Operating Instructions

OM70 - High performance distance sensors with Ethernet interface

Contents

1 General information

1.1 Concerning the contents of this document

This manual contains information for the mounting and start-up of Baumer OM70 high performance distance sensors. It is a supplement to the mounting instructions supplied with each sensor.

Carefully read the operating instructions prior to the use of the product and observe the safety instructions! In addition, the operating instructions must be kept and made available for future reference.

1.2 Safety instructions

The following symbols emphasize safety and warning instructions in this manual. The safe use of this product requires compliance with the safety instructions.

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!

Intended use

This product is a precision device and serves the identification of items and objects and the preparation or provision of measured values for the subsequent system. Unless specifically labeled, this product may not be used in explosive environments.

Start-up

Assembly, mounting and calibration of this product may only be performed by a specialist.

1.3 Liability limitation

Liability of Baumer Electric AG is excluded for the following situations:

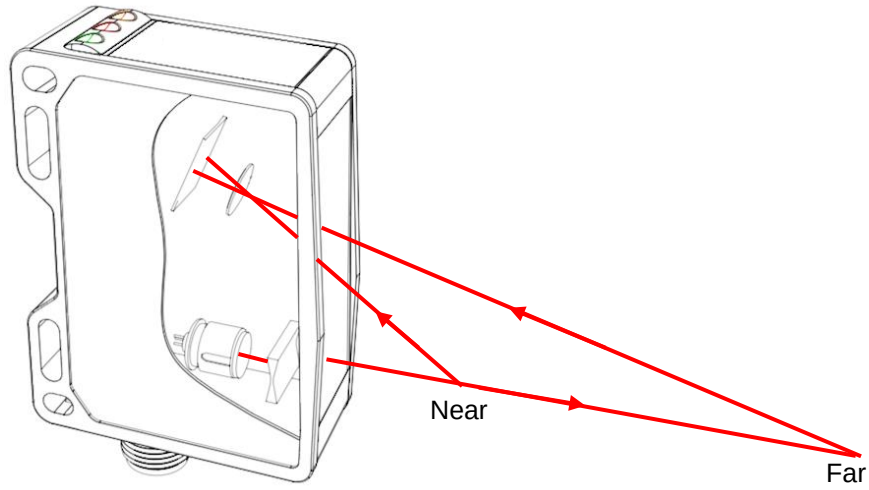
- Non-observance of the instructions
- Non-intended use of the product
- Deployment of untrained staff
- Use of unapproved spare parts
- Unapproved modification of products

CAUTION!

Deviations from the processes and settings stated here can result in hazardous situations!

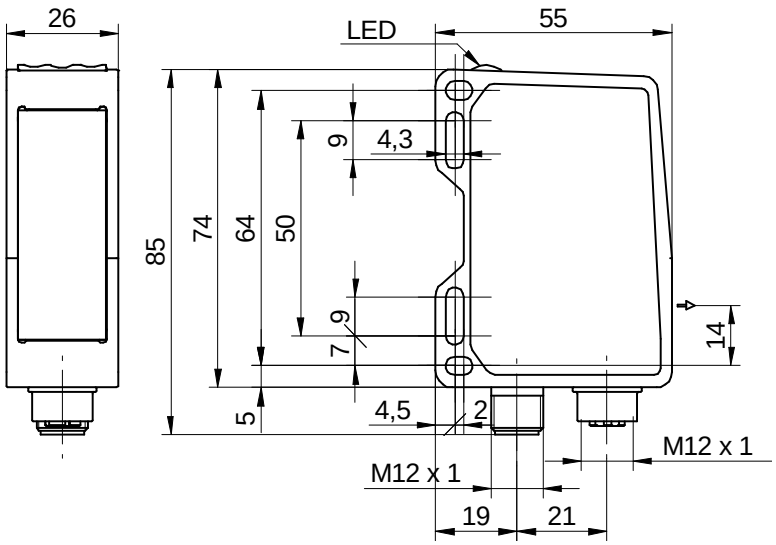
2 Product information

2.1 Functionality

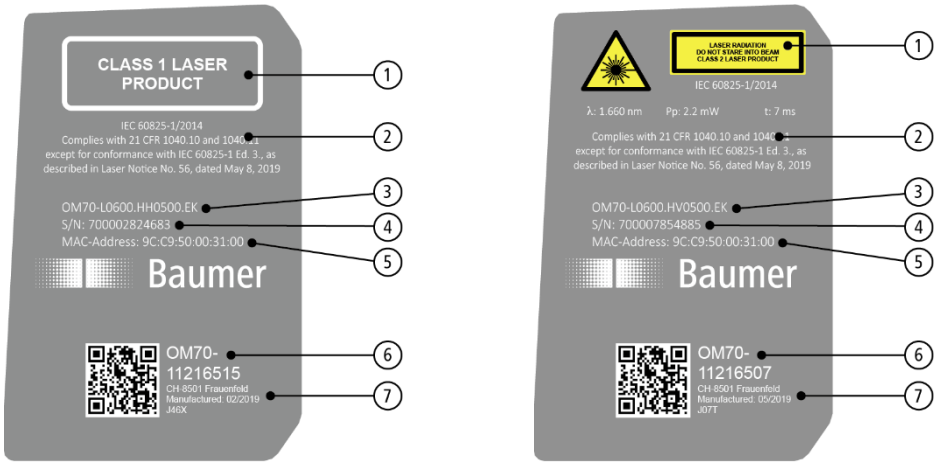


This distance sensor is based on the triangulation principle, which in turn is based on angulation. To carry out the distance measurement, the sensor transmits a light beam, in this case a laser beam, to the object . The light reflected from the object strikes a receiver line inside the sensor at a special angle, depending on the distance. With the help of triangulation, the distance to the object can be determined based on the relationship between the transmission and reception angle.

2.2 Dimensions



2.3 Sensor inscriptions



1. Laser class notice/ warning sign
2. FDA certification sign
3. Article name
4. Serial number
5. MAC address
6. Material number
7. Production code

2.4 Laser radiation

Notice and warning sign	**Class 1: No risk for the eye** **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: Do not stare into the beam** 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	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	

CAUTION!

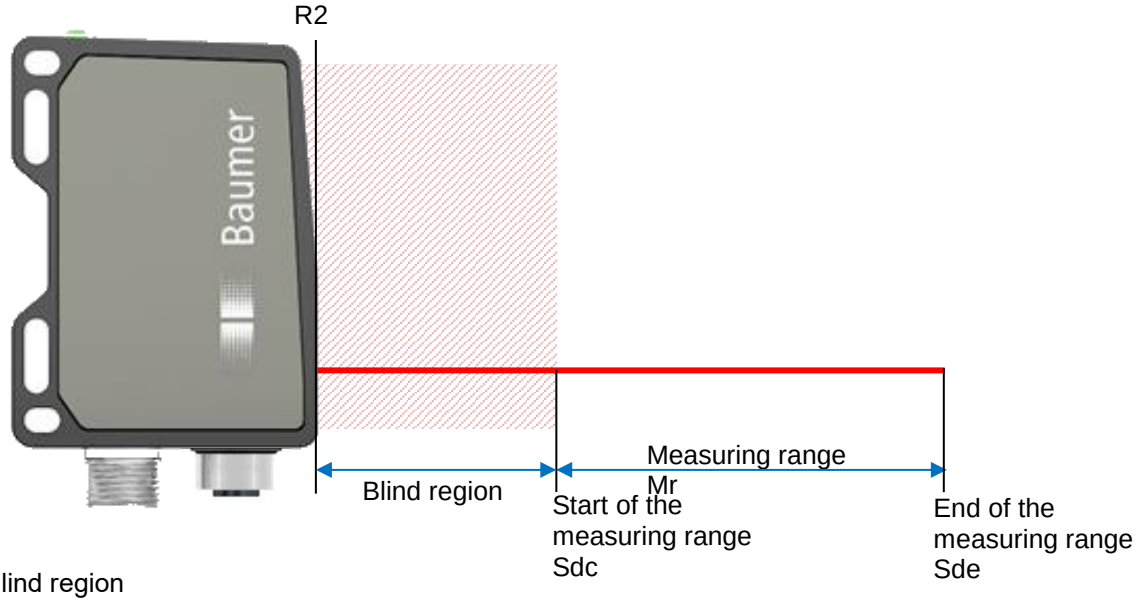
When using a sensor with broken front panel, defective display, loose or separated lens, it must be immediately separated from the power supply to prevent the emission of laser radiation.

2.5 Status LEDs on the sensor

LED	Illuminated	Flashes
Yellow	**Switching Output** Switching output (out 1) is active.	-
Red	**Alarm Output** Alarm output (out 2) is active. No object within the measuring range or signal quality is inadequate.	**Critical Signal** Signal quality is insufficient for a reliable measurement.
Green	**Supply Voltage** Sensor ready for operation, Ethernet connection not available.	**Short Circuit** Check connection to the Switching or Alarm Output.
Blue	**Ethernet Link** Sensor ready for operation, Ethernet connection available.	**Data Transfer** Data packages are received or transmitted via Ethernet.

2.6 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 in the delivery condition.



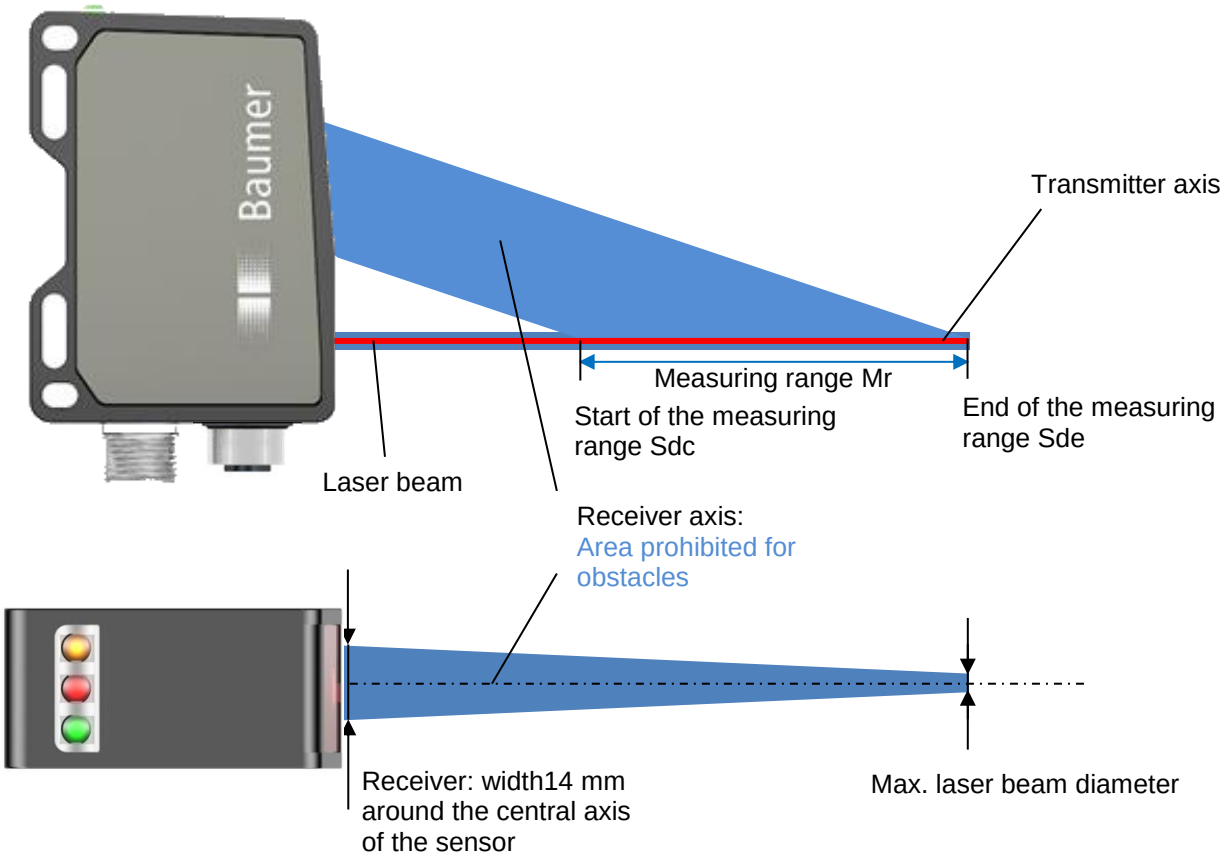
Blind region

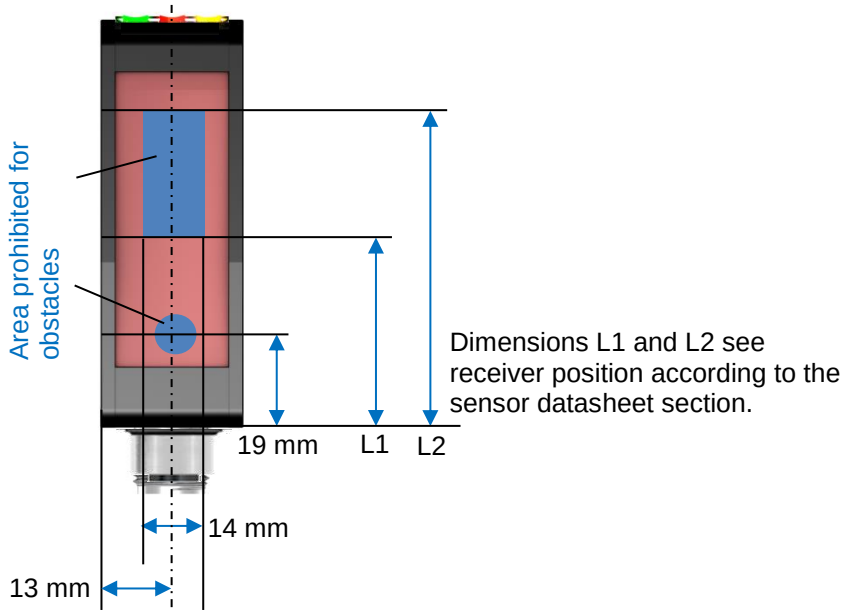
The area from reference level R2 to the start of the measuring range Sdc is called blind region, the sensor cannot detect any objects there.

If there are any objects in this region, this can lead to incorrect measured values.

2.7 Transmitter and receiver axis

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





3 Mounting and connection

3.1 Mounting

Only use the fasteners and fastener accessories intended for this product for the mounting.

CAUTION!

Connection, mounting and start-up may only be performed by specialists. Protect optical surfaces from humidity and contamination to prevent measurement errors.

3.2 Mounting accessories

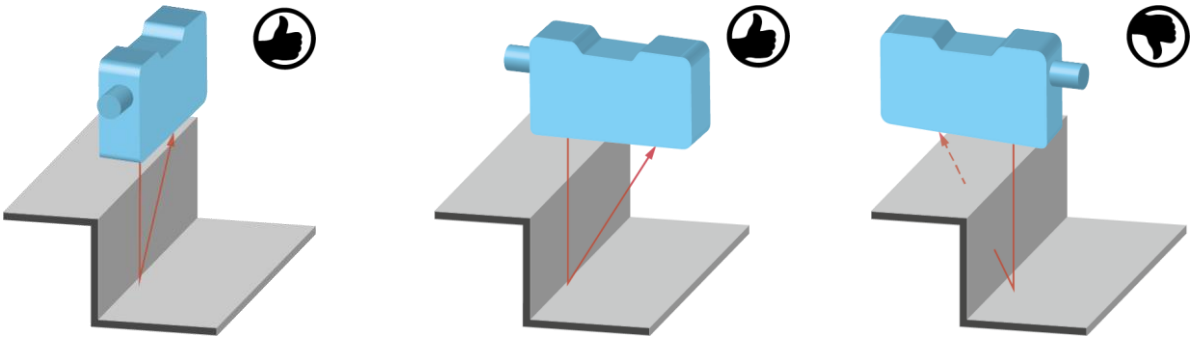
The sensor is equipped with four fastening slits through which it can be flexibly aligned and mounted. For the fastening 2 screws M4x35 and suitable washers are recommended, the maximum torque is 1.2 Nm.

Accessories for easy assembly are linked to the respective product page on the Baumer homepage. Enter the article number in the search field on www.baumer.com and open the product page.

3.2.1 Alignment

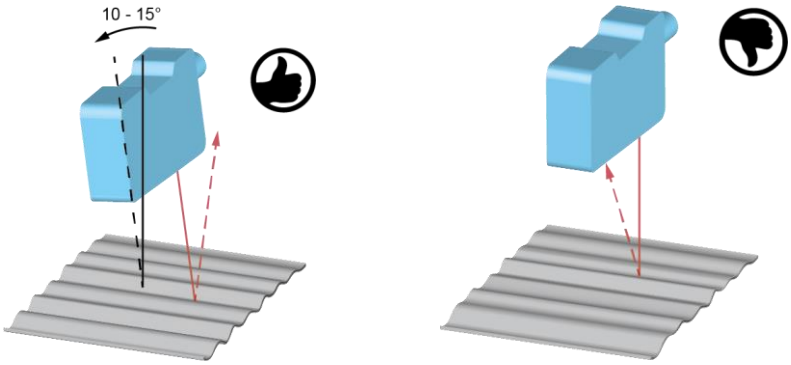
To achieve as reliable and exact measured values as possible, the following hints and tips for mounting should be followed.

3.2.1.1 Steps/edges



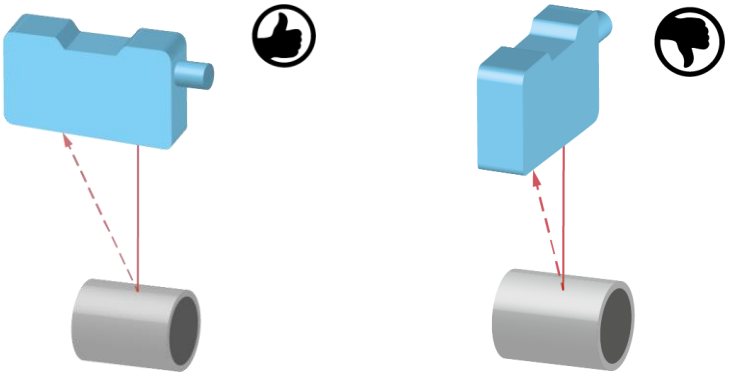
If measurements are carried out directly beside steps/edges, make sure that the reception beam is not covered by the step/edge. The same applies when the depth of holes and cracks is measured.

3.2.1.2 Shiny surfaces



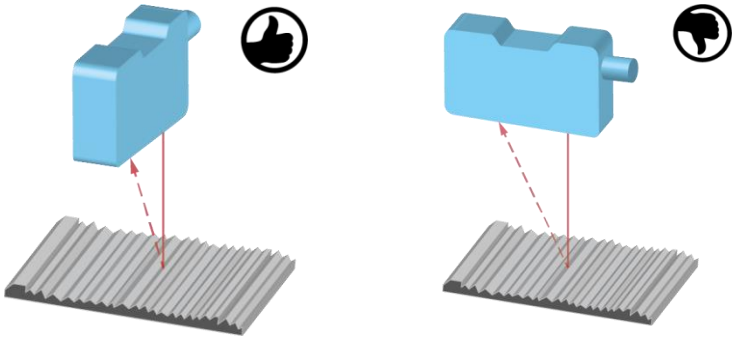
With shiny surfaces, it is important to ensure that the direct reflection does not strike the receiver. This can be prevented by tilting the sensor slightly. To check this, place a sheet of white paper on the disc of the receiver; the direct reflection can then be seen clearly.

3.2.1.3 Round shiny surfaces



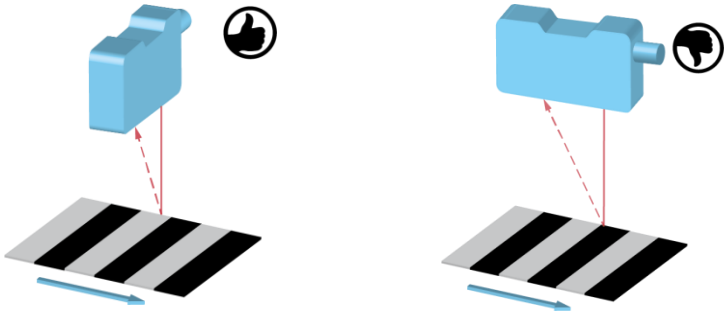
With round, shiny surfaces, the sensor should be aligned in the same axis as the round object in order to avoid reflections.

3.2.1.4 Shiny objects with evenly aligned structure



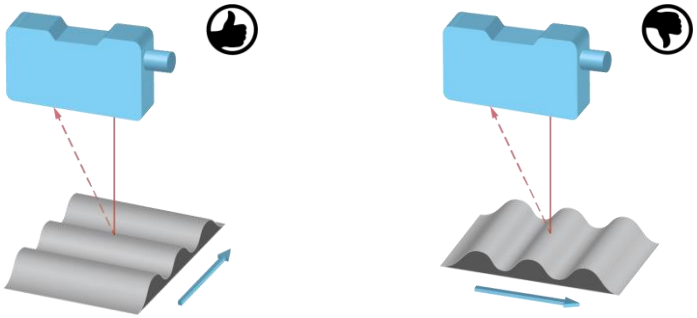
Particularly with shiny objects, for example turned parts, ground surfaces, extruded surfaces and the like, the mounting position affects the measuring result.

3.2.1.5 Objects with evenly aligned colored edges



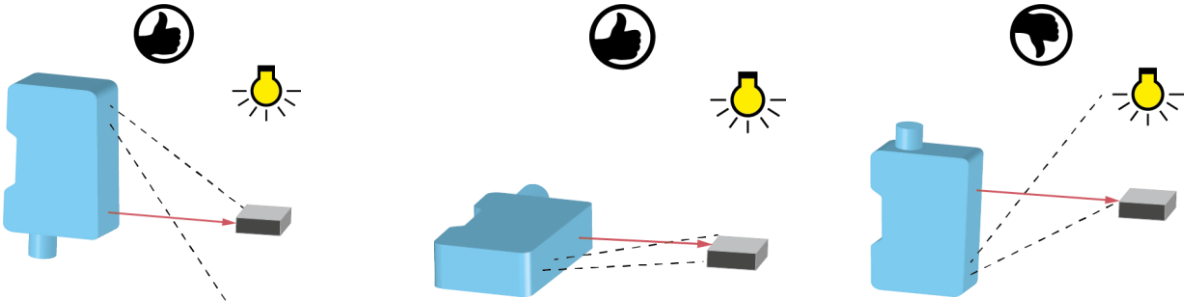
In the correct orientation, the influence on the measuring accuracy is low. In the wrong orientation, the deviations depend on the differences in reflectivity of the various colors.

3.2.1.6 Moving objects



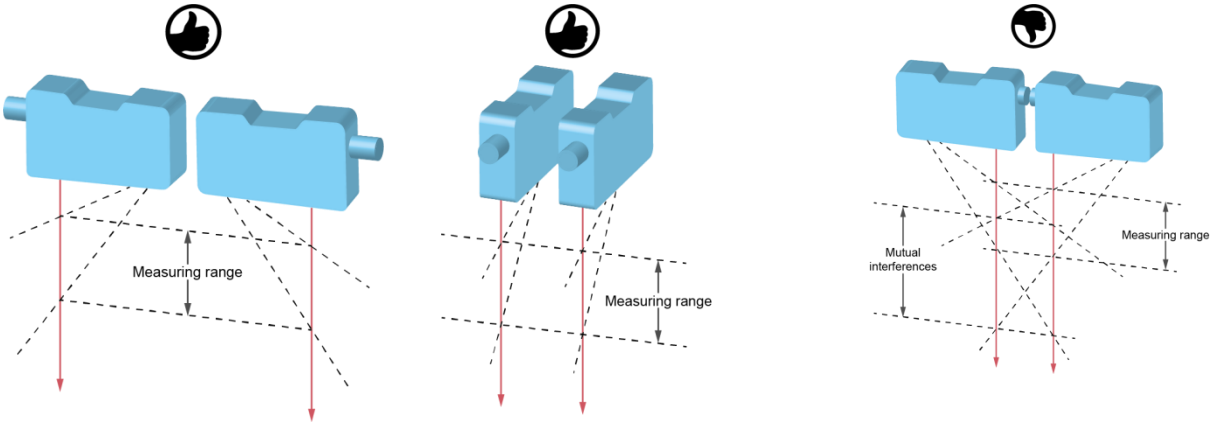
If the contour of an object is measured, it is important to ensure that the object moves at right angles to the sensor, to avoid shadowing and reflections on the receiver.

