



Operating Instructions  
**optoNCDT ILR2250**

ILR2250-100  
ILR2250-100-IO

Laser distance measuring device  
Non-contact laser-optic distance sensor

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## 1. Safety

System operation assumes knowledge of the operating instructions.

### 1.1 Symbols Used

The following symbols are used in these operating instructions:



Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



Indicates a situation that may result in property damage if not avoided.



Indicates a user action.



Indicates a tip for users.

Measurement

Indicates hardware or a software button/menu.

### 1.2 Warnings



Connect the power supply according to the safety regulations for electrical equipment.

- > Risk of injury
- > Damage to or destruction of the sensor



Avoid shocks and impacts to the sensor.

- > Damage to or destruction of the sensor

The supply voltage must not exceed the specified limits.

- > 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

Protect the cables against damage.

- > Damage to or destruction of the sensor
- > Failure of the measuring device

Do not operate the sensor if optical components are steamed up or dirty.

- > Failure of the measuring device

Do not touch the lenses or protective windows. Remove any fingerprints immediately using pure alcohol and a clean cotton cloth without leaving any streaks.

- > Damage to or destruction of the sensor
- > Failure of the measuring device

### 1.3 Notes on CE Marking

The following apply to the optoNCDT ILR 2250:

- 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 and laboratory applications. The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, Article 10.

### 1.4 Intended Use

- The optoNCDT ILR2250 is designed for use in industrial and laboratory applications. It is used for
  - Distance, displacement and position measurement
  - Monitoring quality and checking dimensions
- The system must only be operated within the limits specified in the technical data, [see Chap. 3.4](#).
- The system must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the system.
- Take additional precautions for safety and damage prevention in case of safety-related applications.

### 1.5 Proper Environment

- Protection class: IP65 (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: -10 ... +50 °C
  - Storage: -20 ... +70 °C
- Humidity: 5–95% (non-condensing)
- Ambient pressure: Atmospheric pressure

## 2. Laser Safety

The optoNCDT ILR2250 works with a semi-conductor laser at a wavelength of 655 nm (visible/red).

The sensors fall within laser class 2. The laser is pulsed; the maximum optical power is  $\leq 1$  mW. The pulse frequency depends on the measuring rate set (1 ... 20 Hz). The pulse duration of the peaks is controlled depending on the measuring rate and the reflectivity of the measuring object and can be 0.2 ... 0.8 ns.



Laser radiation. Close your eyes, or immediately turn away if the laser beam hits the eye. Eyes could become irritated or damaged.

**i** Observe the laser regulations!

When operating the sensors, the relevant regulations in accordance with DIN EN 60825-1 (VDE 0837, Part 1, dated 07/2015) and the accident prevention regulation on laser radiation (DGUV 12 [regulation of the Employers' Liability Insurance] dated 04/2007) valid in Germany must be observed. The following apply accordingly:

- With class 2 laser devices, the eye is not endangered by random, brief exposure to laser radiation, i.e. exposure times of up to 0.25 s.
- Class 2 laser devices may therefore be used without further protective measures if you do not intentionally look into the laser beam or into specular-reflected radiation for more than 0.25 s.
- Because the presence of the eyelid protective reflex should not normally be assumed, one should deliberately close the eyes or turn away immediately if the laser beam hits the eye.

Class 2 laser devices are not subject to reporting and a laser protection officer is not required.

The warning sign below is attached to the sensor housing (front):



Fig. 1 Laser warning and laser information sign, optoNCDT ILR2250-100, IEC

The German laser information sign is enclosed, along with an additional international laser information sign.

**i** If both information signs are covered over when the unit is installed, the user must ensure that supplementary information signs are attached at the installation location.

Operation of the laser is indicated visually by the LED on the sensor, [see Chap. 5.3](#).

The optoNCDT ILR2250 housings may only be opened by the manufacturer, [see Chap. 11](#).

### 3. Functional Principle, Technical Data

#### 3.1 Short Description

The optoNCDT ILR2250 is a laser distance measuring device that precisely measures distances in the range of 0.05 m to 150 m without contact. The measurement target can be clearly identified by the red laser measuring point. The maximum range depends on the reflectivity and surface properties of the target.

The device works on the basis of phase comparison measurement. High-frequency modulated laser light is emitted in the process. The light diffusely reflected and phase-shifted by the measuring object is compared with the reference signal. The magnitude of the phase displacement makes it possible to determine the distance to the nearest millimeter.

The distance measurement can be started in various ways:

- A command can be sent by a PC or another control unit via a serial RS422 interface
- External triggering
- Using the autostart function

#### 3.2 Measuring Principle

Light in the visible wavelength range is modulated with suitably chosen frequencies such that the exact distance can be derived from the multiple of the relevant modulation wavelength contained in the distance to be measured and from the size of the remaining interval. The remaining interval is measured using analog phase comparison methods. Several modulation waves are used to determine the distance.

