
	6 ¹⁾	NC	Not connected
	7	RS422 TxD-	Serial RS-422 host interface (sender)
	8 ¹⁾	NC	Not connected
	9	RS422 RxD+	Serial RS-422 host interface (receiver)
	10	RS422 TxD+	Serial RS-422 host interface (sender)
	11 ¹⁾	CAN Low	CAN-BUS Low
12 ¹⁾	CAN High	CAN-BUS High	

Tab. 12: Pin assignment of the “RS-232” connection on the LMS511

1) Available from December 2010.

“I/O” connection M12×12, socket

	Pin	Signal	Function
	1	V _{CC} Out 3-6	
	2 ¹⁾	GND In 1+2	
	3 ¹⁾	In 1	
	4	GND In 3+4	
	5 ¹⁾	In 2	
	6	In 3	
	7	GND Out 3-6	
	8	In 4	
	9 ²⁾	Out 3	
	10 ¹⁾	Out 4	
	11	Out 5	
12	Out 6		

Tab. 13: Pin assignment of the “I/O” connection on the LMS511

1) Available from December 2010.

2) SOPAS software must be configured as Out 1. From December 2010 SOPAS will change to Out 3.

“Ethernet” connection M12×4, socket

	Pin	Signal	Function
	1	Ethernet_TX+	Ethernet interface
	2	Ethernet_RX+	Ethernet interface
	3	Ethernet_TX-	Ethernet interface
4	Ethernet_RX-	Ethernet interface	

Tab. 14: Pin assignment of the “Ethernet” connection on the LMS511

5.3 Preparing the electrical installation

5.3.1 Supply voltage

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

- LMS500/511: 19.2 ... 28.8 V DC as per IEC 60364-4-41

The LMS draws the following power:

- power consumption of the LMS500 with maximum output load 24 W
- power consumption of the LMS511 with maximum heating performance 70 W



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).

5.3.2 Wire cross-sections

- Wire all connections with copper cables!
- Use the following wire cross-sections:
 - supply voltage at least 0.25 mm² (approx. 24 AWG), if local power supply in the immediate vicinity
 - supply voltage at least 1.0 mm² (approx. 18 AWG) at maximum length of 20 m (65.62 ft), if the connection is made to an existing 24 V DC supply
 - switching outputs minimum 0.25 mm² (approx. 24 AWG), maximum cable length 50 m (164.04 ft) with 0.5 mm² (approx. 22 AWG)
 - data interface minimum 0.25mm² (approx. 24 AWG)
 - For the LMS the outside diameter of the common cable must be a maximum of 9 mm (0.35 in) due to the cable entry.
- All communication cables must be twisted and shielded.

Important If you use flexible connecting cables with stranded wire for the connection to the terminals on the LMS500/511, you must **not** use wire end ferrules.

5.4 Perform electrical installation on the LMS



CAUTION

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

5.4.1 Equipment

- tool set
- digital multimeter (current/voltage measurement)

5.4.2 Connection on the USB auxiliary interface and the Ethernet interface of the LMS500/511

Pre-assembled cables are available to configure the LMS via the USB auxiliary interface and via the Ethernet interface.

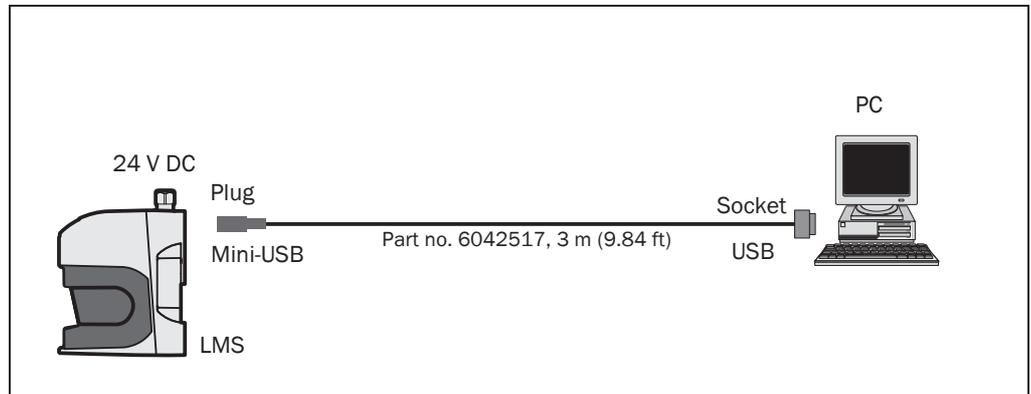


Fig. 34: LMS500/511: USB connection at the auxiliary interface

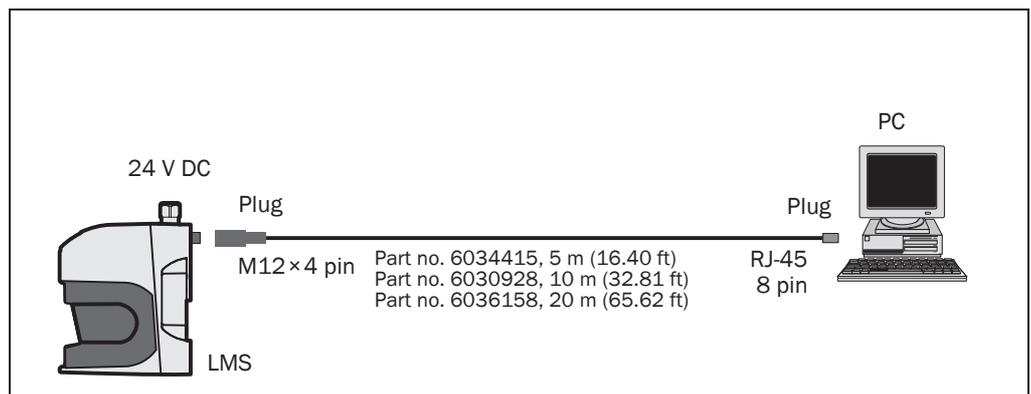


Fig. 35: LMS500/511: Ethernet connection using the Ethernet cable

5.4.3 Connecting the system plug on the LMS500

NOTICE

Reduced enclosure rating!

- If the system plug is removed, the LMS500 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 plug in dry, clean surroundings.
- If necessary, pre-wire and fit the adapter in suitable surroundings.

1. Ensure the power supply to which the LMS is connected is switched off.
2. Remove interface adapter on the underside of the device. For this purpose undo the four fixing screws ([Fig. 9.2.1 on page 70](#)) and pull the adapter carefully off the device perpendicular to the base.
3. The M16 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 M16 cable entry.
5. Pull the cable for supply voltage and switching outputs with maximum outside diameter \varnothing 10 mm (0,39 in) through the plastic insert for the M16 cable entry.
6. Connect electrically isolated wires to the terminal block.
7. If necessary, connect screen braid on the cable to the cable entry.
8. Fit M16 cable entry fitting and tighten.
9. Carefully re-fit the system plug to the LMS.
10. Tighten the fixing screws for the system plug.

5.4.4 Connecting the round M12 plug connector on the LMS511

NOTICE

Only make connection to the LMS511 at the round M12 plug connectors provided for this purpose!

- Only use plug connectors that are compliant with enclosure rating IP 67.

Pre-assembled cables are available as accessories for the connection to the round M12 plug connectors. These comprise the round plug connector and 5, 10 or 20 m (16.40, 32.81 or 65.62 ft) of cable with flying leads.

Connection of the voltage supply on the LMS511

Pre-assembled cables with flying leads are available for the supply to the LMS511.

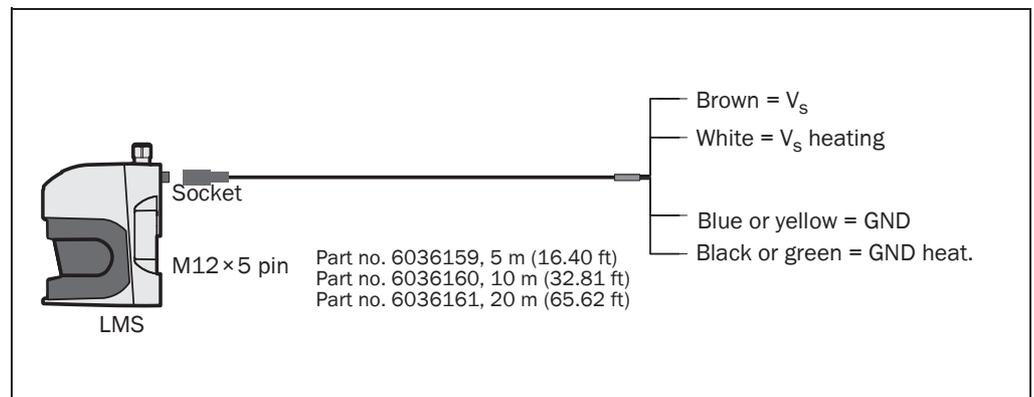


Fig. 36: LMS511: connection of the voltage supply

Important On the connecting cables part no. 6036159, part no. 6036160 and part no. 6036161 the cables for GND and GND heating are either blue and black or yellow and green.

The connecting cables require the following minimum voltages at the open cable end:

- Part no. 6036159, 5 m: 19.2 V
- Part no. 6036160, 10 m: 19.7 V
- Part no. 6036162, 20 m: 21.4 V

