Operating instructions.

OM70 laser point / laser line tolerance sensors

Baumer
Passion for Sensors

Contents

1 General information

1.1 Concerning the contents of this document

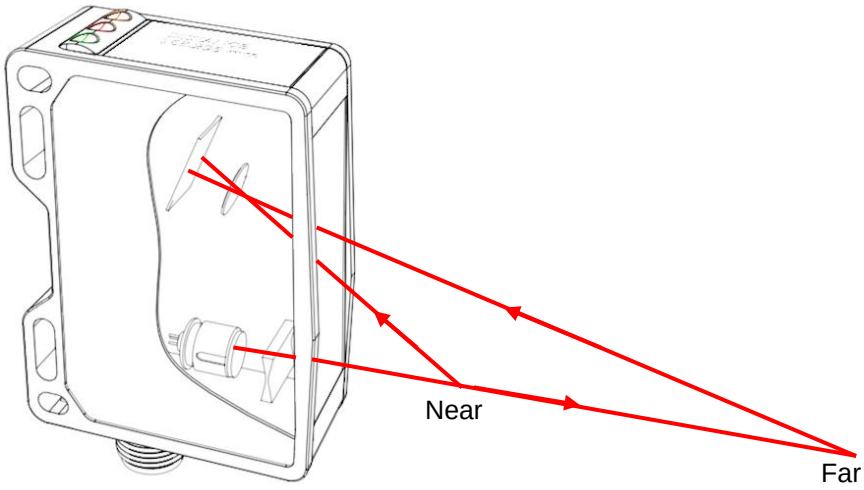
This manual contains information about the installation and initial setup of Baumer OM70 laser point / laser line sensors.
It is a supplement to the mounting instructions supplied with each sensor.

Read these operating instructions carefully and follow the safety instructions!

1.2 Intended use

The Baumer OM70 laser point / laser line sensor measures tolerances in relation to a taught reference. It was specially developed for easy handling, flexible use, and highly accurate measurement.

1.2.1 Functional principle of triangulation

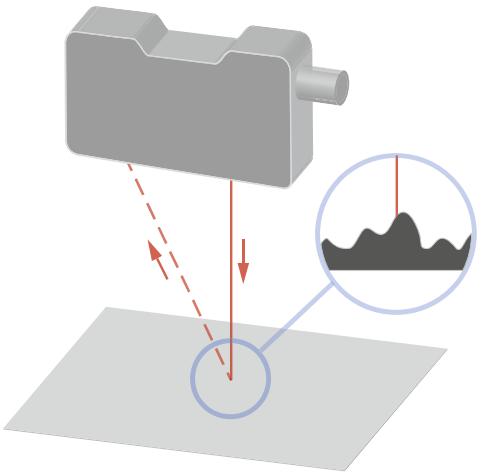


In the triangulation principle, the sensor transmits a light point or light beam to the object to be measured, and the reflected light strikes a receiver line in the sensor at a special angle. Depending on the distance, the angle of incidence changes and thus so does the position of the light spot or light beam on the receiver. The micro-controller allows the suppression of interfering reflections, thus providing reliable data even on critical surfaces.

1.2.2 Laser point or laser line

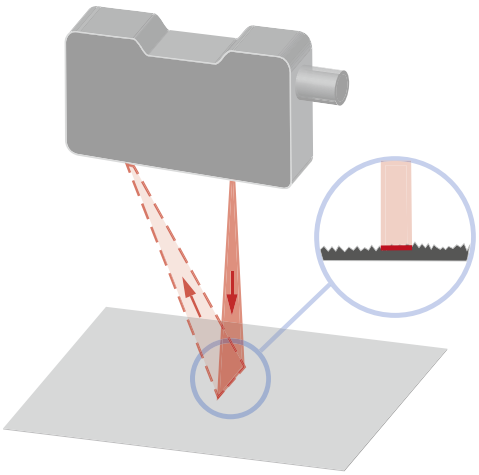
OM70 laser point

For small objects, if accurate positioning of the laser point is important, or for sharp transitions, a sensor with a laser point is suitable.



OM70 laser line

Stable measurements on rough surfaces and textured color surfaces thanks to a fine laser line < 10 mm



1.3 Safety

NOTE

Provides helpful operation instructions or other general recommendations.

CAUTION!

Indicates a potentially hazardous situation. Avoid these situations in order to prevent any personal injury or damage to the device.

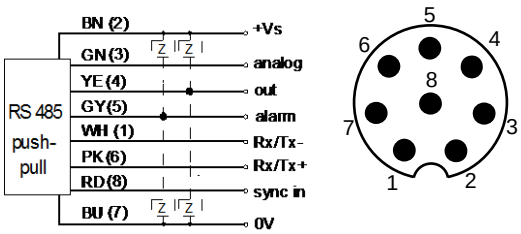
2 Quick start-up guide

After connection and installation, the sensor is configured using the display. The sensor is then ready for operation and shows the measured value in mm on the screen. Optionally, the analog output can also be limited or the switching output configured.

1	Connection
2	Installation
3	Application-specific settings
4	Let's get started

1 Connection

Connect the sensor according to the connection diagram. A shielded connection cable (8-pole M12) must be used.
When everything is correctly connected, the sensor starts up.



Key functions

ESC	= Back
ESC 2 sec.	= Run mode
UP	= Up/increase value
DOWN	= Down/decrease value
SET	= OK
SET 2 sec.	= Save value

Slide over all 4 keys:

---->	= Enable the panel if locked
<----	= Jump to run mode

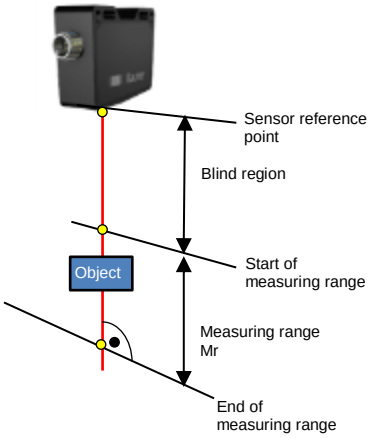
Setting the language

The language is selected and confirmed by pressing SET for 2 seconds.

English
Deutsch
Italiano
Français

2 Installation

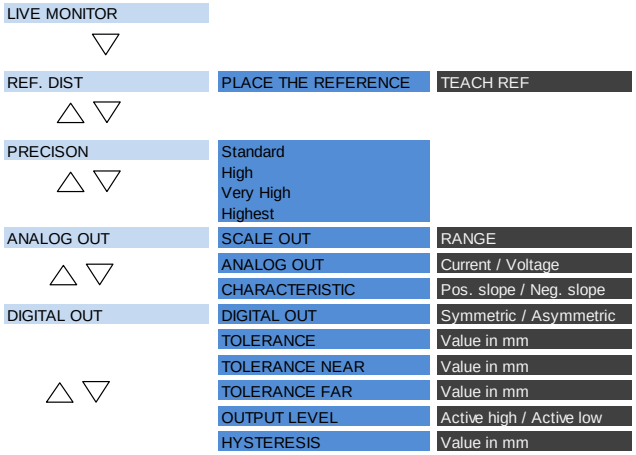
For standard applications, the sensor is mounted and aligned at right angles to the measuring axis. See Alignment Chapter.
The object must be within the measuring range Mr, i.e. between the start of the measuring range Sdc, and the end of the measuring range Sde.



3 Application-specific settings

Teaching the reference

Everything is measured from this reference point. If the object is closer to the sensor, the distance is given with a negative value (-) in mm, and if the object further away, it is given with a positive value (+).



Precision (filter)

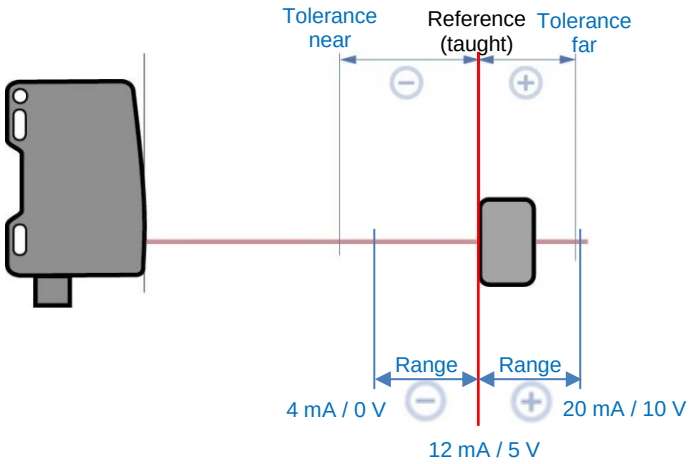
To achieve better resolution, it is possible to alternate between Standard, High ,Very High and Highest by filtering the output values.

Analog Out

With SCALE OUT, the range can be restricted symmetrically around the reference point, thus optimizing the resolution and linearity of the analog output. For the point near the sensor, 0V or 4 mA apply, and for the more distant point 10V or 20mA. The voltage or current output is also selected under ANALOG OUT. The characteristic curve can also be inverted under CHARACTERISTIC.

Digital Out

The sensor has a switching output which can be configured either symmetrically or asymmetrically from the reference point under DIGITAL OUT.
The output level can also be inverted and the hysteresis set here.



4 Let's get started

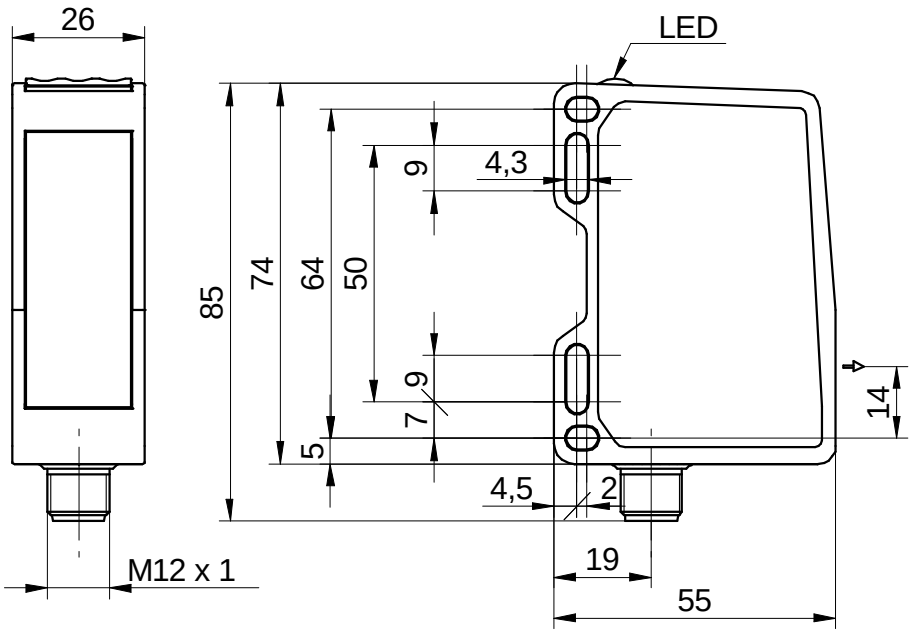
The sensor continuously shows the deviation (tolerance) in mm on the display and transmits it to the controller using the analog output. Alternatively, the measuring value can also be retrieved from the RS-485 interface.

3 Mounting and connections

CAUTION!

Connection, installation and commissioning may only be performed by qualified personnel. Protect optical surfaces from moisture and dirt.

