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:

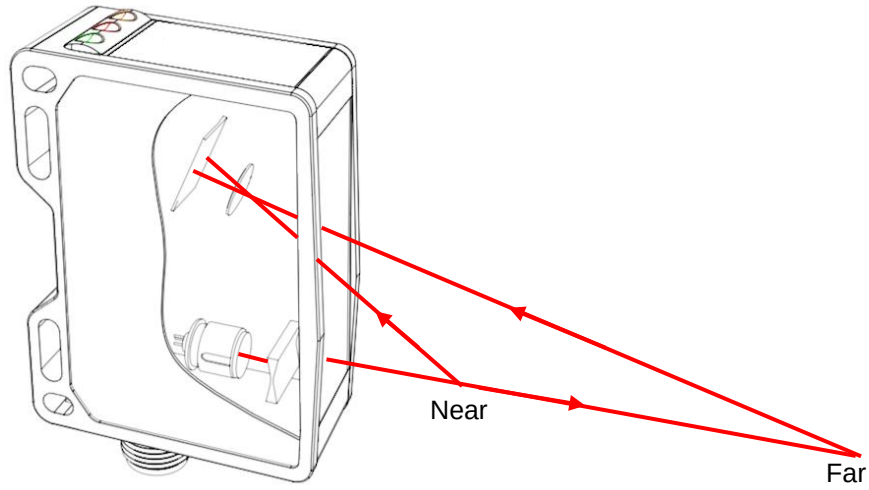
- Non-observance of the instructions
- Non-intended use of the product
- Deployment of untrained staff
- Use of unapproved spare parts
- Unapproved modification of products

CAUTION!

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

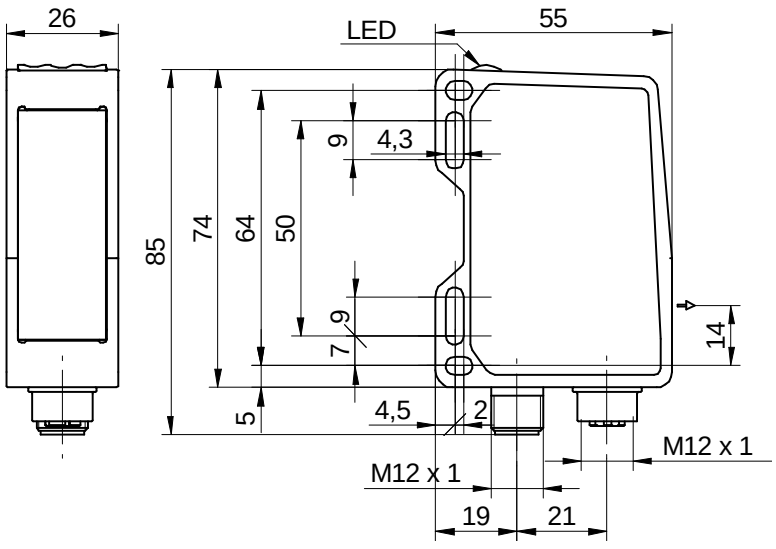
2 Product information

2.1 Functionality

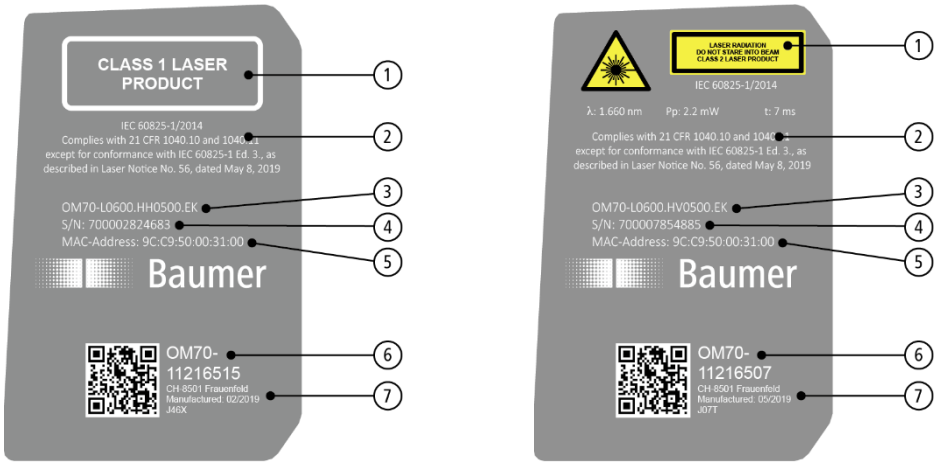


This distance sensor is based on the triangulation principle, which in turn is based on angulation. To carry out the distance measurement, the sensor transmits a light beam, in this case a laser beam, to the object . The light reflected from the object strikes a receiver line inside the sensor at a special 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!

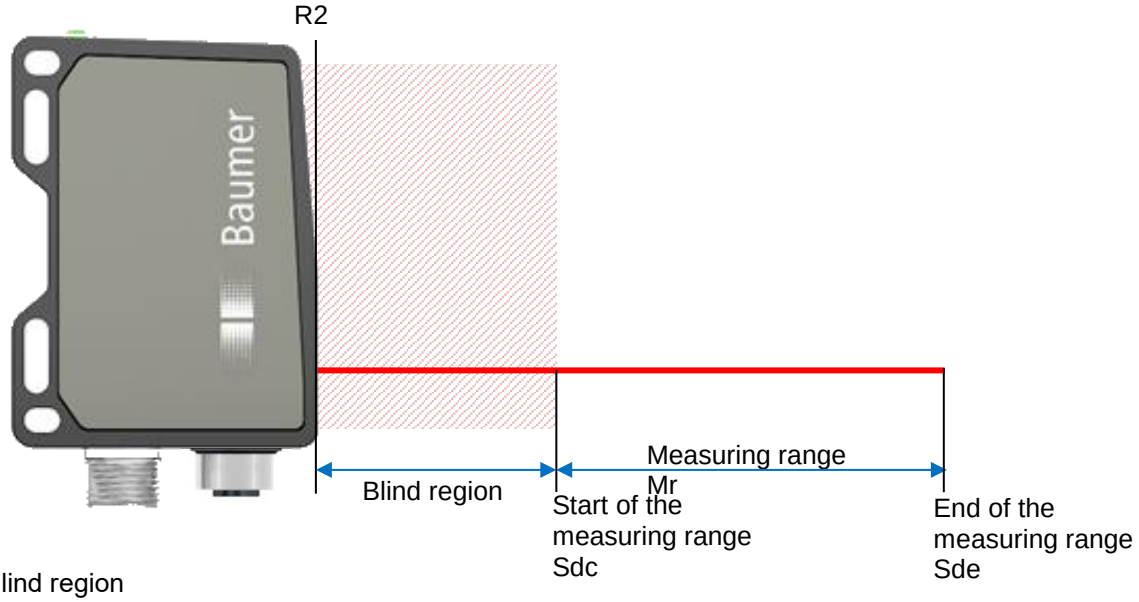
When using a sensor with broken front panel, defective display, loose or separated lens, it must be immediately separated from the power supply to prevent the emission of laser radiation.

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.	**Signal Reserve** Signal Quality close to the signal reserve.
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.



