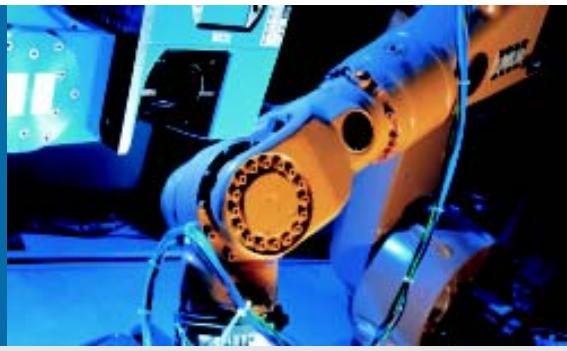
TECHNICAL DESCRIPTION

LMS200/211/221/291
Laser Measurement Systems



Measurably more cost-effective

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Software Version

Device type	Function	Version
LMS200	Firmware for indoor applications (standard)	V 2.30 Q501
LMS211/ LMS221/ LMS291	Firmware for outdoor applications (standard)	X 1.27 Q501
LMS211-/221-Sxx	Firmware for outdoor applications (special software)	depends on type
LMS291-Sxx	Firmware for outdoor applications (special software)	depends on type
LMSIBS	Configuration software (Windows based)	V 5.20 Q393

Function of this document

This document introduces the LMS200/221/221/291 Laser Measurement Systems and describes their range of applications and variety of features. The document supports the application planning, mounting and electrical installation of these systems.
The description applies to the standard and the special device types of the system.

Target group

Planning personnel such as technicians, engineers and design engineers.

Supplementary documentation

The *LMSIBS Configuration Software Operating Instructions* (no. 8009116) and the *Supplement to the Operating Instructions* (no. 8010121) describe how to commission the system for the “area monitoring“ applications respectively for simple measurement tasks using the LMSIBS Configuration Software.

The *LMS2xx Telegram Listing* (no. 8007954) is available for applications which require customer-specific evaluation of the measurement data by an external driver (position/object measurement and other measurement applications).

The *Technical Description for the MST200 Measurement Software Tool* (no. 8008464, for PCs) describes how to develop external evaluation programs using the MST200 Software Tool.

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Latest Document Version

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Content

Used Abbreviations

Laser **L**ight **a**mplification by **s**timulated **e**mission of **r**adiation

LMS **L**aser **M**easurement **S**ystem

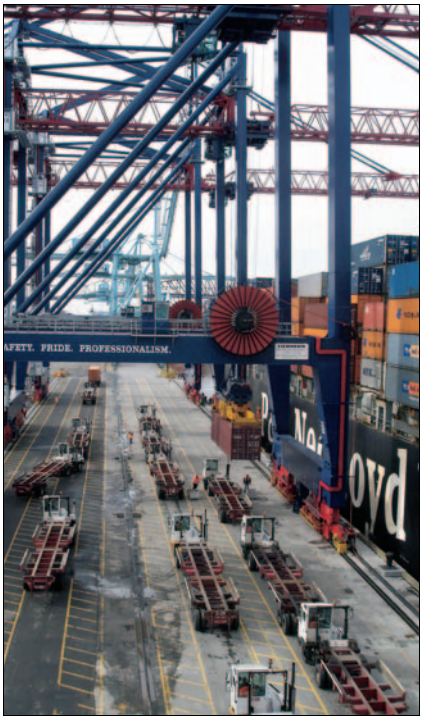
Radar **Ra**dio **d**etecting **a**nd **r**anging

PLC **P**rogrammable **L**ogic **C**ontroller

1 Range of Applications

1.1 LMS200/211/221/291 Laser Measurement Systems

- Determining the volumes or contours of bulk materials
- Determining the volumes of objects (measuring packages, pallets, containers)
- Determining the position of objetcs (pallets, containers, transport vessels)
- Collision prevention for vehicles or cranes
- Controlling docking processes (positioning)
- Classification of objects (vehicle detection, camera trigger)
- Process automation (e.g. calander rollers)
- Checking overhang/area monitoring in automated multi-storey car parks
- Monitoring open spaces for building security (facades, grounds, shafts)
- and many more



Positioning aid for container handling


Collision prevention for robots in automotive production


Monitoring open spaces for building security

Volume measurement of airport luggage


Navigation aid and collision prevention for container cranes


Classification of vehicles (toll collect)


Checking for projections during automated loading/unloading of air cargo containers

Abb. 1-1: Application ranges of the LMS200/221/221/291 Laser Measurement Systems

2 Product Features

The LMS200/221/221/291 Laser Measurement Systems are non-contact measurement systems (NCSDs) in stand-alone operation for industrial applications. The systems scan their surroundings two-dimensionally with a radial field of vision using infra-red laser beams (laser radar). The systems require either reflectors nor position marks.

The laser measurement systems are used for:

- Area monitoring
- Object measurement and detection
- Determining positions

Two field sets, each with a maximum of three monitoring fields, can be configured in the LMS200/221/221/291 for ***area monitoring*** applications. One field set is always active. Each monitored field is assigned a switching output (quiescent voltage typical 24 V DC). Special devices offer relay outputs. Measurement data output can take place parallel to area monitoring.

Standard solutions are available for ***object measurement***, e.g. measuring the volumes of packages and pallets; volume flow measurement for bulk materials, etc.

The measured data of the LMS200/221/221/291 can be individually processes in real-time with external evaluation software for ***determining positions*** and other measurement tasks.

Note From now on, the LMS200/221/221/291 Laser Measurement Systems will simply be referred to as the “LMS2xx“ (unless a distinction is required).

The LMS2xx Laser Measurement Systems are not devices for protecting persons as defined by current machine safety standards.

Maintenance and Cleaning

The LMS2xx requires no maintenance. Depending on its location, the front window should be cleaned occasionally with a damp cloth. Use a soft, lint-free and clean cloth with water. In addition, it is recommended that the state of the drying agent cartridge is also checked regularly in devices used outdoors (LMS211/221) and, if necessary, it should be replaced.

Display of errors

The LMS2xx writes device and functional errors in its error log. With the help of the error diagnosis the content can be read out and interpreted in the LMSIBS Configuration Software or in a telegram. The SICK service team (Phone +49 (0)211/5301-270) is available for handling more serious errors.

Errors caused by a contaminated front window are indicated by the LMS200/LMS291 via the built-in LEDs (warning or error, depending on the contamination level, see *Table 7-4, Page 21*). Otherwise all LMS2xx indicate an error via a pulsed signal at the “OUT C /Weak“ switching output. In addition, the special devices LMS211-/LMS221-S19/-S20 (area monitoring in security applications) offer the option of indicating a warning or error, depending on the level of front window contamination, via at the “OUT C /Weak“ switching output – by switching from a static signal, typically 24 V DC (high), to signal ground (low).

Note **Don’t open the LMS2xx! The producer warranty will be forfeited if the LMS2xx is opened.**

Features and Advantages

- Non-contact optical measurement, even over longer distances
- Rapid scanning times, thus measurement objects can be move at high speed
- No special target-object reflective properties necessary
- No reflectors and no marking of the measurement objects necessary
- Backgrounds and surroundings do not have any influence on the measurements
- Measurement objects may be in any position
- Measurement data is available in real-time and can be used for further processing or control tasks
- Active system – no illumination of the measurement area required
- Simple mounting and commissioning
- Completely wheaterproof variante (IP 67)

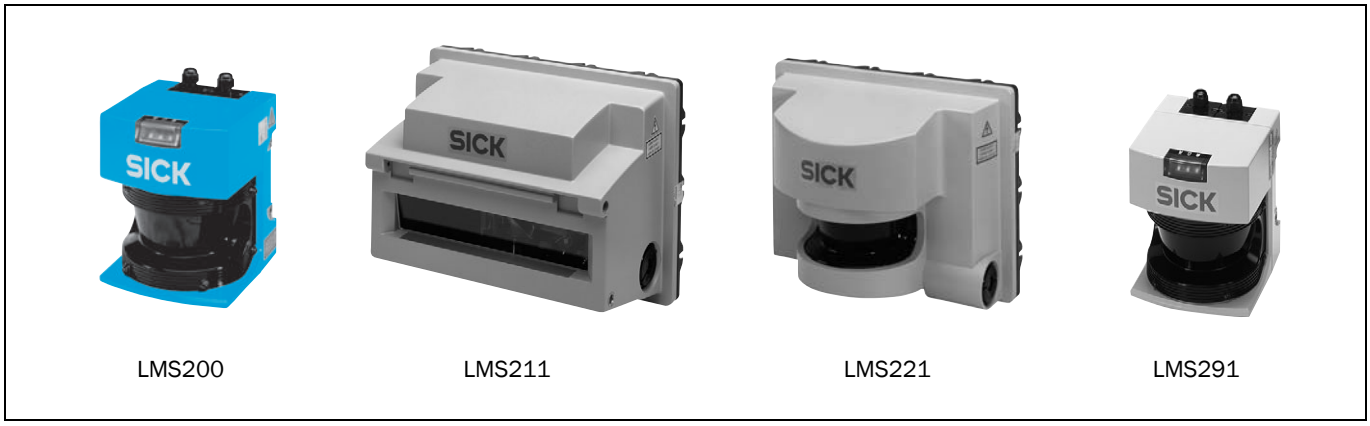


Fig. 2-1: Type overview: Housing designs of the LMS2xx

See also *Chapter 11 Variants/Functions, Page 27*.

Design of the LMS2xx

A standard laser measurement system consists of the following components:

- laser scanner
- evaluation electronics
- measurement and evaluation software (firmware with integrated area monitoring)
- data interface (RS 232/RS422, switchable)
- a digital switching input
- three digital switching outputs
  (special devices of the LMS211/221 series: two relay outputs/one switching output)
- three function indicators (LED), only for LMS200/LMS291

3 Operating Principle

The LMS2xx operates by measuring the time of flight of laser light pulses: a pulsed laser beam is emitted and reflected if it meets an object (*Fig. 3-1*). The reflection is registered by the LMS2xx's receiver. The time between transmission and reception of the impulse is directly proportional to the distance between the LMS2xx and the object (time of flight).

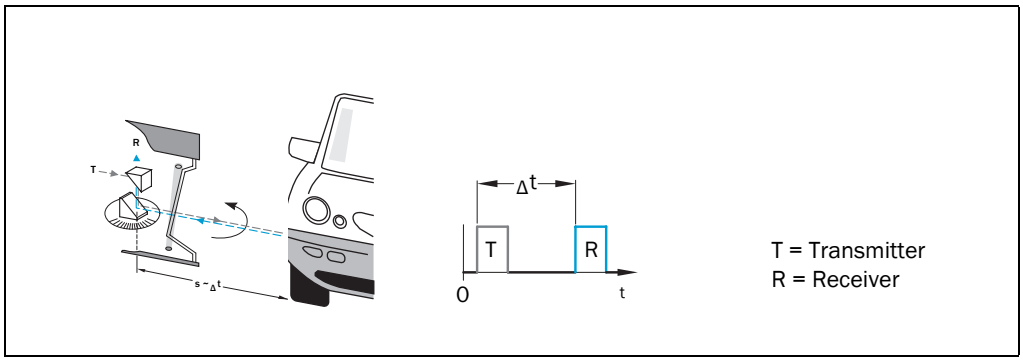


Fig. 3-1: Operating principle

The pulsed laser beam is deflected by an internal rotating mirror so that a fan-shaped scan is made of the surrounding area (laser radar). The contour of the target objects is determined from the sequence of impulses received. The measurement data is available in real-time for further evaluation via the data interface.

Automatic fog correction is active in certain LMS2xx for outdoor use (see also *Table 11-2, Page 27*). Raindrops and snow-flakes are cut out using pixel-oriented evaluation.

3.1 Spot Spacing/Spot Diameter/Range

In a radial field of vision, a light impulse (spot) is emitted every 0.25°, 0.5° or 1° (depending on the set variant). As a result of the beam geometry and the diameter of the individual spots, the spots overlap on the target object or up to a certain distance. *Fig. 3-2* shows spot spacing in relation to the range and the corresponding spot diameter.

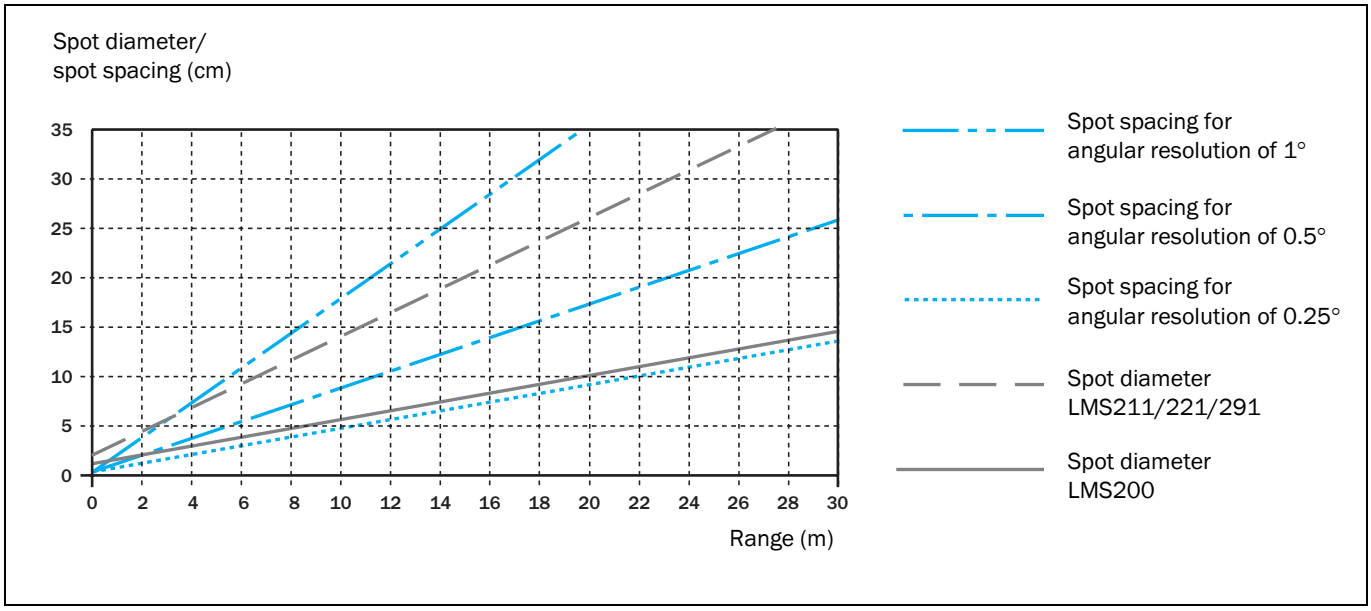


Fig. 3-2: Spot sizes/spot spacing

4 Conditions of use/Range

4.1 Mounting Position

The LMS2xx may be installed in any position. Take notice of the mounting instructions in *Chapter 6 Mounting, Page 13*.

4.2 Heater Operation (LMS211/LMS221)

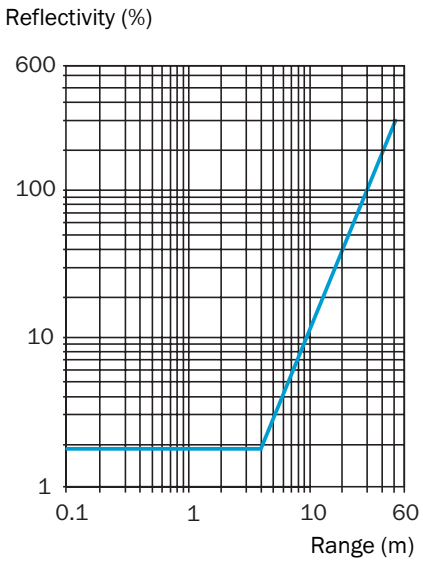
In order to be able to use the LMS211/LMS221 at temperature ranges below 0 °C, a thermostat-controlled heater has been installed in these devices and a supplementary front window heating in the LMS211. The connected heating automatically comes into operation at ≤ 10 °C order to prevent thawing within the housing. Before commissioning the LMS211/LMS221 (e.g. before starting work) the interior of the device must be heated to at least 0 °C and any ice on the front window must be melted. The LMS211/LMS221 takes about 120 minutes to warm up at an outdoor temperature of –30 °C.

4.3 Reflectivity of Various Objects

The range of the LMS2xx depends on the reflectivity of the target object and the transmission strength of the LMS2xx. Some reflectivity values for well-kown materials are listed in *Table 4-2* as an overview (KODAK standards).

LMS with standard range without fog correction	LMS with high range and fog correction
LMS200-30106	LMS211-30206
LMS211-30106	LMS211-S07/S14/S15/S19/S20
LMS221-30106	LMS221-30206
	LMS221-S07/S14/S15/S19/S20
	LMS291-S05/S14/S15

Table 4-1: Type overview: Range/fog correction



Material	Reflectivity
Cardboard, matt black	10 %
Cardboard, grey	20 %
Wood (raw pine, dirty)	40 %
PVC, grey	50 %
Paper, matt white	80 %
Aluminium, anodised, black	110 to 150 %
Steel, rust-free shiny	120 to 150 %
Steel, very shiny	140 to 200 %
Reflectors	>2,000 %

Table 4-2: Reflectivity values

Fig. 4-1: LMS200: Range in relation to object reflectivity

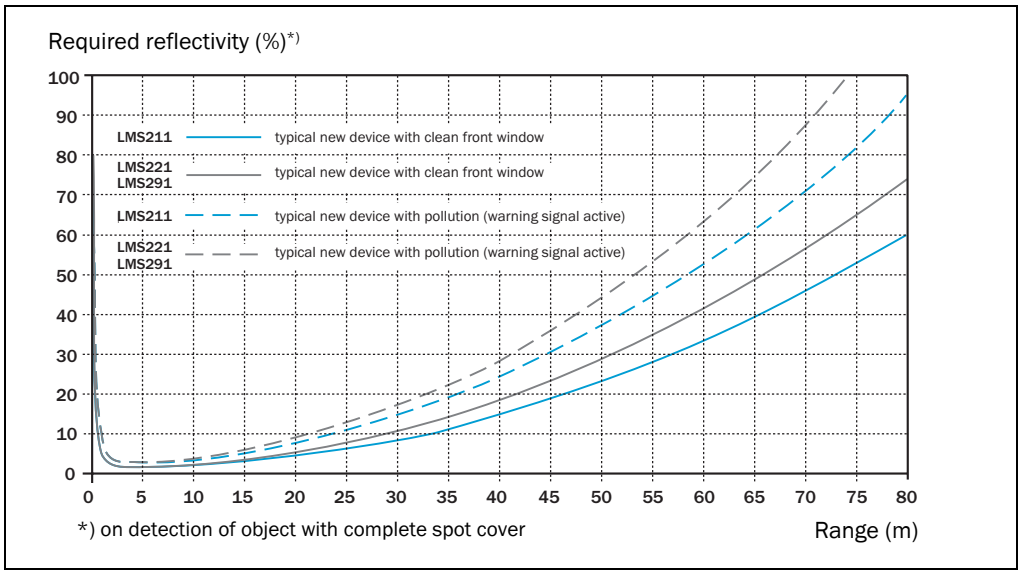


Fig. 4-2: LMS211/LMS221/LMS291: Relationship between reflectivity/range with good visibility

In exceptional cases, sensitivity of the outdoor variants can be changed with the LMSIBS Configuration Software provided:

- Values for standard setting (see *Fig. 4-2*): 30 m range/10 % reflectivity
- Values for less sensitive thresholds: 25 m range/10 % reflectivity
- Values for more sensitive thresholds: 30 m range/5 % reflectivity

Note Note the reflectivity graphes in the range of 0 to 1.5 m for LMS211/LMS221/LMS291.

