MICRO-EPSILON

Operating Instructions
optoNCDT 1900
EtherNet/IP

ILD1900-2-IE
ILD1900-6-IE
ILD1900-10-IE
ILD1900-25-IE
ILD1900-50-IE

ILD1900-100-IE
ILD1900-200-IE
ILD1900-500-IE

ILD1900-2LL-IE
ILD1900-6LL-IE
ILD1900-10LL-IE
ILD1900-25LL-IE
ILD1900-50LL-IE

Intelligent laser-optical displacement measurement

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Appendix

1. Safety

System operation assumes knowledge of the operating instructions.

1.1 Symbols Used

The following symbols are used in these operating instructions:

⚠ CAUTION	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a situation that may result in property damage if not avoided.
➡	Indicates a user action.
i	Indicates a tip for users.
`Measurement`	Indicates hardware or a software button/menu.

1.2 Warnings

⚠ CAUTION

Connect the power supply according to the regulations for electrical equipment.
> Risk of injury
> Damage to or destruction of the sensor

NOTICE

Avoid shocks and impacts to the sensor.

Damage to or destruction of the sensor

Install the sensor on a flat surface using only the mounting holes/threaded holes provided, any type of clamping is not permitted.
> Damage to or destruction of the sensor

The supply voltage must not exceed the specified limits.
> Damage to or destruction of the sensor

Protect the sensor cable against damage. Attach the cable without load, secure the cable after approx. 25 cm and the pigtail on the connector, e.g. using cable ties.
> Destruction of the sensor, failure of the measuring device

NOTICE

Avoid constant exposure of the sensor to splashes of water.
> Damage to or destruction of the sensor

Avoid exposure of sensor to aggressive media (detergents, cooling emulsions).
> Damage to or destruction of the sensor

1.3 Notes on CE Marking

The following apply to the optoNCDT 1900 measuring system:
- EU Directive 2014/30/EU
- EU Directive 2011/65/EU

Products which carry the CE mark satisfy the requirements of the EU directives cited and the relevant applicable harmonized European standards (EN). The measuring system is designed for use in industrial environments.

The EU Declaration of Conformity and the technical documentation are available to the responsible authorities according to the EU Directives.

1.4 Intended Use

- The optoNCDT 1900 is designed for use in industrial and laboratory applications. It is used for
  - Measuring displacement, distance, position and thickness
  - Monitoring quality and checking dimensions
- The sensor must only be operated within the values specified in the technical data, see Chap. 3.3.
- The sensor must be used in such a way that no persons are endangered or machines are damaged in the event of malfunction or total failure of the sensor.
- Take additional precautions for safety and damage prevention in case of safety-related applications.

1.5 Proper Environment

- Protection class: IP67 (applies only when sensor cable is plugged in)

Lenses are excluded from the protection class. Contamination of the lenses causes impairment or failure of the function.

- Temperature range:
  - Operation: 0 ... 50 °C
  - Storage: -20 ... 70 °C
- Humidity: 5 - 95% (non-condensing)
- Ambient pressure: Atmospheric pressure

i The protection class is limited to water, no penetrating liquids or the like.

2. Laser Safety

2.1 General

The optoNCDT 1900 operates with a semiconductor laser with a wavelength of 658 nm (visible/red) or 670 nm (visible/red).

When operating the optoNCDT 1900 sensors, the relevant regulations according to IEC 60825, Part 1 of 05/2014 and the applicable accident prevention regulations must be followed.

i If both warning labels are covered over when the unit is installed, the user must ensure that supplementary labels are applied.

Operation of the laser is indicated visually by the LED on the sensor, see Chap. 5.3.

The housing of the optical sensors may only be opened by the manufacturer, see Chap. 10.

For repair and service purposes, the sensors must always be sent to the manufacturer.

2.2 Laser Class 2

The sensors fall within laser class 2. The laser is operated on a pulsed mode, the maximum optical power is ≤ 1 mW. The pulse frequency depends on the adjusted measuring rate (0.25 ... 10 kHz). The pulse duration of the peaks is regulated depending on the measuring rate and reflectivity of the target and can be 4 up to 3995 μs.

⚠ CAUTION Laser radiation. Irritation or injury of the eyes possible. Close your eyes or immediately turn away if the laser beam hits the eye.

i Observe the laser protection regulations.

Although the laser output is low, directly looking into the laser beam must be avoided. Close your eyes or immediately turn away if the laser beam hits the eye. Lasers of Class 2 are not subject to notification and a laser protection officer is not required.

The following warning labels are attached to the sensor cable:

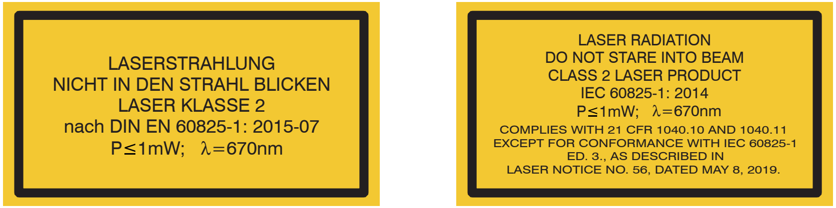


Fig. 1 Laser labels on the sensor cable

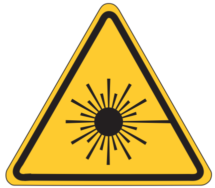


Fig. 2 Laser warning sign on the sensor housing

During operation of the sensor, the pertinent regulations according to IEC 60825-1 on „Safety of laser products“ must be fully observed at all times. The sensor complies with all applicable laws for the manufacturer of laser devices.

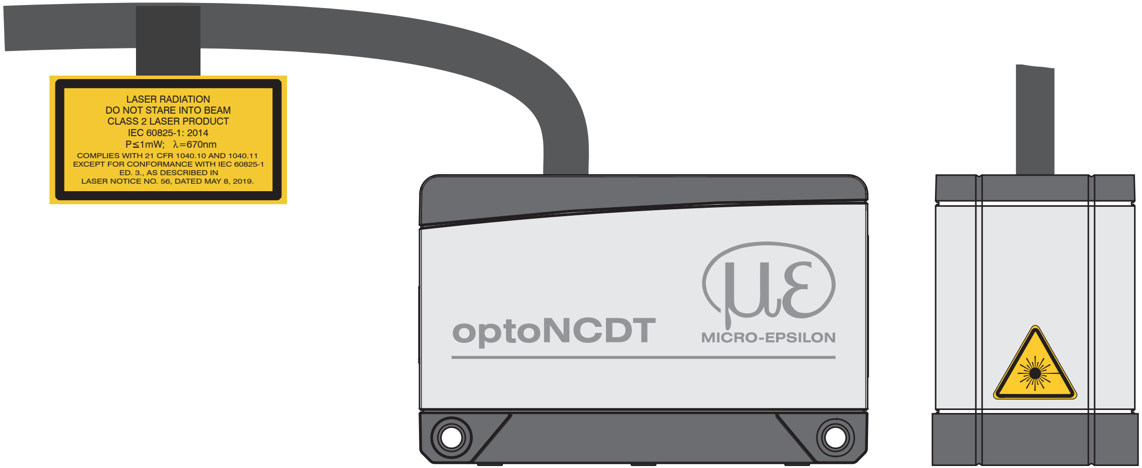


Fig. 3 Sensor cable and sensor with laser sign, class 2

2.3 Laser Class 3R

The sensors fall within laser class 3R. The laser is operated on a pulsed mode, the maximum optical power is ≤ 5 mW. The pulse frequency depends on the adjusted measuring rate (0.25 ... 10 kHz). The pulse duration of the peaks is regulated depending on the measuring rate and reflectivity of the target and can be 4 up to 3995 μs.

CAUTION Laser radiation. Injury of the eyes possible. Use suitable protective equipment and close your eyes or immediately turn away if the laser beam hits the eye.

Observe the laser protection regulations.

Accordingly, the following applies: The accessible laser radiation is harmful to the eyes. Looking directly into the laser beam is harmful to the eyes with laser class 3R devices. Reflections of shiny or mirroring surfaces are also harmful to the eyes.

Class 3R laser sensors require a laser protection officer.

Mark the laser area recognizable and everlasting. During operation the laser area has to be restricted and marked.

The following warning labels are attached to the sensor cable:

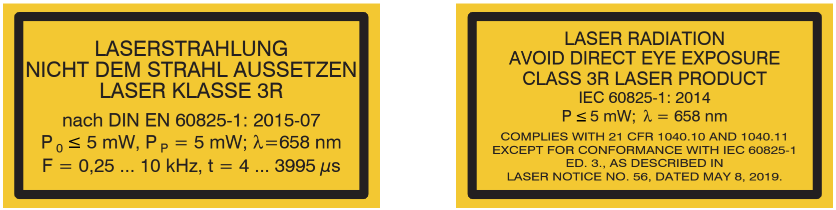


Fig. 4 Laser labels on the sensor cable

Fig. 5 Laser warning sign on the sensor housing

During operation of the sensor, the pertinent regulations according to IEC 60825-1 on „Safety of laser products“ must be fully observed at all times. The sensor complies with all applicable laws for the manufacturer of laser devices.

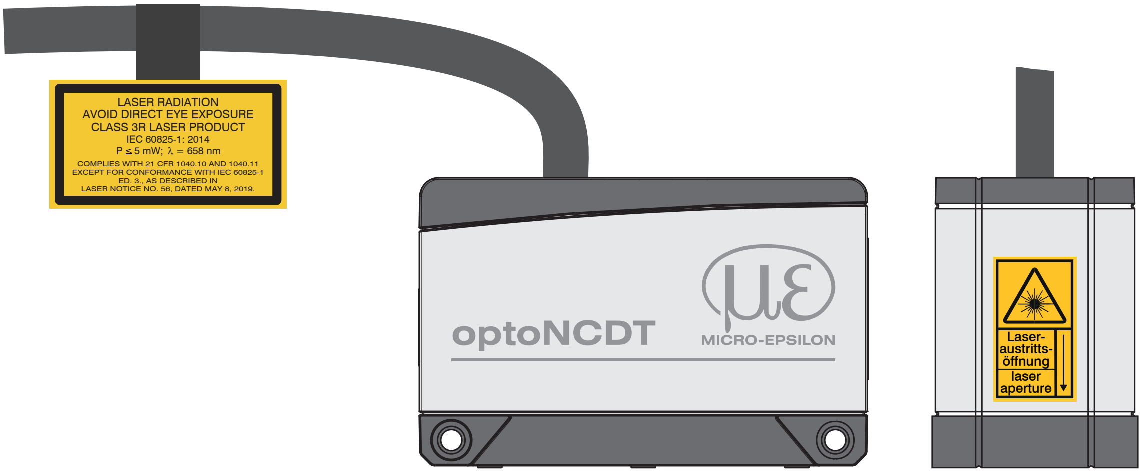


Fig. 6 Sensor cable and sensor with laser sign, class 3R

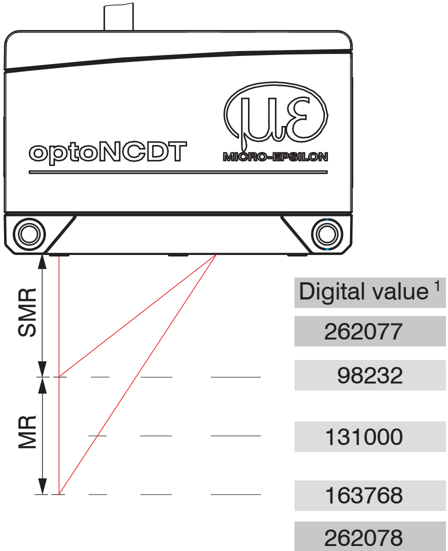
3. Functional Principle, Technical Data

3.1 Short Description

The optoNCDT 1900 operates according to the principle of optical triangulation, i.e. a visible, modulated light spot is projected onto the surface of the measuring object.

The diffuse part of the reflection of this light spot is imaged on a spatial resolution element (CMOS) by a receiver optic arranged at a certain angle to the optical axis of the laser beam.

A signal processor in the sensor calculates the distance between the light spot on the target and the sensor from the output signal of the CMOS element. The distance value is linearized and output via the Ethernet/IP interface.



MR = Measuring range

SMR = Start of measuring range

MMR = Mid of measuring range

EMR = End of measuring range

Fig. 7 Term definitions

1) For displacement values without zero setting or mastering.

3.2 Advanced Surface Compensation

The optoNCDT 1900 is equipped with an intelligent surface control feature. New algorithms generate stable measurement results even on demanding surfaces where changing reflections occur. Furthermore, these new algorithms compensate for ambient light up to 50,000 lux. Therefore, this is the sensor with the highest resistance to ambient light in its class which can even be used in strongly illuminated environments.

3.3 Technical Data

3.3.1 ILD1900-xx

Model	ILD1900-	2-IE	6-IE	10-IE	25-IE	50-IE	100-IE	200-IE	500-IE
Measuring range	mm	2	6	10	25	50	100	200	500
Start measuring range	mm	15	17	20	25	40	50	60	100
Mid measuring range	mm	16	20	25	37.5	65	100	160	350
End measuring range	mm	17	23	30	50	90	150	260	600
Measuring rate [1]		continuously adjustable between 0.25 ... 10 kHz 7 adjustable stages: 10 kHz / 8 kHz / 4 kHz / 2 kHz / 1.0 kHz / 500 Hz / 250 Hz							
Linearity	µm	≤ ±1	≤ ±1.8	≤ ±2	≤ ±5	≤ ±10	≤ ±30	≤ ±100	≤ ±400
	% FSO	≤± 0.05	≤ ±0.03	≤± 0.02			≤± 0.03	≤± 0.05	≤± 0.08
Repeatability [2]	µm	< 0.1	< 0.25	< 0.4	< 0.8	< 1.6	< 4	< 8	< 20 ... 40
Temperature stability [3]	FSO/K	±0.005							
Light spot diameter (± 10 %) [4]	SMR in µm	60 x 75	85 x 105	115 x 150	200 x 265	220 x 300	310 x 460	950 x 1200	950 x 1200
	MMR in µm	55 x 65	57 x 60	60 x 65	70 x 75	95 x 110	140 x 170		
	EMR in µm	65 x 75	105 x 120	120 x 140	220 x 260	260 x 300	380 x 410		
	smallest diameter	55 x 65 µm with 16 mm	57 x 60 with 20 mm	60 x 65 µm with 25 mm	65 x 70 µm with 35 mm	85 x 90 µm with 55 mm	120 x 125 with 75 mm	-	-
Light source		Semiconductor laser < 1 mW, 670 nm (red) with laser class 2 Semiconductor laser ≤ 5 mW, 658 nm (red) with laser class 3R							
Laser class		Class 2 in accordance with DIN EN 60825-1 : 2015-07 optionally class 3R in accordance with DIN EN 60825-1: 2015-07							
Permissible ambient light		50,000 lx					30,000 lx	10,000 lx	
Supply voltage		11 ... 30 V DC or PoE, external supply has priority over PoE							
Power consumption		< 3 W (24 V)							
Signal input		Laser on/off							

Model	**ILD1900-**	**2-IE**	**6-IE**	**10-IE**	**25-IE**	**50-IE**	**100-IE**	**200-IE**	**500-IE**
Digital interface		EtherNet/IP							
Connection		integrated pigtail 0.3 m with 12-pin M12 plug; optional extension to 3 m / 6 m / 9 m / 15 m (see accessories for suitable connection cable)							
Temperature range	Storage	-20 ... +70°C (non-condensing)							
	Operation	0 ... +50°C (non-condensing)							
Shock (DIN EN 60068-2-27)		15 g / 6 ms							
Vibration (DIN EN 60068-2-6)		30 g / 20 ... 500 Hz							
Protection class		IP67 (DIN EN 60529)							
Material		Aluminum housing							
Weight		approx. 185 g (incl. pigtail)							
Control and display elements		Select button: factory setting, change operation mode; Web interface for setup [5]: Application-specific presets; peak selection, video signal; freely selectable averaging possibilities; data reduction; setup management; 3 color LEDs for power / status / EtherNet/IP							

FSO = Full Scale Output

SMR = Start of measuring range, MMR = Mid of measuring range, EMR = End of measuring range

The specified data apply to a white, diffuse reflecting surface (Micro-Epsilon reference ceramic for ILD sensors)

1) Maximum measuring rate depending on fieldbus and bus cycle time; factory setting: measuring rate 4 kHz, median 9;

2) Typical value with measurements at 4 kHz and median 9

3) In the mid of the measuring range; the specified value is only achieved by mounting on a metallic sensor holder. Good heat dissipation from the sensor to the holder must be ensured.