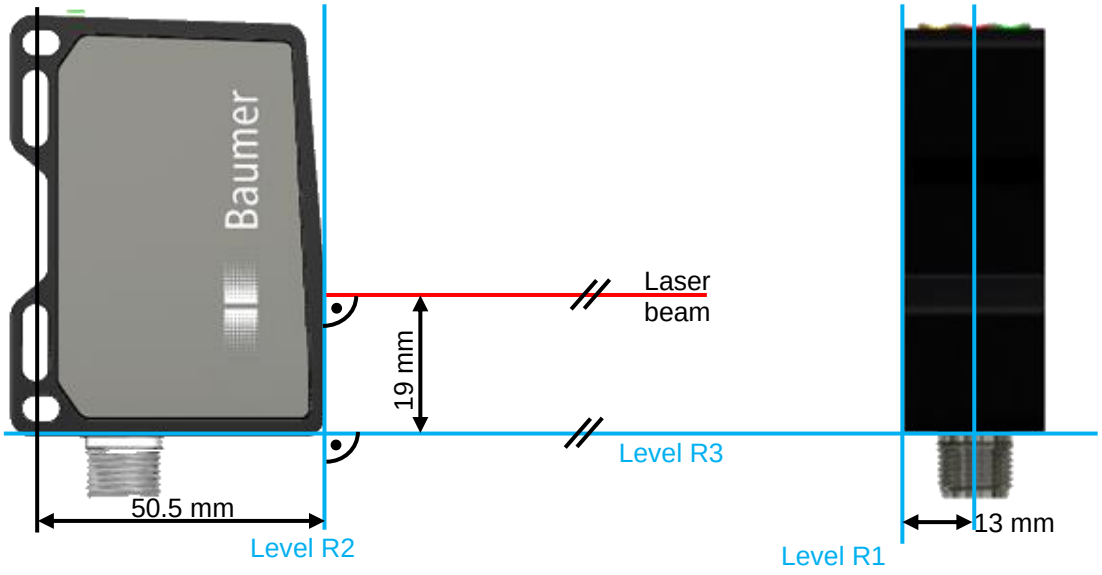
3.1 Dimensions



*Optical axis

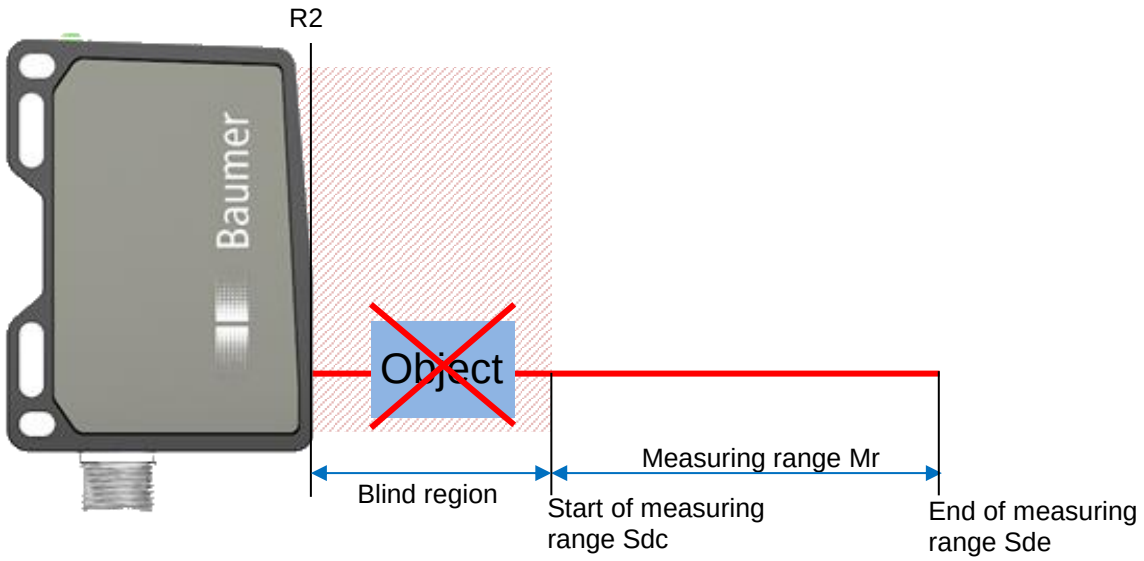
3.1 Sensor reference levels

The sensor can be aligned by the following surfaces:
The laser beam of the sensor runs parallel (//) to level R3 and is at a right angle to levels R1 and R2. Levels R1, R2, and R3 serve as a reference for sensor alignment during installation.



3.2 Definition of the measuring range

The sensor measures distances within the measuring range. The important definitions are described in the following figure. The reference level R2 applies as a reference for 0.



3.2.1 Blind region

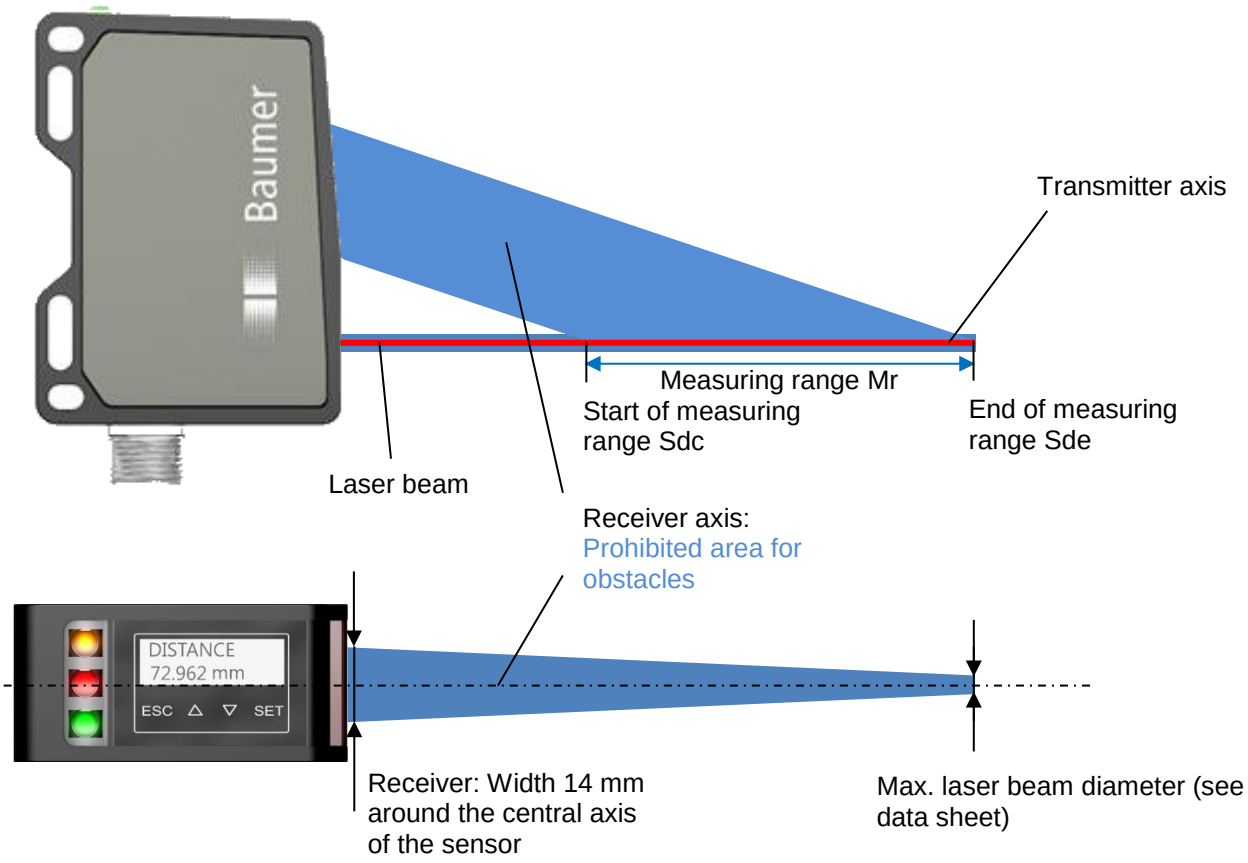
The area from the reference level R2 up to the start of measuring range Sdc is called the blind region, the sensor cannot detect any objects there.
If there are any objects in this region, this can lead to incorrect measured values.

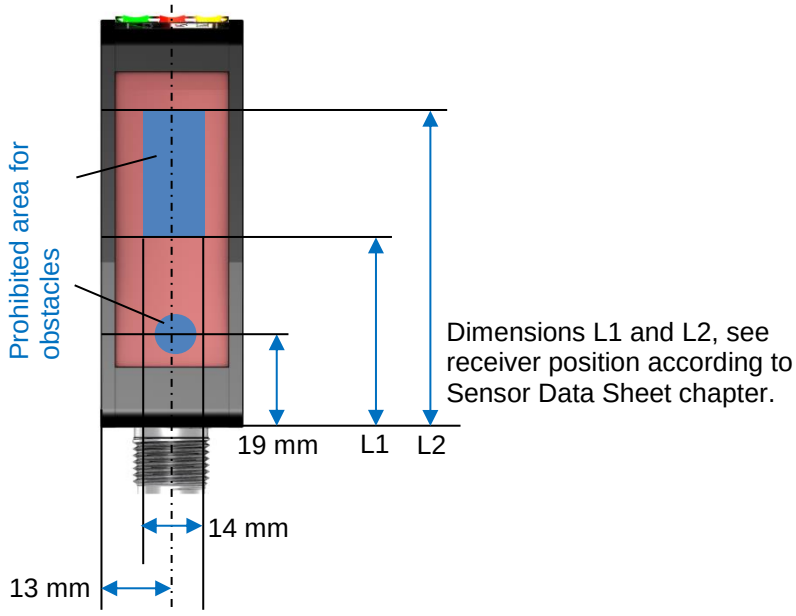
NOTE

See chapter ANALOG OUT for further information on the analog output.

3.2.2 Transmitter and receiver axis

The transmitter and receiver axes must not be covered by obstacles, since this could adversely affect precise measurements.



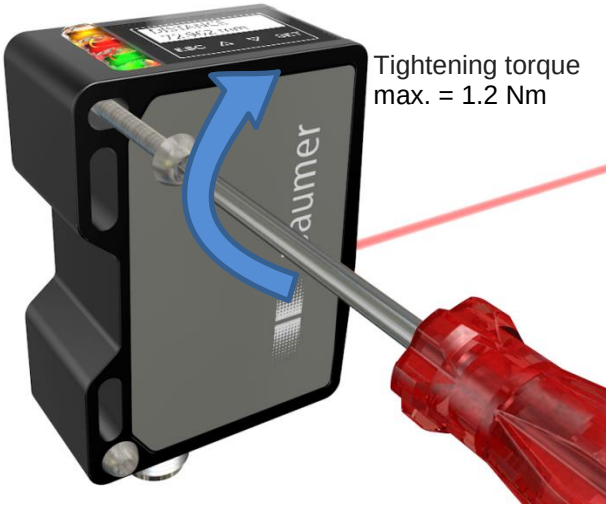


3.2.3 qTarget

The field of view is aligned with the housing reference surfaces at the factory. The beam position is in the same place for every sensor, which simplifies planning and sensor replacement.

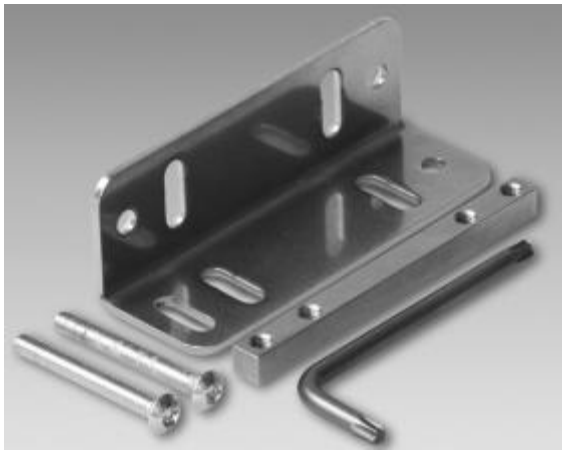
3.3 Mounting

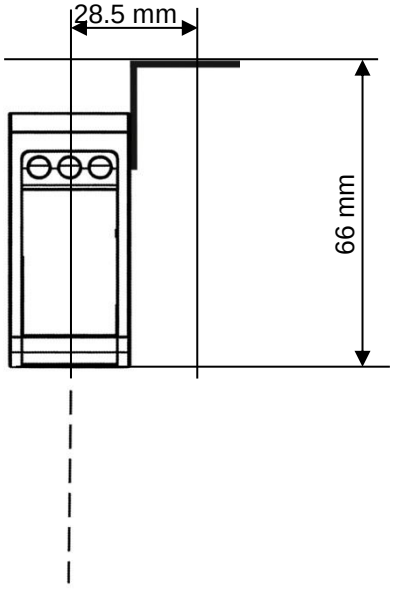
The sensor has four mounting holes for flexible alignment and mounting. The use of 2 M4x35 screws as well as suitable washers is recommended for mounting. The tightening torque is max. 1.2 Nm.