Higher sensitivity improves detection capabilities for dark objects, but increases ambient light sensitivity.

Lower sensitivity reduces detection capabilities for dark objects, but reduces ambient light sensitivity.

4.4 Reflectivity in Fog (LMS211, LMS221, LMS291)

The range diagrams in *Fig. 4-3* to *Fig. 4-4* are valid should there be fog during outdoor operation and are to be observed.

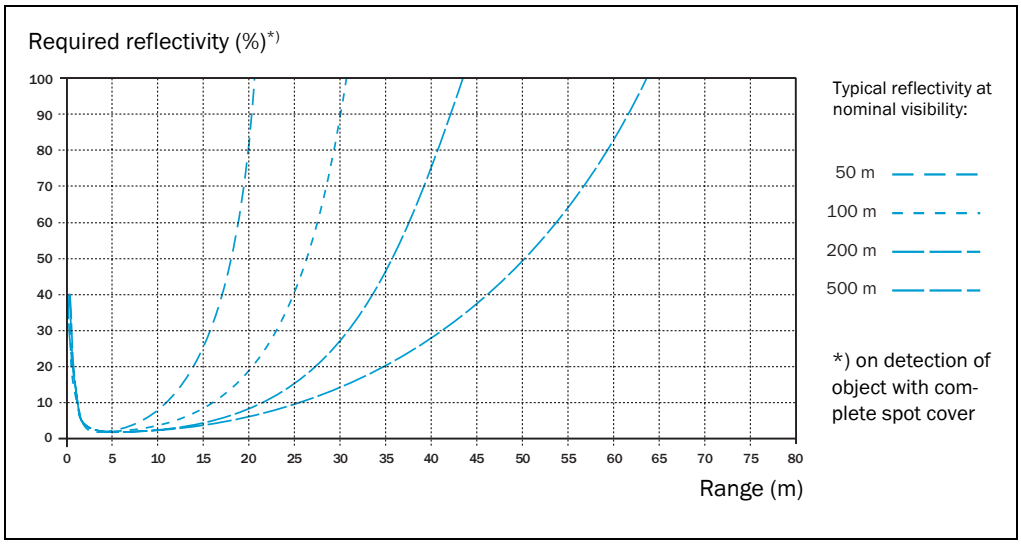


Fig. 4-3: LMS211: Relationship between reflectivity and range in fog

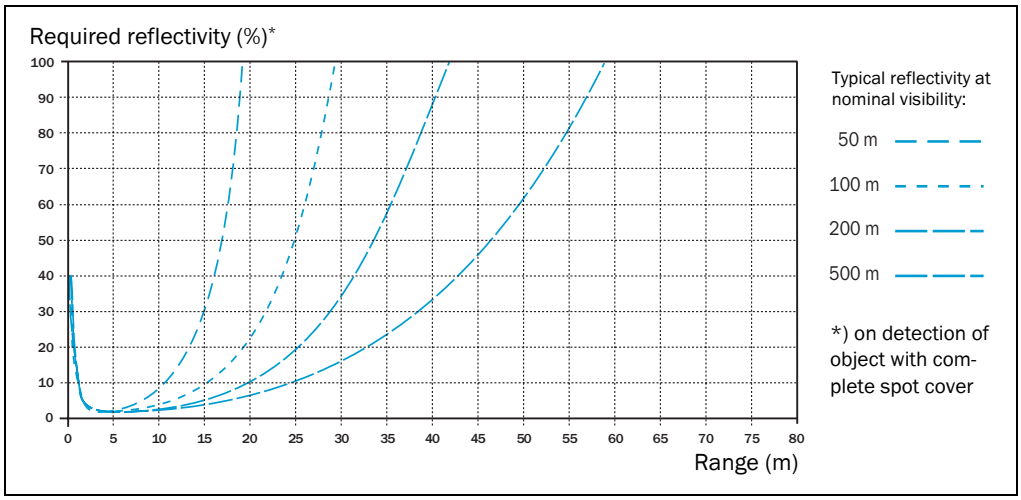


Fig. 4-4: LMS221/LMS291: Relationship between reflectivity and range in fog

4.5 The “Blanking“ Curve for Area Monitoring (LMS211/221)

The object suppression software setting is dependent on distance. An object can only be suppressed up to a certain distance. Futhermore, the LMS211/LMS221 indicates a field infringement independently of objects size.

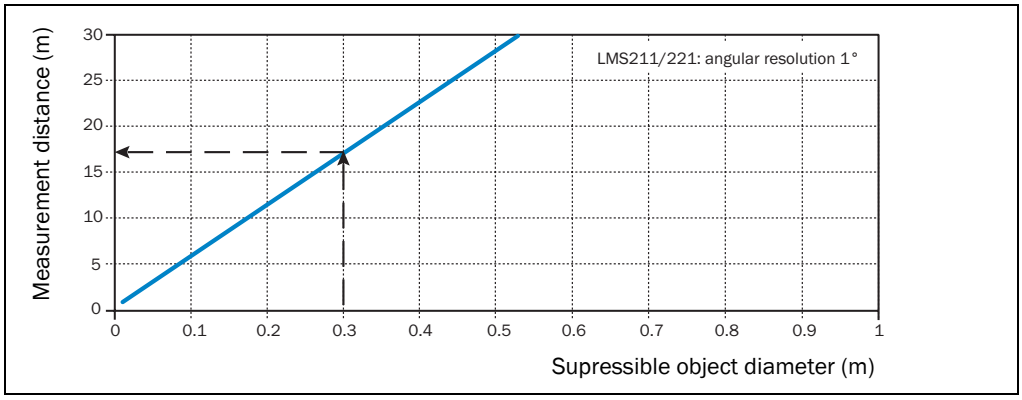


Fig. 4-5: Relationship between the usable range and the defined blanking diameter, e.g. max. 17 m with the blanking diameter of 0.3 m

4.6 The “Contour as Reference“ Curve for A. M. (LMS211/221)

The contour as reference software setting is dependent on distance. The LMS2xx requires a minimum contour as reference depending on the distance. Loss of the contour will not be indicated by the LMS211/LMS221 via the switching outputs if the contour is too small.

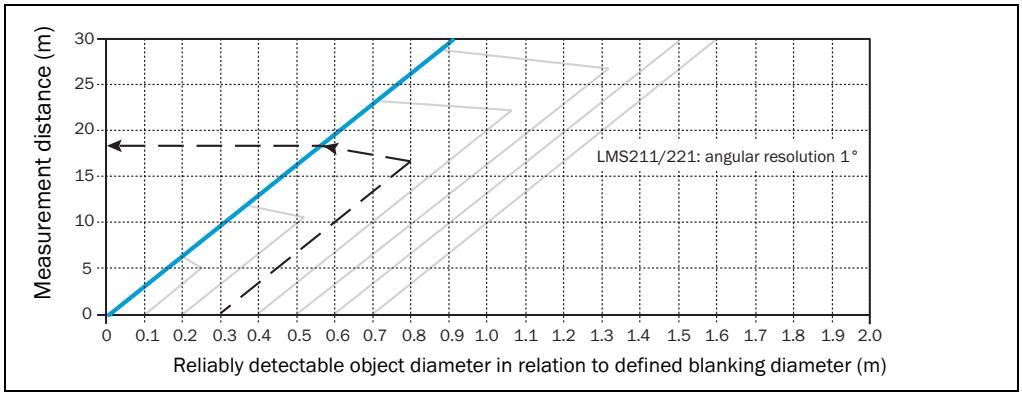


Fig. 4-6: Relationship between the usable range and reliably detected object diameter, e.g. the LMS211/LMS221 switches if it loses the contour in 17 m with a object diameter of 0.3 m

5 Areas of Use

For the LMS2xx, there are three areas of use:

- Object measurement
- Determining positions
- Area monitoring

5.1 Object Measurement/Determining Position

The LMS2xx measurement data (internally processed from the raw measurement data) is used for object measurement and determining position. These measurement data correspond to the surrrounding contour scanned by the LMS2xx and are output in binary format via the RS 232/RS 422 data interface.

The telegram listing required is supplied with the device (PDF file on CD-ROM).

The MST200 Measurement Software Tool provides further support for software connection to the LMS2xx (see *MST200 Technical Description* (no. 8008464)).

Processing Measurement Data

Processing measurement data allows individual adaptation to the system's particular measurement task.

Possible data preparation within the LMS2xx:

- Average value formation from 2 to 250 scans
- Limiting the sector which values are transferred (e.g. beams 10 to 30) for data reduction

Possible external data processing:

- Evaluation of partial sectors of the 100° or 180°- field of vision
- Averaging of the measurement values transferred (increasing accuracy and smoothness)
- Straight line and curve approximations by interpolation of measurement values
- Determination of position/volume of any object
- 3rd dimension provided by shaft decoder, etc. (length information/conveyor speed)

External evaluation (software) can take place at a PC or PLC. Fundamentally, the distance value per individual impulse (spot) is evaluated. This means that a distance value is provided every 0.25°, 0.5° or 1°, depending on the angular resolution of the LMS2xx.

Angular resolution	0.25°	0.5°	1°
Max. scanning angle*)	100°	180°	180°
Max. no. of measured values	401	361	181
*) symmetrical, from the middle			

Table 5-1: Angular resolution, scanning angle and number of measured values

Angular resolution is set using the LMSIBS Configuration Software or a command (telegram).

As the individual values are given out in sequence (beginning with the value 1), particular angular positions can be allocated on the basis of the values' position in the data string. Note that the LMS2xx's laser beam turns towards the left (see *Fig. 5-1, Page 12*).

The LMS2xx is set to the "Measured values on request" mode and "Data transfer rate 9,600 bd" by default (changes can be made using the appropriate command (telegram)).

It is recommended that the LMS2xx is operated in the “9,600 bd on power-on“ mode (default setting). Changing to a different data transfer rate can take place after the complete system has been started up.

5.2 Area Monitoring/Detection

In this application, the LMS2xx is responsible for automatically reporting that an area (freely definable field form) is “clear“. This means that an infringement of a field by a moved or resting object (e.g. human or subject) leads to a switching signal at the associated output.

Pixel-oriented Evaluation/Object Blanking

Pixel-oriented evaluation is used to suppress raindrops and snowflakes or other particles, and thus makes the LMS2xx less sensitive to environmental factors during outdoor operation.

This involves saving the sequential messages (measured values) from each individual spot in each scan, and a separate counter being started for each spot. Erroneous measurements can be filtered out by repeatedly examining the reported spot (multiple reading whose number depends on the setting selected). Pixel-oriented evaluation should be included in the corresponding evaluation software when external data processing is undertaken.

Blanking is used for suppressing an object that is not to be detected, e.g. a steel cable that is lotaced within the monitored field. The object size to be filtered depends on the distance (see *Fig. 4-5, Page 10*).

For detailed information see the *LMSIBS Configuration Software Operating Instructions* (no. 8009116).

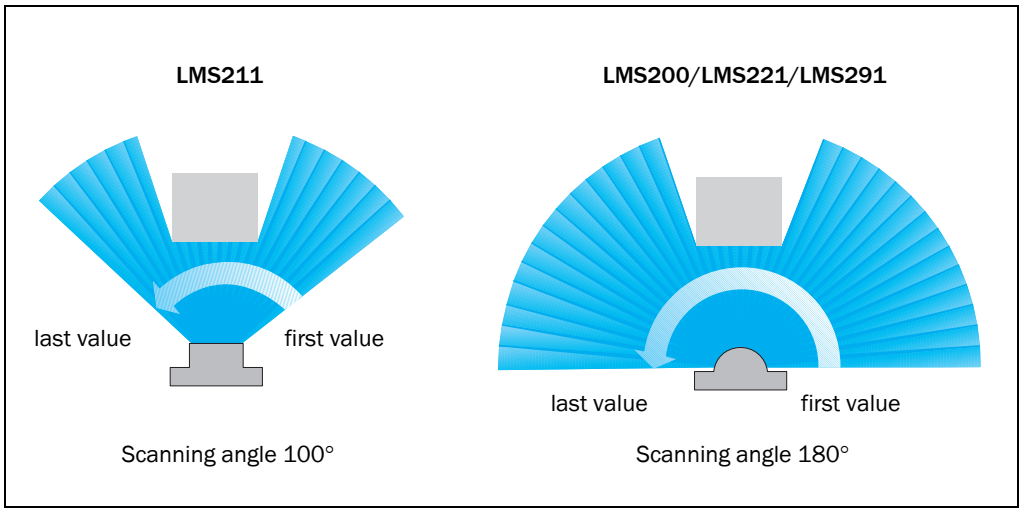


Fig. 5-1: Direction of transmission and maximum scanning angle (standard devices) on top view of the devices

6 Mounting

Several mouting sets are available for easy installation (see *Fig. 6-1* and *Fig. 6-4, Page 14*). They allow adjustment of devices in the vertical and horizontal axes.

The LMS2xx can be installed in any position. To prevent dazzle, avoid direct sunlight on the front window.

LMS2xx for outdoor use should generally be mounted upside down so that the connection plug is located on the lower right-hand side of the back plate (*Fig. 6-1*) in order not to affect contamination measurement (front window).

Outdoor Installation

Provide an appropriate, customer-specific sunshade to prevent direct sunlight falling on the LMS2xx housing (sheet metal, etc., see *Fig. 6-2*). Slots for square nuts M5 are provided on the rear oft the LMS211/LMS221 for attachment of the sunshade.
A dust prevention shield is recommended for preventing dust and/or condensation on the front window (see LMS211). Purging air can be used if dust is present in large quantities.

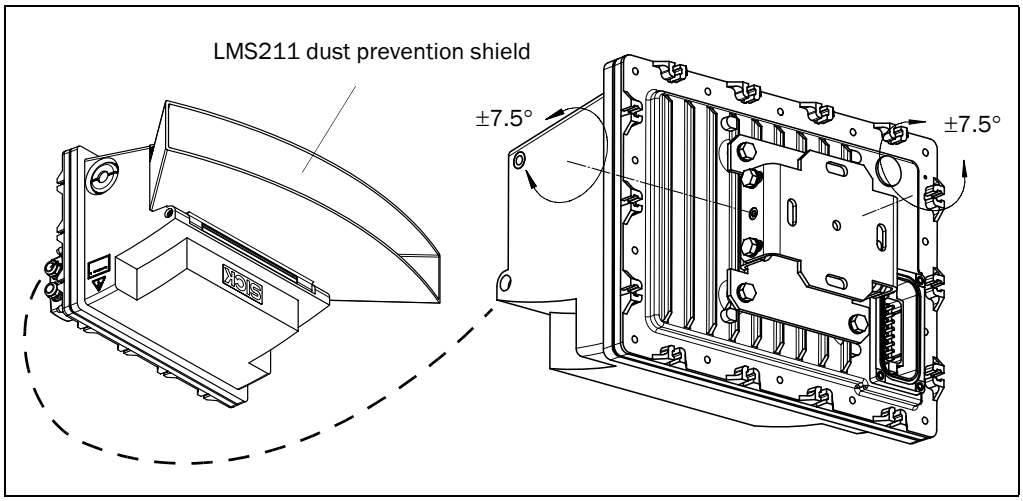


Fig. 6-1: Mounting set no. 2018303 for LMS211/LMS221 (here mounted upside down)

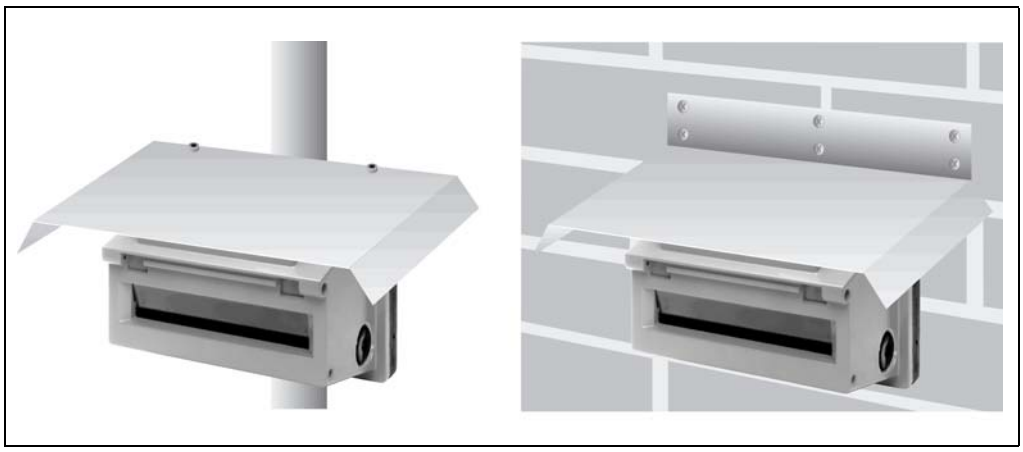


Fig. 6-2: Sunshade for LMS211 (examples)

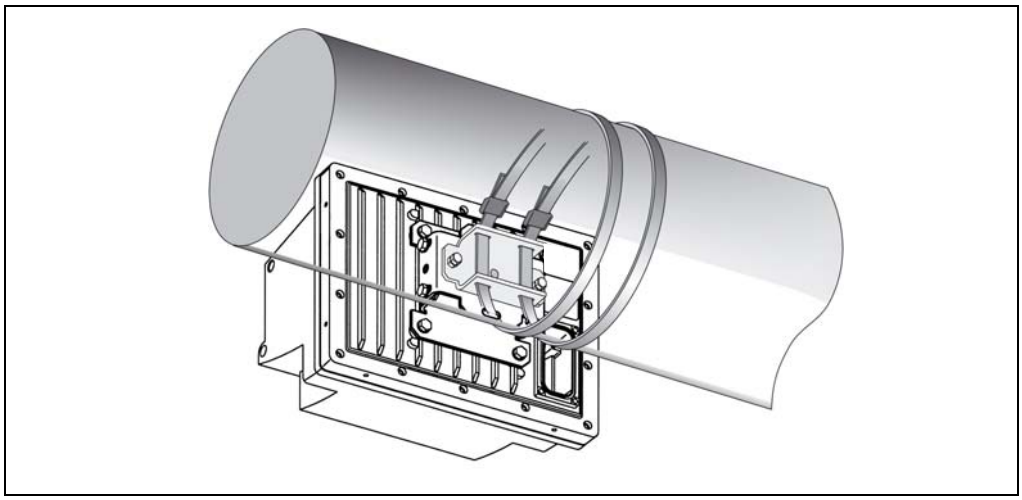


Fig. 6-3: Mounting set (no. 2018303/no. 2018304) for mast mounting of LMS211/LMS221