3.2.1.7 Protection from ambient light



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

3.2.1.8 Reciprocal influence



If several optical sensors are used, they may mutually influence one another. During mounting, 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 mounting, the sensors can be operated asynchronously using the Sync-in input, see section "Trigger Mode".

3.3 Electrical connection

Outputs not in use may not be wired. Unused wires of cable outputs must be insulated. Do not go below permissible cable bending radii. The system must be switched off before electrically connecting the product. If required, shielded cables must be used to prevent electro-magnetic interference. If the customer assembles plug connections to shielded cables, then EMC-version plug connections should be used and the cable shield must be connected to the plug housing across a large surface area.

CAUTION!

Incorrect supply voltage will destroy the device!

CAUTION!

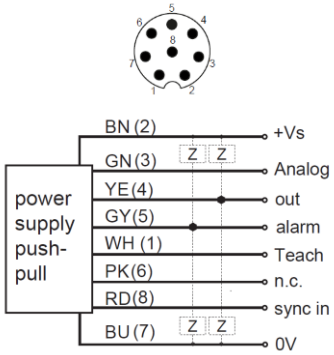
Connection, mounting and start-up may only be performed by specialists.

CAUTION!

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

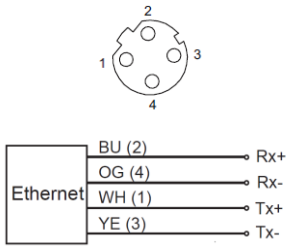
3.3.1 Pin assignment and connection diagram

M12 8-pin



	Color	Function	Description
Pin 1	WH = white	Teach	Teach Input (Zero Position)
Pin 2	BN = brown	+ Vs	Operating voltage (+15 … +28 VDC)
Pin 3	GN = green	Analog	Analog Output
Pin 4	YE = yellow	out	Switching Output
Pin 5	GY = gray	alarm	Alarm Output
Pin 6	PK = pink	n.c.	Not connected
Pin 7	BU = blue	0V	GND
Pin 8	RD = red	Sync-in	Synchronization Input

M12 4-pin



	Color	Function	Description
Pin 1	WH = white	Tx+	TX+ (BI_DA+)
Pin 2	BU = blue	Rx+	RX+ (BI_DB+)
Pin 3	YE = yellow	Tx-	TX- (BI_DA-)
Pin 4	OG = orange	Rx-	RX- (BI_DB-)

NOTE

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

3.3.2 Connection cables

Accessories for a professional connection are linked to the respective product page on the Baumer homepage. Enter the article number in the search field on www.baumer.com and open the product page.

4 Configuration via web interface

The following table presents an overview of the settings in the delivery condition.

Parameterization/configuration option		OM70-x.EK
Language		English
Trigger Mode		Free Running
Measuring Range Limits		Sdc…Sde
Zero Position		0 mm (sensor front)
Tilt Compensation		Off
Precision Filter		Very high
Invalid Value Handling	Value after Dropout	Near
	Hold Time	0 ms
Analog Output	Output Type	4 - 20 mA
	Min. Output Point	Sdc
	Max. Output Point	Sde
	Inverted Characteristics	Off
Switch Points	Switching Mode	Window
	Far Point	Sde - 10 mm
	Near Point	Sdc + 10 mm
	Hysteresis	MR / 1000
	Polarity	Active low
Network	IP address	192.168.0.250
	Subnet mask	255.255.255.0
	Standard gateway	192.168.0.1
	DHCP	Off
	MAC address	See label inscriptions
Time synchronization	NTP	On
	Time server	192.168.0.1
Process interface	Modbus TCP/ IP	On
	OPC UA	On
	Profinet	On
	UDP streaming	Off
	IP address	192.168.0.2
	Port	1234
Password protection		Off

4.1 Starting up the Ethernet interface on the PC

4.1.1 Allocation of an IP address

To use the device in your network you must allocate a unique IP address to the device.

1. If a DHCP server is integrated into the network, this server will allocate the IP address. No other manual adjustments need to be made.
2. If the DHCP functionality is deactivated or no valid IP address can be determined, the static IP address is used. In the delivery condition the IP address is 192.168.0.250 (subnet mask: 255.255.255.0).

NOTE

To avoid network errors, you must ensure that each IP address is unique and not already allocated.

4.1.2 Identifying an unknown sensor IP address

If you don't know the IP address of the sensor, either because it was assigned via DHCP or the information about the static IP address is no longer available, you can query the IP address using the following options:

Option 1: Requesting the IP address via mDNS

1. Open a browser window
2. Type the following command in the address line of the browser: `OM70-[identifier].local.` Replace `[identifier]` either with the eight-digit order number or the MAC address indicated on the sensor. Example: `OM70-12345678.local` or `OM70-11-22-33-44-55-66.local`
3. The web interface of the device will be opened.

Option 2: Requesting the IP address via ping-command

1. Open a Windows command prompt
2. Execute the command `ping OM70-[identifier].local`. Replace `[identifier]` either with the eight-digit order number or the MAC address indicated on the sensor. Example: `ping OM70-12345678.local` or `ping OM70-11-22-33-44-55-66.local`
3. Read the IP address (here: 192.168.0.250) from the command output: `Ping is executed for OM70-12345678.local [192.168.0.250] with 32 bytes of data`

4.2 The web interface

The device is equipped with an integrated web server that provides a graphical user interface (GUI). This allows parameterization as well as evaluation of the data directly via the web browser.

Due to differences in browser technology, there may be deviations in the presentation or even incompatibilities with the device for some browsers and browser versions.

NOTE

Prerequisite for using the web interface is a web browser on your PC, Mozilla Firefox from Version 69 or Google Chrome from Version 77.
Internet Explorer is not supported in any version and cannot be used for connection to the sensor.
Microsoft Edge is not officially supported. However, in most cases it can be used without restrictions.

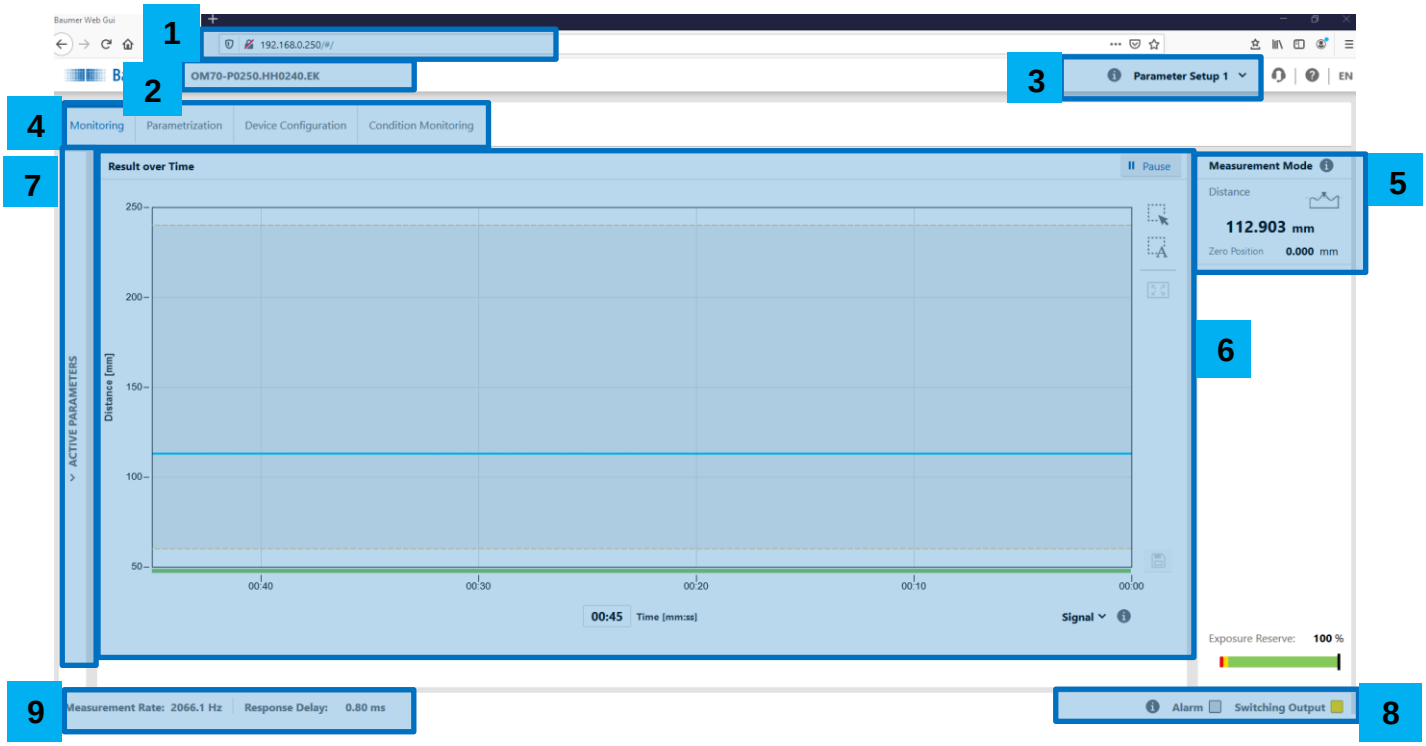
4.2.1 Connecting the web interface

1. Start the web browser
2. Enter the IP address of the sensor in the address line

NOTE

In the delivery condition the set IP address is 192.168.0.250

4.2.2 Overview web interface



1. IP address of the sensor
2. Commercial name of the connected sensor
3. Selection of active parameter setup, which is stored in the sensor
4. Mode: Monitoring, Parameterization or Configuration options and Condition Monitoring
5. Display of the measured distance in relation to the Zero Position
6. Output of the measured value as well as the signal quality/switching output over time
7. Overview of active parameters
8. Display warm up, status alarm and switching output.
9. Display of measuring conditions

4.3 Monitoring

Output and evaluation of the measured values.

1. Measurement Mode
2. Result over Time
3. Measuring conditions

4.3.1 Measurement Mode

The Measurement Mode shows the currently measured distance depending on the Zero Position. The Zero Position describes the offset from the front of the sensor housing on which the output measurement results are based. In the delivery condition the Zero Position is 0, which means it is on the front side of the sensor (level R2 – see section 2.3).

Example:
Zero Position (displayed) + Distance Value (displayed) = Absolute distance to the measured object, e. g.
100 mm + 50 mm = 150 mm (from front side of the sensor to measured object)

For more information about the Zero Position see section 4.4.2.2.

4.3.2 Result over time

The diagram shows the measured values (blue) within the adjustable "time span". The gray background or the gray line indicates the switching output window or the switching point.

4.3.2.1 Signal quality/ Switching output

The color bar underneath the diagram either indicates the signal quality or the switching output. This can be adjusted by the user via the drop down menu underneath the color bar.

Signal quality
Green: Valid signal
Yellow: Low signal
Red: Critical signal

Switching output
Yellow: switching output active
Grey: switching output inactive

4.3.2.2 Store/ Pause

Activating "pause" freezes the diagram. During "pause" the shown measured values can be stored on the PC in the .csv format by pressing the diskette icon.

4.3.3 Measuring conditions

The measurement conditions can be checked quickly and easily by displaying the exposure reserve, the response delay, and the measurement rate.

4.3.3.1 Exposure Reserve

The exposure reserve indicates the light quantity reflected by the measurement object (as a relative factor without unit). The exposure reserve helps you with the following problems, amongm others:

- Check whether a valid measurement result is present (signal quality). The signal quality is weak
  - when the sensor is not optimally aligned, and
  - when the distance between the sensor and measurement object is too large.
- During ongoing operation: Check the front panel of the sensor for contamination – if the exposure reserve decreases over time, it may be an indication of increased contamination of the front panel. Use the histogram function for this purpose

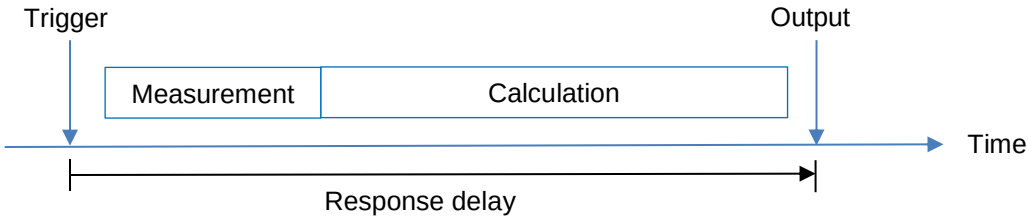
The distribution of the exposure reserve is recorded using the histogram function, which allows changes over time to be visualized (see Chapter 4.6).

NOTE

To prevent faulty measurement, make sure that there is sufficient exposure reserve, which can be accomplished by decreasing the distance to the object or the optimized alignment to the object (see section 3.2.1)

4.3.3.2 Response Delay

Output of the current response delay. The response delay describes the time elapsed between the triggering of the measurement (internal or external signal on the Sync-in) and the change of the measured value on the output.



The duration of the response delay depends on the exposure time. The sensor automatically adjusts its exposure time to the object to always receive an optimal light amount and thus achieve a sufficient exposure reserve. The exposure time depends on the properties of the surface (color, structure, etc.) and the relative position of the sensor towards the measured object.
Dark objects reflect less light and thus need longer exposure times than light objects, increasing the response delay.

NOTE

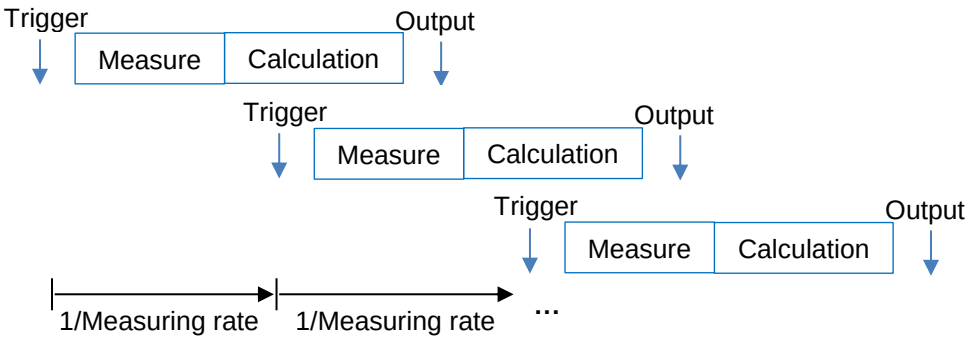
To allow the correlation of the measurement position and the output value for dynamic applications, the response delay should be considered. Filter settings do not affect the response delay.

4.3.3.3 Measurement rate in Hz

The measurement rate defines the number of measurements per second. With a measurement rate of 500 Hz, a measurement takes place every 0.002 s (1/ 500 Hz = 0.002 s).

The measurement rate value depends on the exposure time. The sensor automatically adjusts its exposure time to the object to always receive an optimal light amount and thus achieve a sufficient lighting reserve. The exposure time depends on the properties of the surface (color, structure, etc.) and the relative position of the sensor towards the measured object.
Dark objects reflect less light and thus need longer exposure times than light objects, decreasing the measuring frequency.

Measurement and change of the output always take place with the same frequency.
Example (Trigger Mode Free Running and Interval Mode):



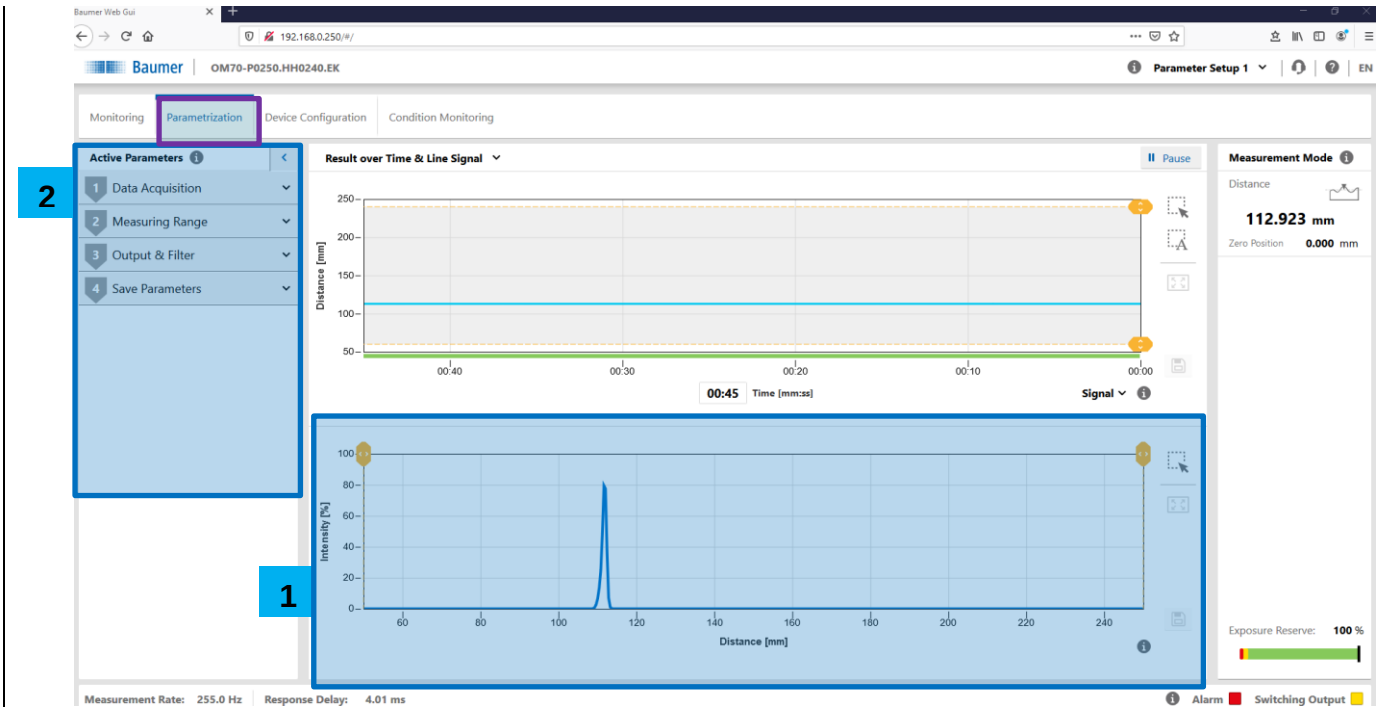
NOTE

The maximum speed for dynamic application is limited by the measurement rate. Filter settings do not affect the measurement rate.

4.4 Parameterization

Parameterization mode of the sensor.

> **NOTE**
>
> In the parameterization mode the alarm output is active and measurement rate lower.



1. Line Signal & Raw Line Signal
2. Active Parameters

4.4.1 Line Signal & Raw Line Signal

After switching the view from "Result over time & line signal" to "Line signal & raw line signal", the raw line signal of the receiver line is displayed.

Line signal:
The line signal indicates the relative received intensity (blue) in relation to the distance from the front side of the sensor housing **after** optimization of signal path (e. g. ambient light suppression). After the stopping/ pausing of the measurement curve, these values can be saved in the .csv format.

Raw line signal:
The raw line signal indicates the relative received intensity (blue) in relation to the distance from the front side of the sensor housing **before** optimization of signal path (e. g. ambient light suppression). After the stopping/ pausing of the measurement curve, these values can be saved in the .csv format.

> **NOTE**
>
> The line and raw line signal offer the opportunity of revealing disruptive signal peaks. Limiting the measurement range (see section 4.4.2.2) can eliminate these disruptive effects. This way, for example, measurements through glass can be implemented.

4.4.2 Active Parameters

4.4.2.1 Data collection

Trigger mode

Free Running mode:
Measurement with the maximum possible measuring frequency as the sensor triggers itself with the help of an internal signal. To achieve this maximum measuring frequency, the trigger is already actuated during data processing after the completion of the actual measurement. Measurement and data processing thus proceed in parallel. In the free-running mode, the measuring frequency varies according to the exposure.

Interval mode:
Measuring cycle with a fixed internal trigger interval (temporal in ms). Data processing can take place in parallel or sequential for the incorporation of new measurement values. The measurement frequency and thus the frequency of output values remain constant.

NOTE

The exposure time is adjusted to the defined trigger interval and thus potentially limited. This can result in a deterioration of the signal quality.

Single Shot mode:
A single shot is triggered with the trailing edge of an external trigger signal on the Sync-in. This measurement value is maintained until the next trailing edge. Approximately half the measurement frequency compared to the Free Running mode can be achieved. A trailing edge during a measurement cycle is ignored.

NOTE

In the Trigger mode "Single Shot" the filter setting "Standard" should be used to obtain the actual measurement value at the time of the trigger and to prevent mixed calculation with previous measurement values.

Note regarding the Sync-in Input:
With the Sync-in Input the measurement of the sensor can be stopped (Sync-in = high) and restarted (Sync-in = low). If the Sync-in Input is not connected, the sensor carries out the measurement as the Input is kept at low internally.

If the trigger mode "Single Shot" is selected, measurement must be initiated via the Sync-in Input. Each trailing edge of the Sync-in signal triggers a new measurement. The existing state of the sensor is maintained until the first trailing edge.

Sync-In	Level	Behavior
Low	0…2.5 V	• Free Running or Interval mode: Measurements are carried out according to the specification. • Single Shot mode: A trailing edge triggers a measurement.
High	8 V…UB (Operating Voltage)	The last measurement value is maintained at all outputs, the laser is deactivated.

4.4.2.2 Measuring Range

Measuring Range Limits:

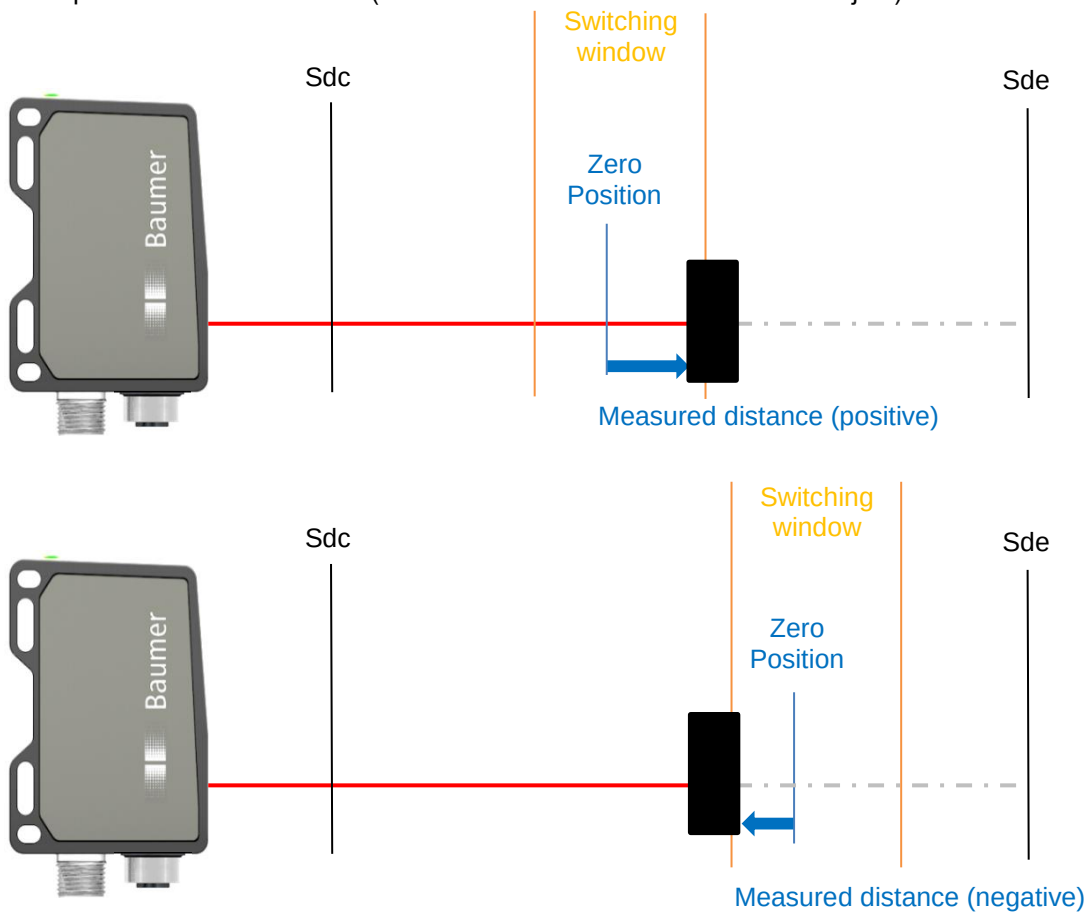
The Measuring Range Limits can be adjusted as part of the maximum limitation of the sensor to eliminate disruptive impulses (e. g. Measurement through glas). The Near Limit must be larger than the minimum limitation (Sdc) and the Far Limit must be smaller than the maximum limitation (Sde) of the sensor measuring range. The Measuring Range Limits are visualized in the Line and Raw Line Signal and allow a simple blanking out of disturbing peaks.
The maximum measuring range of the sensor is stated in the data sheet and can be resettet via "Maximize".