Communication connection on the LMS511

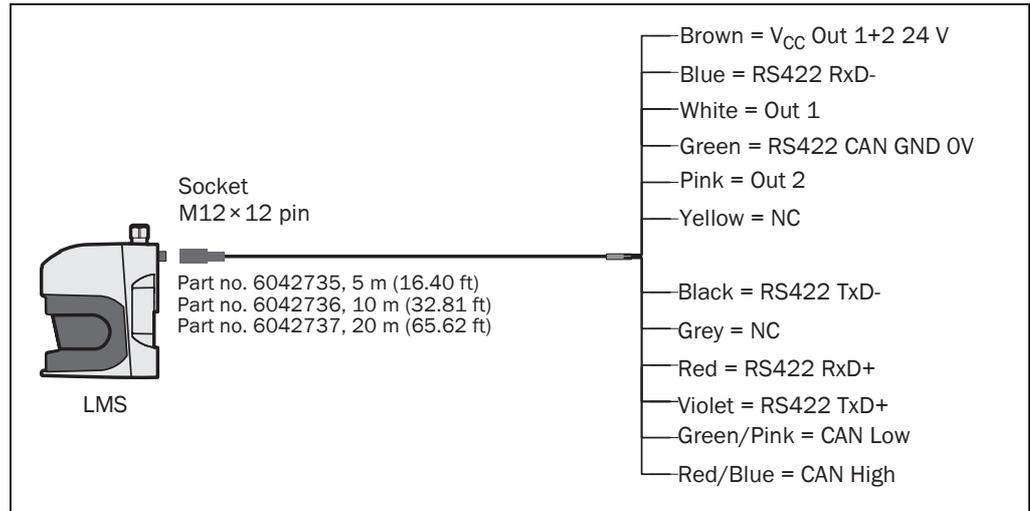


Fig. 37: LMS511: Communication connection

“I/O” connection on the LMS511

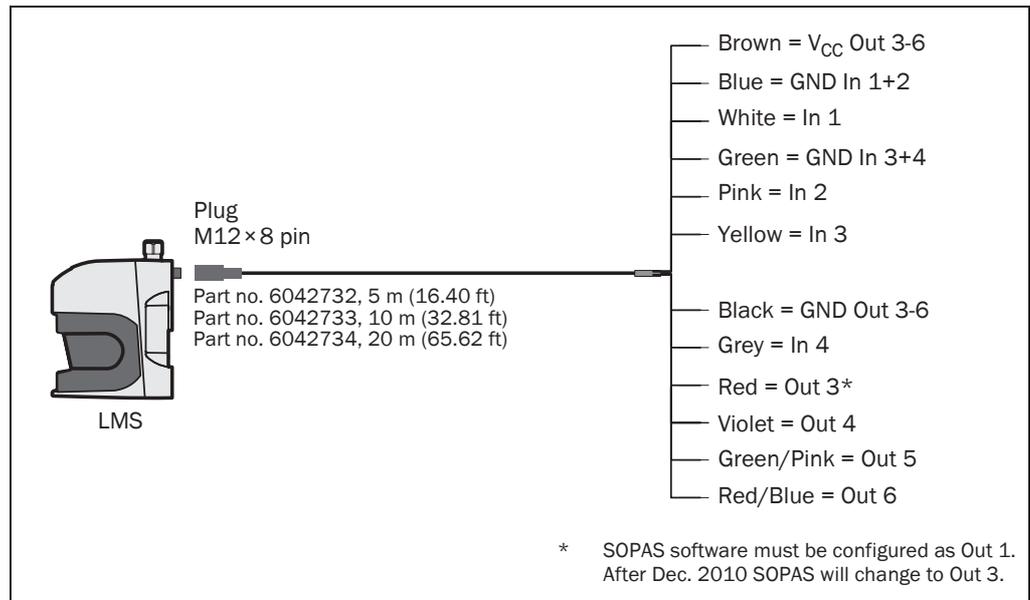


Fig. 38: LMS511: “I/O” connection

5.4.5 Wiring of inputs and outputs on the LMS

Connecting digital inputs as non-floating

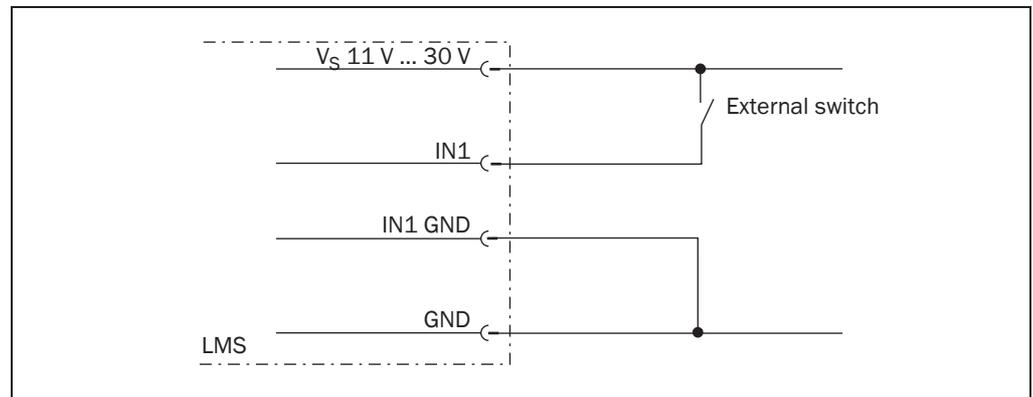


Fig. 39: Connecting digital inputs as non-floating

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

Connecting digital inputs as floating

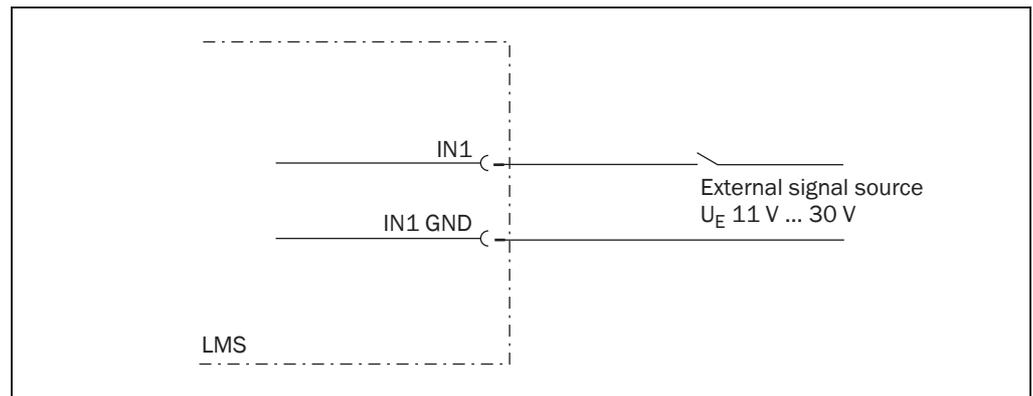


Fig. 40: Connecting digital inputs as floating

Wiring encoder inputs

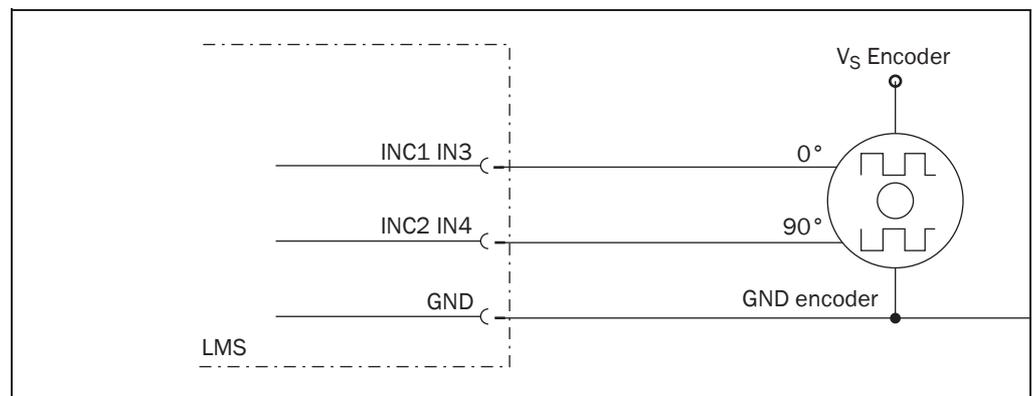


Fig. 41: Wiring encoder inputs

Wiring inputs In 1...4

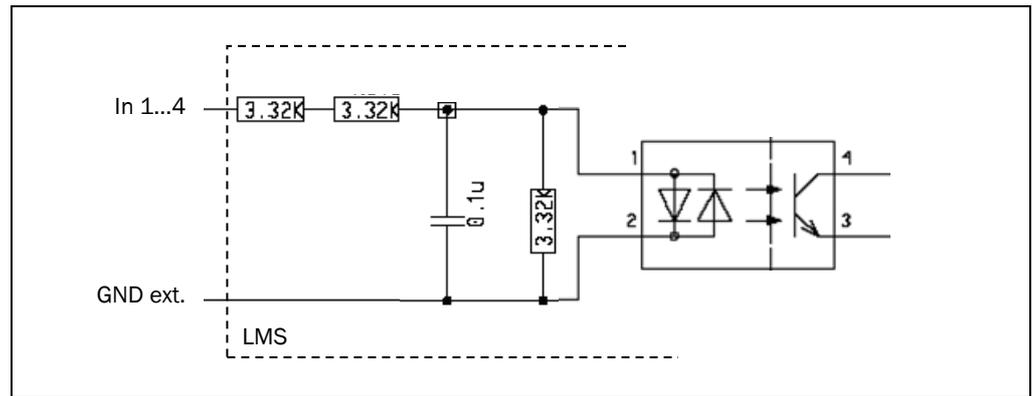


Fig. 42: Wiring inputs In 1...4

Connection of the outputs of the LMS to a PLC

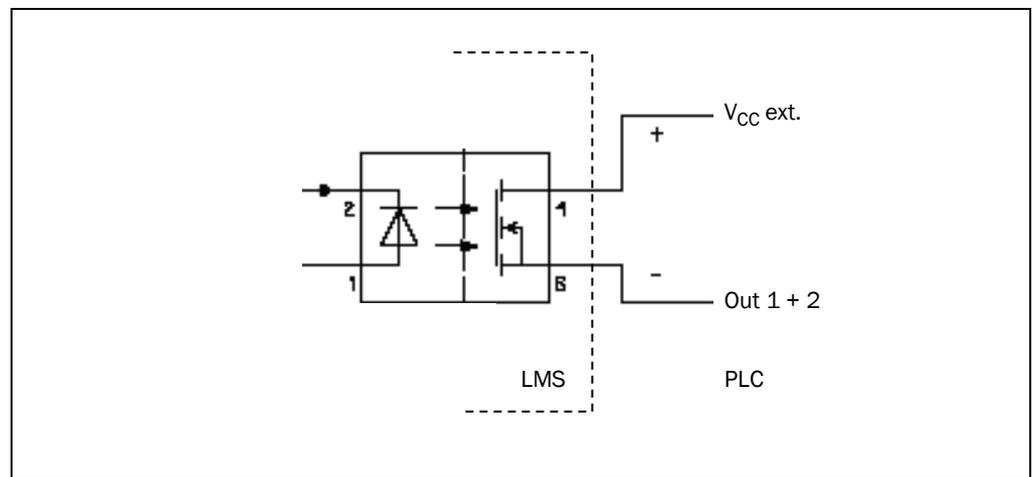


Fig. 43: Connection of the outputs to a PLC (active low)

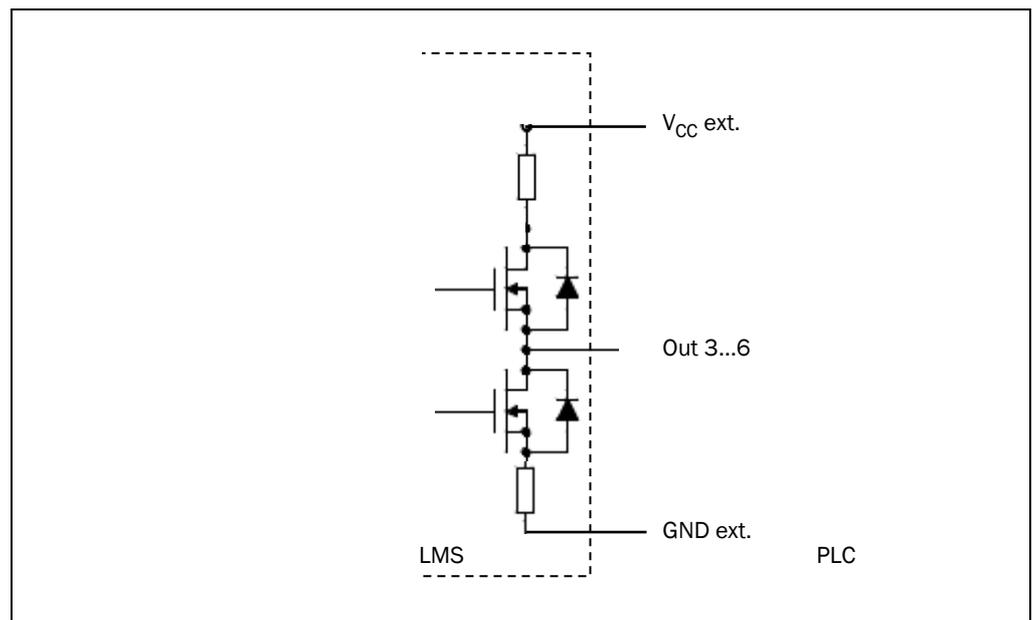


Fig. 44: Connection of the outputs to a PLC (active high)

Wiring the RS-232 or RS-422 interface

A screened cable is required for the wiring of the RS-232 or the RS-422 interface.