4) Light spot diameter determined using a point-shaped laser with Gaussian fit (full $1/e^2$ width); for ILD1900-2-IE determined with emulated 90/10 knife-edge method

5) Connection to PC via network cable

3.3.2 ILD1900-xxLL

Model	**ILD1900-**	**2LL-IE**	**6LL-IE**	**10LL-IE**	**25LL-IE**	**50LL-IE**
Measuring range		2 mm	6 mm	10 mm	25 mm	50 mm
Start of measuring range		15 mm	17 mm	20 mm	25 mm	40 mm
Mid of measuring range		16 mm	20 mm	25 mm	37.5 mm	65 mm
End of measuring range		17 mm	23 mm	30 mm	50 mm	90 mm
Measuring rate [1]		continuously adjustable between 0.25 … 10 kHz; 7 adjustable stages: 10 kHz / 8 kHz / 4 kHz / 2 kHz /1.0 kHz / 500 Hz / 250 Hz				
Linearity		< ±1 µm	< ±1.2 µm	< ±2 µm	< ±5 µm	< ±10 µm
		< ± 0.05 % FSO	< ± 0.02 % FSO	< ± 0.02 % FSO	< ± 0.02 % FSO	< ± 0.02 % FSO
Repeatability [2]		< 0.1 µm	< 0.25 µm	< 0.4 µm	< 0.8 µm	< 1.6 µm
Temperature stability [3]		±0.005 % FSO / K				
Light spot diameter (± 10 %) [4]	SMR	55 x 480 µm	100 x 600 µm	125 x 730 µm	210 x 950 µm	235 x 1280 µm
	MMR	40 x 460 µm	50 x 565 µm	55 x 690 µm	80 x 970 µm	125 x 1500 µm
	EMR	55 x 440 µm	100 x 525 µm	125 x 660 µm	220 x 1000 µm	325 x 1470 µm
	smallest diameter	40 x 460 µm with 16 mm	50 x 565 µm with 20 mm	55 x 690 µm with 25 mm	80 x 970 µm with 37.5 mm	115 x 1450 µm with 59 mm
Light source		Semiconductor laser < 1 mW, 670 nm (red) with laser class 2 Semiconductor laser ≤ 5 mW, 658 nm (red) with laser class 3R				
Laser class		Class 2 in accordance with DIN EN 60825-1 : 2015-07 optionally class 3R in accordance with DIN EN 60825-1: 2015-07				
Permissible ambient light		50,000 lx				
Supply voltage		11 … 30 VDC or PoE, external supply has priority over PoE				
Power consumption		< 3 W (24 V)				

Model	ILD1900-	2LL-IE	6LL-IE	10LL-IE	25LL-IE	50LL-IE
Signal input		Laser on/off				
Digital interface		EtherNet/IP				
Connection		integrated pigtail 0.3 m with 12-pin M12 plug; optional extension to 3 m / 6 m / 9 m / 15 m (see accessories for suitable connection cable)				
Temperature range	Storage	-20 ... +70 °C, non-condensing				
	Operation	0 ... +50 °C, non-condensing				
Shock (DIN EN 60068-2-27)		15 g / 6 ms in 3 axes				
Vibration (DIN EN 60068-2-6)		30 g / 20 … 500 Hz				
Protection class		IP67 (DIN EN 60529)				
Material		Aluminum housing				
Weight		approx. 185 g (incl. pigtail)				
Control and display elements		Select button: factory setting, change operation mode; Web interface for setup 5): Application-specific presets; peak selection, video signal; freely selectable averaging possibilities; data reduction; setup management; 3 color LEDs for power / status / EtherNet/IP				

FSO = Full Scale Output

SMR = Start of measuring range, MMR = Mid of measuring range, EMR = End of measuring range

The specified data apply to a white, diffuse reflecting surface (Micro-Epsilon reference ceramic for ILD sensors)

1) Maximum measuring rate depending on fieldbus and bus cycle time; factory setting: measuring rate 4 kHz, median 9;

2) Typical value with measurements at 4 kHz and median 9

3) In the mid of the measuring range; the specified value is only achieved by mounting on a metallic sensor holder. Good heat dissipation from the sensor to the holder must be ensured.

4) Light spot diameter determined using a point-shaped laser with Gaussian fit (full $1/e^2$ width); for ILD1900-2-IE determined with emulated 90/10 knife-edge method

5) Connection to PC via network cable

4. Delivery

4.1 Unpacking, Included in Delivery

- 1 ILD1900-x-IE sensor
- 1 assembly instructions
- 1 calibration protocol
- Accessories (2 pc. centering sleeves, 2 pc. M3 x 40)

➡ Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.

➡ Check the delivery for completeness and shipping damage immediately after unpacking.

➡ If there is damage or parts are missing, immediately contact the manufacturer or supplier.

Optional accessories are listed in the appendix, see Chap. A 1.

4.2 Storage

Temperature range for storage: -20 ... +70 °C

Humidity: 5 - 95% (non-condensing)

5. Mounting

5.1 Notes for Operation

5.1.1 Reflectance of Target Surface

In principle, the sensor evaluates the diffuse portion of the reflections of the laser light spot.

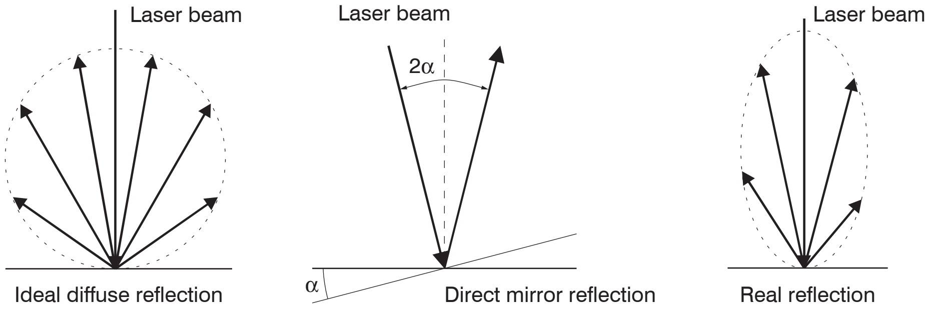


Fig. 8 Reflectance of Target Surface

Any statement about a minimum reflection factor is only possible with reservations, since small diffuse portions can be evaluated even of reflecting surfaces. This happens based on intensity determination of the diffuse reflection from the CMOS signal in real time and subsequent control, see Chap. 3.2. However, for dark or shiny measuring objects, such as black rubber, a longer exposure time may be required. The maximum exposure time is coupled to the measuring rate and can only be increased by lowering the measuring rate of the sensor.

5.1.2 Interferences

5.1.2.1 Ambient Light

Thanks to their integrated optical interference filters, the optoNCDT 1900 laser-optical sensors offer outstanding performance in suppressing ambient light. However, ambient light disturbances can occur with shiny measuring objects and at a reduced measuring rate. In these cases it is recommended to provide shielding against ambient light or to switch on the `Background suppression` function. This applies in particular to measurement work performed in the vicinity of welding devices.

5.1.2.2 Color Differences

Because of intensity compensation, color difference of targets affect the measuring result only slightly. However, such color differences are often combined with different penetration depths of the laser light into the material. Different penetration depths then result in apparent changes of the measuring spot size. Therefore color changes in combination with penetration depth changes may lead to measurement uncertainties.

5.1.2.3 Thermal Influences

When the sensor is commissioned, a warm-up time of at least 20 minutes is required to achieve uniform heat distribution in the sensor. If measurement is performed in the μm accuracy range, the effect of temperature fluctuations on the sensor holder must be considered.

Rapid temperature changes are not detected immediately due to the damping effect of the sensor's heat capacity.

5.1.2.4 Mechanical Vibrations

If a high degree of resolution in the μm range is required, the sensor and target must be mounted on a stable surface that is damped against vibrations.

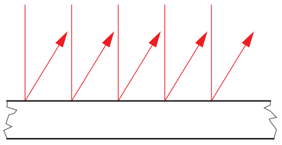
5.1.2.5 Motion Blur

If the objects being measured are fast moving and the measuring rate is low, it is possible that movement blurs may result. Therefore, always select a high measuring rate for high-speed operations to prevent errors.

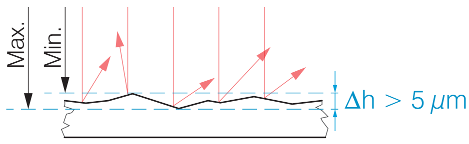
5.1.2.6 Surface Roughness

Laser-optical sensors detect the surface using an extremely small laser spot. They also track slight surface unevenness. In contrast, a tactile, mechanical measurement, e.g. using a caliper, detects a much larger area of the measuring object. In case of traversing measurements, surface roughnesses of 5 µm and more lead to an apparent distance change.

A suitable averaging number may improve the comparability of optical and mechanical measurements.



Ceramic reference surface



Structured surface

Recommendation for parameter choice:
- The averaging number should be selected in such a way that a surface area the size of which is comparable to those with mechanical measurements is averaged.

5.1.2.7 Angular Influences

Target tilt angles around both the X and Y-axis of less than 5° in the case of diffuse reflection only cause problems with surfaces that produce strong direct reflection.

These influences must be taken into account especially when scanning profiled surfaces. In principle, angular behavior of triangulation is also subject to the reflective properties of the target surface.

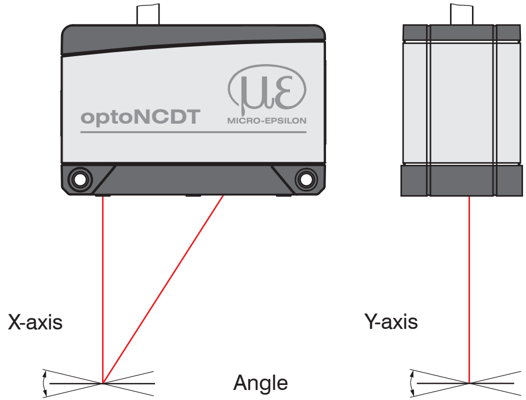
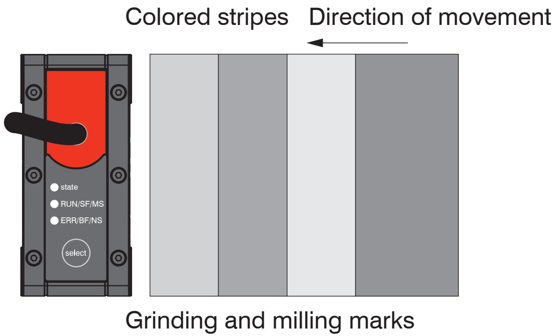


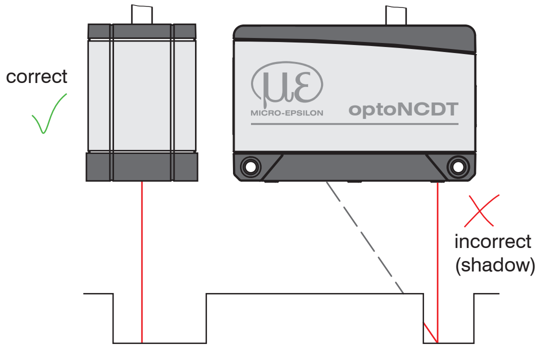
Fig. 9 Measurement error caused by tilt angle with diffuse reflection

5.1.3 Optimizing the Measurement Accuracy



In case of rolled or polished metals that are moved past the sensor, the sensor plane must be arranged in the direction of the rolling or grinding marks. The same arrangement must be used for color strips.

Fig. 10 Sensor arrangement for ground or striped surfaces



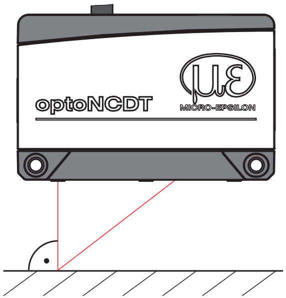
In case of bore holes, blind holes and edges in the surface of moving parts, the sensor must be arranged in such a way that the edge does not obscure the laser spot.

Fig. 11 Sensor arrangement for holes and edges

5.2 Mechanical Fastening, Dimensional Drawing

5.2.1 General

The optoNCDT 1900 sensor is an optical system used to measure in the micrometer range. If the laser beam does not strike the object surface at a perpendicular angle, measurements might be inaccurate.



i Ensure careful handling of the sensor during installation and operation. Mount the sensor only to the existing through-bores on a flat surface. Any type of clamping is not permitted. Do not exceed torques.

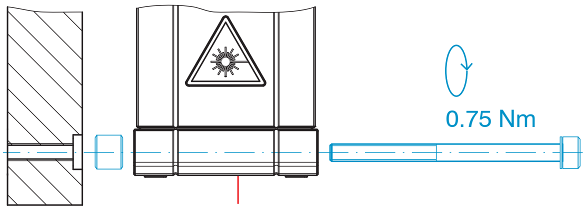
The bearing surfaces surrounding the through-holes (fastening holes) are slightly raised.

Fig. 12 Sensor mounting with diffuse reflection

5.2.2 Mounting

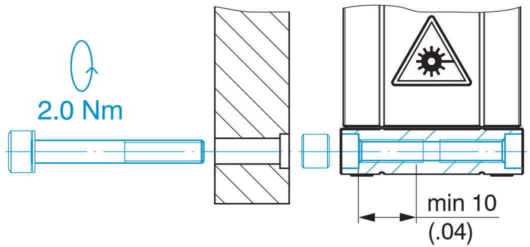
Depending on the installation position, it is recommended to define the sensor position using centering elements and fitting bores. The cylindrical counterbore ø6 H7 is intended for the position-defining centering elements. This allows for the sensor to be mounted in a reproducible and exchangeable way.

Bolt connection

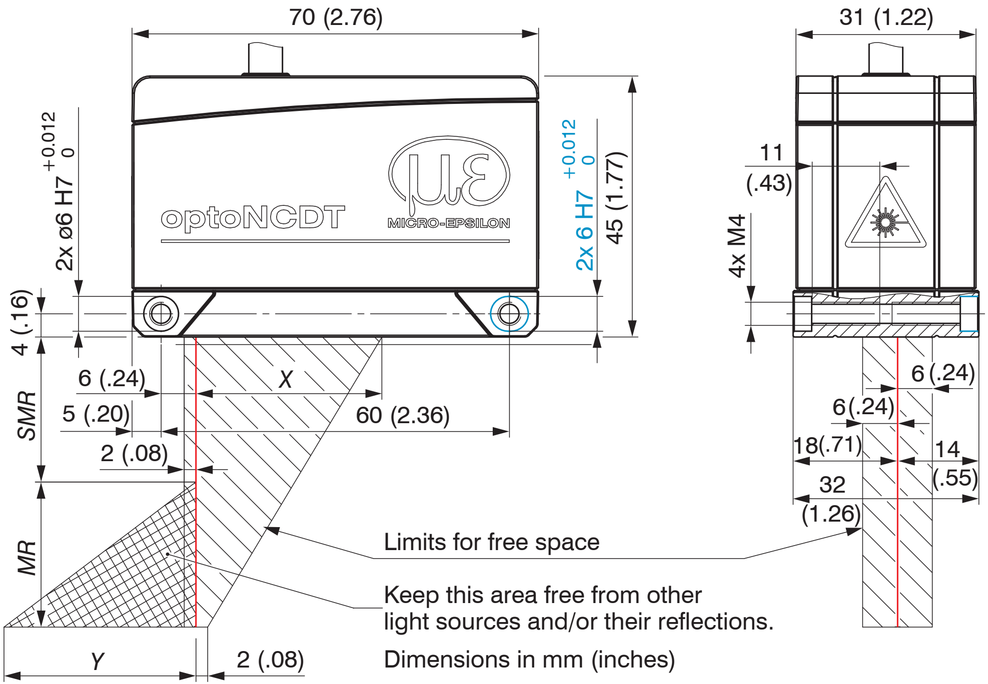


M3 x 40; ISO 4762, A2-70

Direct fastening



M4; ISO 4762, A2-70
Screwing depth min. 10 mm



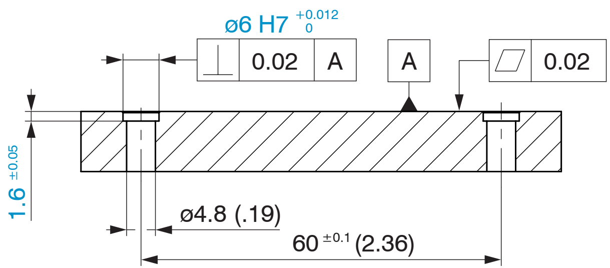


Fig. 13 Dimensional drawing, drilling pattern, mounting plate

i Mount the sensor only to the existing through-bores on a flat surface or screw it directly. Any type of clamping is not permitted.

MR	*SMR*	*X*	*Y*
2/2LL	15	23	3
6/6LL	17	27	9
10/10LL	20	33	14
25/25LL	25	33	33
50/50LL	40	36	45
100	50	37	75
200	60	39	130
500	100	43	215

Dimensions in mm

MR = Measuring range

SMR = Start of measuring range

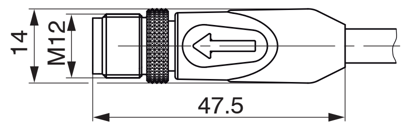
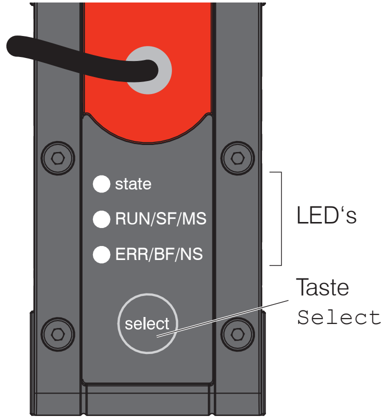


Fig. 14 Dimensional drawing of plug and sensor cable

5.3 Control and Display Elements

LED State / Color / State		**Meaning**
green	On	Measuring object within the measuring range
yellow	On	Measuring object in the mid of the measuring range
red	On	No distance value available, e.g. target outside the measuring range, too low reflection
yellow	Flashing, 1 Hz	Bootloader
yellow	Flashing, 8 Hz	Installation active
	Yellow (briefly), red, yellow, green, off, alternating	Ethernet setup mode
	Off	Laser switched off



Select button	**Meaning**
	- Switching operating mode - Resetting to factory setting

LED **MS** / Color / State		Meaning
○	Off	No voltage: If the device is not supplied with voltage, the module status indication is constantly off.
green	On	Device is functional: When the device is operating properly, the module status indication lights up constantly green.
green	Flashing	Standby: If the device has not yet been configured, the module status indication flashes green.
red	Flashing	Major Recoverable Fault: If the device has detected a Major Recoverable Fault, the module status indication flashes red. NOTE: An invalid or incoherent configuration is considered a minor error.
red	On	Major Unrecoverable Fault: When the device has detected a Major Unrecoverable Fault, the module status indication will be constantly red.
red / green	Flashing	Self test: While the device is performing its power up test, the module status indication flashes green/ red.
LED **NS** / Color / State		Meaning
○	Off	No voltage, no IP address: When the device has no IP address (or is powered off), the network status indication is constantly off.
green	Flashing	No connections: An IP address was configured, but no CIP connection was established and no Exclusive Owner Connection had a timeout.
green	On	Connected: An IP address has been configured. At least one CIP Connection was established and no Exclusive Owner Connection had a timeout.
red	Flashing	Connection timeout: IP address was configured and an Exclusive Owner Connection, for which the device is the target, had a time out. The network status indication will return to permanently green when all Exclusive Owner Connections have been reestablished with timeout.
red	On	IP address assigned twice: If the device has detected that its IP address is already in use, the network status indication will be constantly red.
red / green	Flashing	Self test: While the device is performing its power up test, the network status indication flashes green/ red.