3.3.1 Mounting kit for standard installation Order no. 11120705

With the mounting bracket for standard installation, the sensor can be mounted quickly and easily at a 90° angle to the reference surface.





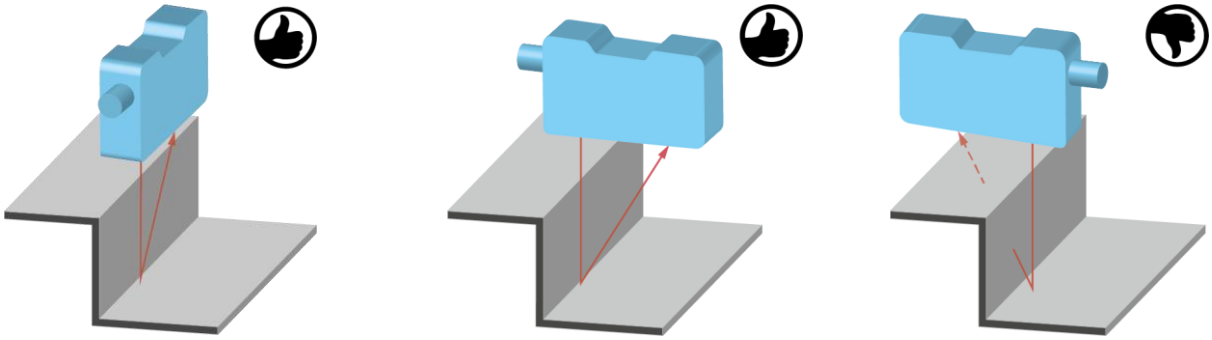
Mounting kit 11120705
Contents of this set:

- 90° mounting bracket
- Threaded plate
- 2x spherical head screw M4x35 Torx
- 1x Torx tool T20

3.4 Alignment

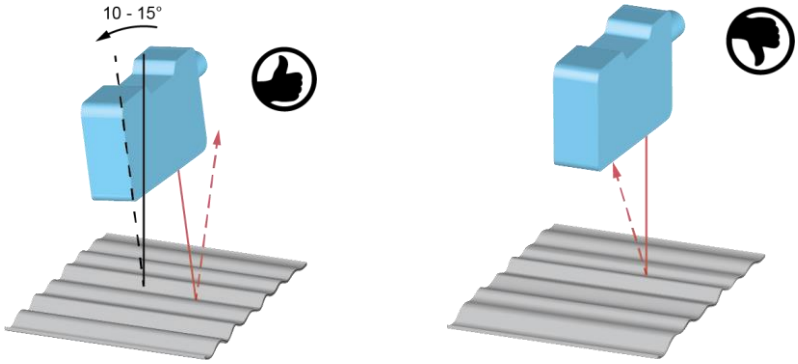
To achieve as reliable and exact measured values as possible, the following hints and tips for mounting should be followed.

3.4.1 Steps / edges



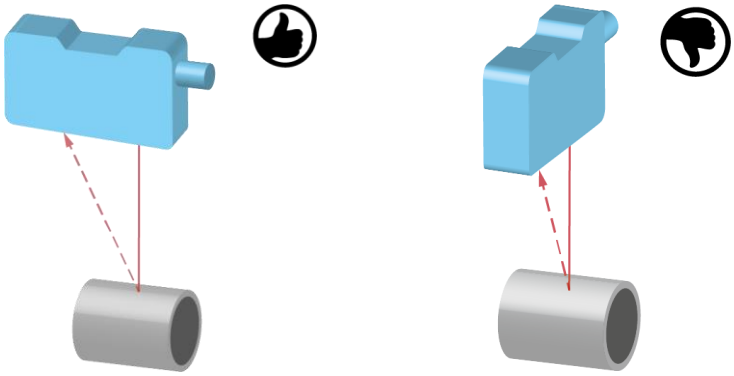
If measurements are carried out directly beside steps/edges, make sure that the reception beam is not covered by the step/edge. The same applies when the depth of holes and cracks is measured.

3.4.2 Shiny surfaces



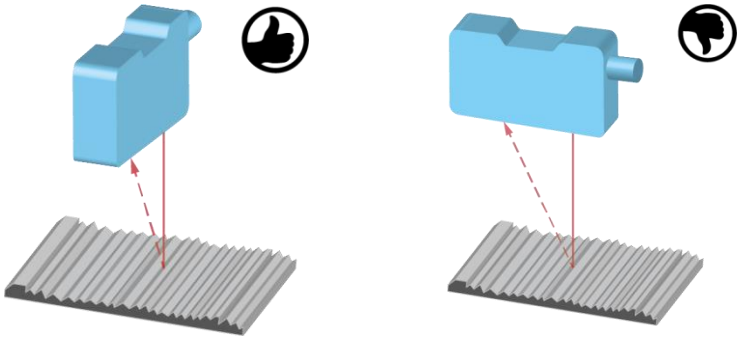
With shiny surfaces, it is important to ensure that the direct reflection does not strike the receiver. This can be prevented by tilting the sensor slightly. To check this, place a sheet of white paper on the disc of the receiver; the direct reflection can then be seen clearly.

3.4.3 Round, shiny surfaces



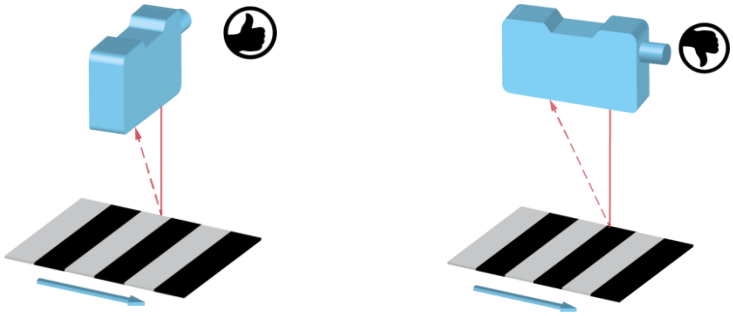
With round, shiny surfaces, the sensor should be aligned in the same axis as the round object in order to avoid reflections.

3.4.4 Shiny objects with evenly aligned structure



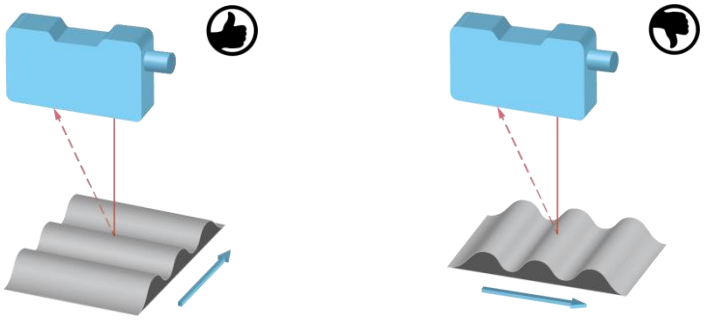
Particularly with shiny objects, for example turned parts, ground surfaces, extruded surfaces and the like, the installation position affects the measuring result.

3.4.5 Objects with evenly aligned colored edges



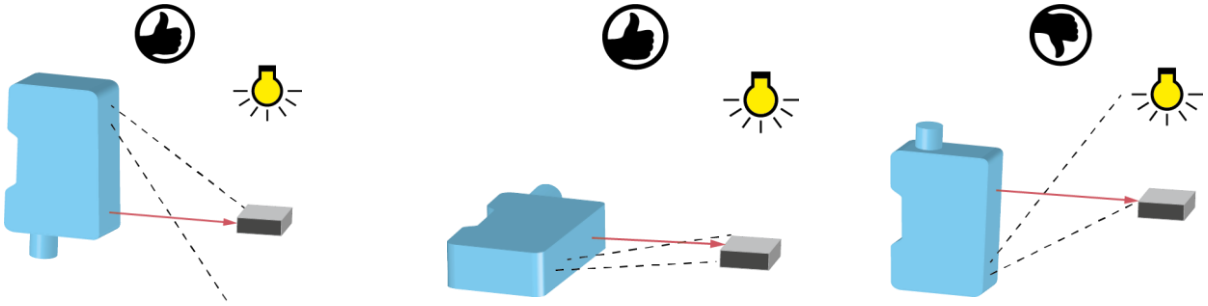
In the correct orientation, the influence on the measuring accuracy is low. In the wrong orientation, the deviations depend on the differences in reflectivity of the various colors.

3.4.6 Moving objects



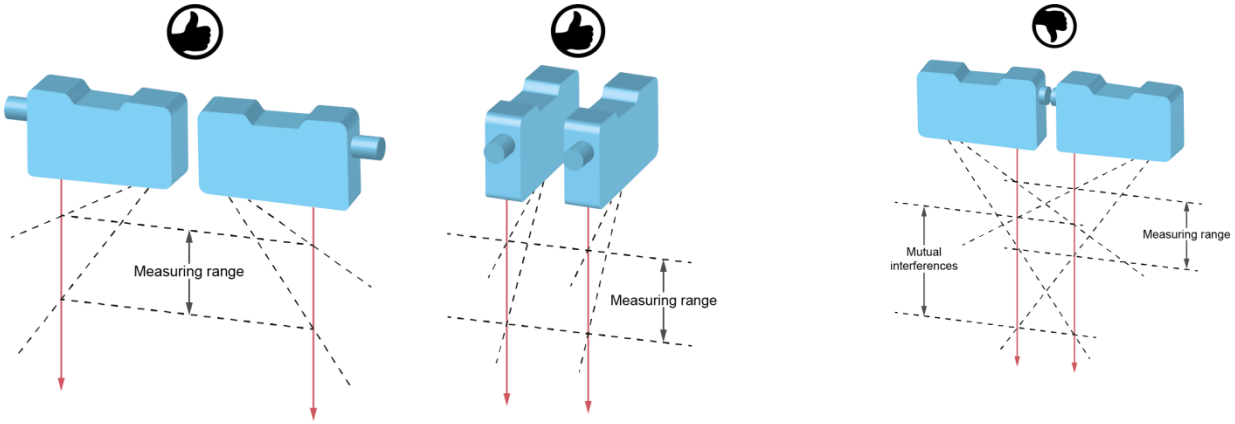
If the contour of an object is measured, it is important to ensure that the object moves at right angles to the sensor, to avoid shadowing and reflections on the receiver.

3.4.7 Protection from ambient light



When installing optical sensors, it is important to ensure that there is no strong ambient light in the area of detection of the receiver.

3.4.8 Reciprocal influence



If several optical sensors are used, they may mutually influence one another. During installation, ensure that only the sensor's own laser spot is in the detection range of the receiver. Up to a measuring range of 600 mm, the sensors can be lined up in a row without them influencing each other (picture in the middle).
If the mutual interference cannot be avoided through installation, the sensors can be operated asynchronously using the Sync-In input, see chapter TRIGGER MODE.

3.5 Connection

CAUTION!

Incorrect supply voltage will destroy the device!

CAUTION!

Connection, installation and commissioning may only be performed by qualified personnel.

CAUTION!

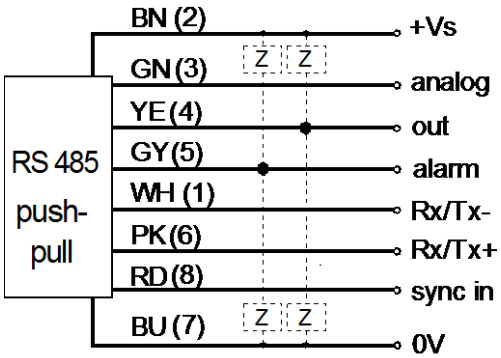
The IP protection class is valid only if all connections are connected as described in the technical documentation.