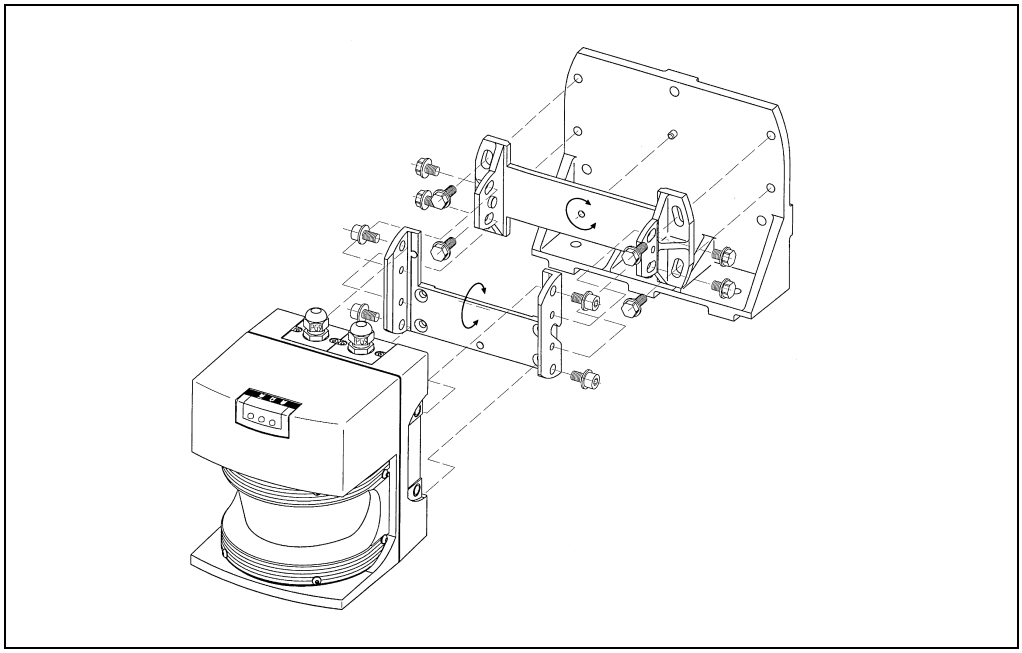


Fig. 6-4: Mounting sets 1 to 3 for LMS200/LMS291

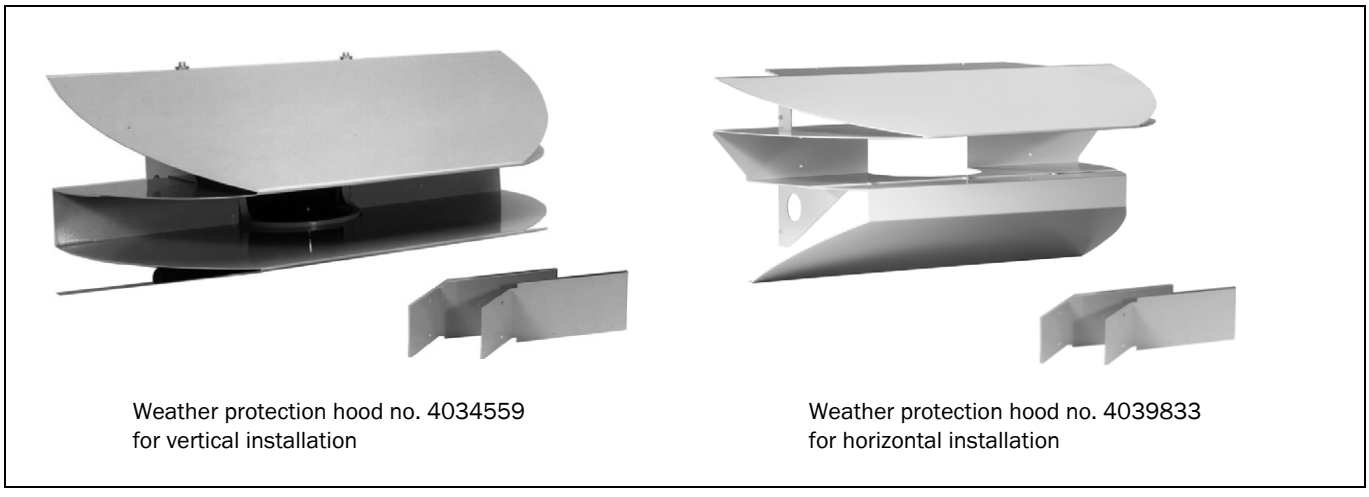


Fig. 6-5: LMS221 weather protection hoods no. 4034559 and no. 4039833

7 Electrical Installation

7.1 LMS211/LMS221

The operating voltage for LMS211/LMS221 is 24 V DC ± 15 % with a power consumption of ≤ 20 W plus the load on the three switching outputs OUT A (max. 250 mA), OUT B (max. 250 mA) and OUT C (max. 100 mA) for standard devices.

7.1.1 Data Interface

The data interface of the LMS2xx is used for setting parameters with a PC and for data traffic during external evaluation (e.g. by SICK's LMI200 Interface). The active interface type (RS 232 or RS 422) is selected using a wire link in the connection plug. Max. cable lenght for RS 232: 10 m, while that of the RS 422 is 1,200 m up to 38.4 KBd and 250 m up to 500 KBd. A pre-assembled service cable is available for setting parameters (see *Fig. 7-5, Page 17*).

Note A shielded cable with twisted pair wires (2 x 2 TP, see *Chapter 14 Ordering Information, Page 40*) is required for operation with external data evaluation in real-time.

7.1.2 Power Supply

The electronics of the LMS2xx is powered directly from a stabilised 24 V DC-power supply.

The heating of the LMS211/LMS221 is controlled internally by a thermostat. A unregulated 24 V DC power supply is sufficient for powering the heater (current consumption of active heater is approx. 6 A). In the connection plug (IP 67) of the LMS211/LMS221 separate terminals are available for connecting the heater.
By using separate wiring it is possible to keep the heater in operation even when the LMS211/LMS221 is switched off for longer periods – in order to maintain the operating temperature at a suitable level until the LMS211/LMS221 is switches back on (prevents subsequent thawing within the LMS211/LMS221).

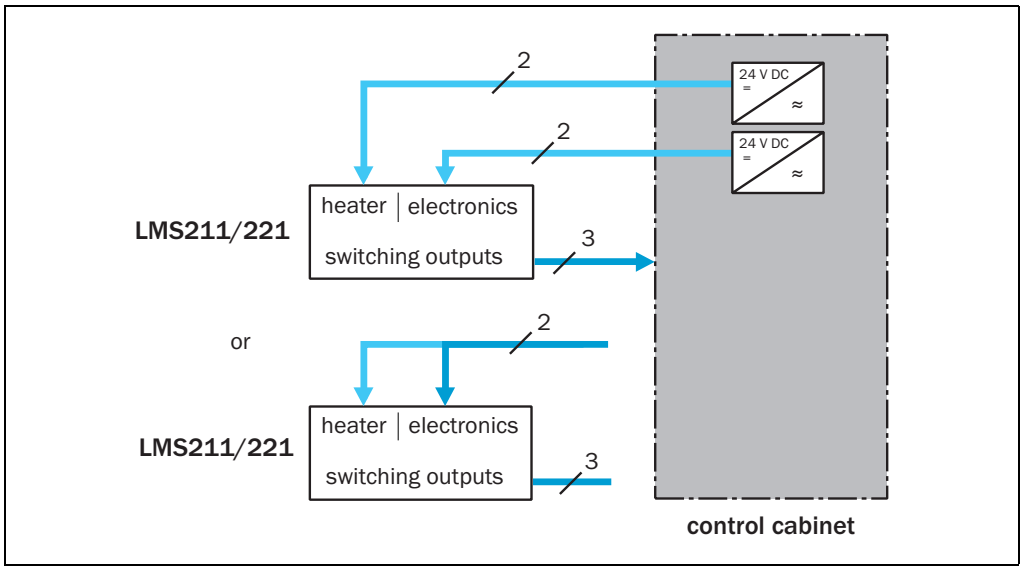


Fig. 7-1: LMS211/LMS221: Wiring for area monitoring (switching application)

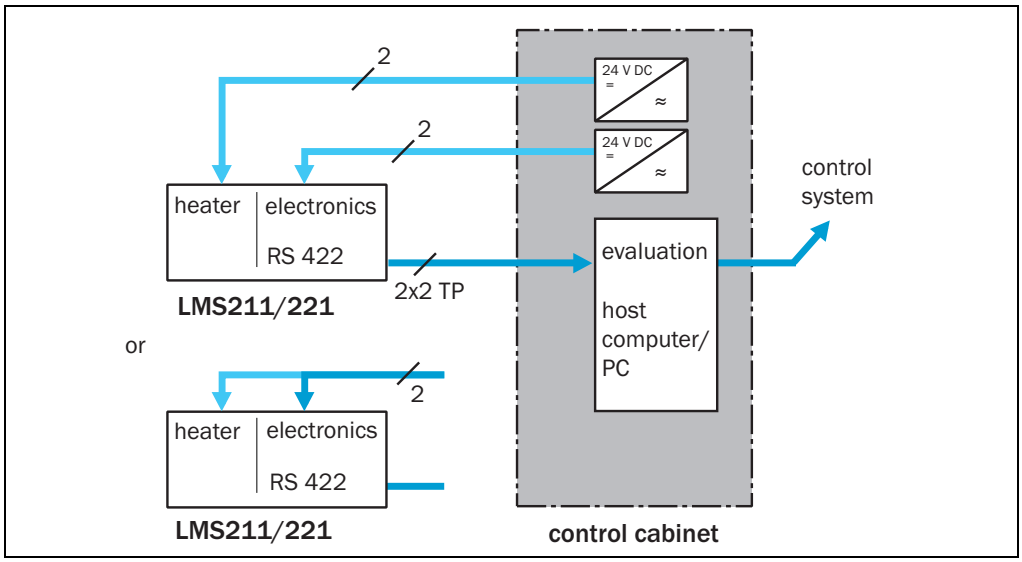


Fig. 7-2: LMS211/LMS221: Wiring for external data processing

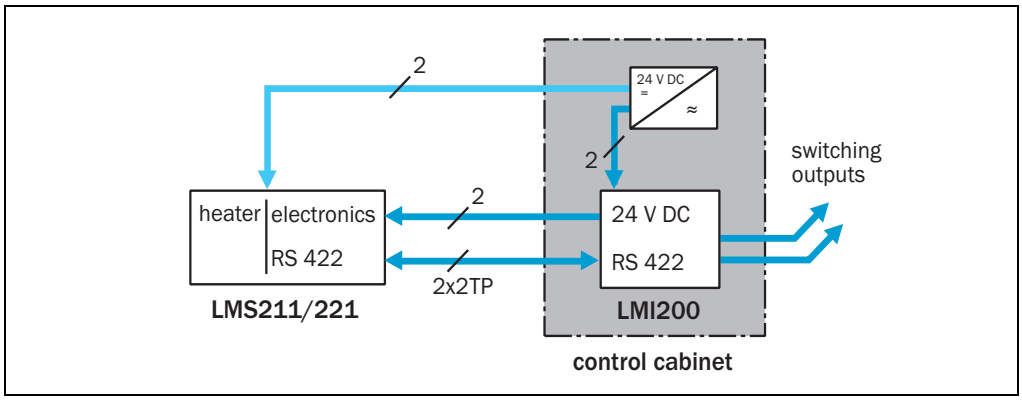


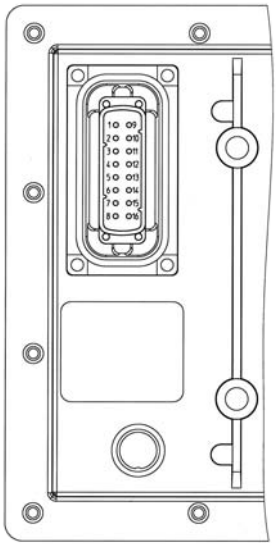
Fig. 7-3: LMS211/LMS221: Wiring in conjunction with LMI200

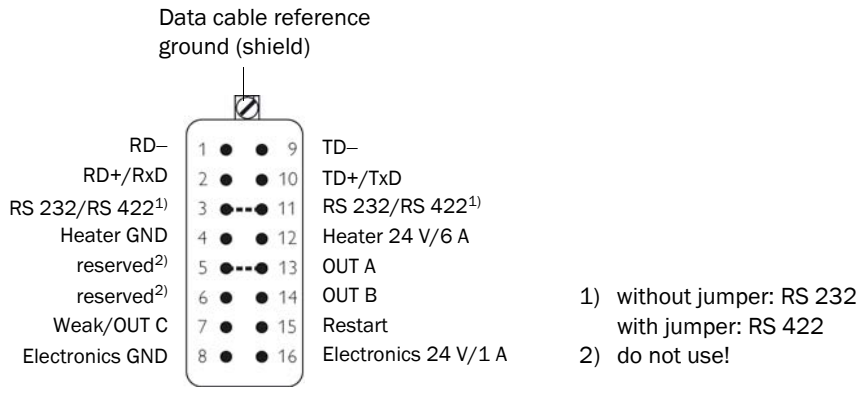
Note Observe admissible voltage drops through the cable. The entire heating capacity (required at temperatures below –10 °C) is only available with at least 24 V rated voltage at the LMS211/LMS221 (see *Chapter 12 Technical Data, Page 29*). The voltage drop through cables at a current flow of 5 A is 0.114 V/m with a wire cross-setion of 1.5 mm² and 0.075 V/m with a wire cross-section of 2.5 mm².

System state	OUT A switching output	OUT B switching output	OUT C switching output[1)]
Start (Initialising)	typical 0 V	typical 0 V	typical 0 V
OK, all fields clear	typical 24 V DC[2)]	typical 24 V DC[2)]	typical 24 V DC[2)]
Field A, B or C infringed	typical 0 V, if A infringed	typical 0 V, if B infringed	typical 0 V, if C infringed
Configuration download	typical 0 V	typical 0 V	typical 0 V
Request at the Restart switching input	depending on the parameterization (field set switching or release of a field)		
Front window contamination (warning)	typical 24 V DC[2)]	typical 24 V DC[2)]	typical 24 V DC[2)]
Front window contamination (error)	typical 0 V	typical 0 V	typical 0 V, 90 % on, 10 % off, 1 Hz
Error	typical 0 V	typical 0 V	typical 0 V, 10 % on, 90 % off, 1 Hz
Fatal error	typical 0 V	typical 0 V	typical 0 V, 50 % on, 50 % off, 5 Hz
1) Special devices LMS211-/221-S19/-S20: optional indication of front window contamination (warning/error) with additional static signal at OUT C switching output 2) The switching circuit is closed in the case of special devices with relay outputs			

Table 7-1: LMS2xx: Behaviour of the switching outputs OUT A to OUT C

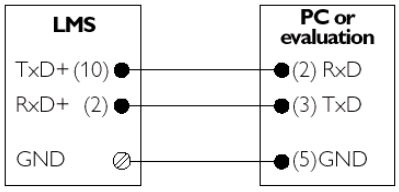
7.1.3 Electrical Connection of LMS211/LMS221 with Switching Outputs



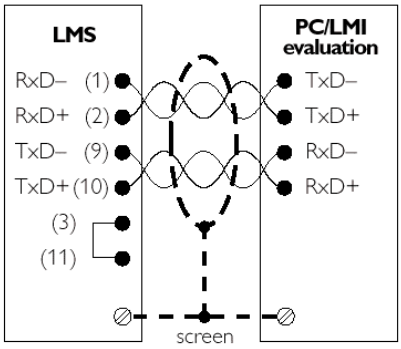


1) without jumper: RS 232
with jumper: RS 422
2) do not use!

Note:
To ensure that the incoming power supply cable is protected against short-circuits/overload, use an external power supply with current limiting (e.g. fuse)

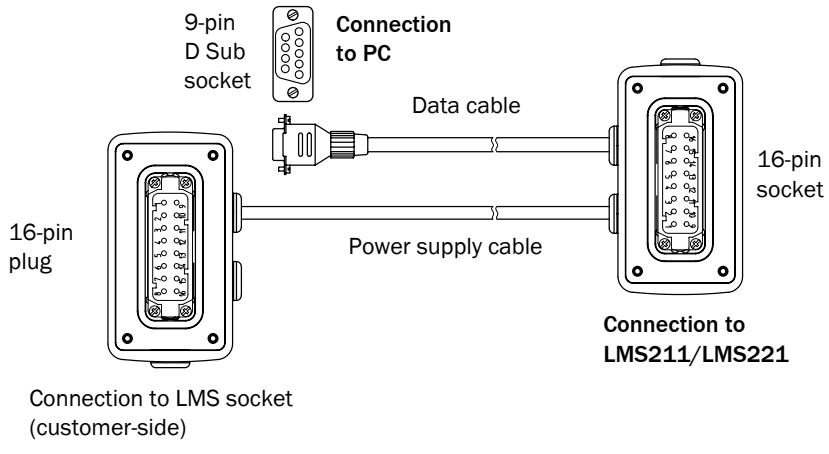


Connecting the RS 232 data interface



Connecting the RS 422 data interface

Fig. 7-4: LMS211/LMS221 (switching outputs): Terminal assignment of the 16-pin plug/wiring the data interfaces



Default setting RS 232 (without jumper).
Can also be used for RS 422 with jumper between terminals 3 und 11 in the 16-pin socket

Fig. 7-5: LMS211/LMS221: Service cable no. 2019561 for setting parameters

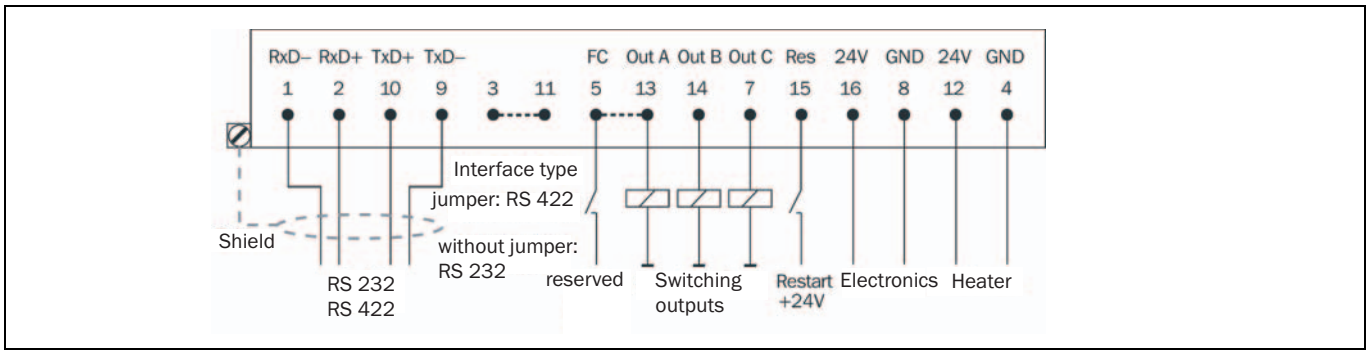


Fig. 7-6: LMS211/LMS221 (switching outputs): Connection diagram of the terminals

7.1.4 Electrical Connection of LMS211/LMS221 with Relay Outputs

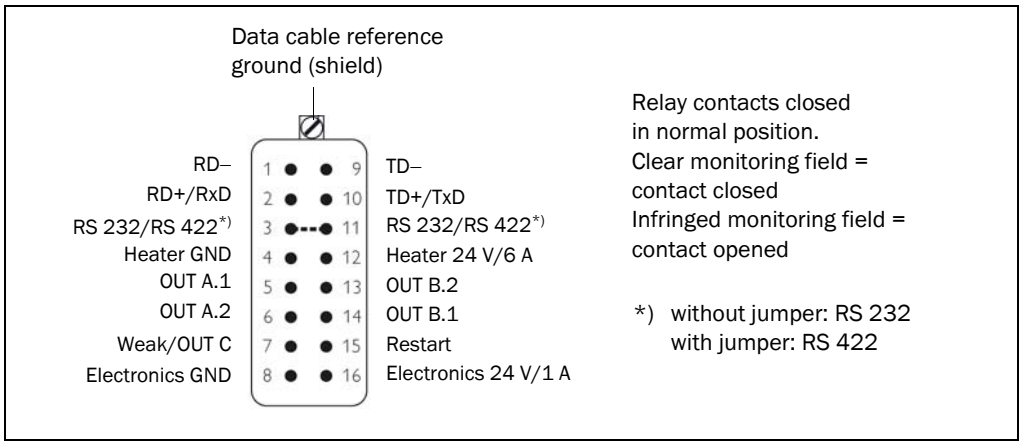


Fig. 7-7: LMS211/LMS221 (relay outputs): Terminals assignment of the connector (plug)

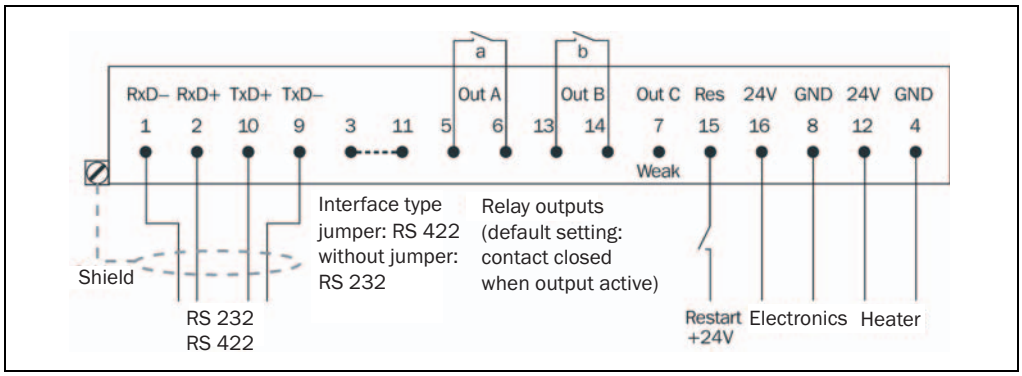


Fig. 7-8: LMS211/LMS221 (relay outputs): Connection diagram of the terminals

7.1.5 Behaviour of the Switching Outputs

The LMS211/LMS221 with switching outputs are designed in such a way, that the three switching outputs are active (normal potential typical 24 V DC) if the corresponding fields are clear. If, however, a field is infringed the relevant output switches to 0 V-level.