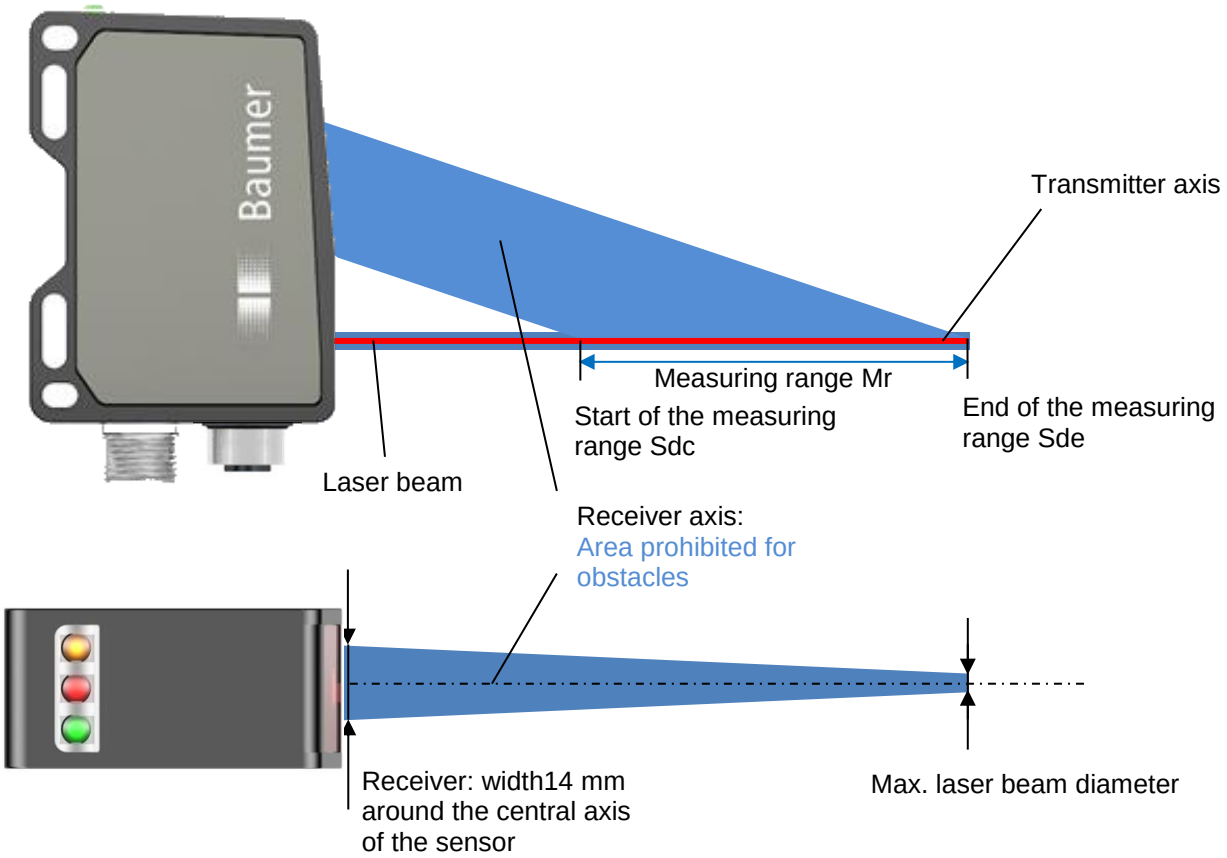
Blind region

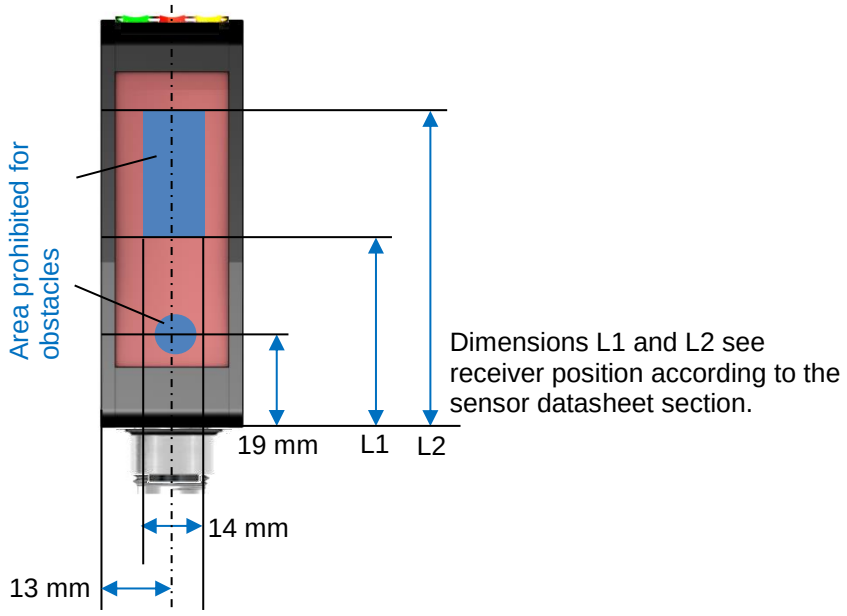
The area from reference level R2 to the start of the measuring range Sdc is called blind region, the sensor cannot detect any objects there.

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 soiling to prevent measurement errors.

3.2 Mounting accessories

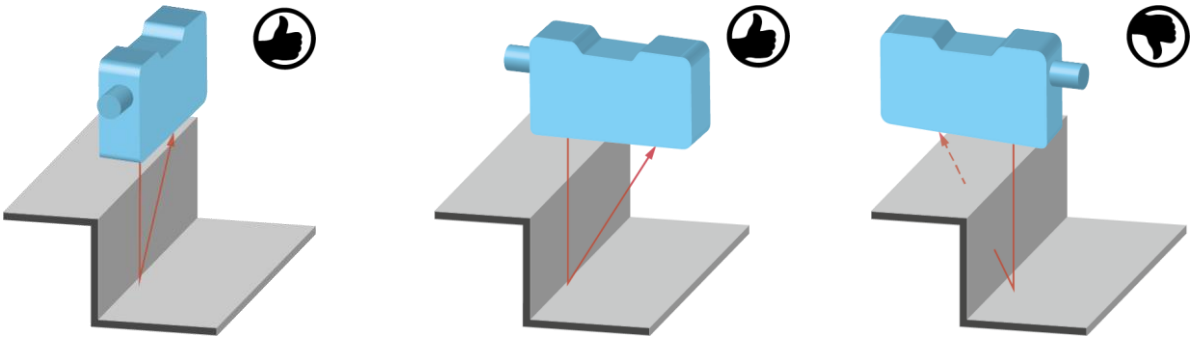
The sensor is equipped with four fastening slits through which it can be flexibly aligned and mounted. For the fastening 2 screws M4x35 and suitable washers are recommended, the maximum torque is 1.2 Nm.

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

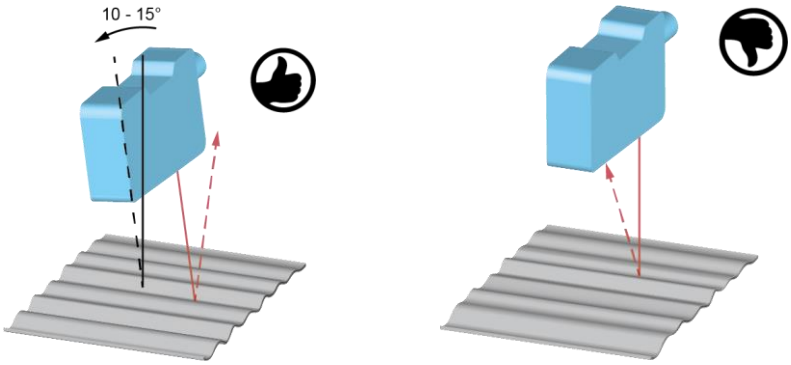
To achieve as reliable and exact measured values as possible, the following hints and tips for mounting should be followed.

3.2.1.1 Steps/edges



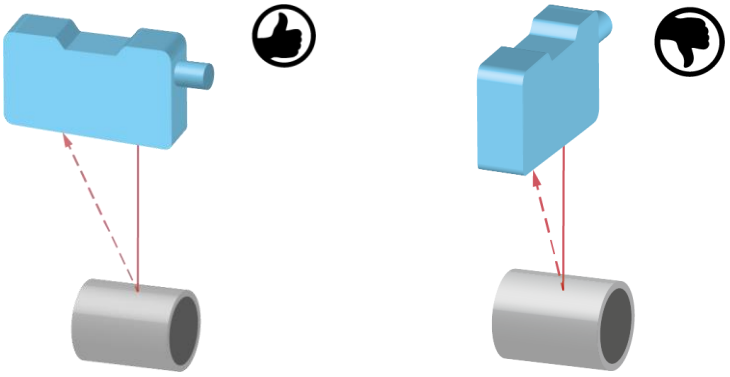
If measurements are carried out directly beside steps/edges, make sure that the reception beam is not covered by the step/edge. The same applies when the depth of holes and cracks is measured.

3.2.1.2 Shiny surfaces



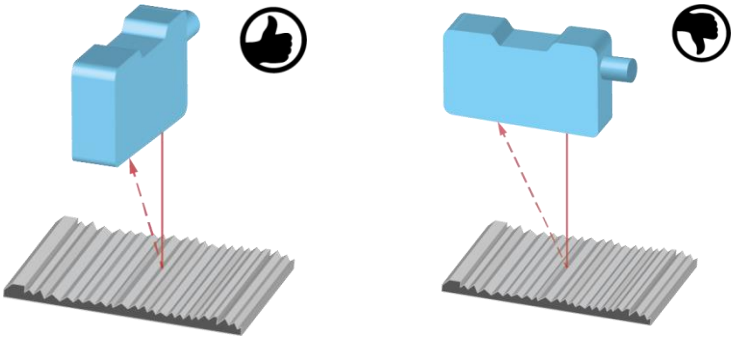
With shiny surfaces, it is important to ensure that the direct reflection does not strike the receiver. This can be prevented by tilting the sensor slightly. To check this, place a sheet of white paper on the disc of the receiver; the direct reflection can then be seen clearly.

3.2.1.3 Round shiny surfaces



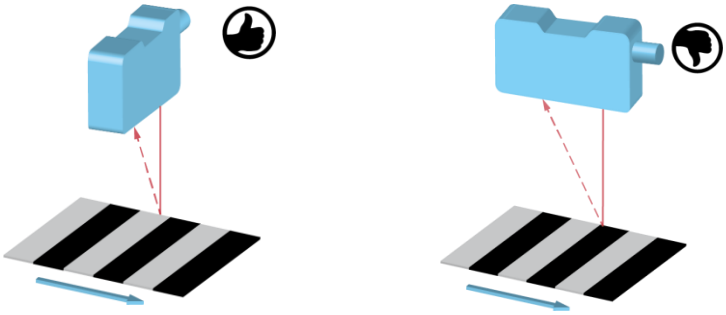
With round, shiny surfaces, the sensor should be aligned in the same axis as the round object in order to avoid reflections.

3.2.1.4 Shiny objects with evenly aligned structure



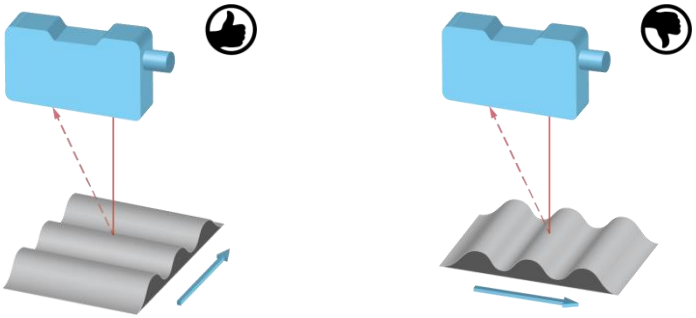
Particularly with shiny objects, for example turned parts, ground surfaces, extruded surfaces and the like, the mounting position affects the measuring result.