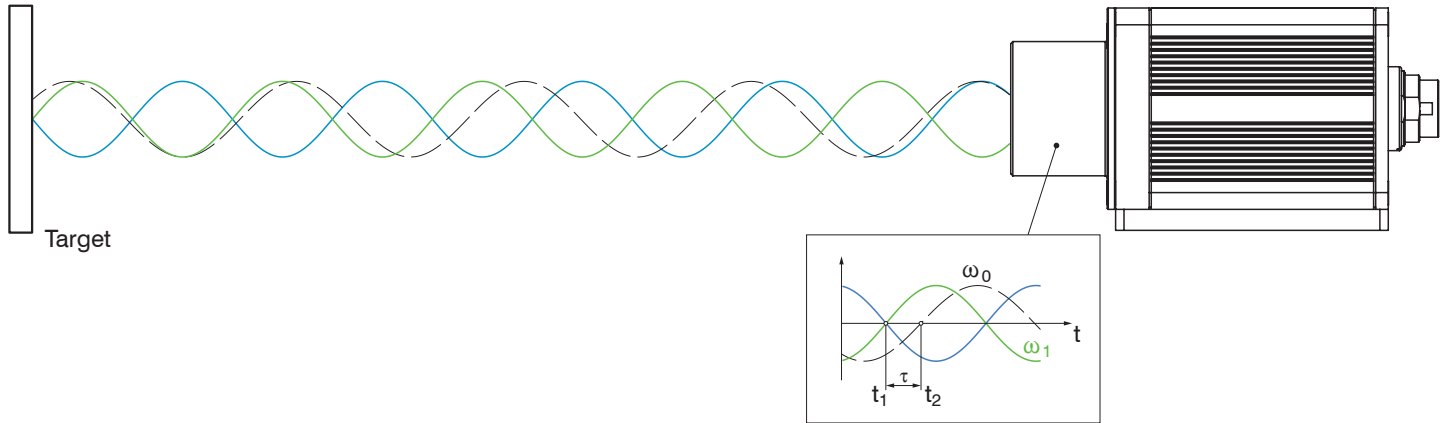
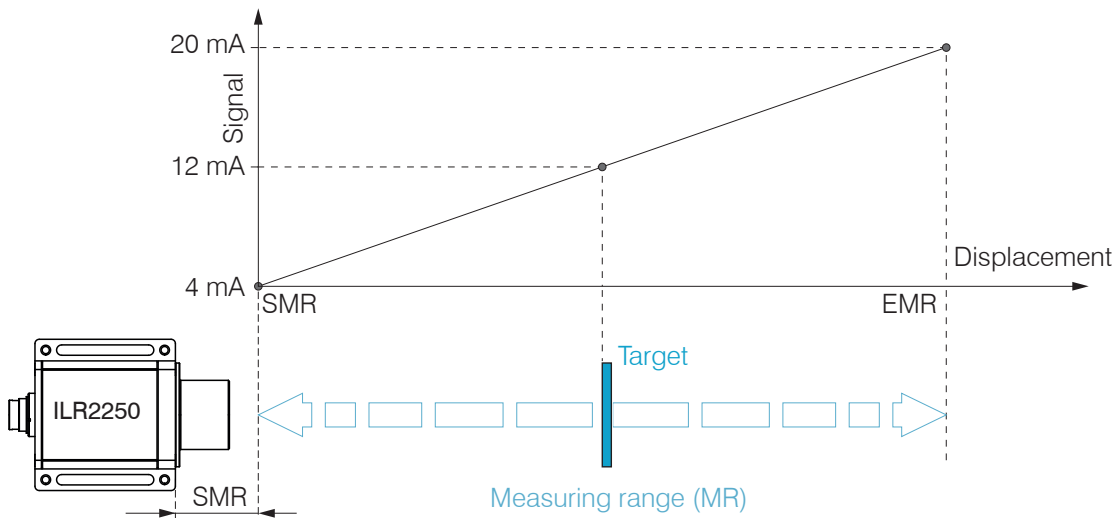


Fig. 2 Evaluation of the phase displacement for determining the distance

#### 3.3 Term Definitions, Analog Output Displacement



- SMR** Start of measuring range, minimum distance between sensor and target
- EMR** End of measuring range (start of measuring range + measuring range), maximum distance between sensor and target
- MR** Measuring range



### 3.4 Technical Data

| Model                           | ILR2250-100   |                                 | ILR2250-100-IO   |        |       |
|---------------------------------|---|---------------------------------|--|--------|-------|
| Item number                     | 7112015   |                                 | 7112016  |        |       |
| Measuring range <sup>1</sup>    |   | SMR                             | EMR  | SMR    | EMR   |
|                                 | black 6 %   | 0.05 m                          | 30 m   | 0.05 m | 30 m  |
|                                 | gray 40 %   | 0.05 m                          | 70 m   | 0.05 m | 70 m  |
|                                 | white 80 %  | 0.05 m                          | 100 m  | 0.05 m | 100 m |
|                                 | Reflector film <sup>2</sup>   | 35 m                            | 150 m  | 35 m   | 150 m |
| Measuring rate                  | 20 Hz   |                                 |  |        |       |
| Resolution                      | 0.1 mm  |                                 |  |        |       |
| Linearity                       | < ±1 mm <sup>3</sup>  |                                 |  |        |       |
| Repeatability <sup>4</sup>      | < 300 μm  |                                 |  |        |       |
| Temperature compensation        | -10 ... +50 °C  |                                 |  |        |       |
| Light source                    | Semiconductor laser < 1 mW, 655 nm (red)  |                                 |  |        |       |
| Typ. service life               | 50,000 h  |                                 |  |        |       |
| Laser safety class              | Class 2 according to DIN EN 60825-1: 2015-07  |                                 |  |        |       |
| Permissible ambient light       | 50,000 lx   |                                 |  |        |       |
| Supply voltage                  | 10 ... 30 VDC   |                                 |  |        |       |
| Power consumption               | < 1.5 W (24 V)  |                                 |  |        |       |
| Signal input                    | Trigger   |                                 | -  |        |       |
| Digital interface               | RS422 / USB <sup>5</sup>  |                                 | IO-Link 1.1; process data, parameter set up and diagnostics                              |        |       |
| Analog output                   | 4 ... 20 mA (16 bit, freely scalable within the measuring range)                          |                                 | -  |        |       |
| Switching output                | Q1 / Q2 / Q3 (configurable)   |                                 | Q1 / Q2 / Q3 (configurable) included in IO-Link process data                             |        |       |
| Connection                      | Supply/signal: 12-pin M16 screw/plug connection<br>(see accessories for connection cable) |                                 | Supply/signal: 5-pin M12 screw/plug connection<br>(see accessories for connection cable) |        |       |
| Mounting                        | Screwing and adjustment on sensor base plate  |                                 |  |        |       |
| Temperature range               | Storage   | -25 ... +70 °C (non-condensing) |  |        |       |
|                                 | Operation   | -10 ... +50 °C (non-condensing) |  |        |       |
| Shock (DIN EN 60068-2-29)       | 15 g / 6 ms in 3 axes, in 3 directions, 1000 shocks each                                  |                                 |  |        |       |
| Vibration (DIN EN 60068-2-6)    | 15 g / 10 ... 500 Hz in 3 axes, 10 cycles each  |                                 |  |        |       |
| Protection class (DIN EN 60529) | IP65  |                                 |  |        |       |
| Material                        | Aluminum housing  |                                 |  |        |       |
| Weight                          | approx. 300 g   |                                 |  |        |       |
| Control and display elements    | 5x LEDs for power, signal strength and switching outputs                                  |                                 |  |        |       |
| Features                        | 4 measurement-specific operating modes via sensorTOOL                                     |                                 | 4 measurement-specific operating modes via IO-Link                                       |        |       |