The contact of the LMS211/LMS221 with mit potential-free relay outputs on OUT A and OUT B are set to N.O. funtion by factory. The corresponding contact is closed when the monitoring field is clear and opens if there is a field infringement. This functionality of the switching outputs means, that the connecting cables are automatically monitored for any breaks.

Output “OUT C/Weak“ is designed to act as a regular field output but automatically assumes an error signalling function if there is a break (see also *Table 7-1, Page 16*).

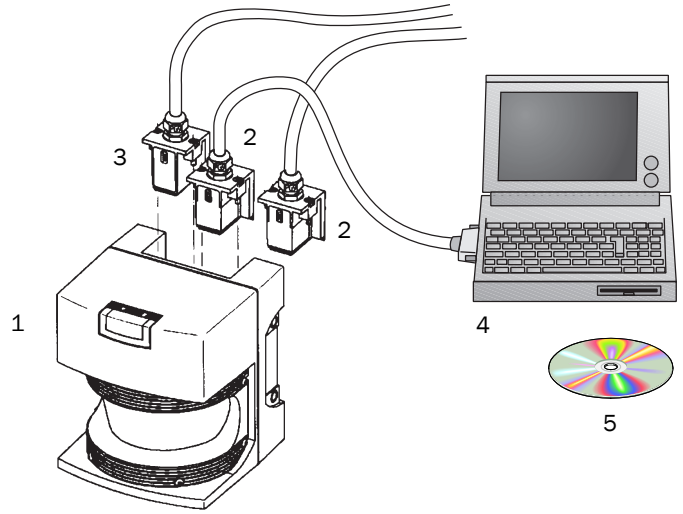
7.2 LMS200/LMS291

7.2.1 Electrical Connecting

The LMS200/LMS291 requires an operating voltage of 24 V DC ± 15 % with a power consumption of ≤ 20 W plus the load on the three switching outputs OUT A (max. 250 mA), OUT B (max. 250 mA) and OUT C (max. 100 mA) for standard devices.

The “RESTART“ input can be allocated as restart or field set switching (see the *LMSIBS Configuration Software Operating Instructions* (no. 8009116)).

Power is supplied to the LMS200/LMS291 using a plug-in connection box (plug module) with a high enclosure rating (see *Fig. 7-10*), while data interface connecting takes place through another connection box (RS 232 or RS422).



1 LMS200/LMS291
2 Plug module with data interface cable to evaluation unit (e.g. controll cabinet, PLC, PC) or data interface cable for temporary connection to PC for configuration and servicing of the device
3 Plug module with connection cable for power supply and switching input/outputs to a machine or a controll cabinet
4 PC for configuration and servicing
5 CD-ROM with LMSIBS Configurations Software and documentation

Fig. 7-9: LMS200/LMS291: Components and typical set-up

7.2.2 Interface Plugs (Plug Modules)

The interface plugs are built in into plug modules. Only when attachment of the plug modules to the devices has been completed does the device corresponds to the IP 65 design and EMC requirements (ESD) according to CE. Furthermore, please note that regarding ESD protection the LMS200/LMS291 should only be operated with the plug modules mounted.

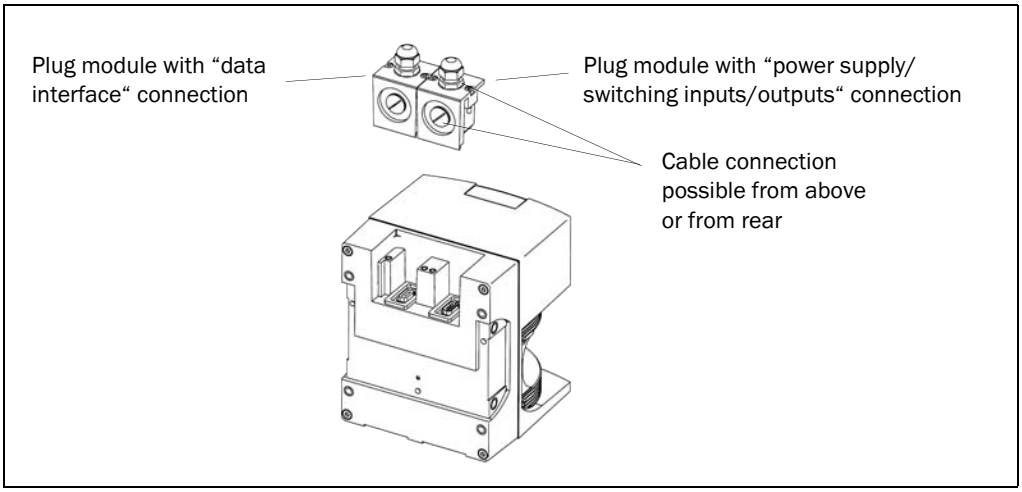
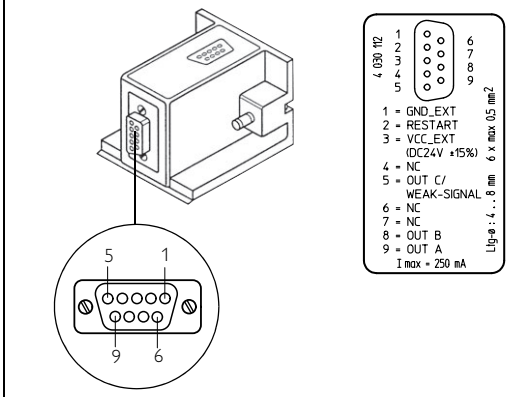


Fig. 7-10: LMS200/LMS291: Housing and plug modules with interfaces

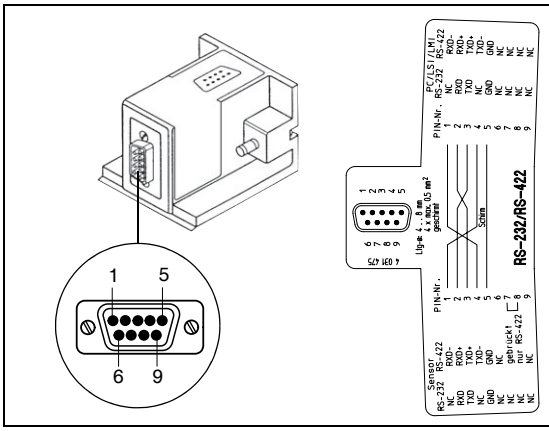
7.2.3 Pin Assignment of the Plug Modules



Pin	Signal	Interface	Wire colours of connection cable*)
1	GND (Ground)	Power supply	Brown
2	Restart	Switching input	Black
3	24 V DC ± 15 %	Power supply	Red
4	n.c.	–	
5	OUT C/Weak	Switching output	Yellow
6	n.c.	–	
7	n.c.	–	
8	OUT B	Switching output	Green
9	OUT A	Switching output	Orange
Device	Shield	–	–
*) “Power supply/switching in-/outputs“ cable of connection set 2 and set 3			

Table 7-2: LMS200/LMS291: Pin assignment of the 9-pin D Sub socket in the “Power supply/switching input/outputs“ plug module

Note Provide current limitation (e.g. fuse) for external power supply.



Pin	Signal	Data Interface
1	RD–	RS 422
2	RD+/RxD	RS 422/RS 232
3	TD–	RS 422
4	TD+/TxD	RS 422/RS 232
5	GND	Ground
6	n.c.	–
7	Brigde to pin 8	Enables the RS 422 interface type
8	Brigde to pin 7	
9	n.c.	–
Device	Shield	–

Table 7-3: LMS200/LMS291: Pin assignment of the 9-pin D Sub plug in the “Data interface“ plug module

Switching the Data Interface Type

The prepared data interface plug of the connection set is converted to an RS 422 type using a bridge. The data interface reverts to the RS 232 type when removing the bridge (delivery status). For the function of the data interface see *Chapter 7.1.1, Page 15*.

Note Bridging may only be carried out within the plug module.

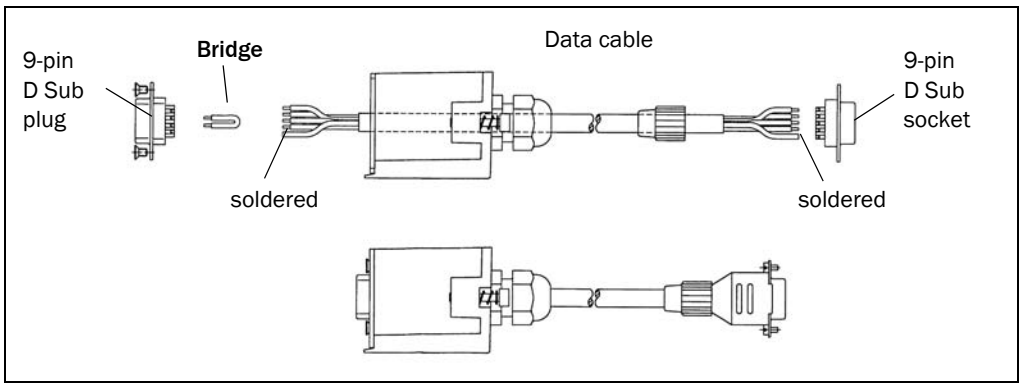


Fig. 7-11: LMS200/LMS291: Convertible data interface in the plug module (RS 232 pre-selected)

7.2.4 Cable Guiding in the Plug Module

The cables can be routed in the module from above or from the rear.

Note In order to ensure that the LMS200/LMS291 is sufficiently sealed (IP 65), the devices must always be provided with plug modules – even when the interface is not in use.
The plug modules must be provided with breech screws or PG calbe glands with seals and D Sub plug respectively socket.

Fig. 7-12: LMS200/LMS291: Design of the plug modules

7.2.5 Functions of the LEDs

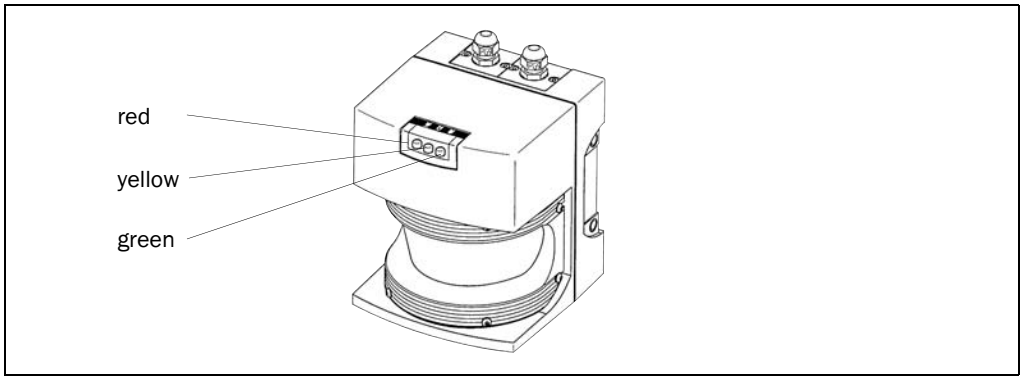


Fig. 7-13: LMS200/LMS291: Position of the LEDs

State of system	LED green	LED yellow	LED red	LED yellow		OUT C switching output[1]
				Frequency	Puls ratio	Puls ratio/frequency
Start (Initialising)	OFF	ON	ON	–	–	typical 0 V
OK, all fields clear	ON	OFF	OFF	–	–	typical 24 V DC[2]
Field A, B or C infringed	OFF	OFF	ON	–	–	typical 0 V
Configuration download	OFF	OFF	ON	–	–	typical 0 V
Request at the Restart input	OFF	ON	ON	–	–	see *Table 7-1, Page 16*
Front window contamination (warning)	OFF	ON	OFF	1 Hz	50 % on, 50 % off	typical 24 V DC[2]
Front window contamination (error)	OFF	ON	ON	1 Hz	90 % on, 10 % off	typical 0 V, 90 % on, 10 % off, 1 Hz
Error	OFF	ON	ON	1 Hz	10 % on, 90 % off	typical 0 V, 10 % on, 90 % off, 1 Hz
Fatal Error	OFF	ON	ON	5 Hz	50 % on, 50 % off	typical 0 V, 50 % on, 50 % off, 5 Hz

1) Special devices LMS211-/221-S19/-S20: optional indication of front window contamination (warning/error) with additional static signal via OUT C switching output
2) The switching circuit is closed in the case of special devices with relay outputs

Table 7-4: LMS200/LMS291: Function of the LEDs/behaviour of the OUT C switching output on all LMS2xx

8 Synchronisation of two LMS2xx

If two LMS2xx are operated in close vicinity to each other using the same transmission direction, e.g. for measuring packages, there may be mutual interferences under certain circumstances. In order to prevent this the rotating mirrors of the two LMS2xx can be synchronised. The mirrors are then maintained in a position displaced by 180° relative to each other. In the process one LMS2xx is defined as MASTER, the other the SLAVE (see also *LMSIBS Configuration Software Operating Instructions* (no. 8009116), *Chapter "LMS Configuration"*).

8.1 Pre-conditions for Synchronisation

The LMS2xx are capable of synchronisation from software version V02.03 and above hardware class serial no. 9919... and above.

The LMS2xx are wired according to the connection diagram (*Fig. 8-1*).

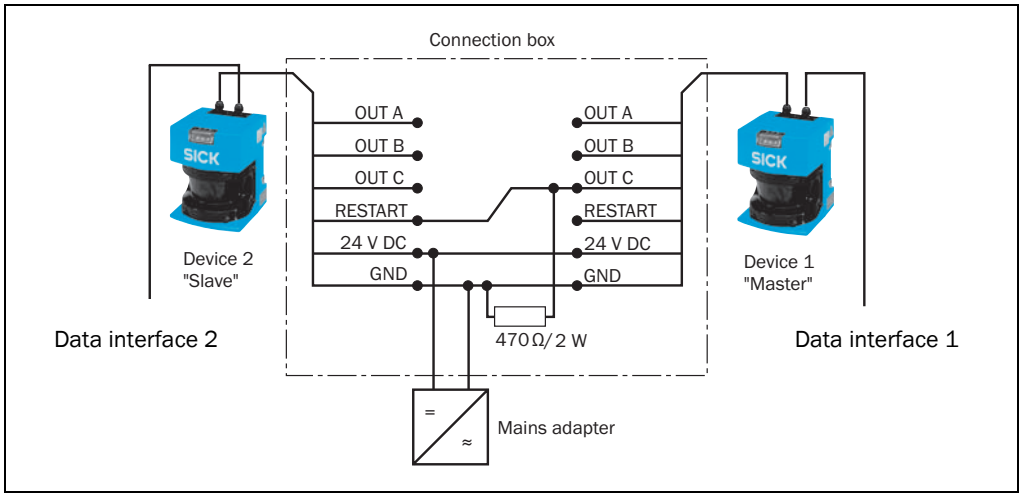


Fig. 8-1: Connection diagram synchronisation

8.2 Procedure

Both LMS2xx must be supplied from a common power supply unit. The separation of the power supply for the LMS2xx must first take place in the connection box (see *Fig. 8-2, Page 23*).

- ➢ The maximum lenght of each of the supply cables should not exceed 5 m.
  Wire the LMS200/291 with the power supply cables from the connection set 2.
- ➢ Connect the MASTER output "OUT C" to the "RESTART" input of the SLAVE.
- ➢ Wire a pull-down resistor of 470 Ohm/2 W to GND (supplied with the connection box).
  The linkage takes place in the connection box.

The remaining LMS2xx switching outputs can be led from the connection box to the control cabinet without any further measures being taken. The two LMS2xx data cables must no be wired through the connection box. When selecting the type of data interface note the admissible cable length according to *Chapter 7.1.1, Page 15*.

8.3 Commissioning Synchronisation

8.3.1 Reaction of the LMS2xx on Power-On

- The MASTER outputs its synchronisation pluse immediately after configuration has taken place

- The SLAVE independently synchronises itself after RESET or POWER-ON

8.3.2 Synchronisation Behaviour of the SLAVE

Possible states after RESET during the synchronisation phase:

Phase	LED			Duration
	red	yellow	green	
1. Waiting for synchronisation signal from MASTER	on	Puls ratio 50 %, 0.5 Hz	off	max. 45 s
2. Synchronisation phase (adaptation of the number of rotations)	on	on	on	
3. Synchronisation adjusted to predefined phase state	on	off	on	approx. 4 s
4. Synchronisation completed	on	on	off	*)
5. Operation state: Slave OK	off	off	on	*)
Error	on	off	off	
*) If the synchronisation process has not been completed after 100 s, the slave aborts the synchronisation process and indicates an error				

Table 8-1: Indication of the Slave synchronisation behaviour by LEDs (LMS200/LMS291 only)

The LEDs of the MASTER act as in standard mode (see *Chapter 7.2.5 Functions of the LEDs, Page 21*). The LEDs are ony visible on the LMS200/LMS291.