3.2.1.5 Objects with evenly aligned colored edges



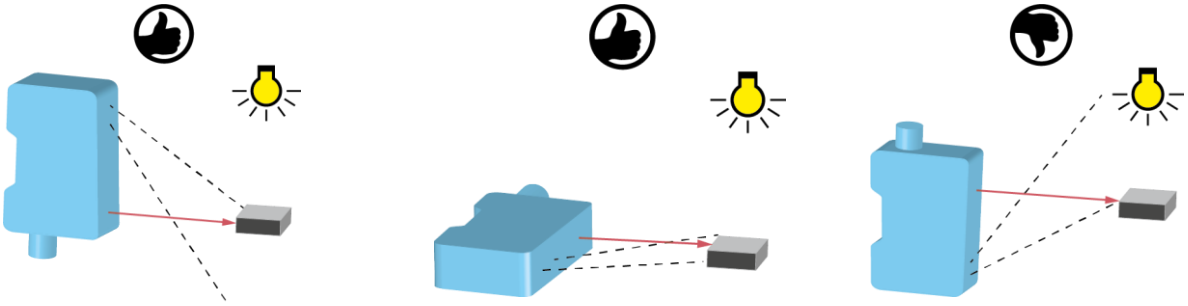
In the correct orientation, the influence on the measuring accuracy is low. In the wrong orientation, the deviations depend on the differences in reflectivity of the various colors.

3.2.1.6 Moving objects



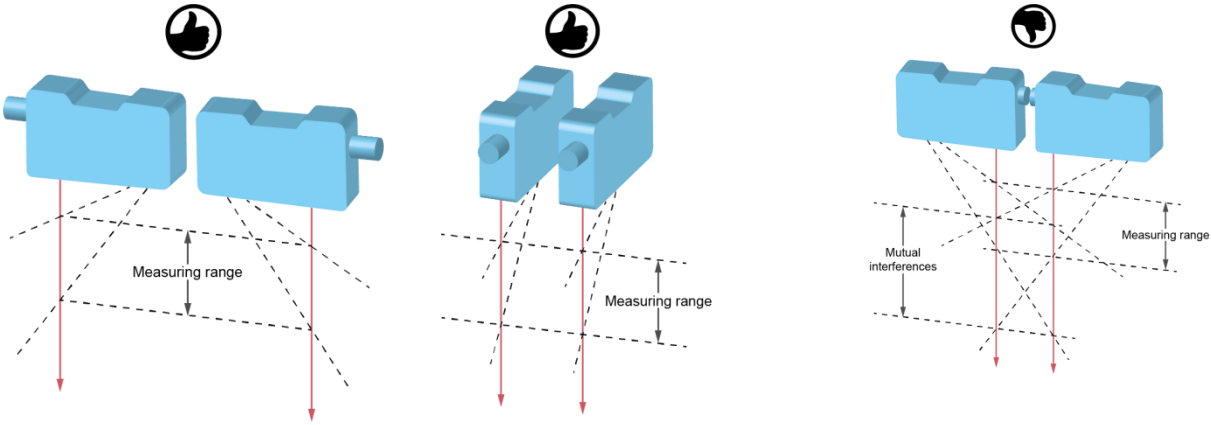
If the contour of an object is measured, it is important to ensure that the object moves at right angles to the sensor, to avoid shadowing and reflections on the receiver.

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!

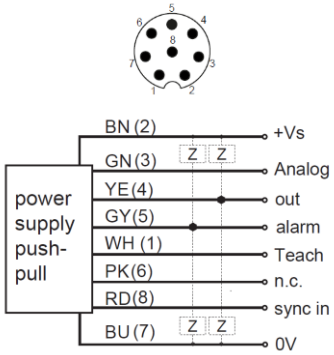
Connection, mounting and start-up may only be performed by specialists.

CAUTION!

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

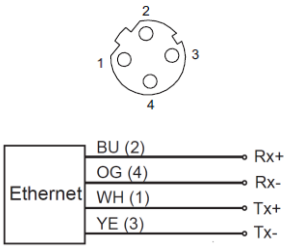
3.3.1 Pin assignment and connection diagram

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)
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.

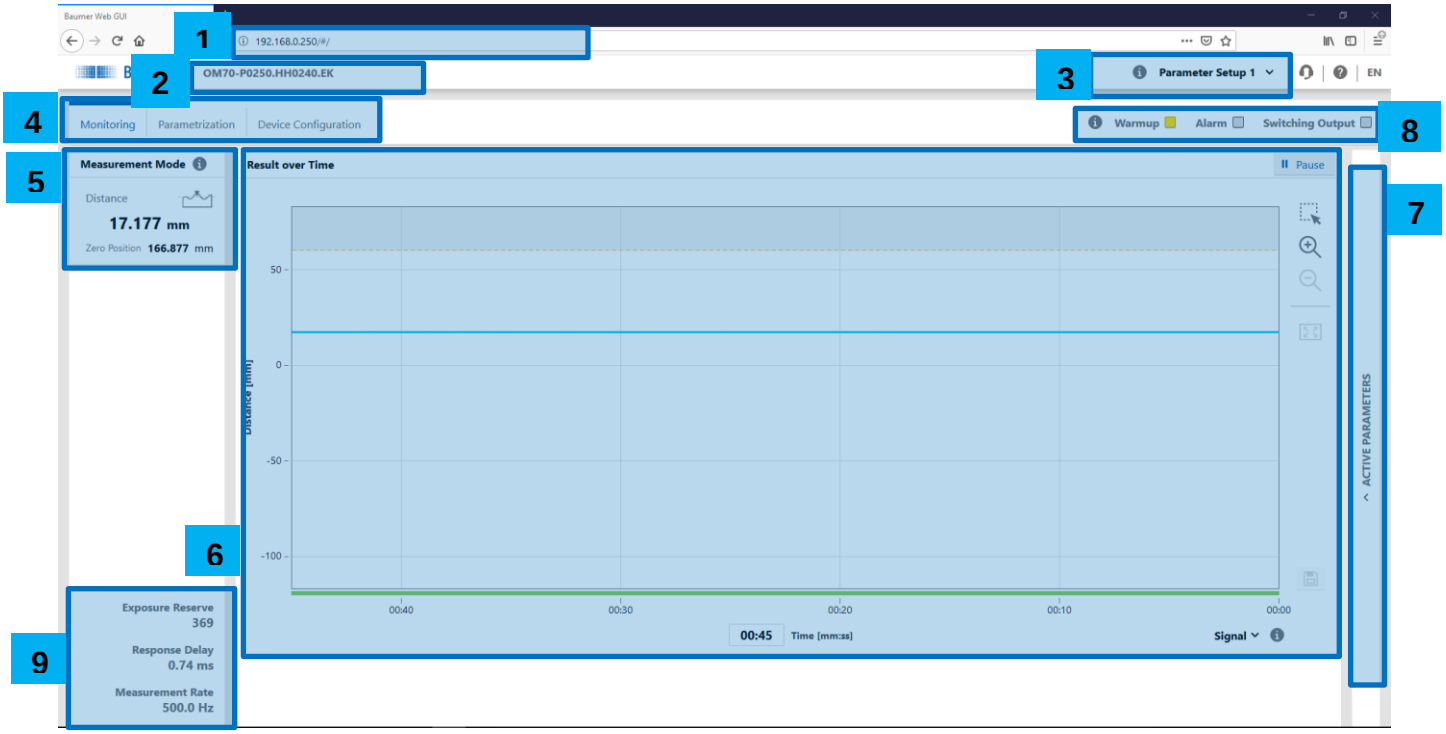
4.2.1 Connecting the web interface

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

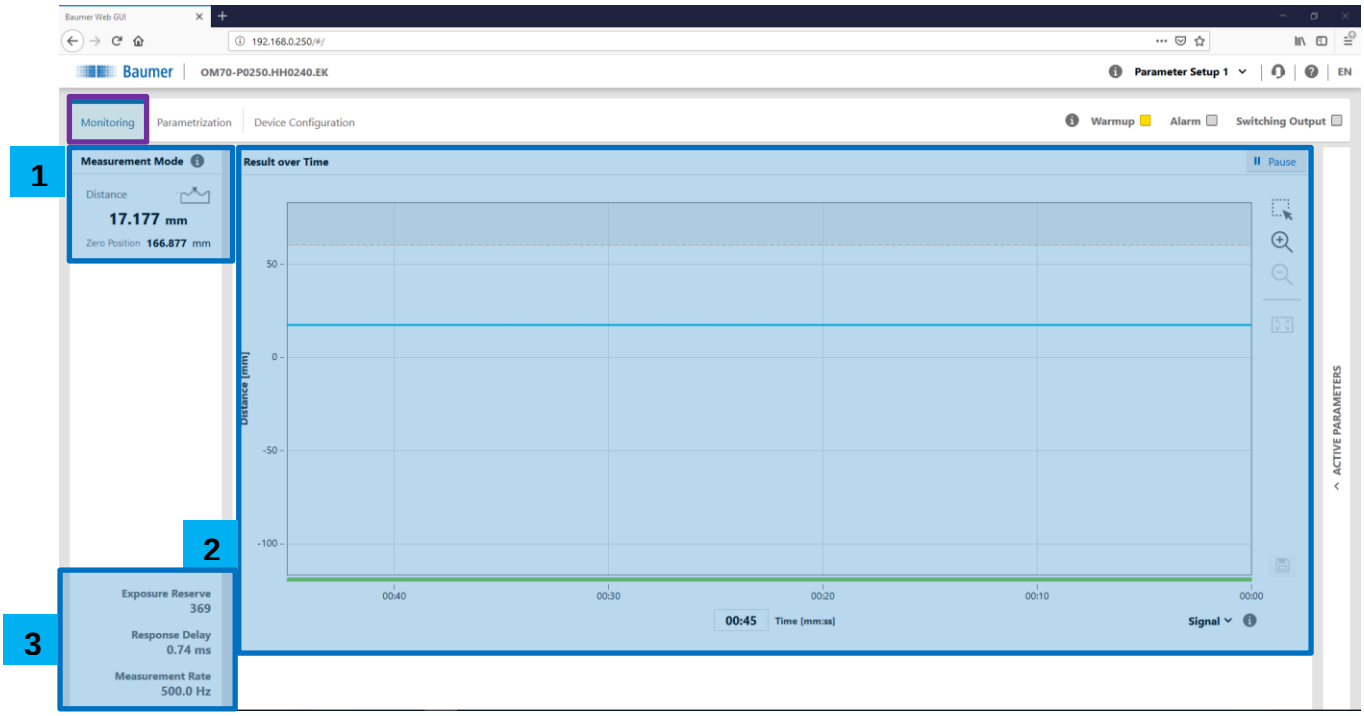
4.2.2 Overview web interface



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
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. If no signal is present, the alarm output is active.