NOTE

The alarm output is activated as soon as no object is located within the Near and Far Limit or the signal quality is insufficient.

Zero Position:

The Zero Position describes the offset from the front of the sensor housing on which the output measurement results are based. Therefore, measurement with an adjusted Zero Position is a relative measurement. In the factory condition the zero position is 0, which means it is on the front side of the sensor. The zero position is the basis for the issued distance, the analog value (unchanged scaling) and the switch points. If the zero position is shifted, the analog window and the switching points are automatically shifted, as the "numerically" configured values are maintained. Negative values are not permitted!
Example Shift of Zero Position (same absolute distance to measured object):



The Zero Position can also be set to the current distance via the external teach Input. For this purpose, the teach line must be set to High for more than 2 seconds. Within this time the green LED blinks. After the successful Teach, the green and yellow LED blink as indicators.

NOTE

The Zero Position offers the possibility of a relative measurement.

Tilt Compensation:
Tilt compensation allows for measuring displacement along the z-axis accurately, irrespective of the sensor tilt angle relative to that axis. Three steps are required to utilize tilt compensation once the sensor is mounted in its final position:

1. Measure the distance from sensor to background. Teach the distance between sensor and background.
2. Measure the distance from the to a reference object (an object with well-defined height). Teach the distance between sensor and reference object.
3. Set the actual height of the reference object.

These three values are independent of each other and can therefore be taught in individually without affecting the other values. For example, simply set a new reference object height for a format change without having to re-teach distance from sensor to background and object.

Resetting the tilt compensation sets all values equal to zero and deactivates the function.

NOTE

It is recommended to set the filtering to a maximum before parameterizing the tilt compensation. The recommended setting is "User defined" with values in the Median filter of 21 and in the Average filter of 256 (see following chapter). In this way, the measured value error can be minimized during the inclination compensation process.

4.4.2.3 Output & Filters

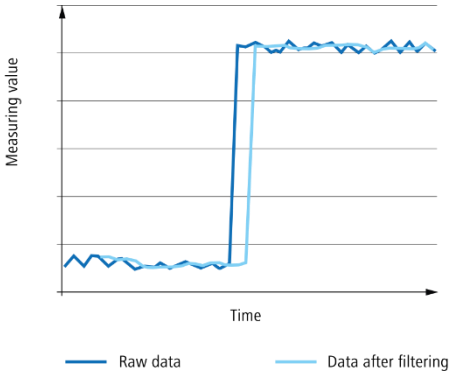
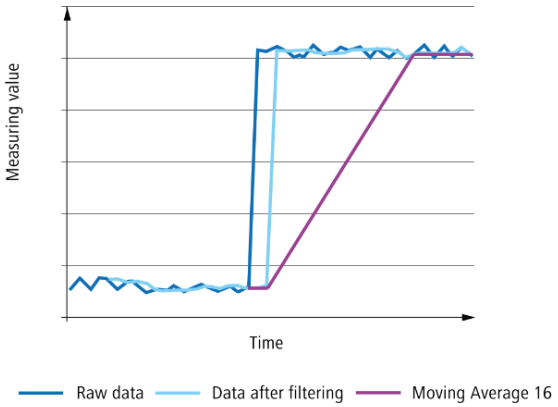
Precision Filter:

With the Filter function, the noise can be reduced and the repeatability increased.
The number of measured values per string of numbers (filter length) can be adjusted as follows via the parameter settings:

- Option 1: Select the required filter length from predefined filter lengths.
  - ▪ Standard
  - ▪ High
  - ▪ Very High
  - ▪ Highest
- Option 2: Enter the required filter length as a numerical value.
  - ▪ Custom

In general
The response and drop-off times are increased and moving objects detected with a delay as a result. The precision filter calculates the results in the form of floating values. The oldest measured value is removed as soon as a new measurement is added. Therefore the measuring frequency is not affected by the precision filter.

The sensor operates with the following two filters:

Moving Median	Moving Average
The median filter consists of processing the central value of a string of numbers sorted by size. When a new measured value is added, the oldest is removed (moving filter). Therefore, a change in distance only becomes apparent upon reaching the central value (with a slight time delay). This filter is used to suppress measurement errors. 	The output value of the moving average filter is the average of the defined number of measured values which have been saved in a string of numbers. When a new measured value is added, the oldest is removed (moving filter). Due to average calculation, a change in distance becomes increasingly visible. This filter is used to obtain more stable distance values. 

The higher the number of measured values per filter, the longer the response time of the sensor. This means that a change in distance only becomes fully visible for the output after a delay.

Option 1: Select the required filter length from predefined filter lengths

The following selection options are available and differ in the number of values that are made available to the filter:

Selection options	Filter dimension "Median"	Filter dimension "Average"
Standard	0	0
High	9	0
Very High	9	16
Highest	9	128

Option 2: Enter the filter length as a numerical value

If the predefined filter lengths are not suitable, an individual filter length can be entered for the Moving Average and Moving Median filters. Especially when it comes to applications without dynamic changes in distances, such as the verification of the position of an object, a greater filter length can improve the performance of the sensor. You can specify the length of the Moving Average and Moving Median filters after selecting the Custom filter.

- Moving Median filter: 1 - 21 values
- Moving Average filter: 1 - 256 values

NOTE

When several sensors are calculated, for example, for thickness measurement, the Standard filter should always be chosen to obtain a raw measured value of both sensors for further calculations measurement values are not included in the filtering.

Invalid Value Handling
The Invalid Value Handling defines the presentation of an invalid measurement value (no object within the valid measurement range, insufficient signal…) on the analog output and defines the time span in which invalid measurement values are suppressed.

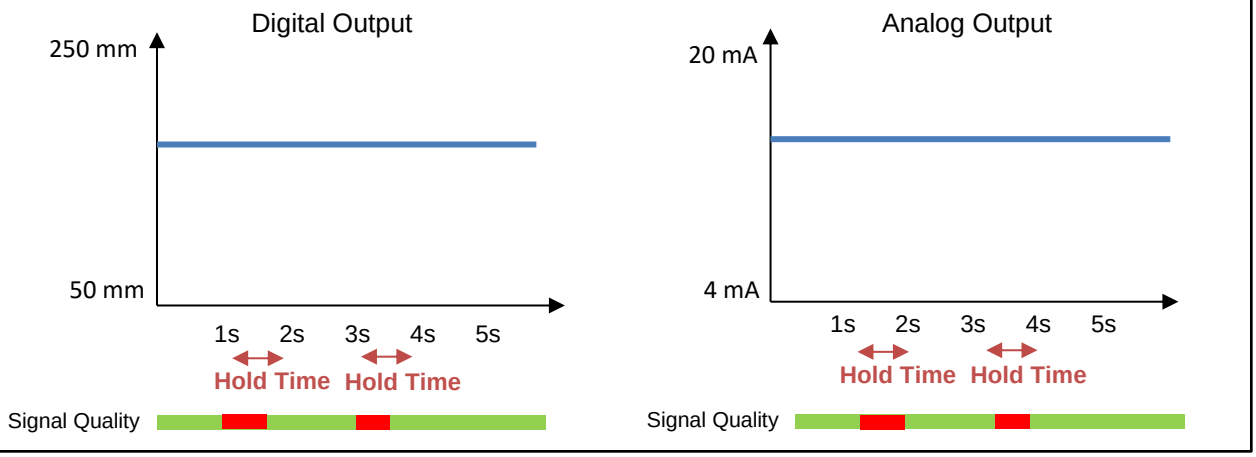
Value after Dropout:
Defines the assumed status of the analog output after a invalid measurement (the switching output maintains its last status and the digital output changes to NAN). See chapter Analog Output below for more information.

- Near: The analog output maintains its min. Output Point (configurable).
- Far: The analog output maintains its max. Output Point (configurable).
- Last valid: The analog output maintains its last valid value.

Hold Time:
The Hold Time defines a time span after an invalid measurement value in which the analog output maintains its last valid value. At the end of this time (without interruption by a valid measurement value) the configured "Value after Dropout" is activated.

Example Invalid Value Handling:

Value after Dropout: Near
Hold Time: 1000 ms

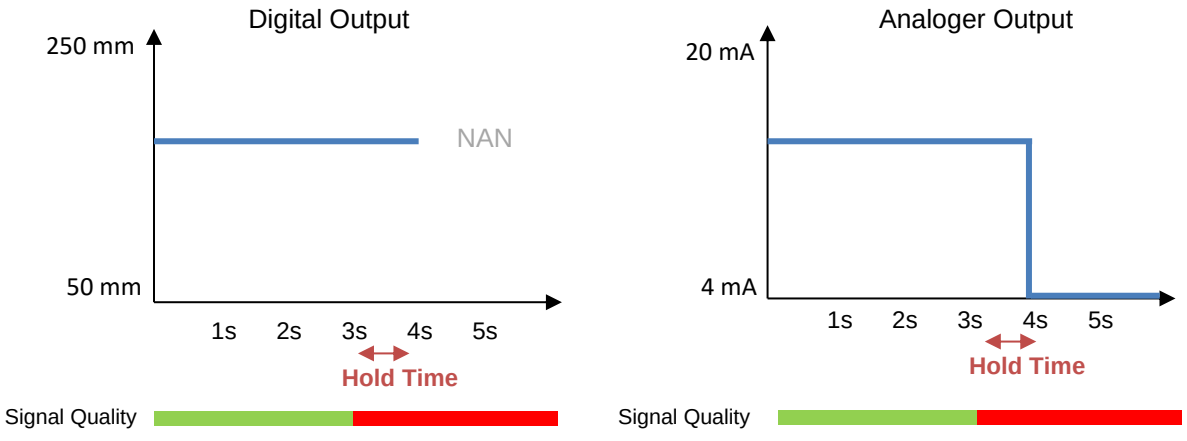


NOTE

The alarm output is only activated after the expiry of the Hold Time. This way, the Hold Time can be used to eliminate invalid measurement values on the outputs.

Example Invalid Value Handling:

Value after Dropout: Near
Hold Time: 1000 ms



Analog output

Output type:

Depending on the application purpose, the analog output can be switched to voltage (0-10 V/ 0-5V) or current (4-20 mA/ 2-10mA). The halved analog output can be used for thickness measuring with two sensors.

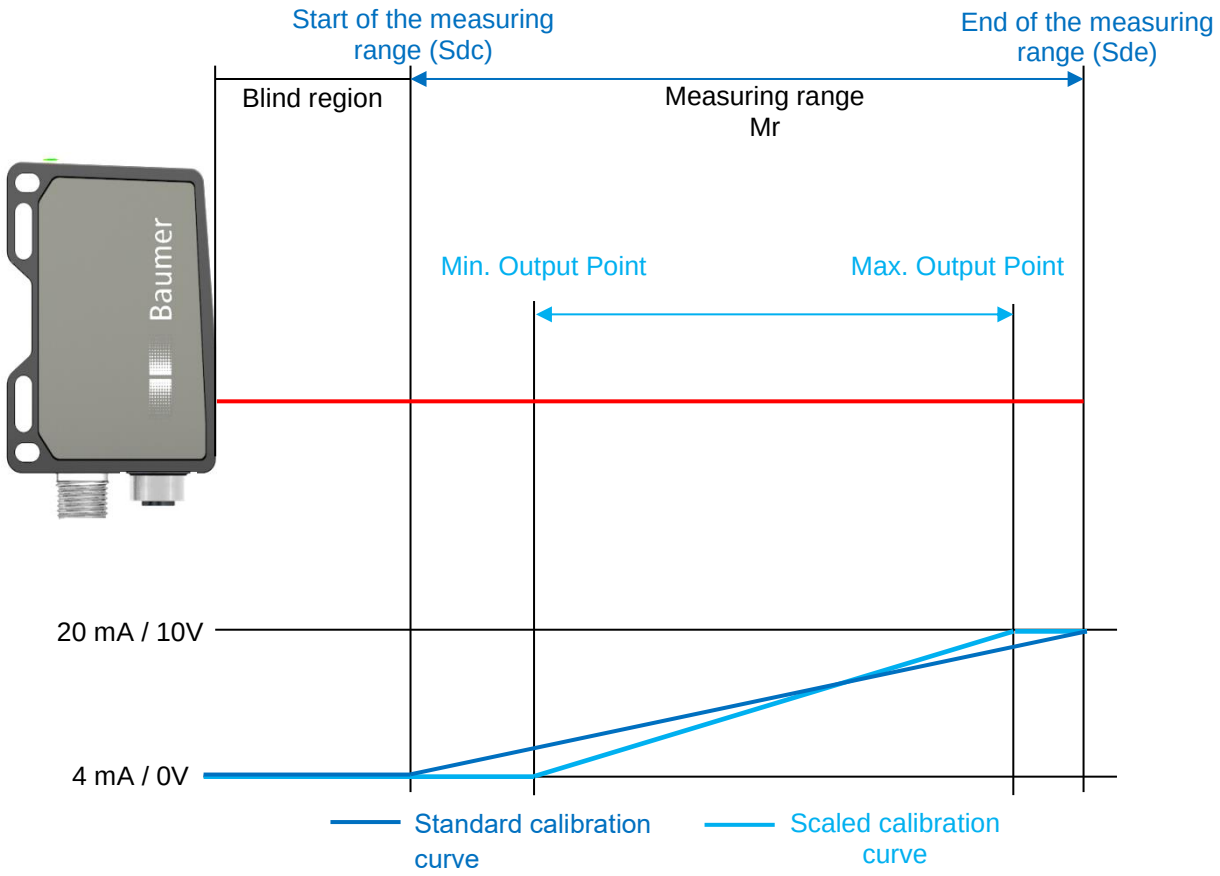
NOTE

To minimize interferences in the wiring, it is recommended to use the current output type.

NOTE

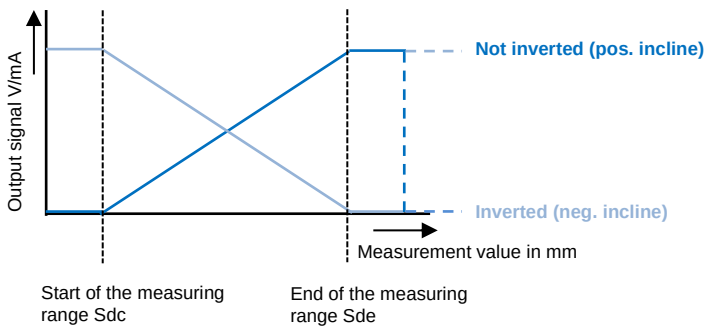
The analog output depends on the Zero Position. Changes to the Zero Point automatically shift the analog measuring field independent of the limits of the measuring range, as the numerical value of the output points remains unaffected.

Min./max. output point:
In the factory condition, the analog output extends across the maximum measuring range Mr (measuring range beginning Sdc – measuring range end Sde). With the numerical definition of the minimum and maximum Output Points the beginning and end of the analog measuring field can be newly defined, which decreases it and changes the slope of the calibration curve. Limiting the analog measuring field does not affect the resolution of the analog output of the sensor.



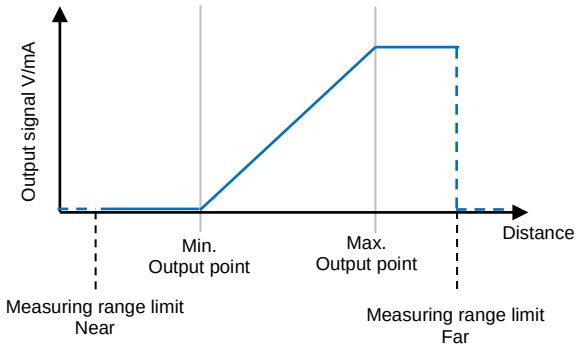
Maximize
With the "maximize" function, the analog measuring field is set to the maximum (Sdc ... Sde) and thus the factory setting.

Invert calibration curve
The calibration curve can be inverted here. With a positive curve, a greater measurement value increases the output signal, with a negative curve the output signal decreases.

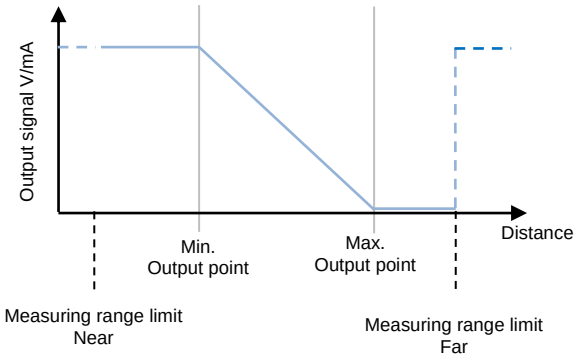


Examples of the behavior of the analog output:

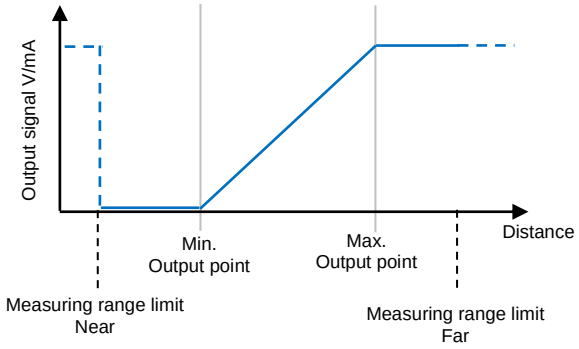
Value after Dropout: Near
Calibration curve inverted: no



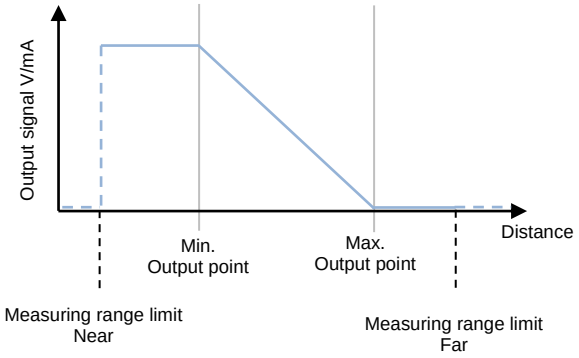
Value after Dropout: Near
Calibration curve inverted: yes



Value after Dropout: Far
Calibration curve inverted: no



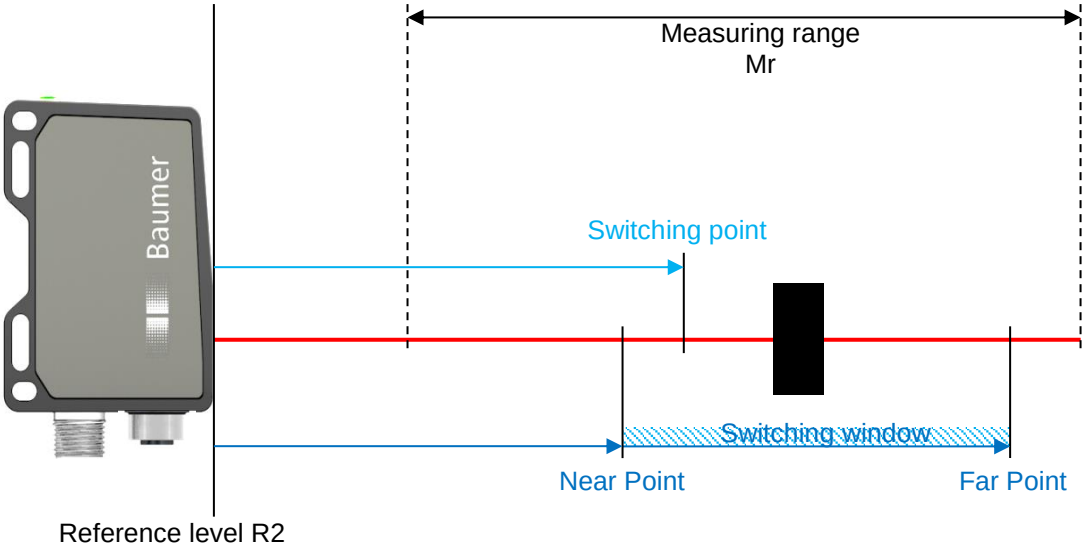
Value after Dropout: Far
Calibration curve inverted: yes



Switch Points

The switching output can be activated by a switching point or switching window as soon as the value exceeds or falls below the defined thresholds.

> **NOTE**
>
> The switching output depends on the Zero Position. Changes to the Zero Position automatically shift the switching point/ switching window independent of the limits of the measuring range.



Far Point

The Far threshold describes the point of the switching window that is Far from the sensor, therefore this value must be greater than the Near Point.

Near Point

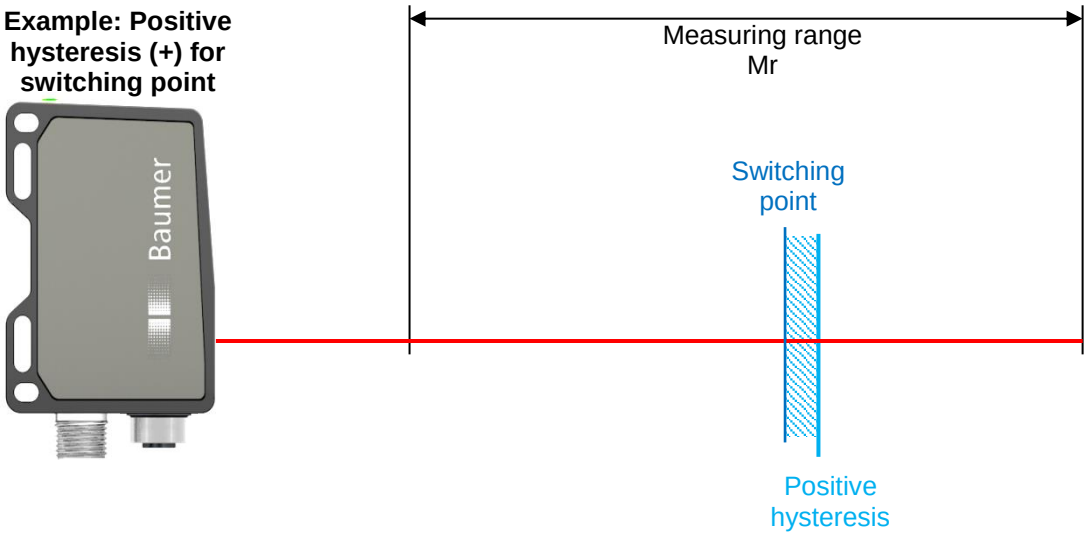
The Near threshold describes the point of the switching window that is Near the sensor, therefore this value must be smaller than the Far Point.