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

The specified data apply for a consistent room temperature of 20 °C, sensor is continuously in operation. Measured on white, diffuse reflecting surface (reference ceramic)

1) Depends on the reflectivity of the target, ambient light interference and atmospheric conditions

2) ILR-RF210 reflector film 210 x 297 mm; art. 7966058

3) Measured in the range of 0.05 ... 20 m; statistical spread 2s

4) Measurement frequency of 20 Hz, moving average 10

5) Connection via interface module, see accessories

## 4. Delivery

### 4.1 Unpacking/Included in Delivery

1 Sensor ILR2250-100

1 Assembly instructions

1 German laser information sign

1 IEC laser information sign

1 Mounting set consisting of:

- 2x Cylinder head bolt, hexagon socket M4x12
- 2x Spring washer M4
- 4x Hexagon socket set screw M4x6

1 PC1100-0,3 IO-Link adapter cable (included with ILR2250-100-IO)

➤ 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,

### 4.2 Storage

Temperature range for storage: -25 ... +70 °C

Humidity: 5 ... 95% (non-condensing)

## 5. Installation and Assembly

### 5.1 Notes for Operation

#### 5.1.1 Reflectance of Target Surface

The optoNCDT ILR2250-100 sensor is an optical system used to measure in the millimeter range. The sensor works based on the phase comparison method and evaluates the direct and diffuse reflections of the laser beam sent back.

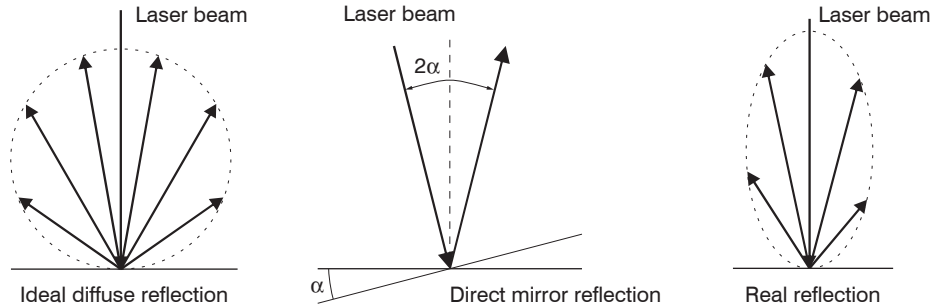


Fig. 3 Reflectance of target surface

The ILR2250-100 sensor is able to work with a reflectivity between 6 % and 100 %.

It is not possible to predict the signal strength for various surfaces due to the myriad environmental influences. The color and surface properties of the target as well as incident ambient light and meteorological influences can all affect the signal quality.

The expected signal quality may be impaired by the color of the measurement target.

| Color impression | Reflection | Maximum range | Comparable material            |
|------------------|------------|---------------|--------------------------------|
| Black            | 6–15%      | 30 meters     | Cardboard, paper, fabric, felt |
| Gray             | 30–50%     | 70 meters     | Concrete, gray hall wall       |
| White            | 80–90%     | 100 meters    | White paper, light wall        |
| Reflector        | 100%       | 150 meters    | ILR-RF210 reflector film       |

The `AUTO Measurement` mode is recommended for dark, reflective and far-away targets. This measurement mode optimizes the measurement frequency of the sensor, depending on the signal quality, and therefore provides the best results even in difficult conditions.

#### 5.1.2 Laser Spot Diameter, Min. Target Size

The laser spot diameter increases with increasing distance (displacement). Keep this in mind for the selection/size of the target. The measuring object must have at least three times the size of the laser spot.

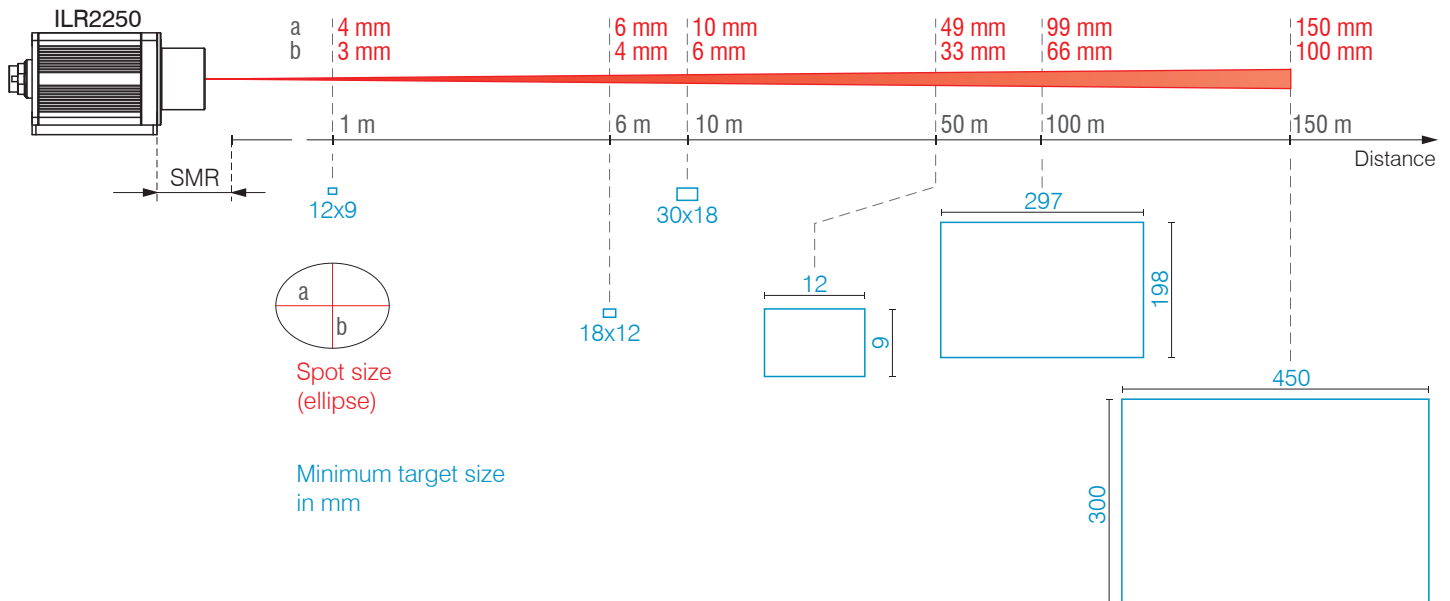


Fig. 4 Laser spot dimensions and size of measuring object depending on the distance

### **5.1.3 Interferences**

#### **5.1.3.1 Ambient Light**

The optoNCDT ILR2250 sensors are very good at suppressing ambient light thanks to their in-built optical interference filter. Nevertheless, highly reflective targets can cause errors on account of the glare caused by the strong reflections. If this happens, a less reflective surface should be used. The ideal target is white, slightly shiny and with a smooth surface. If ambient light is directly incident into the sensor or onto the target, these areas should be shielded.