Signal quality
Green: valid signal
Yellow: low signal
Red: no signal (no valid measured value)

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 is a relative value that defines a factor describing the reflected light quantity on the receiver line. This serves as an indicator for signalling by which factor the reflected amount of light can still be reduced, so that an evaluable signal and thus a valid measurement result can still be obtained.This is a relative value without a unit.
The exposure reserve is calculated as follows:

$$\frac{Maximum\ Exposure\ Reserve}{Current\ Exposure\ Reserve}$$

The higher this factor, the more light reaches the receiver line. The maximum factor that can be reached is 3125 and for a valid measurement, the factor 1 is required as a minimum. Below the factor 1 the sensor receives too little light and does not issue a valid measured value, the signal quality switches to "no signal" and the alarm output is activated.

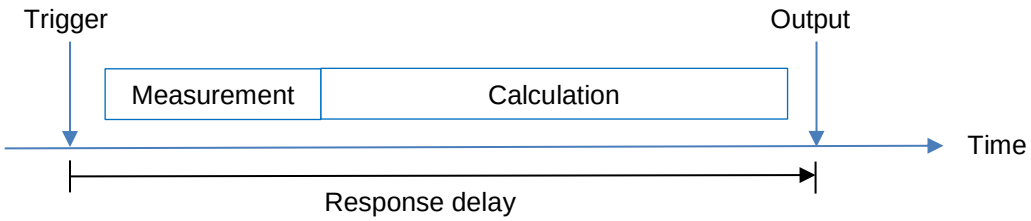
The exposure reserve depends on the properties of the surface (color/structure, etc.) and the relative position of the sensor towards the measured object. For example, the exposure reserve decreases with increased distance to the object.

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 3.2.4)

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

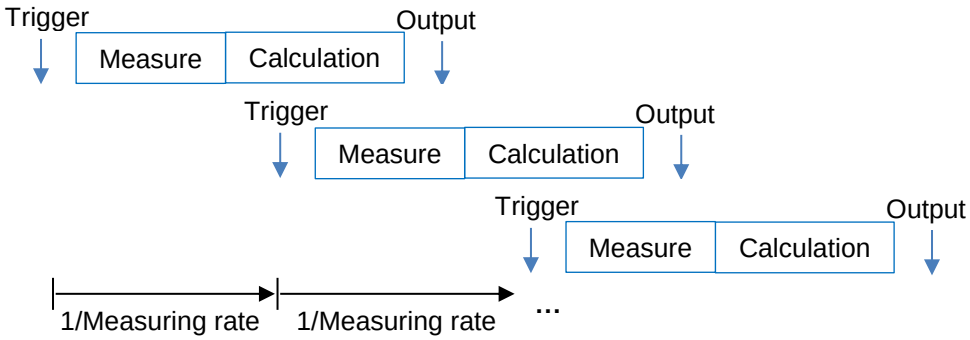
To allow the correlation of the measurement position and the output value for dynamic applications, the response delay should be considered. Filter settings do not affect the response delay.

4.3.3.3 Measuring rate in Hz

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

The measuring 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 measuring frequency. Filter settings do not affect the measuring frequency.

4.4 Parameterization

Parameterization mode of the sensor.

> **NOTE**
>
> In the parameterization mode the alarm output is active.

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:

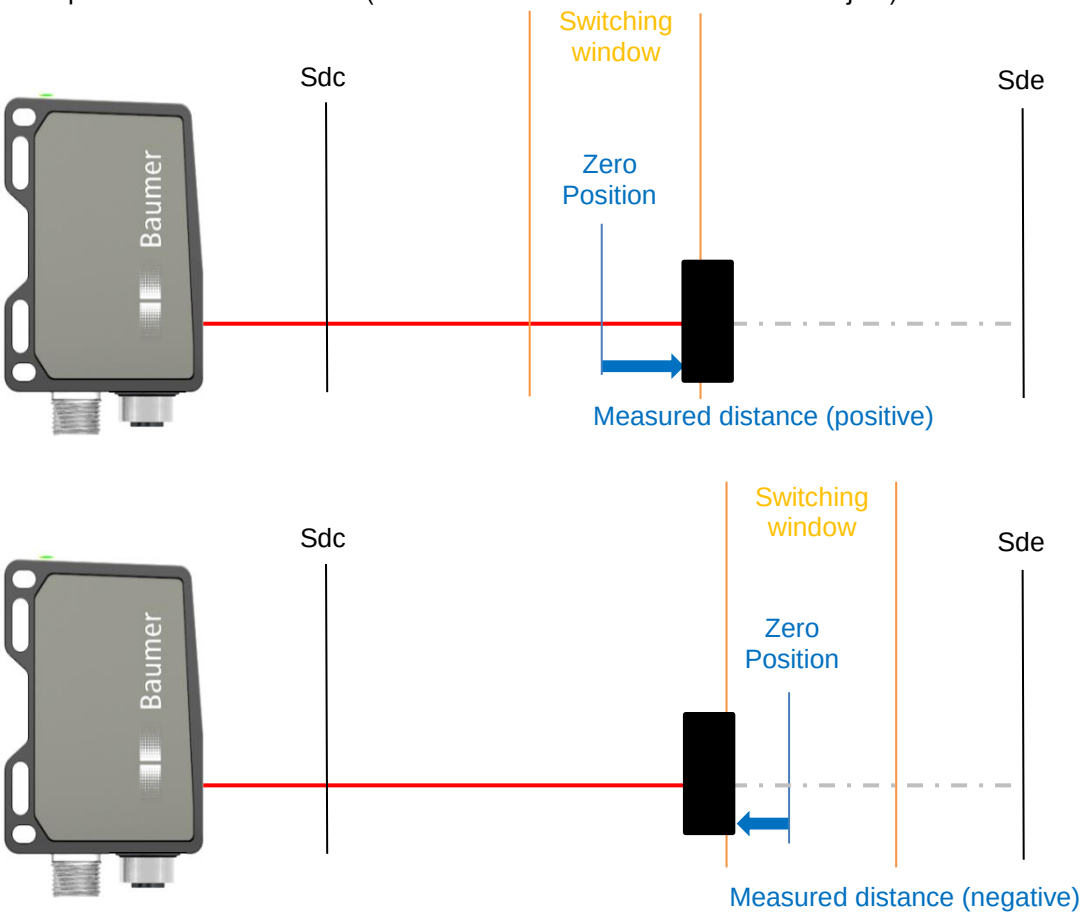
The Measuring Range Limits can be adjusted as part of the maximum limitation of the sensor to eliminate disruptive impulses (e. g. Measurement through glas). The Near Limit must be larger than the minimum limitation (Sdc) and the Far Limit must be smaller than the maximum limitation (Sde) of the sensor 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.

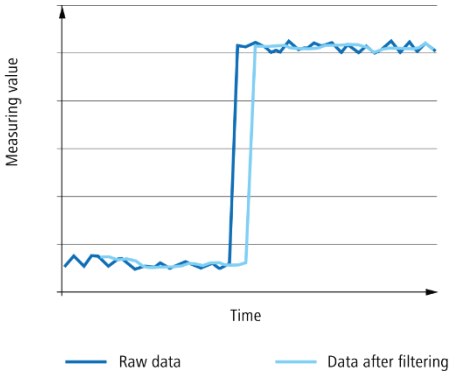
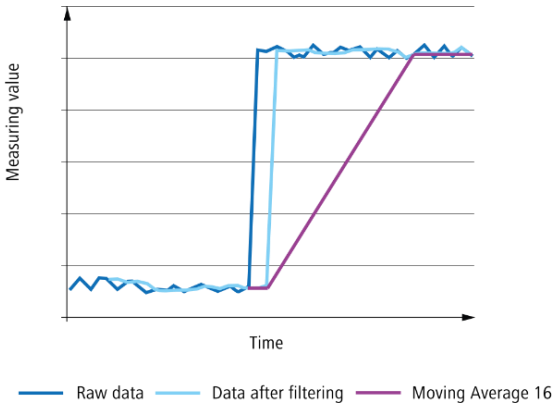
NOTE

The Zero Position offers the possibility of a relative measurement.

4.4.2.3 Output & Filters

Precision Filter:
Activating the filtering can smoothen the signal process to gain reproducible measurement results. These filter value settings apply to the digital output, the switching output, as well as the analog output, i.e. the measurement values are filtered and subsequently made available for the evaluation of the different outputs.

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 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

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

Invalid 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.