Hysteresis

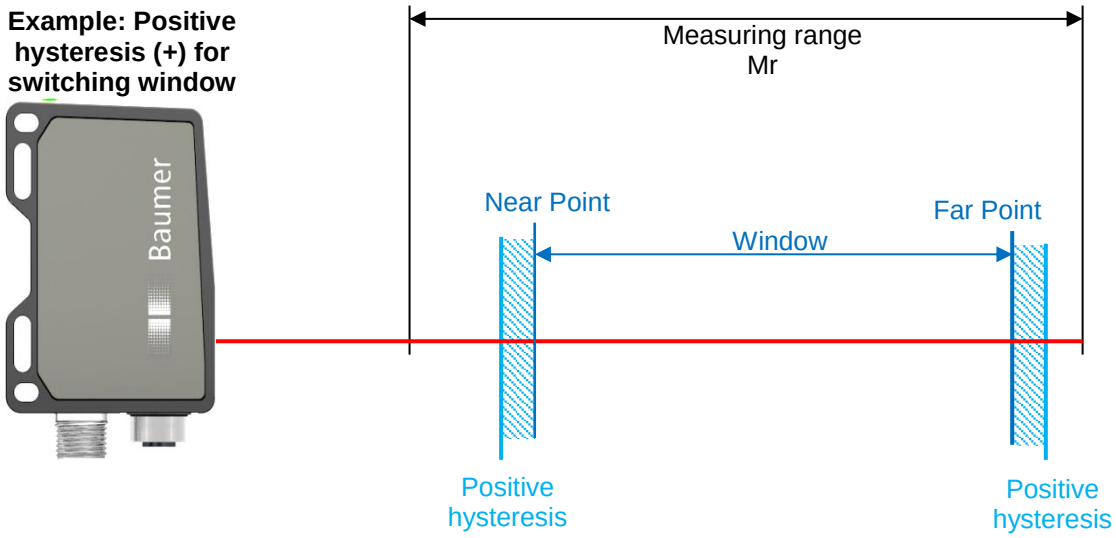
The hysteresis is the difference between the switching point and the reset point, and is specified as a value in mm. Without hysteresis, objects in the border area of the switching point could lead to the switching output switching on and off continuously, or to bouncing. For reasons of reliability,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

If a switching point is set, then a positive value defines a hysteresis aligned to the right and if a switching window is set, it defines a hysteresis aligned outside the window. No maximum hysteresis is defined (limitation: with a switching window it should not fall below the minimum window width).

Example: Positive hysteresis (+) for switching point



Example: Positive hysteresis (+) for switching window

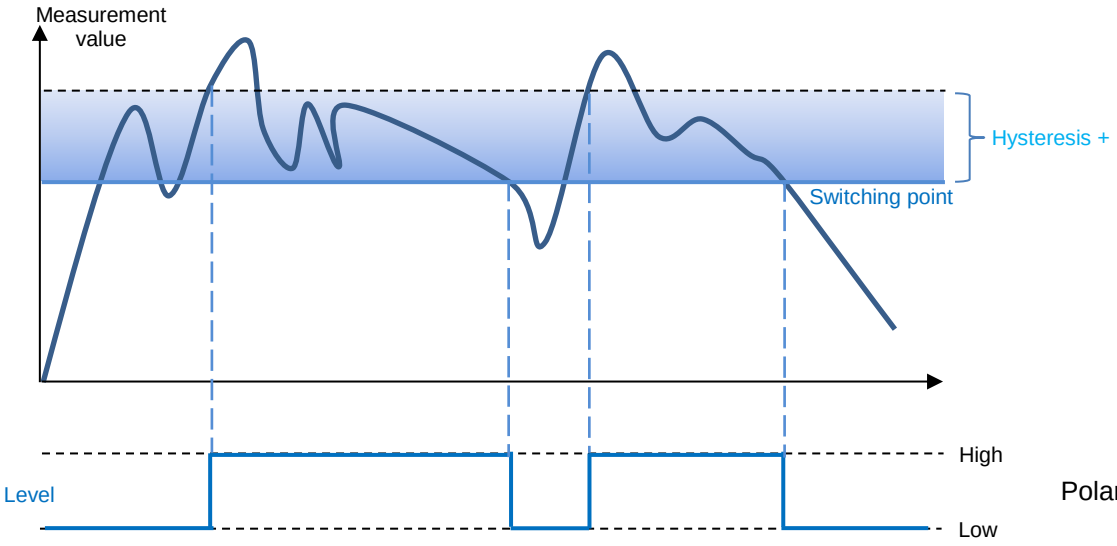


Polarity

The output level can be inverted with the polarity “Active High” or “Active Low”. The inversion also applies to the yellow LED on the sensor.

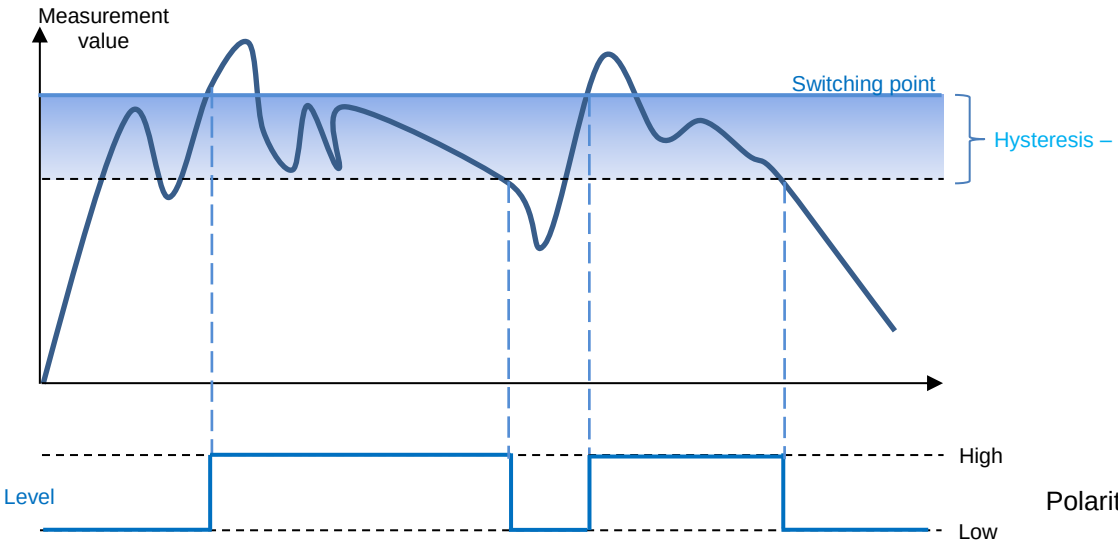
This is shown in the following examples:

Switching point – hysteresis positive



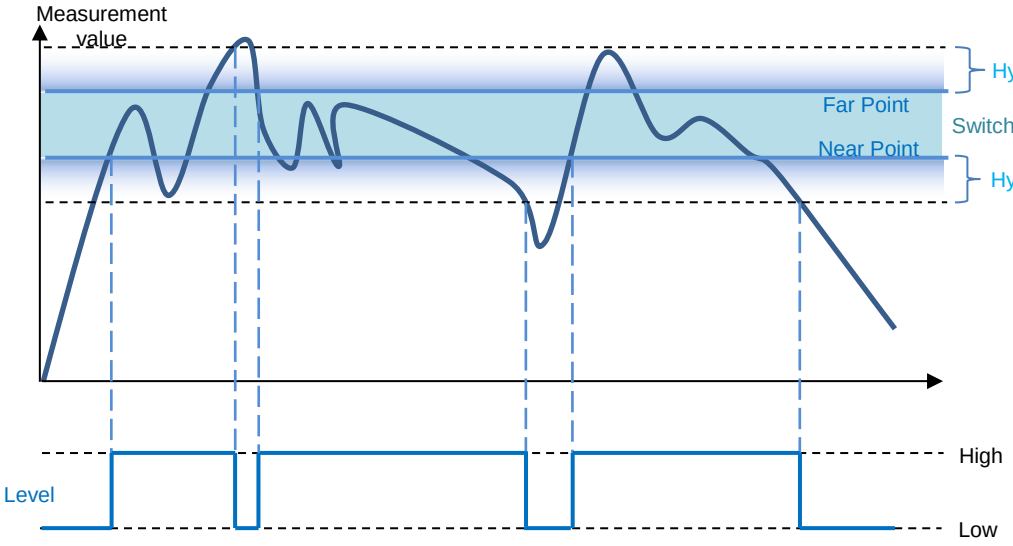
Polarity **Active low**

Switching point – hysteresis negative



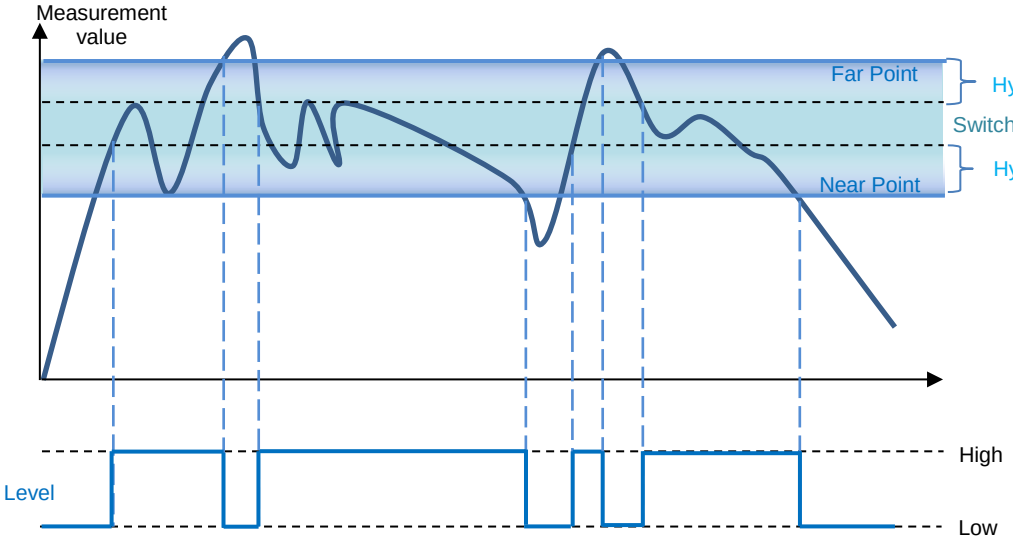
Polarity **Active low**

Switching window – hysteresis positive



Polarity **Active high**

Switching window – hysteresis negative



Polarity **Active high**

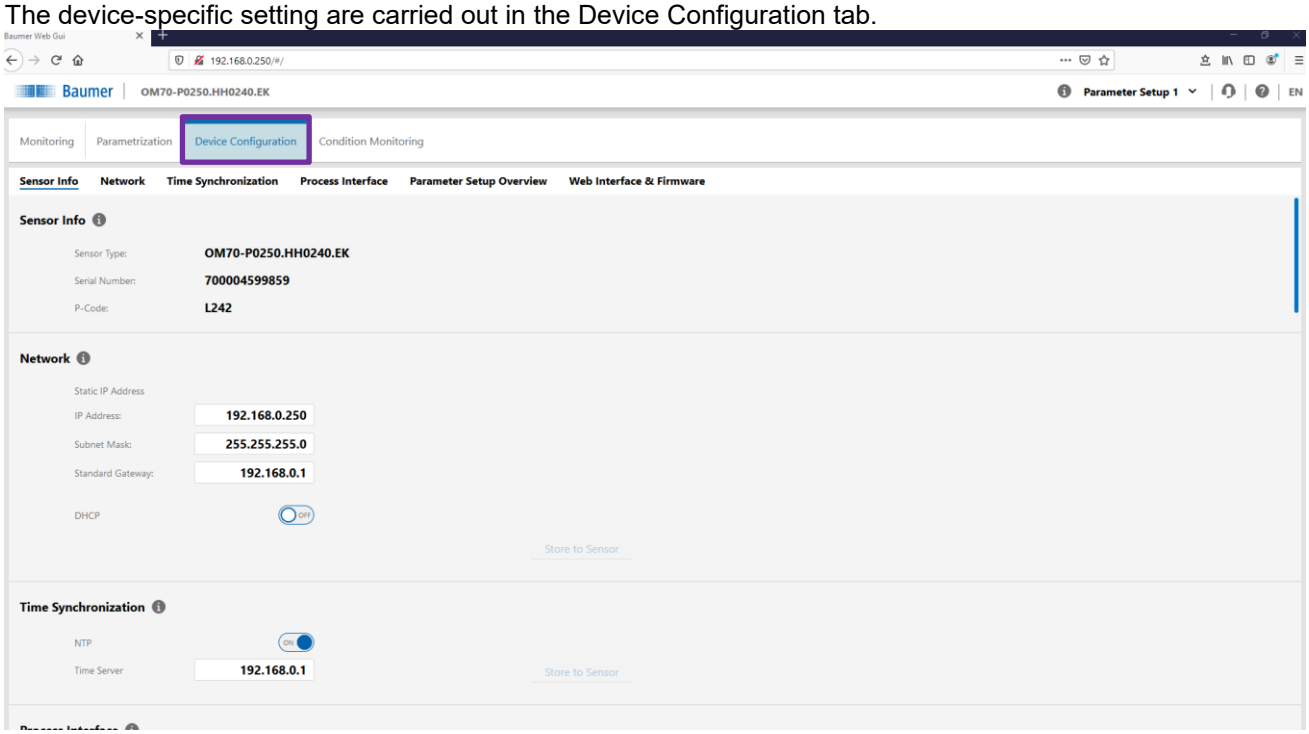
4.4.2.4 Save parameter

Save as Parameter Setup
This function allows storing parameter changes in one of three parameter setups to simplify the change of an entire set of parameters and to also have them available following a restart of the sensor.

Import/ Export
It is possible to transfer parameter setups between sensors. With the "Export" function the existing parameter setup can be exported in .json format and stored externally. The "Import" function allows the import of the stored parameter setup in .json format. Only unchanged export files can be imported.

4.5 Device Configuration

The device-specific setting are carried out in the Device Configuration tab.



4.5.1 Sensor Information

Shows key sensor information such as series, serial number and production code.

NOTE

Note: This information should be made available in case of a service request.

4.5.2 Network

Configuration of network settings. The network settings must be stored on the sensor via the button “Store to Sensor” to activate them.

Static IP address

The device uses a fixed IP address. Here the IP address, subnet mask and the standard gateway must be stated.

DHCP (Dynamic Host Configuration Protocol)

If DHCP is activated, the IP address will change to 0.0.0.0. A valid IP address must be allocated by DHCP server or an appropriate tool. If DHCP is activated the IP address is shown solely for information purposes. If DHCP is deactivated the IP address will be retained.

4.5.3 Time Synchronization

Activation/deactivation of the NTP synchronization. When the NTP function is activated, the sensor synchronizes its internal clock with a defined network time server. The time stamps of the measured values are set according to the synchronization. The time is based on UTC.

A daylight savings time function is not supported!

NOTE

If NTP synchronization is not activated, the time stamp is based on the time that has passed since the start of the device.

4.5.4 Process interface

Activation/ deactivation of the Modbus TCP-, OPC UA, Profinet and EtherNet/IP functionality by selecting the Realtime Ethernet interface or switching the "On/Off" button. If the associated interface is deactivated, the sensor no longer responds to requests via this protocol. Activating UDP streaming results in automatic sending (without request) of measured data.

NOTE

A change to the realtime Ethernet protocol only becomes effective after explicitly saving and restarting the sensor. Modbus TCP, OPC UA and UDP Streaming can be activated without restarting the sensor by saving the configuration.

4.5.5 Parameter Setup Overview

Overview display of the stored values of the parameter set up.

4.5.6 Web interface & firmware

Security

When activating password protection a password can be selected. After it is stored on the sensor, the passwords blocks access to the parameterization and device configuration. These two modes can only be accessed via the web interface after the password has been entered.

Should the user forget the password, the device must be reset to the factory settings via one of the other interfaces of the sensor. Prior to the reset, the set parameters can be exported and imported again after the reset to prevent the loss of the data. The network settings are excluded from this parameter export and are therefore lost.

Web interface

The function "Upload new web interface" offers the option of carrying out an update of the web interface. If required, the manufacturer provides the associated file.

Firmware

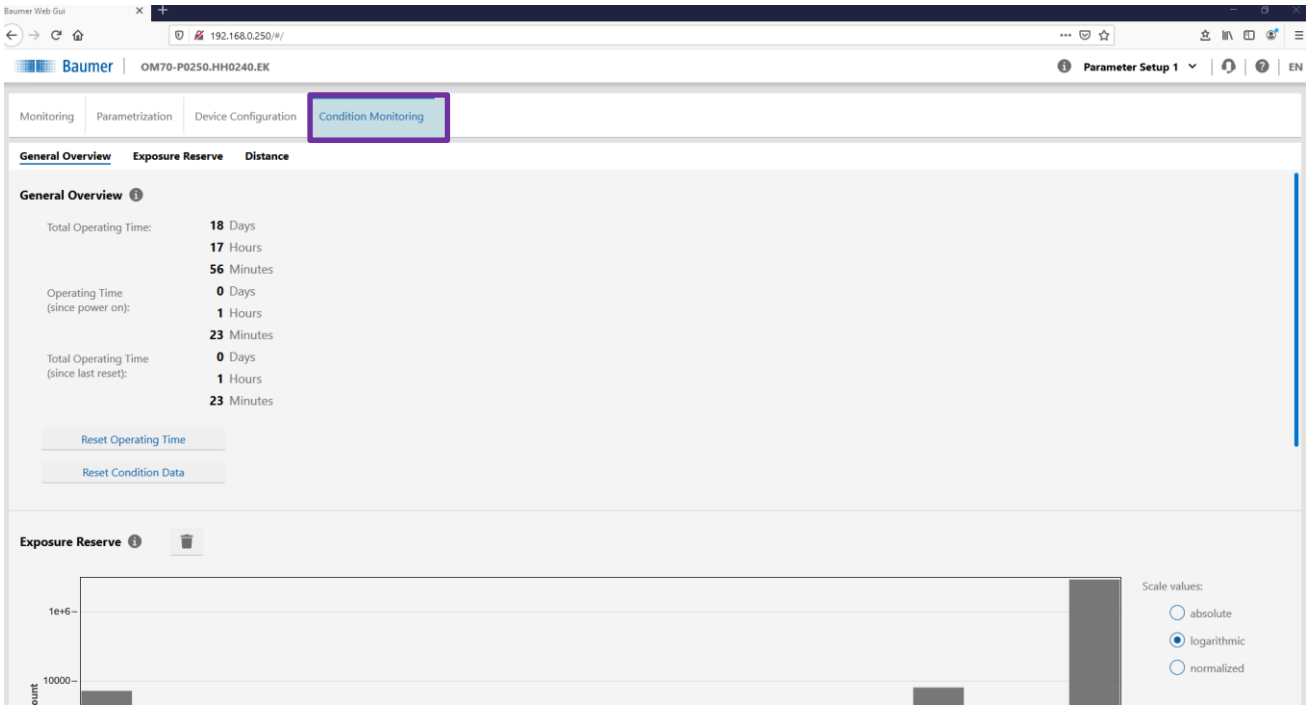
There are two options for resetting the sensor.

1. Resetting the settings resets the parameters, the network configuration remains intact.
2. Resetting the device to the factory settings resets the parameters as well as the network configurations, the sensor returns to the delivery condition.

NOTE

When resetting to the factory settings, the current configuration of the sensor is overwritten, the stored configurations are deleted from the storage and are no longer available.

4.6 Condition Monitoring



Operating Time
The operating time of the sensor is permanently recorded and output as the following values:

- Operating time since the last power up.
- Operating time since an individually configurable point in time (by reset).
- Operating time since the initial power up.

Histogram
With the histogram function, the following key data are recorded within defined intervals (bins):

- Distance
- Exposure reserve

Distance

The Distance histogram contains the number of occurrences of measured distance values. A measured value (distance) is recorded with each cycle. A change in the distance with constant application can indicate, for example, a mechanical misalignment of the mounting components. The following information is available:

- Unit
- Start of valid range
- End of valid range
- Number of intervals/bins

Example:
Measurement range of the sensor: 50 - 550 mm:

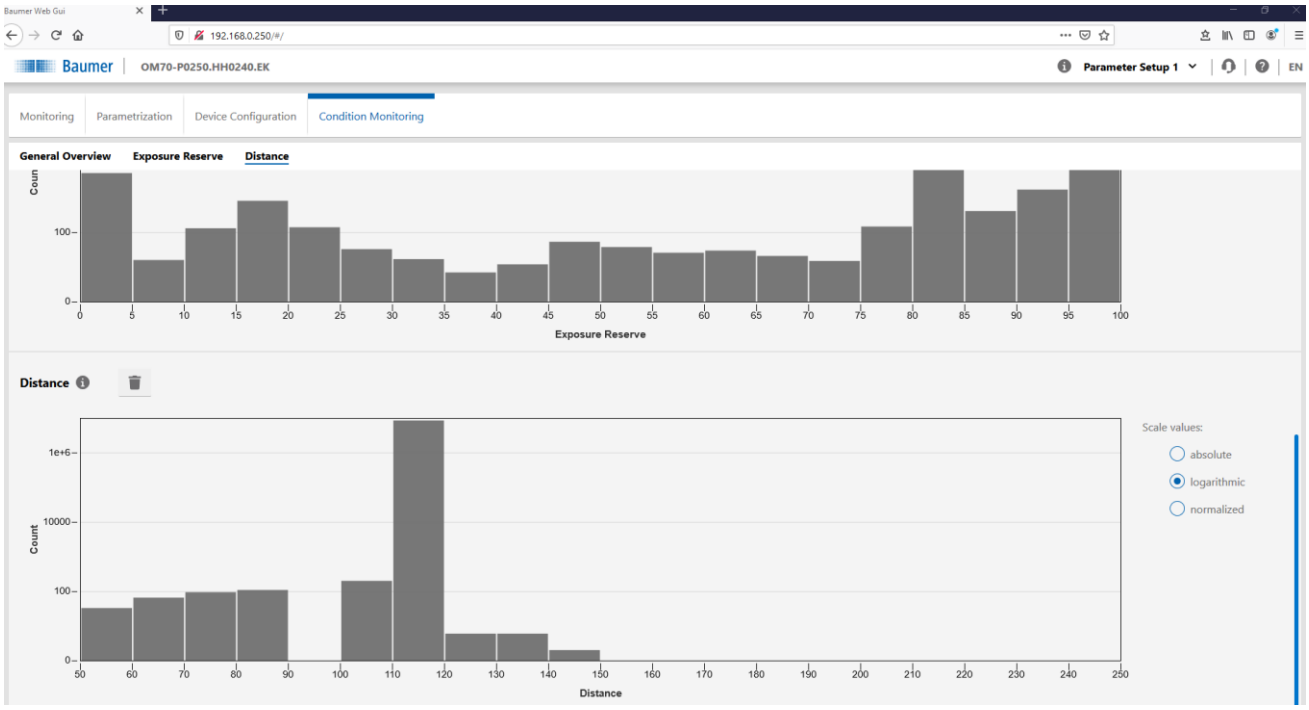
- Unit: mm
- Start of range: 50 mm
- End of range: 550 mm
- Number of intervals/bins: 20

Therefore:
Interval/bin covers the following range: (550 mm - 50 mm)/20 = 25 mm
If the sensor records the value 76 mm 5 times and the value 162 mm 15 times in 20 measurements, it results in the following distribution:

Bin	Value range min.	Value range max.	Number of measurements
Bin 1	50 mm	< 75 mm	0
Bin 2	75 mm	< 100 mm	5
Bin 3	100 mm	< 125 mm	0
Bin 4	125 mm	< 150 mm	0
Bin 5	150 mm	< 175 mm	15
…	…	…	…

HINWEIS

Reset the histogram after the zero position has been moved or the tilt compensation has been activated (the measured distance depends on the zero position and the tilt compensation).



