OMS1/100 CAN-BUS with Preset via Bus
(Device-Net-Slave)

Operating Manual
Laser Measuring Device

Please keep for future use !

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Right of modification

We reserve the right to make modifications to the information contained in this document at any time in the interests of improving our products.

Notation

Italics or **bold** print is used for titles of documents or for emphasis.

`Courier` type is used for text which is visible on the screen/display and for software menu selections.

″ < > ″ is used to refer to the keys of your computer keyboard (e.g. <RETURN>).

Revision History

Note

The cover of this document shows the current revision status and the corresponding date. Since each individual page has its own revision status and date in the footer, there may be different revision statuses within the document.

Documents that are in the appendix have their own revision history.

Document created: 25.09.2002

Revision	Date

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1 Safety

1.1 General Potential for Danger

The Laser Measuring Device OMS1/100 cannot function as a stand-alone unit, i.e. it is a component part that is intended to be installed in a complete system consisting of several such components working together. This means that the Laser Measuring Device does not have a direct protection device of its own.

Warning

At a beam interruption or at too low intensity the laser outputs instead of the actual position an programmed error value (see page 16 - 18). It is therefore essential to integrate the error value into your **own safety system** via the evaluation software (e.g. a PLC).
The corresponding measures must be taken in order to avoid person and property damages.

All persons responsible for the assembly, start-up and operation of the device must

- be suitably qualified
- adhere strictly to this operating manual.

Your safety and the safety of your equipment depends on this!

1.2 Safety information

This operating manual contains information which must be observed in the interests of your own personal safety and that of your equipment. The safety hints are emphasised by a warning triangle and classified according to the degree of danger as follows:

Warning
means that failure to take the relevant safety precautions can lead to death, serious injury or major damage to property.

Caution
means that failure to take the relevant safety precautions can lead to minor injuries or damage to property.

Note
refers to important information and features of the product, plus tips on its application.

1.2.1 Installation Information

Due to the fact that the Laser Measuring Device is normally used as a component part of a larger system, this information is intended to provide a guideline for safe installation of the Laser in its environment.

Warning

- Observe the safety and accident prevention regulations that apply to the specific application.
- In the case of equipment with a fixed connection (stationary installations/systems) without allpole mains switches and/or fuses, you must install a mains switch or a fuse in the system and connect the equipment to a protective earth.
- Before using devices that are running with mains voltage, check whether the adjusted voltage range matches the local mains voltage.
- With a 24-V supply, ensure safe electrical isolation from the mains. Use only mains units that comply with IEC 364-4-41 or HD 384.04.41 (VDE 0100 Part 410) standards.
- Fluctuations or variations from the rated mains voltage may not exceed the tolerances stated in the technical data. If they do, functional failures of the electrical components and hazardous conditions cannot be ruled out.
- You must take precautions to ensure that, after voltage drops and failures, it is possible to restart an interrupted program in an orderly manner. In this context, no dangerous operating status conditions may occure even for a brief period of time. If necessary, you must force an **EMERGENCY STOP.**
- EMERGENCY STOP devices that comply with EN 60204/IEC 204 (VDE 0113) must remain effective in all the operating modes of the automation equipment. Unlocking the EMERGENCY STOP devices must not result in an uncontrolled or undefined restart.
- Install the power and signal lines such that inductive and capacitive interference does not adversely affect the automation functions.
- Equipment of automation and its operation devices have to be sufficiently protected against being operated by mistakes.
- Take appropriate hardware and software measures for the case of cable of wire breakages to prevent undefined status conditions of the automation equipment.

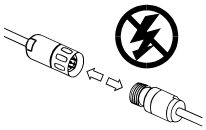
1.2.1.1 General Measures for Interference Suppression

- Route (screened) lines connecting to the Laser either a long way from or completely physically separated from energy lines that carry disturbances.
- Use only completely screened lines for data transfer and ensure they are well earthed. In the case of differential data transfer, (RS422, RS485 etc.), you must additionally use twisted-pair lines.
- Use cables with a minimum cross-section of 0.22 mm² for data transfer.
- Use a ground cable with a minimum cross-section of 10 mm² to avoid equipotential bonding via the screen. In this context, you should ensure that the ground cable's resistance must be much lower than the screen's resistance.
- Wire the screen continuously keeping a large area in contact with special screen connecting terminals.
- Avoid crossing cable. If this is not possible the cables should only cross at right-angles.