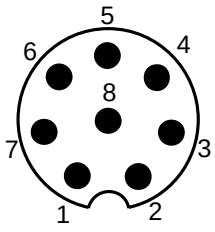
CAUTION!

Products with laser class 1 laser beams in accordance with EN 60825-1:2014 can be operated safely without additional safety precautions. Nevertheless direct contact between the eye and beam should be avoided.

3.5.1 Pin assignment and connection diagram

	Color	Function	Description
Pin 1	WH = white	Rx/Tx-	RS 485 receive/transmit- (B)
Pin 2	BN = brown	+ Vs	Voltage supply (+15…+28 VDC)
Pin 3	GN = green	analog	Analog output (4…20 mA or 0…10V)
Pin 4	YE = yellow	out	Switching output, push-pull
Pin 5	GY = gray	alarm	Alarm output, push-pull
Pin 6	PK = pink	Rx/Tx+	RS-485 receive/transmit+ (A)
Pin 7	BU = blue	0V	Ground GND
Pin 8	RD = red	sync in	Input synchronization





Top view of plug

NOTE

We recommend that you connect unused cables to GND (0V).

3.5.2 Connection cable

An 8-pole, shielded connection cable (connector) is required.

Baumer connection cables with the following order codes are recommended:

- 10127844 ESG 34FH0200G (length 2 m, straight plug)
- 11053961 ESW 33FH0200G (length 2 m, angled plug)
- 10129333 ESG 34FH1000G (length10 m, straight plug)
- 10170054 ESW 33FH1000G (length 10 m, angled plug)

Other cable lengths are available.

When the analog output is used, the cable length affects signal noise. Signal noise increases the longer the connection cable is.

Analog output I_OUT

Noise: 5.92 µA (1 sigma) (10m cable and 680 ohms)
3.59 µA (1 sigma) (2m cable and 680 ohms)

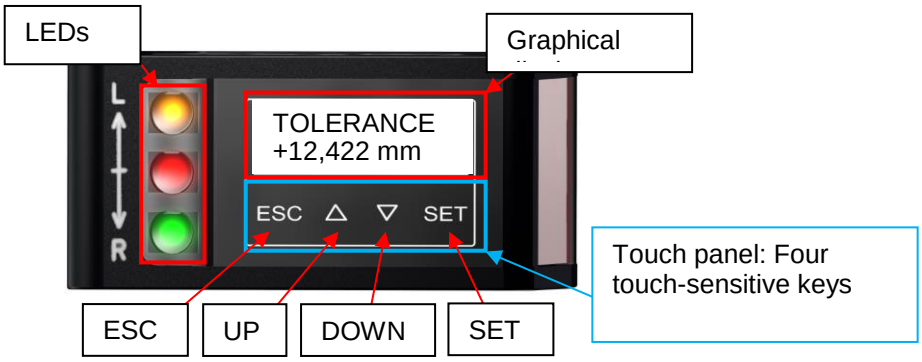
Analog output U_OUT

Noise: 4.80 mV (1 sigma) (10m cable and 100 kOhms)
3.03 mV (1 sigma) (2m cable and 100 kOhms)

We recommend that you use the RS-485 interface for high-precision applications.

4 Configuration

4.1 Overview of control elements



4.1.1 Display modes

+12,422 mm	**Run mode** The sensor is in run mode, the measuring value is displayed in large characters.
TOLERANCE +12,422 mm	**Main menu** In the main menu the active mode is displayed at the top, and the measuring value is displayed at the bottom.
PRECISION STANDARD	**Scroll bar** The square on the right indicates the position within the current menu. The next menu item can be accessed using the arrow keys.
PRECISION VERY HIGH	**Change value** If the function/mode at the top is highlighted in black, the value of the lower line can be adjusted using the UP/DOWN keys and saved with SET (hold).
OK	**Process successful** The display background lights up green: Value successfully saved
FAILURE	**Error** The display background lights up red: Error during the save process or wrong value entered.
	Setting mode As soon as the sensor is in setup mode, the display background lights up blue.
+12,422 mm	**Keys locked** If this symbol is on the left side of the screen, the four pushbuttons are locked for operation.
TOLERANCE +12,422 mm	**Warming up** The warm-up sign appears in the top right of the display. The sensor is not yet in thermal equilibrium; optimum measurement performance is reached after the symbol disappears.

4.1.2 Functions of the individual keys

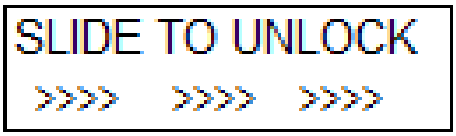
Key	Pressed briefly	Pressed >2 s.
ESC	Back	Jump to run mode
UP △	Up/increase value	
DOWN ▽	Down/decrease value	
SET	OK/submenu/next entry**	Save value*

*Only in setup mode menu when the top line is highlighted in black (change value)
**When entering strings of numbers, use OK to jump to the right. Once the end is reached, the cursor jumps back to the left to the beginning

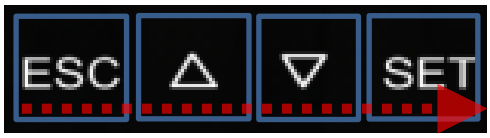
4.1.3 Locking the touch panel

The keys on the control panel are locked when they are not pressed for 5 minutes. A key symbol appears, and the measuring value is displayed in large lettering.

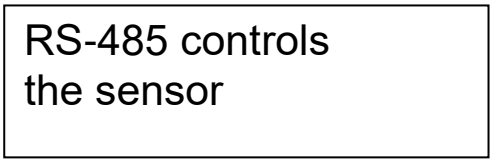
When it is pressed, the following text appears:



To re-enable the touch panel, it is required to quickly slide a finger over all four keys from left to right (slide over ESC, UP, DOWN, and SET).

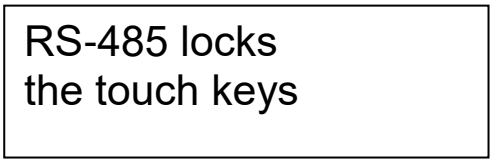


When controlled via RS-485:
When the sensor is controlled using RS-485, it cannot be operated with the display at the same time. The keys are disabled. When the keys are pressed, the following text appears on the display:



Disconnect briefly from the power supply or use an RS-485 command to enable the display and operate the sensor using the display.

Locking using an RS-485 command:
The sensor keys can be permanently locked using an RS-485 command. This lock remains activated even if the sensor is no longer controlled using RS-485. The keys must be unlocked with an RS-485 command. When the locked keys are touched, the following text appears on the display:



4.1.4 Further key functions

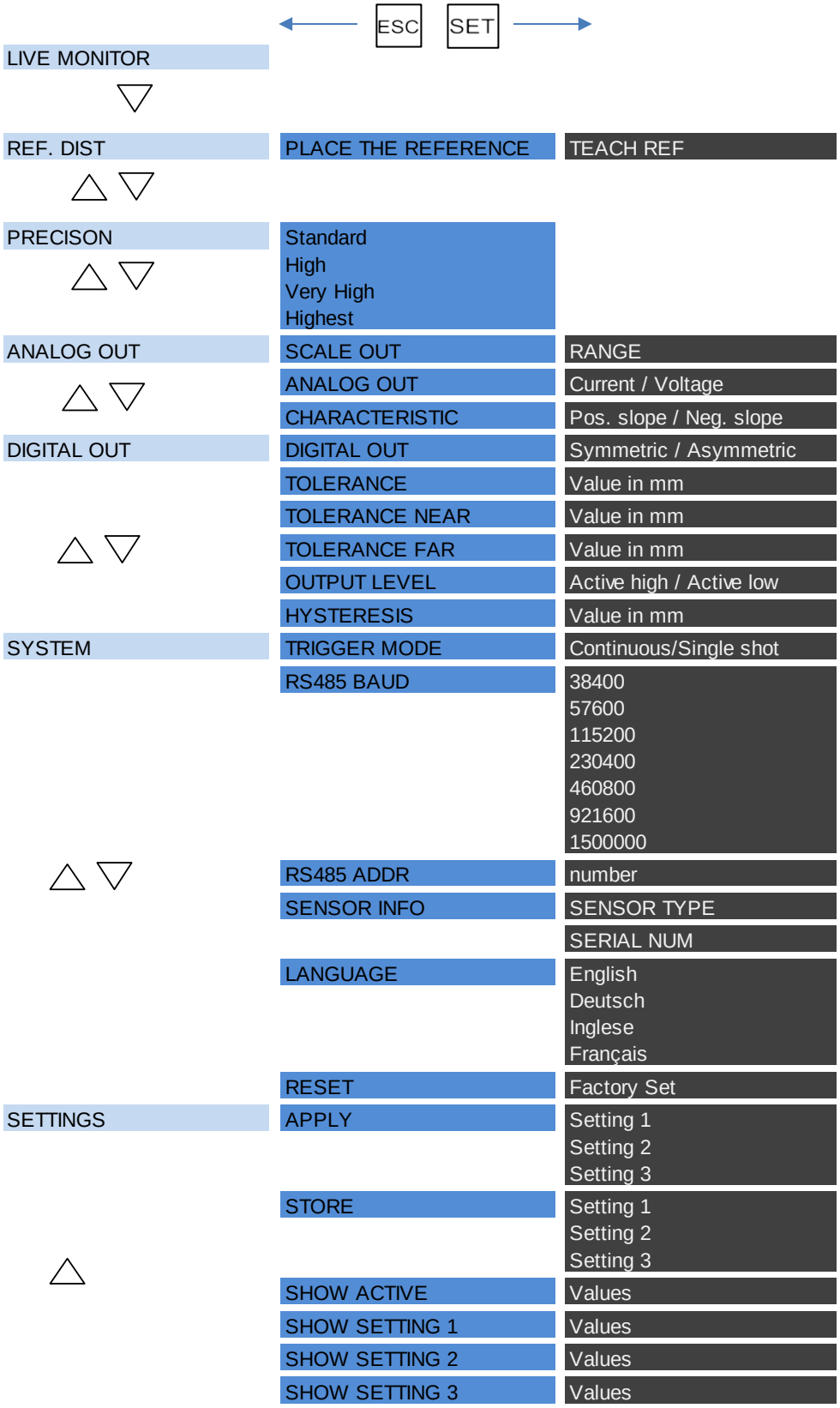
Action	Reaction
Slide over all keys from left to right	**Unlock locked touch panel** Only if touch panel is locked
Slide over all keys from right to left	**Jump directly to run mode** Can be used from any menu

4.1.5 LEDs on the sensor

LED	Lights up	Flashes
Yellow	**out1 activated** Switching output1 active	-
Red	**out2 activated** Alarm output active. No measuring object within the field of measurement or signal quality is inadequate.	**Insufficient signal reserve** Object close to signal reserve or signal quality not ideal
Green	**Supply voltage** Sensor ready for operation.	**Short circuit** Check connection at switch or alarm output.

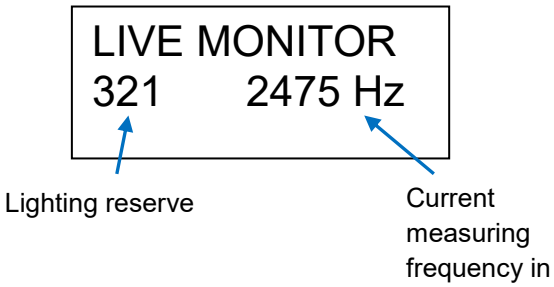
4.2 Function tree

The menu that can be accessed via the touch panel is shown below.



4.3 LIVE MONITOR

The installation conditions can be checked quickly and easily by displaying the lighting reserve as well as the measuring frequency.



4.3.1 Lighting reserve

This factor specifies by how many times an object may become darker in order to obtain a valid measurement nevertheless. For a valid measurement, a minimum of factor 1 is required.
The higher this value is, the shorter the object has to be exposed, which increases the measuring frequency.
Below factor 1, the sensor gets too little light back and does not specify any measured value, the alarm output is active.