#### **5.1.3.2 Thermal Influences**

When the sensor is commissioned, a warm-up time of at least 5 minutes is required to achieve uniform temperature distribution in the sensor.

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

#### **5.1.3.3 Mechanical Vibrations**

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

#### **5.1.3.4 Motion Blur**

A constant travel movement of up to 1.6 m/s is possible in all cases. Targets that move faster or that are not very reflective can cause motion blurring.

#### **5.1.3.5 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.

In principle, angular behavior during laser distance measurement is also affected by the reflective properties of the target surface.

## 5.2 Mechanical Fastening

### 5.2.1 Sensor Mounting

• Ensure careful handling of the sensor during installation and operation.  
**I**

▶ Mount the sensor on the sensor base plate using four M4 screws.

Additionally, 4 grub screws can be used to adjust the sensor.

A visible laser beam helps to align the sensor with the target object. Please also refer to the notes for operation, see [Chap. 5.1](#), when aligning the sensor.

If the laser beam does not strike the object surface at a perpendicular angle, measurements might be inaccurate.

| Bolt connection <sup>1</sup> |                |        |                |  |
|------------------------------|----------------|--------|----------------|--|
| Bolt length                  | Screwing depth | Number | Screw          | Torque   |
| 5 mm                         | Min. 10 mm     | 4      | M4 ISO 4762-A2 | 1.7 Nm for strength class 70<br>2.3 Nm for strength class 80 |

Fig. 6 Installation conditions

• Mount the sensor only to the existing through-bores on a flat surface. Any type of clamping is not permitted.  
**I** Never exceed the specified torques.

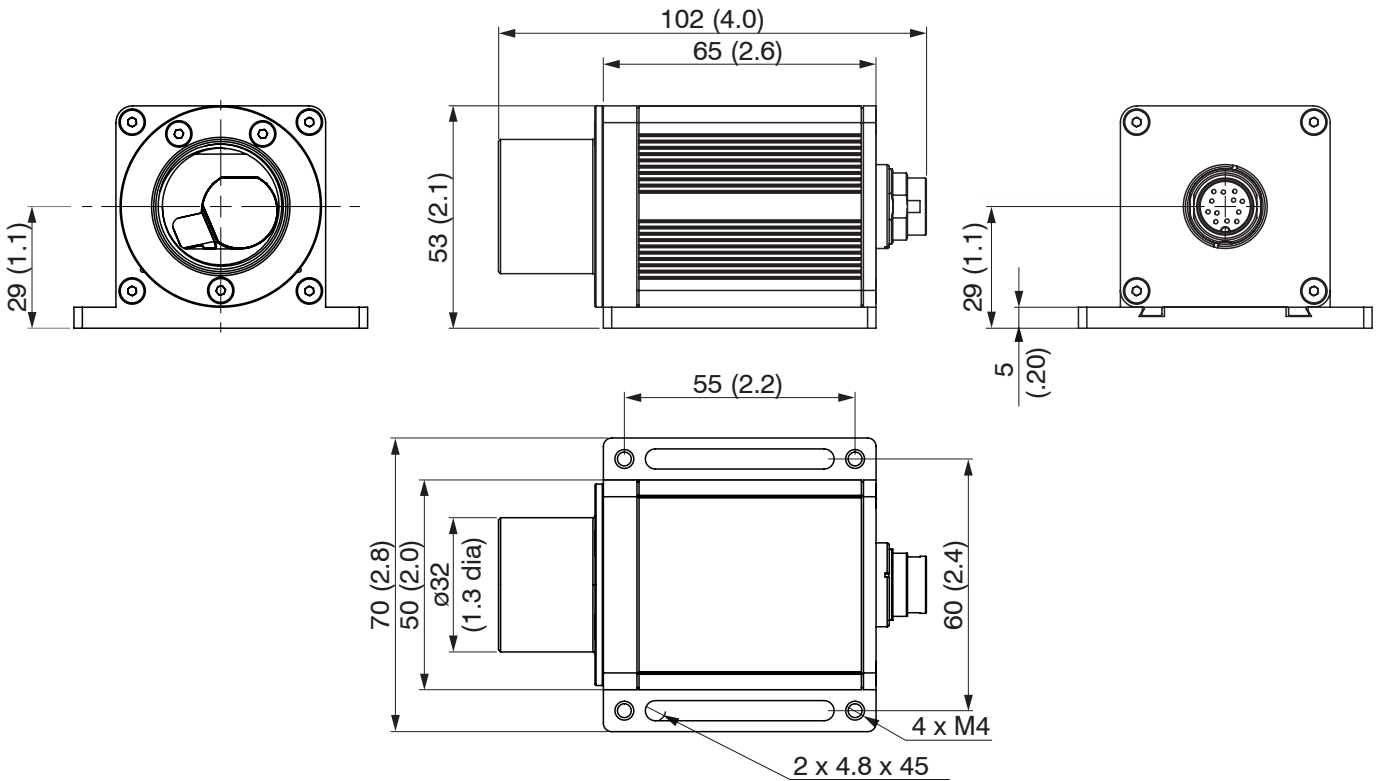


Fig. 7 Dimensional drawing optoNCDT ILR2250-100, dimensions in mm

• Position the sensor so that the connections and display elements are not concealed.  
**I** We recommend maintaining a clearance of 2–3 centimeters at the cooling ribs on the left and right sides.

1) Recommendation: Test under use conditions!

### 5.2.2 Start of Measuring Range

For ILR2250 sensors, the start of the measuring range is placed in front of the sensor. The point of reference is the front housing edge on the sensor housing.