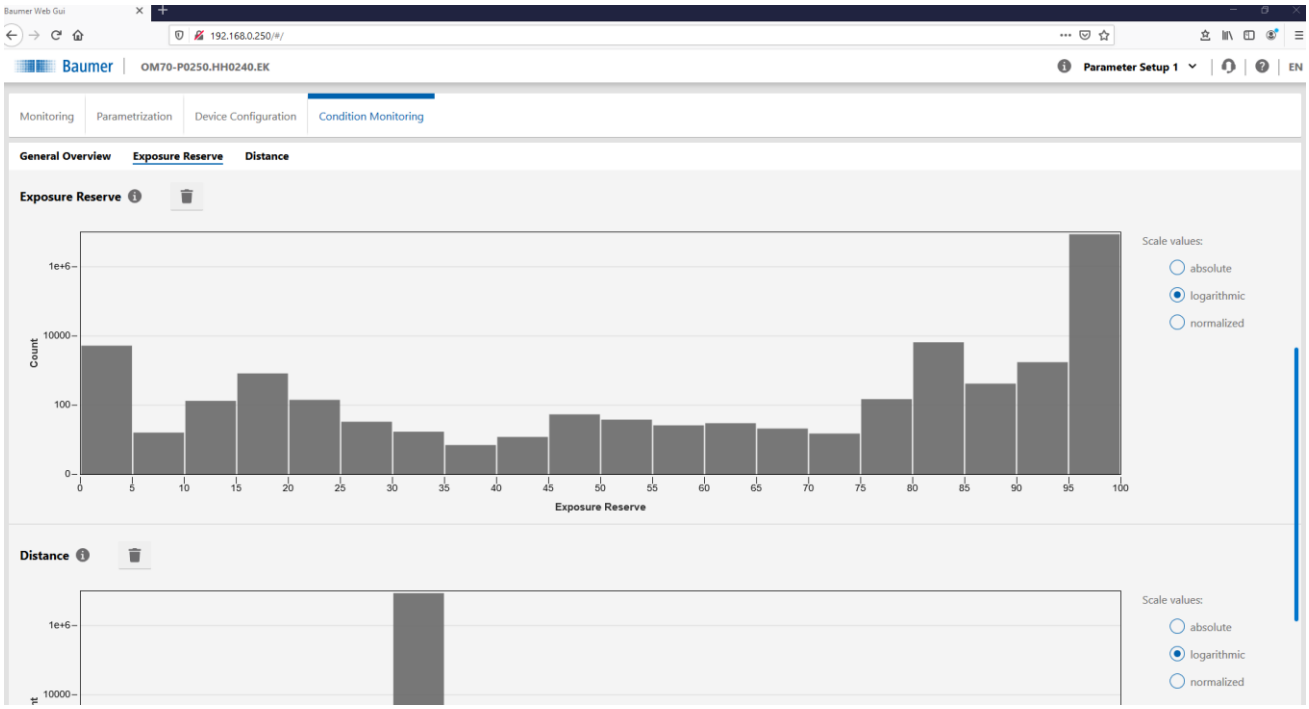
Exposure Reserve

The exposure reserve histogram contains the number of occurrences of exposure reserve values. A value for the exposure reserve is recorded for each measurement. A permanently decreasing exposure reserve could, for example, be an indicator that the front screen of the sensor is dirty.
As the exposure reserve is always described by a fixed value range, the following information has a fixed value:

- Start of valid range: 0
- End of valid range: 100
- Number of intervals/bins: 20

Example:
One interval covers a value range of 5: 100/20 = 5
The measurement object is outside the measurement range for 5 measurements. Therefore, the sensor records an exposure reserve of 0. This results in the following distribution:

Bin	Value range min.	Value range max.	Number of measurements
Bin 1	0	< 5	5
Bin 2	5	< 10	0
Bin 3	10	< 15	0
Bin 4	15	< 20	0
Bin 5	20	< 25	0
…	…	…	…



5 Communication via Profinet IO interface

The OM70-x.EK sensor series supports Profinet IO with Conformance Class B for read out measured values and for configuration.

If an OM70-x.EK sensor is operated via Profinet IO, the other interfaces (web interface, OPC-UA, Modbus TCP) only have reading access to the sensor.

5.1 Profinet device integration

A device master file (GSD-file) is required for the configuration of a Profinet IO device. It describes the configurable functions of the device and must be integrated into the development environment (Tia Portal). The GSD-file is found on the respective product pages of the Baumer website. Go to the Baumer website **www.baumer.com** and enter the article number of your product in the search bar. You can find the GSD-file in download section.

Depending on the measuring range, the corresponding Device Access Point (short: DAP) must be selected:

Device Access Point	Messbereich
OM70-L/P0070.X.EK	30 mm – 70 mm
OM70-L/P0140.X.EK	40 mm – 140 mm
OM70-L/P0250.X.EK	50 mm – 250 mm
OM70-L/P0600.X.EK	100 mm – 600 mm
OM70-L/P1000.X.EK	100 mm – 1000 mm
OM70-L/P1500.X.EK	150 mm – 1500 mm
OM70-L/P1700.X.EK	150 mm – 1700 mm

NOTE

The GSD-file is available for download in the download area on the product page of the concerned sensor at **www.baumer.com**.

5.2 Module overview

The functions (modules) described in the GSD-file allow reading out and configuration of the sensor and are defined by the following variables:

- **Module ID**: Name of the concerned module/description of its function
- **Size:** Size of the data to be transferred in Bytes
- **Module type:** Input module: Cyclical data is transferred from the device to the control.
  Output module: Cyclical data is transferred from the control to the device.
  Parameter module: Configuration data is exchanged noncyclical.
- **Sub-module ID:** Name of the concerned sub-module/description of its function
- **Data type:** Data type of data in a sub-module

Category 00_Measurements:

Module ID	Size [Byte]	Module type	Submodule ID	Data type
01_Distance	4	Input Module	Distance [mm]	Float32
02_Distance/TimeStamp	14	Input Module	Distance [mm]	Float32
			TimeStamp [s]	Unsigned32
			TimeStamp [µs]	Unsigned32
			DigitalOutputs	Unsigned8
			Quality	Unsigned8
03_AllMeasurements	30	Input Module	Distance [mm]	Float32
			TimeStamp [s]	Unsigned32
			TimeStamp [us]	Unsigned32
			DigitalOutputs	Unsigned8
			Quality	Unsigned8
			ResponseDelay [s]	Unsigned32
			ResponseDelay [µs]	Unsigned32
			MeasurementRate [Hz]	Float32
			ExposureReserve	Float32
04_Status	2	Input Module	ConfigurationModeActive	Boolean
			Warmup	Boolean
			Distance [mm]	Boolean
			Tilt Compensation	Boolean

Category 10_Device Configuration:

Module ID	Size [Byte]	Module type	Submodule ID	Data type
11_ZeroPositionTeach	1	Parameter Module	ZeroPositionTeach	Boolean
12_ZeroPositionValue	4	Parameter Module	ZeroPositionValue [µm]	Integer32
13_Laser	1	Parameter Module	Laser ON/OFF	Boolean
14_ParameterSetup	40	Parameter Module	ParameterSetup (see Module description)	-
15_TiltCompensation	19	Parameter Module	TiltCompensation (see Module description)	-

5.1 Submodule overview

Each module consists of at least one submodule. One data value can be transmitted per submodule.

5.1.1 Category 00_Measurements

Module: 01_Distance
This module supplies the distance value in relation to the Zero Position.

Input Value	Output Value	Value Range	Data type	Comment
Distance [mm]	-	-	Float32	

Module: 02_Distance/TimeStamp
This module supplies the distance value in relation to the Zero Position, the associated time stamp, the switching and alarm output as well as the quality of the measurement signal. The time stamp is divided into seconds and microseconds.

Input Value	Output Value	Value Range	Data type	Comment
Distance [mm]	-	-	Float32	
TimeStamp [s]	-	-	Unsigned32	Seconds [**s**:µs]
TimeStamp [µs]	-	-	Unsigned32	Microseconds [s:**µs**]
DigitalOutputs	-	-	Unsigned8	Bit 0: State Switching Output 0 = Inactive 1 = Active Bit 1: State Alarm Output 0 = Inactive 1 = Active
Quality	-	0…2	Unsigned8	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal

Module: 03_AllMeasurements
This module supplies all measurement data, including the distance value, the associated time stamp, the status of the switching and alarm output, the quality of the measurement signal, the response delay, the measurement rate and the exposure reserve. The time stamp and the response delay are divided into seconds and microseconds.

Input Value	Output Value	Value Range	Data type	Comment
Distance [mm]	-	-	Float32	
TimeStamp [s]	-	-	Unsigned32	Seconds [**s**:µs]
TimeStamp [µs]	-	-	Unsigned32	Microseconds [s:**µs**]
DigitalOutputs	-	-	Unsigned8	Bit 0: State Switching Output 0 = Inactive 1 = Active Bit 1: State Alarm Output 0 = Inactive 1 = Active
Quality	-	0…2	Unsigned8	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal
ResponseDelay [s]	-	-	Unsigned32	Seconds [**s**: µs]
ResponseDelay [µs]	-	-	Unsigned32	Microseconds [s: **µs**]
MeasurementRate [Hz]	-	-	Float32	
ExposureReserve	-	-	Float32	Relative value

Module: 04_Status
This module provides the sensor status consisting of the information whether the sensor is in configuration mode, whether the sensor is synchronized with an NTP time server and whether the sensor is in the warm-up phase.

Input Value	Output Value	Value Range	Data type	Comment
ConfigurationModeActive	-	True/False	Boolean	State Configurationmode TRUE: Active FALSE: Inactive
TimeSynced	-	True/False	Boolean	NTP-Timeserver Synchronisation TRUE: Active FALSE: Inactive
Warmup	-	True/False	Boolean	State Warmup TRUE: Active FALSE: Inactive
TiltCompensation	-	True/False	Boolean	State Tilt Compensation: TRUE: Active FALSE: Inactive

NOTE
For communication via the Profinet interface, the Configuration Mode is permanently inactive or “FALSE”.

5.1.2 Category 10_Device Configuration

Module: 11_ZeroPositionTeach
This module is used to teach in a new Zero Position. The measured value, the switch points and the analog output refer to this Zero Position. The measuring range limits are not affected.
TRUE must be written for teach-in.

Input Value	Output Value	Value Range	Data type	Comment
-	ZeroPositionTeach	-	Boolean	TRUE must be written to teach current distance as reference.

NOTE
Teaching the zero point position with the aid of the teach line is not possible during a connection via the Profinet IO interface. The command above must be used for this.

Module: 12_ZeroPositionValue
This module is used for numerical setting of a new sensor Zero Position.

Input Value	Output Value	Value Range	Data type	Comment
ZeroPositionValue [µm]	ZeroPositionValue [µm]	0…Sde	Integer32	

Module: 13_Laser
With this input/ output module the laser can be switched on and off.

Input Value	Output Value	Value Range	Data type	Comment
Laser ON/ OFF	Laser ON/ OFF	True/ False	Boolean	TRUE: Laser on FALSE: Laser off

Module: 14_ParameterSetup
This module contains parameters for the configuration of the sensor.
Mr = Measuring Range
Sdc = Sensing distance close (Measuring Range start)
Sde = Sensing distance far (Measuring Range end)

Parameter Name	Value Range	Data type	Comment
Trigger Mode	0...2	Unsigned16	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
Trigger Interval [µs]	550…50000	Unsigned32	Time interval in Interval mode
Near Limit [mm]	Sdc…Sde	Float32	Measuring Range start
Far Limit [mm]	Sdc…Sde	Float32	Measuring Range end
Zero Position [µm]	0…Sde	Int32	Value in µm: Maximum specification is Sde * 1000
Precision Filter	0…3	Unsigned16	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
Custom Median Filter Length	1…21	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the median filter
Custom Average Filter Length	1…256	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the average filter
Invalid Value Handling Mode	0…2	Unsigned16	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
Hold Time [ms]	0…60000	Unsigned16	Hold Time of Analog Output
Switch Mode	1/2	Unsigned16	Selection Switch Mode: 1 = Point 2 = Window
Far Point [mm]	-Mr…Sde	Float32	Far point to sensor NOTE: Only this value is used in the “Point” Switch Mode
Near Point [mm]	-Mr…Sde	Float32	Near point to sensor
Hysteresis [mm]	-Mr…Mr	Float32	
Polarity	0/1	Unsigned16	0 = Active Low 1 = Active High

Modul: 15_TiltCompensation
This module contains parameters for the inclination compensation of the sensor. Chapter 4.4.2.2 describes the parameterization procedure in detail.

Index 1

Parameter Name	Value Range	Data type	Comment
Tilt angle	-	Float32	Reading out the parameterized tilt angle

Note: The tilt angle is permanently stored and is also available after restarting the sensor.

Index 2

Parameter Name	Value Range	Data type	Comment
Reference object height	-	Float32	Height of an object with uniquely defined height

Index 3

Parameter Name	Value Range	Data type	Comment
Teach distance to background	True/ False	Boolean	TRUE must be written to teach current distance.

Index 4

Parameter Name	Value Range	Data type	Comment
Distance to background	-	Float32	Reading out teached distance.

Index 5

Parameter Name	Value Range	Data type	Comment
Teach distance to reference object	True/ False	Boolean	TRUE must be written to teach current distance.

Index 6

Parameter Name	Value Range	Data type	Comment
Distance to reference object	-	Float32	Reading out teached distance.

Index 7

Parameter Name	Value Range	Data type	Comment
Deactivation Neigungskompensation	True/ False	Boolean	Resetting the parameterized values and thus deactivating tilt compensation

6 Communication via EtherNet/IP interface

EtherNet/IP is a TCP/IP- and UDP/IP-based network protocol that is widely used in automation technology. As with other protocols developed further by ODVA, it uses the Common Industrial Protocol (CIP) in the application layer.
If an OM70-x.EK sensor is operated via EtherNet/IP, the other interfaces (web interface, OPC-UA, Modbus TCP) only have reading access to the sensor.

HINWEIS

EtherNet/IP is deactivated as standard in the factory settings of the sensor. Activation can be done via the web interface integrated in the sensor. Navigate to the device configuration and select “EtherNet/IP” in the Realtime Ethernet list in section Process Interfaces. The change only becomes effective after explicitly saving and restarting the sensor.

6.1 Overview of available connections

An implicit connection can be established with or without a configuration assembly. The following paths should be used:

- Input Only Connection: 20 04 24 EE 2C 64
  (Output Assembly: 238. Input Assembly: 100)

- Input Only Connection with Configuration Assembly: 20 04 24 97 2C EE 2C 64
  (Config Assembly: 151, Output Assembly: 238, Input Assembly: 100)

Data size Originator to Target: 0 bytes (without additional header)
Data size Target to Originator: 34 bytes (without additional header)

6.2 Mapping the sensor functions on the CIP assembly objects

The following tables give an overview of the arrangement of the sensor functions (data elements) in the individual assembly objects. The assembly objects can be accessed via either an implicit or an explicit connection.
A device master file (EDS-file) can be used for the configuration of a EtherNet/IP device. The EDS-file is found on the respective product pages of the Baumer website. Go to the Baumer website **www.baumer.com** and enter the article number of your product in the search bar. You can find the EDS-file in download section.

Sensor input data to PLC (Bit numbering LSB):
Assembly object (Class Code: 0x04), Instance 100, Size 34 bytes

Byte	Field Name	Data type	Description
0 … 3	Distance [mm]	Float32	
4 … 7	TimeStamp [s]	Unsigned32	Seconds [**s**:µs]
8 … 11	TimeStamp [us]	Unsigned32	Microseconds [s:**µs**]
12	DigitalOutputs	Unsigned8	Bit 0: State Switching Output 0 = Inactive 1 = Active Bit 1: State Alarm Output 0 = Inative 1 = Active

13	Quality	Unsigned8	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal
14 … 17	ResponseDelay [s]	Unsigned32	Seconds [**s**: µs]
18 … 21	ResponseDelay [µs]	Unsigned32	Microseconds [s: **µs**]
22 … 25	MeasurementRate [Hz]	Float32	
26 … 29	ExposureReserve	Float32	Relative value
30	ConfigurationModeActive	Unsigned8	State Configurationmode 1: Active 0: Inactive
31	TimeSynced	Unsigned8	NTP-Timeserver Synchronisation 1: Active 0: Inactive
32	WarmUp	Unsigned8	State Warmup 1: Active 0: Inactive
33	TiltCompensation	Unsigned8	State Tilt Compensation: 1: Active 0: Inactive

NOTE

For communication via the EtherNet/IP interface, the Configuration Mode is permanently inactive or “0”.

PLC parametrisation data to sensor:
Assembly Object (Class Code: 0x04), Instance 151, Size 44 bytes

Byte	Field Name	Data type	Description
0 … 1	Trigger Mode	Unsigned16	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
2 … 5	Trigger Interval [µs]	Unsigned32	Time interval in Interval mode
6 … 9	Near Limit [mm]	Float32	Measuring Range start
10 … 13	Far Limit [mm]	Float32	Measuring Range end
14 … 17	Zero Position [µm]	Int32	Value in µm: Maximum specification is Sde * 1000
18 … 19	Precision Filter	Unsigned16	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
20 … 21	Custom Median Filter Length	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the median filter
22 … 23	Custom Average Filter Length	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the average filter

24 … 25	Invalid Value Handling Mode	Unsigned16	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
26 … 27	Hold Time [ms]	Unsigned16	Hold Time of Analog Output
28 … 29	Switch Mode	Unsigned16	Selection Switch Mode: 1 = Point 2 = Window
30 … 33	Far Point [mm]	Float32	Far point to sensor NOTE: Only this value is used in the “Point” Switch Mode
34 … 37	Near Point	Float32	Nearer Point to the sensor
38 … 41	Hysteresis [mm]	Float32	
42 … 43	Polarity	Unsigned16	0 = Active Low 1 = Active High

6.3 Parameter Object (Class Code 0x0f)

In addition to the presented assemblies it is also possible to read (R) and partly write (W) individual sensor parameters via the corresponding instances of the parameter object.
Reading a parameter is done via the service "Get Attribute Single" (service code 14) on attribute 1. A parameter is written to attribute 1 using the "Set Attribute Single" service (service code 16).

The tables below show the available instances with the supported data types and further notes.

Status

Instance ID	Field Name	Data type	Description
1	Status Parameter Write	Unsigned16	Read/ Write Status after parameter writing 1 = Done OK 2 = Done Error 3 = Busy

Note: If the sensor responses “Done Error” a wrong parameter is written to the sensor or the sensor is set to configuration mode via one of the other interfaces, e. g. the web interface is opend in Parametrization tab.

Zero Position Teach

Instance ID	Field Name	Data type	Description
3	Zero Position Teach	Boolean	Read/ Write TRUE must be written to teach current distance as reference

Zero Position Value

Instance ID	Field Name	Data type	Description
4	Zero Position [µm]	Integer32	Read/ Write Set the zero position

Laser

Instance ID	Field Name	Data type	Description
5	Laser ON/ OFF	Boolean	Read/ Write TRUE = Laser ON FALSE = Laser OFF

Tilt Compensation

Instance ID	Field Name	Data type	Description
6	Tilt angle [deg]	Float32	Read only Reading out the parameterized tilt angle
7	Reference object height	Float32	Read/ Write Height of an object with uniquely defined height
8	Teach distance to background	Boolean	Read/ Write TRUE must be written to teach current distance
9	Distance to background	Float32	Read only Reading out teached distance.
10	Teach distance to reference object	Boolean	Read/ Write TRUE must be written to teach current distance
11	Distance to reference object	Float32	Read only Reading out teached distance.
12	Reset tilt compensation	Boolean	Read/ Write Resetting the parameterized values and thus deactivating tilt compensation

Note: The tilt angle is permanently stored and is also available after restarting the sensor.

Other parameters from the Config Assembly (all parameters have read/ write access):

Instance ID	Field Name	Data type	Description
13	Trigger Mode	Unsigned16	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
14	Trigger Interval [µs]	Unsigned32	Time interval in Interval mode
15	Measuring Range Near Limit [mm]	Float32	Measuring Range start
16	Measuring Range Far Limit [mm]	Float32	Measuring Range end
4	Zero Position [µm]	Integer32	Value in µm: Maximum specification is Sde * 1000
17	Precision Filter	Unsigned16	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
18	Custom Median Filter Length	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the median filter
19	Custom Average Filter Length	Unsigned16	If Precision Filter “Custom” is set: Parametrizable filter length of the average filter

20	Invalid Value Handling Mode	Unsigned16	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
21	Invalid Value Handling Hold Time [ms]	Unsigned16	Hold Time of Analog Output
22	Switch Point Mode	Unsigned16	Selection Switch Mode: 1 = Point 2 = Window
23	Switch Point Far Point [mm]	Float32	Far point to sensor NOTE: Only this value is used in the “Point” Switch Mode
24	Switch Point Near Point [mm]	Float32	Nearer Point to the sensor
25	Switch Point Hysteresis [mm]	Float32	
26	Switch Point Polarity	Unsigned16	0 = Active Low 1 = Active High

7 Communication via Modbus TCP interface

The OM70-x.EK sensor series supports Modbus TCP for calling up measured values and for configuration.

If an OM70-x.EK sensor is operated via Modbus TCP, the other interfaces (web interface, OPC-UA, Profinet) only have reading access to the sensor. One connection is allowed for each interface, the maximum measurement frequency can be reduced.

7.2 Protocol parameters

The Modbus TCP server integrated in the sensor (Modbus TCP slave) can be addressed using the following parameters:

- TCP port no.: 502
- Modbus TCP unit identifier: 1

7.3 Mapping the sensor functionality to the Modbus data model

The sensor functionality can be accessed by reading or writing entries in the "Discrete inputs", "Input registers", and "Holding registers" tables. The following Modbus function codes (FC) are supported here:

- Read Discrete Inputs (FC 02)
- Read Input Registers (FC 04)
- Read Holding Registers (FC 03)
- Write Single Holding Register (FC 06)
- Write Multiple Holding Registers (FC 16)

The three tables are independent of one another, meaning that the same address can represent a different functionality in the different tables. The number of the register to be read or written with a Modbus command must match the length specified for the respective sensor functionality. It is not possible to read or write just some of the parameters.
If the data type of a sensor parameter is wider than a 16-bit Modbus register, the parameter is split across several Modbus registers. In such cases, the lower-value bits are placed on the lower address and the higher value bits on the higher address.

The registers are defined by the following variables:

- **Address**: Address of register
- **Size:** Total size of the data to be transmitted
- **Command:** Name of the respective register/ description of the function
- **Description:** Explanation of function

NOTE
Write access to the sensor is only possible after activation of the configuration mode. Address 0 must be written for this purpose. After parameterization of the sensor, it is recommended to exit the configuration mode by writing address 1, since the performance of the sensor (measuring rate) can be influenced.