- Pay attention to the max. cable length.

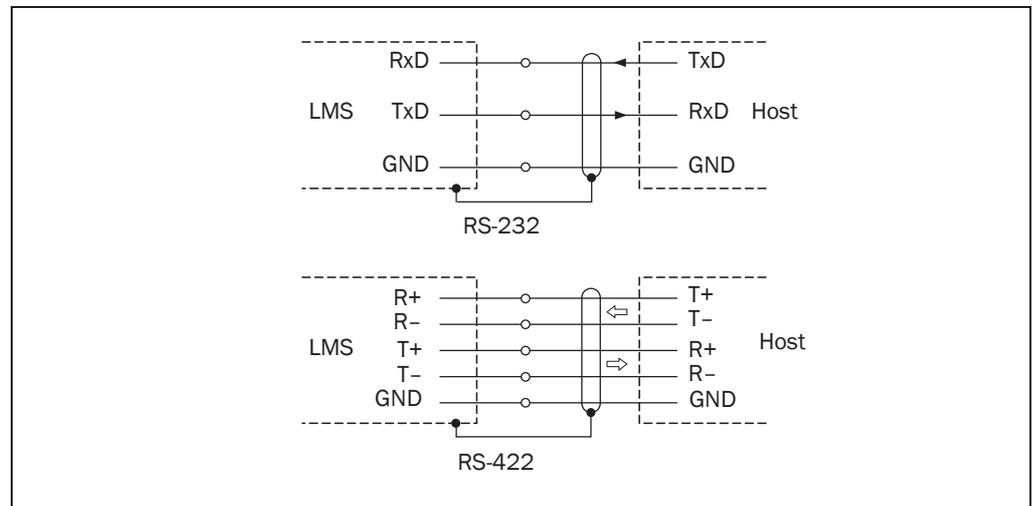


Fig. 45: Wiring of the RS-232 or RS-422 interface

6 Commissioning and configuration



WARNING

Commissioning requires a thorough check by qualified personnel!

Before you operate a system equipped with the LMS 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 2 “For your safety” on page 11](#).

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

6.1 Overview of the commissioning steps

- install SOPAS ET configuration software
- establish communication with the LMS
- create a custom parameter set using SOPAS ET and save in non-volatile memory in the LMS
- test LMS for correct function

6.2 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 LMS
- password-protected configuration with different operating levels
- system diagnostics

6.2.1 System requirements for SOPAS ET

- standard Intel Pentium PC or compatible, at least Pentium III, 500 MHz
- minimum 256 MB RAM, 512 MB RAM recommended
- data interface RS-232, Ethernet or CAN
- operating system: MS Windows 2000, XP or VISTA
- monitor with 256 colours minimum, 65.536 colours recommended (16 Bit High Color)
- screen resolution at least 800 × 600

- hard disc: minimum 170 MB free memory
- CD-ROM drive
- HTML browser on PC, e.g. Internet Explorer™, for the online help system for SOPAS ET

6.2.2 Installation of SOPAS ET

1. Start PC and insert installation CD.
2. If the installation does not start automatically, run the file setup.exe on the CD-ROM.
3. To complete the installation, follow the instructions.

6.2.3 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 LMS	Immediate on change, temporary in the LMS RAM
Upload of the parameters from the LMS	After switching online, automatic
Window layout	3 (project tree, help, working area)
Serial communication	COM1: 9,600 Bd/19,200 Bd, 8 data bits, no parity, 1 stop bit

Tab. 15: SOPAS ET default setting

6.3 Establish communication with the LMS

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

On the connection of PC/host, following this sequence:

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

6.3.1 Connect the data interfaces

➤ Connect PC and LMS together as per table.

Data interface	Comment
Ethernet	Connect the PC to the LMS using the Ethernet cable (see Fig. 35 on page 51)

Or:

USB	Connect the PC (USB interface) to the LMS (see Fig. 34 on page 51)
-----	---

Or:

RS-232/RS-422	Connect the PC (serial interface) to the LMS (see Fig. 37 on page 54)
---------------	--

Tab. 16: Connect the data interfaces

6.3.2 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.

6.3.3 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.

6.3.4 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.

6.3.5 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.

6.4 Initial commissioning

The LMS is adapted to the local measurement 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 LMS (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 the non-volatile memory in the laser measurement system. In addition, the parameter set can be saved as a project file (spr- file with configuration data) on the PC and archived.

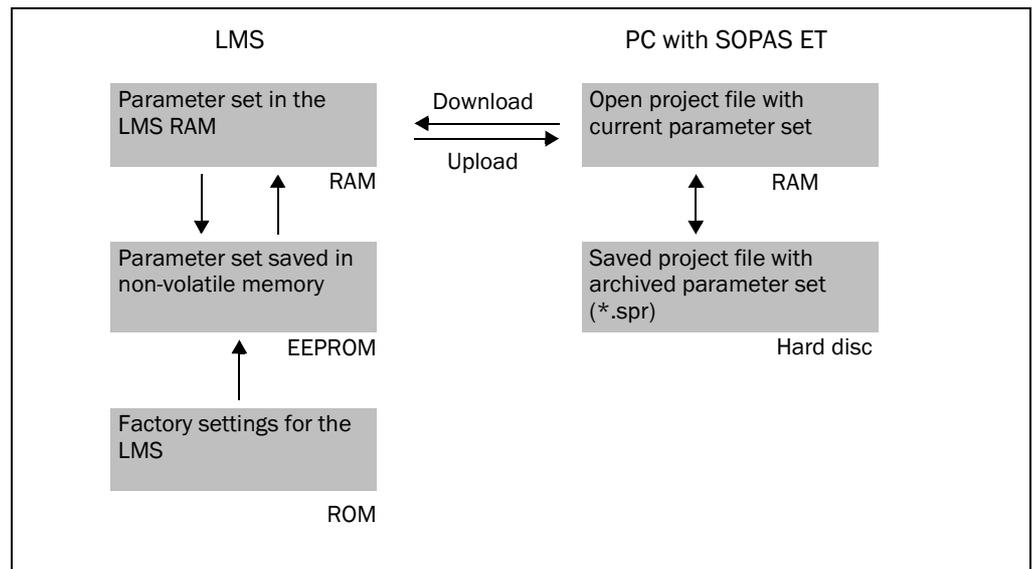


Fig. 46: Principle of data storage

6.4.1 Configuring the LMS

You can configure the LMS in two ways:

- interactively using SOPAS ET
This section describes the interactive configuration.
- using configuration messages
On this subject please read [section 3.11 “Data communication using messages” on page 37](#).

Interactive configuration using SOPAS ET

All parameters that can be configured for the LMS are combined into a corresponding device description (jar 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 LMS is password protected. Following completion of the configuration, you should change the password so that it can perform its protective function.

User level	Password
Maintenance personnel	main
Authorised client	client

Tab. 17: Passwords LMS

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

Do not switch off the voltage supply during configuration!

Switching off the voltage supply during configuration causes all parameters already configured to be lost.

1. From the OPTIONS menu select the LOGIN DEVICE command and log in to the system using the password “client” as AUTHORISED CLIENT.
2. Configure the LMS 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.

Resetting configuration

Recommendation To reset the LMS 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.

6.5 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 LMS: menu LMS..., PARAMETER, SAVE PERMANENT.

7 Maintenance

NOTICE

Claims under the warranty rendered void!

The housing screws of the LMS 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 authorised service personnel.

7.1 Maintenance during operation

7.1.1 Cleaning the front screen

The LMS laser measurement system is largely maintenance-free. The front screen on the LMS should however be regularly cleaned and also if contaminated.

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

Important Static charges cause dust particles to be attracted to the front screen. You reduce this effect by using the antistatic plastic cleaner (SICK part no. 5600006) and the SICK lens cloth (part no. 4003353) (see [section 10.3.1 “Consumables” on page 95](#)).

How to clean the front screen:

- Use a clean and soft brush to remove dust from the front screen.
- Then wipe the view window of the front screen with a clean and damp cloth.

7.2 Exchanging an LMS

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

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

1. Switch off the voltage supply for the LMS.
2. Remove the connection cable/s from the LMS.
3. Mount the replacement device (see [chapter 4 “Mounting” on page 39](#)).
4. Configuring a replacement device (see [chapter 6 “Commissioning and configuration” on page 58](#)).

8 Troubleshooting

NOTICE

Claims under the warranty rendered void!

The housing screws of the LMS 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 authorised service personnel.

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

8.1 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.

8.2 Error displays of the LEDs

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	front screen contaminated, still in operation	➤ Clean the front screen.
 flashes with 1 Hz	front screen contaminated, no operation	➤ Clean the front screen.
 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. 18: Error displays of the LEDs

8.3 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.
	LMS faulty	➤ Send the LMS to the manufacturer for repair.

Tab. 19: Indications of the 7-segment display

8.4 Detailed error analysis

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

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

8.4.1 Field evaluation monitor

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

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



8.4.2 Field evaluation logging

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

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



9 Technical specifications

9.1 Data sheet LMS laser measurement system

	Minimum	Typical	Maximum
Functional data			
Scan angle			190°
Scanning frequency	25 Hz		100 Hz
Remission	2%		Several 1,000% ¹⁾ (reflectors)
Angular resolution	0.166°		1°
Measurement error 1st reflected pulse ²⁾			
Systematic error (@ 10% object remission)			
Standard resolution 1-10 m		±25 mm (±0.98 in)	
Standard resolution 10-20 m		±35 mm (±1.38 in)	
Standard resolution 20-30 m		±50 mm (±1.97 in)	
High resolution 1-10 m		±25 mm (±0.98 in)	
High resolution 10-20 m		±35 mm (±1.38 in)	
Statistical error (1σ) (@ 10% object remission)			
Standard resolution 1-10 m		±6 mm (±0.24 in)	
Standard resolution 10-20 m		±8 mm (±0.31 in)	
Standard resolution 20-30 m		±14 mm (±0.55 in)	
High resolution 1-10 m		±7 mm (±0.28 in)	
High resolution 10-20 m		±9 mm (±0.35 in)	
Immunity to external light		70 klx	
Distance from mirror axis of rotation (zero point on the X and Y axis) to the rear of the device	93 mm (3.66 in)		
Distance between centre of the scan plane and the bottom edge of the housing	63 mm (2.48 in)		
Distance measuring range			
LMS500-10000/LMS511-10100	0.7 m (2.30 ft)		65 m (213.25 ft)
LMS511-20100	0.7 m (2.30 ft)		65 m (213.25 ft)
Distance measuring range @ 10% object remission			
LMS500-10000/LMS511-10100	0.7 m (2.30 ft)		26 m (85.30 ft)
LMS511-20100	1 m (3.28 ft)		40 m (131.23 ft)