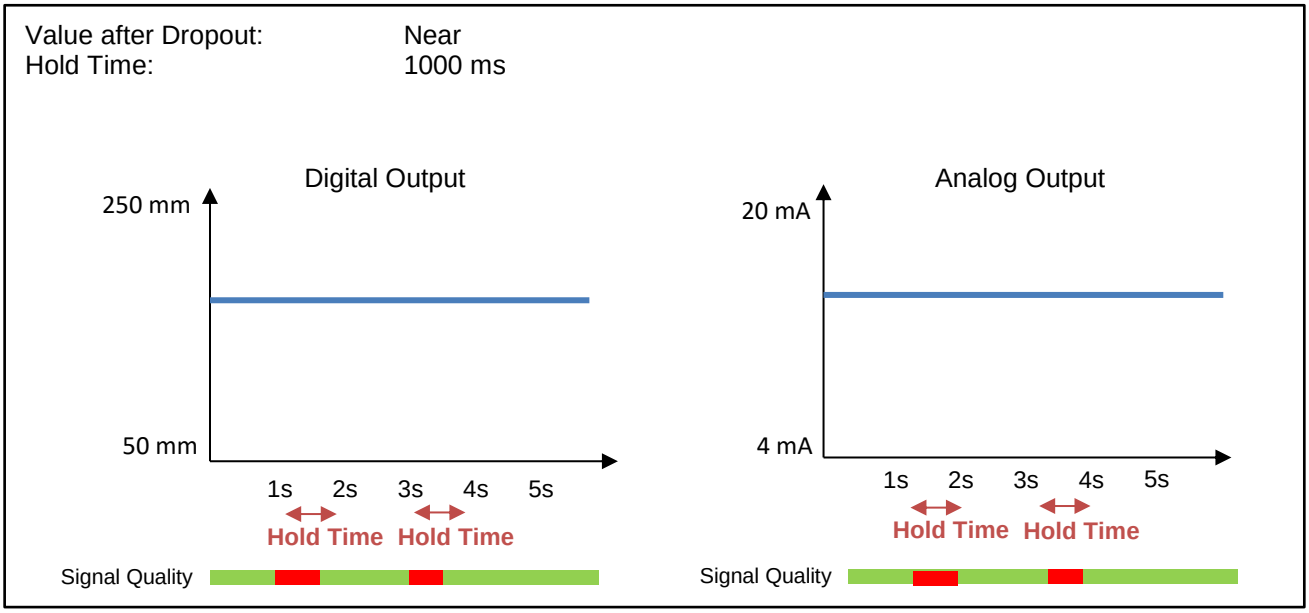
Value after Dropout:
Defines the assumed status of the analog output after a invalid measurement (the switching output maintains its last status and the digital output changes to NAN). See chapter Analog Output below for more information.

- 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

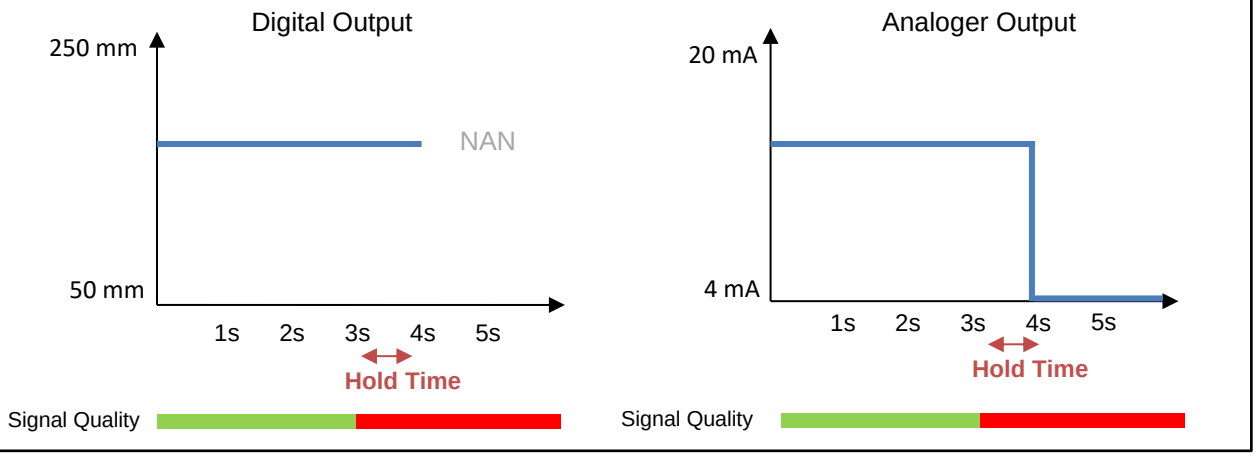


NOTE

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.

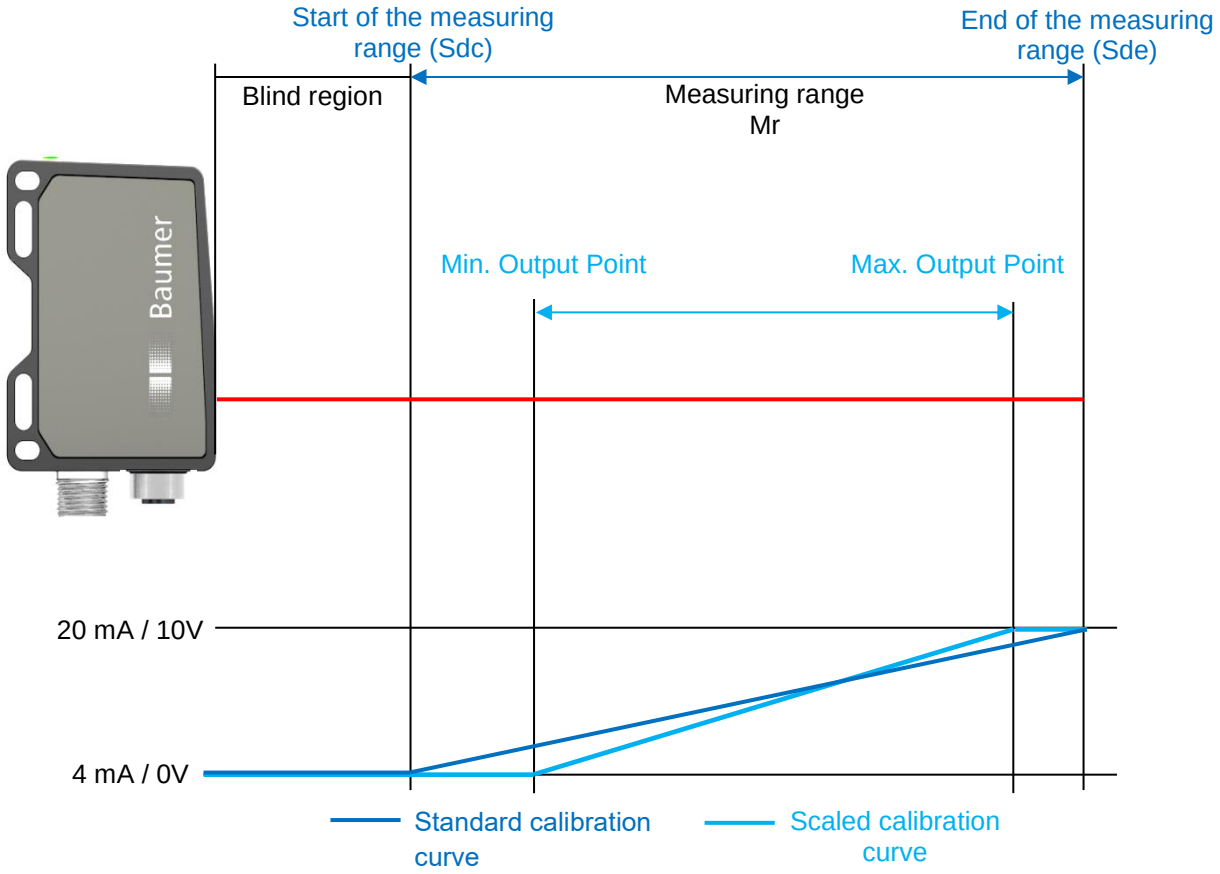
NOTE

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

NOTE

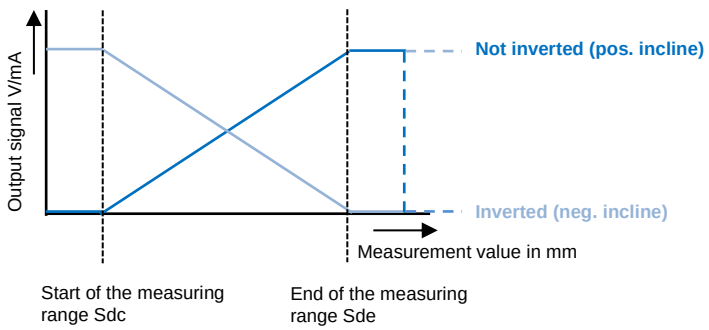
The analog output depends on the Zero Position. Changes to the Zero Point automatically shift the analog measuring field independent of the limits of the measuring range, as the numerical value of the output points remains unaffected.

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.



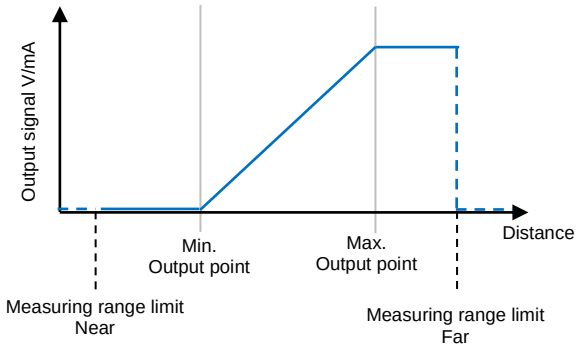
Maximize
With the "maximize" function, the analog measuring field is set to the maximum (Sdc ... Sde) and thus the factory setting.

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.