7.4 Modbus TCP commands: Holding register

7.4.1 Overview of index commands for holding register function 03/6/16

The following table shows an overview of commands. In the following chapters the respective commands are explained:

Address	Size [Register]	Command	Description
0	1	Enter Config Mode	Activation of parametrization mode
1	1	Leave Config Mode	Deactivation of parametrization mode
2	2	Session Timeout	Timeout
10	1	Get DHCP Client State	Activation/ Deactivation DHCP Client
11	4	Set IP Address	Set IP address of sensor
15	4	Set Subnet Mask	Set subnet mask of sensor
19	4	Set Gateway Address	Set gateway address
27	1	Store Eth Parameters	Activation of set IP configurations
32	1	OPC UA State	Activation/ Deactivation OPC UA
50	1	Time Sync Mode	Selection of time synchronization mode
51	4	NTP Server 1	IP address NTP Server 1
55	4	NTP Server 2	IP address NTP Server 2
101	1	Precision	Selection of filter settings
102	1	Custom Median Filter Length	Filter length median filter
103	1	Custom Average Filter Length	Filter length average filter
180	2	Zero Position	Numerical setting of Zero Position
185	1	Teach Zero Position	Teach of Zero Position (current distance)
200	4	Meas Range	Determination measuring range limits
220	1	Meas Range to Max	Maximize measuring range
300	9	Switching Output Configuration	Configuration Switching Output
400	8	Trigger Mode Settings	Configuration Trigger mode
410	1	Laser ON/OFF	Turn on/ off the Laser
500	1	Store Setting	Store Parameter Setup
501	1	Load Setting	Load Parameter Setup
502	1	Reset Setting	Reset Parameter Setup
503	1	Sensor Reset	Reset Sensor (factory setting)
700	1	Analog Output Type	Define output type of Analog Output
701	4	Analog Output Points	Define output range of Analog Output
705	1	Is Analog Output Inverted	Invert the Analog Output
706	1	Analog Output to Max	Maximize Analog Output
800	1	Hold Time	Hold time of analog value for invalid value handling
801	1	Invalid Value Handling Mode	Invalid Value Handling
900	1	UDP Streamer State	State of UDP Streaming (Running/ Stop)
901	4	UDP Streamer Configuration	Configuration of UDP Streaming
905	1	Realtime Ethernet Protocol	Select protocol

1000	1	Reset All Statistics	Reset Condition Monitoring data
1001	1	Reset Operation Time	Reset Operation Time (resettable)
1002	1	Reset Distance Histogram	Reset Distance Histogram
1003	1	Reset Exposure Reserve Histogram	Reset Exposure Reserve Histogram
1100	1	Tilt Compensation - Teach Background	Teach background distance
1101	1	Tilt Compensation - Teach Distance to Object	Teach distance to reference object
1102	2	Tilt Compensation - Object Height	Reference object height
1104	1	Tilt Compensation - Deactivation	Reset and deactivate tilt compensation

7.4.1.1 Address 0 - Enter Config Mode

Address	Access	Length	Datatype	Description
0	Write Only	1	uint16_t	Activation Parametrization Mode: Any number can be written.

7.4.1.2 Address 1 - Leave Config Mode

Address	Access	Length	Datatype	Description
1	Write Only	1	uint16_t	Deactivation Parametrization Mode: Any number can be written.

7.4.1.3 Address 2 - Session Timeout

Address	Access	Length	Datatype	Description
2 - 3	Read/ Write	2	uint32_t	Session Timeout [sec]

7.4.1.4 Address 10 - DHCP Client State

Address	Access	Length	Datatype	Description
10	Read/ Write	1	uint16_t	Activation/ Deactivation DHCP Client: 0: Inactive 1: Active

7.4.1.5 Address 11 - Set IP Address

The IP address can be written autonomously. Only after writing the address 27 - Store Ethernet Parameters the written IP address is activated.

Address	Access	Length	Datatype	Description
11	Write Only	1	uint16_t	IP Address (Byte 0)
12	Write Only	1	uint16_t	IP Address (Byte 1)
13	Write Only	1	uint16_t	IP Address (Byte 2)
14	Write Only	1	uint16_t	IP Address (Byte 3)

7.4.1.6 Address 15 - Set Subnet Mask

The Subnet Mask address can be written autonomously. Only after writing the address 27 - Store Ethernet Parameters the written IP address is activated.

Address	Access	Length	Datatype	Description
15	Write Only	1	uint16_t	Subnet Mask (Byte 0)
16	Write Only	1	uint16_t	Subnet Mask (Byte 1)
17	Write Only	1	uint16_t	Subnet Mask (Byte 2)
18	Write Only	1	uint16_t	Subnet Mask (Byte 3)

7.4.1.7 Address 19 - Set Gateway Address

The Gateway address can be written autonomously. Only after writing the address 27 - Store Ethernet Parameters the written IP address is activated.

Address	Access	Length	Datatype	Description
19	Write Only	1	uint16_t	Gateway Address (Byte 0)
20	Write Only	1	uint16_t	Gateway Address (Byte 1)
21	Write Only	1	uint16_t	Gateway Address (Byte 2)
22	Write Only	1	uint16_t	Gateway Address (Byte 3)

7.4.1.8 Address 27 - Store Eth Parameters

Address	Access	Length	Datatype	Description
27	Write Only	1	uint16_t	Activation of set IP configurations: Any number can be written

7.4.1.9 Address 32 - OPCUA State

Address	Access	Length	Datatype	Description
32	Read/ Write	1	uint16_t	Activation/ Deactivation of OPC UA: 0: Deactivation 1: Activation

7.4.1.10 Address 50 - Time Sync Mode

Address	Access	Length	Datatype	Description
50	Read/ Write	1	uint16_t	Selection of time synchronization mode: 0 = Internal 1 = NTP

7.4.1.11 Address 51 - NTP Server 1

Address	Access	Length	Datatype	Description
51	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 0)
52	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 1)
53	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 2)
54	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 3)

7.4.1.12 Address 55 - NTP Server 2

Address	Access	Length	Datatype	Description
55	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 0)
56	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 1)
57	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 2)
58	Read/ Write	1	uint16_t	NTP Server IP Address (Byte 3)

7.4.1.13 Address 101 – Precision

Address	Access	Length	Datatype	Description
101	Read/ Write	1	uint16_t	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom

7.4.1.14 Address 102 – Custom Median Filter Length

Address	Access	Length	Datatype	Description
102	Read/ Write	1	uint16_t	If precision filter “Custom” is set: Filter length Median Filter

7.4.1.15 Address 103 – Custom Average Filter Length

Address	Access	Length	Datatype	Description
103	Read/ Write	1	uint16_t	If precision filter “Custom” is set: Filter length Average Filter

7.4.1.16 Address 180 – Zero Position

Address	Access	Length	Datatype	Description
180 - 181	Read/ Write	2	int32_t	Numerical Setting of Zero Position [µm]

7.4.1.17 Address 185 – Teach Zero Position

Address	Access	Length	Datatype	Description
185	Read/ Write	1	uint16_t	Teach of Zero Position (current distance): Any number can be written

7.4.1.18 Address 200 – Meas Range

Address	Access	Length	Datatype	Description
200 - 201	Read/ Write	2	float32_t	Measuring Range Near Limit [mm]
202 - 203	Read/ Write	2	float32_t	Measuring Range Far Limit [mm]

7.4.1.19 Address 220 – Meas Range to MAX

Address	Access	Length	Datatype	Description
220	Write Only	1	uint16_t	Maximize Measuring Range: Any number can be written

7.4.1.20 Address 300 - Switching Output Configuration

Address	Access	Length	Datatype	Description
300 - 301	Read/ Write	2	float32_t	Far Point
302 - 303	Read/ Write	2	float32_t	Near Point
304 - 305	Read/ Write	2	int32_t	Selection SwitchMode 1 = Point 2 = Window
306 - 307	Read/ Write	2	float32_t	Hysteresis
308	Read/ Write	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High

7.4.1.21 Address 400 - Trigger Mode Settings

Address	Access	Length	Datatype	Description
400 - 401	Read/ Write	2	int32_t	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
402 - 403	Read/ Write	2	uint32_t	Numerical time interval (only in Interval Mode) [µs]
404 - 405	Read	2	uint32_t	Minimal time interval [µs]
406 - 407	Read	2	uint32_t	Maximal time interval [µs]

7.4.1.22 Address 410 - Laser On/Off

Address	Access	Length	Datatype	Description
410	Read/ Write	1	uint16_t	State Laser: 0 = OFF 1 = ON

7.4.1.23 Address 500 - Store Setting

Address	Access	Length	Datatype	Description
500	Write Only	1	uint16_t	Save Parameter Setup: 1 = Parameter Setup 1 2 = Parameter Setup 2 3 = Parameter Setup 3

7.4.1.24 Address 501 - Load Setting

Address	Access	Length	Datatype	Description
501	Write Only	1	uint16_t	Load Parameter Setup: 1 = Parameter Setup 1 2 = Parameter Setup 2 3 = Parameter Setup 3

7.4.1.25 Address 502 - Reset Setting

Address	Access	Length	Datatype	Description
502	Write Only	1	uint16_t	Reset Parameter Setup: 1 = Parameter Setup 1 2 = Parameter Setup 2 3 = Parameter Setup 3

7.4.1.26 Address 503 - Sensor Reset

Address	Access	Length	Datatype	Description
503	Write Only	1	uint16_t	Reset sensor (factory settings): Any number can be written

7.4.1.27 Address 700 – Analog Output Type

Address	Access	Length	Datatype	Description
700	Read/ Write	1	uint16_t	Define output type of Analog Output: 0 = 0 bis 5 V 1 = 0 bis 10 V 5 = 4 bis 20 mA 6 = 2 bis 10 mA

7.4.1.28 Address 701 – Analog Output Points

Address	Access	Length	Datatype	Description
701 - 702	Read/ Write	2	float32_t	Min. Output Point Analog [mm]
703 - 704	Read/ Write	2	float32_t	Max. Output Point Analog [mm]

7.4.1.29 Address 705 – Is Analog Output Inverted

Address	Access	Length	Datatype	Description
705	Read/ Write	1	bool_t	Invert Analog Output: True = Inverted False = Not inverted

7.4.1.30 Address 706 – Analog Output to MAX

Address	Access	Length	Datatype	Description
706	Write Only	1	uint16_t	Maximize Anlalog Output: Any number can be written

7.4.1.31 Addresse 800 – Hold Time

Address	Access	Length	Datatype	Description
800	Read/ Write	1	uint16_t	Hold time of analog value for invalid value handling : Dropout Timeout [ms]

7.4.1.32 Address 801 – Invalid Value Handling Mode

Address	Access	Length	Datatype	Description
801	Read/ Write	1	uint16_t	Invalid value handling: 0 = Last valid 1 = Near 2 = Far

7.4.1.33 Address 900 – UDP Streamer State

Address	Access	Length	Datatype	Description
900	Read/ Write	1	uint16_t	State UDP Streaming: 0 = Stop 1 = Running

7.4.1.34 Address 901 – UDP Streamer Configuration

Address	Access	Length	Datatype	Description
901 - 902	Read/ Write	2	uint32_t	Destination address (IPv4)
903 - 904	Read/ Write	2	uint32_t	Destination port

7.4.1.35 Address 905 – Realtime Ethernet Protocol

Address	Access	Length	Datatype	Description
905	Read/ Write	1	uint16_t	Select Realtime Ethernet protocol 0 = None 1 = PROFINET 2 = EtherNet/IP

Note: A change to the real-time Ethernet protocol only becomes effective after explicitly saving and restarting the sensor.

7.4.1.36 Address 1000 – Reset All Statistics

Address	Access	Length	Datatype	Description
1000	Write Only	1	uint16_t	Reset Condition Monitoring data: Any number can be written

7.4.1.37 Address 1001 – Reset Operation Time

Address	Access	Length	Datatype	Description
1001	Write Only	1	uint16_t	Reset Operation Time (resettable): Any number can be written

7.4.1.38 Address 1002 – Reset Distance Histogram

Address	Access	Length	Datatype	Description
1002	Write Only	1	uint16_t	Reset Distance Histogram: Any number can be written

7.4.1.39 Address 1003 – Reset Exposure Reserve Histogram

Address	Access	Length	Datatype	Description
1003	Write Only	1	uint16_t	Reset Exposure Reserve Histogram: Any number can be written

7.4.1.40 Address 1100 – Tilt Compensation - Teach Background

Address	Access	Length	Datatype	Description
1100	Write Only	1	uint16_t	Teach distance to background: Any number can be written

7.4.1.41 Address 1101 – Tilt Compensation - Teach Object

Address	Access	Length	Datatype	Description
1101	Read/ Write	1	uint16_t	Teach distance to reference object: Any number can be written

7.4.1.42 Address 1102 – Tilt Compensation - Object Height

Address	Access	Length	Datatype	Description
1102	Read/ Write	2	uint32_t	Reference object height in mm.

7.4.1.43 Address 1104 – Tilt Compensation - Reset

Address	Access	Length	Datatype	Description
1104	Write Only	1	uint16_t	Reset and deactivte Tilt Compensation: Any number can be written

7.4.2 Modbus TCP commands: Input register

7.4.2.1 Overview of index commands Input Register Function 04

The following table shows an overview of commands. In the following chapters the respective commands are explained:

Address	Size [Register]	Command	Description
0	33	Vendor Information	Vendor name
40	45	Device Information	Information for device
90	5	Frontend Version	Informationen for frontend
100	6	Ethernet Configuration	Reading IP/ Subnet/ Gateway address
120	6	MAC Address	Reading MAC address
150	6	Meas Range Limits	Measuring Range Limits
200	17	All Measurements	Measuring values and additional information
250	14	Teachable Range	Configuration of Switching Output
300	2	Hold Time Limits	Limiting Hold Time
301	2	Operation Time: Powerup	Operation Time since power on
303	2	Operation Time: Resettable	Operation Time (resettable)
305	2	Operation Time: Lifetime	Operation Time in Total
307	1	Histogram Distance: Unit	Histogram Distance: Unit
308	2	Histogram Distance: Range Start	Histogram Distance: Start of range
310	2	Histogram Distance: Range End	Histogram Distance: End of range
312	1	Histogram Distance: Number of Bins	Histogramm Distance: Number of intervals the range is divied in
313	40	Histogram Distance: Bin 1 - 20	Histogram Distance: Frequency distribution
353	2	Histogram Exposure Reserve: Range Start	Histogram Exposure Reserve: Start of range
355	2	Histogram Exposure Reserve: Range End	Histogram Exposure Reserve: End of range
357	1	Histogram Exposure Reserve: Number of Bins	Histogram Exposure Reserve: Number of intervals the range is divied in
358	40	Histogram Exposure Reserve: Bin 1 - 20	Histogramm Belichtungsreserve: Häufigkeitsverteilung
400	1	Unsaved Configuration	Display status unsaved configuration
401	1	Active Setting Number	Show active Parameter Setup number
410	28	Get Setting 1	Show Parameter Setup 1
450	28	Get Setting 2	Show Parameter Setup 2
490	28	Get Setting 3	Show Parameter Setup 3
550	2	Tilt Angle	Calculated Tilt Angle
552	2	Teached Background Distance	Distance to background
554	2	Teached Object Distance	Distance to reference object
600	112	Get Block Mode Memory 0	Reading stored measured values block 0
712	112	Get Block Mode Memory 1	Reading stored measured values block 1
824	112	Get Block Mode Memory 2	Reading stored measured values block 2
936	112	Get Block Mode Memory 3	Reading stored measured values block 3

1048	112	Get Block Mode Memory 4	Reading stored measured values block 4
1160	112	Get Block Mode Memory 5	Reading stored measured values block 5
1272	112	Get Block Mode Memory 6	Reading stored measured values block 6
1384	112	Get Block Mode Memory 7	Reading stored measured values block 7
1496	112	Get Block Mode Memory 8	Reading stored measured values block 8
1608	112	Get Block Mode Memory 9	Reading stored measured values block 9
1720	112	Get Block Mode Memory 10	Reading stored measured values block 10
1832	112	Get Block Mode Memory 11	Reading stored measured values block 11
1944	112	Get Block Mode Memory 12	Reading stored measured values block 12
2056	112	Get Block Mode Memory 13	Reading stored measured values block 13
2168	112	Get Block Mode Memory 14	Reading stored measured values block 14

7.4.2.2 Address 0 - Vendor Information

Address	Access	Length	Datatype	Description
0 - 32	Read	33	STRING[65]	Vendor name

7.4.2.3 Address 40 - Device Information

Address	Access	Length	Datatype	Description
40 - 43	Read	45	STRING[9]	Product ID
44	Read		STRING[65]	High Byte: Product ID/ Low Byte: Sensor type
45 - 76	Read			Sensor type
77 - 84	Read		STRING[65]	Serial number

7.4.2.4 Address 90 - Frontend Version

Address	Access	Length	Datatype	Description
90 - 94	Read	5	STRING[9]	Frontend Version

7.4.2.5 Address 100 - Ethernet Configuration

Address	Access	Length	Datatype	Description
100 - 101	Read	2	uint32_t	IP Address
102 - 103	Read	2	uint32_t	Subnet Mask
104 - 105	Read	2	uint32_t	Gateway address

7.4.2.6 Address 120 - MAC Address

Address	Access	Length	Datatype	Description
120	Read	1	uint16_t	MAC address Byte 0
121	Read	1	uint16_t	MAC address Byte 1
122	Read	1	uint16_t	MAC address Byte 2
123	Read	1	uint16_t	MAC address Byte 3
124	Read	1	uint16_t	MAC address Byte 4
125	Read	1	uint16_t	MAC address Byte 5

7.4.2.7 Address 150 - Meas Range Limits

Address	Access	Length	Datatype	Description
150 - 151	Read	2	float32_t	Measuring Range Near Limit [mm]
152 - 153	Read	2	float32_t	Measuring Range Far Limit [mm]
154 - 155	Read	2	float32_t	Min. Measuring Range [mm]

7.4.2.8 Address 200 - All Measurements

Address	Access	Length	Datatype	Description
200	Read	1	uint16_t	General Status Bit 0: State Configurationmode 0 = Inactive 1 = Active Bit 1: NTP-Timeserver Synchronisation 0 = Inactive 1 = Active Bit 2: State Warmup 0 = Inactive 1 = Active Bit 3: Tilt Compensation 0 = Inactive 1 = Active
201	Read	1	uint16_t	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal
202	Read	1	uint16_t	Bit 0: State Switching Output 0 = Inactive 1 = Active Bit 1: State Alarm Output 0 = Inactive 1 = Active
203 - 204	Read	2	float32_t	Distance [mm]
205 - 206	Read	2	float32_t	Measurement Rate [Hz]
207 - 208	Read	2	float32_t	Exposure Reserve
209 - 210	Read	2	uint32_t	Response Delay seconds [**s**: µs]
211 - 212	Read	2	uint32_t	Response delay microseconds [s: **µs**]
213 - 214	Read	2	uint32_t	Time stamp seconds [**s**: µs]
215 - 216	Read	2	uint32_t	Time stamp microseconds [s: **µs**]

7.4.2.9 Address 250 - Teachable Range

Address	Access	Length	Datatype	Description
250 - 251	Read	2	float32_t	Minimum Far Point
252 - 253	Read	2	float32_t	Maximum Far Point
254 - 255	Read	2	float32_t	Minimum Near Point
256 - 257	Read	2	float32_t	Maximum Near Point
258 - 259	Read	2	float32_t	Minimum Hysteresis [mm]
260 - 261	Read	2	float32_t	Maximum Hysteresis [mm]
262 - 263	Read	2	float32_t	Minimum Distance between Swicht Points

7.4.2.10 Address 300 – Hold Time Limits

Address	Access	Length	Datatype	Description
300	Read	1	uint16_t	Hold Time Min [ms]
301	Read	1	uint16_t	Hold Time Max [ms]

7.4.2.11 Address 301 - Operation Time: Powerup

Address	Access	Length	Datatype	Description
301	Read	2	uint32_t	Operation Time since power on

7.4.2.12 Address 303 - Operation Time: Resetable

Address	Access	Length	Datatype	Description
303	Read	2	uint32_t	Operation Time (resettable)

7.4.2.13 Address 305 - Operation Time: Lifetime

Address	Access	Length	Datatype	Description
305	Read	2	uint32_t	Operation Time in total

7.4.2.14 Address 307 - Histogram Distance: Unit

Address	Access	Length	Datatype	Description
307	Read	1	string	Histogram Distance: Unit (mm)

7.4.2.15 Address 308 - Histogram Distance: Range Start

Address	Access	Length	Datatype	Description
308	Read	2	int32_t	Histogram Distance: Start of range

7.4.2.16 Address 310 - Histogram Distance: Range End

Address	Access	Length	Datatype	Description
310	Read	2	int32_t	Histogram Distance: End of range

7.4.2.17 Address 312 - Histogram Distance: Number of Bins

Address	Access	Length	Datatype	Description
312	Read	1	uint16_t	Histogram Distance: Number of intervals/ bins

7.4.2.18 Address 312 - Histogram Distance: Bin 1 - 20

Address	Access	Length	Datatype	Description
313	Read	40	uint32_t	Histogram Distance: Frequency Distribution Bin 1: Number of distance values Bin 2: Number of distance values …

7.4.2.19 Address 353 - Histogram Exposure Reserve: Range Start

Address	Access	Length	Datatype	Description
353	Read	2	int32_t	Histogram Expsoure Reserve : Start of range

7.4.2.20 Address 355 - Histogram Exposure Reserve: Range End

Address	Access	Length	Datatype	Description
355	Read	2	int32_t	Histogram Expsoure Reserve : End of range

Address 357 - Histogram Exposure Reserve: Number of Bins

Address	Access	Length	Datatype	Description
357	Read	1	uint16_t	Histogram Exposure Reserve: Number of intervals/ bins

7.4.2.21 Address 358 - Histogram Exposure Reserve: Bin 1 - 20

Address	Access	Length	Datatype	Description
358	Read	40	uint32_t	Histogram Exposure Reserve: Frequency Distribution Bin 1: Number of Exposure Reserve values Bin 2: Number of Exposure Reserve values …

7.4.2.22 Address 400 - Unsaved Configuration

Address	Access	Length	Datatype	Description
400	Read	1	uint16_t	Status unsaved configurations: 0 = No unsaved configurations 1 = Unsaved configurations

7.4.2.23 Address 401 - Active Setting Number

Address	Access	Length	Datatype	Description
401	Read	1	uint16_t	Display of active Parameter Setup 1 = Parameter Setup 1 2 = Parameter Setup 2 3 = Parameter Setup 3

7.4.2.24 Address 410 - Setting 1

Address	Access	Length	Datatype	Description
410 - 411	Read	2	int32_t	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
412 - 413	Read	2	uint32_t	Numerical time interval (only in Interval Mode) [µs]
414	Read	1	uint16_t	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
415	Read	1	uint16_t	Precision Filter «Custom»: Filter length Median Filter
416	Read	1	uint16_t	Precision Filter «Custom»: Filter length Average Filter
417 - 418	Read	2	int32_t	Numerical Zero Position [µm]
419 - 420	Read	2	float32_t	Measuring Range Near Limit [mm]
421 - 422	Read	2	float32_t	Measuring Range Far Limit [mm]
423 - 424	Read	2	float32_t	Far Point
425 - 426	Read	2	float32_t	Near Point
427 - 428	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
429 - 430	Read	2	float32_t	Hysteresis [mm]
431	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
432	Read	1	int16_t	Define output type of Analog Output: 0 = 0 bis 5 V 1 = 0 bis 10 V 5 = 4 bis 20 mA 6 = 2 bis 10 mA
433 - 434	Read	2	float32_t	Min. Output Point Analog [mm]
435 - 436	Read	2	float32_t	Max. Output Point Analog [mm]
437	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
438	Read	1	uint16_t	Hold Time [ms]
439	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
440 - 441	Read	2	float32_t	Calculated Tilt Angle if Tilt Compensation is active

7.4.2.25 Address 450 - Setting 2

Address	Access	Length	Datatype	Description
450 - 451	Read	2	int32_t	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
452 - 453	Read	2	uint32_t	Numerical time interval (only in Interval Mode) [µs]
454	Read	1	uint16_t	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
455	Read	1	uint16_t	Precision Filter «Custom»: Filter length Median Filter
456	Read	1	uint16_t	Precision Filter «Custom»: Filter length Average Filter
457 - 458	Read	2	int32_t	Numerical Zero Position [µm]
459 - 460	Read	2	float32_t	Measuring Range Near Limit [mm]
461 - 462	Read	2	float32_t	Measuring Range Far Limit [mm]
463 - 464	Read	2	float32_t	Far Point
465 - 466	Read	2	float32_t	Near Point
467 - 468	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
469 - 470	Read	2	float32_t	Hysteresis [mm]
471	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
472	Read	1	int16_t	Define output type of Analog Output: 0 = 0 bis 5 V 1 = 0 bis 10 V 5 = 4 bis 20 mA 6 = 2 bis 10 mA
473 - 474	Read	2	float32_t	Min. Output Point Analog [mm]
475 - 476	Read	2	float32_t	Max. Output Point Analog [mm]
477	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
478	Read	1	uint16_t	Hold Time [ms]
479	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
480 - 481	Read	2	float32_t	Calculated Tilt Angle if Tilt Compensation is active

7.4.2.26 Address 490 - Setting 3

Address	Access	Length	Datatype	Description
490 - 491	Read	2	int32_t	Selection Triggermode 0 = Free Running 1 = Single Shot 2 = Interval
492 - 493	Read	2	uint32_t	Numerical time interval (only in Interval Mode) [µs]
494	Read	1	uint16_t	Selection filtering: 0 = Standard 1 = High 2 =Very High 3 = Highest 4 = Custom
495	Read	1	uint16_t	Precision Filter «Custom»: Filter length Median Filter
496	Read	1	uint16_t	Precision Filter «Custom»: Filter length Average Filter
497 - 498	Read	2	int32_t	Numerical Zero Position [µm]
499 - 500	Read	2	float32_t	Measuring Range Near Limit [mm]
501 - 502	Read	2	float32_t	Measuring Range Far Limit [mm]
503 - 504	Read	2	float32_t	Far Point
505 - 506	Read	2	float32_t	Near Point
507 - 508	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
509 - 510	Read	2	float32_t	Hysteresis [mm]
511	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
512	Read	1	int16_t	Define output type of Analog Output: 0 = 0 bis 5 V 1 = 0 bis 10 V 5 = 4 bis 20 mA 6 = 2 bis 10 mA
513 - 514	Read	2	float32_t	Min. Output Point Analog [mm]
515 - 516	Read	2	float32_t	Max. Output Point Analog [mm]
517	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
518	Read	1	uint16_t	Hold Time [ms]
519	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far
520 - 521	Read	2	float32_t	Calculated Tilt Angle if Tilt Compensation is active

7.4.2.27 Address 550 - Tilt Angle

Address	Access	Length	Datatype	Description
550	Read	2	float32_t	Calculated Tilt Angle

7.4.2.28 Address 550 - Teached Background Distance

Address	Access	Length	Datatype	Description
552	Read	2	float32_t	Distance to background

7.4.2.29 Address 554 - Teached Object Distance

Address	Access	Length	Datatype	Description
554	Read	2	float32_t	Distance to reference object

7.4.2.30 Address 600-2168 - Block Mode Memory

To enable all measurement values to be retrieved in full with the maximum measurement rate, all measurement values are stored in a buffer containing up to 100 entries. When accessing the input register with address 600, the content of the buffer is copied to the Modbus TCP output buffer. From here, the content can then be retrieved sequentially in multiple sub-blocks.