1.3 Appropriate Use

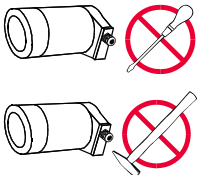
The measuring system is used for recording linear movements as well as to condition measuring data for a controller on the output side which has a CAN-fieldbus interface according to ISO/DIS 11898.

Warning



Switch off the voltage supply before carrying out wiring work or opening and closing electrical connections!
Short-circuits, voltage peaks, etc. can cause operating failures and uncontrolled operating states, as well as serious personal injuries and damage to property.

Check all electrical connections before switching on the system!
Incorrectly wired connections can cause operating failures, while wrong connections can lead to serious personal injuries and damage to property.



Mechanical or electrical modifications to the measuring systems ***are prohibited for safety reasons!***

Caution

Laser beam
Do not look into the beam

Laser class	: 2
Acc. to EN 60 825-1	: 1994
Max. laser power $P_{max.}$	: ≤ 1 mW
Wavelength λ	: 670 nm

- In the case of Class 2 laser devices, the eye is protected against brief, accidental glances at the beam by the blinking reflex. For this reason, devices of this class can be used without additional protective measures provided the operator is not required to look into the laser beam deliberately for longer periods, i.e. 0.25 s, or to look repeatedly into the laser beam itself or the directly reflected beam.

- The device must be installed in such a way that the exposure of persons to the laser beam can only happen accidentally.

- The laser beam may only extend as far as is necessary for the range measurement. The beam must be limited at the end of the useful range by a diffusely reflecting target area in such a way as to minimise the danger from direct or diffuse reflection. For this purpose, you should use the Leuze electronic reflecting foil supplied with the device.

- The area outside the operating range where the unshielded laser beam falls should be limited as far as possible and should remain out of bounds, particularly in the area above and below eye level.

i ***Note***

The start-up, operating and programming instructions contained in this manual are mandatory.

1.4 Authorized Operators

A device may only be commissioned by qualified personnel. In the context of the safety-specific information in this document, qualified personnel are considered to be persons who are authorized to commission, ground and mark circuits, equipment and systems in accordance with recognized safety standards.

1.5 Safety Measures at the Place of Assembly

Warning

Do not perform any welding work once the device is connected and switched on!
Variations in potential can destroy the device or restrict its operation.

Do not touch plug contacts with your hands!
Static charges may destroy electronic components of the device.

Do not connect unused inputs (see pin assignment)!

Observe the voltage supply range:

Standard device:	18-27 V DC (± 5 %)
Device with heating:	24 V DC (± 5 %)

i ***Note***
Make sure that the environment of the installation site is protected against corrosive media (acids, etc.)

2 Transportation / Commissioning

2.1 Transportation / Storage

Transport instructions

Do not drop the device or expose it to shocks or vibrations!
Device contains an optical system with glass elements.

Only use the original packaging!
The wrong packaging material can cause damage to the device during transportation.

Storage

Storage temperature : -20 to +75°C

Store in dry conditions.

2.2 Assembly instructions

Aligning the Laser Measuring Device

The measuring device or reflector is attached to the moving object and the reflector/sensor to the fixed remote station in such a way that the reflector always remains within the visual field of the sensor. This can be done using the light spot of the laser diode, which is still clearly visible on the reflecting foil even at long distance. When aligning the laser measuring device, the user may need to take measures to ensure that it can be mechanically adjusted.

The size of the reflecting foil must be such that the light spot cannot be displaced from the reflector by vibrations. The device comes with a reflecting foil measuring 20 x 20 [cm], but other sizes can be ordered on request.

i ***Note***

Reflecting foils by other manufacturers should be used only after consultation with Leuze electronic, as all the information in the "Technical Data" chapter refers to the foil already supplied with the device.