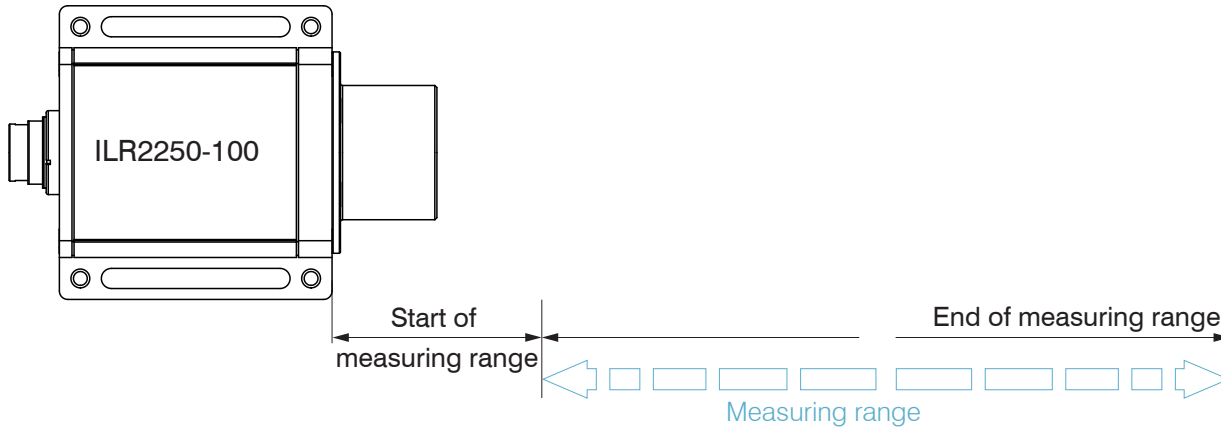


Fig. 8 Housing edge as point of reference for start of measuring range

### 5.2.3 Reflector Installation

The sensor measures the distance to moving and stationary objects:

- In the range of 0.05 m ... 100 m for diffuse surfaces
- Between 35 and 150 m onto reflectors (e.g. ILR-RF210, Scotchlite by 3M etc.)

The measurement laser can be used for alignment. When aligning the sensor, proceed as follows:

- ▶ Position the sensor close to the reflector (for example < 1 m).
- The visible point of light of the measurement laser should be in the center of the reflector.
- ▶ Position the sensor at the furthest possible point from the reflector.
- ▶ Check that the measurement laser is pointing at the center of the reflector and adjust if necessary.

The center of the spot must be in the center of the reflector over the entire measuring range.

Target (reflector) and sensor can only be tilted by at most 5° relative to one another.

### 5.3 Display Elements

| LED    | Function              | Display | Status                          |  |
|--------|-----------------------|---------|---------------------------------|--|
| Out 1  | Switching output 1    | Off     | Switching output inactive       |  |
|        |                       | white   | Switching output active         |  |
| Out 2  | Switching output 2    | Off     | Switching output inactive       |  |
|        |                       | white   | Switching output active         |  |
| Out 3  | Switching output 3    | Off     | Switching output inactive       |  |
|        |                       | white   | Switching output active         |  |
| Signal | Reflection strength   | Green   | Signal very good                |  |
|        |                       | Yellow  | Signal satisfactory             |  |
|        |                       | Red     | Weak signal <sup>1</sup> /error |  |
| Power  | Operational readiness | Off     | No supply voltage               |  |
|        |                       | Green   | Ready to use                    |  |
|        |                       | Yellow  | Warm-up time <sup>2</sup>       |  |

The Signal LED indicates the reflection strength of a measurement. This LED generally lights up when a measurement is started.

1) Reduced measurement accuracy and measurement frequency possible  
 2) For sensors with optional heating function

## 5.4 Electrical Connections ILR2250-100

### 5.4.1 Connection Options

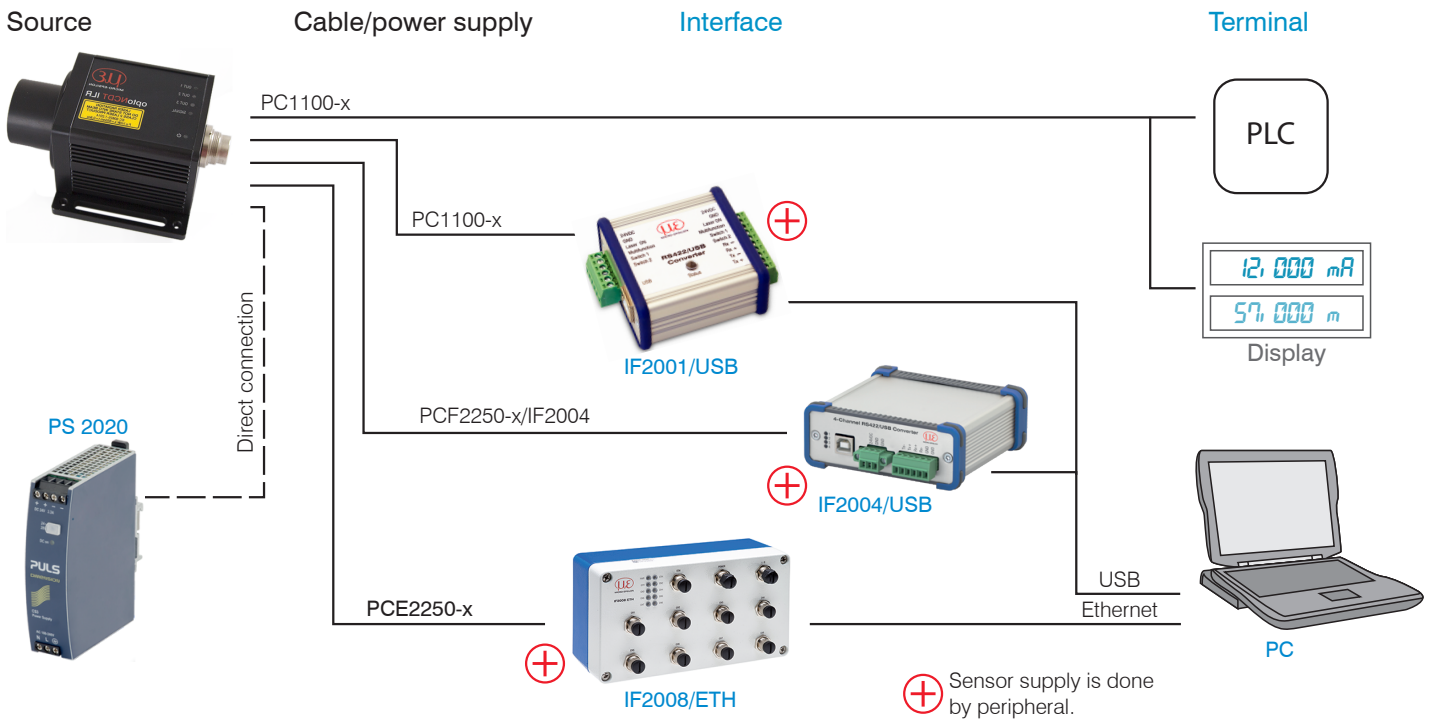


Fig. 9 Connection examples for ILR2250

The various peripheral devices can be connected to the sensor.