After synchronisation has taken place in the initialisation phase, the synchronisation status is cyclically controlled and monitored. On loss of synchronisation for a period longer than 10 to 30 s the SLAVE enters an info in its error log. On loss of synchronisation for a period longer than 30 s the SLAVE enters an error in its error log. If the SLAVE is able to synchronise itself again to the MASTER, the SLAVE deletes the error entry or saves the entry as a non-current error.

In synchronisation mode the MASTER suffers just one restriction, namely that the “OUT C“ switching output cannot be used for the area monitoring function.

Note The connection box corresponds to enclosure rating IP 65, but IP 54 on use of the PG 11 und PG 16 cable glands supplied. If enclosure rating IP 65 is required, the appropriate PG cable glands are to be used (tradeware).

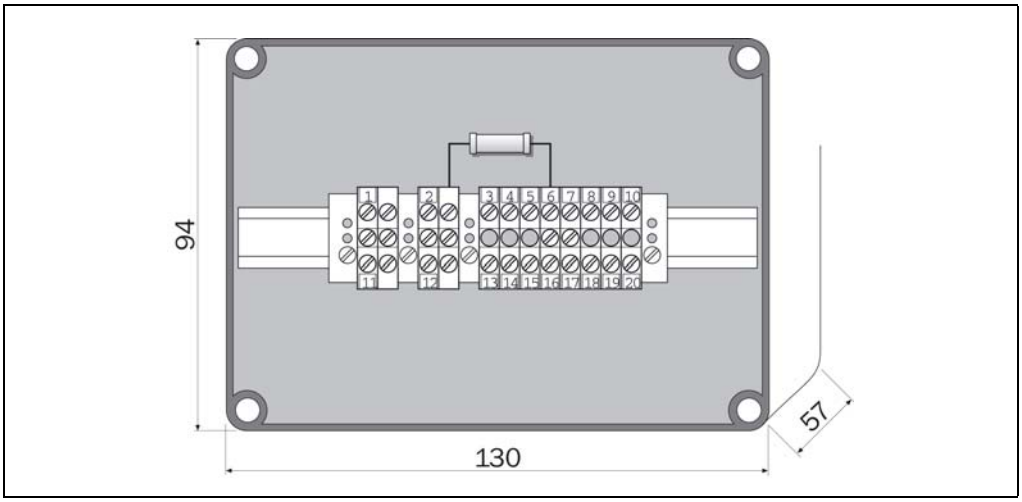


Fig. 8-2: Connection box no. 2021520 for synchronisation

9 Heating plate for LMS200/LMS291

A supplementary, external heating plate is required if the LMS200/LMS291 are operated in a temperature range below 0 °C.

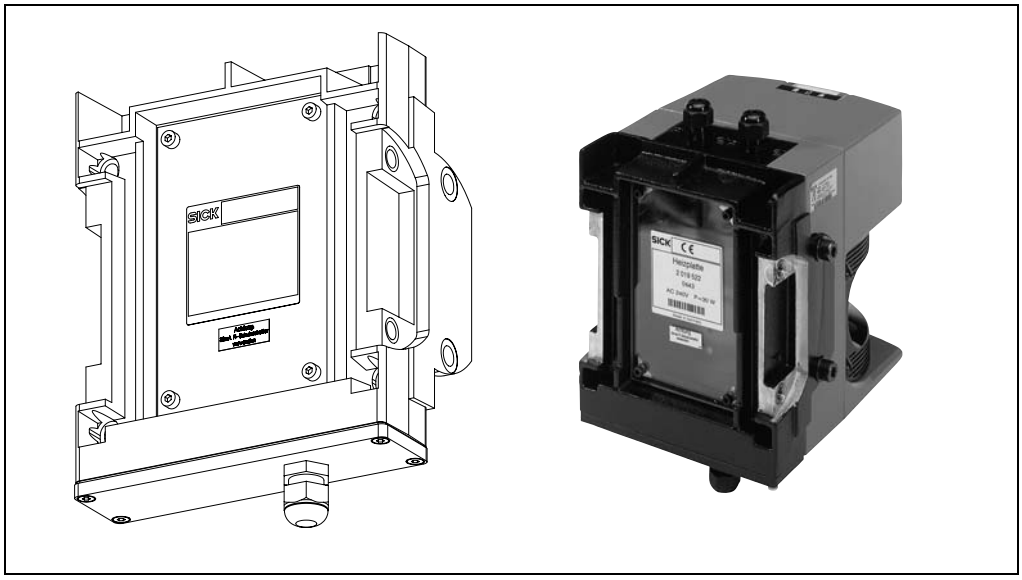


Fig. 9-1: External heating plate (no. 2019522) for LMS200/LMS291

The heating plate is mounted between the device back plate and the mounting set 1 (*Fig. 9-2*). The temperature of the heating plate is controlled internally by a thermostat.

Take care that the heating plate lies level on the LMS200/LMS291 device rear and that the transfer of warmth is not hindered.

The connection terminals for the power supply are below the cover. Conventional cables can be used for connection.

Note **Protect the heating using a FI safety switch (30 mA)!**

LMS200/LMS291 heating-up time	Approx. 20 min. when switching on at T_U = –12 °C
Electrical connections	– Terminal compartment: screw terminals for wire diameter of max. 1.5 mm² – Cable gland: PG 9 for cable diameter 4 to 8 mm
Operating voltage	230 V AC 50 Hz ± 10 % (125 V AC/ 50 to 60 Hz)
Power consumption	Approx. 30 W (cyclic, thermostat-controlled)
Peak current on power-on	< 2.5 A
Housing	Aluminium die-cast
Enclosure rating	Max. IP 65 according to DIN 40 050
EMC test	According to EN 61000-6-2, EN 61000-6-4
Weight	Approx. 1.4 kg
Dimensions	See *Fig. 9-2, Page 25*
Mounting	4 x screw M8 x 15
Temperature (ambient/storage)	–12 to +50 °C/–20 to +70 °C
Colour	Black (RAL 9005)

Table 9-1: Technical data of the heating plate no. 2019522

Note The heating plate is intended for use only in industrial environments.
Use in residential areas can cause RF interferences.

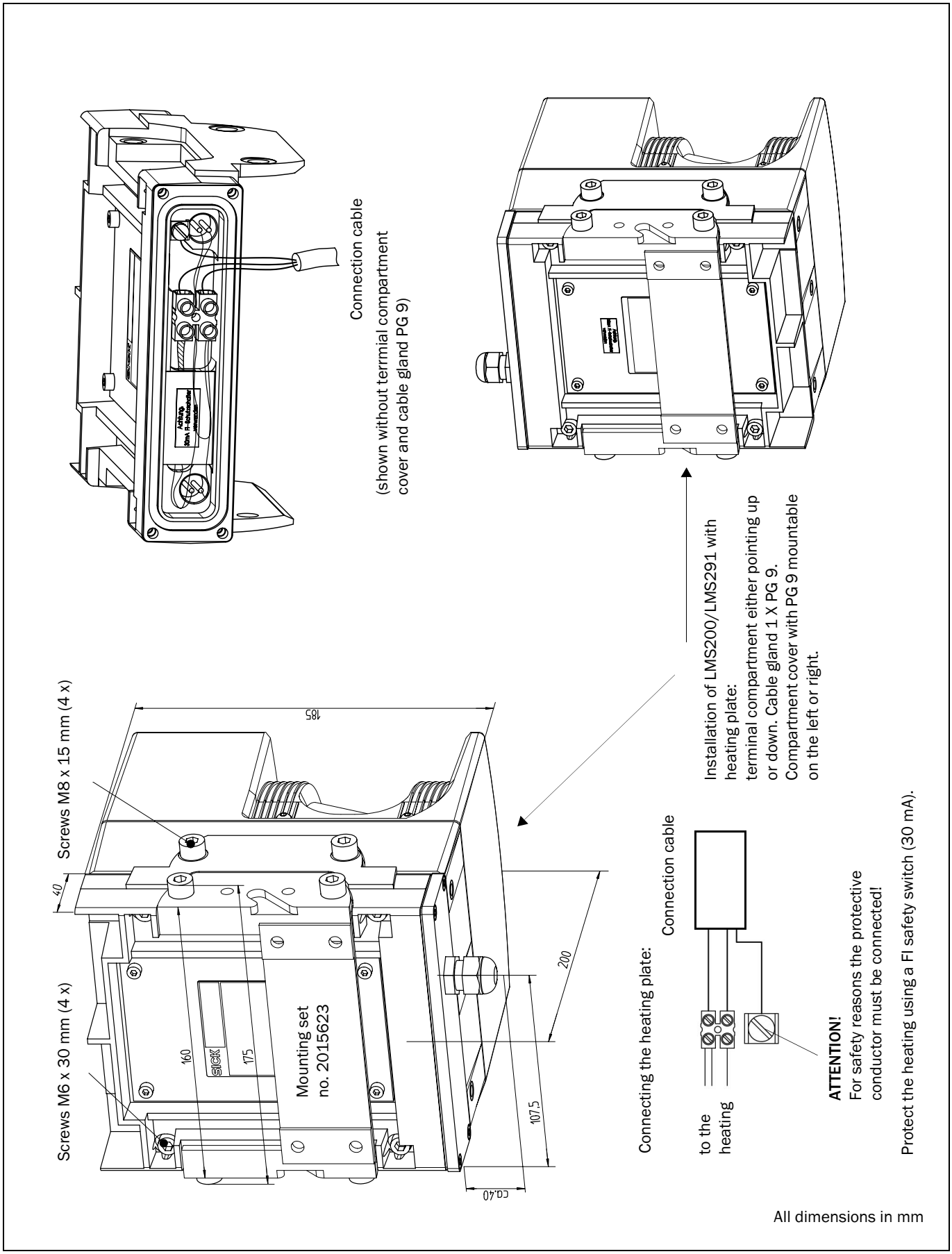


Fig. 9-2: Installation of the heating plate on the LMS200/LMS291

10 Configuration/Operating

The LMS2xx operates completely automatically. No activity is required during operation. The only exception here is the optional release of a field, previously infringed during area monitoring, using a button connected to the LMS2xx. During the external further processing of measurement data, the LMS2xx transmits the data on request from the customer's driver (application).

Configuration of the LMS2xx for *area monitoring* takes place with the LMSIBS Configuration Software supplied. The online Help system supports parameterisation.

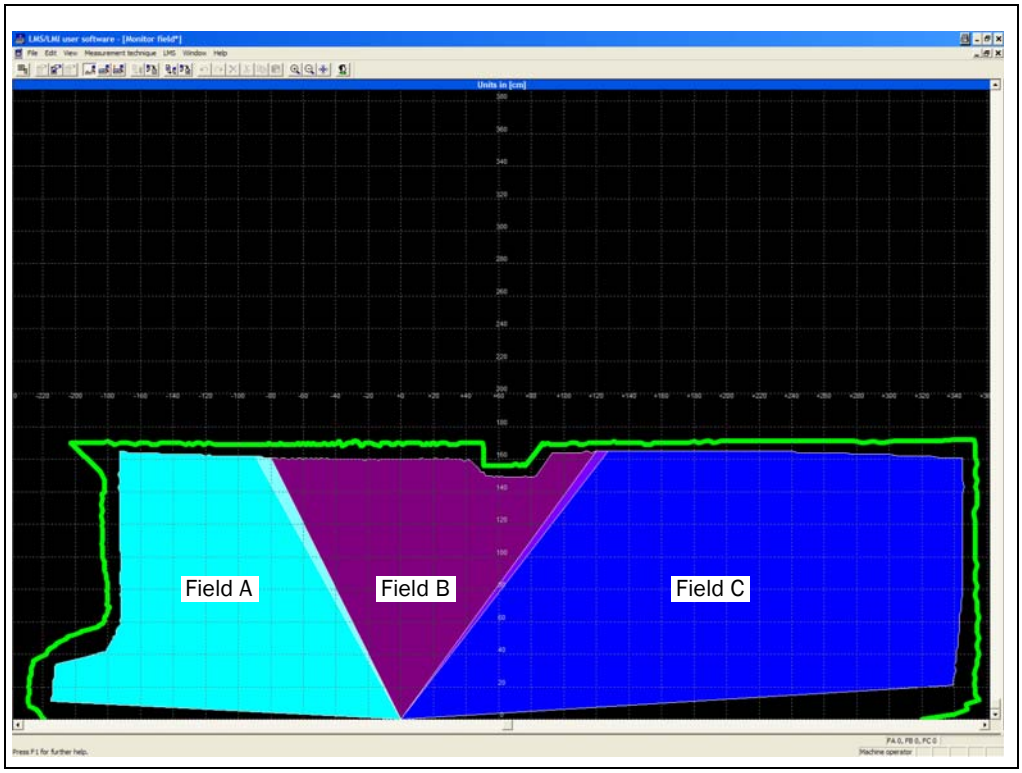


Fig. 10-1: User interface of the LMSIBS Configuration Software for parameterisation of the monitored area

The LMSIBS Configuration Software is also used for the basic configuration of the LMS2xx for the output and external further processing of measurement data in real time. In addition to other useful functions, it also allows the output and display of simple processed measurement data from the raw measurement data. The error log of the LMS2xx can be read out and interpreted with the help of the diagnosis function. Access to the configuring functions of the software is password-protected.

PC hardware required:

- Pentium II, 350 MHz or higher, 64 MB RAM minimum, colour monitor (min. resolution 800 x 600), mouse, CD-ROM drive, serial RS 232 or RS 422 data interface
- operating system: MS-Windows 98™ or XP™
- approx. 5 MB free hard-disk space

11 Variants/Functions

11.1 Overview of Variants

LMS200	LMS211	LMS221	LMS291
			
IP 65	IP 67	IP 67	IP 65

Table 11-1: Overview of LMS2xx types (variants of housing)

Type	Scanning angle	Angular resolution	Resolution/ typical Measurement Accuracy	Typical Range[1]	Temperature Range	Heating	Fog Correction
LMS200-30106[2]	180°	0.25°; 0.5°; 1°	10 mm/±15 mm	10 m	0 to +50 °C	Accessory[8]	no
LMS209-S02[2][3]	180°	0.25°; 0.5°; 1°	10 mm/±15 mm	10 m	0 to +50 °C	Accessory[8]	no
LMS211-30206	100°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS211-30106	100°	0.25°; 0.5°; 1°	10 mm/±15 mm	10 m	–30 to +50 °C	yes[9]	no
LMS221-30206[2]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-30106[2]	180°	0.25°; 0.5°; 1°	10 mm/±15 mm	10 m	–30 to +50 °C	yes	no
LMS291-S05[2]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	0 to +50 °C	Accessory[8]	yes
LMS291-S14[4]	90°	0.5°	10 mm/±35 mm	30 m	0 to +50 °C	Accessory[8]	yes
LMS291-S15[2][6]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	0 to +50 °C	Accessory[8]	yes
LMS211-S07[5]	100°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS211-S14[4]	90°	0.5°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS211-S15[6]	100°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS211-S19[10]	100°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS211-S20[5][10]	100°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes[9]	yes
LMS221-S07[2][5]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-S14[4]	90°	0.5°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-S15[2][6]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-S16[2][7]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-S19[10]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes
LMS221-S20[5][10]	180°	0.25°; 0.5°; 1°	10 mm/±35 mm	30 m	–30 to +50 °C	yes	yes

1) with 10 % reflectivity
2) max. scan angle 100° with angular resolution 0.25°
3) Features as LMS200-30106, but housing not lacquered
4) LMS Fast (without “area monitoring“ function)
5) with 2 relay outputs/1 digital switching output
6) reduced data output volume
7) default setting: data transmission rate 500 KBd
8) external heating plate, expands the admissible temperature range from -12 to +50 °C
9) front window heating additionally to the inner heater
10) for security applications (area monitoring); max. 2 subtractive fields, indication for front window contamination (warning/error) via OUT C switching output

Table 11-2: Overview of LMS types (standard and special devices)

11.2 Features

Function	Performance Characteristsics	Remarks	Default setting
Monitoring fields, static	• Rectangular • Segmented (also teach-in)		A, B, C segmented each 50 mm radial (indoor) each 5 cm radial (outdoor)
Number of field sets	2, each with 3 fields	Each with field A, B, C	
Switching field sets	With static signal via external switch (“Restart“ input) or by telegram		
Switching outputs (OUT A, B, C)	3	PNP, normal potential typ. 24 V DC	
Switching outputs LMS 211/221-S07/-S20 alternative with relay contacts	2 (OUT A, OUT B)	OUT C as PNP	Normally closed when active (set by factory)
Subtractive fields	LMS2xx standard: 1 field LMS-211/221-S19/20: 2 fields	• Standard: monitored area = field A minus field B • Special devices: monitored area 1= field A minus field C monitored area 2 = field B minus field C	No subtractive field
Field evaluation	• Scan-oriented (blanking possible) • Pixel-oriented (blanking not possible) • Contour as reference		Pixel-oriented No blanking 2 scans multiple reading
Restart after field infringement (reset of switching outputs)	• Direct restart, automatically • Restart after defined delay, automatically • Restart triggered manually by a button	External button for restart. Restart of the several fields independent of each other	Automatically, direct after clearing the field
Temporay field set	Yes	Field set is defined online by external software (telegram)	
Measured value transfer in real-time (500 kBd, RS 422)	Yes	High Speed interface RS 422 on PC required	
Selectable baud rate: 9.6 kBd, 19.2 kBd, 38.4 kBd, 500 kBd	Yes	500 kBd required for real-time transfer	9.6 kBd Parity: none
Measurement range in mm Measurement range in cm	Up to 8 m/16 m/32 m Up to 80 m	Selectable range	mm (indoor use) cm (outdoor use)
Conversion of polar co-ordinates into Cartesian co-ordinates	Yes	Max. 200 measured values as Cartesian co-ordinates	Polar co-ordinates
Measured value flags	• Infringement of field A, B, C *or* • Detection of reflector *or* • Dazzle, field Feld A, B	Data output supplementary information, e.g. for navigation using reflector marks	Field A, B; dazzle
Minimum perpendicular distance	Yes	Measured values for field A, B, C	
Measured value output	• All measured values of a scan • Average measured values (up to 250 scans) • Measured values for partitioned sector • Average measured values for partitioned sector (up to 250 scans)		Measured values on request

Table 11-3: Overview of features

12 Technical Data

Type	**Indoor: LMS200, Outdoor: LMS211, LMS221, LMS291**
Scanning angle (field of vision)	100°/180° (type-dependent, see *Table 11-1, Page 27*)
Motor speed	75 Hz
Angular resolution (response time)	0.25°[1] (53.33 ms); 0.5° (26.66 ms); 1° (13.33 ms); selectable
Range	Max. 80 m (type-dependent, see *Table 11-2, Page 27*)
Measurement resolution	10 mm
Measurement accuracy	typical ±35 mm (LMS200-30106, LMS211/LMS221-30106: typical ±15 mm)
Systematic error[2]	LMS200-30106/LMS211-30106/LMS221-30106: – mm-mode: typical ±15 mm at range 1 to 8 m – cm-mode: typical ±4 cm at range 1 to 20 m LMS211/LMS211-30206/LMS291/LMS221-30106/LMS2x1-Sxx: – mm-mode: typical ±35 mm at range 1 to 20 m – cm-mode: typical ±5 cm at range 1 to 20 m
Statistical error[3]	LMS200-30106/LMS211-30106/LMS221-30106: mm-mode: typical 5 mm at range ≤ 8 m/ reflectivity ≥ 10 %/ light ≤ 5 klx LMS211/LMS211-30206/LMS291/LMS221-30106/LMS2x1-Sxx: mm-mode: typical 10 mm at range 1 to 20 m/ reflectivity ≥ 10 %/ light ≤ 5 klx
Laser diode (wavelength)	Infra-red (λ = 905 nm)
MTBF of LMS2xx[4]	Indoor devices: 70,000 h Outdoor devices: 50,000 h
Laser class of device	Class 1 (eye-safe), to EN/IEC 60825-1 and to 21CFR 1040.10
Optical indicators	3 x LED (LMS200/LMS291 only)
Data interface	RS 232 or RS 422 (selectable in the connector plug)
Data transfer rate	RS 232: 9.6 / 19.2 kbd RS 422: 9.6 / 19.2/ 38.4/ 500 kbd
Data format	1 start bit, 8 data bits, 1 stop bit, no parity (fixed)
Switching inputs	All LMS2xx except LMS2xx-S14 (LMS Fast): 1 x (“Restart“ or “Field set switching“), U_{in} = 12 to 24 V, I_{in} = 5 mA
Switching outputs (standard device)	LMS200/LMS291/LMS211/LMS221: 3 x PNP (OUT A to OUT C), high, typical 24 V DC (“field OK“), short-circuit-proof, selectable restart delay after field infringement (0; 100 ms to 255 s) – OUT A, OUT B (each max. 250 mA): “field infringement“ – OUT C (max. 100 mA): “field infringement/error indication (Weak)[5]“

1) Angular resolution 0.25° not possible in the area monitoring mode

2) Definition measurement accurcy:
Resolution:
The resolution of a measuring device is the smallest possible distance different from zero between two consecutive individual measurement values.
The resolution can be reduced by using averaged values.
Systematic error:
Environmental conditions: good visibilty, T_a = 23 °C, reflectivity 10 to 10,000 %.
The systematic error is the sum of all the deviations over a defined excent of range and reflectivity, which cannot be reduced even using averaged values.