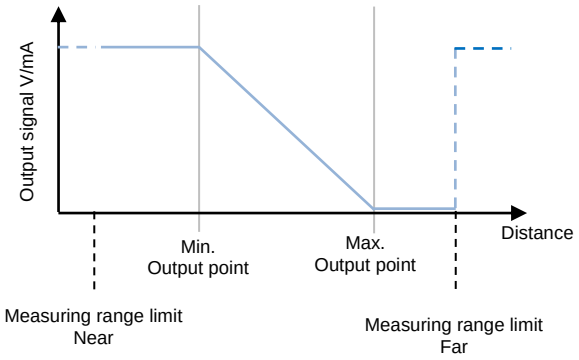


Examples of the behavior of the analog output:

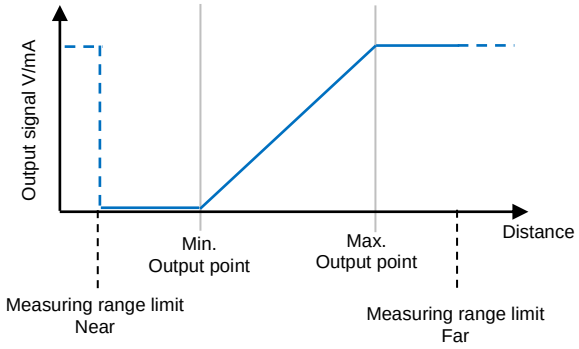
Value after Dropout: Near
Calibration curve inverted: no



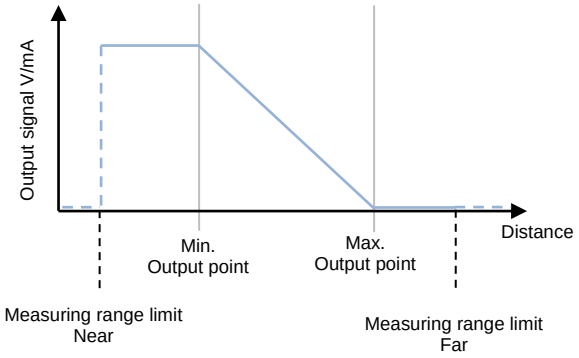
Value after Dropout: Near
Calibration curve inverted: yes



Value after Dropout: Far
Calibration curve inverted: no



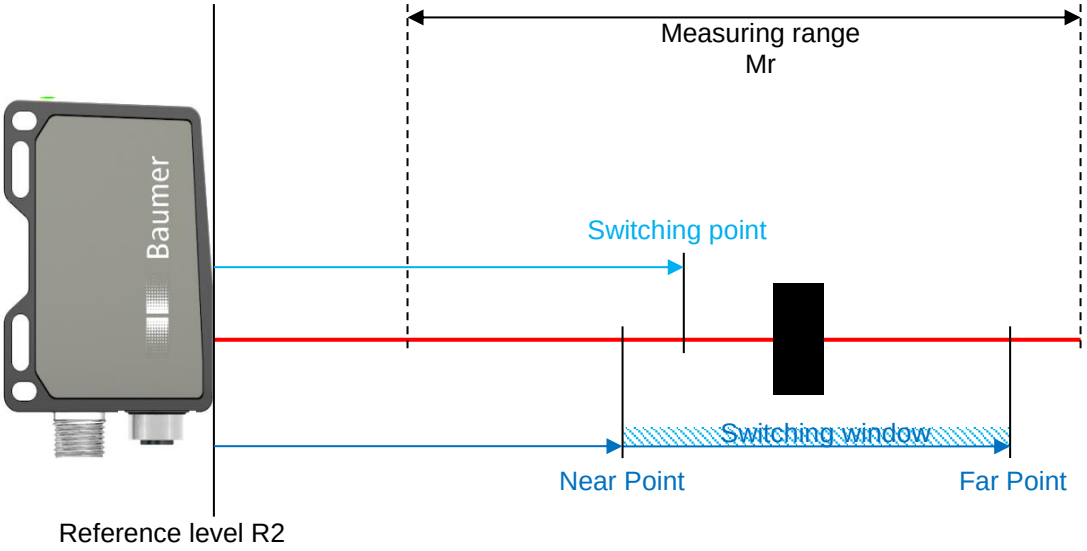
Value after Dropout: Far
Calibration curve inverted: yes



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. The smallest switching window is 2 mm.

> **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

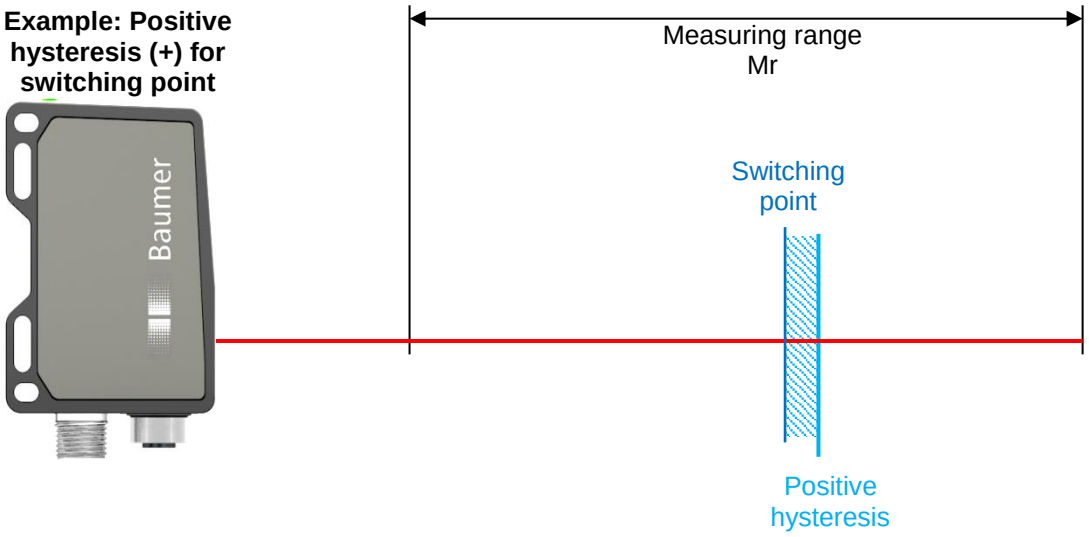
The Near threshold describes the point of the switching window that is Near the sensor, therefore this value must be smaller than the Far Point.

Hysteresis

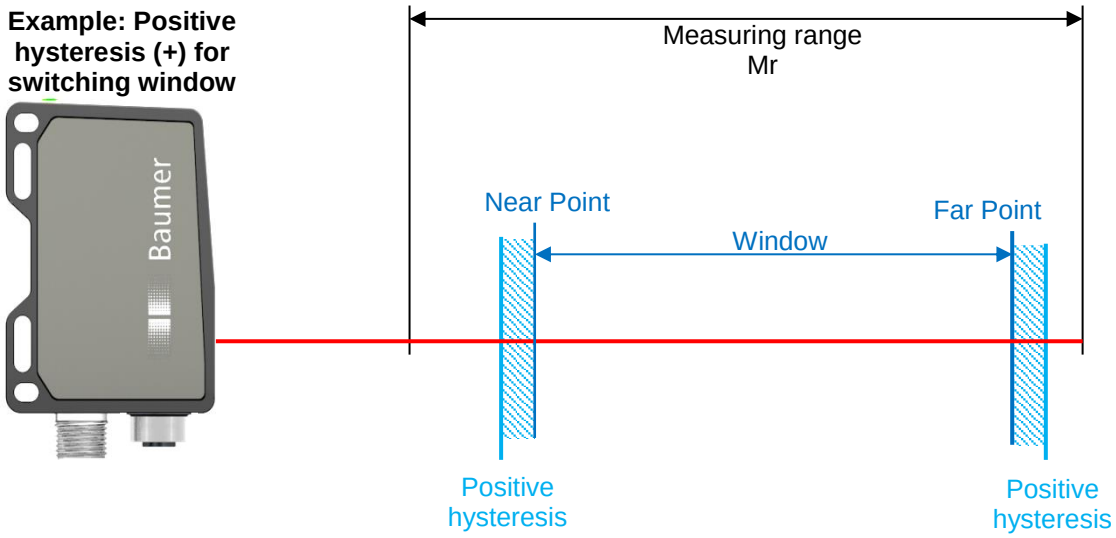
The hysteresis is the difference between the switching point and the reset point, and is specified as a value in mm. Without hysteresis, objects in the border area of the switching point could lead to the switching output switching on and off continuously, or to bouncing. For reasons of reliability,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

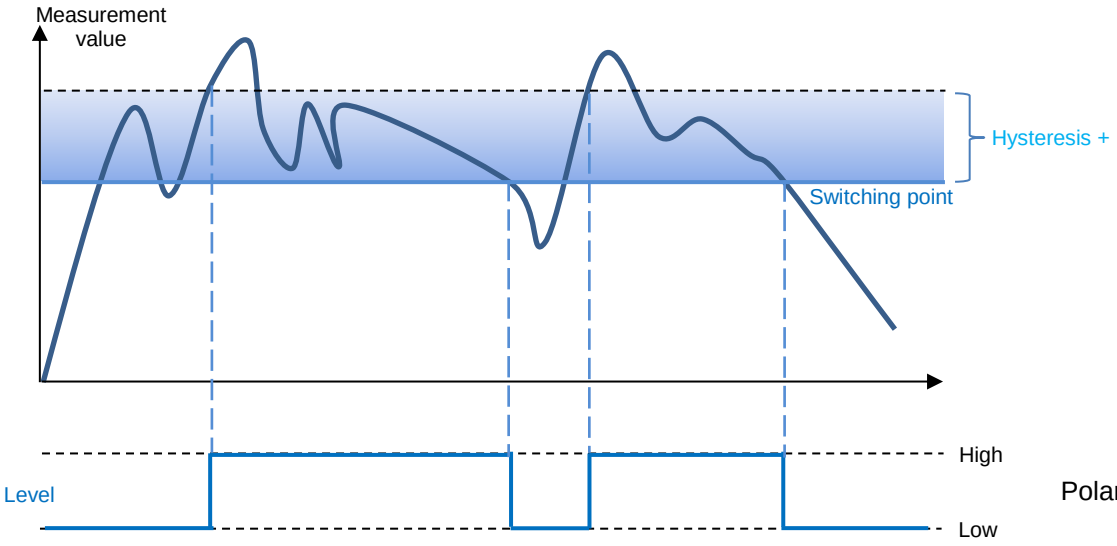


Polarity

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.