The IF2001/USB, IF2004/USB and IF2008/ETH converters also supply the supply voltage (24 V DC) to the sensor. The voltage supply for the converters is provided, for example, by the optionally available PS 2020 power supply.

### 5.4.2 Pin Assignment

The plug connection is located on the back of the sensor. It is a 723 series 12-pin circular connector (flange plug) from the company Binder.

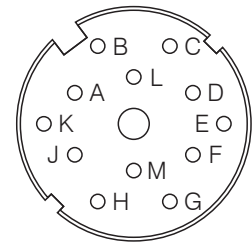
This plug connector ensures optimum shielding as well as a high IP protection class. You will need a corresponding cable socket with a shielding ring as the counterpart.

PC11xx cables with open ends and finished in various ways are optionally available, see Chap. A 1. The optionally available PC1100-x and PC1100/90-x supply/output cables can be used with drag chains and have the following bend radii:

- 47 mm (once)
- 116 mm (permanent)

**HINWEIS** Make sure that cable ends are not exposed. This could cause short circuits. Connecting input signals to outputs can damage the sensor!

| Signal Sensor | PC1100-x |            |                            | Comments, circuitry  |
|---------------|----------|------------|----------------------------|--|
|               | Pin      | Wire color | Explanation                |  |
| RX+           | A        | White      | RS422 input (symmetrical)  | Internally terminated with 120 Ohm   |
| RX-           | B        | Brown      |                            |  |
| TRIG          | C        | Green      | Switching input            | Trigger input, $t_i > 2$ ms  |
| $I_{OUT}$     | D        | Yellow     | Analog output              | 4 ... 20 mA  |
| TX-           | E        | Gray       | RS422 output (symmetrical) | Receiver terminated with 120 Ohm   |
| TX+           | F        | Pink       |                            |  |
| $+U_B$        | G        | Red        | Supply voltage             | 10 ... 30 VDC, typ. 24 VDC   |
| OUT1          | H        | Black      | Switching output 1         | Switching behavior programmable: NPN, PNP, push-pull, push-pull negated<br>$I_{max} = 50$ mA |
| OUT2          | K        | Gray/pink  | Switching output 2         |  |
| OUT3          | M        | Blue       | Switching output 3         | Protected against polarity reversal, overload and excessive temperature                      |
| GND           | L        | Red/blue   | Supply ground              | Reference potential for switching outputs as well  |
| GND           | J        | Purple     | Signal ground              | Reference potential for analog output  |



View: Solder side 12-pin cable socket  
Power supply and signal socket M16x0.75; 12-pin

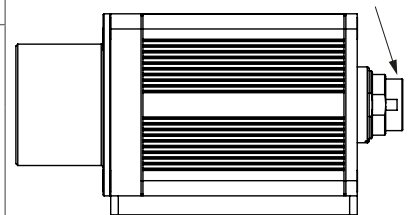


Fig. 10 Pin assignment for power supply and signal, 12-pin plug connector

The ground lines are connected internally and are the reference potential for all voltage values given below. The limit values for the voltages, loads and logic level comply with RS422 standards. All outputs are designed to be permanently resistant to short circuits.



### 5.4.3 Supply voltage

Nominal value 24 VDC (10 ... 30 V,  $P < 5.5 \text{ W}$  (max. for Out1 ... Out3,  $I_{\text{out}}$  and measurement mode active))

- Only turn on the power supply after wiring has been completed.
- Connect the G (red) and L (red/blue) inputs on the sensor to a 24 V voltage supply.

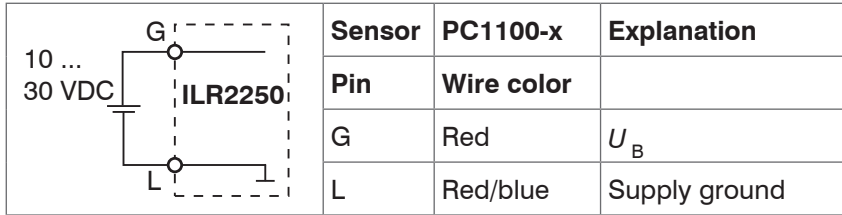


Fig. 11 Supply voltage connection

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 the optionally available PS2020 power supply, see Chap. A 1, for the sensor.

### 5.4.4 Analog output

The sensor produces a current output of 4 ... 20 mA

- The output may not be used continuously in short-circuit operation without a load resistor.
- i** Continuous short-circuit operation leads to thermal overloading and thus causes the output to switch off automatically.

- Connect the D (yellow) and J (purple) inputs on the sensor to a measuring device.

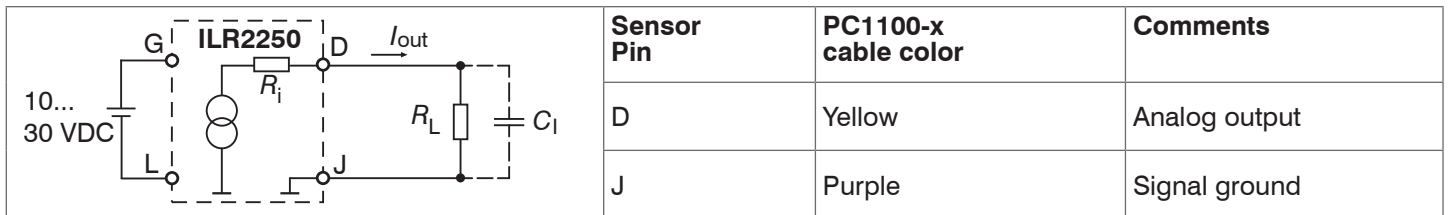


Fig. 12 Analog output switching

| Analog Output Properties           |                                      |   |
|------------------------------------|--------------------------------------|---|
| - 4 ... 20 mA                      | - Behavior when error reported: 3 mA | Load<br>$R_L < U_B - 1 \text{ V} / 20 \text{ mA}$<br>@10 V: $R_L < 450 \text{ Ohm}$<br>@24 V: $R_L < 1150 \text{ Ohm}$<br>@30 V: $R_L < 1450 \text{ Ohm}$ |
| - $R_i$ 30 Ohm                     | - Accuracy: 0.1 % FSO                |   |
| - Distance range limits adjustable | - Resistant to short circuits        |   |
| - Resolution: 16 bit DA converter  |                                      |   |

The current impressed in the line is proportional to the measured distance. You can find more details on this in the Analog Output section, see Chap. 6.6.