2.3 Commissioning

2.3.1 General

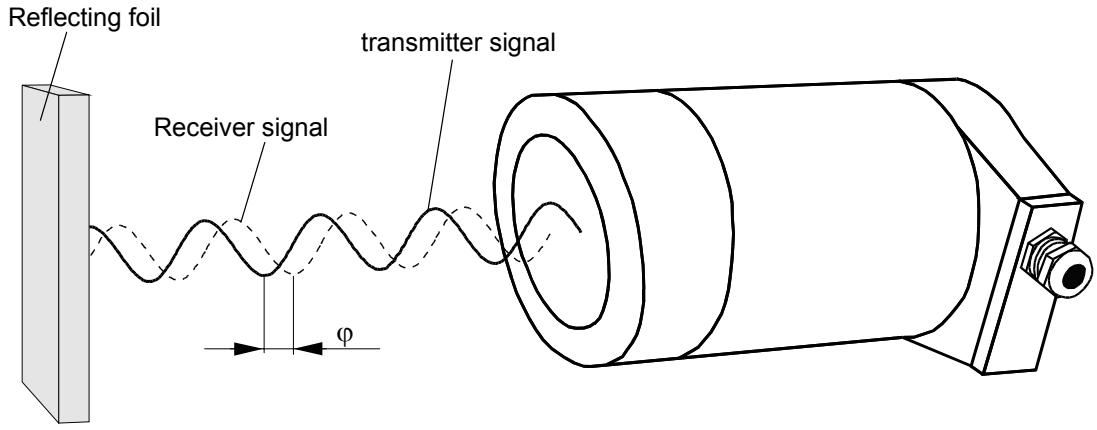
The OMS1/100 series Laser Measuring Devices are optical sensors for contactless measurement of the distance between the sensor and a reflector.

For this purpose, the measuring device or reflector attached to the moving object and the reflector/sensor to the fixed remote station in such a way that the reflector always remains within the visual field of the sensor.

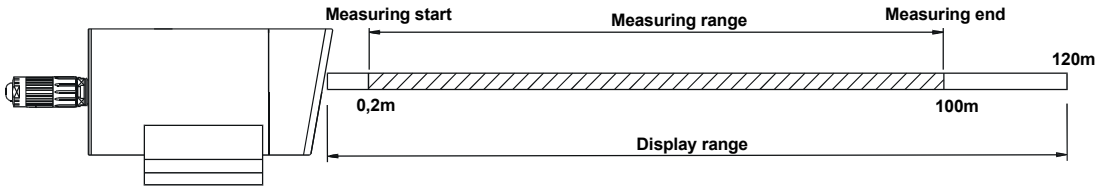
The laser diode inside the device emits a beam which bounces back off the reflector and is re-received by a detector also housed inside the measuring device. The phase angle of the received signal in relation to the transmitted signal is the measure of distance. The absolute distance value thus obtained is then transferred to the control system via the interface.

The Laser Measuring Devices are configured by a automation device (PLC, process control computer) directly via the CAN-Bus.

Principle:



φ = Phase displacement
d = Distance
d = f (φ)



2.3.2 Laser Interface

The CAN-Fieldbus-Interface (separated galvanically by CAN-BUS-Driver SJA1000) in the Laser is determined according to the international standard ISO/DIS 11898 and covers the two lower layers of the ISO/OSI reference module.
The transformation of Laser information into the CAN protocol occurs by the protocol chip SJA1000. The function of the protocol chip is monitored by a watchdog.

The **PREDEFINED MASTER/SLAVE CONNECTION SET** is used for the Laser who only works as a slave. It will be used only the **Group 2 Messages** with the exception of the **Group 1 Message For Slave I/O Poll Response**.
Establishing or breakdown of a connection must occur via **Group 2 Only Unconnected Explicit Request Message**.
The Laser contains an **I/O Communication Port** and an **Explicit Message Communication Port**. The I/O **communication port** is used for polling the Laser position and must be made accessible by setting the watchdog (after the I/O connection master/slave was set up before). Is the I/O port not retriggered (polled) punctually the connection is interrupted and the red LED flashes. The connection for the I/O port must be installed again.

i ***Note***
During programming, data is exchanged between the Laser and the master in binary form.

2.3.2.1 Messages

Following messages are supported by the Laser:

- I/O Poll Command/Respond Message
  This message is sent directly by the master to the desired slave (point-to point). For every slave which is polled the master must sent an own poll command message. As response on a Poll Command the slave sends back to the master the Poll Response I/O Message.

- Explicit Response/Request Message
  Explicit Request Messages are used for processing of write/read attribute's. Explicit Response Messages contains the result of an Explicit Request Message Service.

- Group 2 Only Unconnected Explicit Request Message
  Group 2 Only Unconnected Explicit Request Message serves for the establishing or breakdown of connections for the Predefined Master/Slave Connection Set.

- Duplicate MAC ID Check Message
  After switch-on the slave he reports Duplicate MAC ID Messages.