RSA = Register Start Address

Address	Access	Length	Datatype	Description
600, 712, 824, 936, 1048, 1160, 1272, 1384, 1496, 1608, 1720, 1832, 1944, 2056, 2168	Read	112		Length of last address: 32

Address	Access	Length	Datatype	Description
RSA	Read	1	uint16_t	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal
RSA + 1	Read	1	uint16_t	Bit 0: State Switching Output 0 = Active 1 = Inactive Bit 1: State Alarm Output 0 = Active 1 = Inactive
RSA + 2 RSA + 3	Read	2	float32_t	Distance [mm]
RSA + 4 RSA + 5	Read	2	float32_t	Measurment Rate [Hz]
RSA + 6 RSA + 7	Read	2	float32_t	Exposure Reserve
RSA + 8 RSA + 9	Read	2	uint32_t	Response Delay seconds [**s**:µs]
RSA + 10 RSA + 11	Read	2	uint32_t	Response Delay microseconds [s:**µs**]
RSA + 12 RSA + 13	Read	2	uint32_t	Time Stamp [**s**:µs]
RSA + 14 RSA + 15	Read	2	uint32_t	Time Stamp [s:**µs**]

7.4.1 Modbus TCP commands: Discrete Input register

The following table shows an overview of commands.

Address	Access	Length	Datatype	Description
0	Read	1	bit	State Switching Output 0 = Inactive 1 = Active
1	Read	1	bit	State Alarm Output 0 = Inactive 1 = Active

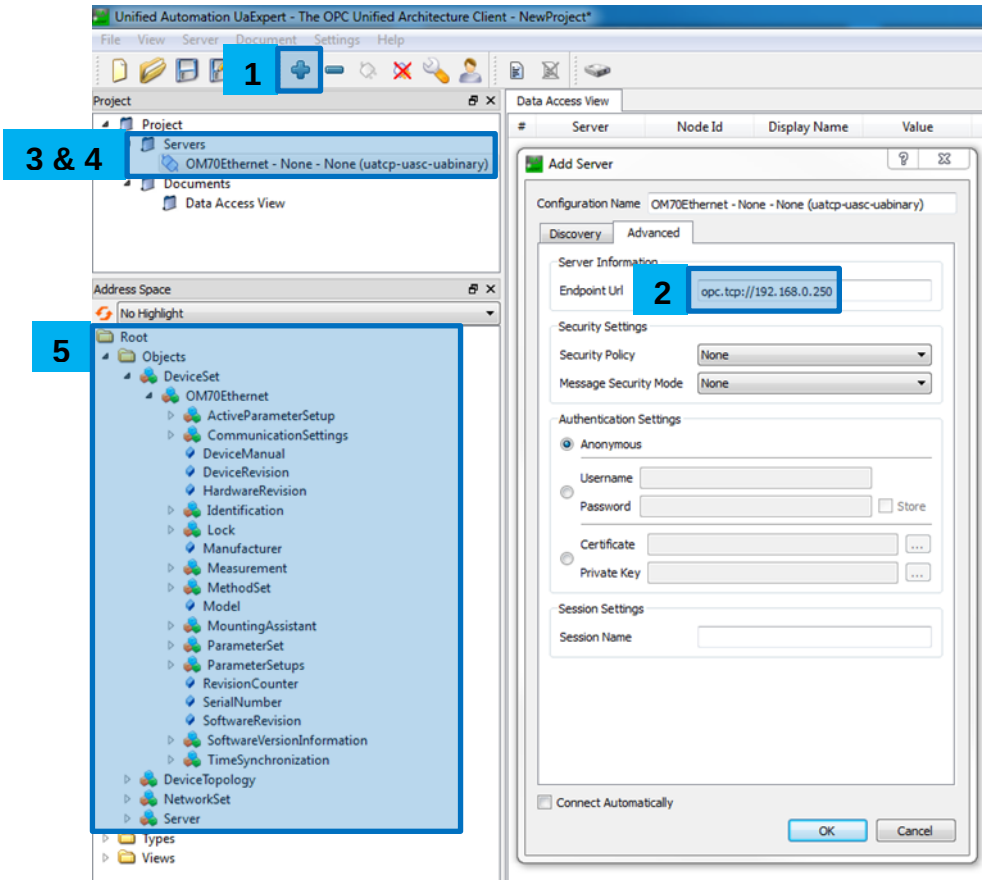
8 OPC UA

The OM70-x.EK sensor series supports OPC UA for calling up measured values and for configuration.

Various software libraries are available for PC-based systems. For additional information, visit the website of the OPC foundation (https://opcfoundation.org).

The following steps are required to operate the sensor via OPC UA:

1. Add Server
2. Enter the IP address of the sensor (example: opc.tcp://192.168.0.250)
3. In the project the sensor now appears in the server area
4. The sensor can be connected using the right mouse button
5. The function tree of the sensor was read out and is now displayed
6. Für die erfolgreiche Kommunikation mit dem Sensor muss einmalig das Kommando InitLock aufgerufen werden



9 UDP Streaming

The OM70-x.EK sensor series supports UDP Streaming for calling up measured values.

The following data packet is output without request at the end of a measurement cycle, i.e. the measurement rate corresponds to the frequency of the transmission.

Size [Byte]	Data type	Description
4	uint32_t	Block ID (for grouping several UDP packets)
1	uint8_t	Frame type 0 = SingleFrame, the block consists of one frame 1 = FirstFrame, the block consists of several frames, the number of frames is in "Number Frames Counter". 2 = ConsecutiveFrame, this is the x-th frame (the frame number is in "Number Frames Counter")
1	uint8_t	Reserve
2	uint16_t	Number Frames Counter Frame type = 1: Total number of Frames Frame type = 2: Current Count of Frame
1	uint8_t	Quality of Measuring signal 0 = ok 1 = low signal 2 = critical signal
1	bool_t	Bit 0: State Switching Output 0 = Active 1 = Inactive
1	bool_t	Bit 1: State Alarm Output 0 = Active 1 = Inactive
1		Padding
4	float32_t	Distance [mm]
4	float32_t	Measurement Rate [Hz]
4	float32_t	Exposure Reserve
4	uint32_t	Response Delay seconds [**s**:µs]
4	uint32_t	Response Delay microseconds [s:**µs**]
4	uint32_t	Time Stamp [**s**:µs]
4	uint32_t	Time Stamp [s:**µs**]

10 Error Correction

Error	Error correction
No function	Check electrical connection: ➔ Pin 2 (+Vs, brown): 15 … 28 VDC ➔ Pin 7 (GND, blue): 0 VDC
LED Green blinking	Check connection: ➔ Short circuit on the switching outputs.
Laser off/ LED Red blinking/ No valid measurement value	1. Check Sync-In Input: Sync-In on High (8V … UB - Operating Voltage): Laser off ➔ Sync-In auf Low (0V … 2.5V) legen: Messung 2. Check refelction: A direct reflection of the laser beam into the transmitter element of the sensor ensures that the laser is switched off for safety reasons. This can occur especially with shiny objects and can be remedied by tilting the sensor (see chapter 3.2.4.2).
Laser on/ LED Red blinking/ No valid measurement value	1. Check Measuring Range Limits: No object within the measuring range ➔ Adjust configurations of measuring range limits 2. Mounting/ ambient conditions: Bad or too weak signal on the receiving element ➔ Ceck Exposure Reserve and adjust mounting ➔ Remove dirt from the window of the sensor
Incorrect measurement results	Mounting: The direct reflex of the transmitter hits the receiver (shiny objects) ➔ Adjust mounting of sensor (see chapter 3.2.4.2)
Measured value jumps	Ambient conditions: The influence of ambient light leads to disturbing peaks on the receiving element. Visualization in the raw line signal. ➔ Reduce ambient light (Cover etc.)

11 Factory Reset

A factory reset can be carried out via the web interface.
If another communication interface is write active at this time, the data can only be read via the web interface. The connection must be disconnected in order to obtain write access.

NOTE
The factory reset via the web interface allocates the sensor the default IP address 192.168.0.250.

If the sensor can no longer be accessed due to an IP address change, for example, you can proceed as follows:

- Disconnect the sensor from the power supply.
- Short-circuit the switching output (pin 4) and the alarm output (pin 5) during the start-up process.
- Enter the following (factory default) IP address to access the sensor: 192.168.0.250

12 Maintance

The laser distance sensors are maintenance-free.

For an error-free sensor function, the front window of the sensor must be cleaned of dirt (dust, fingerprints, etc.). The cleaning interval depends on the ambient conditions.
The front window can be cleaned with a dry, clean (!), soft cloth. If the front window is heavily soiled, alcohol or soapy water can be used for cleaning.

13 Disposal

This device contains electronic components and must therefore not be disposed of with household waste. The components must be disposed of in accordance with the applicable national regulations for the disposal of electronic equipment. Improper disposal can be dangerous for the environment.

14 Sensor data sheet

14.1 Measuring range types 30…70 mm

General data	11216522 Laser class 1 Laser point Focal dist. 48 mm	11216521 Laser class 1 Laser line Focal dist. 48 mm	11216511 Laser class 1 Laser point Focal dist. 65 mm	11216505 Laser class 1 Laser line Focal dist. 65 mm
Beam shape	Laser point	Laser line	Laser point	Laser line
Laser class	1		1	
Function	Distance		Distance	
Measuring range (distance)	30…70 mm		30…70 mm	
Start of measuring range Sdc	30 mm		30 mm	
End of measuring range Sde	70 mm		70 mm	
Blind region	0…30 mm		0…30 mm	
Measuring range Mr	40 mm		40 mm	
Sweet spot	48 mm		65 mm	
Measuring frequency	2000 Hz[1,2]		2000 Hz[1,2]	
Response delay - Single shot - Continuous	 0.8 ms[1,2] 1.2 ms[1,2]		 0.8 ms[1,2] 1.2 ms[1,2]	
Resolution Without filter Precision high Precision very high Precision highest	 2.6…4 µm[1,2] 1.3…2 µm[1,2,3] 0.9…1.4 µm[1,2,3] 0.7…1 µm[1,2,3]		 2.6…4 µm[1,2] 1.3…2 µm[1,2,3] 0.9…1.4 µm[1,2,3] 0.7…1 µm[1,2,3]	
Spatial repeatability	14 µm		14 µm	
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 0.4…1.2 µm[1,2] 0.2…0.6 µm[1,2,3] 0.2…0.4 µm[1,2,3] 0.1…0.3 µm[1,2,3]		 0.4…1.2 µm[1,2] 0.2…0.6 µm[1,2,3] 0.2…0.4 µm[1,2,3] 0.1…0.3 µm[1,2,3]	
Linearity error	± 22 µm[1,2]		± 22 µm[1,2]	
Linearity deviation in % of Mr	± 0.06%[1,2]		± 0.06%[1,2]	
Temperature drift	± 0.01% Sde/K[1,2]		± 0.01% Sde/K[1,2]	

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

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

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
Hysteresis digital output	Adjustable in mm	Adjustable in mm
Minimum window size for digital output	0.07 mm	0.07 mm
Minimum window size for analog output	1 mm	1 mm
Power on indication	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED
Switch-on delay	<1200 ms	<1200 ms
Light source	Red laser diode, pulsed	Red laser diode, pulsed
Setting	Web interface or digital interface	Web interface or digital interface

Electrical data	**11216522** **Laser class 1** **Laser point** **Focal dist. 48 mm**	**11216521** **Laser class 1** **Laser line** **Focal dist. 48 mm**	**11216511** **Laser class 1** **Laser point** **Focal dist. 65 mm**	**11216505** **Laser class 1** **Laser line** **Focal dist. 65 mm**
Voltage supply range +Vs	15 ... 28 VDC		15 ... 28 VDC	
Max. supply current (without load)	120 mA		120 mA	
Output circuit	Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)	
Switching output	Push-pull		Push-pull	
Output function	Out 1 / alarm		Out 1 / alarm	
Output current	< 100 mA		< 100 mA	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes	

Mechanical data	**11216522** **Laser class 1** **Laser point** **Focal dist. 48 mm**	**11216521** **Laser class 1** **Laser line** **Focal dist. 48 mm**	**11216511** **Laser class 1** **Laser point** **Focal dist. 65 mm**	**11216505** **Laser class 1** **Laser line** **Focal dist. 65 mm**
Width / Height / Length	26 / 74 / 55 mm		26 / 74 / 55 mm	
Design	Rectangular, front view		Rectangular, front view	
Housing material	Aluminum		Aluminum	
Front optic	Glass		Glass	
Connection method	Plug M12 8 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin	
Weight	135 g		135 g	

Ambient conditions	11216522 Laser class 1 Laser point Focal dist. 48 mm	11216521 Laser class 1 Laser line Focal dist. 48 mm	11216511 Laser class 1 Laser point Focal dist. 65 mm	11216505 Laser class 1 Laser line Focal dist. 65 mm
Ambient light immunity	< 28 kLux	< 28 kLux	< 28 kLux	< 28 kLux
Operating temperature	-10 … +50 °C		-10 … +50 °C	
Storage temperature	-20 … +60 °C		-20 … +60 °C	
Heating period	20 min.		20 min.	
protection class	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	
Shock resistance	**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	11216522 Laser class 1 Laser point Focal dist. 48 mm	11216521 Laser class 1 Laser line Focal dist. 48 mm	11216511 Laser class 1 Laser point Focal dist. 65 mm	11216505 Laser class 1 Laser line Focal dist. 65 mm
Light source	AlGaInP laser diode		AlGaInP laser diode	
Wave length	660 nm		660 nm	
Operating mode	pulsed		pulsed	
Pulse duration	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms
Pulse period	0.4…5 ms	0.4…5 ms	0.4…5 ms	0.4…5 ms
Total emitted pulse power	0.24mW	0.29mW	0.24mW	0.24mW
Beam shape	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	34 mm 50 mm		34 mm 50 mm	
Focal distance df	48 mm		65 mm	
Nominal ocular hazard distance (NOHD)1	N/A	N/A	N/A	N/A
Laser classification (as per IEC 60825-1/2014)	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

14.2 Measuring range types 40…140 mm

General data	11220192 Laser class 1 Laser point Focal dist. 70 mm	11220165 Laser class 1 Laser line Focal dist. 70 mm	11220193 Laser class 1 Laser point Focal dist. 100 mm	11220166 Laser class 1 Laser line Focal dist. 100 mm	11216512 Laser class 1 Laser point Focal dist. 130 mm	11216506 Laser class 1 Laser line Focal dist. 130 mm
Beam shape	Laser point	Laser line	Laser point	Laser line	Laser point	Laser line
Laser class	1		1		1	
Function	Distance		Distance		Distance	
Measuring range (distance)	40…140 mm		40…140 mm		40…140 mm	
Start of measuring range Sdc	40 mm		40 mm		40 mm	
End of measuring range Sde	140 mm		140 mm		140 mm	
Blind region	0…40 mm		0…40 mm		0…40 mm	
Measuring range Mr	100 mm		100 mm		100 mm	
Sweet spot	70 mm		100 mm		130 mm	
Measuring frequency	2000 Hz[12]		2000 Hz[12]		2000 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	 4.8…10 µm[12] 2.4…5 µm[123] 1.6…3.4 µm[123] 1.2…2.5 µm[123]		 4.8…10 µm[12] 2.4…5 µm[123] 1.6…3.4 µm[123] 1.2…2.5 µm[123]		 4.8…10 µm[12] 2.4…5 µm[123] 1.6…3.4 µm[123] 1.2…2.5 µm[123]	
Spatial repeatability	22 µm		22 µm		22 µm	
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 1…2.5 µm[12] 0.5…1.3 µm[123] 0.4…0.9 µm[123] 0.3…0.7 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…2.5 µm[12] 0.5…1.3 µm[123] 0.4…0.9 µm[123] 0.3…0.7 µm[123]	
Linearity error	± 65 µm[12]		± 65 µm[12]		± 65 µm[12]	
Linearity deviation in % of Mr	± 0.07%[12]		± 0.07%[12]		± 0.07%[12]	
Temperature drift	± 0.015% Sde/K[12]		± 0.015% Sde/K[12]		± 0.015% Sde/K[12]	
PRECISION filter values: Standard High	Median Average Off Off 9 Off		Median Average Off Off 9 Off		Median Average Off Off 9 Off	

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

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

Very high Highest	9 16 9 128	9 16 9 128	9 16 9 128
Hysteresis digital output	Adjustable in mm	Adjustable in mm	Adjustable in mm
Minimum window size for digital output	0.14 mm	0.14 mm	0.14 mm
Minimum window size for analog output	1 mm	1 mm	1 mm
Power on indication	Green LED	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED	Blue 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	Web interface or digital interface	Web interface or digital interface	Touch display, RS-485

Electrical data	**11220192** **Laser class 1** **Laser point** **Focal dist. 70 mm**	**11220165** **Laser class 1** **Laser line** **Focal dist. 70 mm**	**11220193** **Laser class 1** **Laser point** **Focal dist. 100 mm**	**11220166** **Laser class 1** **Laser line** **Focal dist. 100 mm**	**11216512** **Laser class 1** **Laser point** **Focal dist. 130 mm**	**11216506** **Laser class 1** **Laser line** **Focal dist. 130 mm**
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 digital		Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA / 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA / 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA / 0 … 5 VDC/ 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	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes		Yes	

Mechanical data	**11220192** **Laser class 1** **Laser point** **Focal dist. 70 mm**	**11220165** **Laser class 1** **Laser line** **Focal dist. 70 mm**	**11220193** **Laser class 1** **Laser point** **Focal dist. 100 mm**	**11220166** **Laser class 1** **Laser line** **Focal dist. 100 mm**	**11216512** **Laser class 1** **Laser point** **Focal dist. 130 mm**	**11216506** **Laser class 1** **Laser line** **Focal dist. 130 mm**
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 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin	
Weight	135 g		135 g		135 g	

Ambient conditions	11220192 Laser class 1 Laser point Focal dist. 70 mm	11220165 Laser class 1 Laser line Focal dist. 70 mm	11220193 Laser class 1 Laser point Focal dist. 100 mm	11220166 Laser class 1 Laser line Focal dist. 100 mm	11216512 Laser class 1 Laser point Focal dist. 130 mm	11216506 Laser class 1 Laser line Focal dist. 130 mm
Ambient light immunity	< 35 kLux		< 35 kLux		< 35 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	**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	11220192 Laser class 1 Laser point Focal dist. 70 mm	11220165 Laser class 1 Laser line Focal dist. 70 mm	11220193 Laser class 1 Laser point Focal dist. 100 mm	11220166 Laser class 1 Laser line Focal dist. 100 mm	11216512 Laser class 1 Laser point Focal dist. 130 mm	11216506 Laser class 1 Laser line Focal dist. 130 mm
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…2.5ms	4 µs…2.5ms	4 µs…2.5ms	4 µs…2.5ms	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	0.2 mW	0.2 mW	0.2 mW	0.2 mW	0.28 mW	0.27 mW
Beam shape	Point laser	Short line	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	36 mm 53 mm		36 mm 53 mm		36 mm 53 mm	
Focal distance df	70 mm		100 mm		130 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

14.3 Measuring range types 50…250 mm

General data	11220194 Laser class 1 Laser point Focal dist. 130 mm	11220167 Laser class 1 Laser line Focal dist. 130 mm	11220195 Laser class 1 Laser point Focal dist. 180 mm	11220168 Laser class 1 Laser line Focal dist. 180 mm	11194696 Laser class 1 Laser point Focal dist. 240 mm	11194698 Laser class 1 Laser line Focal dist. 240 mm
Beam shape	Laser point	Laser line	Laser point	Laser line	Laser point	Laser line
Laser class	1		1		1	
Function	Distance		Distance		Distance	
Measuring range (distance)	50…250 mm		50…250 mm		50…250 mm	
Start of measuring range Sdc	50 mm		50 mm		50 mm	
End of measuring range Sde	250 mm		250 mm		250 mm	
Blind region	0…50 mm		0…50 mm		0…50 mm	
Measuring range Mr	200 mm		200 mm		200 mm	
Sweet spot	130 mm		180 mm		240 mm	
Measuring frequency	2000 Hz[12]		2000 Hz[12]		2000 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	 5.3…25 µm[12] 2.7…12.5 µm[123] 1.8…8.4 µm[123] 1.4…6.3 µm[123]		 5.3…25 µm[12] 2.7…12.5 µm[123] 1.8…8.4 µm[123] 1.4…6.3 µm[123]		 5.3…25 µm[12] 2.7…12.5 µm[123] 1.8…8.4 µm[123] 1.4…6.3 µm[123]	
Spatial repeatability	60 µm		60 µm		60 µm	
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 1…8 µm[12] 0.5…4 µm[123] 0.4…2.7 µm[123] 0.3…2 µm[123]		 1…8 µm[12] 0.5…4 µm[123] 0.4…2.7 µm[123] 0.3…2 µm[123]		 1…8 µm[12] 0.5…4 µm[123] 0.4…2.7 µm[123] 0.3…2 µm[123]	
Linearity error	± 170 µm[12]		± 170 µm[12]		± 170 µm[12]	
Linearity deviation in % of Mr	± 0.09%[12]		± 0.09%[12]		± 0.09%[12]	
Temperature drift	± 0.024% Sde/K[12]		± 0.024% Sde/K[12]		± 0.024% Sde/K[12]	
PRECISION filter values: Standard High	Median Average Off Off 9 Off		Median Average Off Off 9 Off		Median Average Off Off 9 Off	