- i** The measured values are always output via the analog output.

### 5.4.5 RS422 (with IF2001/USB Converter)

The RS422 interface can be used for configuration as well as for permanent data transmission, even over longer distances. It is interference-resistant and suitable for industrial applications. Distances of up to 1200 m are possible with a twisted-pair cable.

For the connection between sensor and PC, the lines must be crossed.

**i** Only disconnect or connect the sub-D connection between the RS422 and USB converter when no voltage is flowing.

#### Characteristics

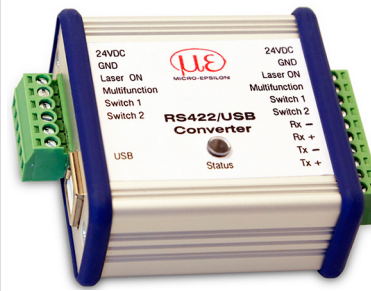
- Maximum input voltage RX+, RX- :  $\pm 14 V_{max}$  internally terminated with 120 Ohm.
- Output voltage TX:  $\pm 2 V$ , differential at  $2 \times 50 \text{ Ohm}$

#### Parameter

- Baud rate 115200 baud
- Data bits: 8
- Parity: None
- Start/stop bit: 1
- Handshake: No
- Command protocol: ASCII

**i** The RS422 interface is widely used in industrial applications. Use a suitable USB converter, e.g. the IF2001/USB, see Chap. A 1, if your PC/Notebook only has USB ports.

| Sensor |                               |          | Terminal, PLC, IF2001/USB Converter from MICRO-EPSILON |
|--------|-------------------------------|----------|--|
| Pin    | Cable color (Cable: PC1100-x) | Function | Function   |
| A      | White                         | Rx+      | Tx+  |
| B      | Brown                         | Rx-      | Tx-  |
| E      | Gray                          | Tx-      | Rx-  |
| F      | Pink                          | Tx+      | Rx+  |
| J      | Purple                        | GND      | GND  |



Symmetrical differential signals according to EIA-422, not electrically separated from the voltage supply.

Use a shielded cable with twisted wires, e.g. PC1100-x.

Fig. 13 Crossed data lines on receive and transmit side

### 5.4.6 Trigger Input

The trigger input allows you to trigger a distance measurement using an external signal in the form of a voltage pulse.

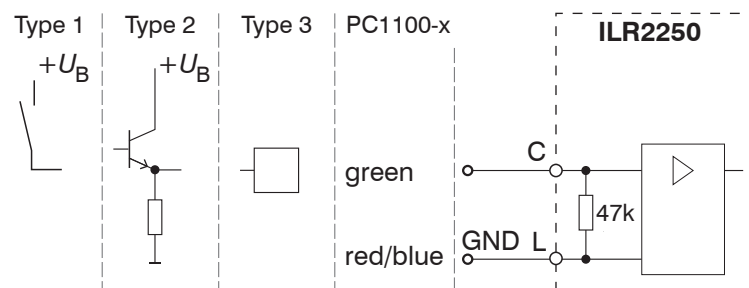


Fig. 14 Basic circuit for triggering

Trigger pulse:  $> 2 \text{ ms}$

High approx.  $2/3 * +U_B$

Low approx.  $1/3 * +U_B$

Internal pull-down resistor, an open input is detected as Low.

Connect the input to  $+U_B$  in order to trigger the function.

Configure the desired triggering behavior

- with the sensorTOOL program
- or using ASCII commands (e.g. TRIGGER and TRIGGERLEVEL), see Chap. A 3.4.1.

The number of measured values received can be specified on the ILR2250 after a trigger pulse.

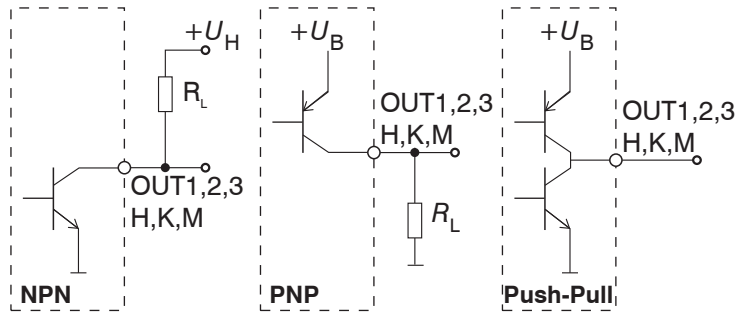
You can start level triggering with

- $+U_B$  at the trigger input for H-level triggering
- $0 V$  at the trigger input for L-level triggering

### 5.4.7 Switching Output

The switching behavior (NPN, PNP, push-pull, push-pull negated) of the switching output depends on the programming.

With the digital switching output, objects to be measured can be monitored for thresholds being exceeded. A measurement window must be parameterized for this. The parameters for the upper and lower switching threshold and for the switching hysteresis can be freely selected, see Chap. 6.7.



The outputs are not electrically separated.

The outputs are resistant to short circuits.

HT logic,

$$I_{\max} = 50 \text{ mA},$$

$$U_{H, \max} = 36 \text{ V saturation voltage at } I_{\max} = 50 \text{ mA}$$

Low-side < 1 V (output – GND) at 50 mA

High-side < 1 V (output –  $+U_B$ ) at 50 mA

Fig. 15 Basic circuit for switching output

| Switching behavior |                       |                           |
|--------------------|-----------------------|---------------------------|
| Name               | Output active (error) | Output passive (no error) |
| NPN (Low side)     | GND                   | Approx. $+U_H$            |
| PNP (High side)    | $+U_B$                | Approx. GND               |
| Push-pull          | $+U_B$                | GND                       |
| Push-pull, negated | GND                   | $+U_B$                    |

Fig. 16 Switching output behavior

The switching output is activated when there is no target, when the target is too close/far or when no valid measurement value can be determined.