2.3.2.2 Classes

The communication objects are divided into classes. The Laser supports the following classes:

Object Class	Number of instances
Identity	1
Message Router	1
DeviceNet	1
Connection	2
Assembly	2
Parameter	8
Position Sensor	1

2.3.2.3 I/O Instance

Input Instance

Number	Name
1	Position value

Input Data Format

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	Low Byte Position Value							
	1	.							
	2	.							
	3	High Byte Position Value							

Output Instance

Number	Name
1	Preset

Output Data Format

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	0	0	0	0	0	0	0	Preset 1

To adjust the Laser to the internal stored preset 1 value, bit 2^0 of the out-byte has to be set to "1".
For a new adjustment each of the bits has to be reset to "0" for at least one polling cycle. Preset cycles lower than 500ms are not allowed.

3 Parameter Programming

3.1 Configuration Assembly Data Attribute Format

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
42	0	Direction of counting							
	1	Clear Preset							
	2 to 5	Step Length in 1/1000 mm							
	6 to 9	Error value							
	10 to 13	Low Byte Preset 1 / High Byte Preset 1							
	14 to 15	Data Check							

While programming the parameters via the "Assembly-Class" the Laser returns as response while reading the programmed values (16 bytes total) to the master. The data check is practised automatically.

3.2 Parameter Object Instances

Number	Name	Data type
1	Direction of Counting	USINT
2	Clear Preset	USINT
3	Step Length in 1/1000 mm	UDINT
4	Error value	UDINT
5	Preset 1	USINT
6	Data-Check	UINT
7	Adjustment	UDINT
8	Software version	UDINT

If the parameters are programmed via the "Parameter-Class", for taking over the data, a Data-Check must be practised subsequently (otherwise the programmed values are lost after Power off/on).

3.3 Parameters / Value Ranges

3.3.1 Direction of Counting - Service 001 Hex

Value 0 (2^{31} to 2^{0}) = movement away from the laser, values increasing
Value $\neq 0$ (2^{31} to 2^{0}) = movement towards the laser, values increasing

3.3.2 Clear Preset - Service 002 Hex

Via this parameter, the calculated zero-point is deleted (difference of the desired preset value to the physical laser position). After deletion of the zero-point correction the laser outputs his "real" physical position.

3.3.3 Step-Length in 1/1000 mm - Service 003 Hex

Via the parameter "Step-Length", the resolution of the measuring system is defined.

Input value in 1/1000 mm
For example 1 mm corresponds to the input value 1000, this indicates that the laser outputs 1 step/mm.

3.3.4 Error value - Service 004 Hex

Determination of the error value which is output instead of the actual value at a beam interruption.

3.3.5 Preset value 1 - Service 005 Hex

Specification of the position value, on which the Laser is adjusted when the preset function is activated (see "I/O Instance" on page 15).

The value must be within the measurement range of 100 m.

3.3.6 Preset-Adjustment - Service 007 Hex

By adjustment, via the CAN-bus the Laser is set to the desired position value.
After the adjustment, no Data-Check is necessary.

The value must be within the measurement range of 100 m.

4 Disturbance

4.1 Cause of Fault and Remedy

Malfunction Code	Cause	Remedy
Output of the error value which is output instead of the actual value at a beam interruption or a below-minimum intensity (service 004), see page 16 - 18.	The device checks the intensity of the received laser signal continuously, it was detected a below-minimum intensity.	1. Clean measuring system optics 2. Clean reflecting foil 3. Rule out an interruption of the laser beam After elimination of the disturbance the actual position is output again automatically. If the possibility of soiling or interruption of the laser signal can be ruled out, the device must be replaced.

5 Appendix

5.1 Technical Data

> **i** ***Note***
> The electric characteristics have validity, only after an operating time of approximate 30 minutes.