Tab. 20: Data sheet LMS500/511

	Minimum	Typical	Maximum
Power-up delay			60 s
Of a configured device		15 s	
Configurable restart after	2 s		60 s
General data			
Laser protection class	Laser class 1 according to IEC 60825-1 (2007-3) (complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, June 2007)		
Enclosure rating	As per EN 60529 (1991-10); A1 (2002-02)		
LMS500	IP 65		
LMS511	IP 67		
EMC test	As per EN 61000-6-2 (2005-08), EN 61000-6-3 (2007-03)		
Electrical safety	As per EN 50178 (1997-10)		
Operating temperature range			
LMS500	0 °C (32 °F)		+50 °C (122 °F)
LMS511	-30 °C (-22 °F)		+50 °C (122 °F)
Storage temperature range	-30 °C (-22 °F)		+70 °C (158 °F) max. 24 h
Humidity (taking into account the operating temperature range)	DIN EN 60068-2-61, method 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 (0.53 oz), 11 ms		
Continuous shock	10 g (0.35 oz), 16 ms		
Sender	Pulsed laser diode		
Wave length	895 nm	905 nm	915 nm
Divergence of the collimated beam (solid angle)			
High resolution		3.6 mrad	
Standard resolution		11 mrad	
Housing			
Material	GD-ALSI12 3.2582.05		
Colour LMS500	RAL 5012 (blue)		
Colour LMS511	RAL 7032 (grey)		
Alloy	Excellent weather resistance as per DIN EN 106:1988, plate 3		
Front screen			
Material	Polycarbonate		
Surface finish	Outside with scratch-resistant coating		

Tab. 20: Data sheet LMS500/511 (cont.)

	Minimum	Typical	Maximum
Dimensions ³⁾			
Height			185 mm (7.28 in)
Width			155 mm (6.10 in)
Depth			160 mm (6.30 in)
Total weight (without connecting cables)		3.7 kg (8.15 lb)	

Electrical data

Supply voltage LMS at the scanner	19.2 V	24 V	28.8 V
Permissible residual ripple			±5%
Supply voltage for the LMS511 heating	19.2 V	24 V	28.8 V
Switch on current			2 A
Operating current at 24 V		0.9 A	
Operating current with max. output load		1.9 A	
Operating current with maximum heating performance		2.3 A	2.5 A
Power consumption with maximum output load		22 W	25 W
Power consumption with maximum heating performance		65 W	70 W
Electrical connection LMS511	Round M12 plug connector		
Electrical connection LMS500	System plug with screw terminal block		
Switching inputs			
Number	0 (2) ⁴⁾		
Encoder inputs			
Number	2		
Digital switching outputs			
Number	3 (6) ⁴⁾		
Maximum current output 1 + 2 ⁵⁾			250 mA
Maximum current output 3 + 4			100 mA
Serial auxiliary interface			
Communication protocol	USB 2.0		
Transmission speed	9,600 Baud	57.6 kBd	115.2 kBd
Serial host interface			
Communication protocol	RS-232 (proprietary)/RS-422		
Transmission speed (selectable)	9,600 Baud	57.6 kBd	115.2 kBd
Ethernet	10/100 MBit/s		

Tab. 20: Data sheet LMS500/511 (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) Without fixing screws and projection of cable glands with system plug mounted.
- 4) Available from December 2010.
- 5) Outputs are short-circuit protected (no overload protection).

9.2 Dimensional drawings

9.2.1 Dimensional drawing LMS500

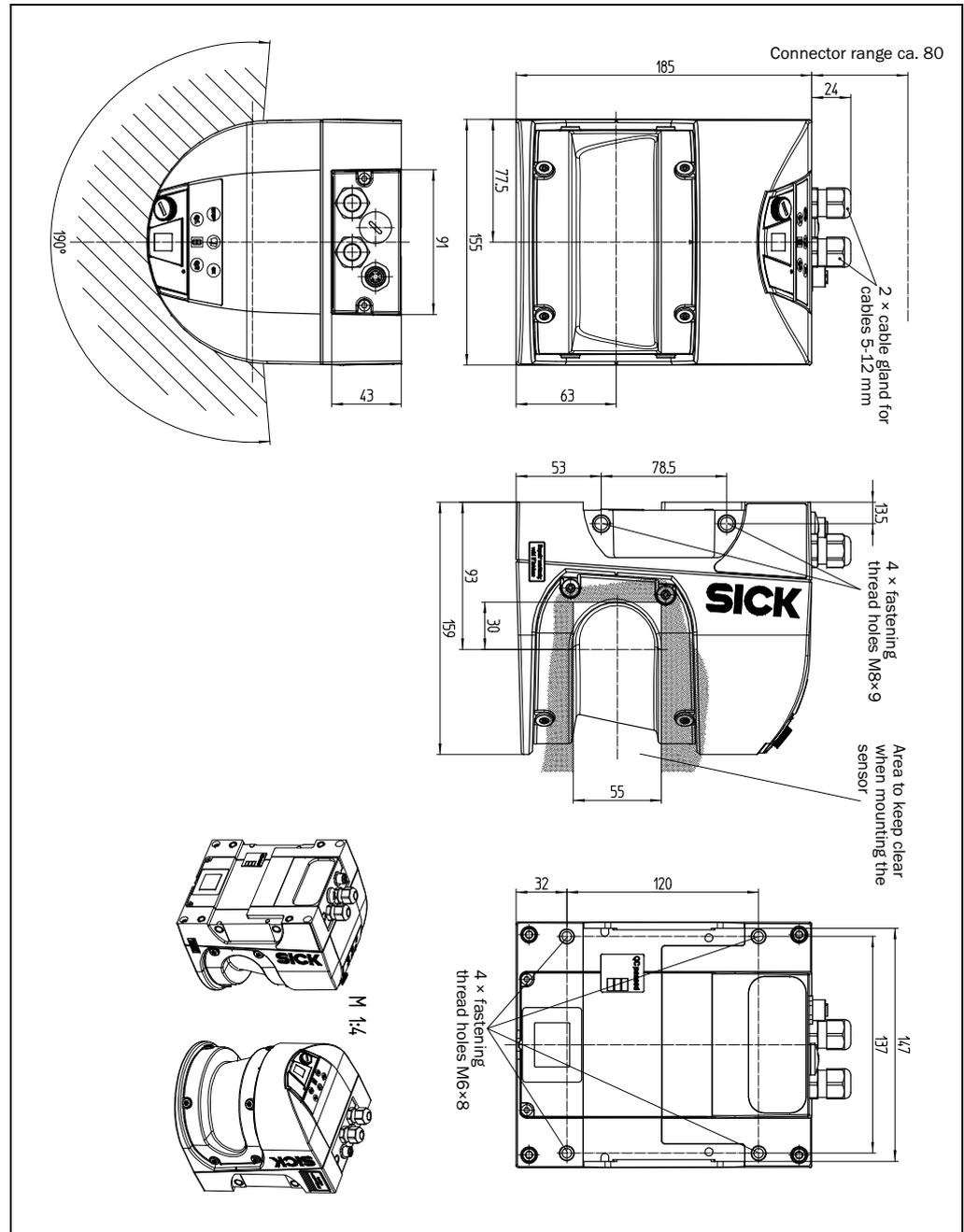


Fig. 47: Dimensional drawing LMS500 (mm)

9.2.2 Dimensional drawing LMS511

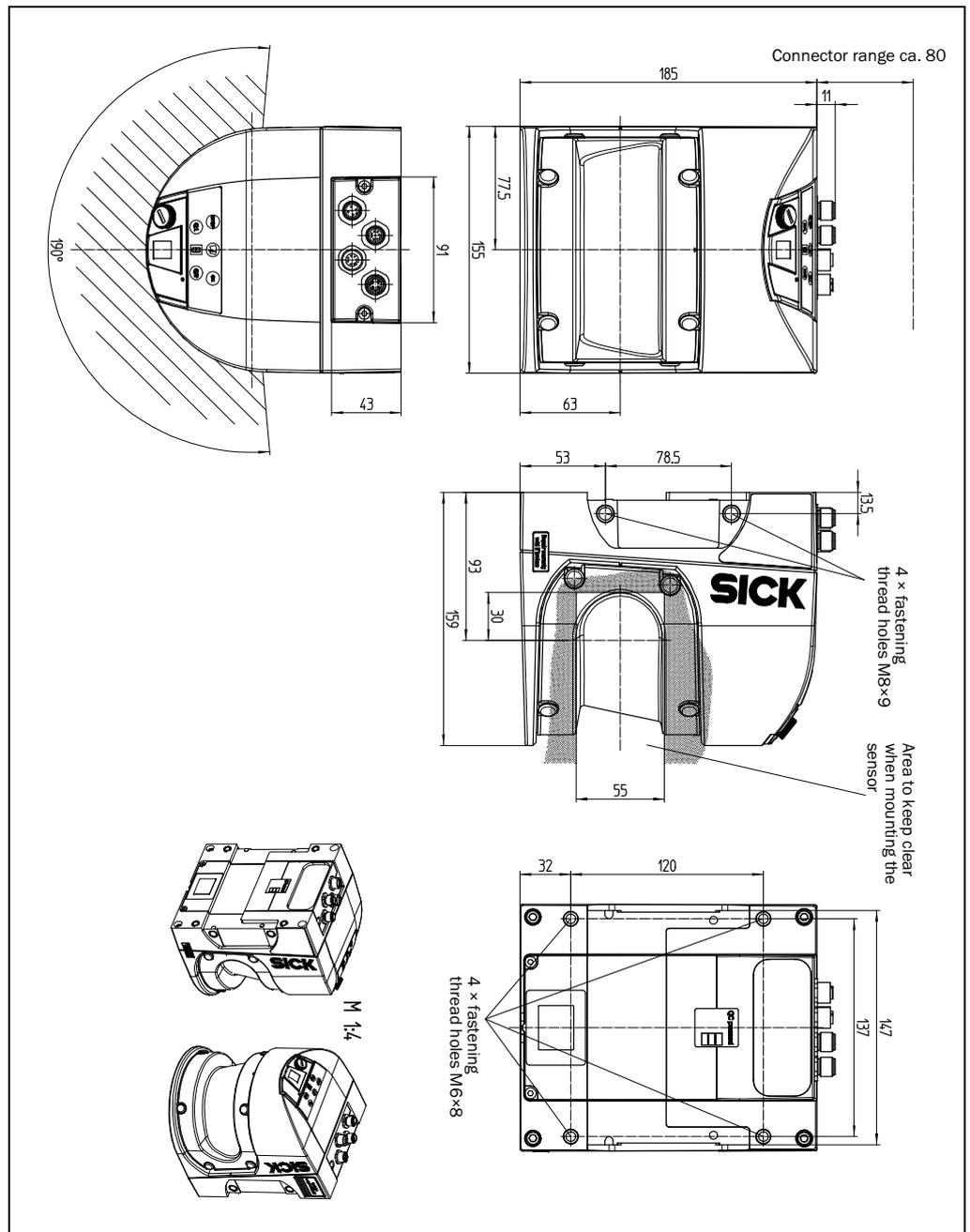


Fig. 48: Dimensional drawing LMS511 (mm)