4.3.2 Measuring frequency in Hz

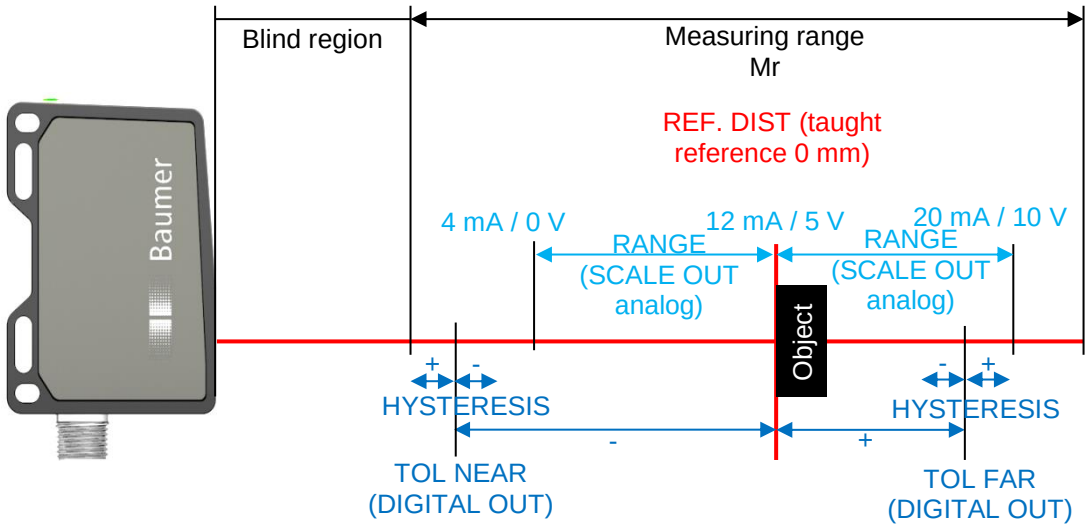
Displays the current measuring frequency in Hz.
For more information, see the chapter on measuring frequency, measuring repeat time and response time.

NOTE

For the fastest response time as well as maximum exposure reserve, the object should be as bright as possible (not shiny).

4.4 REF. DIST

With tolerance sensors, the reference REF DIST can be moved to any point within the measuring field. This newly defined reference point represents 0 mm, everything is measured from this point. If the object is closer to the sensor, the measured value is given with a negative sign (-), and if the object is further away, it is given with a positive value (+).



PLACE THE REFERENCE

Confirm with SET as soon as the object has been placed.
Typically, the object is taught in its nominal position.

4.4.1 TEACH REF

Teaching the new reference point by pressing SET for 2 seconds.

If the display lights up in red, the conditions for teaching the reference have not been fulfilled. This must first be rectified before the new reference point can be taught.

Symbol	Error description	Error correction
	REF.DIST and/or the analog measuring range is outside the measuring range.	Adjust the reference distance or analog RANGE (see SCALE OUT) until all points are within the measuring range.
	The sensor is in **single-shot** mode or the sync-in line is set to high (sensor in waiting mode).	Set mode to **Continuous** and set sync-in line to Low. See Chapter TRIGGER MODE.
	REF.DIST and/or the switching output is outside the measuring range.	Adjust the reference distance or DIGITAL OUT until all points are within the measuring range.

NOTE

Teaching or changing the reference does not affect the settings of the analog or digital output.

4.5 PRECISION

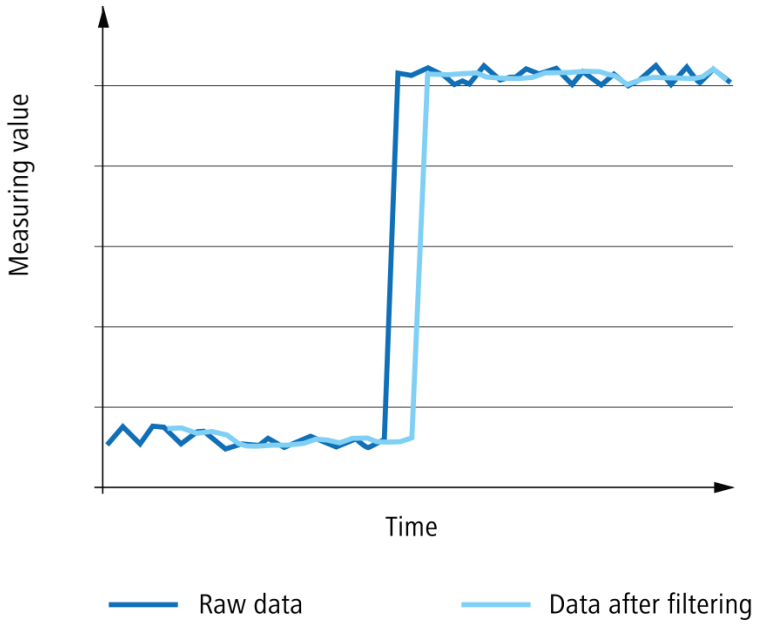
Activating filtering can reduce noise and thus increase resolution and repeat accuracy. This increases the response time, but the measuring frequency remains unchanged.

Standard	= normal resolution[1][2]
High	= resolution is approximately twice as high[1][2]
Very high	= resolution about three times as high[1][2]
Highest	= resolution about four times as high[1][2]

4.5.1 Influences of the PRECISION filter

The higher the precision is set, the more response times and release times increase, which means that the response time for moving objects slows down. The measuring frequency is not affected by the use of this filter.
PRECISION works with moving median as well as moving average filters.

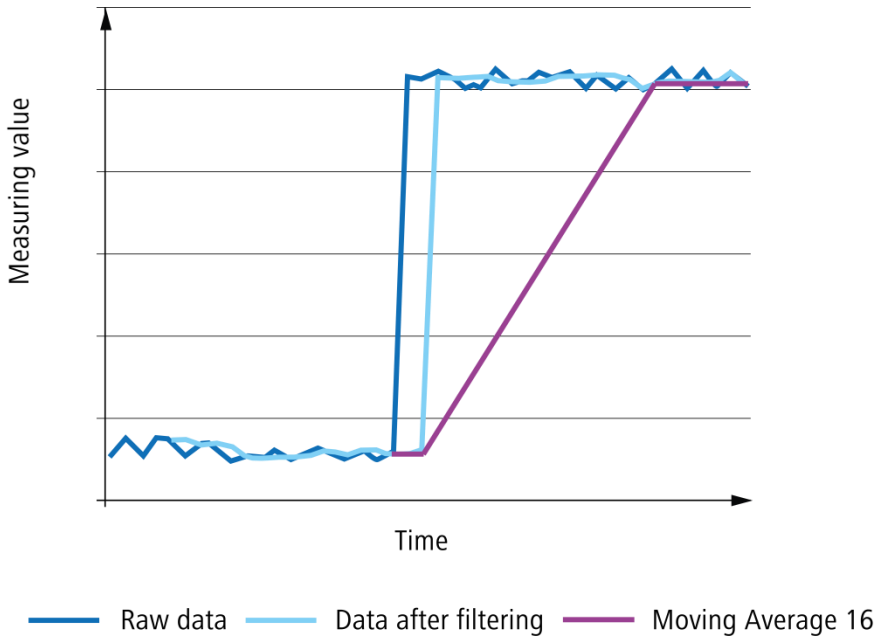
Moving median
The median of a finite list is the measurement with the middle measured value of a string of numbers (e.g. median of {3, 3, 5, 9, 11} is 5). The number of measured values saved in an array is called the number of measured values, e.g. {3, 3, 5, 9, 11} corresponds to 5 measured values. When a new measured value is added, the oldest is removed (moving filter). A sudden change in measured values will only lead to a changed after half of the saved number of measured values (e.g. number of measured values = 5 means that the measured value at the output is only affected after 3 measured values).



This diagram shows the effects of the median (number of measured values 5). The filter is used to suppress measurement errors. The output only changes after a defined number of measured values (number of measured values/2). The measuring frequency is not affected by this filter, but the response time is.

[1] In accordance with chapter Sensor Data Sheet
[2] Depending on the object to be measured

Moving average
The output value of the moving average filter is the average of the defined number of measured values which have been saved. When a new measured value is added, the oldest is removed (moving filter).



As shown in the diagram, the moving average evens out the output value. In contrast to the median filter, it is possible that with the moving average, the displayed measured values were never measured as such. The measuring frequency is not affected by this filter, but the response time is.

Number of measured values required until the correct measured value is displayed:

- In the PRECISION = HIGH mode, the distance must be stable for 4 + 16 measured values before the correct value is displayed
- In the PRECISION = VERY HIGH mode, the distance must be stable for 8 + 128 measured values before the correct value is displayed

Example
Calculate the response time with a measurement frequency of 500 Hz, PRECISION = VERY HIGH

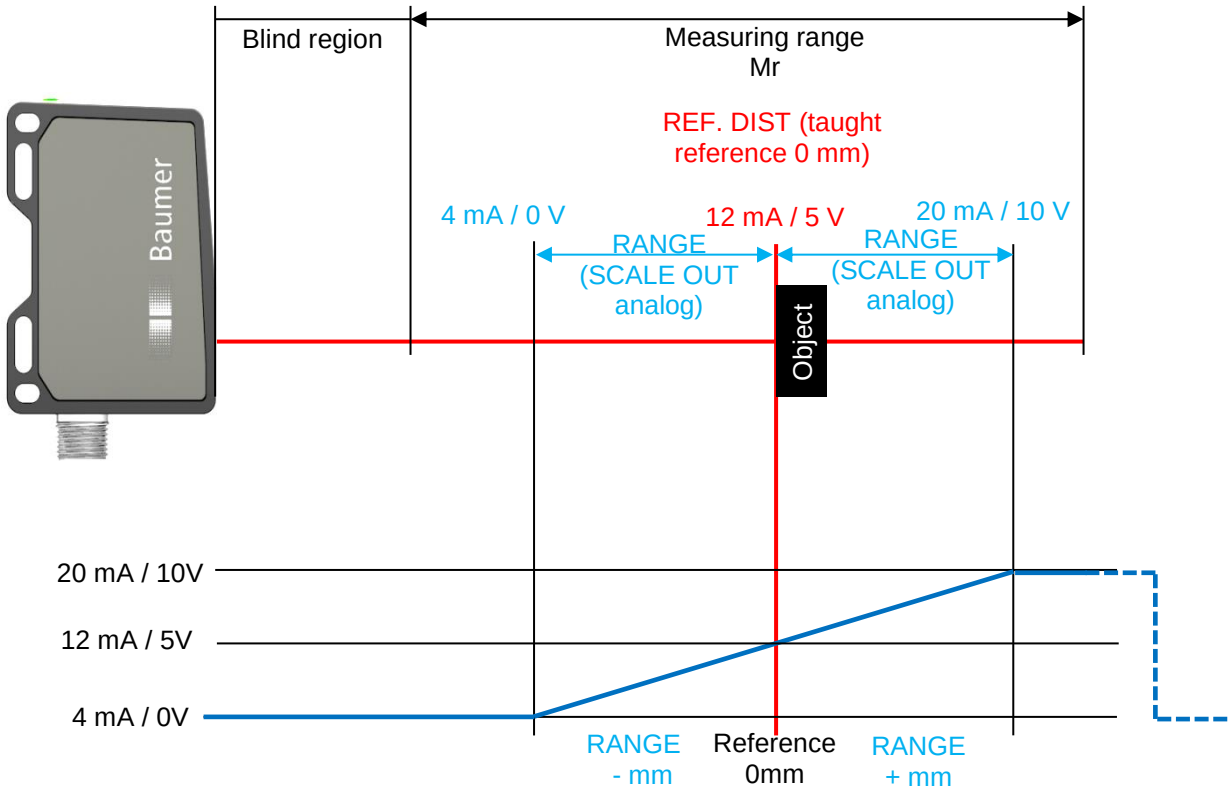
1 / 500 Hz = **0.002 s**
Median = 9 / 2 (formula: measured value / 2) = 4.5 = 5
Average = **16**
Response time = 0.002 * (5 + 16) = 0.042 s = 42 ms

4.6 ANALOG OUT

The settings of the analog output are defined here.
The display shows the sensitivity of the analog output in µA/mm or mV/mm (depending on the setting ANALOG OUT current/voltage). Adjusting the analog calibration curve through RANGE changes the displayed sensitivity value of the analog output. This value can be used to convert the analog signal (µA/mm or mV/mm) into a value in mm or vice versa.