5.4 Electrical Connections

5.4.1 RJ45, PoE Connections

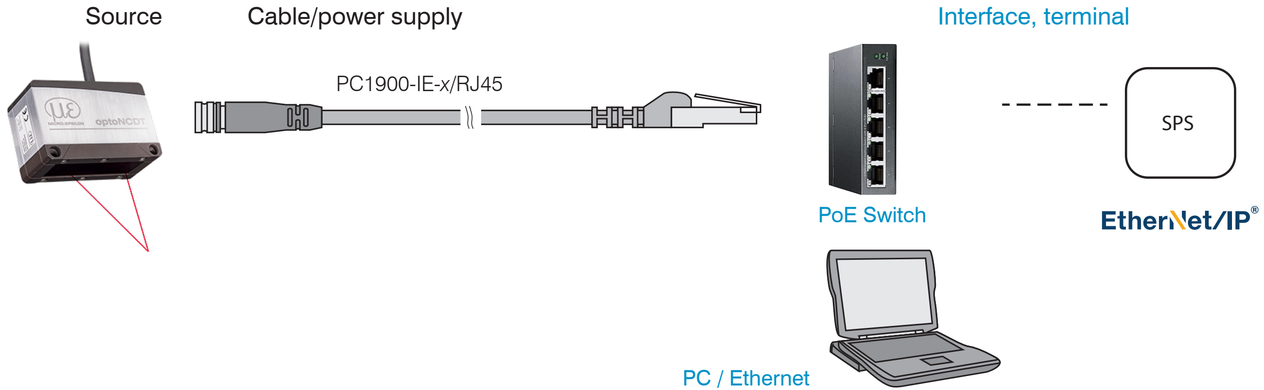


Fig. 15 ILD1900-IE connection example, laser on/off via software

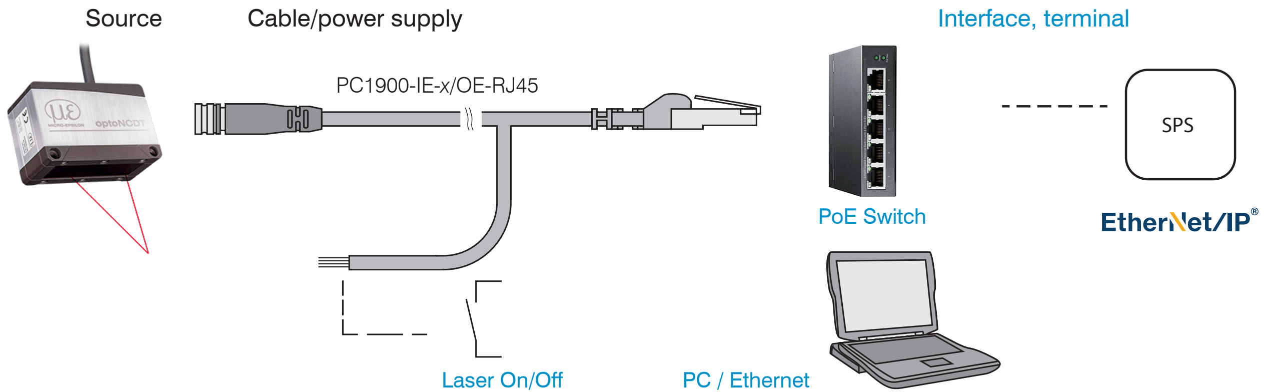


Fig. 16 ILD1900-IE connection example, laser on/off via hardware

5.4.2 RJ45 Connection

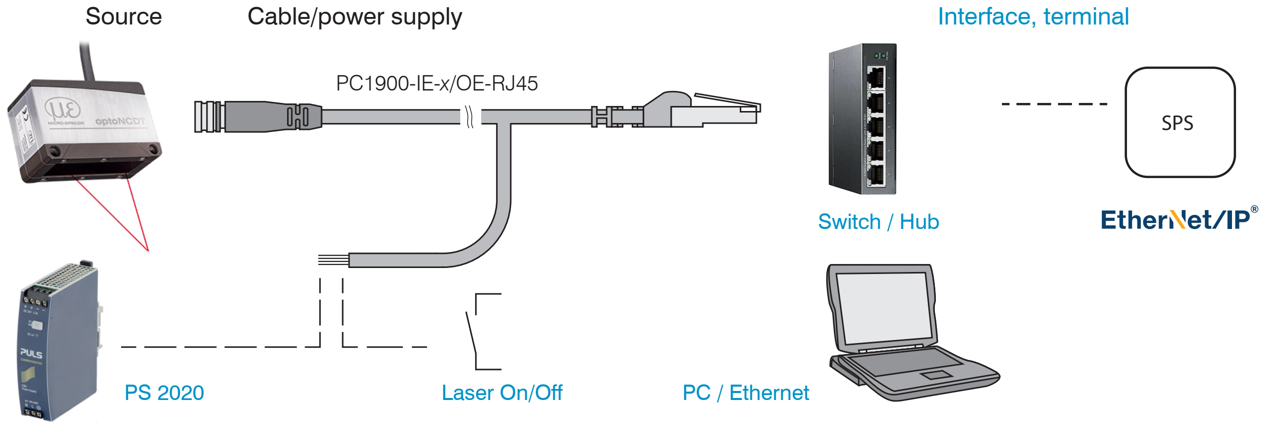


Fig. 17 ILD1900-IE connection example, supply via optional power supply unit, laser on/off via hardware

5.4.3 Pin Assignment

Signal	Wire color PC1900-IE-x/OE-RJ45	Comments	
V_+	Red	Power supply	11 ... 30 VDC, typ. 24 VDC
GND	Blue	Reference ground	
Laser on/off +	Black	Switching input	Laser in the sensor is active if both pins are connected to each other.
Laser on/off -	Violet		

Fig. 18 Open end connections, PC1900-IE-x/OE-RJ45

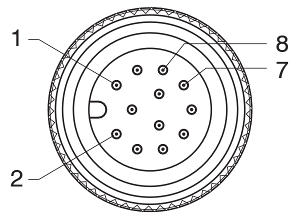
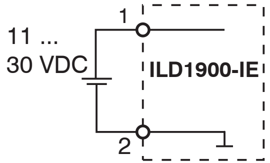
Signal	Pin	Comments		
V_+	1	Power supply	11 ... 30 VDC, typ. 24 VDC	
GND	2	Reference ground		
Laser on/off +	7	Switching inputs		12-pin plug-in connector, M12, pin side of pigtail cable connector
Laser on/off -	8			

Fig. 19 Pigtail connections on the sensor

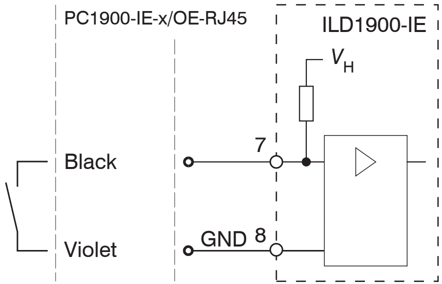
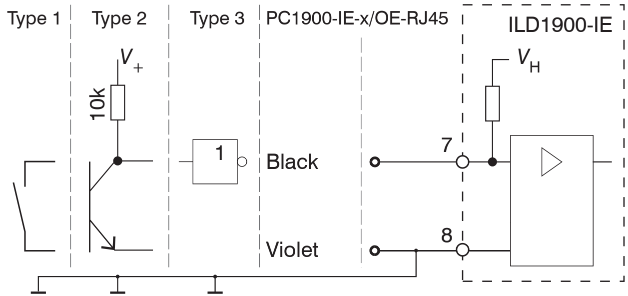
5.4.4 Supply Voltage

Nominal value: 24 V DC (11 ... 30 V, P < 3 W).

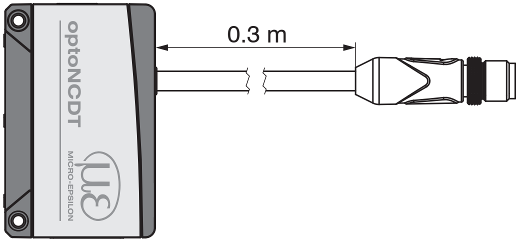
<table>
<tr><th>Industrial Ethernet with PoE</th><th colspan="4">Industrial Ethernet without PoE</th></tr>
<tr><td rowspan="5">Sensor supply is via a PoE-capable switch. Phantom powering (PoE) is possible via the
- PC1900-IE-x/RJ45 or
- PC1900-IE-x/OE-RJ45
possible.</td><td colspan="4">Sensor supply is via the PC1900-IE-x/OE-RJ45 cable.</td></tr>
<tr><td rowspan="3">
</td><td>Sensor pin</td><td>PC1900-IE-x/OE-RJ45 Color</td><td>Power supply</td></tr>
<tr><td>1</td><td>Red</td><td>V_+</td></tr>
<tr><td>2</td><td>Blue</td><td>GND</td></tr>
<tr><td colspan="4">As an alternative to PoE, the sensor can be supplied with the optional PS2020 power supply unit, see Fig. 17.
Voltage supply only for measuring devices, not to be used for drives or similar sources of impulse interference at the same time. MICRO-EPSILON recommends using an optional available power supply unit PS2020 for the sensor.
➡ Only turn on the power supply after wiring has been completed.
➡ Connect the inputs Pin 1 and Pin 2 at the sensor with a 24V power supply.</td></tr>
</table>

5.4.5 Turning on the Laser

The measuring laser on the sensor is switched on via a software command or a switching input. This allows to switch off the sensor for maintenance purposes or similar. Response time: after the laser is switched on, the sensor needs depending on the measuring rate 5 cycles to send correct measured data.

<table>
<tr><td>Laser on/off via software, Supply with PoE
The measuring laser on the sensor is activated via a software command.</td><td>Laser on/off via hardware, Supply with PoE
The measuring laser on the sensor is activated via a switch or similar.</td><td>Laser on/off via hardware, Supply without PoE
A switching transistor with open collector (for example in an optocoupler), a relay contact or a digital TTL or HTL signal are suitable for switching.</td></tr>
<tr><td rowspan="4">Activation using the PC1900-IE-x/OE-RJ45 cable is possible.</td><td>Activation using the PC1900-IE-x/OE-RJ45 cable is possible.</td><td>Activation using the PC1900-IE-x/OE-RJ45 cable is possible.</td></tr>
<tr><td rowspan="2">
</td><td>
</td></tr>
<tr><td>The inputs are not electrically separated.
24 V logic (HTL): Low level ≤ 3 V; High level ≥ 8 V (max 30 V)
internal pull-up resistor, an open input is detected as High.
Max. switching frequency 10 Hz
The ground of the logic circuit must be galvanically connected to "Laser on/off -".</td></tr>
<tr><td colspan="2">No external resistance is required for current limitation. For permanent "Laser on", connect the black and violet wires.</td></tr>
</table>

5.4.6 Plug-In Connection, Supply and Output Cable



ILD1900-IE with pigtail

- Do not bend the sensor cable more tightly than 30 mm (fixed installation) or 75 mm (permanently flexible).

i The firmly connected sensor cable is drag-chain suitable.

i Unused open cable ends must be insulated to protect against short circuits or sensor malfunctions.

MICRO-EPSILON recommends the use of the PC1900-IE drag-chain compatible standard connection cables from the optional accessories, see Chap. A 1.

- Fasten the plug connection of the cable plug and socket when using a drag-chain compatible PC1900-IE sensor cable.
- Avoid excessive pull on the cables. If a cable of over 5 m in length is used and it hangs vertically without being secured, make sure that some form of strain relief is provided close to the plug connection.
- Do not twist a mated connection.
- Connect the cable shield to the potential equalization (PE, protective earth conductor) on the evaluator (control cabinet, PC housing) and avoid ground loops.
- Never lay signal lines next to or together with power cables or pulse-loaded cables (e.g., for drives or solenoid valves) in a single bundle or duct. Always use separate ducts.

6. Operation

6.1 Getting Ready for Operation

➡ Mount the optoNCDT 1900 according to the assembly instructions, see Chap. 5.

➡ Connect the sensor to the downstream display or monitoring units and to the voltage supply, if no PoE is used.

The laser diode in the sensor is only activated
- due to software command or
- if the black and violet wires of the PC1900-IE-x/OE-RJ45 are connected, see Chap. 5.4.5.

Once the power supply has been switched on, the sensor runs through an initialization sequence. Already within the first second a connection to the sensor can be established and the measurement can be started.

During the first three seconds, an internal function check in the sensor is indicated by the Status LED, which lights up in the colors red, yellow and green one after another.

Initialization takes a maximum of 3 seconds. Within this period, only the reset or the bootloader command is executed via the `Select` button.

The sensor typically requires a warm-up time of 20 min for reproducible measurements.

If the `State` LED is off, the laser light source has been switched off.

If all LEDs are off, no power is being supplied.

6.2 Operation via Web Interface, Ethernet

6.2.1 General

The sensors start with the last stored operating mode. Standard is EtherNet/IP.

i An ILD1900-IE with EtherNet/IP is delivered in DHCP mode. A DHCP server is required, see Chap. A 3, to assign an IP address to the sensor. Subsequently, it is also possible to assign a static IP address.

A web server is implemented in the sensor; the web interface displays, among other things, the current settings of the sensor. Operation is only possible while there is an Ethernet connection to the sensor.

EtherNet/IP Operation

➡ Assign an IP address to the sensor.

With EtherNet/IP the web interface can be accessed without switching to the Ethernet setup mode.

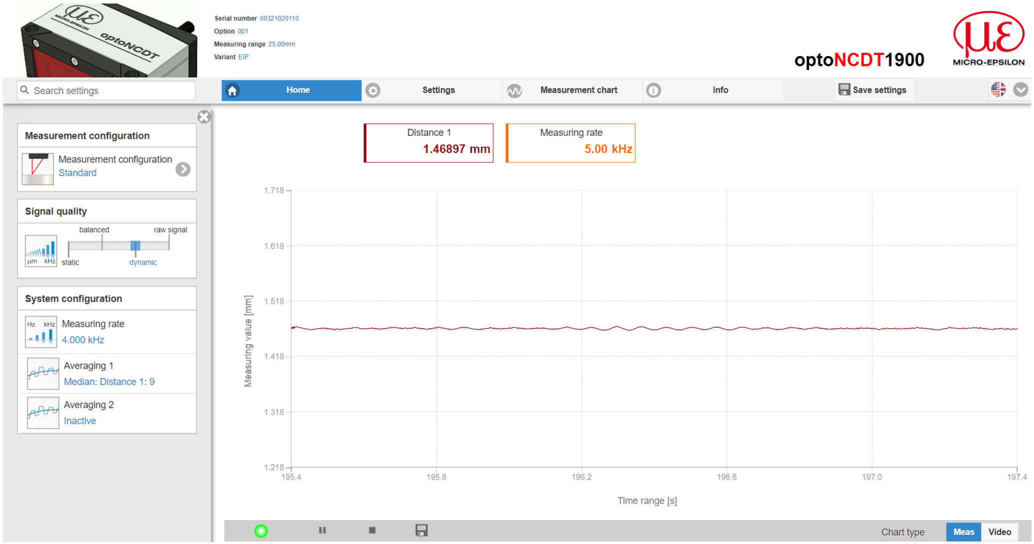
You can find an example of this in the appendix, see Chap. A 3.

➡ Start your web browser and type the IP address of the sensor into the address bar.

6.2.2 Access via Web Interface

➡ Start the sensor web interface, see Chap. 6.2.1.

Interactive web pages you can use to configure the sensor are now displayed in the web browser. The sensor is active and supplies measurement values. Real-time measurement is thus not guaranteed with the web interface. The currently running measurement can be controlled using the function buttons in the `Chart type`.



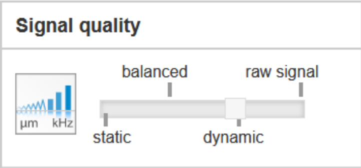
The horizontal navigation includes the functions below:

- The search function permits time-saving access to functions and parameters.
- `Home`. The web interface automatically starts in this view with measurement chart, Configuration and Signal quality.
- `Measurement configuration`. Allows a selection of predefined measurement settings.
- `Settings`. This menu includes all sensor parameters, see Chap. 7.
- `Measurement chart`. Measurement chart or video signal.
- `Info`. Includes information about the sensor, such as measuring range, serial number and software status.

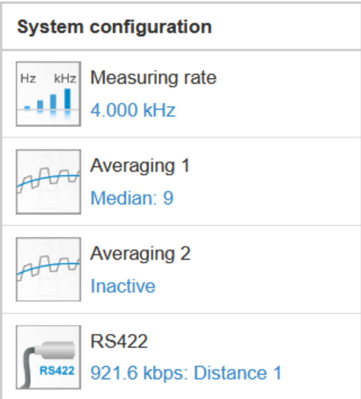
Fig. 20 First page after web interface has been accessed in Ethernet mode

For configuration, you can switch between the video signal and a display of the measured values over time. The appearance of the websites can change dependent of the functions. Dynamic help text with excerpts from the operating instructions supports you during sensor configuration.

i Depending on the selected measuring rate and the PC used, measured values may be reduced in the display. That is, not all measured values are transmitted to the web interface for display and saving.



Averaging	Description
Balanced Median with 9 values + Moving with 64 values	In the `Signal quality` section you can switch between four predefined basic settings (static, balanced, dynamic and without averaging). The reaction in the chart and system configuration is immediately visible. i If the sensor starts up with a user-defined measurement setting (setup), see Chap. 7.7.3, the signal quality cannot be changed. The `Signal quality` function can be used to specify the predefined presets more precisely for the individual measurement task.
Raw signal, without averaging	
Static Median with 9 values + Moving with 128 values	
Dynamic Median, 9 values	



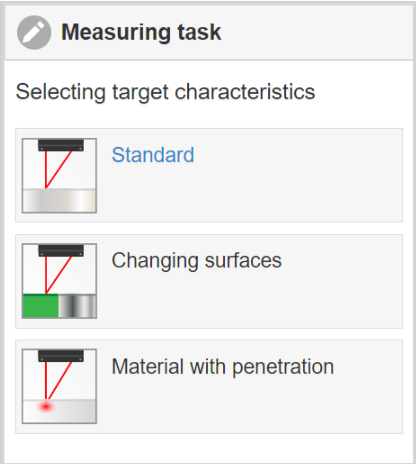
The `System configuration` section shows the current settings for Measuring rate, Averaging and RS422 in blue. You can change the settings via the `Signal Quality` slider or in the `Settings` tab.