9.2.3 Dimensional drawings, mounting kits

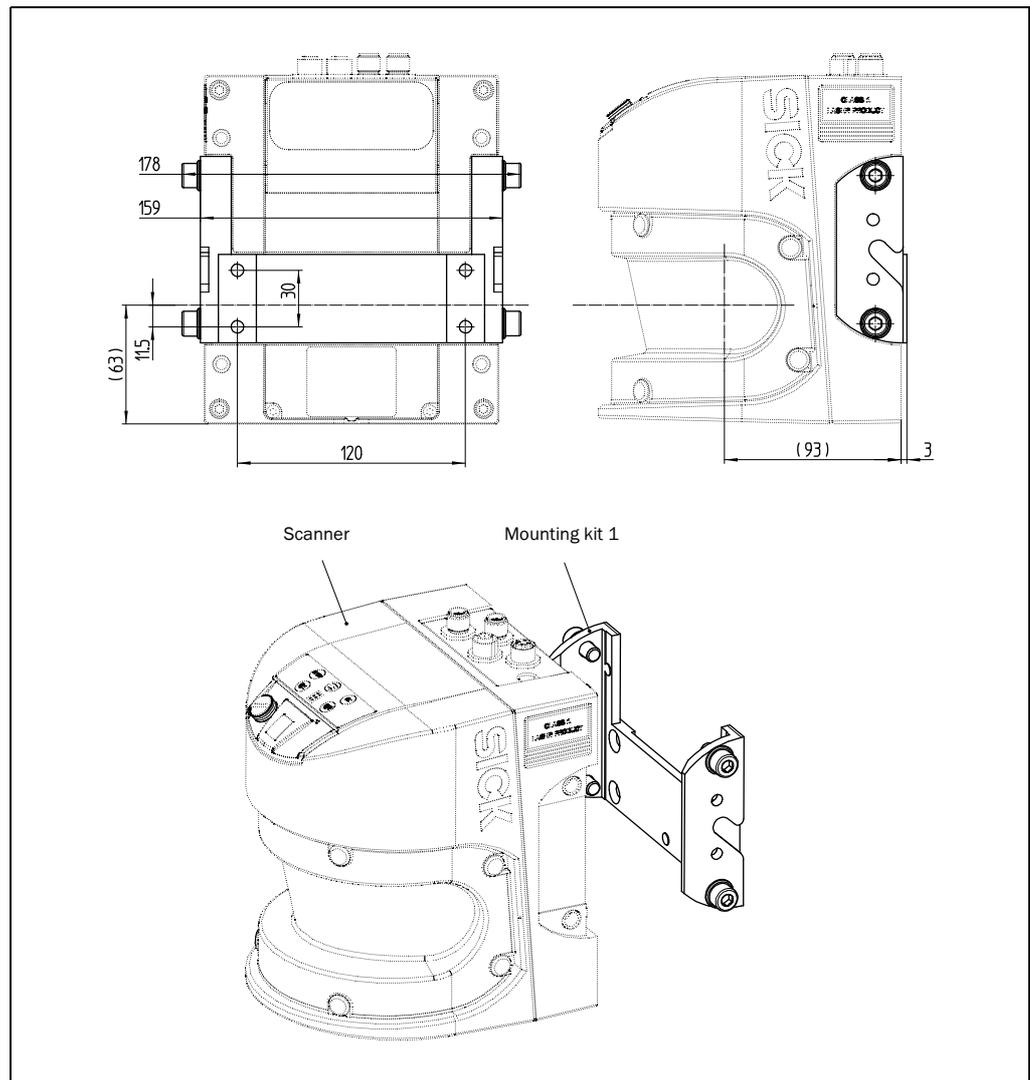


Fig. 49: Dimensional drawing, mounting kit 1

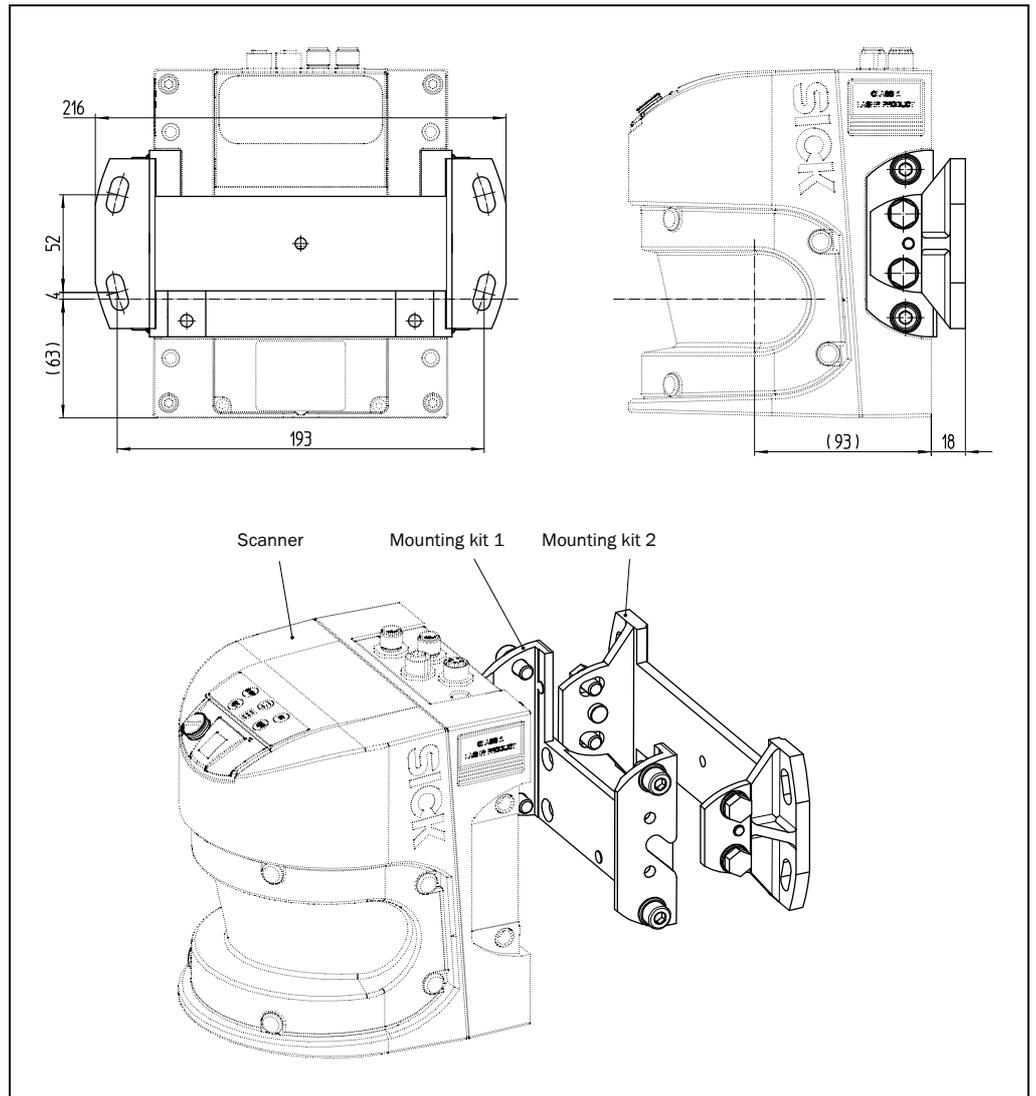


Fig. 50: Dimensional drawing, mounting kit 2

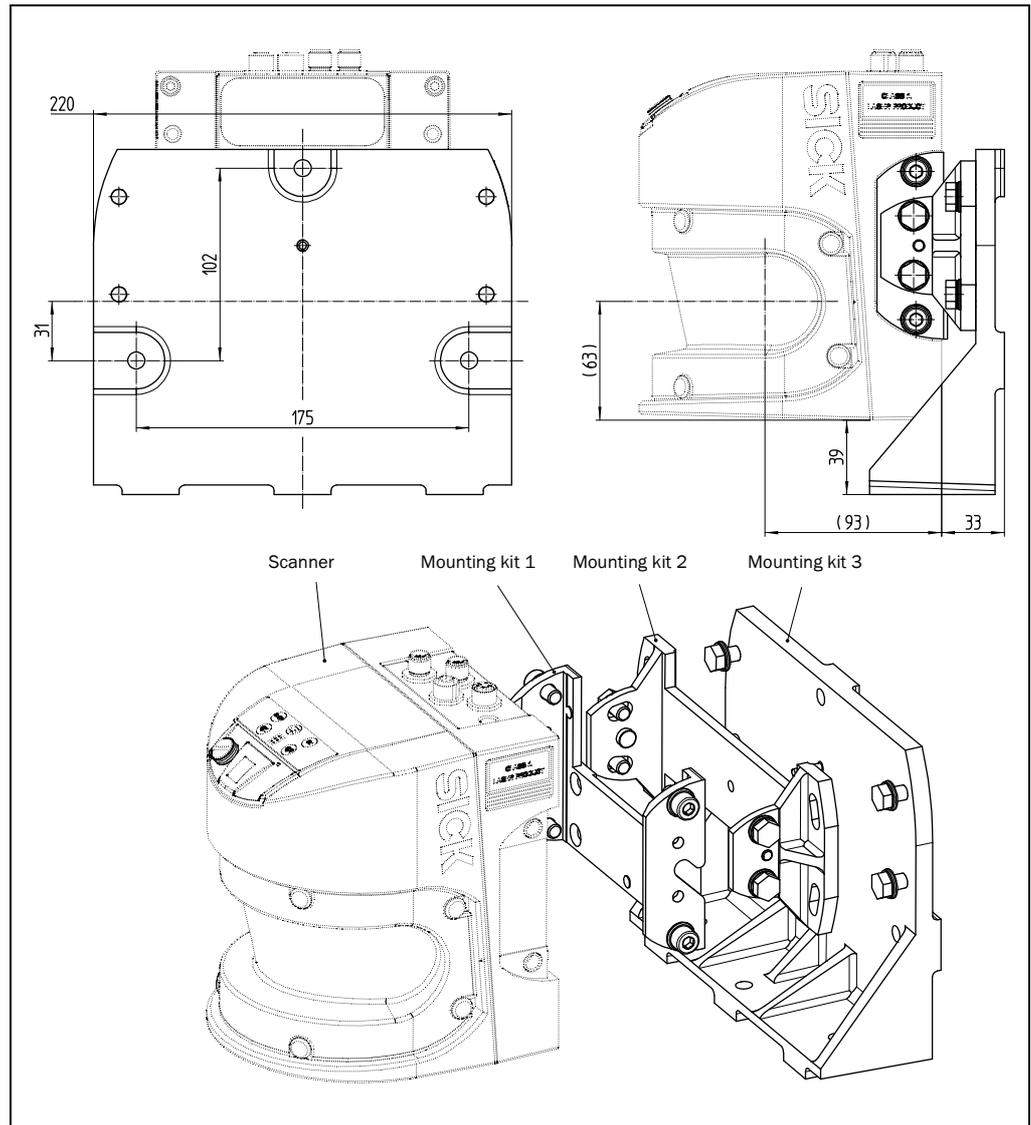


Fig. 51: Dimensional drawing, mounting kit 3

9.2.4 Dimensional drawings, weather protection hoods

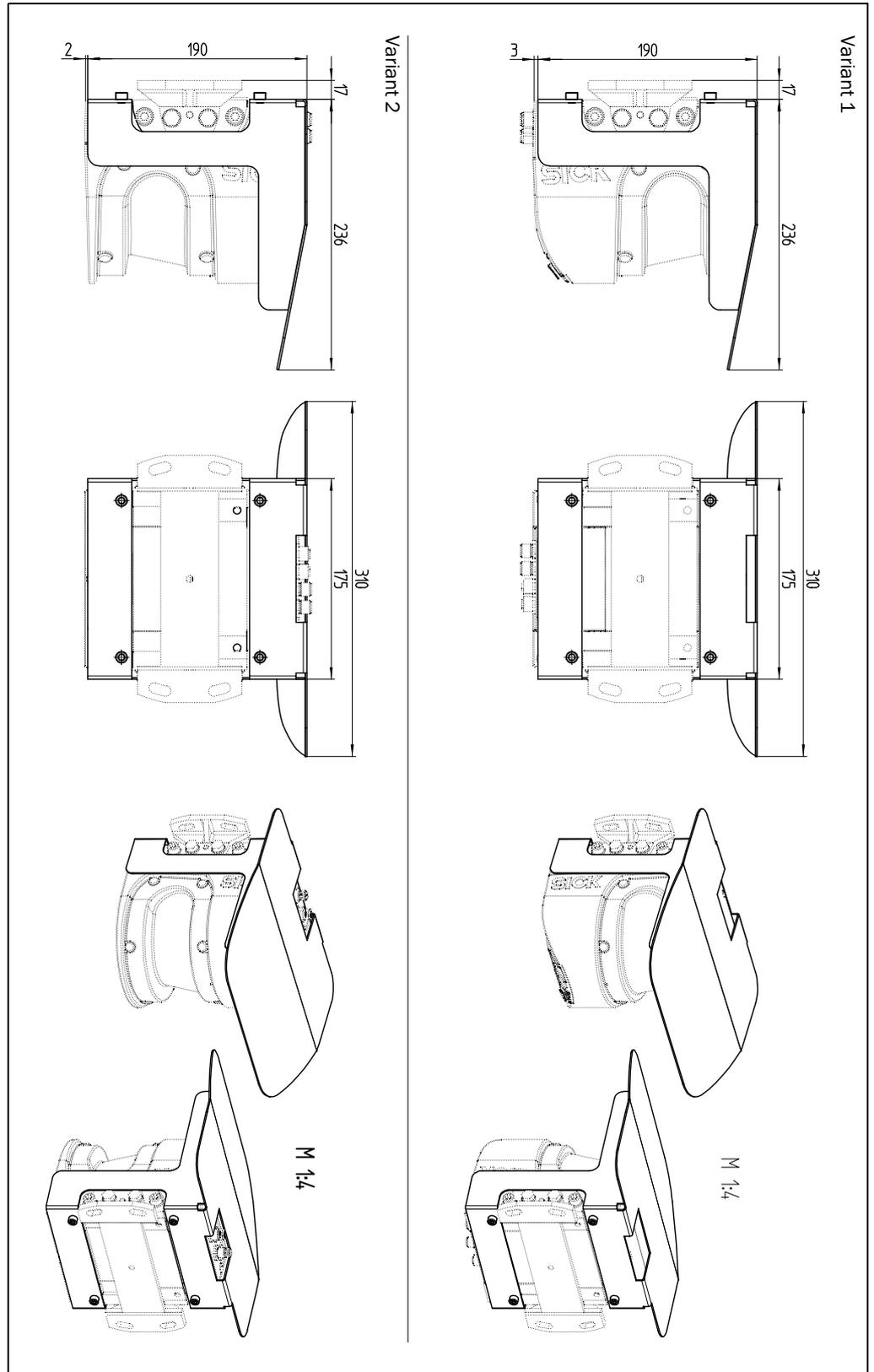


Fig. 52: Dimensional drawing weather protection hoods

10 Annex

10.1 Overview of the annexes

The annex contains the following supplementary information:

- message descriptions
- ordering information
- glossary
- illustration containing the EU Declaration of Conformity

10.2 Messages

Notation

The individual message sections are each to be separated by a space (ASCII code 32, 20h).¹⁾ The LMS interprets the parameters transferred as follows:

- Parameters with a leading “+” or “-” are interpreted as a decimal value (ASCII notation).
- Parameters without a leading “+” or “-” are interpreted as a hexadecimal value (ASCII notation).
- The LMS interprets each parameter individually, i.e. the different notations can be mixed within a message.
- All examples used in the following message lists refer to the CoLa-A protocol.

Variable types

The variable types are given in the message syntax. The following variable types are possible:

Variable type	Length (byte)	Value range	Sign
bool_1	1	0 or 1	No
uint_8	1	0 ... 255	No
int_8	1	-128 ... +127	Yes
uint_16	2	0 ... 65,535	No
int_16	2	-32,768 ... +32,767	Yes
uint_32	4	0 ... 4,294,967,295	No
int_32	4	-2,147,483,648 ... +2,147,483,647	Yes
float_32	4	$\pm \sim 10^{-44.85} \dots +10^{38.53}$	Yes
string	Context-dependent	Important: strings are not terminated in zeroes	

Tab. 21: Variable types

- Important**
- The information in the “Length” column of the table refers to the binary transfer of the numeric parameters.
 - The information in the “Value range” column in the table refers to the value range mathematically possible for the variable type. The actual value ranges for the parameters may be different. You will find these in the message syntax that follows.

1) In the examples “{SPC}” is used for “space”.

10.2.1 Start measurement

The LMS starts measuring.

Important The required user level is “Authorised client” (see [section 10.2.7 “Select user level/login” on page 87](#)).

Sequence:

- Login
- sMN LMCstartmeas
- Logout (see [10.2.12](#))

Request

Message structure: **sMN LMCstartmeas**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Start measurement	string	12	LMCstartmeas

Message syntax I: Request “Start measurement”

Answer

Message structure: **sAN LMCstartmeas ErrorCode**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Start measurement	string	12	LMCstartmeas
ErrorCode	The command has been accepted if the error code 0 is returned.	Enum8	1	0 no error 1 error, status change not permitted

Message syntax II: Answer to the “Start measurement” request

Example

Request: <STX>sMN{SPC}LMCstartmeas<ETX>

HEX string: 02 73 4D 4E 20 4C 4D 43 73 74 61 72 74 6D 65 61 73 03

Answer: <STX>sAN{SPC}LMCstartmeas{SPC}0<ETX>

HEX string: 02 73 41 4E 20 4C 4D 43 73 74 61 72 74 6D 65 61 73 20 30 03

10.2.2 Stop measurement

The LMS stops measuring.

Important The required user level is “Authorised client” (see [section 10.2.7 “Select user level/login” on page 87](#)).

Request

Message structure: **sMN LMCstopmeas**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Stop measurement	string	11	LMCstopmeas

Message syntax III: Request “Stop measurement”

Answer

Message structure: **sAN LMCstopmeas ErrorCode**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Acknowledgement of receipt (SOPAS answer)	string	3	sAN
Command	Stop measurement	string	11	LMCstopmeas