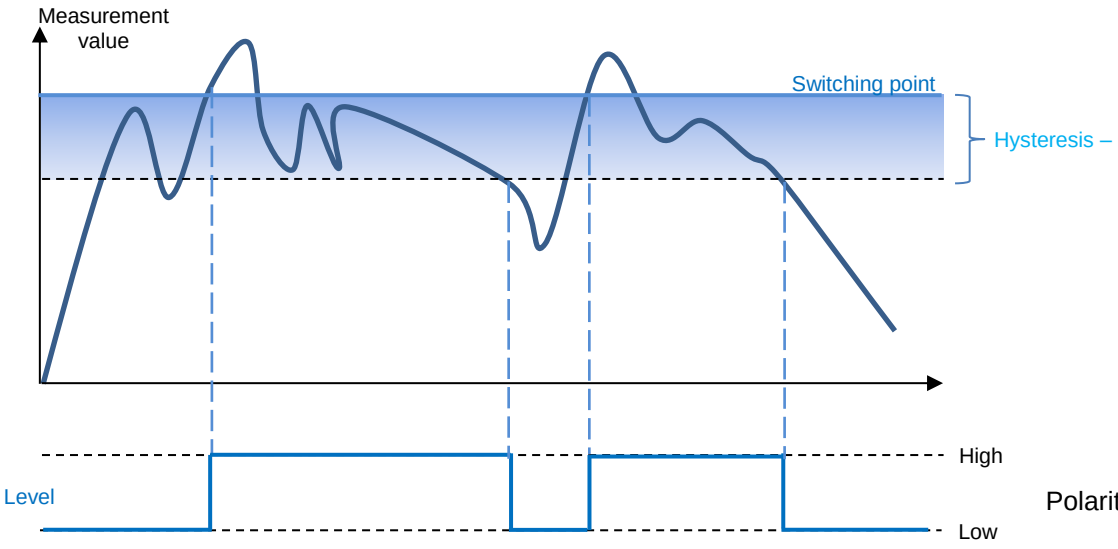
This is shown in the following examples:

Switching point – hysteresis positive



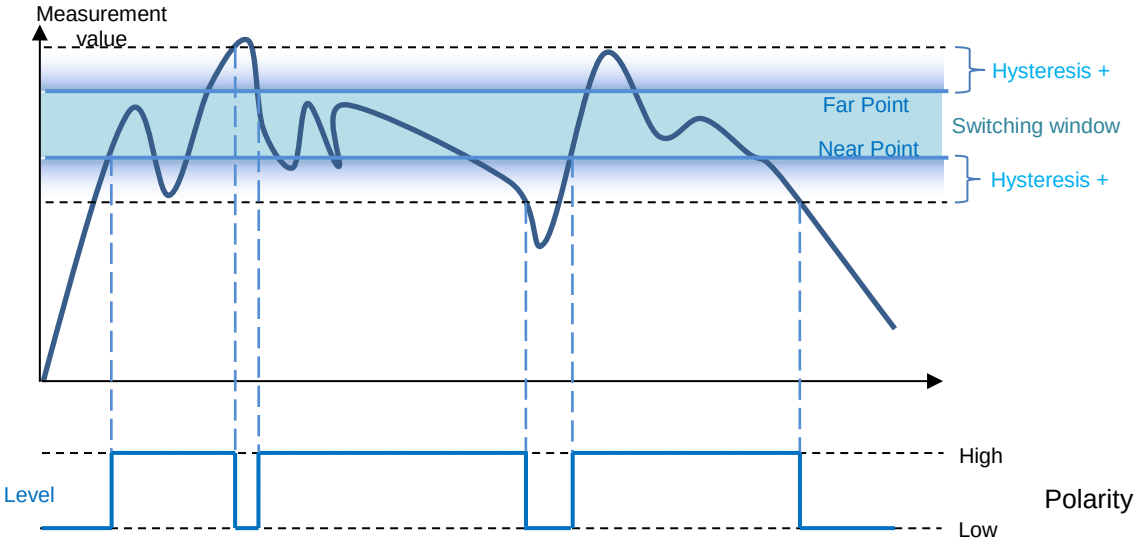
Polarity **Active low**

Switching point – hysteresis negative



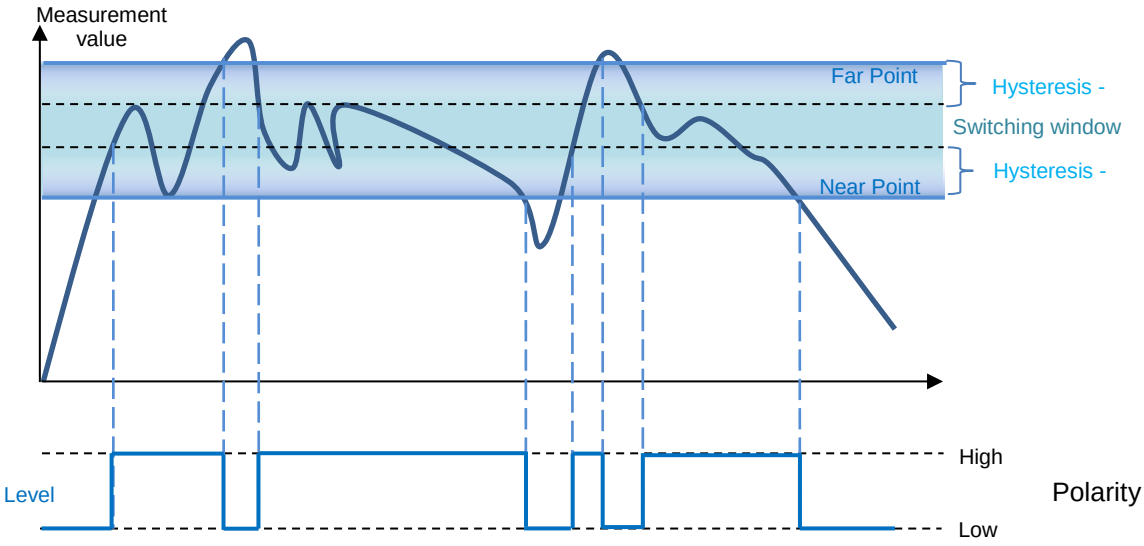
Polarity **Active low**

Switching window – hysteresis positive



Polarity **Active high**

Switching window – hysteresis negative



Polarity **Active high**

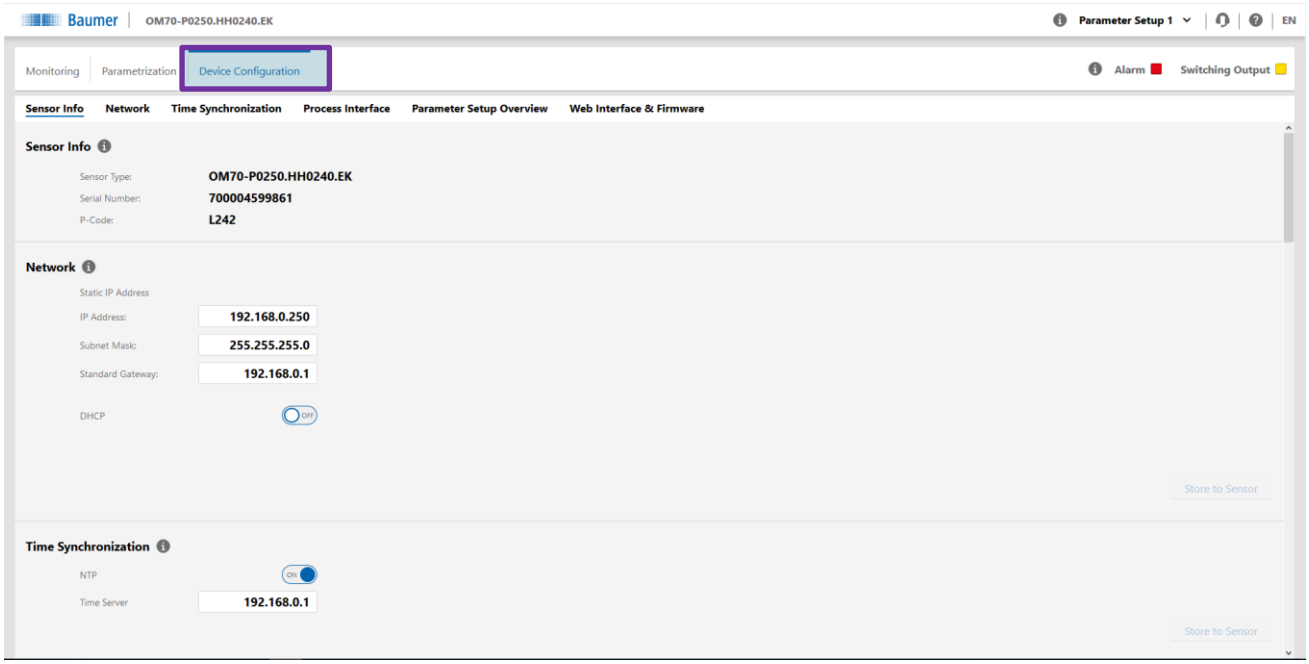
4.4.2.4 Save parameter

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 a DHCP server is integrated into the same network, this server will allocate the IP address. The sensor waits for the assignment of an IP address as long as DHCP is switched on. During this time it can still be reached via the last configured static IP address.

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, and Profinet functionality by 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

Activation/deactivation of the Profinet interface takes place only after a restart of the sensor. Modbus TCP, OPC UA and the UDP streamer can be activated without a restart by storing the configuration to the sensor.

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.

5 Communication via Profinet IO interface

The OM70-x.EK sensor series supports Profinet IO with Conformance Class A for calling up 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. One connection is allowed for each interface, the maximum measurement frequency can be reduced.

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 under downloads.