The `Chart Type` area enables you to switch between the graphical representation of a measurement values over time or the video signal.

i After parameterization, store all settings permanently in a parameter set so that they are available again the next time the sensor is switched on.
To do this, use the `Save settings` button.

6.2.3 Measurement Task Selection

Conventional measurement configurations (presets) for various target surfaces are saved in the sensor. They allow for a quick start in the individual measuring task. Selecting a preset, which is suitable for the target surface activates a predefined configuration of settings that will produce the best results for the material selected.



Standard	Ceramics, metal
Changing surfaces [1]	PCBs, hybrid metal
Material with penetration [1]	Plastics (Teflon, POM), materials with strong penetration depth of the laser

1) Available for the ILD1900-2/6/10/25/50 sensor models

6.2.4 Display of Measurement Values in the Web Browser

➡ Display the measurement values in the `Measurement chart` tab.

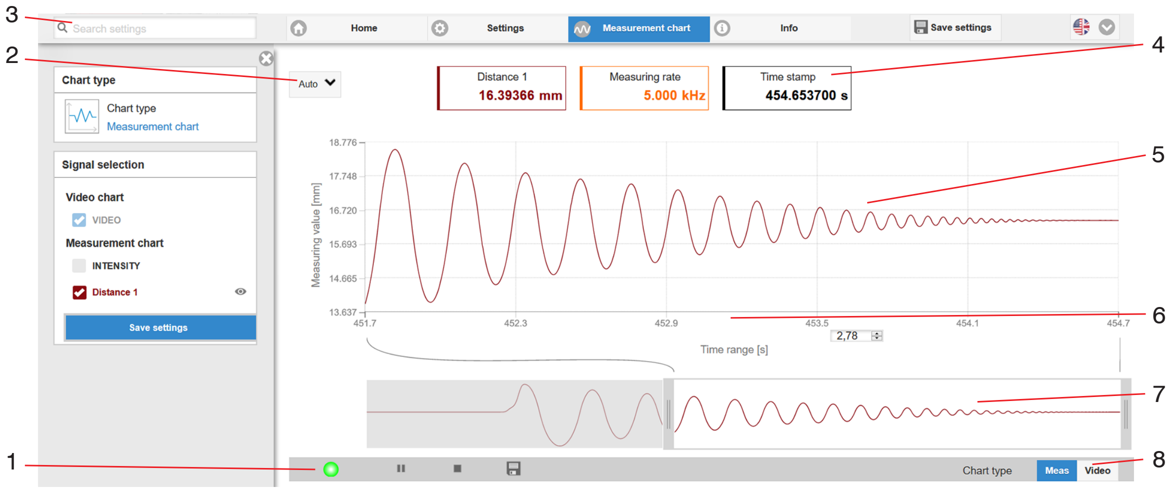


Fig. 21 Measurement (distance measurement) web page

1 The LED visualizes the status of the transmission of measured values:
- green: transmission of measured values is running.
- yellow: waiting for data in trigger mode
- gray: transmission of measured values stopped

Data queries are controlled by using the `Play/Pause/Stop/Save` buttons of the measured values that were transmitted

`Stop` pauses the chart; you can still use the data selection and zoom functions. `Pause` stops the recording. `Save` opens the Windows selection dialog for the file name and storage location to save the last 10,000 values in a CSV file (separation using semicolon).

➡ Click the ▶ button (Start) to display the measurement results.

2 To scale the axis in the graph for the measured values (y-axis), you can use `Auto` (= automatic scaling) or `Manual` (= manual scaling).

3 The search function permits time-saving access to functions and parameters.

4 The text boxes above the graphic display the current values for distance, exposure time, current measuring rate, display rate and time stamp.

5 Mouseover function. When the chart has been stopped and you move the mouse over the graph, points on the curve are marked with a circle and the associated values are displayed in the text boxes above the graph. Peak intensity is also updated.

6 The x-axis can be scaled in the input field under the time axis.

7 Scaling the x-axis: During an ongoing measurement, you can use the left-hand slider to enlarge the entire signal (zoom). When the chart has been stopped, the right-hand slider can also be used. You can also move the zoom window with the mouse in the center of the zoom window (four-sided arrow).

8 Select a chart type: measurement values or video signal

6.2.5 Video Signal Display in the Web Browser

➡ Display the video signal in the `Video` section of the `Chart type` selection.

The graph displayed in the large chart area on the right represents the video signal and the receiving row. The video signal displayed in the chart area displays the intensity distribution of the pixels in the receiving row. Left 0 % (small distance), and right 100 % (large distance). The corresponding measured value is marked by a vertical line (peak marking).

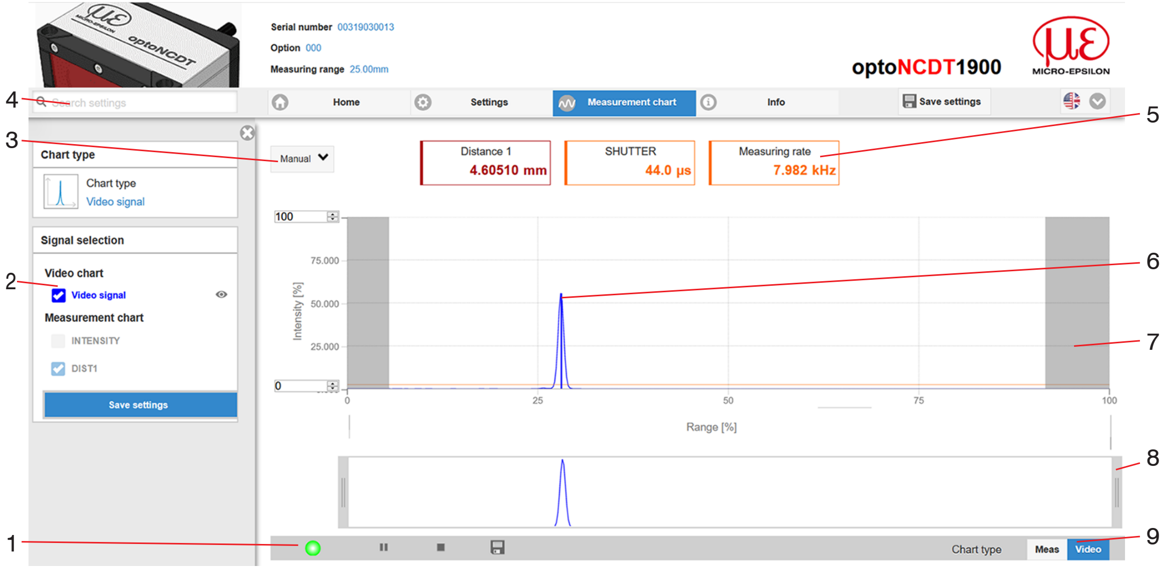


Fig. 22 Video signal web page

1 The LED visualizes the status of the transmission of measured values:
- green: transmission of measured values is running.
- yellow: waiting for data in trigger mode
- gray: transmission of measured values stopped

Data queries are controlled by using the `Play/Pause/Stop/Save` buttons of the measured values that were transmitted

`Stop` pauses the chart; you can still use the data selection and zoom functions. `Save` opens a Windows selection dialog for the file name and storage location to save the video signal in a CSV file.

➡ Click on the ▶ button (Start) to display the video signal.

2 In the left-hand window, the video channels to be displayed can be switched on or off during or after the measurement. Inactive curves are grayed out and can be added by clicking on the check mark. If you want to have displayed one single signal, click on its name.
- Peak marking (vertical blue line), corresponds to the evaluated measured value
- Linearized measuring range (limited by gray hatching), not changeable
- Masked range (limited by light blue hatching), changeable

3 To scale the intensity axis in the graph for the measured values (y-axis), you can use `Auto` (= automatic scaling) or `Manual` (= manual scaling).

4 The search function permits time-saving access to functions and parameters.

5 The text boxes display the current values for distance, exposure time, current measuring rate, display rate and time stamp.

6 Mouseover function. When the chart has been stopped and you move the mouse over the graph, points on the curve are marked with a circle and the associated intensity is displayed. The corresponding x position is displayed in % above the graph window.

7 The linearized range is in the graph between the gray shadows and can not be changed. Only peaks of which the centers are in this range can be evaluated. The masked range may be limited if needed. Then an additional pale blue shadow limits the range on the right and on the left side. The peaks remaining in the resulting range are used for evaluation, see Chap. 7.4.5.

8 Scaling the x-axis: You can zoom into the graph shown above with the two sliders on the right and left in the lower overall signal section. You can also move it to the side with the mouse in the center of the zoom window (four-sided arrow).

9 Select a chart type: measurement values or video signal

The display shows how the adjustable measurement task (target material), peak selection and possible interfering signals due to reflections or similar affect the video signal. There is no linear relationship between the position of the peak in the video signal display and the output measured value.

6.3 Parameterization via EtherNet/IP

EtherNet/IP includes a mechanism for parameterizing the adapters. Objects are defined for this purpose, which contain the parameters for configuring the sensor. For details about reading and changing objects, please refer to the description of your PLC.

An overview of the available objects can be found in the manufacturer specific objects section, see Chap. 8.4.2.

6.4 Timing, Measurement Value Cycles

The sensor needs five internal cycles for measuring and processing: The measurement value N is transmitted to the EtherCAT master in the fifth cycle.

Measurement, processing and transmission take place in parallel, so that the next measurement value (N+1) is transmitted in the following cycle.

6.5 Operation via Membrane Key

You can restore the factory setting with the `Select` button.

Reset to factory setting does not change the IP address.

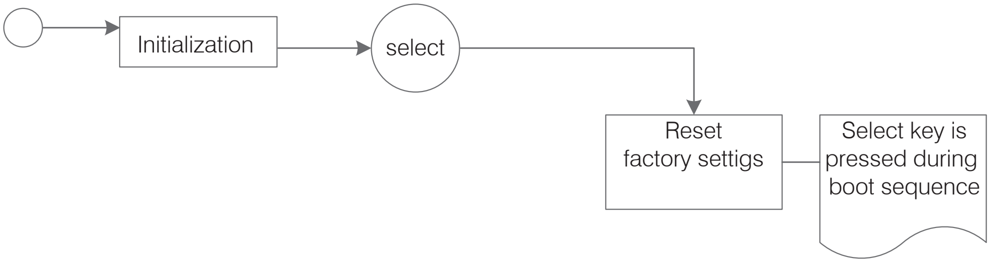


Fig. 23 Process: calling up the factory settings or boot loader via `Select` *button*

7. Setting Sensor Parameters

7.1 Preliminary Remarks about the Setting Options

There are two ways to parameterize the optoNCDT 1900:
- via web browser and sensor web interface,
- by means of EtherNet/IP and the manufacturer-specific objects, see Chap. 8.4.2.

i If you do not permanently save the parameter set in the sensor, the settings are lost when the sensor is turned off. Alternatively values for the EtherNet/IP objects can be stored in the project of your PLC software and transferred to the sensor when the system is started.

7.2 Parameters Overview

The following parameters can be set or changed in the optoNCDT 1900, see `Settings` tab.

Inputs	Laser power
Data Recording	Measurement task, measuring rate, evaluation range, exposure mode, peak selection
Signal Processing	Averaged measurement 1/2, zeroing/mastering
System Settings	Web interface unit, Load & Save, Import & Export, Reset sensor (factory setting)

7.3 Inputs

➡ Change to the `Inputs` menu in the `Settings` tab.

Laser power	*Full*	*Full power for standard surfaces*	*The laser light source is only enabled if pin 7 is connected to pin 8, see* Chap. 5.4.5.
	Medium	*Optimized power for strongly reflecting surfaces and small measuring ranges*	
	Reduced	*Min. power for service purposes*	
	Off	*Laser is off*	
Synchronization with EtherNet/IP		*In case several sensors should measure the same target synchronously, you can synchronize the sensors with each other. Details can be found in the synchronization section, see Chap.* 8.10.	

i Pay attention to the signal intensity when switching the laser power. You achieve best possible results with a signal intensity of 25 ... 50 %.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

7.4 Data Recording

7.4.1 Preliminary Remarks

➡ On the `Settings` tab, switch to the `Data recording` menu.

According to the previous setting in the `Chart type` area, a graph is displayed in the right part of the display. The diagram is active and all settings become immediately visible. Notes on the chosen settings are displayed below.

In the left area, the `Data recording` menus are displayed.

7.4.2 Measurement Configuration

Details dazu finden Sie in der Bedienung des Webinterfaces, see Chap. 6.2.3.

7.4.3 Measuring Rate

The measuring rate indicates the number of measurements per second.

➡ Select the required measuring rate.

Measuring rate	*250 Hz / 500 Hz / 1 kHz / 2 kHz / 4 kHz / 8 kHz / 10 kHz*		*Use a high measuring rate for bright and mat measuring objects. Use a low measuring rate for dark or shiny measuring objects (e.g. black painted surfaces) to improve the measurement result. The max. measuring rate depends on the fieldbus and the bus cycle time.*
	free measuring rate	*Value*	

At a maximum measuring rate of 10 kHz, the CMOS element is exposed 10,000 times per second. The lower the measuring rate, the longer the maximum exposure time.

The measuring rate is factory set to 4 kHz.

7.4.4 Reset Counter

You can reset the counter readings for the measured values, timestamps, trigger event counters and trigger value counters. It is not possible to display the counter readings in the web interface.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

7.4.5 ROI Masking

Masking limits the evaluating range (ROI - Region of Interest) for the distance calculation in the video signal. This function is used in order to e.g. suppress interfering reflections or ambient light.

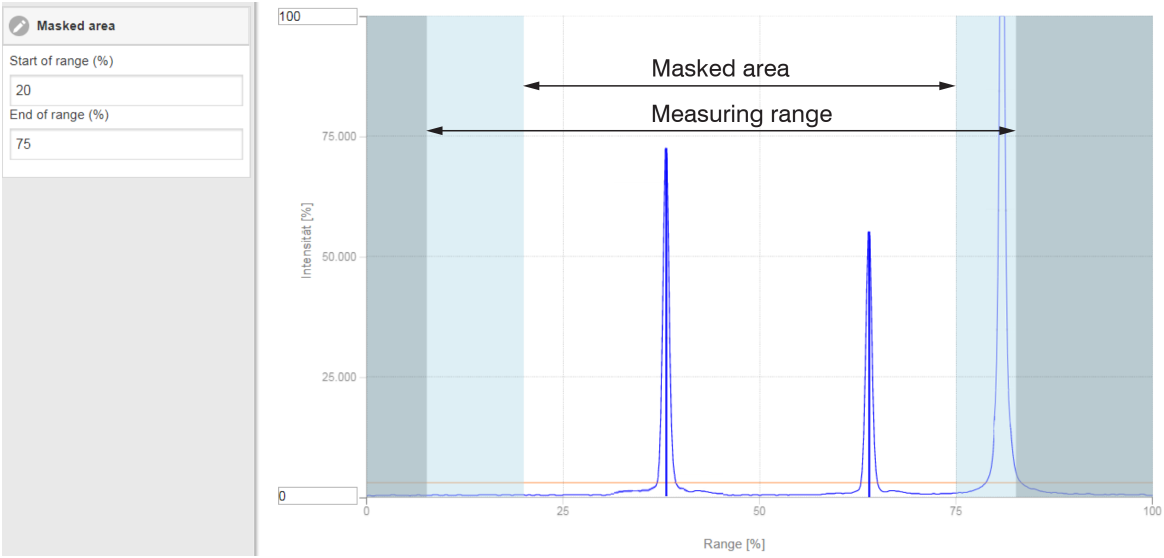
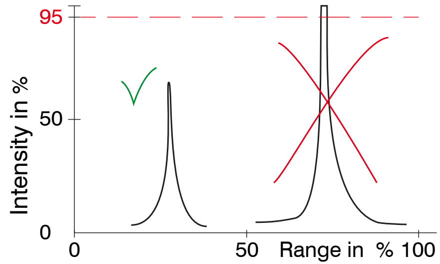


Fig. 24 Light-blue regions delimit the region of interest

The exposure control optimizes the peaks in the evaluation range. Therefore, small peaks can be optimally adjusted when a high interference peak is outside the evaluation range.

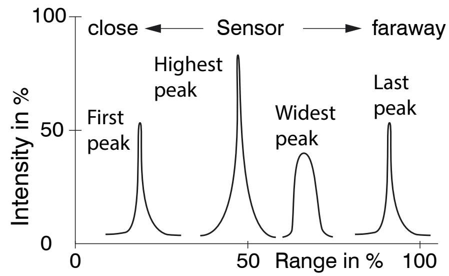
7.4.6 Exposure Mode

Exposure mode	*Automatic mode*	*Standard / Intelligent control / Background suppression*		 *Standard: The sensor itself determines the optimal exposure time. The sensor adjusts the signal intensity to approx. 50%.* *Intelligent control: This intelligent algorithm is particularly advantageous for measurements on moving objects or in the case of transitions between different materials.* *Background suppression: Suppresses interference caused by ambient light. This significantly improves the ambient light tolerance of the sensor. The output rate of the sensor is halved.*
	Manuel mode	Exposure time in µs	*Value*	*In manual mode, with the video signal shown, the exposure time is set by the user. Vary the exposure time in order to obtain a signal intensity of up to 95%.*

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

7.4.7 Peak Selection

Peak selection	*First Peak / Highest Peak / Last Peak / Widest Peak*	*Defines which signal in the array signal is used for the evaluation. First peak: Nearest peak to sensor. Highest peak: Standard, peak with the highest intensity. Last peak: Peak furthest away from sensor. Largest peak: Peak with the largest surface.*	

If a measuring object contains multiple transparent layers, a correct measurement result is determined only for the first peak.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

7.5 Signal Processing

7.5.1 Preliminary Remarks

Change to the `Signal processing` menu in the `Settings` tab.