3) **Statistical error:**
Standard deviation 1 sigma. The standard deviation is calculated using at least 100 measuring values of a target (object) with a certain reflectivity at a certain distance with a certain amount of illumination.

4) at T_a = 25 °C

5) For indicating an error, the output pulses with 1 Hz/5 Hz and different pulse ratios depending on the error type, see *Table 7-4, Page 21*.
Special devices LMS211/221-S19/-S20: indication of front window contamination (warning/error) additionally via OUT C switching output by statical signal

Table 12-1: Technical specifications of LMS200/LMS211/LMS221/LMS291

Type	Indoor: LMS200, Outdoor: LMS211, LMS221, LMS291
Switching outputs (special devices)	LMS211/LMS221-S07/-S20: – 2 x relay (OUT A, OUT B), contact closed (normal positon): “field OK“ max. switching voltage 48 V DC/26 V AC (extra-low voltage, safe isolation from mains) max. switching current 0.7 A, max. switching power 30 W – 1 x PNP (OUT C/Weak), High, typical 24 V DC, max. 100 mA, short-circuit-proof: “field infringement/error indication (Weak)[5]“ Restart delay after field infringement 0; 100 ms to 255 s (selectable)
Electrical connections	LMS200/LMS291: – 1 x plug module plug with 9-pin D Sub socket (solder connection) – 1 x plug module with 9-pin D Sub plug (solder connection) Each module plug with PG 9 cable gland for cable diameter 4 to 8 mm LMS211/LMS221: 1 x 16-pin plug (screw terminals) with 3 x PG 11 cable glands for cable diameter 5 to 12 mm
Operating voltage (according to IEC 364-4-41)	LMS electronics: 24 V DC ± 15 % (max. 500 mV ripple), current consumption max. 1.8 A (with output load) Heating (LMS211/LMS221): 24 V DC (max. 6 V ripple), current consumption max. 6 A (cyclic) Heating (LMS200/LMS291, via external heating plate (accessory)): 230 V AC ± 10 %, current consumption max. 2.5 A (cyclic)
Power consumption	Approx. 20 W (without load), additionally with heating: LMS211/LMS221 approx. 140 W LMS200/LMS291 approx. 30 W
Housing	LMS200/LMS291: Aluminium die-cast LMS211/LMS221: Aluminium die-cast (ground plate), PU (casing)
Enclosure rating (to DIN 40 050)	LMS200/LMS291: IP 65 LMS211/LMS221: IP 67
Protection class	Class 2 (to VDE 0106/IEC 1010-1), safety insulated
EMC test	to EN 61000-6-2, EN 61000-6-3/A11 (2004-07)
vibration test[6]	to IEC 68 part 2-6, table 2c (Frequency range 10 to 150 Hz, amplitude 0.35 mm or 5 g)
Shock test	single shock: to IEC 68 part 2-27, table 2, 15 g/11 ms permanen shock: to IEC 68 part 2-29, 10 g/16 ms
Weight (without installation accessories)	LMS200/LMS291: approx. 4.5 kg LMS211/LMS221: approx. 9 kg
Dimensions	*see Chapter 13 Dimensional Drawings, Page 31*
Mounting	LMS200/LMS291: 7 x fastening screw threads M6, 8 mm deep 4 x fastening screw threads M8, 9 mm deep LMS211/LMS221: 4 x fastening screw threads M8, 9 mm deep 14 x slots (square nuts M5) for mounting accessories like suneshade etc.
Ambient operating temperature	LMS200/LMS291: 0 to +50 °C (with heating plate –12 to +50 °C) LMS211/LMS221: –30 to +50 °C (warming-up time approx. 120 min. at –30 °C)
Storage temperature	–30 to +70 °C
Max. rel. humidity	90 %, non condensing (IP 65)
Colour	LMS200: SICK Blue (RAL 5012) LMS209-S02: not lacquered LMS211/LMS221/LMS291: grey (RAL 7032)

5) For indicating an error, the output pulses with 1 Hz/5 Hz and different pulse ratios depending on the error type, see *Table 7-4, Page 21*.
Special devices LMS211/221-S19/-S20: indication of front window contamination (warning/error) additionally via OUT C switching output by statical signal

6) Shock absorbers (on request) are recommended for heavy vibration and impact demands (e.g. AGV applications)

Table 12-1: Technical specifications of LMS200/LMS211/LMS221/LMS291 (contd.)