4.6.1 SCALE OUT

The RANGE in ± mm defines where the analog measuring field begins (4 mA / 0V) and where it ends (20 mA / 10V) and is placed symmetrically around the reference point. RANGE must be within the Mr measuring range and comply with the minimum analog output window size as specified in the chapter Sensor Data Sheet.



NOTE

As soon as the alarm output is active, the analog and switching outputs for 75 measuring cycles are kept at the last valid value. See chapter Alarm Output.

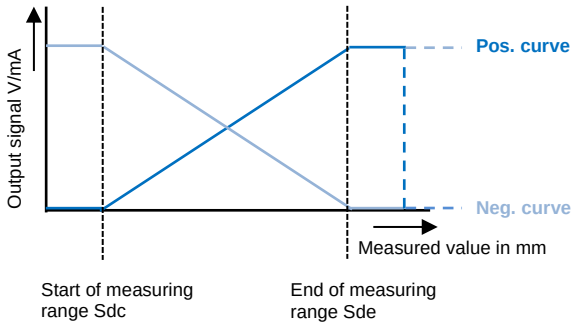
4.6.2 ANALOG OUT

The analog output can be reset to voltage (0-10 V) or current (4-20 mA), depending on the intended purpose. In order to minimize interference in the wiring, we recommend using the current output.

- Current
- Voltage

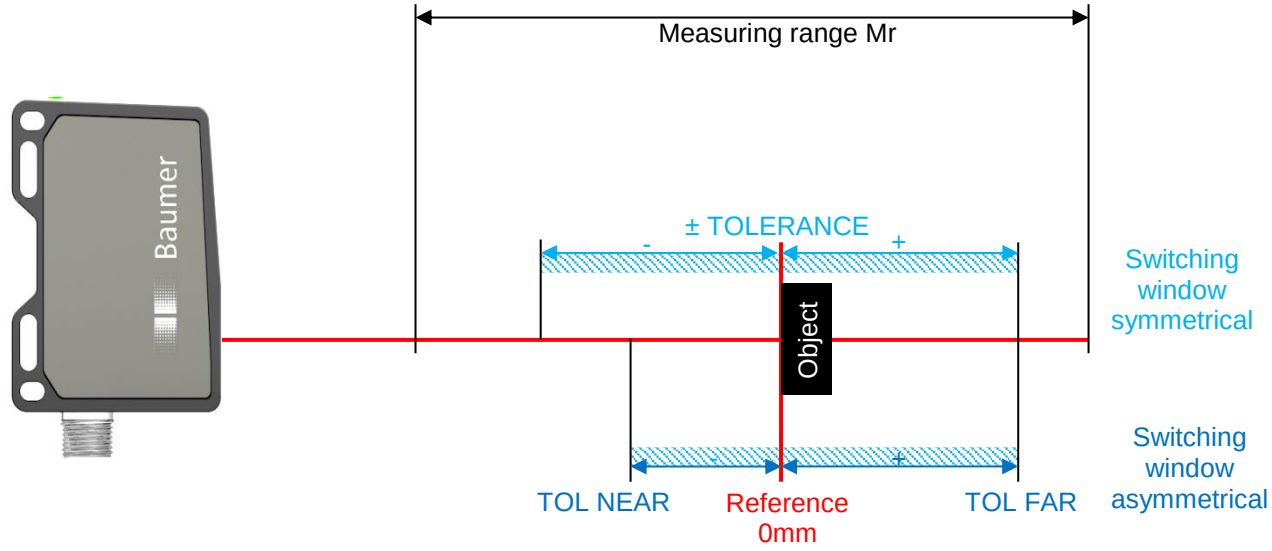
4.6.3 CHARACTER.

The calibration curve can be inverted here. In a positive curve, the output signal increases when the measured value rises, while the output signal decreases in a negative curve.



4.7 DIGITAL OUT

With Pin 4 (out), the user has a configurable switching output.
This can be set as a symmetrical or asymmetrical window around the reference point. Pin 4 switches as soon as the defined values are exceeded or undershot.
The switching points can be set within as well as outside the analog measuring field limited by SCALE OUT, as long as they are within the maximum measuring range (see also SCALE OUT).
For a reliable switching signal, there is an adjustable hysteresis.



4.7.1 DIGITAL OUT

Whether the switching output is to be placed **symmetrically** or **asymmetrically** around the reference point is defined here.

4.7.2 TOLERANCE

The tolerance value (switching output symmetrical) is defined in mm from the reference and is placed symmetrically around the reference point. The TOLERANCE starting and end points must be within the measuring field, but are independent of the analog measuring field SCALE OUT.

4.7.3 TOL NEAR

The starting point of the tolerance window (switching output asymmetrical) is defined from the reference in mm in the direction of the sensor. The point must be within the measuring range, but is independent of the analog measuring field SCALE OUT. This value must be closer to the sensor, or smaller than TOL FAR.
See the minimum digital output window size in accordance with chapter Sensor Data Sheet.

4.7.4 TOL FAR

The end point of the tolerance window (switching output asymmetrical) is defined from the reference in mm in the direction away from the sensor. The point must be within the measuring range, but is independent of the analog measuring field SCALE OUT. This value must be further away from the sensor, or greater than TOL NEAR.
See the minimum digital output window size in accordance with chapter Sensor Data Sheet.

4.7.5 LEVEL

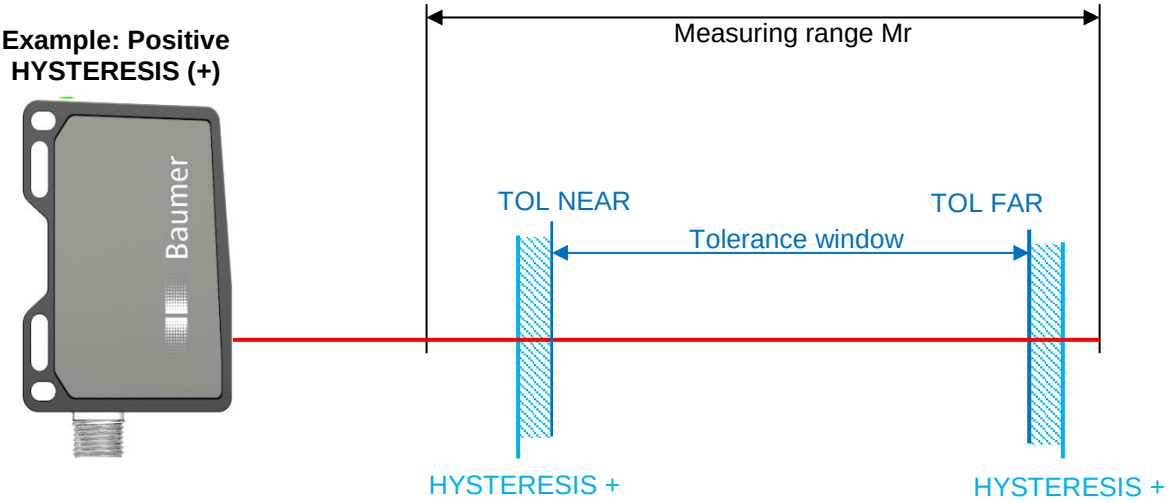
Here, the output level can be inverted with **Active High** (High active if object is within the tolerance) or **Active Low**. The inversion applies equally to the yellow LED on the sensor.

4.7.6 HYSTERESIS

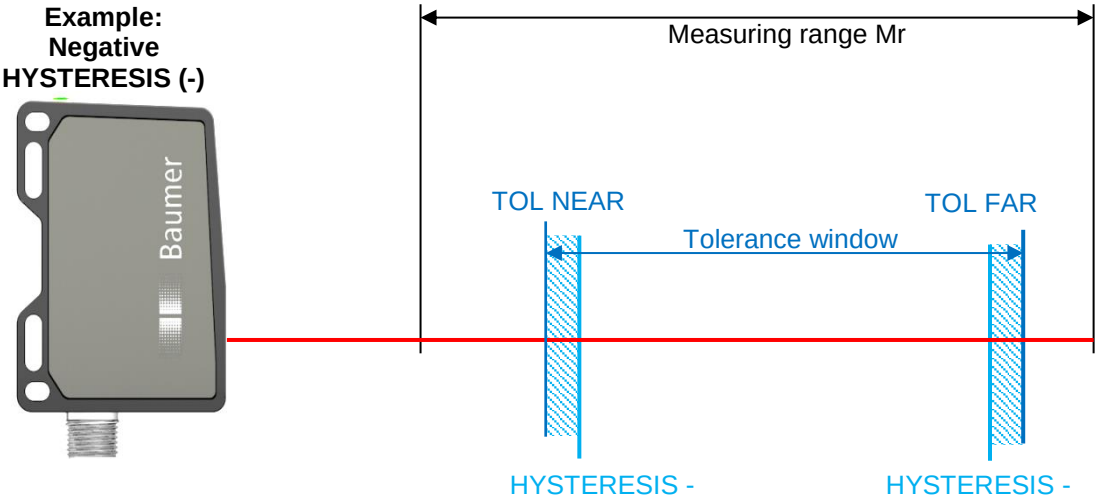
The hysteresis is the difference between the switching point and the reset point, and is specified as a value in mm. Without hysteresis, H objects in the border area of the switching point could lead to the switching output switching on and off continuously, or to bouncing. For reasons of reliability, the use of hysteresis is recommended (at least as great as the resolution of the sensor).

A positive value (+) means towards the outside, a negative value (-) on the inside of the tolerance window.

Example: Positive HYSTERESIS (+)

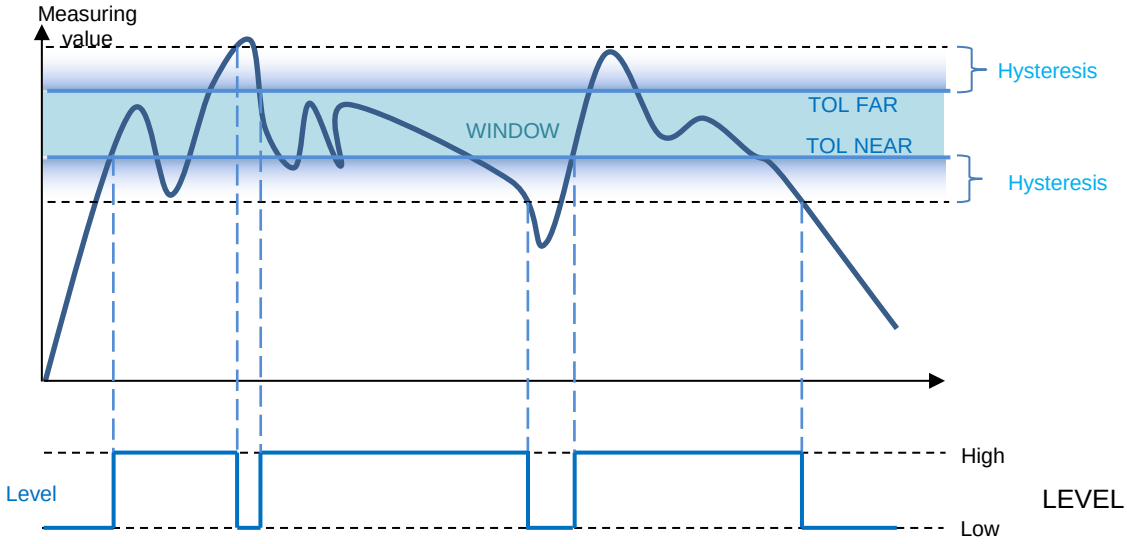


Example: Negative HYSTERESIS (-)