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

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

Very high Highest	9 16 9 128	9 16 9 128	9 16 9 128
Hysteresis digital output	Adjustable in mm	Adjustable in mm	Adjustable in mm
Minimum window size for digital output	0.25 mm	0.25 mm	0.25 mm
Minimum window size for analog output	1 mm	1 mm	1 mm
Power on indication	Green LED	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED	Blue 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	Web interface and digital interface	Web interface and digital interface	Web interface and digital interface

Electrical data	**11220194** **Laser class 1** **Laser point** **Focal dist. 130 mm**	**11220167** **Laser class 1** **Laser line** **Focal dist. 130 mm**	**11220195** **Laser class 1** **Laser point** **Focal dist. 180 mm**	**11220168** **Laser class 1** **Laser line** **Focal dist. 180 mm**	**11194696** **Laser class 1** **Laser point** **Focal dist. 240 mm**	**11194698** **Laser class 1** **Laser line** **Focal dist. 240 mm**
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 digital		Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 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	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes		Yes	

Mechanical data	**11220194** **Laser class 1** **Laser point** **Focal dist. 130 mm**	**11220167** **Laser class 1** **Laser line** **Focal dist. 130 mm**	**11220195** **Laser class 1** **Laser point** **Focal dist. 180 mm**	**11220168** **Laser class 1** **Laser line** **Focal dist. 180 mm**	**11194696** **Laser class 1** **Laser point** **Focal dist. 240 mm**	**11194698** **Laser class 1** **Laser line** **Focal dist. 240 mm**
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 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin	
Weight	135 g		135 g		135 g	

Ambient conditions	11220194 Laser class 1 Laser point Focal dist. 130 mm	11220167 Laser class 1 Laser line Focal dist. 130 mm	11220195 Laser class 1 Laser point Focal dist. 180 mm	11220168 Laser class 1 Laser line Focal dist. 180 mm	11194696 Laser class 1 Laser point Focal dist. 240 mm	11194698 Laser class 1 Laser line Focal dist. 240 mm
Ambient light immunity	< 170 kLux		< 170 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	**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	11220194 Laser class 1 Laser point Focal dist. 130 mm	11220167 Laser class 1 Laser line Focal dist. 130 mm	11220195 Laser class 1 Laser point Focal dist. 180 mm	11220168 Laser class 1 Laser line Focal dist. 180 mm	11194696 Laser class 1 Laser point Focal dist. 240 mm	11194698 Laser class 1 Laser line Focal dist. 240 mm
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…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms
Pulse period	0.4…6 ms	0.4…6 ms	0.4…6 ms	0.4…6 ms	0.4…6 ms	0.4…9 ms
Total emitted pulse power	0.65 mW	0.65 mW	0.65 mW	0.65 mW	0.65 mW	0.95 mW
Beam shape	Point laser	Short line	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	38 mm 55 mm		38 mm 55 mm		38 mm 55 mm	
Focal distance df	130 mm	130 mm	180 mm	180 mm	240 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

14.4 Measuring range types 100…600 mm

General data	11220196 Laser class 2 Laser point Focal dist. 350 mm	11220169 Laser class 2 Laser line Focal dist. 350 mm	11216518 Laser class 1 Laser point Focal dist. 500 mm	11216515 Laser class 1 Laser line Focal dist. 500 mm	11186912 Laser class 2 Laser point Focal dist. 500 mm	11216507 Laser class 2 Laser line Focal dist. 500 mm
Beam shape	Laser point	Laser line	Laser point	Laser line	Laser point	Laser line
Laser class	2		1		2	
Function	Distance		Distance		Distance	
Measuring range (distance)	100…600 mm		100…600 mm		100…600 mm	
Start of measuring range Sdc	100mm		100mm		100mm	
End of measuring range Sde	600 mm		600 mm		600 mm	
Blind region	0…100 mm		0…100 mm		0…100 mm	
Measuring range Mr	500 mm		500 mm		500 mm	
Sweet spot	350 mm		500 mm		500 mm	
Measuring frequency	2000 Hz[12]		2000 Hz[12]		2000 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	 10…95 µm[12] 5…48 µm[123] 4…32 µm[123] 3…24 µm[123]		 10…95 µm[12] 5…48 µm[123] 4…32 µm[123] 3…24 µm[123]		 10…95 µm[12] 5…48 µm[123] 4…32 µm[123] 3…24 µm[123]	
Spatial repeatability	250 µm		250 µm		250 µm	
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 3…36 µm[12] 2…18 µm[123] 1…12 µm[123] 1…9 µm[123]		 3…36 µm[12] 2…18 µm[123] 1…12 µm[123] 1…9 µm[123]		 3…36 µm[12] 2…18 µm[123] 1…12 µm[123] 1…9 µm[123]	
Linearity error	± 600 µm[12]		± 600 µm[12]		± 600 µm[12]	
Linearity deviation in % of Mr	± 0.12%[12]		± 0.12%[12]		± 0.12%[12]	
Temperature drift	± 0.04% Sde/K[12]		± 0.04% Sde/K[12]		± 0.04% Sde/K[12]	
PRECISION filter values: Standard High	Median Average Off Off 9 Off		Median Average Off Off 9 Off		Median Average Off Off 9 Off	

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

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

Very high Highest	9 16 9 128	9 16 9 128	9 16 9 128
Hysteresis digital output	Adjustable in mm	Adjustable in mm	Adjustable in mm
Minimum window size for digital output	0.6 mm	0.6 mm	0.6 mm
Minimum window size for analog output	1 mm	1 mm	1 mm
Power on indication	Green LED	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED	Blue 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	Web interface and digital interface	Web interface and digital interface	Web interface and digital interface

Electrical data	**11220196** **Laser class 2** **Laser point** **Focal dist. 350 mm**	**11220169** **Laser class 2** **Laser line** **Focal dist. 350 mm**	**11216518** **Laser class 1** **Laser point** **Focal dist. 500 mm**	**11216515** **Laser class 1** **Laser line** **Focal dist. 500 mm**	**11186912** **Laser class 2** **Laser point** **Focal dist. 500 mm**	**11216507** **Laser class 2** **Laser line** **Focal dist. 500 mm**
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 digital		Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 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	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes		Yes	

Mechanical data	**11220196** **Laser class 2** **Laser point** **Focal dist. 350 mm**	**11220169** **Laser class 2** **Laser line** **Focal dist. 350 mm**	**11216518** **Laser class 1** **Laser point** **Focal dist. 500 mm**	**11216515** **Laser class 1** **Laser line** **Focal dist. 500 mm**	**11186912** **Laser class 2** **Laser point** **Focal dist. 500 mm**	**11216507** **Laser class 2** **Laser line** **Focal dist. 500 mm**
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 pin & 4 pin		Plug M12 8 pin & 4 pin		Plug M12 8 pin & 4 pin	
Weight	135 g		135 g		135 g	

Ambient conditions	11220196 Laser class 2 Laser point Focal dist. 350 mm	11220169 Laser class 2 Laser line Focal dist. 350 mm	11216518 Laser class 1 Laser point Focal dist. 500 mm	11216515 Laser class 1 Laser line Focal dist. 500 mm	11186912 Laser class 2 Laser point Focal dist. 500 mm	11216507 Laser class 2 Laser line Focal dist. 500 mm
Ambient light immunity	< 300 kLux	< 170 kLux	< 300 kLux	< 170 kLux	< 300 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	**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	11220196 Laser class 2 Laser point Focal dist. 350 mm	11220169 Laser class 2 Laser line Focal dist. 350 mm	11216518 Laser class 1 Laser point Focal dist. 500 mm	11216515 Laser class 1 Laser line Focal dist. 500 mm	11186912 Laser class 2 Laser point Focal dist. 500 mm	11216507 Laser class 2 Laser line Focal dist. 500 mm
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…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms	4 µs…2.5 ms
Pulse period	0.4…5 ms	0.4…5 ms	0.4…9 ms	0.4…8 ms	0.4…5 ms	0.4…5 ms
Total emitted pulse power	0.98 mW	0.88 mW	0.98 mW	0.88 mW	0.98 mW	0.88 mW
Beam shape	Point laser	Short line	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	41 mm 57 mm		41 mm 57 mm		41 mm 57 mm	
Focal distance df	350	350 mm	500 mm	500 mm	500 mm	500 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 2		Laser class 1		Laser class 2	

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

14.5 Measuring range types 100…1000 mm

General data	11220197 Laser class 2 Laser point Focal dist. 500 mm	11220190 Laser class 2 Laser line Focal dist. 500 mm	11220198 Laser class 2 Laser point Focal dist. 700 mm	11220191 Laser class 2 Laser line Focal dist. 700 mm
Beam shape	Laser point	Laser line	Laser point	Laser line
Laser class	2		2	
Function	Distance		Distance	
Measuring range (distance)	100…1000 mm		100…1000 mm	
Start of measuring range Sdc	100 mm		100 mm	
End of measuring range Sde	1000 mm		1000 mm	
Blind region	0…100 mm		0…100 mm	
Measuring range Mr	900 mm		900 mm	
Sweet spot	500 mm		700 mm	
Measuring frequency	2000 Hz[1,2]		2000 Hz[1,2]	
Response time - Single shot - Continuous	0.8 ms[1,2] 1.2 ms[1,2]		0.8 ms[1,2] 1.2 ms[1,2]	
Resolution Without filter Precision high Precision very high Precision highest	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]
Spatial repeatability	650 µm	650 µm	650 µm	650 µm
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	3…125 µm[1,2] 2…63 µm[1,2,3] 1…42 µm[1,2,3] 2…32 µm[1,2,3]		3…125 µm[1,2] 2…63 µm[1,2,3] 1…42 µm[1,2,3] 2…32 µm[1,2,3]	
Linearity error	± 1700 µm[1,2]		± 1700 µm[1,2]	
Linearity deviation in % of Mr	± 0.19%[1,2]		± 0.19%[1,2]	
Temperature drift	± 0.065% Sde/K[1,2]		± 0.065% Sde/K[1,2]	

General data	11216519 Laser class 1 Laser point Focal dist. 1000 mm	11216516 Laser class 1 Laser line Focal dist. 1000 mm	11216513 Laser class 2 Laser point Focal dist. 1000 mm	11216508 Laser class 2 Laser line Focal dist. 1000 mm
Beam shape	Laser point	Laser line	Laser point	Laser line
Laser class	1		2	
Function	Distance		Distance	
Measuring range (distance)	100…1000 mm		100…1000 mm	
Start of measuring range Sdc	100 mm		100 mm	
End of measuring range Sde	1000 mm		1000 mm	
Blind region	0…100 mm		0…100 mm	
Measuring range Mr	900 mm		900 mm	
Sweet spot	1000 mm		1000 mm	
Measuring frequency	2000 Hz[1,2]		2000 Hz[1,2]	
Response time - Single shot - Continuous	0.8 ms[1,2] 1.2 ms[1,2]		0.7 ms[1,2] 1.2 ms[1,2]	
Resolution Without filter Precision high Precision very high Precision highest	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]	10…250 µm[1,2] 5…125 µm[1,2,3] 4…84 µm[1,2,3] 3…63 µm[1,2,3]
Spatial repeatability	650 µm	650 µm	650 µm	650 µm
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	3…125 µm[1,2] 2…63 µm[1,2,3] 1…42 µm[1,2,3] 2…32 µm[1,2,3]		3…125 µm[1,2] 2…63 µm[1,2,3] 1…42 µm[1,2,3] 2…32 µm[1,2,3]	
Linearity error	± 1700 µm[1,2]		± 1700 µm[1,2]	
Linearity deviation in % of Mr	± 0.19%[1,2]		± 0.19%[1,2]	
Temperature drift	± 0.065% Sde/K[1,2]		± 0.065% Sde/K[1,2]	

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

[2] Measurement on 90% reflectivity (white)

[3] Measurement with filtering

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	Median Average Off Off 9 Off 9 16 9 128
Hysteresis digital output	Adjustable in mm	Adjustable in mm	Adjustable in mm	Adjustable in mm
Minimum window size for digital output	1 mm	1 mm	1 mm	1 mm
Minimum window size for analog output	1 mm	1 mm	1 mm	1 mm
Power on indication	Green LED	Green LED	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED	Blue LED	Blue LED
Switch-on delay	<1200 ms	<1200 ms	<1200 ms	<1200 ms
Light source	Red laser diode, pulsed	Red laser diode, pulsed	Red laser diode, pulsed	Red laser diode, pulsed
Setting	Web interface or digital interface	Web interface or digital interface	Web interface or digital interface	Web interface or digital interface

Electrical data	**11220197** **Laser class 2** **Laser point** **Focal dist. 500 mm**	**11220190** **Laser class 2** **Laser line** **Focal dist. 500 mm**	**11220198** **Laser class 2** **Laser point** **Focal dist. 700 mm**	**11220191** **Laser class 2** **Laser line** **Focal dist. 700 mm**	**11216519** **Laser class 1** **Laser point** **Focal dist. 1000 mm**	**11216516** **Laser class 1** **Laser line** **Focal dist. 1000 mm**	**11216513** **Laser class 2** **Laser point** **Focal dist. 1000 mm**	**11216508** **Laser class 2** **Laser line** **Focal dist. 1000 mm**
Voltage supply range +Vs	15 ... 28 VDC		15 ... 28 VDC		15 ... 28 VDC		15 ... 28 VDC	
Max. supply current (without load)	120 mA		120 mA		120 mA		120 mA	
Output circuit	Analog and digital		Analog and digital		Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)	
Switching output	Push-pull		Push-pull		Push-pull		Push-pull	
Output function	Out 1 / alarm		Out 1 / alarm		Out 1 / alarm		Out 1 / alarm	
Output current	< 100 mA		< 100 mA		< 100 mA		< 100 mA	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes		Yes		Yes	

Mechanical data	**11220197** **Laser class 2** **Laser point** **Focal dist. 500 mm**	**11220190** **Laser class 2** **Laser line** **Focal dist. 500 mm**	**11220198** **Laser class 2** **Laser point** **Focal dist. 700 mm**	**11220191** **Laser class 2** **Laser line** **Focal dist. 700 mm**	**11216519** **Laser class 1** **Laser point** **Focal dist. 1000 mm**	**11216516** **Laser class 1** **Laser line** **Focal dist. 1000 mm**	**11216513** **Laser class 2** **Laser point** **Focal dist. 1000 mm**	**11216508** **Laser class 2** **Laser line** **Focal dist. 1000 mm**
Width / Height / Length	26 / 74 / 55 mm		26 / 74 / 55 mm		26 / 74 / 55 mm		26 / 74 / 55 mm	
Design	Rectangular, front view		Rectangular, front view		Rectangular, front view		Rectangular, front view	
Housing material	Aluminum		Aluminum		Aluminum		Aluminum	
Front optic	Glass		Glass		Glass		Glass	
Connection method	Plug M12 8-pole		Plug M12 8-pole		Plug M12 8-pole		Plug M12 8-pole	
Weight	135 g		135 g		135 g		135 g	

Ambient conditions	11220197 Laser class 2 Laser point Focal dist. 500 mm	11220190 Laser class 2 Laser line Focal dist. 500 mm	11220198 Laser class 2 Laser point Focal dist. 700 mm	11220191 Laser class 2 Laser line Focal dist. 700 mm	11216519 Laser class 1 Laser point Focal dist. 1000 mm	11216516 Laser class 1 Laser line Focal dist. 1000 mm	11216513 Laser class 2 Laser point Focal dist. 1000 mm	11216508 Laser class 2 Laser line Focal dist. 1000 mm
Ambient light immunity	< 100 kLux	< 100 kLux	< 100 kLux	< 100 kLux	< 100 kLux	< 100 kLux	< 100 kLux	< 100 kLux
Operating temperature	-10 … +50 °C		-10 … +50 °C		-10 … +50 °C		-10 … +50 °C	
Storage temperature	-20 … +60 °C		-20 … +60 °C		-20 … +60 °C		-20 … +60 °C	
Heating period	20 min.		20 min.		20 min.		20 min.	
protection class	IP 67		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		**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	**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		**IEC 60068-2-27:2009** 30 g / 11 ms, 6 jolts per axis and direction	

Optical properties	11220197 Laser class 2 Laser point Focal dist. 500 mm	11220190 Laser class 2 Laser line Focal dist. 500 mm	11220198 Laser class 2 Laser point Focal dist. 700 mm	11220191 Laser class 2 Laser line Focal dist. 700 mm	11216519 Laser class 1 Laser point Focal dist. 1000 mm	11216516 Laser class 1 Laser line Focal dist. 1000 mm	11216513 Laser class 2 Laser point Focal dist. 1000 mm	11216508 Laser class 2 Laser line Focal dist. 1000 mm
Light source	AlGaInP laser diode		AlGaInP laser diode		AlGaInP laser diode		AlGaInP laser diode	
Wave length	660 nm		660 nm		660 nm		660 nm	
Operating mode	pulsed		pulsed		pulsed		pulsed	
Pulse duration	4 µs…2.5 ms		4 µs…2 ms		4 µs…2 ms		4 µs…2 ms	
Pulse period	0.4…5 ms	0.4…7 ms	0.4…8 ms	0.4…7 ms	0.4…19 ms	0.4…17 ms	0.4…8 ms	0.4…7 ms
Total emitted pulse power	1.01 mW	1.9 mW	2.1 mW	1.9 mW	2.1 mW	1.9 mW	2.1 mW	1.9 mW
Beam shape	Point laser	Short line	Point laser	Short line	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	42 mm 57 mm		42 mm 57 mm		42 mm 57 mm		42 mm 57 mm	
Focal distance df	500 mm	500 mm	700 mm	700 mm	1000 mm	1000 mm	1000 mm	1000 mm
Nominal ocular hazard distance (NOHD)1	N/A	N/A	inf	7.0 m	inf	7.0 m	inf	7.0 m
Laser classification (as per IEC 60825-1/2014)	Laser class 2		Laser class 2		Laser class 1		Laser class 2	

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

14.6 Measuring range types 150…1500 mm

General data	11216520 Laser class 1 Laser point Focal dist. 1500 mm	11216517 Laser class 1 Laser line Focal dist. 1500 mm	11216514 Laser class 2 Laser point Focal dist. 1500 mm	11216510 Laser class 2 Laser line Focal dist. 1500 mm
Beam shape	Laser point	Laser line	Laser point	Laser line
Laser class	1		2	
Function	Distance		Distance	
Measuring range (distance)	150…1500 mm		150…1500 mm	
Start of measuring range Sdc	150 mm		150 mm	
End of measuring range Sde	1500 mm		1500 mm	
Blind region	0…150 mm		0…150 mm	
Measuring range Mr	1350 mm		1350 mm	
Sweet spot	1500 mm		1500 mm	
Measuring frequency	2000 Hz[12]		2000 Hz[12]	
Response time - Single shot - Continuous	 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	 50…500 µm[12] 25…250 µm[123] 17…167 µm[123] 13…125 µm[123]	 50…500 µm[12] 25…250 µm[123] 17…167 µm[123] 13…125 µm[123]	 50…500 µm[12] 25…250 µm[123] 17…167 µm[123] 13…125 µm[123]	 50…500 µm[12] 25…250 µm[123] 17…167 µm[123] 13…125 µm[123]
Spatial repeatability	1.5 mm	1.5 mm	1.5 mm	1.5 mm
Repeat accuracy in time Without filter Precision high Precision very high Precision highest	 10…250 µm[12] 5…125 µm[123] 4…84 µm[123] 3…63 µm[123]		 10…250 µm[12] 5…125 µm[123] 4…84 µm[123] 3…63 µm[123]	
Linearity error	± 4320 µm[12]		± 4320 µm[12]	
Linearity deviation in % of Mr	± 0.32%[12]		± 0.32%[12]	
Temperature drift	± 0.1% Sde/K[12]		± 0.1% 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	
Hysteresis digital output	Adjustable in mm		Adjustable in 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

Minimum window size for digital output	1.5 mm	1.5 mm
Minimum window size for analog output	1 mm	1 mm
Power on indication	Green LED	Green LED
Output indicator	Yellow LED / red LED	Yellow LED / red LED
Ethernet link	Blue LED	Blue LED
Switch-on delay	<1200 ms	<1200 ms
Light source	Red laser diode, pulsed	Red laser diode, pulsed
Setting	Web interface and digital interface	Web interface and digital interface

Electrical data	**11216520 Laser class 1 Laser point Focal dist. 1500 mm**	**11216517 Laser class 1 Laser line Focal dist. 1500 mm**	**11216514 Laser class 2 Laser point Focal dist. 1500 mm**	**11216510 Laser class 2 Laser line Focal dist. 1500 mm**
Voltage supply range +Vs	15 ... 28 VDC		15 ... 28 VDC	
Max. supply current (without load)	120 mA		120 mA	
Output circuit	Analog and digital		Analog and digital	
Output signal	2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)		2 … 10 mA/ 4 ... 20 mA/ 0 … 5 VDC/ 0 ... 10 VDC (adjustable)	
Switching output	Push-pull		Push-pull	
Output function	Out 1 / alarm		Out 1 / alarm	
Output current	< 100 mA		< 100 mA	
Reverse polarity protection	Yes, Vs to GND		Yes, Vs to GND	
Short circuit protection	Yes		Yes	

Mechanical data	**11216520 Laser class 1 Laser point Focal dist. 1500 mm**	**11216517 Laser class 1 Laser line Focal dist. 1500 mm**	**11216514 Laser class 2 Laser point Focal dist. 1500 mm**	**11216510 Laser class 2 Laser line Focal dist. 1500 mm**
Width / Height / Length	26 / 74 / 55 mm		26 / 74 / 55 mm	
Design	Rectangular, front view		Rectangular, front view	
Housing material	Aluminum		Aluminum	
Front optic	Glass		Glass	
Connection method	Plug M12 8 pin & M12 4 pin		Plug M12 8 pin & M12 4 pin	
Weight	135 g		135 g	

Ambient conditions	11216520 Laser class 1 Laser point Focal dist. 1500 mm	11216517 Laser class 1 Laser line Focal dist. 1500 mm	11216514 Laser class 2 Laser point Focal dist. 1500 mm	11216510 Laser class 2 Laser line Focal dist. 1500 mm
Ambient light immunity	< 35 kLux	< 35 kLux	< 35 kLux	< 35 kLux
Operating temperature	-10 … +50 °C		-10 … +50 °C	
Storage temperature	-20 … +60 °C		-20 … +60 °C	
Heating period	20 min.		20 min.	
protection class	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	
Shock resistance	**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	11216520 Laser class 1 Laser point Focal dist. 1500 mm	11216517 Laser class 1 Laser line Focal dist. 1500 mm	11216514 Laser class 2 Laser point Focal dist. 1500 mm	11216510 Laser class 2 Laser line Focal dist. 1500 mm
Light source	AlGaInP laser diode		AlGaInP laser diode	
Wave length	660 nm		660 nm	
Operating mode	pulsed		pulsed	
Pulse duration	4 µs…2.5 ms		4 µs…2.5 ms	
Pulse period	0.4…19 ms	0.4…17 ms	0.4…8 ms	0.4…7 ms
Total emitted pulse power	2.1 mW	1.9 mW	2.1 mW	1.9 mW
Beam shape	Point laser	Short line	Point laser	Short line
Receiver position L1 L2	42 mm 57 mm		42 mm 57 mm	
Focal distance df	1500 mm	1500 mm	1500 mm	1500 mm
Nominal ocular hazard distance (NOHD)1	N/A	N/A	inf	7.0 m
Laser classification (as per IEC 60825-1/2014)	Laser class 1		Laser class 2	

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

Passion for Sensors

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