13 Dimensional Drawings

13.1 LMS200/LMS291

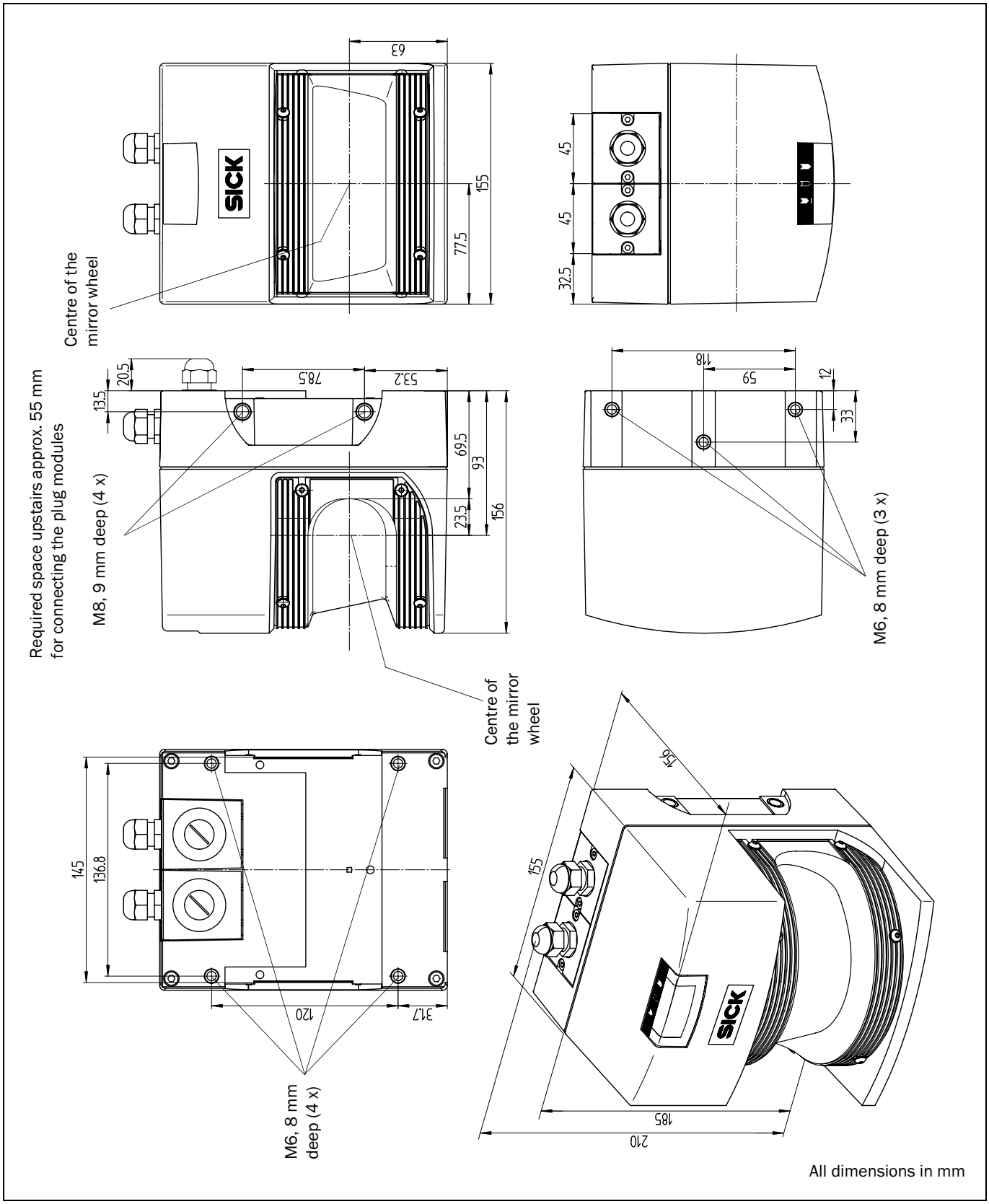


Fig. 13-1: LMS200/LMS291 dimensions

13.2 LMS211

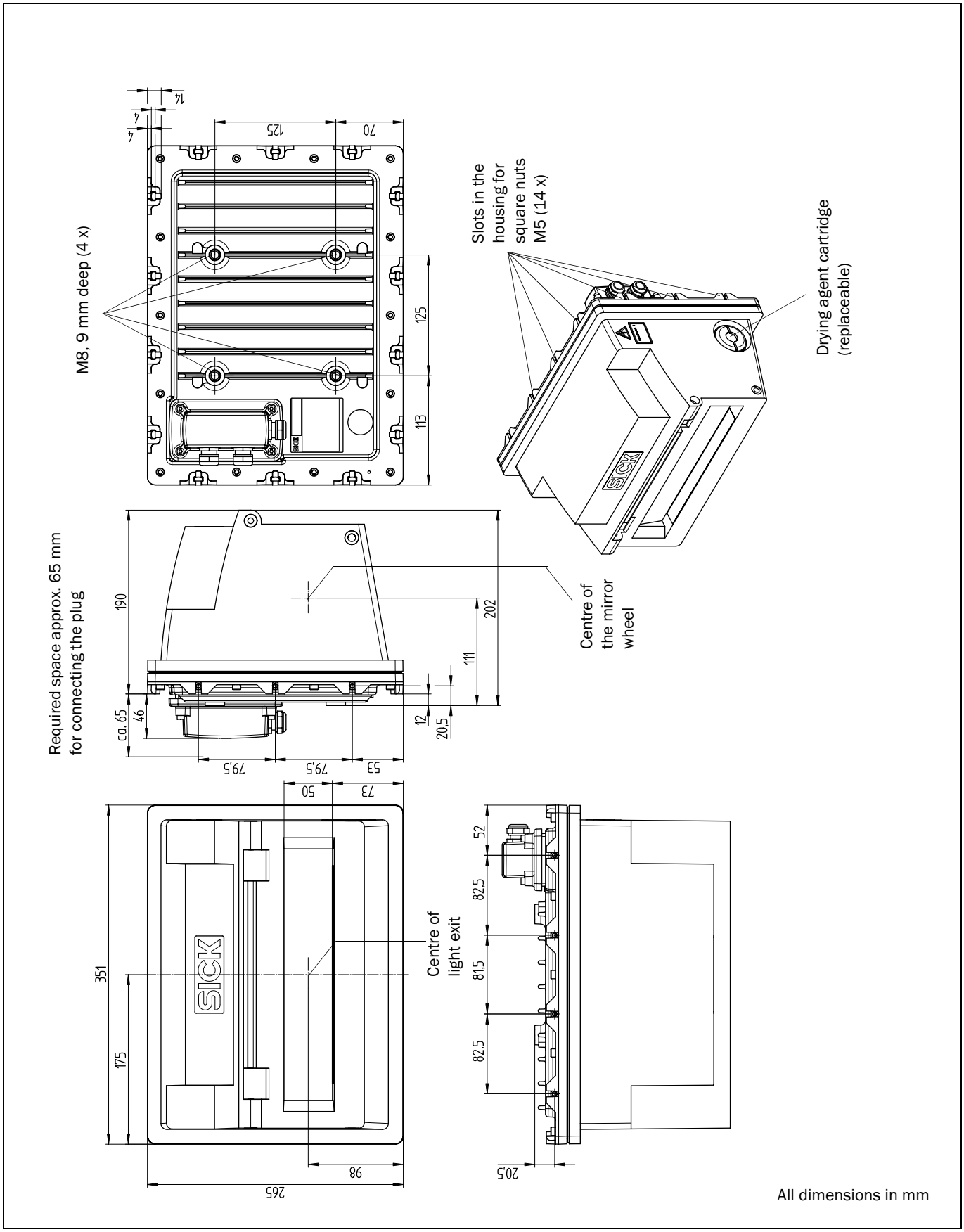


Fig. 13-2: LMS211 dimensions

13.3 LMS211 with Dust Prevention Shield

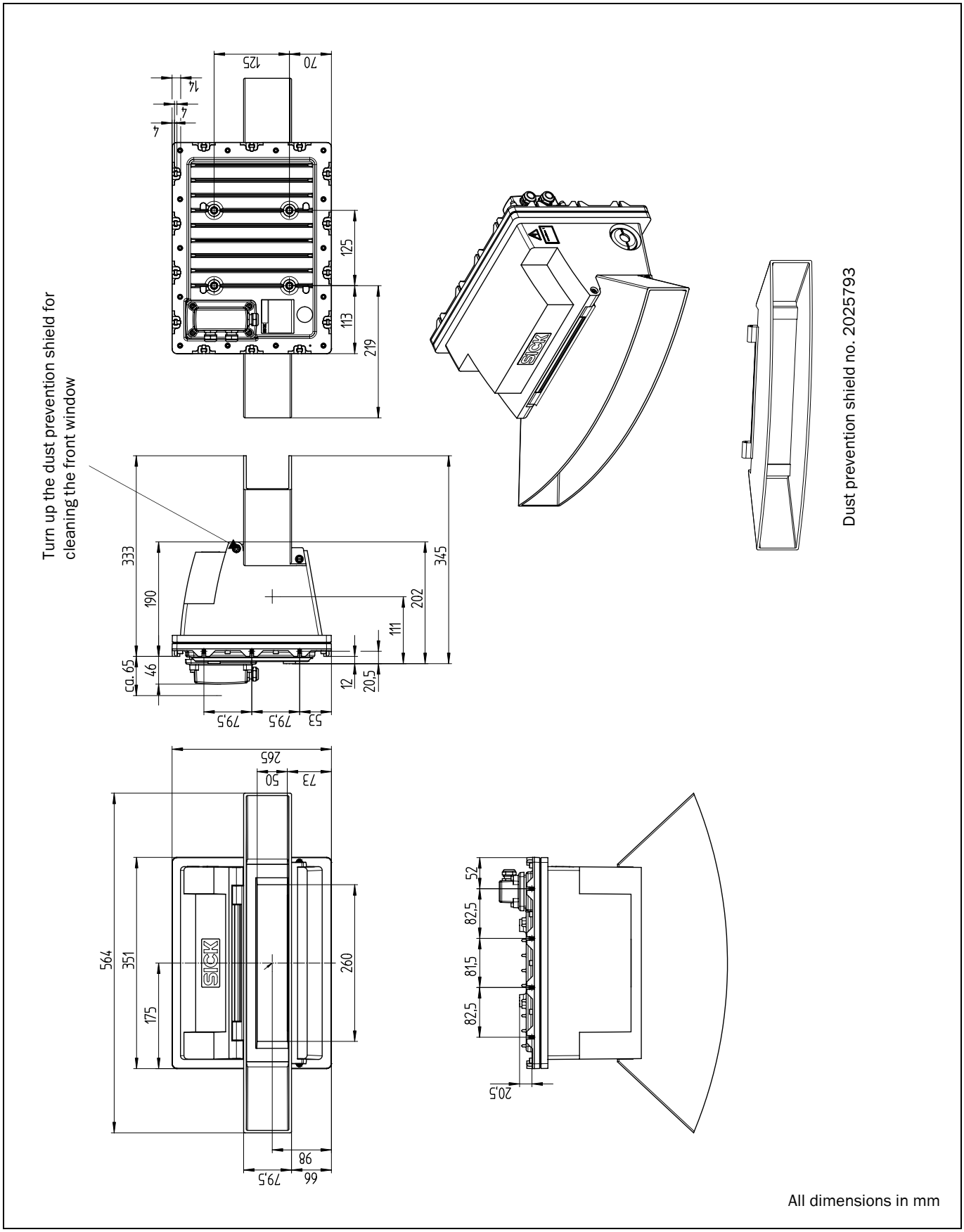


Fig. 13-3: Dimensions of LMS211 with mounted dust prevention shield no. 2025793

13.4 LMS221

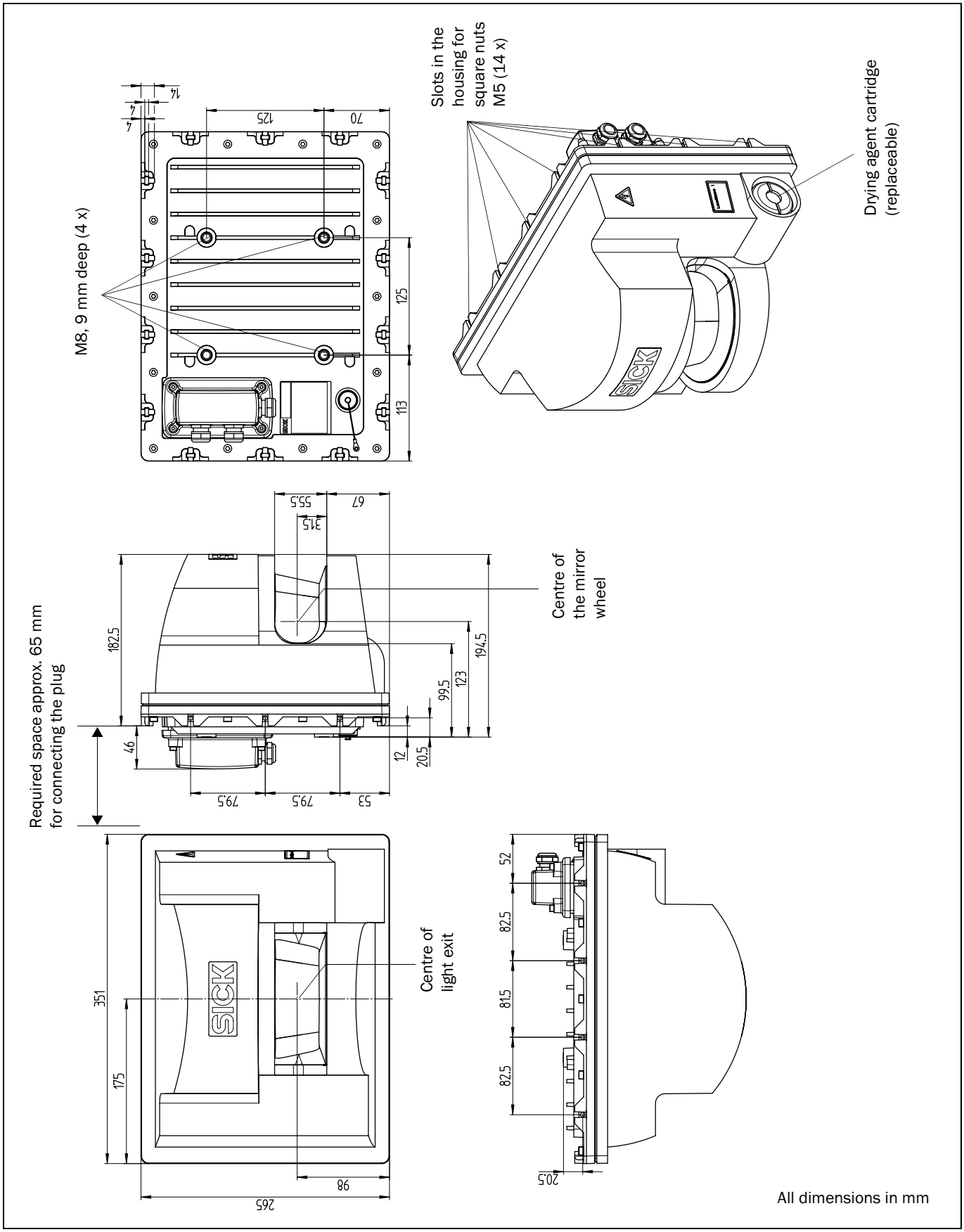
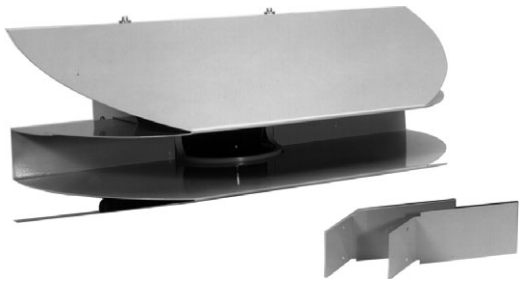
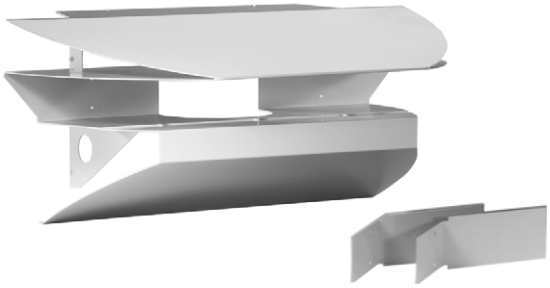


Fig. 13-4: Abmessungen des LMS221

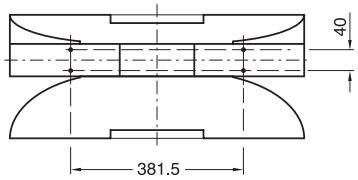
13.5 Accessories



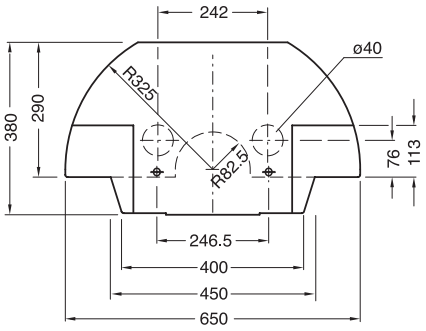
Weather protection hood no. 4034559
for vertical mounting

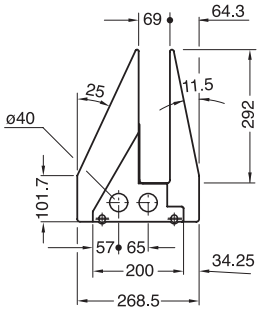


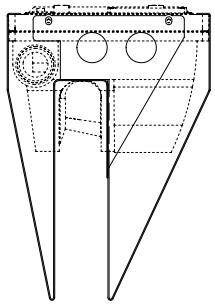
Weather protection hood no. 4039833
for horizontal mounting

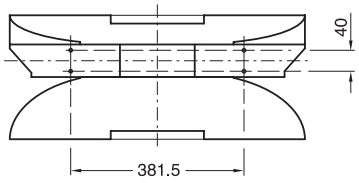


Weather protection hood no. 4034559
for vertical mounting the LMS221

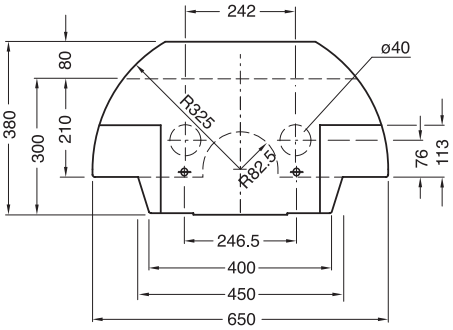


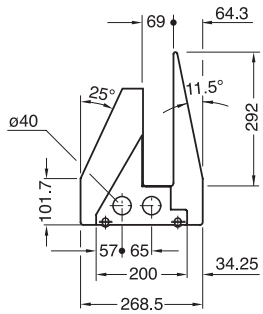


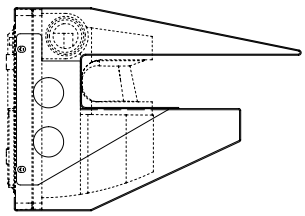




Weather protection hood no. 4039833
for horizontal mounting the LMS221







All dimensions in mm

Fig. 13-5: Dimensions of LMS221 weather protection hoods no. 4034559 and no. 4039833

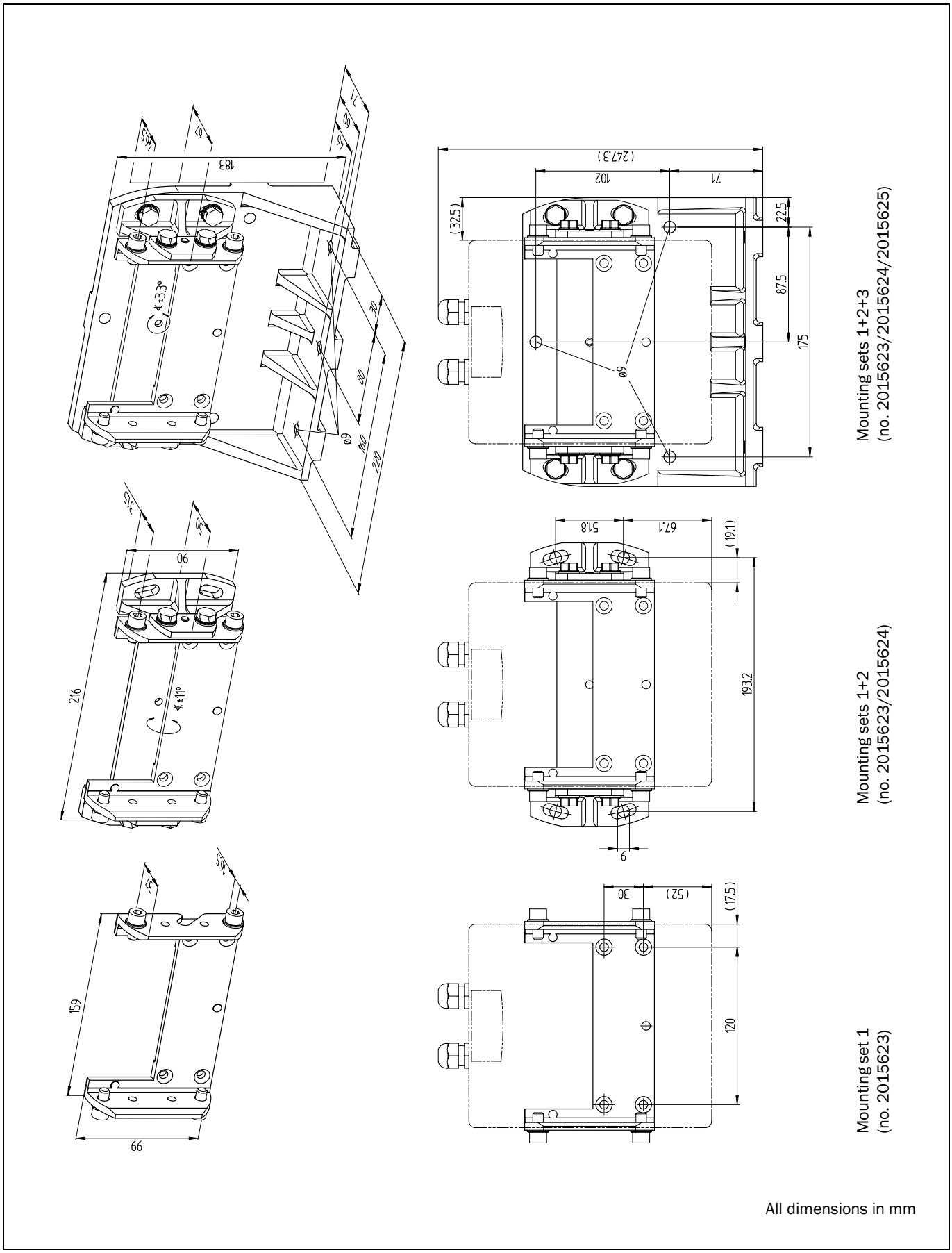
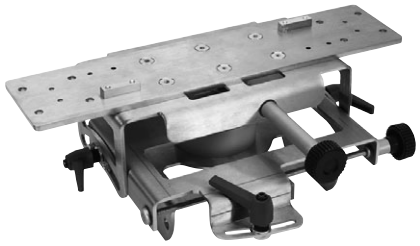
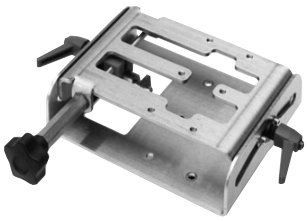


Fig. 13-6: Dimensions of mounting sets 1, 2 and 3 for LMS200/LMS291

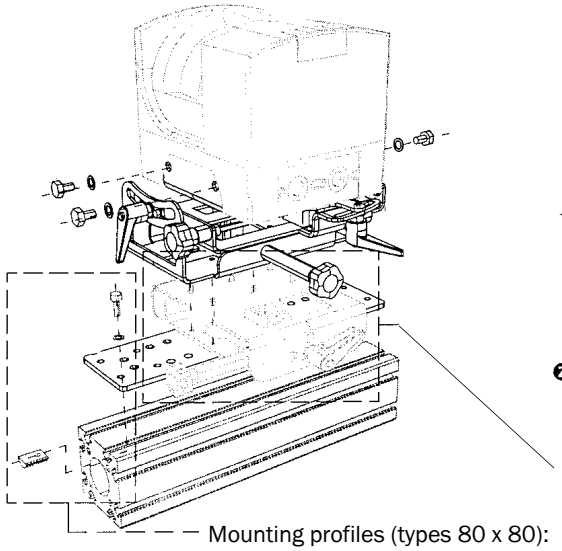


Mounting set no. 2020295



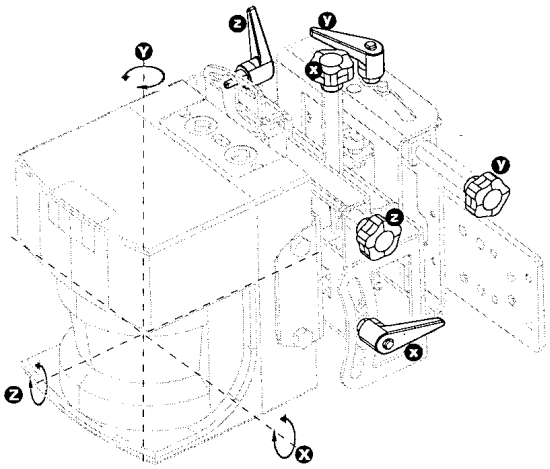
Mounting set no. 2020296

Mounting



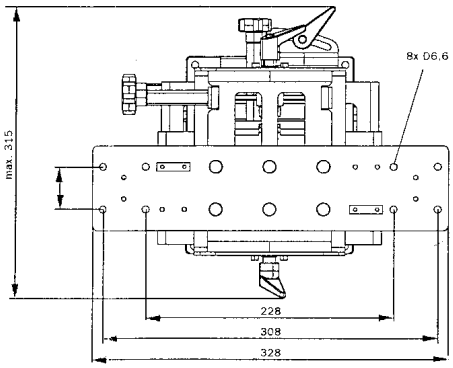
Mounting profiles (types 80 x 80):
4 x sliding block 8StM6, heavy
4 x screws
4 x washers
(not included in delivery)

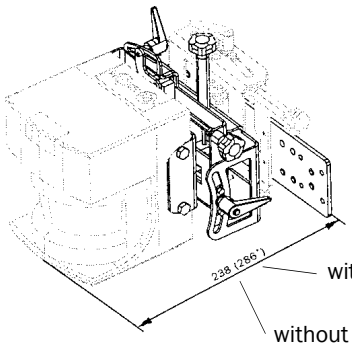
Adjusting the LMS200/LMS291



3rd axis
(mounting set
no. 2020926)

For detailed instructions see the mounting instructions enclosed to the mounting sets.





with 3rd axis

without 3rd axis

All dimensions in mm

Fig. 13-7: LMS200/LMS291 fine adjustment mounting sets no. 2020295/no. 2020296

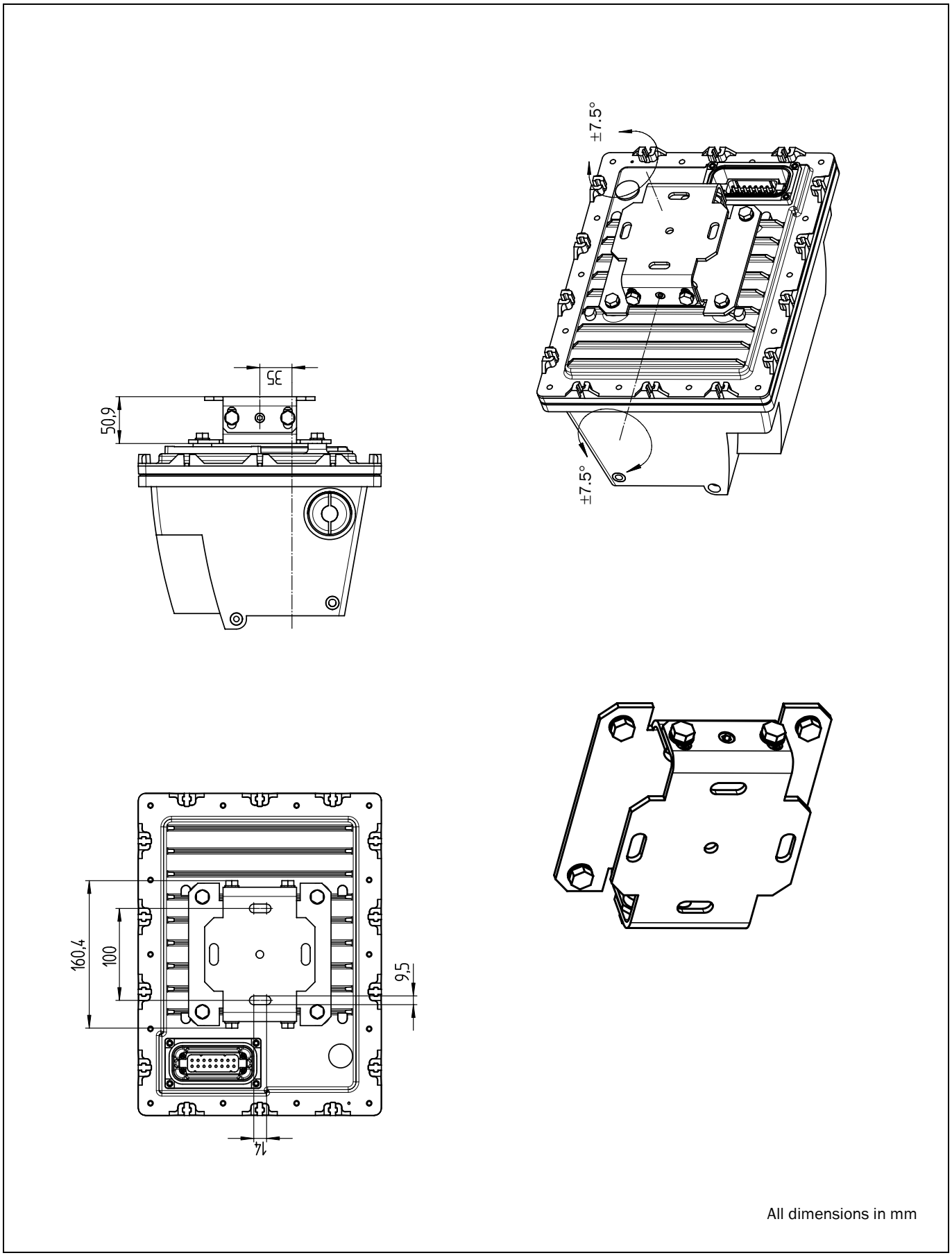


Fig. 13-8: Mounting set no. 2018303 for LMS211/LMS221 (wall mounting)