ErrorCode	The command has been accepted if the error code 0 is returned.	Enum8	1	0 no error 1 error, status change not permitted

Message syntax IV: Answer to the “Stop measurement” request

Example

Request: <STX>sMN{SPC}LMCstopmeas<ETX>

HEX string: 02 73 4D 4E 20 4C 4D 43 73 74 6F 70 6D 65 61 73 03

Answer: <STX>sAN{SPC}LMCstopmeas{SPC}0<ETX>

HEX string: 02 73 41 4E 20 4C 4D 43 73 74 6F 70 6D 65 61 73 20 30 03

10.2.3 Query status

Returns the status of the LMS.

Important Only when the status 7 = “Measurement” (see 10.2.4) is achieved can measured data be requested from the LMS.

Request

Message structure: **sRN STlms**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS read by name)	string	3	sRN
Command	Query status	string	5	STlms

Message syntax V: Request “Query status”

Answer

Message structure: **sRA STlms Status OperatingTemperatureRange Time Date [LED1 LED2 LED3]**

Message part	Description	Variable type	Length (byte)	Value range	
Type of command	Acknowledgement of receipt (SOPAS read answer)	string	3	sRA	
Command	Query status	string	5	STlms	
Status	Status of the LMS	Enum16	1	0 undefined 1 initialisation 2 configuration 3 idle 4 rotating 5 in preparation 6 ready 7 measurement 8 ... 11 reserved	
Operating temperature range	Indicates whether the operating temperature range is met or not	bool_1	1	0 yes 1 no	
Time	Flexible range, the string can contain 0 to 10 characters	string	0 ... 10	
Date	Flexible range, the string can contain 0 to 10 characters	string	0 ... 10	
LEDS	LED1	Currently without function, values always 0	uint_32	4	0 reserved
	LED2		uint_32	4	0 reserved
	LED3		uint_32	4	0 reserved

Message syntax VI: Answer to the “Query status” request

Example

Request: <STX>sRN{SPC}STlms<ETX>
 Answer: <STX>sRA {SPC}STlms{SPC}7{SPC}0{SPC}8{SPC}00:00:00{SPC}8{SPC}01.01.06{SPC}0{SPC}0{SPC}0<ETX>

10.2.4 Read scan data

The measured value output is started using this message. It is a prerequisite for this action that the LMS is in the “Measurement” status. For this purpose the measurement mode must be started, there are two ways you can undertake this action:

- start via SOPAS ET
PROJECT TREE, LMS..., PARAMETER, BASIC PARAMETERS, area MEASUREMENT.
- start via message (see [section 10.2.1 “Start measurement” on page 77](#))



Single or continuous measured value output

There are two ways of requesting measured value output (see [section 3.7.3 “Measured value output” on page 27](#)):

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

Request method 1: single measured value output

Message structure: **sRN LMDscandata**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS read by name)	string	3	sRN
Command	Data request	string	11	LMDscandata

Message syntax VII: Request “Read scan data”

Request method 2: continuous measured value output

Message structure: **sEN LMDscandata MeasurementStartStop**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS event by name)	string	3	sEN
Command	Data request	string	11	LMDscandata
MeasurementStartStop		Enum8	1	0 stop of the measured value output 1 start of the measured value output

Message syntax VIII: Request “Read scan data”

Message structure: **sRA/sSN LMDscandata** VersionNumber DeviceNumber SerialNumber DeviceStatus MessageCounter ScanCounter PowerUpDuration TransmissionDuration InputStatus OutputStatus ReservedByteA ScanningFrequency MeasurementFrequency NumberEncoders [EncoderPosition EncoderSpeed] NumberChannels16Bit [MeasuredDataContent ScalingFactor ScalingOffset StartingAngle AngularStepWidth NumberData [Data_1 Data_n]] NumberChannels8Bit [MeasuredDataContent ScalingFactor ScalingOffset StartingAngle AngularStepWidth [NumberData Data_1 Data_n] Position [XPosition YPosition ZPosition XRotation YRotation ZRotation RotationType] Name