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

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

Category 10_Device Configuration:

Module ID	Size [Byte]	Module type	Submodule ID	Data type
11_ZeroPositionTeach	1	Output Module	ZeroPositionTeach	Boolean
12_ZeroPositionValue	4	Input/Output Module	ZeroPositionValue [µm]	Integer32
13_Laser	1	Input/Output Module	Laser ON/OFF	Boolean
14_ParameterSetup	40	Parameter Module	ParameterSetup	-

5.1 Module 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 = no 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 = Inative 1 = Active
Quality	-	0…2	Unsigned8	Quality of Measuring signal 0 = ok 1 = low signal 2 = no 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

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
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
Near Point [mm]	-Mr…Sde	Float32	Nearer point to sensor
Far Point [mm]	-Mr…Sde	Float32	Far point to sensor NOTE: Only this value is used in the “Point” Switch Mode
Hysteresis [mm]	-Mr…Mr	Float32	
Polarity	0/1	Unsigned16	0 = Active Low 1 = Active High

5.2 Factory Reset

A factory reset can be carried out via the web interface.
For this purpose, an IP address must be allocated by Profinet that is not equal to 0.0.0.0. The web interface can be called up in the browser via this IP address. If the Profinet is still active at this time, then the data can only be read via the web interface. The Profinet connection must be disconnected to receive write access. However, the sensor may not be switched off during this process or else the IP address is reset to 0.0.0.0.

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

6 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.

6.2 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

6.3 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

6.4 Modbus TCP commands: Holding register

6.4.1 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 [Byte]	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
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
902	1	Profinet State	State Profinet (Active/ Inactive)

6.4.1.1 Address 0 - Enter Config Mode

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

6.4.1.2 Address 1 - Leave Config Mode

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

6.4.1.3 Address 2 - Session Timeout

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

6.4.1.4 Address 10 - DHCP Client State

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

6.4.1.5 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)

6.4.1.6 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)

6.4.1.7 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)

6.4.1.8 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

6.4.1.9 Address 32 - OPCUA State

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

6.4.1.10 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

6.4.1.11 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)

6.4.1.12 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)

6.4.1.13 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

6.4.1.14 Address 180 – Zero Position

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

6.4.1.15 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

6.4.1.16 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]

6.4.1.17 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

6.4.1.18 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

6.4.1.19 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]

6.4.1.20 Address 410 - Laser On/Off

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

6.4.1.21 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

6.4.1.22 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

6.4.1.23 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

6.4.1.24 Address 503 - Sensor Reset

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

6.4.1.25 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

6.4.1.26 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]

6.4.1.27 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

6.4.1.28 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

6.4.1.29 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]

6.4.1.30 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

6.4.1.31 Address 900 – UDP Streamer State

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

6.4.1.32 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

6.4.1.33 Address 902 – Profinet State

Address	Access	Length	Datatype	Description
905	Read/ Write	1	uint16_t	State Profinet 0 = Deactivation 1 = Activation

6.4.2 Modbus TCP commands: Input register

6.4.2.1 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 [Byte]	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
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
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

6.4.2.2 Address 0 - Vendor Information

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

6.4.2.3 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

6.4.2.4 Address 90 - Frontend Version

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

6.4.2.5 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

6.4.2.6 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

6.4.2.7 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]

6.4.2.8 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
201	Read	1	uint16_t	Quality of Measuring signal 0 = ok 1 = low signal 2 = no signal
202	Read	1	uint16_t	Bit 0: State Switching Output 0 = Active 1 = Inactive Bit 1: State Alarm Output 0 = Active 1 = Inactive
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**]

6.4.2.9 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

6.4.2.10 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]

6.4.2.11 Address 400 - Unsaved Configuration

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

6.4.2.12 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

6.4.2.13 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
415 - 416	Read	2	int32_t	Numerical Zero Position [µm]
417 - 418	Read	2	float32_t	Measuring Range Near Limit [mm]
419 - 420	Read	2	float32_t	Measuring Range Far Limit [mm]
421 - 422	Read	2	float32_t	Far Point
423 - 424	Read	2	float32_t	Near Point
425 - 426	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
427 - 428	Read	2	float32_t	Hysteresis [mm]
429	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
430	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
431 - 432	Read	2	float32_t	Min. Output Point Analog [mm]
433 - 434	Read	2	float32_t	Max. Output Point Analog [mm]
435	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
436	Read	1	uint16_t	Hold Time [ms]
437	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far

6.4.2.14 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
455 - 456	Read	2	int32_t	Numerical Zero Position [µm]
457 - 458	Read	2	float32_t	Measuring Range Near Limit [mm]
459 - 460	Read	2	float32_t	Measuring Range Far Limit [mm]
461 - 462	Read	2	float32_t	Far Point
463 - 464	Read	2	float32_t	Near Point
465 - 466	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
467 - 468	Read	2	float32_t	Hysteresis [mm]
469	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
470	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
471 - 472	Read	2	float32_t	Min. Output Point Analog [mm]
473 - 474	Read	2	float32_t	Max. Output Point Analog [mm]
475	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
476	Read	1	uint16_t	Hold Time [ms]
477	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far

6.4.2.15 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
495 - 496	Read	2	int32_t	Numerical Zero Position [µm]
497 - 498	Read	2	float32_t	Measuring Range Near Limit [mm]
499 - 500	Read	2	float32_t	Measuring Range Far Limit [mm]
501 - 502	Read	2	float32_t	Far Point
503 - 504	Read	2	float32_t	Near Point
505 - 506	Read	2	int32_t	Selection Switch Mode 1 = Point 2 = Window
507 - 508	Read	2	float32_t	Hysteresis [mm]
509	Read	1	uint16_t	Polarity of Switching Output: 0 = Aktiv Low 1 = Aktiv High
510	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
511 - 512	Read	2	float32_t	Min. Output Point Analog [mm]
513 - 514	Read	2	float32_t	Max. Output Point Analog [mm]
515	Read	1	bool_t	Invert Analog Output: True = Inverted False = Not Inverted
516	Read	1	uint16_t	Hold Time [ms]
517	Read	1	uint16_t	Selection Invalid Value Handling: 0 = Last valid 1 = Near 2 = Far

6.4.2.16 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 = no 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**]

6.4.1 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

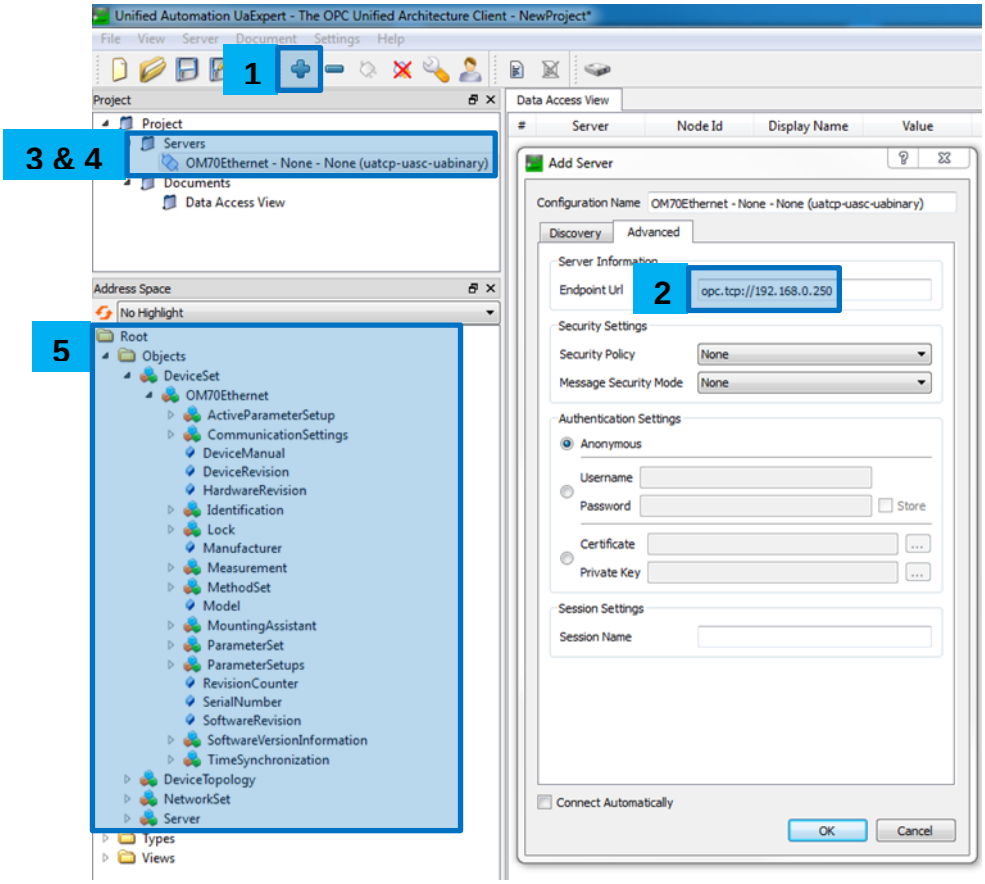
7 OPC UA

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



8 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 = no 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**]

9 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.)

10 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.

11 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.

12 Sensor data sheet

12.1 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

12.2 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

12.3 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

12.4 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

12.5 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	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 point	Laser line	Laser point	Laser line
Laser class	2		2		1		2	
Function	Distance		Distance		Distance		Distance	
Measuring range (distance)	100…1000 mm		100…1000 mm		100…1000 mm		100…1000 mm	
Start of measuring range Sdc	100 mm		100 mm		100 mm		100 mm	
End of measuring range Sde	1000 mm		1000 mm		1000 mm		1000 mm	
Blind region	0…100 mm		0…100 mm		0…100 mm		0…100 mm	
Measuring range Mr	900 mm		900 mm		900 mm		900 mm	
Sweet spot	500 mm		700 mm		1000 mm		1000 mm	
Measuring frequency	2000 Hz[1,2]		2000 Hz[1,2]		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]		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]	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	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]		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]		± 1700 µm[1,2]		± 1700 µm[1,2]	
Linearity deviation in % of Mr	± 0.19%[1,2]		± 0.19%[1,2]		± 0.19%[1,2]		± 0.19%[1,2]	
Temperature drift	± 0.065% Sde/K[1,2]		± 0.065% Sde/K[1,2]		± 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

12.6 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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