According to the previous setting in the `Chart type` area, a graph is displayed in the right part of the display. The diagram is active and all settings become immediately visible. Notes on the chosen settings are displayed below.

In the left area, the `Signal processing` menus are displayed.

7.5.2 Averaging

7.5.2.1 General

Averaging is recommended for static measurements or slowly changing measured values. The `Averaging 1` function is executed before the `Averaging 2` function.

Measurement averaging	*No averaging*			*No measurement value averaging.*
	Moving N values	2 / 4 / 8 ... 4096	*Value*	*Specify the type of averaging. The averaging number N indicates how many consecutive values are averaged in the sensor.*
	Recursive N values	2 ... 32767	*Value*	
	Median N values	3 / 5 / 7 / 9	*Value*	

Measurement averaging is performed after the distance values have been calculated, and before they are issued through the relevant interfaces.

Averaging

- improves the resolution,
- allows masking individual interference points or
- "smoothes" the measurement result.

Linearity is not affected by averaging.

The average values are continuously recalculated with each measurement. The desired averaging depth is only achieved after the number of recorded measurement values corresponds at least to the averaging depth.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

i The defined type of average value and the averaging number must be stored in the sensor so that they are retained after switching off.

Averaging has no effect on the measuring rate or data rate in case of digital measurement value output. The averaging numbers can also be programmed via the digital interfaces. The optoNCDT 1900 sensor is delivered with “Median 9” as factory settings, i.e. median averaging over 9 measurement values.

Depending on the type of average and the number of averaged values, different transition response times result thereof, see Chap. 6.4.

7.5.2.2 Moving Average

The definable number N for successive measurements (window width) is used to calculate the arithmetic average M_{mov} according to the following formula:

$$M_{mov} = \frac{\sum_{k=1}^{N} MV(k)}{N}$$

MV	Measurement value,
N	Averaging number,
k	Continuous index (in the window)
M_{mov} =	Average value or output value

Method:

Each new measured value is added, the first (oldest) measured value is removed from the averaging (from the window) again. In this way, it is possible to achieve short transition response times with measured value jumps.

Example: N = 4

... 0, 1, 2, 2, 1, 3	... 1, 2, 2, 1, 3, 4	Measurement values
$\frac{2, 2, 1, 3}{4} = M_{mov}(n)$	$\frac{2, 1, 3, 4}{4} = M_{mov}(n+1)$	Output value

Note:

For the moving averaging in the optoNCDT 1900, only powers of 2 are permitted for the averaging number *N*. Range of values for the averaging number *N* is 1 / 2 / 4 / 8 ... 4096.

7.5.2.3 Recursive Average

Formula:

$$M_{rec}(n) = \frac{MV_{(n)} + (N\text{-}1) \times M_{rec\,(n\text{-}1)}}{N}$$

Mv	Measurement value,
N	Averaging number,
n	Measured value index
M_{rec}	Average value or output value

Method:

The weighted value of each new measured value MV(n) is added to the sum of the previous average values M_{rec} $(n\text{-}1)$.

Note:

The recursive averaging enables very strong smoothing of the measured values, however it needs very long settling times for measured value jumps. The recursive average value shows low-pass behavior. The range of values for the averaging number N is 2 ... 32767.

7.5.2.4 Median

A median value is formed from a preselected number of measurements.

Methods:

The incoming measured values (3, 5, 7 or 9 measurement values) are also sorted again after each measurement. The median value is then output as the median. 3, 5, 7 or 9 measured values are taken into account for the calculation of the median, i.e. there is no median 1.

Note:

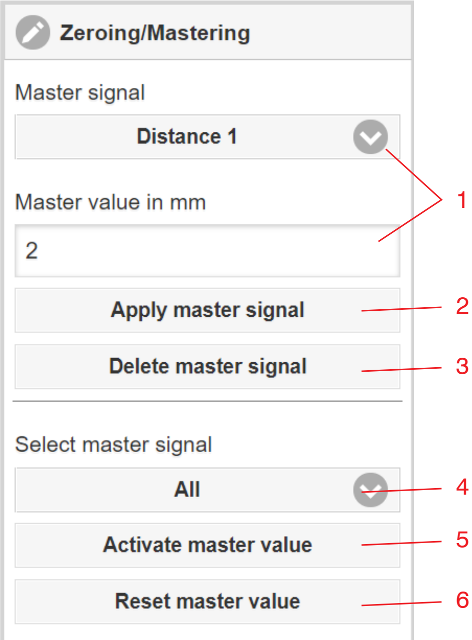
This averaging type suppresses individual interference pulses. However, the smoothing of the measured value curves is not very strong.

Example: mean value from five readings

... 0 1 $\underline{2\ 4\ 5\ 1\ 3}$ → Sorted measurement values: 1 2 $\boxed{3}$ 4 5 Median $_{(n)} = 3$

... 1 2 $\underline{4\ 5\ 1\ 3\ 5}$ → Sorted measurement values: 1 3 $\boxed{4}$ 5 5 Median $_{(n+1)} = 4$

7.5.3 Zeroing, Mastering



Use zeroing and setting masters to define a target value within the measuring range. This shifts the output range. This feature can be useful, for example, when several sensors carry out thickness and planarity measurements when placed next to one another or when replacing a sensor.

Mastering (setting masters) is used to compensate for mechanical tolerances in the sensor measurement setup or to correct chronological (thermal) changes to the measuring system. The master value, also called calibration value, is defined as the target value.

The master value is the reading that is issued as result of measuring a master object. Zeroing is when you set a master with 0 (zero) as the master value.

i `Mastering` or `Zeroing` requires a target object to be present in the measuring range.
`Mastering` or `Zeroing` the digital output and the display equally.

1 Selects a signal for the function, assigns master value
2 Saves master value in volatile memory. [1]
3 Deletes master value in volatile memory.
4 Selects a specific signal or function
5 Starts function
6 Ends function, returns to absolute measurement.

Mastering / Zeroing:

➡ Place target and sensor into the desired positions.

➡ Send the Master command (EtherCAT) or click the `Activate master value` button.

After setting the master, the controller will issue new readings that relate to the master value. The `Reset master value` button resets the system to the state before mastering.

1) The `Save settings` function permanently saves the master value to a setup.

7.6 Digital Output EtherNet/IP

7.6.1 Values, Ranges

The digital measurement values are issued as unsigned digital values (raw values). 16 or 18 bits can be transferred per value. Below you will find a compilation of the output values and the conversion of the digital value.

Value	**Length**	**Variables**		**Value range**	**Formula**
Distance	18 Bit	*x*	Digital value	[0; 230604]	$d = \frac{x - 98232}{65536} * MR$
		MR	Measuring range in mm	{2/6/10/25/50/100/200/500}	
		d	Distance in mm	without mastering [-0.01*MR*; 1.01*MR*]	
				with mastering [-2*MR*; 2*MR*]	
Exposure time	16 Bit	*x*	Digital value	[1000; 40000]	$ET = \frac{1}{10} x$
		BZ	Exposure time in µs	[100; 4000]	
Intensity	16 Bit	*x*	Digital value	[0; 1023]	$I = \frac{100}{1023} x$
		I	Intensity in %	[0; 100]	

Sensor status	18 Bit	*x*	Digital value	[0; 242143]	Bit 0 (LSB): peak starts before ROI
			Bit coding	[0; 1]	Bit 1: peak ends after ROI
					Bit 2: no peak found
		SMR	Start of measuring range		Bit 5: Distance before SMR (extended)
		EMR	End of measuring range		Bit 6: Distance after EMR (extended)
					Bit 15: Measurement value is triggered
Measured Value Counter	18 Bit	*x*	Digital value	[0; 262143]	

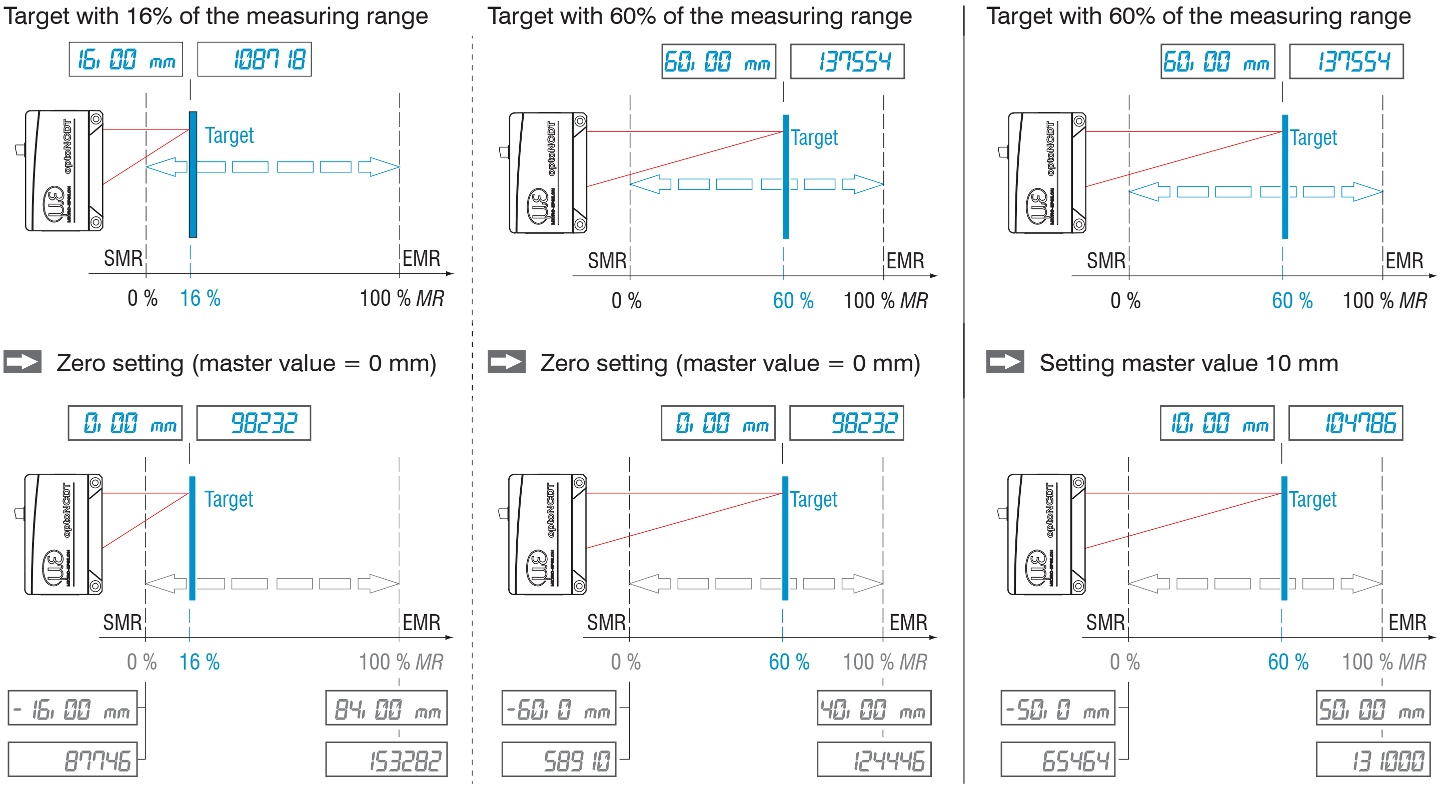
Timestamp	32 Bit	x	Digital value	[0; 4294967295]	$t = \frac{1}{1000} x$
		t	Time stamp in µs	[0; 1h11m34.967s]	
Unlinearized center of gravity	18 Bit	x	Digital value	[0; 262143]	$US = \frac{100}{262143} x$
		US	Center of gravity in %	[0; 100]	
Measurement frequency	18 Bit	x f	Digital value Frequency in Hz	[2500; 100000]	$f = \frac{x}{10}$

State information transferred in the distance value

Distance value	Description
262076	There is no peak present
262077	Peak is before measuring range (MR)
262078	Peak is after measuring range (MR)
262080	Measurement value cannot be evaluated
262081	Peak is too wide
262082	Laser is off

7.6.2 Behavior of the Digital Output

Master values based on the zeroing or master function are coded with 18 bits. The master can assume twice the measuring range. The examples demonstrate the behavior of the digital value with an ILD1900-100-IE, measuring range 100 mm.



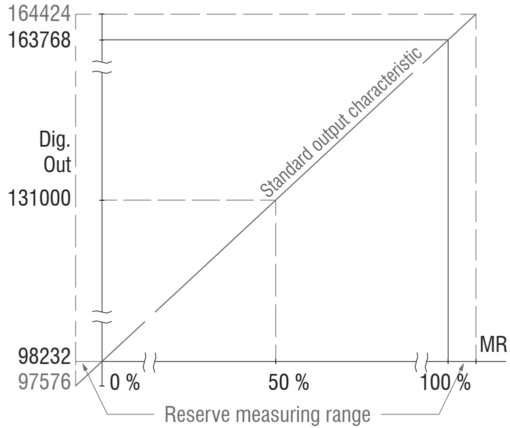


Fig. 25 Digital values without zeroing or mastering

Target with 80% of the measuring range (80 mm)

Setting master value 200 mm

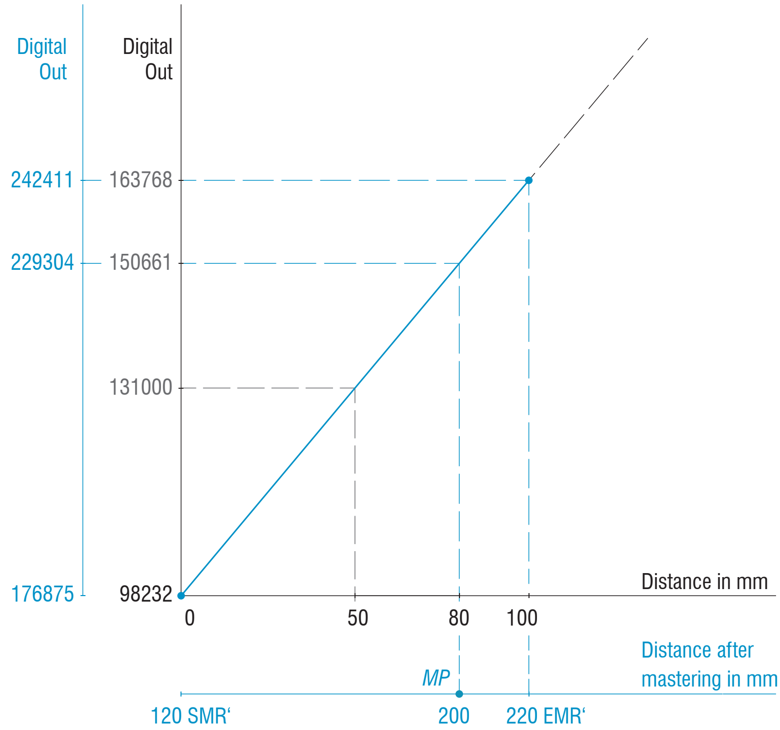


Fig. 26 Digital values 1900-100-IE after mastering with 200 mm master value

7.7 System Settings

7.7.1 General

After programming, save all settings permanently to a parameter set so that they will be available again the next time you switch on the sensor.

7.7.2 Unit, Language

The web interface promotes the units millimeter (mm) and inch when displaying measuring results. You can choose German or English in the web interface. You can change the language in the menu bar.

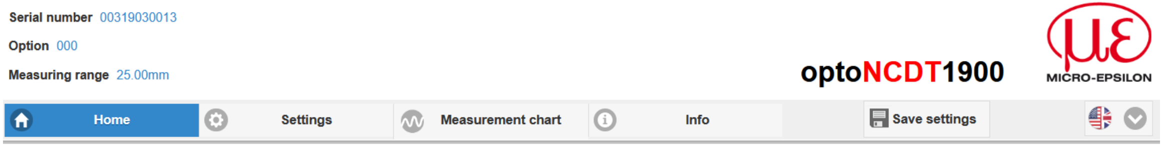
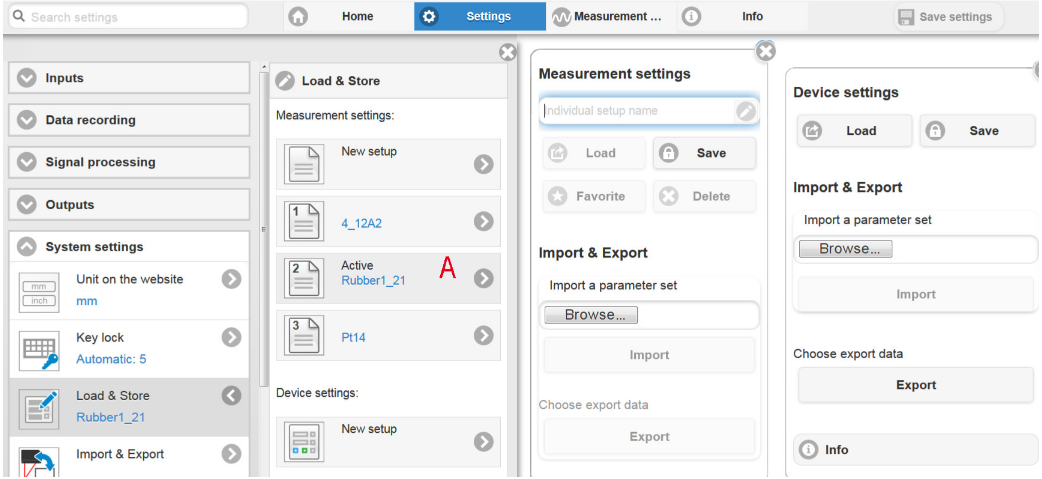


Fig. 27 Language selection in the menu bar

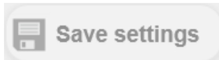
7.7.3 Load & Save

All sensor settings can be permanently saved in user programs, so-called setups, in the sensor.



For details about measurement and device settings, please refer to the section reset sensor, see Chap. 7.7.5.