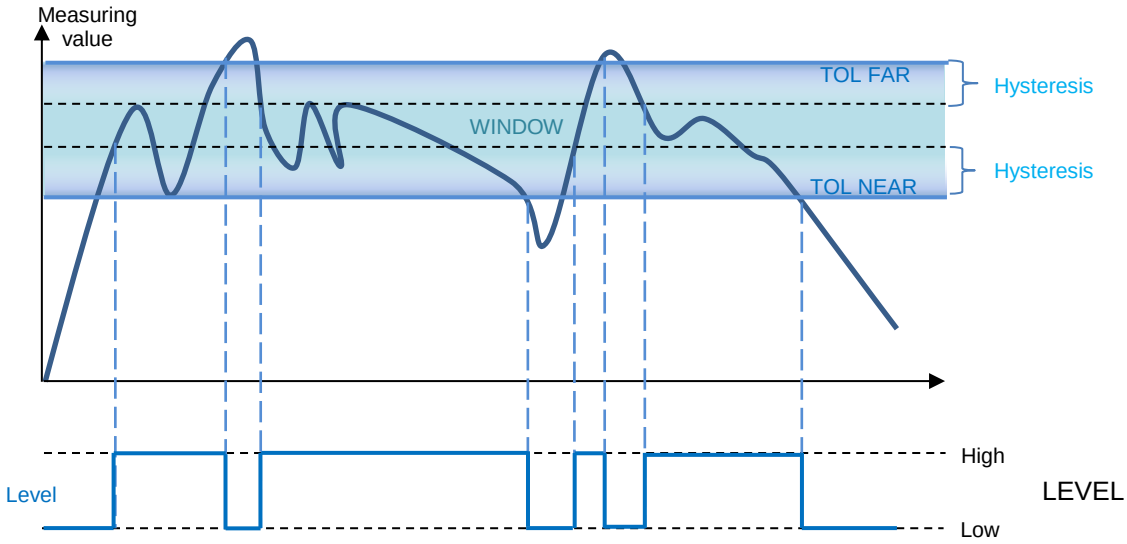
Behavior of the switching output for WINDOW

Example: HYSTERESIS positive (+)



LEVEL **Active high**

Example: Hysteresis negative (-)



LEVEL **Active high**

4.8 SYSTEM

4.8.1 TRIGGER MODE

In **Continuous** mode, the sensor measures permanently as long as the Sync line is set to Low. As soon as the Sync line is set to High, the sensor goes into hold mode shows no new measured values (the last measured value is frozen), the laser is disabled.
In **Single shot** mode the sensor measures exactly once on the trailing edge of the Sync signal and outputs the value. In single-shot measurements, the preset filters (see chapter PRECISION) have no effect.

Properties

- The previous measurement cycle is always completed first, even if Sync-In is on high
- While Hold is high, all outputs are frozen at their last state
- During the waiting time (Hold) the power of the laser beam is reduced (Laser off)
- Sync-In must remain on low for at least 5 µs in order for the sensor to begin measuring again

Sync-In	Level	Measurement
Sync-In low	0…2.5 V	Run
Sync-In high	8 V…UB (operating voltage)	Hold

NOTE

As soon as the Sync-In is set to high (Hold), all output functions are frozen at their last state until the next measurement, and the laser is switched off.

4.8.2 RS485 BAUD

The baud rate is the number of symbols transmitted per second. The baud rate of data transmission must be identical on the transmit and receive sides.
The sensor can be operated at the following baud rates:

- 38400
- 57600
- 115200
- 230400
- 460800
- 921600
- 1500000

4.8.3 RS485 ADDR

Each sensor has its own RS485 address, allowing the selected sensor to be addressed directly. This address is preset to 001 and can be changed in 3 digits. Sensors must not have the same address in the same network, to prevent the occurrence of bus conflicts. No more than 32 sensors may be connected to one bus.

4.8.4 SENSOR INFO

The sensor type and serial number are displayed here to allow unequivocal identification of the sensor.

- SENSOR TYPE
- SERIAL NUMBER

4.8.5 LANGUAGE

Language selection:

- English
- Deutsch
- Italiano
- Français

4.8.6 RESET (factory settings)

This resets all settings in sensor parameters to the factory settings.

REF. DIST	= Center of measuring range
PRECISION	= Very high
SCALE OUT	= RANGE ±10 mm
ANALOG OUT	= Current
CHARACTER.	= Positive sensitivity
DIGITAL OUT	= SYMMETRICAL
TOLERANCE	= ±10 mm
LEVEL	= Active High
HYSTERESIS	= % Mr
TRIGGER MODE	= continuous
RS485 lock	= 1 (activated)
RS485 BAUD	= 57600
RS485 ADR	= 1
ANALOG OUT	= Current

NOTE

With "Reset", the current configuration in the sensor is overwritten. and the stored configurations are also deleted from the memory. The unit is reset to the factory settings.

4.9 SETTING

The settings entered in the sensor can be applied, stored or displayed here.

4.9.1 APPLY

The settings saved under SAVE can be activated here.

- Setting 1
- Setting 2
- Setting 3

4.9.2 SAVE

The settings entered in the sensor can be stored here.
Three storage spaces are available.

- Setting 1
- Setting 2
- Setting 3

4.9.3 SHOW

SHOW displays the setting values.

SHOW Active
Displays the active settings.

SHOW settings 1-3
Displays the settings stored in storage spaces 1-3

The values are displayed successively; it is possible to jump to the next value using the DOWN key.

REF. DIST
PRECISION
RANGE
ANALOG OUT
CHARACTER.
DIGITAL OUT
TOLERANCE
TOL NEAR
TOL FAR
LEVEL
HYSTERESIS
TRIGGER MODE

4.10 Configuration using the RS-485 interface

The precision (resolution, repeat accuracy and linearity) of the output values is higher through RS-485 than through the analog output. The use of this interface is recommended for high-precision applications. No more than 32 sensors may be connected to one bus during operation with RS-485.

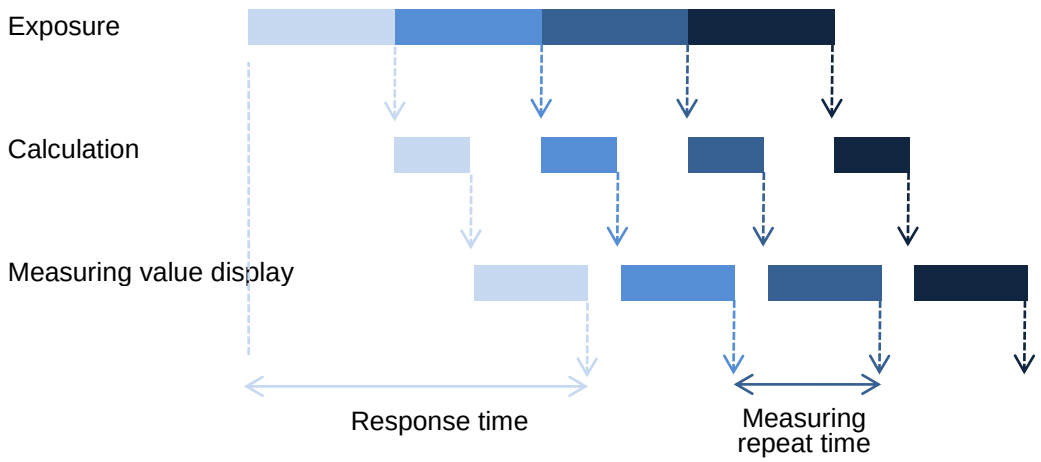
When the RS-485 interface is activated, the analog output, digital output and alarm output are deactivated or switched as if there were no object within the measuring range. Then the sensor can only be configured through RS-485; the display is locked for operation.
If required, the digital outputs as well as the display control can be reactivated using the relevant RS-485 commands.

See separate RS-485 manual for further information.

5 Operation

5.1 Measuring frequency, measuring repeat time and response time

A complete measuring cycle consists of exposure, calculation and measuring value display. In order to increase the measuring speed, process steps are executed simultaneously.



5.1.1 Measuring frequency and measuring repeat time

The time between two exposure times is referred to as measuring repeat time. This time can be converted into a frequency (Hz), which indicates how many measured values can be issued by the sensor in one second.

$$Measuring\ frequency\ [kHz] = {}^{1}/_{Masuring\ repeat\ time\ [ms]}$$

5.1.2 Automatic exposure control

The color and surface of the object have an influence on the amount of reflected light. A longer exposure time is required for dark objects than for light objects. The sensor automatically controls the exposure time on the basis of the amount of light reflected by the object. This slows down the measuring frequency and the response time. In this case, the degree of slowdown is dependent on the laser class of the sensor.

5.2 Alarm output

The alarm signal is output as a push-pull signal (active high) when the object is outside the measuring range or the signal quality is insufficient for evaluation. If the signal quality is insufficient, the analog and switching outputs for 75 measuring cycles are kept at the last valid value. After this time has elapsed, the analog and switching outputs are set as if an object were at the start of the measuring range.

5.3 Influence of ambient light

Ambient light from lamps, the sun, etc. in the view field of the sensor can lead to malfunctions or a reduction of accuracy and should be avoided as much as possible.

5.4 Error correction and tips

Error	Error correction
No function	• Check connection. Power supply 15…28 VDC on pin 2 (+Vs, brown) and pin 7 (GND, blue)
Green LED flashes	• Short circuit on switching outputs. Check connection.
Red LED lights up	• Object outside measuring field (near, far or to the side) • Amplitude of the received signal is insufficient (e.g. in case of soiling)
Touch panel cannot be operated	• Touch panel locked. Re-enable panel for operation by sliding a finger over the 4 keys from left to right. • RS-485 controls the sensor--> operation via the touch panel not possible at the same time • RS-485 locks the touch keys--> the touch panel was locked via RS-485 and can only be re-enabled with a command via RS-485
Touch panel does not react	• Clean panel. The panel is dirty or wet, which makes it harder to press the keys
Sensor does not provide the expected measuring results	• The object is not in the measuring range • Bright object, avoid direct reflexes from the transmitter to the receiver
Unreliable measuring value: The measuring value jumps back and forth	• The object is not in the measuring range • Avoid bright object • Avoid very dark object • Too much ambient light
Transmitting laser light is dim	Sync-In input is on High--> set to Low

6 Safety instructions and maintenance

6.1 General safety instructions

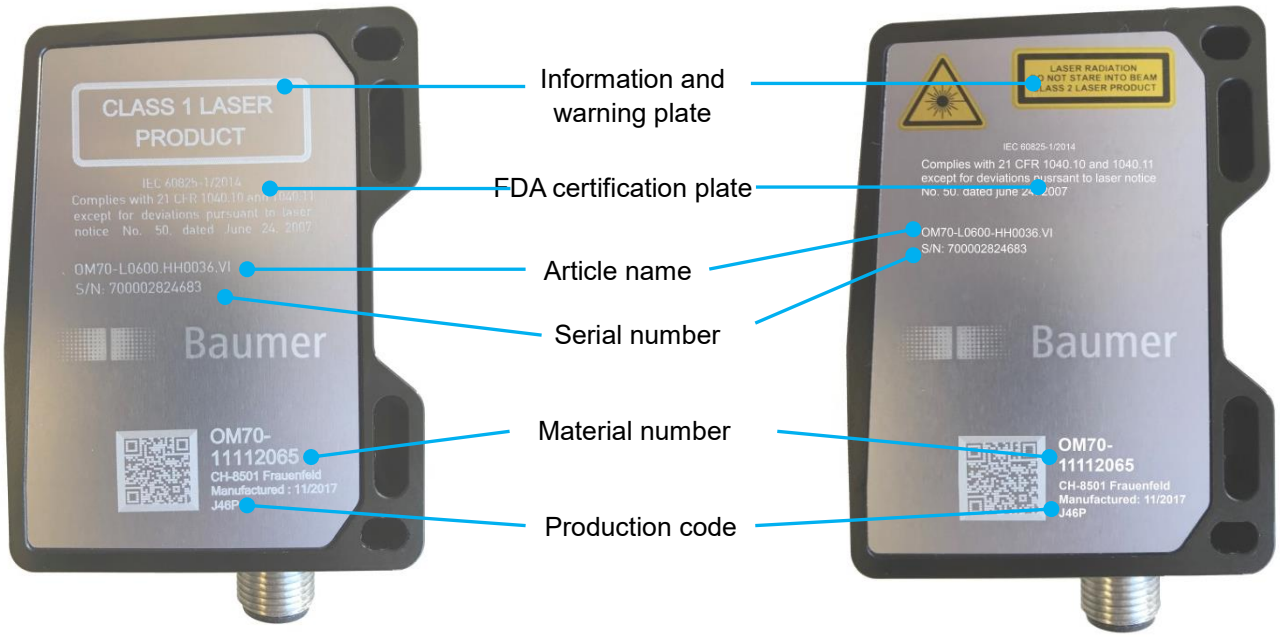
Intended use
This product is a precision device and is used for object detection and the preparation and/or provision of measuring values as electrical quantities for a subsequent system. Unless this product is specially labeled, it must not be used for operation in potentially explosive environments.