[DeviceName] Comment [CommentContent] TimeInfo [Year Month Day Hour Minute Second Microseconds] EventInfo [EventType EncoderPosition EventTime AngularPosition]

Message part		Description	Variable type	Length (byte)	Value range
Type of command		Answer (SOPAS read answer/SOPAS send event)	string	3	sRA/sSN
Command		Data request	string	11	LMDscandata
VersionNumber		Version information for the measured data	uint_16	2	0000h ... FFFFh
Device information	DeviceNumber	Device ID as configured in SOPAS ET	uint_16	2	0000h ... FFFFh
	Serial number	Factory serial number	uint_32	4	00000000h ... FFFFFFFFh
	DeviceStatus	Status of the LMS	uint_x	2 × 1	00 00h Devices OK 00 01h Device error 00 02h Contamination warning 00 04h Contamination error
Status information	MessageCounter	Counter, starting at the first measured value message (cyclic data) after confirmation of the measured value message. When the upper limit is reached, the counter starts again at 0 (= 1st message).	uint_16	2	0000h 0 FFFFh 65,535
	ScanCounter	Counter, starting with the first scan after confirmation of the measured value message. When the upper limit is reached, the counter starts again at 0 (= 1. scan).	uint_16	2	0000h 0 FFFFh 65,535
	PowerUpDuration	Time since the LMS was switched on in µs	uint_32	4	00000000h 0 FFFFFFFFh 4,294,976,295 µs
	TransmissionDuration	Time since the transfer of the measured values in µs	uint_32	4	00000000h 0 FFFFFFFFh 4,294,976,295 µs
	InputStatus	The least significant byte reflects the state of the digital inputs by bit. The least significant bit corresponds to input 1.	uint_x	2 × 1	00 00h all inputs off 00 03h all inputs on
	OutputStatus	The least significant byte reflects the state of the digital outputs by bit. The least significant bit corresponds to output 1.	uint_x	2 × 1	00 00h all outputs off 00 07h all outputs on
	ReservedByteA	Reserved	uint_16	2	-
Measurement parameters	ScanningFrequency	Information 1/100 Hz	uint_32	4	2,500 25 Hz 3,500 35 Hz 5,000 50 Hz 7,500 75 Hz 10,000 100 Hz
	MeasurementFrequency	Frequency between two separate measurements in 100 Hz	uint_32	4	00000000h ... FFFFFFFFh

Message syntax IX: Answer to the "Read scan data" request

Message part		Description	Variable type	Length (byte)	Value range
NumberEncoders		Defines the number of encoders from which data are output	uint_16	2	0 ... 3 1 to 3 encoder
Encoder	EncoderPosition	Information in ticks	uint_32	4	00000000h ... FFFFFFFFh
	EncoderSpeed	Information in ticks/mm	uint_16	2	0000h ... FFFFh
NumberChannels16Bit		Defines the number of 16-bit output channels on which measured data are output. If "0 output channels" are selected, no data are output.	uint_16	2	1 ... 5 0 or 5 output channels
Output channel 1 ... 5 (16 bit)	MeasuredDataContent	The message part defines the contents of the output channel.	string	5	DIST1 Radial distance for the first reflected pulse DIST2 Radial distance for the second reflected pulse DIST3 Radial distance for the third reflected pulse DIST4 Radial distance for the fourth reflected pulse DIST5 Radial distance for the fifth reflected pulse
	ScalingFactor	Multiplier for the values in the message parts Data_1 to Data_n	Real	4	00000000h ... FFFFFFFFh
	ScalingOffset	For the LMS always 0	Real	4	00000000h ... FFFFFFFFh
	Starting angle	Information 1/10,000 degree	int_32	4	-50,000 ... +1,850,000
	Angular step width	Information 1/10,000 degree	uint_16	2	1,667 ... 10,000
	NumberData	Defines the number of items of measured data output	uint_16	2	0 ... 1,141
	Data_1 Data_n	Output of the measured values 1 to n. The contents and the unit depend on the message part "MeasuredDataContent". DIST in mm	uint_16 uint_16	2 2	0000h ... FFFFh 0000h ... FFFFh

Message syntax IX: Answer to the "Read scan data" request

Message part	Description	Variable type	Length (byte)	Value range	
NumberChannels8Bit	Defines the number of 8-bit output channels on which measured data are output. If "0 output channels" are selected, no data are output.	uint_16	2	1 ... 5 1 or 5 output channels	
Position	Defines whether position data are output	uint_16	2	0 no position data 1 Output of position data	
Position information	XPosition	X coordinate for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	YPosition	Y coordinate for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	ZPosition	Z coordinate for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	XRotation	X angle of rotation for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	YRotation	Y angle of rotation for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	ZRotation	Z angle of rotation for the LMS in a coordinate system	Real	4	00000000h ... FFFFFFFFh
	RotationType	Rotation type	Enum8	1	0 none 1 Pitching 2 Rolling 3 free rotation
Name	Determines whether the device name is to be output	uint_16	2	0 no device name 1 Output of the device name	
DeviceName	Flexible range from 0 to 16 characters (20h ... FFh)	string	0 ... 16	
Comment	Defines whether a comment is output	uint_16	2	0 no comment 1 Output of the comment	
CommentContent	Entered comment	string	0 ... 128	
TimeInfo	Defines whether time information is output	uint_16	2	0 no time output 1 Output of the time information	
TimeInformation	Year	Year	uint_16	2	0000h ... 270Fh
	Month	Month from 1 to 12	uint_8	1	00h ... 0Ch
	Day	Day of the month from 1 to 31	uint_8	1	00h ... 1Fh
	Hour	Hour from 0 to 23	uint_8	1	00h ... 17h
	Minute	Minute from 0 to 59	uint_8	1	00h ... 3Bh
	Second	Second from 0 to 59	uint_8	1	00h ... 3Bh
	Micro seconds	Micro seconds from 0 to 999,999	uint_32	4	00000000h ... 000F423Fh

Message syntax IX: Answer to the "Read scan data" request

Message part		Description	Variable type	Length (byte)	Value range
EventInfo		Defines whether event information is output	uint_16	2	0 no event information 1 Output of the event information
Event information	Event type	Fast digital input event	string	4	FDIN
	Encoder position	Encoder position at the time of the event, information in ticks	uint_32	4	00000000h ... FFFFFFFFh
	EventTime	Time since the LMS was switched on in μ s	uint_32	4	00000000h 0 FFFFFFFh 4,294,967,295 μs
	Angular position	Angular position of the LMS at the time of the event, information in 1/10,000 Grad	int_32	4	0 ... 3,600,000

Message syntax IX: Answer to the "Read scan data" request

10.2.5 Read scanning frequency, angular resolution and scan area

Reads the scanning frequency, the angular resolution and the starting/stopping angle from the LMS.

Request

Message structure: **sRN LMPscancfg**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS read by name)	string	3	sRN
Command	Reading of scanning frequency and angular resolution	string	10	LMPscancfg

Message syntax X: Request "Read scanning frequency, angular resolution and scan area"

Answer

Message structure: **sRA LMPscancfg ScanningFrequency NumberSegments AngularResolution StartingAngle StoppingAngle**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS read answer)	string	3	sRA
Command	Configuration of scanning frequency and angular resolution	string	10	LMPscancfg
ScanningFrequency	Information 1/100 Hz	uint_32	4	2,500 25 Hz 3,500 35 Hz 5,000 50 Hz 7,500 75 Hz 10,000 100 Hz
NumberSegments	For the LMS500 always 1	uint_16	2	1 1 segment
AngleResolution	Information 1/10,000 degree	uint_32	4	1,667 0.1667° 2,500 0.25° 3,333 0.3333° 5,000 0.5° 6,667 0.6667° 7,500 0.75° 10,000 1.0°
Starting angle	Information 1/10,000 degree	int_32	4	-50,000 ... +1,850,000
StoppingAngle	Information 1/10,000 degree	int_32	4	-50,000 ... +1,850,000

Message syntax XI: Answer to the "Read scanning frequency, angular resolution and scan area" request

Example

Request: <STX>sRN {SPC}LMPscancfg<ETX>

HEX string: 02 73 52 4E 20 4C 4D 50 73 63 61 6E 63 66 67 03

Answer: <STX>sRA {SPC}LMPscancfg{SPC}0{SPC}9C4{SPC}1{SPC}9C4{SPC}FFFF3CB0{SPC}1C3A90<ETX>

HEX string: 02 73 52 41 20 4C 4D 50 73 63 61 6E 63 66 67 20 31 33 38 38 20 31 20 31 33 38 38 20 46 46 46 46 33 43 42 30 20 31 43 33 41 39 30

10.2.6 Read contamination level

Returns the contamination level of the LMS.

Note The level depends on the chosen strategy.

Request

Message structure: **sRN LCMstate**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS read by name)	string	3	sRN
Command	Read contamination level	string	8	LCMstate

Message syntax XII: Request "Read contamination level"

Answer

Message structure: **sRA LCMstate Contamination level**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Acknowledgement of receipt (SOPAS read answer)	string	3	sRA
Command	Read contamination level	string	8	LCMstate
Contamination level	Determines the level of contamination	Enum8	1	0 no contamination 1 contamination warning 2 contamination error 3 serious contamination error

Message syntax XIII: Answer to the "Read contamination level" request

Example

Request: <STX>sRN{SPC}LCMstate<ETX>

HEX string: 02 73 52 4E 20 4C 43 4D 73 74 61 74 65 20 03

Answer: <STX>sRA{SPC}LCMstate{SPC}0<ETX>

HEX string: 02 73 52 41 20 4C 43 4D 73 74 61 74 65 20 30 03

10.2.7 Select user level/login

By means of the selection of a user level and transfer of the corresponding password, permits configuration of the LMS via messages. The LMS expects the password in the message in coded form (hash value).

User level	Password	Hash value
Maintenance personnel	main	B21ACE26h
Authorised client	client	F4724744h

Tab. 22: Hash values of the passwords

Note Measurement values will not be provided until the user logs out (see [section 10.2.12 “Start the device/logout” on page 94](#)).

Request

Message structure: **sMN SetAccessMode** User level password

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Select user level	string	12	SetAccessMode
User level	A valid user level must be included in the transmission. Otherwise the LMS declines the command.	int_8	1	02h maintenance personnel 03h authorised client 04h service
Password	E.g. encoded value for “client”	uint_32	4	0000000h ... FFFFFFFh

Message syntax XIV: Request “Select user level”

Answer

Message structure: **sAN SetAccessMode** ChangeUserLevel

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Select user level	string	12	SetAccessMode
ChangeUserLevel	A new user level is opened.	bool_1	1	00h error 01h user level change successful

Message syntax XV: Answer to the “Select user level” request

Example

Request: <STX>sMN{SPC}SetAccessMode{SPC}03{SPC}F4724744<ETX>

HEX string: 02 73 4D 4E 20 53 65 74 41 63 63 65 73 73 4D 6F 64 65 20 30 33 20 46 34 37 32 34 37 34 34 03

Answer: <STX>sAN{SPC}SetAccessMode{SPC}<ETX>

HEX string: 02 73 41 4E 20 53 65 74 41 63 63 65 73 73 4D 6F 64 65 20 31 03

10.2.8 Configure scanning frequency, angular resolution and scan area

Configures the LMS by means of the exact definition of scanning frequency, angular resolution and starting/stopping angle. The LMS calculates the technically possible values based on these parameters and supplies the parameters actually used in the response as result.