Fig. 28 Managing user settings

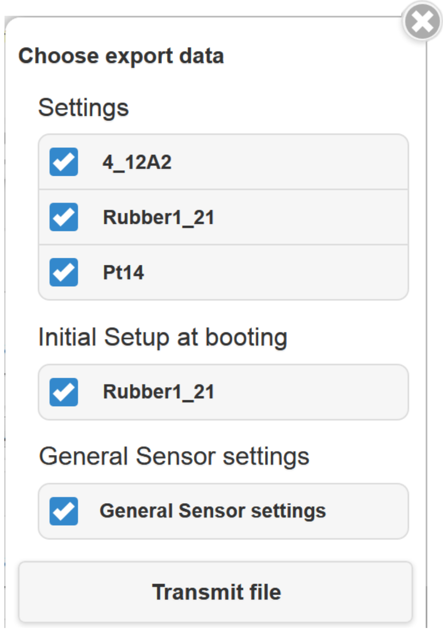
How to manage the sensor settings, options			
Saving the Settings	**Activating existing setup**	**Saving changes in active setup**	**Defining setup after booting**
`New setup` menu	`Load & Save` menu	Menu bar	`Load & Save` menu
➡ Enter the name for the setup into field  e.g. Rubber 1_21 and click the `Save` button.	➡ Click on the desired setup with the left mouse button, area A. The `Measurement settings` dialog opens. ➡ Click the `Load` button.	➡ Click the  button.	➡ Click on the desired setup with the left mouse button, area A. The `Measurement settings` dialog opens. ➡ Click the `Favorite` button.

Exchange setups with PC/notebook, possibilities	
Saving setup on PC	**Load setup from PC**
`Load & Save` menu	`Load & Save` menu
➡ Click on the desired setup with the left mouse button, area A. The `Measurement settings` dialog opens. ➡ Click `Export`.	➡ Click `New setup` with the left mouse button. The `Measurement settings` dialog opens. ➡ Click `Search`. A Windows dialog for file selection opens. ➡ Choose the desired file and click the `Open` button. ➡ Click the `Import` button.

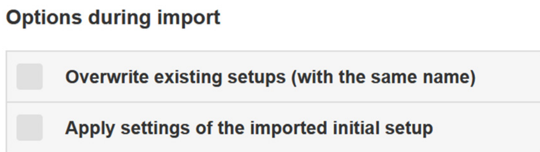
7.7.4 Import, Export

A parameter set includes the current settings, setup(s) and the initial setup when booting the sensor. The `Import & Export` menu enables easy exchange of parameter sets with a PC/notebook.

Exchange of parameter sets with PC/notebook, possibilities	
Storing parameter set on PC	Loading parameter set from PC
`Import & Export` menu	`Import & Export` menu
➡ Left-click on the `Create a parameter set` button. The dialog `Choose export data` opens. ➡ Compose a parameter set by checking/unchecking the checkboxes. ➡ Click the `Transmit file` button. A Windows dialog for data transfer opens. ➡ Confirm the dialog with OK. The operating system files the parameter set in `Download`. The file name for the adjacent example is `<...\Downloads\ILD1900_BASICSETTINGS_MEASSETTINGS_....JSON>`	➡ Click `Search`. A Windows dialog for file selection opens. ➡ Choose the desired file and click the `Open` button. The dialog `Choose import data` opens. ➡ Select the operations to be performed by checking/unchecking the checkboxes. ➡ Click the `Transmit file` button.



In order to avoid that an already existing setup is overwritten unintentionally during import, an automatic security request is carried out, see adjacent figure.



7.7.5 Reset Sensor

Reset Sensor	Device settings	*Button*	*Clears the settings for baud rate, language, unit, key lock and echo mode and loads the default parameters.*
	Measurement setting	*Button*	*Clears the settings for measuring rate, trigger, evaluation range, peak selection, error handling, averaging, zeroing/mastering, data reduction and setups. Loads the 1st preset.*
	Reset all	*Button*	*Clears the sensor settings, measurement settings, access authorization, password and setups. Loads the 1st preset.*
	Reboot sensor	*Button*	*Reboots the sensor with the settings from the favorite setup,* see Chap. 7.7.4.

7.7.6 Boot Mode

The `Boot Mode` function including the switch to `Ethernet Setup Mode` is required for ILD1900-IE sensors with EtherCAT or Profinet. An ILD1900-IE sensor with EtherNet/IP does not support the `Boot Mode` function. It is not recommended to use it.

The sensor must have an IP adress with it the web interface and a PLC can access the sensor in parallel via Ethernet (TCP/IP and UDP protocols) see Chap. A 3.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

8. EtherNet/IP, Documentation

8.1 Preliminary Remarks

The sensor starts with the last stored operating mode. Standard is EtherNet/IP.

The EtherNet/IP mode, as well as the Ethernet setup mode, allow easy programming of a sensor, see Chap. 6.2.1, see Chap. 7.

8.2 Saving the Settings, Continuing EtherNet/IP Operation

➡ Go to `Settings > System settings > Load & Save` or click the `Save settings` button, see Chap. 7.7.3.

The sensor now also saves the settings to the objects for use in EtherNet/IP operation.

Continue working in your PLC environment.

8.3 General

EtherNet/IP is an Ethernet-based fieldbus, which is based on the TCP and UDP protocols, developed by the Open DeviceNet Vendor Association (ODVA). The `IP` in EtherNet/IP stands for Industrial Protocol. The Common Industrial Protocol (CIP) is used as the application protocol. CIP decides between

- Implicit Messages: time-critical, cyclic process data; transmission via UDP,
- Explicit Messages: acyclic demand data; transmission is via TCP.

Explicit messages work according to the client/server model and Implicit Messages work according to the producer/consumer model.

Both require a CIP connection. It is also possible to exchange Explicit Messages without a CIP connection via so-called Unconnected Explicit Messages.

CIP (Common Industrial Protocol)		
Implicit Messages		Explicit Messages
UDP		TCP
I/O-Connections		Explicit Messaging Connections
Exchange of process data from a producer to one or more consumers		Exchange of data between two devices according to the client/server model

Fig. 29 CIP stack and transport of data according to the ISO/OSI reference model

EtherNet/IP distinguishes two types of devices: EtherNet/IP scanners and EtherNet/IP adapters. The ILD1900-IE sensor with EtherNet/IP is an EtherNet/IP adapter. To exchange data with an EtherNet/IP adapter, an EtherNet/IP scanner is required.

8.4 Explicit Messaging

CIP is an object-oriented concept, which is based on object-oriented programming. An Ethernet/IP device is modeled by a set of CIP objects. An object consists of a class, of which in turn one or more instances may exist. Classes and instances still have attributes. Attributes are used to configure the EtherNet/IP device which is accessed by reading or writing. An object is addressed via the Class ID, Instance ID and Attribute ID. It is also important how an object is accessed, e.g. whether it is read or written. This information is defined by the service code.

Object 1			Object 2	Object n
Class (Class-ID)	Attribute 1 (Attribute-ID) ... Attribute n	read/write		
Instance 1 (Instance-ID)	Attribute 1 (Attribute-ID) ... Attribute n	read/write		
... Instance n	Attribute 1 ... Attribute n	read/write		

Fig. 30 Example Explicit Message with the information about Class ID, Instance ID, Attribute ID and Service Code

The objects are distinguished between
- standard objects, which always have the same structure even with different devices, and
- manufacturer-specific objects, which have a different structure depending on the manufacturer.

The standard objects have a Class ID in the range from 0x000 to 0x063 or from 0x0F0 to 0x2FF. The Class ID of manufacturer specific objects ranges from 0x064 to 0x0C7 or 0x300 to 0x4FF.

8.4.1 Standard Objects

8.4.1.1 Overview

Class ID	Name
0x01	Identity Object
0x02	Message Router Object
0x04	Assembly Object
0x06	Connection Manager
0x47	DLR Object
0x48	QoS Object
0xF5	TCP/IP Interface Object
0xF6	Ethernet Link Object
0x43	Time Sync Object
0x109	LLDP Management Object

Fig. 31 Overview of standard objects

8.4.1.2 Object 0x01h: Identity

Class attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance attributes

Attribute ID	Name	Access	Description	Data type
1	Vendor ID	Get	Vendor Identification	UINT
2	Device Type	Get	Indication of general type of product	UINT
3	Product Code	Get	Identification of a particular product of an individual vendor	UINT
4	Revision	Get	Revision of the product	STRUCT [1]
5	Status	Get	Summary status of device	WORD
6	Serial Number	Get	Serial number of device	UDINT
7	Product Name	Get	Human readable identification	SHORT_STRING
8	State	Get	Present state of the device	USINT

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 1/2`.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x01	Get Attribute All	Yes	Yes	Retrieve all attribute values
0x05	Reset	Yes	Yes	Reset the decvice
0x4B	Flash LEDs	No	Yes	Flash the device's LEDs for identification
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	Yes	Yes	Modify attribute value

You can reset the sensor to factory settings via the service `Reset` (0x05 hex) of instance 1 or directly via the class of the Identity Object (0x01 hex). The reset service contains the parameter `Reset Type` of data type USINT, for which the following values are valid:

- 0 Performs a power cycle
- 1 Resets the sensor to factory settings and then performs a power cycle

i After resetting the sensor to factory settings, it is configured to DHCP.

8.4.1.3 Object 0x02 Message Router

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance attributes

This object does not provide any instances.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

8.4.1.4 Object 0x04 Assembly

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance attributes

Attribute ID	Name	Access	Description	Data type
1	Number of member	Get	Number of members in List	UINT
2	Member	Get	Member list	STRUCT [1]
3	Object Data	Get/Set	Current process data	Array of OCTET
4	Object Size	Get	Process data size in number of bytes	UINT

Attributes 1 and 2 are not available for configuration assembly instances.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value
0x18	Get Member	No	Yes	Get a member of instance attribute 2

1) More details for the data types STRUCT can be found in the THE CIP NETWORKS LIBRARY, Volume 1/2.

8.4.1.5 Object 0x06 Connection Manager

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

This object does not provide any instances.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value
0x54	Forward Open	No	Yes	Open new connection
0x4E	Forward Close	No	Yes	Close connection

8.4.1.6 Object 0x47 Device Level Ring DLR

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
1	Network Topology	Get	Current network topology	USINT
2	Network Status	Get	Current network status	USINT
10	Active Supervisor	Get	Active Supervisor Address	STRUCT [1]
12	Capability Flags	Get	DLR capability of the device	DWORD

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

8.4.1.7 Object 0x48 Quality of Service QoS

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
2	DSCP PTP Event	Get/Set	DSCP value for PTP Event frames	USINT
3	DSCP PTP General	Get/Set	DSCP value for PTP general frames	USINT
4	DSCP Urgent	Get/Set	DSCP value for implicit messages with urgent priority	USINT
5	DSCP Scheduled	Get/Set	DSCP value for implicit messages with scheduled priority	USINT
6	DSCP High	Get/Set	DSCP value for implicit messages with high priority	USINT
7	DSCP Low	Get/Set	DSCP value for implicit messages with low priority	USINT
8	DSCP Explicit	Get/Set	DSCP value for explicit messages	USINT

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

8.4.1.8 Object 0xF5 TCP/IP Interface

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
1	Status	Get	Interface status	DWORD
2	Configuration Capability	Get	Interface capability flags	DWORD
3	Configuration Control	Set	Interface control flags	DWORD
4	Physical Link Object	Get	Path to physical link object	STRUCT [1]
5	TCP/IP Interface Configuration	Get/Set	Interface Configuration (IP address, subnet mask, gateway address etc.)	STRUCT [1]

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

6	Host Name	Get/Set	The Host Name attribute contains the device’s host name, which can be used for informational purposes.	STRING
8	TTL Value	Get/Set	TTL value for EtherNet/IP multicast packets	USINT
9	Mcast Config	Get/Set	IP multicast address Configuration	STRUCT [1]
10	SelectAcd	Get/Set	Activates the use of ACD	BOOL
11	LastConflictDetected	Get/Set	Structure containing information related to the last conflict detected	STRUCT [1]
13	Encapsulation Inactivity Timeout	Get/Set	Number of seconds till TCP connection is closed on encapsulation inactivity	UINT
14	IANA Port Admin	Get	IANA port admin configuration	STRUCT [1]

Assign an IP address to the sensor via DHCP. Via attribute 3 of instance 1 of the TCP/IP class (0xF5 hex) you can choose between DHCP, BOOTP and static IP address.

Attribute 3 has the data type DWORD (bit string - 32 bits). The individual bits have the following meaning:

Bits	Name	Description
0-3	IP configuration	0 = The device uses a static IP address 1 = The device obtains its IP address via BOOTP 2 = The device obtains its IP address via DHCP 3-15 = Reserved
4	DNS Enable	If 1 (TRUE), the device shall resolve hostnames by querying a DNS server.
5-31	Reserved	Reserved, should be set to 0.

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

You can change the IP address and the network mask via attribute 5 of instance 1 of the TCP/IP class (0xF5).

Attribute 5 is a structure composed of the following data types:

Name	Data type	Description	Values
IP address	UDINT	IP address of the sensor	A value of 0 means that no IP address has been configured. Otherwise, the IP address should be set to a valid class A, B or C address. The IP address must not be set to the loopback address (127.0.0.1).
Network mask	UDINT	Network mask of the sensor	A value of 0 means that no network mask has been configured.
Gateway	UDINT	Gateway-IP address of the sensor	A value of 0 means that no IP address has been configured. Otherwise, the IP address should be set to a valid class A, B or C address. The IP address must not be set to the loopback address (127.0.0.1).
Name Server	UDINT	Primary Name Server	A value of 0 means that no name server address has been configured. The name server address should be a class A, B or C address.
Name Server 2	UDINT	Secondary Name Server	A value of 0 means that no name server address has been configured. The name server address should be a class A, B or C address.
Domain name	STRING	Standard domain name	The maximum length is 48 ASCII characters. The number of characterized must be filled up to an even number (length does not include fill characters). A length of 0 means that no domain name is configured.

Attribute 3 and attribute 5 are stored retentively in the sensor.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x01	Get Attribute All	No	Yes	Returns content of instance or class attributes
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

8.4.1.9 Object 0xF6 Ethernet Link

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
1	Interface Speed	Get	Interface speed currently in use	UDINT
2	Interface Flags	Get	Interface status flags	DWORD
3	Physical Address	Get	MAC layer address	ARRAY of USINT [1]
4	Interface Counters	Get	Interface specific counters	STRUCT [1]
5	Media Counters	Get	Media specific counters	STRUCT [1]
6	Interface Control	Get/Set	Configuration for physical interface	STRUCT [1]
7	Interface Type	Get	Type of interface: twisted pair, fiber	USINT
8	Interface State	Get	Current state of interface	USINT
9	Admin State	Get/Set	Administrative state:	USINT
10	Interface Label	Get	Human readable identification	SHORT STRING

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

11	Interface Capability	Get	Indication of capabilities of the interface			STRUCT [1]
768	MDIX	Get/Set	MDIX configuration Format: uint8_t, range [1 .. 3]			
			1	EIP_EN_INTF_MDIX_AUTO	Auto detect	USINT
			2	EIP_EN_INTF_MDIX_MDI	Explicit MDI	USINT
			3	EIP_EN_INTF_MDIX_MDIX	Explicit MDIX	USINT

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x01	Get Attribute All	No	Yes	Returns content of instance or class attributes
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

Class-specific services

Service Code	Name	Access		Description
		Class Level	Instance Level	
0x4C	Get and Clear	No	Yes	Retrieves attribute value and subsequently sets the attribute value to zero (only for attributes Interface-Counters and Media-Counters).

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

8.4.1.10 Object 0x43 Time Sync

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	ULINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
1	PTPEnable	Get/Set	PTP Enable	BOOL
2	IsSynchronized	Get	Local clock is synchronized with master	BOOL
3	SystemTimeMicroseconds	Get	Current value of system_time in microseconds	UINT
4	SystemTimeNanoseconds	Get	Current value of system_time in nanoseconds	ULINT
5	OffsetFromMaster	Get	Offset between local clock and master clock	LINT
6	MaxOffsetFromMaster	Get/Set	Maximum offset between local clock and master clock since last reset of this value.	ULINT
7	MeanPathDelayToMaster	Get	Mean path delay to master	LINT
8	GrandMasterClockInfo	Get	Grandmaster Clock Info	STRUCT [1]
9	ParentClockInfo	Get	Parent Clock Info	STRUCT [1]
10	LocalClockIno	Get	Local Clock Info	STRUCT [1]

1) More details for the data types `STRUCT` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

11	NumberOfPorts	Get	Number of ports	UINT
12	PortStateInfo	Get	Port state info	STRUCT [1]
13	PortEnableCfg	Get/Set	Port enable cfg	STRUCT [1]
14	PortLogAnnounceIntervalCfg	Get/Set	Port log announce interval cfg	STRUCT [1]
15	PortLogSyncIntervalCfg	Get/Set	Port log sync interval cfg	STRUCT [1]
18	DomainNumber	Get/Set	Domain number	USINT
19	ClockType	Get	Clock type	WORD
20	ManufactureIdentity	Get	Manufacture identity	USINT[4]
21	ProductDescription	Get	Product description	STRUCT [1]
22	RevisionData	Get	Revision data	STRUCT [1]
23	UserDescription	Get	User description	STRUCT [1]
24	PortProfileIdentityInfo	Get	Port profile identity info	STRUCT [1]
25	PortPhysicalAddressInfo	Get	Port physical address info	STRUCT [1]
26	PortProtocolAddressInfo	Get	Port protocol address info	STRUCT [1]
27	StepsRemoved	Get	Steps removed	UINT
28	SystemTimeAndOffset	Get	System time and offset	STRUCT [1]
29	AssociatedInterfaceObjects	Get	Objects associated with PTP ports	STRUCT [1]
768	SyncParameters	Get/Set [2]	Synchronization Parameters	

1) More details for the data types STRUCT can be found in the THE CIP NETWORKS LIBRARY, Volume 1.

2) The time sync parameter attribute (attribute 768) is not available through the GetAttributesList and SetAttributesList services.