Commissioning
Installation, mounting and adjustment of this product may be performed only by a qualified person.

Installation
For mounting, use only the mechanical mountings and mechanical mounting accessories intended for this product. Unused outputs must not be wired. In cable versions with unused cores, these cores must be insulated. Always comply with admissible cable bending radii. Prior to electrical connection of the product, the system must be disconnected from the power supply. In areas where shielded cables are mandatory, they must be used as protection against electromagnetic disturbances. If the customer makes plug connections to shielded cables, an EMC version of the connectors should be used, and the shield must be connected to the connector housing across a large area.

Caution
Deviation from the procedures and settings specified here can lead to hazardous radiation effects.

6.2 Sensor inscriptions



Information and warning plate	**Class 1: No risk for eyes** **CLASS 1 LASER PRODUCT** Class 1 lasers are safe under reasonably foreseeable operational conditions of normal use, including direct long-term viewing of the beam, even when exposure occurs using a magnifying optic.	**Class 2:** LASER RADI ATION DO NOT S TARE IN TO BEAM Wavelength: 640...670nm IEC 60825-1, Ed. 3, 2014 CLASS 2 LASER PRODUCT Accidental short-term exposure (up to 0.25 s) does not damage the eye, because the corneal reflex can automatically protect the eye sufficiently from longer radiation. Class 2 lasers may be used without any further protection if intentional staring into the beam is not required for the application.
FDA certification plate	IEC 60825-1/2014 Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019	

6.3 Front optic

In the event of a broken front optic, defective display, or loose or exposed laser lens, the sensor must be disconnected from the power supply immediately. It must not be put into operation again until it has been repaired by an authorized person. Non-compliance with these safety instructions may lead to the release of hazardous laser beams.

CAUTION!

The use of a sensor with a broken front optic or loose or exposed lens can lead to hazardous laser radiation.

6.4 Cleaning the sensors

The laser distance sensors do not require any maintenance, except that the front window must be kept clean. Dust and fingerprints can impair sensor function. It is normally sufficient to wipe the windows with a dry, clean (!), soft lens cleaning cloth. Alcohol or soapy water can be used in case of severe soiling.
The display and the keys must be kept free from dirt and moisture. Water and dirt on the keys can impair their function.

6.5 Disposal

This sensor contains electronic components. Dispose of parts according to country-specific provisions.

7 Sensor data sheet

General data	OM70T-11195786 OM70T-P0070.HH0065.VI	OM70T-11175113 OM70T-L0070.HH0065.VI	OM70T-11175099 OM70T-P0140.HH0130.VI	OM70T-11175110 OM70T-L0140.HH0130.VI	OM70T-11175094 OM70T-P0250.HH0240.VI	OM70T-11175097 OM70T-L0250.HH0240.VI
Beam shape	Laser point	Laser line	Laser point	Laser line	Laser point	Laser line
Laser class	1		1		1	
Function	Tolerance measurement		Tolerance measurement		Tolerance measurement	
Measuring range (distance)	30…70 mm		40…140 mm		50…250 mm	
Start of measuring range Sdc	30 mm		40 mm		50 mm	
End of measuring range Sde	70 mm		140 mm		250 mm	
Blind region	0…30 mm		0…40 mm		0…50 mm	
Measuring range Mr	40 mm		100 mm		200 mm	
Sweet spot	65 mm		130 mm		240 mm	
Focal range	55…70 mm		110…140 mm		200…250 mm	
Measuring frequency	2500 Hz[12]		2500 Hz[12]		2500 Hz[12]	
Response time - Single shot - Continuous	 0.8 ms[12] 1.2 ms[12]		 0.8 ms[12] 1.2 ms[12]		 0.8 ms[12] 1.2 ms[12]	
Resolution Without filter Precision high Precision very high Precision highest	 2.6…4 µm[12] 1.3…2 µm[123] 0.9…1.4 µm[123] 0.7…1 µm[123]		 4.8…10 µm[12] 2.4…5 µm[123] 1.6…3.4 µm[123] 1.2…2.5 µm[123]		 5.3…25 µm[12] 2.7…12.5 µm[13] 1.8…8.4 µm[123] 1.4…6.3 µm[123]	
Spatial repeatability	14 µm		22 µm		60 µm	
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 0.4…1.2 µm[12] 0.2…0.6 µm[123] 0.2…0.4 µm[123] 0.1…0.3 µm[123]		 1…2.5 µm[12] 0.5…1.3 µm[123] 0.4…0.9 µm[123] 0.3…0.7 µm[123]		 1…8 µm[12] 0.5…4 µm[123] 0.4…2.7 µm[123] 0.3…2 µm[123]	
Linearity error	± 22 µm[12]		± 65 µm[12]		± 170 µm[12]	
Linearity deviation in % of Mr	± 0.06%[12]		± 0.07%[12]		± 0.09%[12]	
Temperature drift	± 0.01% Sde/K[12]		± 0.015% Sde/K[12]		± 0.025% Sde/K[12]	
PRECISION filter values: Standard High Very high Highest	Median Average Off Off 9 Off 9 16 9 128		Median Average Off Off 9 Off 9 16 9 128		Median Average Off Off 9 Off 9 16 9 128	
Hysteresis digital output	Adjustable in mm		Adjustable in mm		Adjustable in mm	
Minimum window size for digital output	0.07 mm		0.14 mm		0.25 mm	
Minimum window size for analog output	1 mm		1 mm		1 mm	

[1] Measurements with standard Baumer measuring equipment and objects dependent on measuring range Sd

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

Power on indication	Green LED	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED
Switch-on delay	<1200 ms	<1200 ms	<1200 ms
Light source	Red laser diode, pulsed	Red laser diode, pulsed	Red laser diode, pulsed
Setting	Touch display, RS-485	Touch display, RS-485	Touch display, RS-485

Electrical data	**OM70T-11195786 OM70T-P0070.HH0065.VI**	**OM70T-11175113 OM70T-L0070.HH0065.VI**	**OM70T-11175099 OM70T-P0140.HH0130.VI**	**OM70T-11175110 OM70T-L0140.HH0130.VI**	**OM70T-11175094 OM70T-P0250.HH0240.VI**	**OM70T-11175097 OM70T-L0250.HH0240.VI**
Voltage supply range +Vs	15 ... 28 VDC		15 ... 28 VDC		15 ... 28 VDC	
Max. supply current (without load)	120 mA		120 mA		120 mA	
Output circuit	Analog and RS-485		Analog and RS-485		Analog and RS-485	
Output signal	4 ... 20 mA / 0 ... 10 VDC (adjustable)		4 ... 20 mA / 0 ... 10 VDC (adjustable)		4 ... 20 mA / 0 ... 10 VDC (adjustable)	
Switching output	Push-pull		Push-pull		Push-pull	
Output function	Out 1 / alarm		Out 1 / alarm		Out 1 / alarm	
Output current	< 100 mA		< 100 mA		< 100 mA	
Baud rate	Adjustable		Adjustable		Adjustable	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes		Yes	

Mechanical data	**OM70T-11195786 OM70T-P0070.HH0065.VI**	**OM70T-11175113 OM70T-L0070.HH0065.VI**	**OM70T-11175099 OM70T-P0140.HH0130.VI**	**OM70T-11175110 OM70T-L0140.HH0130.VI**	**OM70T-11175094 OM70T-P0250.HH0240.VI**	**OM70T-11175097 OM70T-L0250.HH0240.VI**
Width / Height / Length	26 / 74 / 55 mm		26 / 74 / 55 mm		26 / 74 / 55 mm	
Design	Rectangular, front view		Rectangular, front view		Rectangular, front view	
Housing material	Aluminum		Aluminum		Aluminum	
Front optic	Glass		Glass		Glass	
Connection method	Plug M12 8-pole		Plug M12 8-pole		Plug M12 8-pole	
Weight	130 g		130 g		130 g	

Ambient conditions	**OM70T-11195786 OM70T-P0070.HH0065.VI**	**OM70T-11175113 OM70T-L0070.HH0065.VI**	**OM70T-11175099 OM70T-P0140.HH0130.VI**	**OM70T-11175110 OM70T-L0140.HH0130.VI**	**OM70T-11175094 OM70T-P0250.HH0240.VI**	**OM70T-11175097 OM70T-L0250.HH0240.VI**
Ambient light immunity	< 28 kLux		< 35 kLux		< 170 kLux	
Operating temperature	-10 … +50 °C		-10 … +50 °C		-10 … +50 °C	
Storage temperature	-20…+60 °C		-20…+60 °C		-20…+60 °C	
Heating period	20 min.		20 min.		20 min.	
protection class	IP 67		IP 67		IP 67	
Vibration resistance (sinusoidal)	**IEC 60068-2-6:2008** 1 mm p-p at f = 10 - 55 Hz, duration 5 min per axis 30 min endurance at f = 55 Hz per axis		**IEC 60068-2-6:2008** 1 mm p-p at f = 10 - 55 Hz, duration 5 min per axis 30 min endurance at f = 55 Hz per axis		**IEC 60068-2-6:2008** 1 mm p-p at f = 10 - 55 Hz, duration 5 min per axis 30 min endurance at f = 55 Hz per axis	
Shock resistance (semi-sinusoidal)	**IEC 60068-2-27:2009** 30 g / 11 ms, 6 jolts per axis and direction		**IEC 60068-2-27:2009** 30 g / 11 ms, 6 jolts per axis and direction		**IEC 60068-2-27:2009** 30 g / 11 ms, 6 jolts per axis and direction	

Optical properties	OM70T-11195786 OM70T-P0070.HH0065.VI	OM70T-11175113 OM70T-L0070.HH0065.VI	OM70T-11175099 OM70T-P0140.HH0130.VI	OM70T-11175110 OM70T-L0140.HH0130.VI	OM70T-11175094 OM70T-P0250.HH0240.VI	OM70T-11175097 OM70T-L0250.HH0240.VI
Light source	AlGaInP laser diode		AlGaInP laser diode		AlGaInP laser diode	
Wave length	660 nm		660 nm		660 nm	
Operating mode	pulsed		pulsed		pulsed	
Pulse duration	4 µs…2.5 ms		4 µs…2.5ms		4 µs…2.5ms	
Pulse period	0.4…5 ms	0.4…5 ms	0.4…5 ms	0.4…5 ms	0.4…5 ms	0.4…5 ms
Total emitted pulse power	0.24mW	0.19mW	0.28 mW	0.24mW	0.19mW	0.28 mW
Beam shape	Point laser	Short line	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	34 mm 50 mm		36 mm 53 mm		38 mm 55 mm	
Focal distance df	65 mm mm		130 mm		240 mm	
Nominal ocular hazard distance (NOHD)1	N/A	N/A	N/A	N/A	N/A	N/A
Laser classification (as per IEC 60825-1/2014)	Laser class 1		Laser class 1		Laser class 1	

[1] Outside the "Nominal ocular hazard distance", the radiation exposure is below the limit value of laser class 1

8 Revision history

12/8/2017	tof	Manual released in version 1.0
01/11/2018	tof	Structural changes. Complete revision
05/30/2018	tof	Data sheet changes and optimizations

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