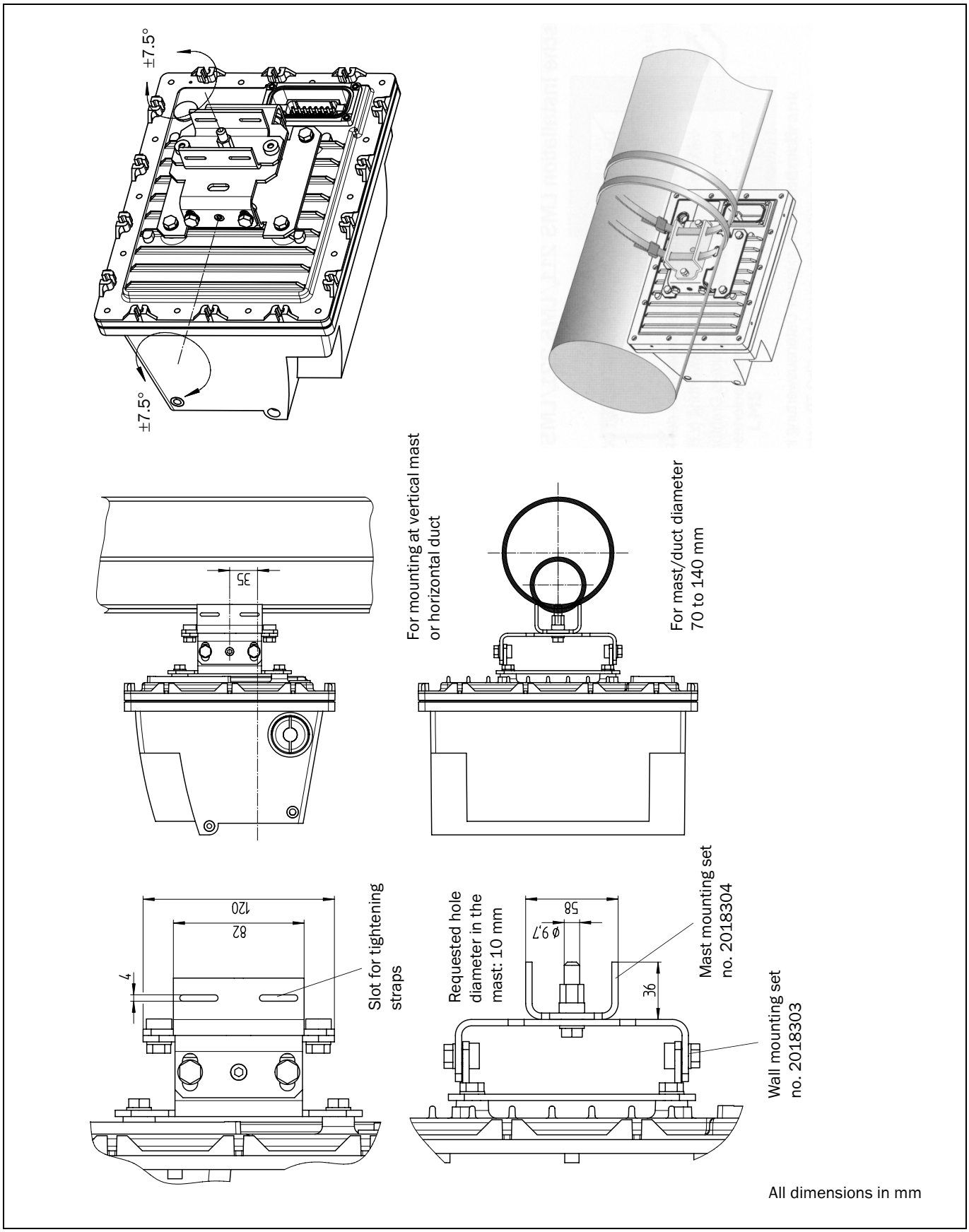


Fig. 13-9: Mounting sets no. 2018303/no. 2018304 for LMS211/LMS221 (mast mounting)

14 Ordering Information

14.1 LMS2xx Laser Measurement Systems

Order no.	Type	Scanning Angle	Angular Resolution	Typical range [1]	Temperature Range	Heating	Fog Correction
1015850	LMS200-30106[2]	180°	0.25°; 0.5°; 1°	10 m	0 to +50 °C	Accessory[8]	no
1016414	LMS209-S02[2][3]	180°	0.25°; 0.5°; 1°	10 m	0 to +50 °C	Accessory[8]	no
1018023	LMS211-30206	100°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes[9]	yes
1025629	LMS211-30106	100°	0.25°; 0.5°; 1°	10 m	–30 to +50 °C	yes[9]	no
1018022	LMS221-30206[2]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes
1026000	LMS221-30106[2]	180°	0.25°; 0.5°; 1°	10 m	–30 to +50 °C	yes	no
1018028	LMS291-S05[2]	180°	0.25°; 0.5°; 1°	30 m	0 to +50 °C	Accessory[8]	yes
1025329	LMS291-S14[4]	90°	0.5°	30 m	0 to +50 °C	Accessory[8]	yes
1026226	LMS291-S15[2][6]	180°	0.25°; 0.5°; 1°	30 m	0 to +50 °C	Accessory[8]	yes
1018966	LMS211-S07[5]	100°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes[9]	yes
1025487	LMS211-S14[4]	90°	0.5°	30 m	–30 to +50 °C	yes[9]	yes
1026225	LMS211-S15[6]	100°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes[9]	yes
1040061	LMS211-S19[10]	100°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes[9]	yes
1040435	LMS211-S20[5][10]	100°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes[9]	yes
1018965	LMS221-S07[2][5]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes
1025328	LMS221-S14[4]	90°	0.5°	30 m	–30 to +50 °C	yes	yes
1026224	LMS221-S15[2][6]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes
1027192	LMS221-S16[2][7]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes
1040060	LMS221-S19[10]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes
1040434	LMS221-S20[5][10]	180°	0.25°; 0.5°; 1°	30 m	–30 to +50 °C	yes	yes

1) with 10 % reflectivity
2) max. scan angle 100° with angular resolution 0.25°
3) Features as LMS200-30106, but housing not lacquered
4) LMS Fast (without “area monitoring“ function)
5) with 2 relay outputs/1 digital switching output
6) reduced data output volume
7) default setting: data transmission rate 500 KBd
8) external heating plate, expands the admissible temperature range from -12 to +50 °C
9) front window heating additionally to the inner heater
10) for security applications (area monitoring); max. 2 subtractive fields, indication for front window contamination (warning/error) via OUT C switching output

Table 14-1: Available LMS types (standard and special devices)

Scope of Delivery:

- Ordered LMS2xx type
- CD-ROM (no. 2034261) with LMSIB Configuration Software and manuals (see *Table 14-5, Page 45*)
- Ordered accessories

14.2 Accessories

14.2.1 LMS 200/LMS 291 Accessories

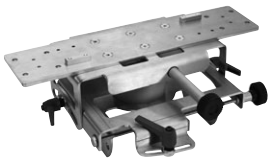
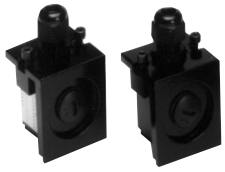
Order no.	Description	View
2015623	Mounting set 1, metal, weight approx. 250 g (incl. mounting accessories), black anodised. See also *Fig. 13-6, Page 36*.	
2015624	Mounting set 2, metal, weight approx. 350 g (incl. mounting accessories), black anodised. For installation mounting set 2 is also required. See also *Fig. 13-6, Page 36*.	
2015625	Mounting set 3, metal, weight approx. 1.6 kg (incl. mounting accessories), black anodised. For installation mounting sets 1 and 2 are also required. See also *Fig. 13-6, Page 36*.	
2020925	Fine adjustment mounting set (2-axis), basic unit, metall, weight approx. 3.3 kg (incl. mounting accessories). See also *Fig. 13-7, Page 37*.	
2020926	Extension for fine adjustment mounting set no. 2020925 (3rd axis), metall, weight approx. 1.4 kg (incl. mounting accessories). See also *Fig. 13-7, Page 37*.	
2018963	Connection set 1 (without cables): • 1 x LMS plug module (9-pin D Sub socket) for power supply/switching input/outputs • 1 x LMS plug module (9-pin D Sub plug) for RS 232/RS 422 data interface Each plug module provided with a cable gland (metal) M16 x 1.5 for cable diameter 4 to 8 mm	
2027786	Connection set 2: • 1 x cable for power supply/switching input/outputs with LMS plug module (9-pin D Sub socket) and open end, 6 x 0.56 mm², shielded, length 5 m • 1 x data interface cable (pre-set to RS 232) with LMS plug module (9-pin D Sub plug) and 9-pin D Sub socket, shielded, length 5 m	
2027787	Connection set 3, as 2027786, but length 10 m	–

Table 14-2: LMS 200/LMS 291 Accessories

Order no.	Description	View
2027788	Connection set 4: • 1 x cable for power supply/switching input/outputs with LMS plug module (9-pin D Sub socket) and open end, 6 x 0.56 mm², shielded, length 10 m • 1 x data cable (pre-set to RS 232) with LMS plug module (9-pin D Sub plug) and 9-pin D Sub socket, shielded, length 10 m. For connecting the LMS200/LMS291 to the PC interface card Quatech DSC-200/300 (2 x RS 422 High Speed, 500 kBd)	
2019522	External heating plate, 230 V AC/30 W, metal, weight approx. 1.4 kg (incl. mounting accessories), black (RAL 9005). See also *Fig. 9-2, Page 25*.	

Table 14-2: LMS 200/LMS 291 Accessories

14.2.2 LMS 211/LMS 221 Accessories

Order no.	Description	View
2018303	Mounting set for wall mounting, metall, weight approx. 1.6 kg (incl. mounting accessories). See also *Fig. 13-8, Page 38*.	
2018304	Mast attachment set, metall, weight approx. 400 g (incl. mounting accessories). For installation mounting set no. 2018803 is also required. See also *Fig. 13-9, Page 39*.	
5306222	Steel tightening strap for mast attachment set (per metre), 19 mm x 0.7 mm	–
5306221	Steel tightening strap lock	–
2025793	Dust prevention shield for **LMS211**, plastic (PU), weight approx. 800 g, grey (RAL 7032). See also *Fig. 13-3, Page 33*.	

Table 14-3: LMS211/LMS221 Accessories

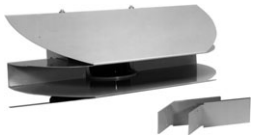
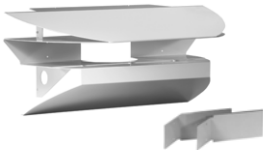
Order no.	Description	View
7040289	Purging air fan SLV 4, 230 V AC/50 Hz, weight approx. 13 kg	
1029127	Purging air fan, 24 V DC, weight approx. 13 kg	–
7044003	Purging air hood for **LMS211**, weight approx 12.45 kg	–
7040396	Purging air tube, ∅ 40 mm, length 3 m	–
7040397	Purging air tube, ∅ 40 mm, length 5 m	–
7040398	Purging air tube, ∅ 40 mm, length 10 m	–
4034559	Weather protection hood if the **LMS221** is mounted in vertical position. Aluminium alloy ALMG3G22, surface IGP polyester coated, weight approx. 3.6 kg (incl. mounting accessories), grey (RAL 7032). See also *Fig. 13-5, Page 35*.	
4039833	Weather protection hood if the **LMS221** is mounted in horizontal position. Aluminium alloy ALMG3G22, surface IGP polyester coated, weight approx. 3.6 kg (incl. mounting accessories), grey (RAL 7032). See also *Fig. 13-5, Page 35*.	
2019561	Service cable, pre-set to RS 232 (switchable to RS 422 using a bridge in the LMS plug module), consists of: • 1 x LMS connector (16-pin socket) with data cable (RS 232/422) and 9-pin D Sub socket, shielded, length 5 m • 1 x cable for power supply with LMS connector (16-pin plug), 2 x 0.93 mm^2, shielded, length 5 m. The service cable is used for being interconnected between an extisting connection from the LMS211/ LMS221 connector (plug) to the customer-specific wired socket.	

Table 14-3: LMS211/LMS221 Accessories (contd.)

14.2.3 LMS2xx General Accessories

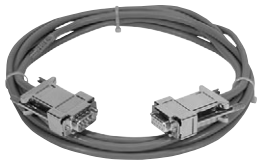
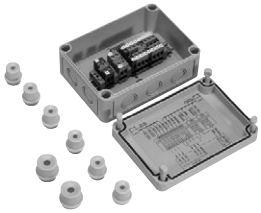
Order no.	Description	View
6011103	Data cable, wheatherproof, diameter 7.5 mm, 2 x 2 x 0.22 mm², twisted pair, shielded, black outer line, suitable for laying directly in the ground, per metre	–
2016401	Data cable (pre-set for RS232), with 9-pin D Sub plug and socket, 2 x 2 wires, twisted pair, shielded, length 3 m. For connecting the PC to the LMS 200/LMS 291 to configure the system.	
2016402	Data cable, as 2016401, but length 5 m	–
2016403	Data cable, as 2016401, but length 10 m	–
6022515	Serial interface card for PC (PCI bus), 2 x RS 422, high speed (500 kBd)	
6022427	Power supply unit 100 to 240 V AC, 50 to 60 Hz/24 V DC/**2.5 A**, enclosure rating IP 20, 45 mm x 75 mm x (91 mm + DIN top hat rail), weight approx. 230 g	
6010362	Power supply unit 100 to 240 V AC, 50 to 60 Hz/24 V DC/**4 A**, enclosure rating IP 20, 80 mm x 135 mm x 120 mm	–
6020875	Power supply unit 115/230 V AC, 50 to 60 Hz/24 V DC/**10 A**, enclosure rating IP 20, 120 mm x 124 mm x (102 mm + DIN-DIN top hat rail), weight approx. 1.2 kg	
6020756	LS-70B scan finder (alignment aid) for manual/continuous operation, with LED display and acoustic indicator, power supply from 9 V block batterie (supplied).	
2021520	External connection box for synchronisation of two LMS2xx, plastic, with 10 screw terminals on DIN top hat rail for wire diameter 0.2 to 2.5 mm², 130 mm x 94 mm x 57 mm, enclosure rating IP 54 (for IP 65 the approppriate PG cable glands are to be used, tradeware). See also *Fig. 8-2, Page 23*.	
4003353	SICK lens cloth for cleaning the front window	–
One request	Shock absorber	–
2034261	CD-ROM with LMSIBS Configuration Software and manuals	See *Table 14-5, Page 45*

Table 14-4: LMS2xx accessories, general

14.2.4 Software/Manuals (included in the scope of delivery)

Order no.	Description	Format
–	LMSIBS Configuration software, German/English edition	–
8009115 8010120	LMSIBS Configuration Software Operating Instructions, German edition Supplement to the Operating Instructions	PDF PDF
8009116 8010121	LMSIBS Configuration Software Operating Instructions, English edition Supplement to the Operating Instructions	PDF PDF
8007953 8007954	LMS2xx Telegram Listing, German edition LMS2xx Telegram Listing, English edition	PDF PDF
8008969 8008970	LMS 200 to LMS291 Technical Desription, German edition LMS 200 to LMS291 Technical Desription, English edition	PDF PDF
–	Acrobat Reader (latest version) for reading/printing PDF files	PDF

Table 14-5: Accessories: Software/Manuals on CD-ROM (no. 2034261)

14.2.5 LMS200/LMS291 Spare Parts

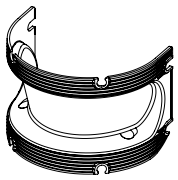
Order no.	Description	View
2022271	Front window kit	

Table 14-6: Accessories: LMS200/LMS291 spare part

14.2.6 LMS211/LMS221 Spare Parts

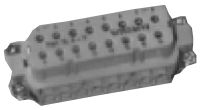
Order no.	Description	View
5306179	Drying agent cartridge, srew in thread M36 x 1.5. See also *Fig. 13-2, Page 32* and *Fig. 13-4, Page 34*.	
2018301	16-pin plug (insert included) with housing	
6004379	16-pin plug insert (socket), for plug no. 2018301	

Table 14-7: Accessories: LMS211/LMS221 spare parts

14.2.7 System Applications/Extensions

Order no.	Description
1016761	LMI200 Interface (evaluation and control unit for measurement applications)
On Request	Customer-specific evaluations

Table 14-8: Accessories: System applications/extentions

15 Glossary of Terms

Monitoring fields Freely configurable, two-dimensionsal zones (areas). If an detected object is in a particular zone (field infringement) the LMS2xx changes the signal level at the associated switching output. This means that the LMS2xx switches the statical signal from typical 24 V DC (high) to signal ground (low). In contrast, special devices with relay outputs (normal position: contact closed) opens the external circuit.

Field set A field set comprises max. 3 configurable monitoring fields (field A, B, C). The LMS2xx can store 2 field sets.

Field set switching Change between the two field sets in the LMS2xx. When starting the system always field set 1 is active. Switching to field set 2 takes place via the restart input using a statical 24 V DC-signal or using a command (telegram) via the data interface.

Field infringement An object is detected within a specified monitoring field.

Field, teach-in Instead of configuring a segmented field the data can be taugh in. The LMS2xx defines its entire free field of vision as a monitoring area. The field limits follows the environment contour precisely. Field areas that are not required can be deleted manually.

Field, subtractive Allows a zone to be monitored that is the “space remaining“ when field B is deducted from field A. Special devices for security applications can operate with max. 2 subtractive fields.

Field, temporary A field form can be defined and activated by external data information, transfer time to the LMS2xx is about ca. 200 ms (temporary because when is power supply is removed the field is lost).

Blanking Is set in cm as the so-called blanking factor. The blanking factor defines the minimum object size (depends on distance) that can lead to registration at the switching outputs. In the area monitoring, the blanking is only possible in conjunction with scan-oriented evaluation (not in conjunction with pixel-oriented evaluation).

Field evaluation To prevent errorneous switching causes by particles, etc. the LMS2xx evaluates the fields using various processes (scan-oriented or pixel-oriented, always in conjunction with multiple reading).

Field evaluation, scan-oriented With scan-oriented evaluation the LMS2xx stores and verifies a field infringement (at any particular location) using multiple readings. If the LMS2xx registers further infringements in subsequent scans in the field (at any particular location) the signal level at the associated switching output changes after the number of multiple readings defined have elapsed.

Field evaluation, pixel-oriented In contrast to the scan-oriented evaluation, the LMS2xx evaluates every single beam in pixel-oriented mode. If further infringements occur consecutively at the same beam position, the signal level at the associated switching output changes. This method is best suited for increasing availability in rain or snow.

Contour as reference Using this function the LMS2xx monitors the surrounding area (background) of a monitored field. This means that an object’s existence (e.g. house wall) is constantly being verified. If the contour ceases to be registered the corresponding switching output changes the signal level even without any infringement of a field. The range of validity of the reference contour can be set as desired. The function can also be used to prevent sabotage.

Restart *Automatic:* The associated field switching output is activated as soon as the field becomes clear (see above).
After delay: The associated field switching output is activated after a set time delay has elapsed (when the field is clear (see above)).
With button: The associated field switching output is activated when the external button is actuated when the field is clear (see above)).

16 EC Declaration of Conformity

Fig. 16-1 shows the scaled down copy of the EC Declaration of Conformity (page 1).
Complete copy of EC Declaration of Conformity on request.

SICK

EC Declaration of conformity

Ident-No. : 9055675 O639

The undersigned, representing the following manufacturer

SICK AG
Nimburger Straße 11
79276 Reute
Deutschland

herewith declares that the product

LMS2..

is in conformity with the provisions of the following EC directive(s) (including all applicable amendments), and that the standards and/or technical specifications referenced in page 2 have been applied.

(place),..Reute..... (date),..2004-12-15

ppa. Pierenkemper
(Manager Development
Division Auto Ident)

ppa. Walter
(Manager Production
Division Auto Ident)

Fig. 16-1: Copy of the Declaration of Conformity, Page 1 (scaled down)

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