Details to the object `Time Sync`, attribute 768 (0x300h):

Variable	Type	Value/Range	Description
Sync0Interval	UDINT	100.000 … 4.000.000 ns	Sync0 Interval in nanoseconds. This parameter specifies the interval of the Sync 0 signal in nanoseconds. The value 0 means the signal is deactivated. The starting point of the Sync0 signal is dependent on the Sync0 Offset (see parameter Sync0Offset).
Sync0Offset	UDINT	smaller than ulSync0Interval Default: 0	Sync 0 Offset in nanoseconds. This parameter specifies the offset for the Sync 0 signal relative to the system time (time of the Sync Master).
Sync1Interval	UDINT	0,10000 … 999999999 Default: 0	Sync1 Interval in nanoseconds. This parameter specifies the interval of the Sync 1 signal in nanoseconds. The value 0 means the signal is deactivated. The starting point of the Sync1 signal is dependent on the Sync1 Offset (see parameter ulSync1Offset).
Sync1Offset	UDINT	smaller than ulSync1Interval Default: 0	Sync 1 Offset in nanoseconds. This parameter specifies the offset for the Sync 1 signal relative to the system time (time of the Sync Master).
PulseLength	UDINT	1 … 500 and smaller than the minimum of the values Sync0Interval and Sync1Interval, when converted to microseconds. Default value: 4 µs	Pulse length of the Sync0 and Sync1 signals in microseconds

The sensors work exclusively with the Sync0 signal. The Sync1 signal is not used.

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x03	Get Attributes List All	No	Yes	The Get_Attribute_List service returns the contents of the selected attributes of the specified object class or instance
0x04	Set Attributes List	No	Yes	The Set_Attribute_List service sets the contents of selected attributes of the specified object class or instance
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

8.4.1.11 Object 0x109 LLDP Management

Class Attributes

Attribute ID	Name	Access	Description	Data type
1	Revision	Get	Revision of this object	UINT
2	Max. Instance	Get	Maximum instance number of an object currently created in this class level of the device	UINT
3	Number of Instances	Get	The number of instances currently created in this class	UINT
6	Maximum ID Number Class Attributes	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	UINT
7	Maximum ID Number Instance Attributes	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	UINT

Instance Attributes

Attribute ID	Name	Access	Description	Data type
1	LLDP Enable	Get/Set	Enables/Disables LLDP global or per port.	STRUCT [1]
2	msgTxInterval	Get/Set	From 802.1AB-2016. The interval in seconds for transmitting LLDP frames from this device.	UINT
3	msgTxHold	Get/Set	From 802.1AB-2016. A multiplier of msgTxInterval to determine the value of the TTL TLV sent to neighboring devices.	USINT
4	LLDP Datastore	Get	An indication of the retrieval methods for the LLDP database supported by the device.	WORD
5	Last Change	Get/Set	A counter in seconds from the last time any entry in the local LLDP database changed or power up.	UDINT

1) More details for the data types `STRUCT of` can be found in the `THE CIP NETWORKS LIBRARY, Volume 2.`

Services

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	No	Yes	Modify attribute value

8.4.2 Manufacturer Specific Objects

The manufacturer-specific objects do not have any instances. They exclusively support the services
- Get Attribute Single and
- Set Attribute Single.

Service Code	Name	Access		Description
		Class level	Instance level	
0x0E	Get Attribute Single	Yes	Yes	Retrieve attribute value
0x10	Set Attribute Single	Yes	Yes	Modify attribute value

Specify the following when addressing:
- Class ID,
- Attribute ID and
- Service Code.

For the Instance ID you can use any value, because it is not checked by the sensor.

8.4.2.1 Object 0x64 Sensor Information

Class Attributes

Attribute ID	Name	Access		Data type
0	Hardwa60re version	Get		STRING(32)
1	Software version	Get		STRING(32)
2	Measurement range	Get		FLOAT
3	Option	Get		STRING(32)

8.4.2.2 Object 0x70 Data Acquisition

Class Attributes

Attribute ID	Name	Access	Description	Data type
0	Laser power	Get/Set	Switch laser on and off 0 - Off 2 – Reduced 1 - Full	USINT
20	Measuring task	Get/Set	Measurement task, object properties 0 - Standard 2 - Penetration 1 - Multisurface	USINT
22	Measuring rate	Get/Set	Free measuring rate; 250 ... 10,000 Hz; Max. bus cycle 1 kHz, max. oversampling 8	REAL
29	Start of range	Get/Set	Start of evaluation range	UINT
30	End of range	Get/Set	End of evaluation range	UINT
39	Shutter mode	Get/Set	Exposure mode, automatic or manual 0 - Manual 1 - Automatic	USINT
40	Shutter time in us	Get/Set	Exposure time for manual mode; 1 ... 4,000 µs	REAL
41	Exposure mode	Get/Set	Automatic exposure selection 0 - Standard 2 - Background 1 - Intelligent	USINT
49	Peak selection	Get/Set	Peak selection video signal for distance calculation 0 - Highest peak 2 - Last peak 1 - Widest peak 3 - First peak	USINT
59	Error handling type	Get/Set	Behavior of digital output in case of error 0 - None 2 - Infinite 1 - Value	USINT
60	Error handling values	Get/Set	Hold value for 1 ... 1,024 measuring cycles	UDINT

8.4.2.3 Object 0x80 Signal Processing

Class Attributes

Attribute ID	Name		Access	Description		Data type
0	Average 1 type	Workflow average: - Select the averaging type (Average 1 or 2 type) - Define the averaging depth (Average 1 or 2 number of values for ...)	Get/Set	Average type 0 - None 1 - Median	 2 - Moving 3 - Recursive	USINT
1	Average 1 number of values for moving average		Get/Set	Number of values over which the average is taken 2 - 2 4 - 4 8 - 8	 16 - 16 ... 4096 - 4096	UDINT
2	Average 1 number of values for median		Get/Set	3 - 3 5 - 5	7 - 7 9 - 9	UDINT
3	Average 1 number of values for recursive		Get/Set	2 - 2 3 - 3 4 - 4	5 - 5 ... 32000 - 32000	UDINT
10	Average 2 type		Get/Set	Average type 0 - None 1 - Median	 2 - Moving 3 - Recursive	USINT
11	Average 2 number of values for moving average		Get/Set	Number of values over which the average is taken 2 - 2 4 - 4 8 - 8	 16 - 16 ... 4096 - 4096	UDINT
12	Average 2 number of values for median		Get/Set	3 - 3 5 - 5	7 - 7 9 - 9	UDINT
13	Average 2 number of values for recursive		Get/Set	2 - 2 3 - 3 4 - 4	5 - 5 ... 32000 - 32000	UDINT
203	Mastering set/reset		Get/Set	Perform zeroing or mastering or terminate 0 - Reset	 1 - Set	BOOL
204	Mastering value		Get/Set	Specify the thickness of a master object. Value range -2 to +2 x measuring range		REAL

8.4.2.4 Object 0x90 Settings

Class Attributes

Attribute ID	Name	Access	Description	Data type
0	Key lock	Get/Set	Key lock Select button	USINT
1	Key lock countdown [min]	Get/Set	For Auto function : after expiration, key lock sets; 1 ... 60 min	USINT
10	Current access authorization	Get	User level query 1 - User 3 - Professional	USINT
11	Login	Set	Password for a change to the Professional level	STRING(32)
12	Logout	Get/Set	Change to `User` level 0 - No 1 - Yes	BOOL
13	User level when restarting	Get/Set	Setting the user level after a restart of the sensor 1 - User 2 - Professional	USINT
14	Change password old	Set	Create and change password for the `Professional` level	STRING(32)
15	Change password new	Set		STRING(32)
16	Change password repeat	Set		STRING(32)
20	Reset to factory measurement settings	Set	Reset measurement settings 0 - False 1 - True	BOOL
21	Reset to factory device settings	Set	Reset device settings 0 - False 1 - True	BOOL
23	Reset to factory all settings	Set	Reset all 0 - False 1 - True	BOOL
24	Reboot sensor	Set	Reboot sensor 0 - False 1 - True	BOOL
40	Device settings load	Set	Loads the saved device settings from the sensor 0 - False 1 - True	BOOL

Class Attributes 0x90 (Settings)

Attribute ID	Name	Access	Description	Data type
41	Device settings save	Set	Saves the current device settings in the sensor 0 - False 1 - True	BOOL
60	Preset settings mode	Get/Set	Returns the currently used preset mode (signal quality); with <Parameter> the preset mode (signal quality) to be used is set. 0 - None 3 - Dynamic 1 - Static 4 - No averaging 2 - Balanced	USINT
61	Preset settings list	Get	Lists all existing manufacturer-specific programs.	STRING(230)
62	Preset settings read	Set	Loads and executes a preset <Name> for use in the sensor.	STRING(32)
80	Measurement settings current	Get	Contains the currently used user program (setup) in the `String` field.	STRING(32)
81	Measurement settings read	Set	Read loads a measuring program and activates it, enter the setup name in the `String` field and confirm with `OK`.	STRING(32)
82	Measurement settings store	Set	Store saves a measuring program, enter the setup name in the `String` field and confirm with `OK`.	STRING(32)
83	Measurement settings delete	Set	Enter setup name in the `String` field and confirm with `OK`	STRING(32)
84	Measurement settings initial	Get/Set	Displays the user program to be loaded when the sensor is started.	STRING(32)
85	Measurement settings list	Get	Displays the names of the user programs (setups).	STRING(230)

8.4.2.5 Object 0xC0 Mappings

Class Attributes

Attribute ID	Name	Access	Data type	Initial value
0	Reset mapping	Set	USINT	1
1	Size	Get	UINT	36
2	Oversampling	Get/Set	USINT	1
10	Frequency + shutter	Get/Set	USINT	1
11	Frame time stamp	Get/Set	USINT	1
12	Frame counter	Get/Set	USINT	1
13	Frame status	Get/Set	USINT	1
14	Not linearized center of gravity (Unlin) + intensity + linearized center of gravity (Lin)	Get/Set	USINT	1
15	Peak 1 distance	Get/Set	USINT	1

For more information, refer to the I/O Connection section, see Chap. 8.5.4.

8.4.2.6 Object 0xC1 Process Data

Class Attributes

Attribute ID	Name	Access	Description	Data type
0	out_shutter	Get	Exposure time	UDINT
1	out_frequency	Get	Measurement frequency	UDINT
2	out_frametimestamp	Get	Time stamp	UDINT
3	out_framecounter	Get	Measured value counter	UDINT
4	out_framestatus	Get	Sensor state	UDINT
5	out_01_md_unlin	Get	Unlinearized center of gravity	UDINT
6	out_01_md_intensity	Get	Intensity	UDINT
7	out_01_md_lin	Get	Linearized center of gravity	UDINT
8	out_01_peak1_distance	Get	Distance	UDINT

8.5 Implicit Messaging

8.5.1 General

Via implicit messaging, the ILD1900-IE with EtherNet/IP cyclically sends input data to the EtherNet/IP scanner. To run implicit messaging, it is necessary to open an I/O connection. I/O connections contain so-called assemblies. An assembly contains one or more parameters that specify the structure of the process data.

There are three different types of I/O connections
- Input Only: The I/O connection contains only input process data
- Listen Only: The I/O connection contains only input process data
- Exclusive Owner: The I/O connection contains input and output process data

An I/O connection of the type Listen Only can only be established if an I/O connection of the type Input Only has already been established with the same assemblies. Thus, multiple participants can receive input process data from an adapter according to the producer/consumer model.

Since the ILD1900-IE with EtherNet/IP only has input process data, the ILD1900-IE with EtherNet/IP has no I/O connections of the Exclusive Owner type.

An I/O connection can contain up to 4 different assemblies. A basic distinction is made between input, output and configuration assemblies. While input and output assemblies are intended for permanent cyclic process data exchange, the data of a configuration assembly is sent once when the I/O connection is established.

- Input assembly: Cyclic process data, adapter > scanner
- Output assembly: Cyclic process data, scanner > adapter
- Input configuration assembly: One-time data when setting up the connection, adapter > scanner
- Output configuration assembly: one-time data when setting up the connection, scanner > adapter

The ILD1900-IE with EtherNet/IP provides four different I/O connections:

Name	Size of the input assembly in bytes	Type
Fixed OV1 Input Only	36	Input Only
Fixed OV1 Listen Only	36	Listen Only
Mappable Input Only	0 - 288	Input Only
Mappable Listen Only	0 - 288	Listen Only

8.5.2 I/O-Connection Fixed OV1 Input Only

This I/O connection has only one input assembly with a fixed size of 36 bytes. All input process data available in the sensor are transmitted with an oversampling of 1. The I/O connection does not include output or configuration assemblies. The process data is structured as follows:

Bytes	Measurement value name	Description
0 - 3	out_shutter	Exposure time
4 – 7	out_frequency	Measurement frequency
8 - 11	out_frametimestamp	Time stamp
12 - 15	out_framecounter	Measured value counter
16 - 19	out_framestatus	Sensor state
20 - 23	out_01_md_unlin	Unlinearized center of gravity
24 - 27	out_md_intensity	Intensity
28 - 31	out_01_md_lin	Linearized center of gravity
32 - 35	out_01_peak1_distance	Distance

8.5.3 I/O-Connection Fixed OV1 Listen Only

This I/O connection corresponds to the structure of the input process data of the I/O connection Fixed OV1 Input Only. The difference is that you can only use this I/O connection if the Fixed OV1 Input Only I/O connection already exists.

8.5.4 I/O Connection Mappable Input Only

The I/O connection contains an input assembly and an input configuration assembly. The input assembly has a variable size that depends on the mapped input process data. Unlike Fixed OV1 Input Only, you can configure the contents of the input assembly individually. This approach is called mapping.

You have two options to configure the mapping:
- Configuration assembly of the I/O connection or
- Mapping Object 0xC0.

The configuration assembly is structured as follows:

<table>
<tr><th>Byte</th><th>Name</th><th>Default</th><th>Min</th><th>Max</th><th>Description</th><th>Process data size in byte</th></tr>
<tr><td>0</td><td>Activation</td><td>0</td><td>0</td><td>1</td><td>If you set this value to 0, the sensor will ignore the data in the configuration assembly and use the last configured mapping in the mapping object 0xC0 instead. If you set this value to 1, the sensor will overwrite the mapping in the mapping object 0xC0 based on the transmitted data of the configuration assembly and use this configuration.</td><td></td></tr>
<tr><td>1</td><td>Oversampling</td><td>1</td><td>1</td><td>8</td><td>Select an oversampling factor between 1 and 8. The process data size is then derived from the mapping multiplied by the oversampling factor.</td><td></td></tr>
<tr><td>2</td><td>Frequency + shutter</td><td>1</td><td>0</td><td>1</td><td rowspan="6">1 = Process data are mapped
0 = Process data are not mapped</td><td>8</td></tr>
<tr><td>3</td><td>Frame time stamp</td><td>1</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>4</td><td>Frame counter</td><td>1</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>5</td><td>Frame status</td><td>1</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td>6</td><td>Unlin + Intensity + Lin</td><td>1</td><td>0</td><td>1</td><td>12</td></tr>
<tr><td>7</td><td>Peak 1 distance</td><td>1</td><td>0</td><td>1</td><td>4</td></tr>
</table>

Provided that your PLC software supports this, the values for the configuration assembly can be stored permanently in your PLC project, so that the mapping is transmitted anew at each commissioning.

If you configure the mapping via the configuration assembly, you have to adjust the size of the input assembly accordingly. The size of the input assembly is calculated as follows:

Input assembly size = (mapping size 0 + mapping size 1 + ... + mapping size n) * oversampling

Example: Frequency + Shutter and Frametimestamp are mapped with an oversampling of 2.

Byte	Name	Configured value	Process data size
0	Activation	1	
1	Oversampling	2	
2	Frequency + Shutter	1	8
3	Frame time stamp	1	4
4	Frame counter	0	4
5	Frame status	0	4
6	Unlin + Intensity + Lin	0	12
7	Peak 1 distance	0	4

Size of the input assembly = (8 byte + 4 byte) * 2 = 24 byte

As an alternative to the configuration assembly, you can configure the mapping via the mapping object 0xC0. In this Object you will find the same mappings as well as the oversampling.

The attributes of the mapping object are structured as follows:

Attribute	Name	Description	Standard value
0	Reset mapping	Resets the mapping object to the default configuration when a 1 is written. See the Default Value column.	
1	Size	Returns the size of the input assembly based on the currently configured mapping. By reading this attribute, you do not have to calculate the size yourself.	36
2	Oversampling		
10	Frequency + shutter	1 = Process data are mapped 0 = Process data are not mapped	1
11	Frame time stamp		1
12	Frame counter		1
13	Frame status		1
14	Unlin + Intensity + Lin		1
15	Peak 1 distance		1

Example: Frequency + Shutter, Frame counter and Peak 1 distance are mapped with an oversampling of 3.

Attribute	Name	Configured value	Process data size
0	Reset mapping	0	
1	Size		48
2	Oversampling	3	
10	Frequency + Shutter	1	8
11	Frame time stamp	0	4
12	Frame counter	1	4
13	Frame status	0	4
14	Unlin + Intensity + Lin	0	12
15	Peak 1 distance	1	4

Size of `Size` = (8 bytes + 4 bytes + 4 bytes) * 3 = 48 bytes

i Remember to set the byte 0 `Activation` in the Configuration Assembly to `0` when configuring the mapping via class 0xC0. Otherwise, your configuration will be overwritten by the configuration assembly when the I/O connection is established.

8.5.5 I/O Connection Mappable Listen Only

This I/O connection corresponds to the structure of the input process data of the I/O connection Mappable Input Only. The difference is that you can only use this I/O connection if the Mappable Input Only I/O connection already exists.

8.6 Device description file EDS

You must integrate the EDS file (Electronic Data Sheet) associated with the device into your PLC software in order to operate the ILD1900 EtherNet/IP. Each device is uniquely identified by the vendor ID, product code, and major and minor revision. You can find this information in your `*.eds` file. Make sure that the *.eds file matches the revision of your device.

You can read the revision from the device via attribute 4 of instance 1 of the Identity object (0x01).