5.1.1 Electrical Characteristic Data

Measuring principle: ..... Phase delay time measurement

Range (measurement on reflecting foil): ..... 0,2 – 100 m
Range > 100m..... upon request

Operating voltage
Standard device: ..... 18-27 V DC (+/- 5%)
Device with heating: ..... 24 V DC

Power consumption (no-load): ..... < 6 watts

Power consumption with heating: ..... < 60 watts

Opto-transmitter: ..... Laser diode (red light)
Wavelength λ: ..... 670 nm
Max. laser power: ..... P ≤ 1 mW
Laser protection class: ..... 2 (IEC 825)
Lifetime: ..... 50 000 h

Opto-receiver: ..... Photodiode

Resolution: ..... ≥ 0,001 mm

Updating / refresh cycle: ..... 1000 values / s

Reproduction: ..... ± 2 mm (at 5 sigma for sigma = 0,4 mm)

Integration time: ..... < 2 ms

Can-DeviceNet Interface: ..... CAN-Fieldbus-Interface (opto-isolated)
CAN-BUS-Driver (ISO/DIS 11898)
Baud rate (adjustable): ..... 125 kbaud, line length up to 500 m
250 kbaud, line length up to 250 m
500 kbaud, line length up to 100 m
Output code: ..... Binary
Special features: ..... Programming of following parameters via the CAN-Bus:
- Direction of Counting
- Clear Preset
- Step-Length
- Error value
- Preset 1
- Preset-Adjustment

5.1.2 Environmental conditions

EMC:	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating temperature range:	0-50°C
Device with heating:	-30 to +50°C
Thermal drift:	1 ppm / °C
Storage temperature range:	-20 to +75°C
Relative air humidity:	98 % (no moisture condensation)
***** **Degree of protection:**	IP 65 (DIN 40 050)

***** The degree of protection is based on the assumption that the Laser Measuring Device cables are correctly screwed in and connected.

Connector pin assignment Laser Measuring Devices OMS1/100 DeviceNet

General note:

The CAN-Bus line has to be terminated at the beginning or at the end with a terminating resistor of 121 ohms ***(CAN-TERMINATOR)***.

Explanation of terms:

COMBICON 9-pole:	Connector Phoenix COMBICON 12A/250V, grid 5.08 mm		
Connection:	inflexible 0,2 - 2,5 mm^2	flexible 0,2 - 2,5 mm^2	Conductor sizes (AWG) 24 - 12
	flexible with wire end sleeve without plastic sleeve: -	flexible with wire end sleeve with plastic sleeve: -	
US:	Supply voltage: Standard device: 18 - 27 V DC, Device with heating: 24 V DC		

X1 - COMBICON 9-pole

Pin 1 CAN_H
Pin 2 CAN_L
Pin 3 CAN_GND
Pin 4 N.C.
Pin 5 Shield
Pin 6 Do not connect !
Pin 7 Do not connect !
Pin 8 0V - supply voltage
Pin 9 US - supply voltage

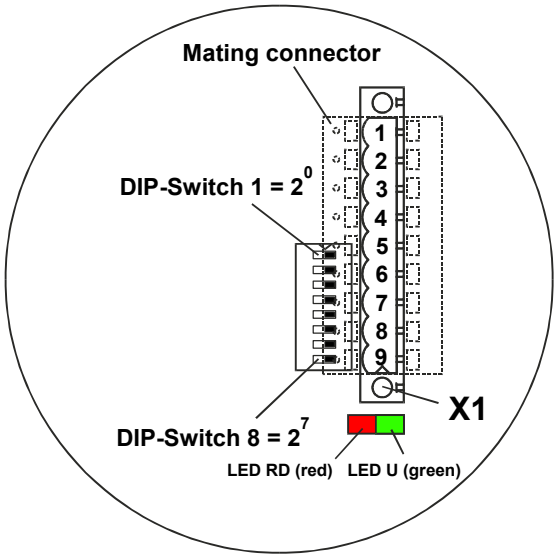
LED off	Encoder is not on-line - No Dup_MAC_ID-test - Device may not be powered
green	On-line, with connections in the established state - Device is allocated to a master
green flashing	Dup-MAC-ID test successful Device is not allocated to a master
red flashing	Recoverable fault - e.g. I/O-connections are in the timed-out state
red	- Turn off system, after that turn on system - Replace encoder

Identifier

DIP-switch 6 = identifier 2^5	DIP-switch 5 = identifier 2^4	DIP-switch 4 = identifier 2^3	DIP-switch 3 = identifier 2^2	DIP-switch 2 = identifier 2^1	DIP-switch 1 = identifier 2^0	Encoder address = identifier
off	off	off	off	off	off	0
off	off	off	off	off	on	1
off	off	off	off	on	off	2
.	.	.	.	.	.	.
.	.	.	.	.	.	.
on	on	on	on	on	off	62
on	on	on	on	on	on	63