Important The required user level is “Authorised client” (see [section 10.2.7 “Select user level/login” on page 87](#)).

Request

Message structure: **sMN mLMPsetscafcfg** ScanningFrequency NumberSegments
AngularResolution StartingAngle StoppingAngle

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Configuration of scanning frequency and angular resolution	string	14	mLMPsetscafcfg
ScanningFrequency	Information in 1/100 Hz, the transmitted value can be 25 Hz or 50 Hz.	uint_32	4	2,500 25 Hz 3,500 35 Hz 5,000 50 Hz 7,500 75 Hz 10,000 100 Hz
NumberSegments	For the LMS500 always 1	uint_16	2	1 1 segment
AngleResolution	Information in 1/10.000 degrees, the transmitted value can be 0.25° or 0.5°	uint_32	4	1,667 0.1667° 2,500 0.25° 3,333 0.3333° 5,000 0.5° 6,667 0.6667° 7,500 0.75° 10,000 1.0°
Starting angle	Not currently possible, in future information in 1/10,000 degree	int_32	4	-50,000 ... +1,850,000
StoppingAngle	Not currently possible, in future information in 1/10,000 degree	int_32	4	-50,000 ... +1,850,000

Message syntax XVI: Request “Configure scanning frequency, angular resolution and scan area”

Answer

Message structure: **sAN mLMPsetscancfg** ErrorCode ScanFrequency NumberSegments AngularResolution StartingAngle StoppingAngle

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Configuration of scanning frequency and angular resolution	string	14	mLMPsetscancfg
Error code	The command has been accepted if the error code 0 is returned.	Enum8	1	0 no error 1 invalid frequency 2 invalid angular resolution 3 invalid frequency and angular resolution 4 invalid scan area 5 other error
ScanningFrequency	Information 1/100 Hz	uint_32	4	09C4 25 Hz 0DAC 35 Hz 1388 50 Hz 1D4C 75 Hz 2710 100 Hz
NumberSegments	For the LMS500 always 1	uint_16	2	1 1 segment
AngleResolution	Information 1/10,000 degree	uint_32	4	0683 0.1667° 09C4 0.25° 0D05 0.3333° 1388 0.5° 1A0B 0.6667° 1D4C 0.75° 2710 1.0°
Starting angle	Information 1/10,000 degree	int_32	4	FFFF3CB0 ... 1C3A90
StoppingAngle	Information 1/10,000 degree	int_32	4	FFFF3CB0 ... 1C3A90

Message syntax XVII: Answer to the “Configure scanning frequency, angular resolution and scan area” request

The frequencies and angular resolutions are pre-defined:

25 Hz	25 Hz	35 Hz	35 Hz	50 Hz	50 Hz	75 Hz	75 Hz	100 Hz	100 Hz
0.1667°	0.25°	0.25°	0.5°	0.333°	0.5°	0.5°	1.0°	0.667°	1.0°

Example

Request: <STX>sMN{SPC}mLMPsetscancfg{SPC}+2500{SPC}+1{SPC}+2500{SPC}-50000{SPC}+1850000<ETX>

HEX string: 02 73 4D 4E 20 6D 4C 4D 50 73 65 74 73 63 61 6E 63 66 67 20 2B 35 30 30 30 20 2B 31 20 2B 35 30 30 30 20 2D 34 35 30 30 30 30 20 2B 32 32 35 30 30 30 03

Answer: <STX>sAN{SPC}mLMPsetscancfg{SPC}0{SPC}9C4{SPC}1{SPC}9C4{SPC}FFFF3CB0{SPC}1C3A90<ETX>

HEX string: 02 73 41 4E 20 6D 4C 4D 50 73 65 74 73 63 61 6E 63 66 67 20 30 20 31 33 38 38 20 31 20 31 33 38 38 20 46 46 46 46 33 43 42 30 20 31 43 33 41 39 30

Important The data are not stored in non-volatile memory after a message has been sent. Therefore you must save the data in non-volatile memory in the EEPROM on the LMS using a message (see [10.2.11 on page 93](#)) or send the message to the LMS again after switch on.

10.2.9 Configure scan data output

Defines which data are output with the message [section 10.2.4 “Read scan data” on page 80](#).

Important The required user level is “Authorised client” (see [section 10.2.7 “Select user level/login” on page 87](#)).

Request

Message structure: **sWN LMDscandatacfg** OutputChannel Remission Resolution
Unit Encoder Position Devicename Comment Time
OutputInterval

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS write by name)	string	3	sWN
Command	Configure scan data output	string	14	LMDscandatacfg
Reserved		uint_16	2	00h
Reserved		bool_1	1	00h
Resolution	Defines whether the remission values are output with 8-bit or 16-bit resolution	Enum8	1	0 8 Bit 1 16 Bit
Unit	Defines the unit in which the remission values are output	Enum8	1	0 digits
Encoder	The measured data message has several output channels for encoder data. The message part defines which output channel is activated.	uint_16	2	00h no encoder data 01h encoder channel 1 02h reserved ... FFh reserved
Position	Defines whether position values are output	bool_1	1	00h no 01h yes
DeviceName	Determines whether the device name is to be output	bool_1	1	00h no 01h yes
Comment	Defines whether a comment saved in the configuration is output	bool_1	1	00h no 01h yes
Time	Defines whether time information is output	bool_1	1	00h no 01h yes
Output interval	Defines which scan is output	uint_16	2	01 every scan 02 every 2nd scan ... 50,000 every 50,000th scan

Message syntax XVIII: Request “Configure scan data output”

Answer

Message structure: **sWA LMDscandatacfg**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS write answer)	string	3	sWA
Command	Configure scan data output	string	14	LMDscandatacfg

Message syntax XIX: Answer to the “Configure scan data output” request

Example 1

Output channel 1 active, each measured data message:

Request: <STX>sWN{SPC}LMDscandatacfg{SPC}01{SPC}00{SPC}0{SPC}1{SPC}0{SPC}00{SPC}00{SPC}0{SPC}0{SPC}0{SPC}0{SPC}0{SPC}+1<ETX>
 HEX string: 02 73 57 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 63 66 67 20 30 31 20 30 30 20 30 20 31 20 30 20 30 30 20 30 30 20 30 20 30 20 30 20 30 20 2B 31 03
 Answer: <STX>sWA{SPC}LMDscandatacfg<ETX>
 HEX string: 02 73 57 41 20 4C 4D 44 73 63 61 6E 64 61 74 61 63 66 67 03

Example 2

Output channel 2 active, encoder channel 1 active, each 10th measured data message:

Request: <STX>sWN{SPC}LMDscandatacfg{SPC}02{SPC}00{SPC}0{SPC}1{SPC}0{SPC}01{SPC}00{SPC}0{SPC}0{SPC}0{SPC}0{SPC}0{SPC}0{SPC}+10<ETX>
 HEX string: 02 73 57 4E 20 4C 4D 44 73 63 61 6E 64 61 74 61 63 66 67 20 30 32 20 30 30 20 30 20 31 20 30 20 30 31 20 30 30 20 30 20 30 20 30 20 30 20 30 20 2B 31 30 03
 Answer: <STX>sWA{SPC}LMDscandatacfg<ETX>
 HEX string: 02 73 57 41 20 4C 4D 44 73 63 61 6E 64 61 74 61 63 66 67 03

Request

Message structure: **sWN FREchoFilter**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS write by name)	string	3	sWN
Command	Configure echo filter	string	12	FREchoFilter
Echo filter		Enum8	1	0 First echo 1 All echoes 2 Last echo (default)

Message syntax XX: Request "Configure echo filter"

10.2.10 Set LMS output

The message sets the outputs on the LMS, if the output is configured to SOPAS command in SOPAS ET.



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

Important If the status of several outputs is to be set, then the message must be sent separately for each output.

Request

Message structure: **sMN mDOSetOutput** Status output

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Set output	string	12	mDOSetOutput
Output	Output number	uint_8	1	0 output 1 1 output 2 2 output 3 3 output 4 4 output 5 5 output 6
Status	State of the output	uint_8	1	0 inactive 1 active

Message syntax XXI: Request "Set LMS output"

Answer

Message structure: **sAN mDOSetOutput** ErrorCode

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Set output	string	12	mDOSetOutput
ErrorCode	The command has been accepted if the error code 1 is returned.	bool_1	1	0 error 1 no error

Message syntax XXII: Answer to the "Set LMS output" request

Example

Request: <STX>sMN{SPC}mDOSetOutput{SPC}0{SPC}1<ETX>

Answer: <STX>sAN{SPC}mDOSetOutput{SPC}1<ETX>

10.2.11 Save data permanently

Via the message, the parameters are saved in the EEPROM of the system configuration plug and will also be available after the device is switched off and on again.

Important The required user level is “Authorised client” (see [section 10.2.7 “Select user level/login” on page 87](#)).

Request

Message structure: **sMN mEEwriteall**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Save data permanently	string	11	mEEwriteall

Message syntax XXIII: Request “Save data permanently”

Answer

Message structure: **sAN mEEwriteall ErrorCode**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Save data permanently	string	11	mEEwriteall
ErrorCode	The command has been accepted if the error code 1 is returned.	bool_1	1	0 error 1 no error

Message syntax XXIV: Answer to the “Save data permanently” request

Example

Request: <STX>sMN {SPC}mEEwriteall<ETX>

HEX string: 02 73 4D 4E 20 6D 45 45 77 72 69 74 65 61 6C 6C 03

Answer: <STX>sAN {SPC}mEEwriteall {SPC}1<ETX>

HEX string: 02 73 41 4E 20 6D 45 45 77 72 69 74 65 61 6C 6C 20 31 03

10.2.12 Start the device/logout

The device is returned to the measurement mode after configuration.

Request

Message structure: **sMN Run**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Request (SOPAS method by name)	string	3	sMN
Command	Start the device	string	3	Run

Message syntax XXV: Request "Start device"

Answer

Message structure: **sAN Run ErrorCode**

Message part	Description	Variable type	Length (byte)	Value range
Type of command	Answer (SOPAS answer)	string	3	sAN
Command	Start the device	string	3	Run
ErrorCode	The command has been accepted if the error code 0 is returned.	Bool	1	0 error 1 no error

Message syntax XXVI: Answer to the "Start device" request

Example

Request: <STX>sMN{SPC}Run<ETX>

Answer: <STX>sAN{SPC}Run{SPC}0<ETX>

10.3 Ordering information

Ordering information about the product and the accessories can be found in the product information LMS500/511 (No. 8013797) which is included on the provided CD-ROM "Manuals & Software Auto Ident" (No. 2039442).

10.3.1 Consumables

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

Tab. 23: Consumables

10.4 Glossary

Download

Transmission of the parameter set that has been modified offline in the SOPAS ET configuration software from the PC to the LMS. SOPAS ET transmits either always a complete copy to the memory (RAM) of the LMS (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 LMS.

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 LMS are initialised and activated. Is transmitted from the LMS 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 LMS in dialog mode.

Upload

Transmission of the parameter set from the LMS 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.

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