8.7 Oversampling

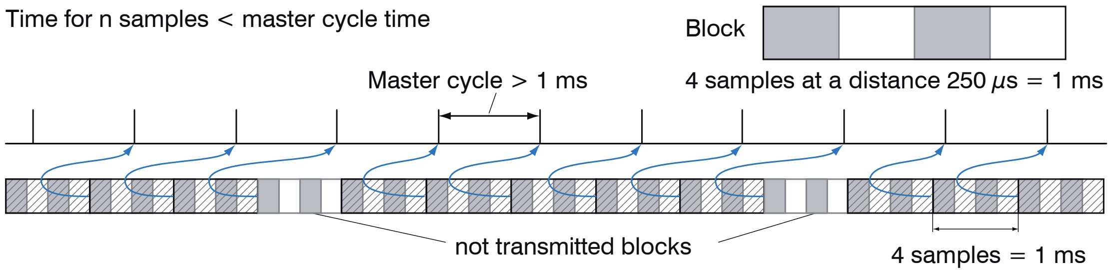
With the ILD1900-IE with EtherNet/IP the oversampling is set globally via the Configuration Assembly or via the mapping object 0xC0. The ILD1900-IE with EtherNet/IP supports an oversampling of up to 8.

In operation without oversampling, the last accumulated measured value data set is transferred to the EtherNet/IP adapter with each fieldbus cycle. Therefore, for long fieldbus cycle periods data records with measured values are possibly not available. Configurable oversampling ensures that all (or selected) measured value data records are gathered and transmitted together to the adapter during the next fieldbus cycle. In general, a possible oversampling depends on the ratio of sensor measuring rate to fieldbus cycle time.

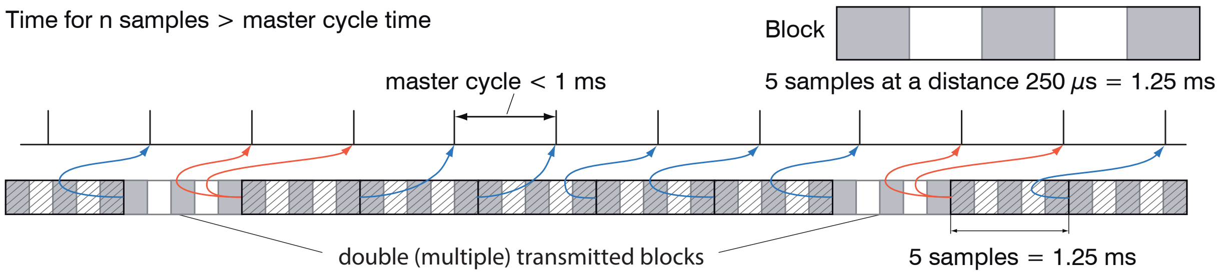
The oversampling factor specifies how many samples per bus cycle are transmitted. Currently the ILD1900-IE supports oversampling of 1, 2, 3, 4, 5, 6, 7 and 8. For example, an oversampling factor of 2 means that 2 samples are transferred per bus cycle.

To ensure that no samples are lost due to the asynchronous nature between the master cycle and slave cycle, the master cycle time should always be less than the time for building a block from n samples.

An entire block with the specified samples is only made available to the adapter side after all specified samples have been written to the block. If the time for filling a block is less than the master cycle time, individual blocks are not transferred. It can indeed happen that the next block is already being filled with samples before the previously filled block is picked up in a master cycle.



But if you select a number of samples sufficiently large so that the time for filling a block is greater than the master cycle time, each block will be picked up in a master cycle. Individual blocks (and therefore samples), however, will be transferred two or more times. This can be detected on the adapter side by transferring the timestamp or value counter.



8.8 IP Address Sensor Unknown

If you do not know the IP address of the sensor because your DHCP/BOOTP server does not display the address or because you have forgotten the static IP address, you can still find the sensor via a CIP List Identity Request. A CIP List Identity Request is sent as a broadcast via UPD or TCP.

The sensor will then reply as a unicast on its IP address. Check to what extent your PLC software supports the List Identity Request. A tool that also supports the List Identity Request is e.g. the EtherNet/IP tool from Molex.

8.9 IP Configuration

The sensor is delivered in DHCP mode. You need a DHCP server to assign an IP address to the sensor. Implicit and explicit messaging is only possible if the sensor has a valid IP address.

8.10 Synchronization of Sensors

8.10.1 General

Measuring with the Sync0 frequency of the PLC instead of the internal measuring rate

A sensor works with the internal measuring rate. Furthermore, you can let the sensor measure with the Sync0 frequency from the Time Sync object to reduce jitter.

Procedure:

- Use the object 0x43 Time Sync.
- Set the instance attribute 1 (PTPEnable, 0x1h) to 1 (=enabled).
- Set the values for the instance attribute 768 (SyncParameters, 0x300h).

i Note that the sensor only works with the `Sync0 signal` works. The `Sync1 signal` is not used. You can therefore set `Sync1Interval` and `Sync1Offset` to `0`. For the pulse length we recommend to keep the default value of 4 μs.

If PTPEnable is set to 0 (disabled), then you must set PTPEnable to 1 (enabled) either before or after configuring the SyncParameter attribute.

If you want to measure with the internal measuring rate in the sensor instead of the Sync0 frequency, you must either set the attribute PTPEnable to 0 (Disabled) or the Sync0 frequency in the attribute SyncParameters to 0.

8.10.2 Simultaneous Synchronization

All sensors measure at the same time.

Example: The sensors should measure with a measuring rate of 2 kHz.

Procedure:

- Set the instance attribute 1 (PTPEnable, 0x1h) to 1 (=enabled) via Set Attribute Single service (0x10).
- Set the values for the instance attribute 768 (SyncParameters, 0x300h) in all sensors via Set Attribute Single service (0x10).

Variable	Type	Value/Range
Sync0Interval	UDINT	500.000 ns
Sync0Offset	UDINT	0 ns
PulseLength	UDINT	Default value: 4 µs

9. Cleaning

We recommend cleaning the protective glass at regular intervals.

Dry Cleaning

This can be accomplished with an anti-static lens brush or by blowing off the windows with dehumidified, clean, oil-free compressed air.

Wet Cleaning

Use a clean, soft, lint-free cloth or lens cleaning paper and pure alcohol (isopropyl alcohol) to clean the protective glass pane.

Never use commercially available glass cleaner or other cleaning agents.

10. Disclaimer

All components of the device have been checked and tested for functionality in the factory. However, should any defects occur despite careful quality control, these shall be reported immediately to MICRO-EPSILON or to your distributor/retailer.

MICRO-EPSILON undertakes no liability whatsoever for damage, loss or costs caused by or related in any way to the product, in particular consequential damage, e.g., due to

- non-observance of these instructions/this manual,
- improper use or improper handling (in particular due to improper installation, commissioning, operation and maintenance) of the product,
- repairs or modifications by third parties,
- the use of force or other handling by unqualified persons.

This limitation of liability also applies to defects resulting from normal wear and tear (e.g., to wearing parts) and in the event of non-compliance with the specified maintenance intervals (if applicable).

MICRO-EPSILON is exclusively responsible for repairs. It is not permitted to make unauthorized structural and / or technical modifications or alterations to the product. In the interest of further development, MICRO-EPSILON reserves the right to modify the design.

In addition, the General Terms of Business of MICRO-EPSILON shall apply, which can be accessed under Legal details | Micro-Epsilon https://www.micro-epsilon.com/impressum/. For translations into other languages, the German version shall prevail.

11. Service, Repair

If the sensor or sensor cable is defective:

- If possible, save the current sensor settings in a parameter set, see Chap. 7.7.3, to reload them into the sensor after the repair.
- Please send us the affected parts for repair or exchange.

If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

MICRO-EPSILON Optronic GmbH
Lessingstraße 14

01465 Langebrück / Deutschland

Tel. +49 (0) 35201 / 729-0
Fax +49 (0) 35201 / 729-90
optronic@micro-epsilon.de
www.micro-epsilon.de

12. Decommissioning, Disposal

In order to avoid the release of environmentally harmful substances and to ensure the reuse of valuable raw materials, we draw your attention to the following regulations and obligations:

- Remove all cables from the sensor and/or controller.
- Dispose of the sensor and/or the controller, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.
- You are obliged to comply with all relevant national laws and regulations

For Germany / the EU, the following (disposal) instructions apply in particular:

- Waste equipment marked with a crossed garbage can must not be disposed of with normal industrial waste (e.g. residual waste can or the yellow recycling bin) and must be disposed of separately. This avoids hazards to the environment due to incorrect disposal and ensures proper recycling of the old appliances.

- A list of national laws and contacts in the EU member states can be found at https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en. Here you can inform yourself about the respective national collection and return points.
- Old devices can also be returned for disposal to MICRO-EPSILON at the address given in the imprint at https://www.micro-epsilon.de/impressum/.
- We would like to point out that you are responsible for deleting the measurement-specific and personal data on the old devices to be disposed of.
- Under the registration number WEEE-Reg.-Nr. DE28605721, we are registered at the foundation Elektro-Altgeräte Register, Nordostpark 72, 90411 Nuremberg, as a manufacturer of electrical and/or electronic equipment.

Appendix

A 1 Optional Accessories

PS2020		Power supply for DIN rail installation, input 230 VAC, output 24 VDC/2.5 A
PC1900-IE-*x*/RJ45		Interfaces and supply cable Length x = 3, 6 or 9 m 12-pin round socket and RJ45 plug for fieldbus connection
PC1900-IE-*x*/OE-RJ45		Power and output cable, Length x = 3, 6 or 9 m 12-pin round socket, RJ45 plug for fieldbus connection or open ends for supply and laser activation

A 2 Factory Settings

Measurement averaging	Median, 9 values
Peak selection	Highest peak

Measuring rate	4 kHz
Language	German

Measuring range	100 % FSO: digital 163768 0 % FSO: digital 98232

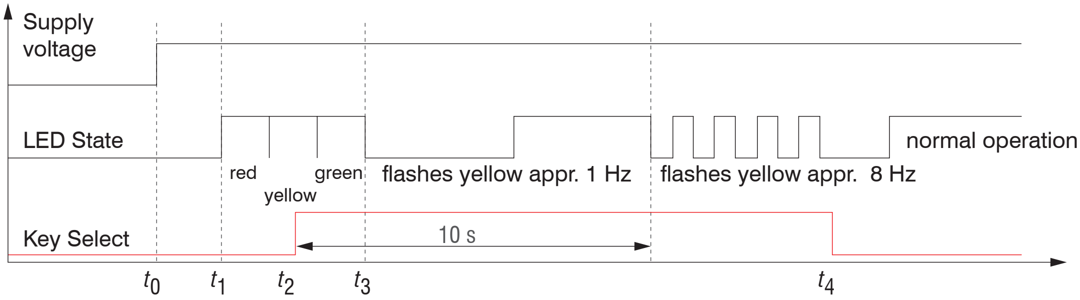


Fig. 32 Flowchart for starting a sensor with factory settings

t_0: Supply voltage is applied

t_1 ... t_3: both LEDs indicate the start sequence (red-yellow-green each for 1 sec.)

t_2: `Select` button is pushed during the start sequence (t_1 ... t_3)

t_4: `Select` button is released while the `State` LED is flashing yellow
$\Delta t = t_4 - t_2$; Δt (key stroke duration) must be at least 10 sec., max. 15 sec.

Reset to factory setting: Press the `Select` key after having switched on the sensor while the two LEDs light up „red - yellow - green“. Hold the key pressed. After 10 seconds, the Status LED starts flashing quickly. If you release the key while it flashes quickly, the sensor is reset to factory settings. If you hold the key pressed for longer than 15 seconds, the sensor is not reset to factory settings. If the `Select` key is kept pressed when switching on the sensor (or with a reset), the sensor switches to the Bootloader mode.

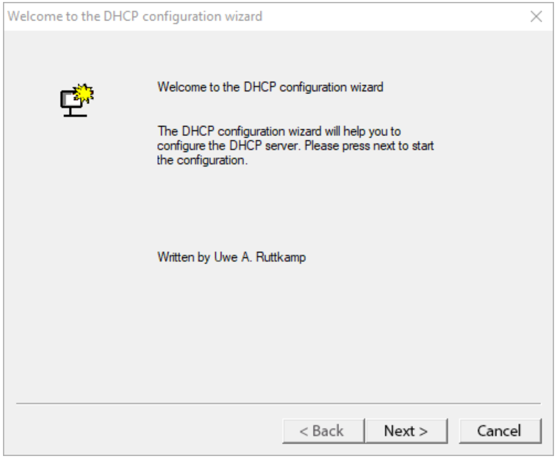
A 3 DHCP Server, IP Assignment

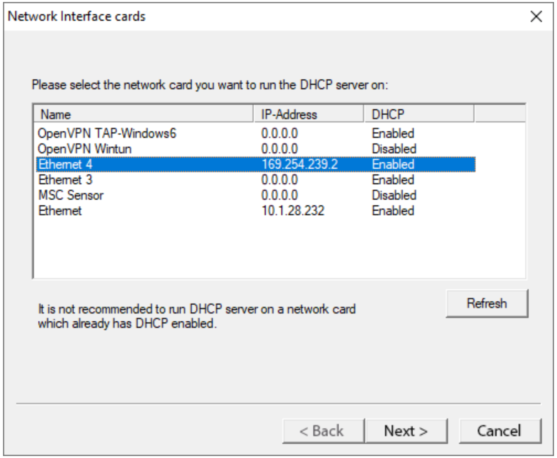
An ILD1900-IE with EtherNet/IP is delivered in DHCP mode. A DHCP server is required, to assign an IP address to the sensor.

The following steps show an example of an address assignment. The freeware is included in the `DHCP Server V2.5.2` package. A free download is available at the following address: https://www.dhcpserver.de/cms/download/.

i You need admin rights to run this program.
Start this program from a local hard disk only.

- Connect the sensor to your PC/notebook.
- Start the program `dhcpwiz.exe`.

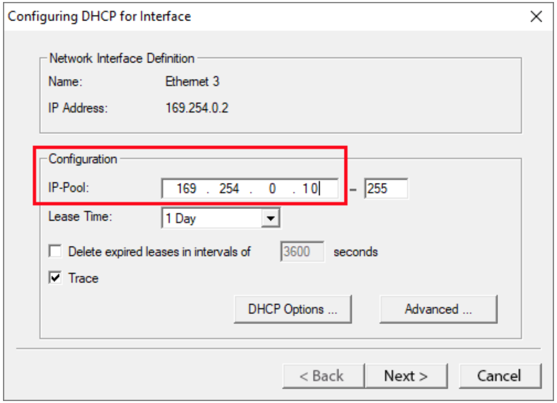




The wizard lists all available network connections.

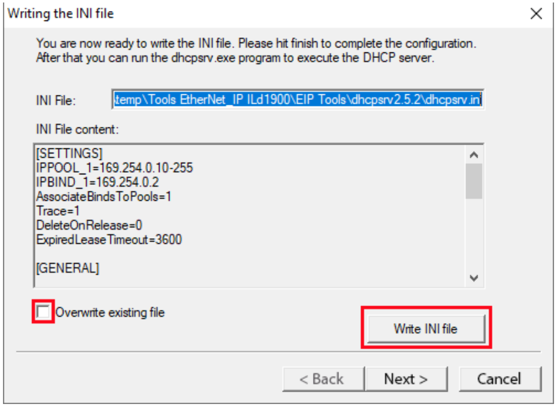
- Select the network port to which your sensor is connected. Confirm with Next.

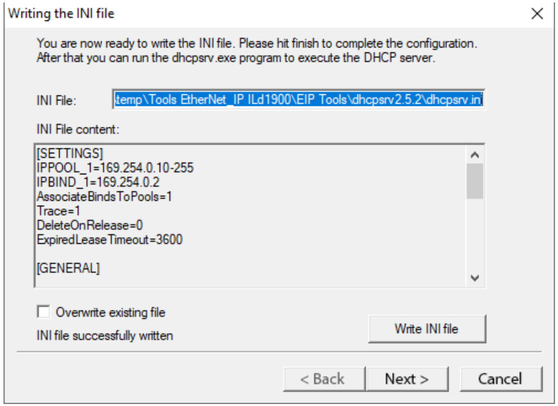
You can skip the following query about the supported protocols without specifying anything.



Define the possible range for the IP addresses in the `Configuration` field.

A client is assigned an IP address from this range.

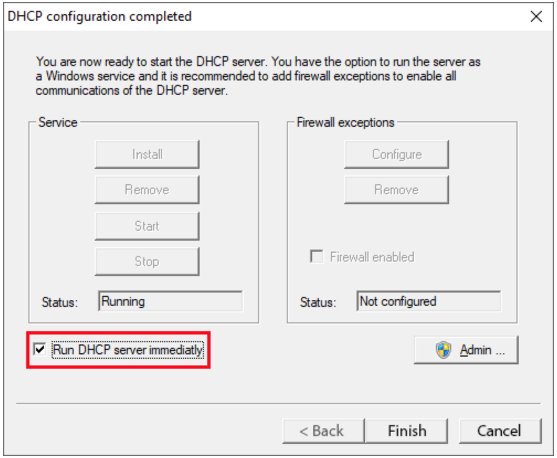


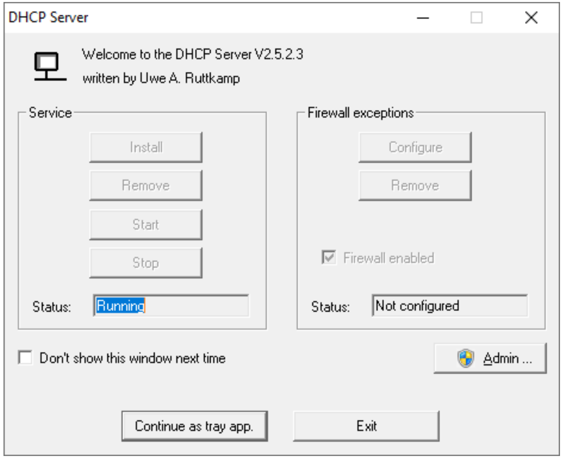


Select the `Overwrite existing file` field and click `Write INI file`.

➡ Disconnect the power supply to the sensor; then reconnect the sensor to the power supply. This will force the sensor to restart.

According to this example, the connected sensor is available under the IP address 169.254.0.10.





➡ Click the Finish button to exit the wizard.

If you select the option `Run DHCP server immediately`, the `DHCP server` (dhcpsrv.exe) starts automatically. The field `Status` reports a successful configuration with the entry `Running`.

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