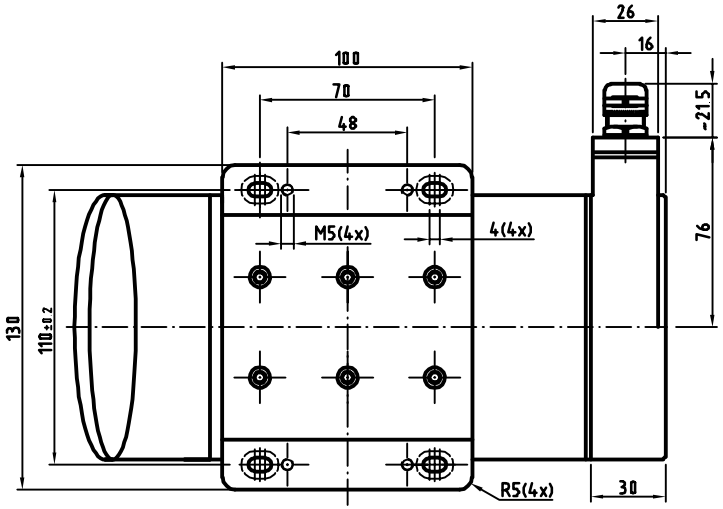
Baud rate

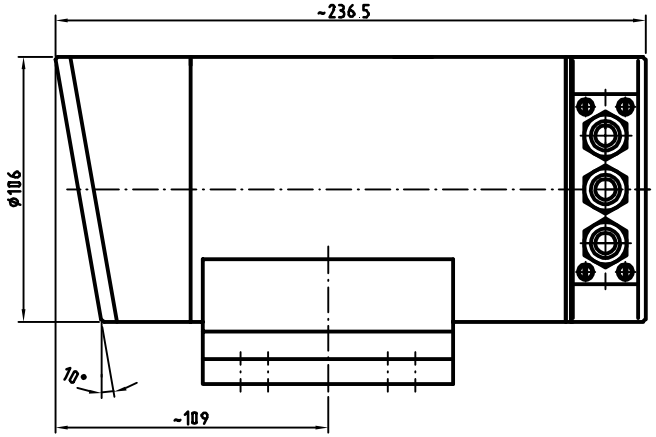
DIP-switch 8	DIP-switch 7	Baud rate
off	off	125 kbps
off	on	250 kbps
on	off	500 kbps

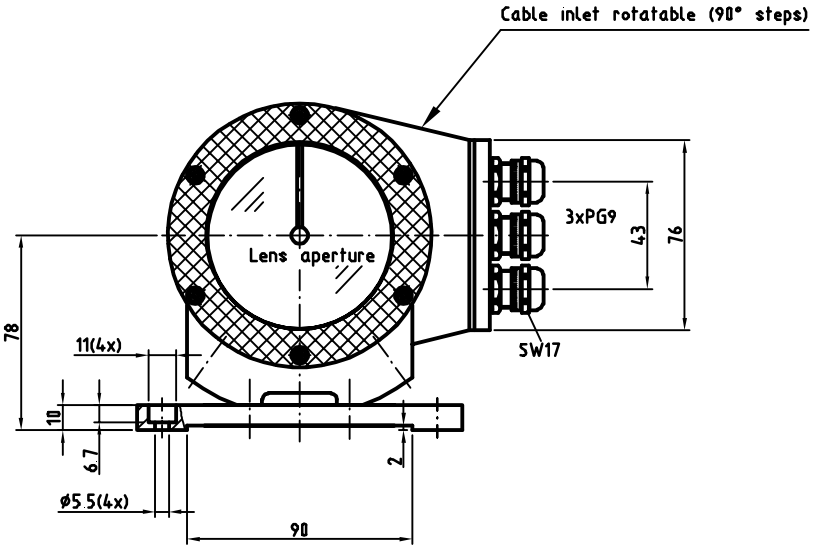


Range selector switch

OFF: <100m
ON : >100m: Do not move the measuring system in the voltage-loose state below or above the 100m mark! The non-compliance leads to measuring errors, the measuring system must be moved back into the range as described.







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						Article-No.:	
						Order-No.:	
					Datum	Name	
				Erstellt			Type: CAN/DEVICE NET
				Bearb.			
				Gepr.			
				Norm			
				Pin connections:		Drawing-No.:	Blatt 1
				-			Bl
Zust.	Änderung	Datum	Name	EDV-NR.:			

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