## 5.5 Electrical Connections ILR2250-100-IO

### 5.5.1 Connection Options

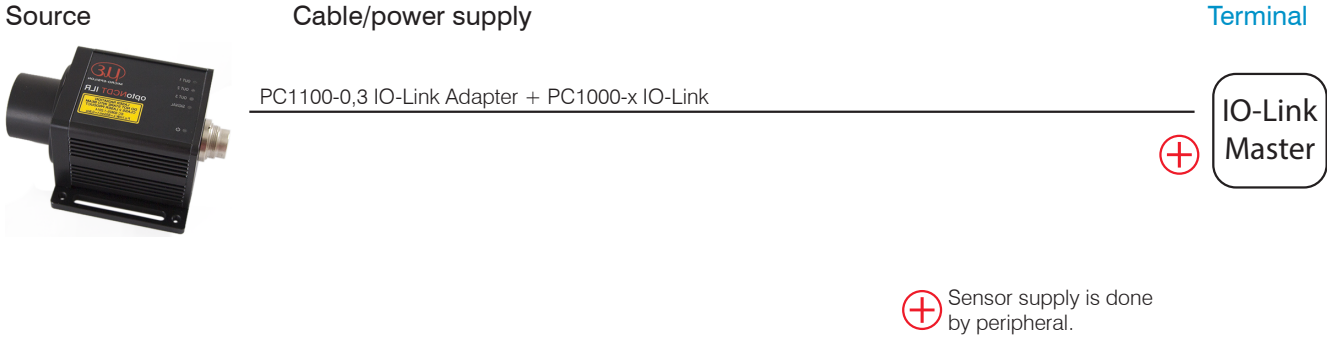


Fig. 17 ILR2250-100-IO connection example

The IO-Link master also supplies the supply voltage (24 V DC) to the sensor.

### 5.5.2 Pin Assignment

The plug connection is located on the back of the sensor. It is a 723 series 12-pin circular connector (flange plug) from the company Binder. This plug connector ensures optimum shielding as well as a high IP protection class. You will need a corresponding cable socket with a shielding ring as the counterpart.

The PC1100-0,3 IO-Link adapter cable included consists of

- a 12-pin cable socket, sensor connection
- a 5-pin cable connector, PC1000-x IO-Link connection

The optionally available PC1000-x IO-Link extension cable contains an M12 plug or socket at both ends.

Both cables can be used with drag chains and have the following bend radii:

- 22 mm (once)
- 44 mm (permanent)

| Signal Sensor   | PC1100-0,3 IO-Link adapter                       |            | Explanation                                  | PC1000-x IO-Link                                   |            |
|-----------------|--|------------|--|--|------------|
|                 | Pin  | Wire color |  | Pin  | Wire color |
| NC              | A  |            |  |  |            |
| NC              | B  |            |  |  |            |
| NC              | C  |            |  |  |            |
| NC              | D  |            |  |  |            |
| NC              | E  |            |  |  |            |
| NC              | F  |            |  |  |            |
| +U <sub>B</sub> | G  | Brown      | Supply voltage<br>10 ... 30 VDC, typ. 24 VDC | 1  | Brown      |
| C/Q             | H  | Black      | Standard Input/Output                        | 4  | Black      |
| NC              | K  |            |  |  |            |
| NC              | M  |            |  |  |            |
| GND             | L  | Blue       | Supply ground                                | 3  | Blue       |
| NC              | J  |            |  |  |            |
|                 | <p>View: Solder side 12-pin M16 cable socket</p> |            |  | <p>View: Solder side 5-pin M12 cable connector</p> |            |

Fig. 18 Pin assignment for power supply and signal

### 5.5.3 Supply Voltage

Nominal value 24 VDC (10 ... 30 V,  $P < 4 \text{ W}$ )

The ILR2250-100-IO sensor is supplied via the IO-Link master.

- ▶ Only turn on the power supply after wiring has been completed.
- ▶ Alternatively, you connect the G (brown) and L (blue) inputs on the sensor to a 24 V power supply.

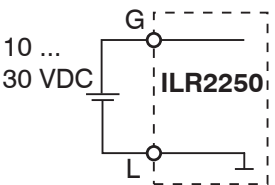
|  | Sensor | PC1100-0,3 IO-Link adapter |              | PC1000-x IO-Link |            | Explanation   |
|--|--------|----------------------------|--------------|------------------|------------|---------------|
|  | Pin    | Pin, 12 poles              | Pin, 5 poles | Pin              | Wire color |               |
|  | G      | G                          | 1            | 1                | Brown      | $U_B$         |
|  | L      | L                          | 3            | 3                | Blue       | Supply ground |

Fig. 19 Supply voltage connection

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 the optionally available PS2020 power supply, see Chap. A 1, for the sensor.

## 6. Operation ILR2250-100

### 6.1 Getting Ready for Operation

- Install the ILR2250 sensor as per the installation instructions, see Chap. 5.1.
- Connect the system to the downstream display or monitoring units and to the voltage supply.

**NOTICE**

The sensor may only be connected to peripherals when it does not carry power, that is, only when the supply voltage has been switched off.

The measurement laser starts when the supply voltage is applied if an active measurement (see LASER MEASURE ON) has previously been saved in the sensor.

The sensor is ready to use after approx. 2 s, digital accuracy is immediate. The sensor typically requires a warm-up time of 5 min for reproducible measurements via the analog output.


- The sensor can be put in an autostart state. To do this, all desired parameters must be set and saved on the sensor.
- If the sensor is then switched off during an active measurement, it immediately resumes the saved measurement task once the power supply is connected again.

If the POWER LED is off, no power is being supplied.

### 6.2 Operation using sensorTOOL

The sensor must be connected to a PC/Notebook via an RS422 converter and the supply voltage must be applied.

The sensorTOOL program also finds connected sensors via a network. You can find this program online at <https://www.micro-epsilon.de/download/software/sensorTOOL.exe>.

- Launch the sensorTOOL program and click on the  button.

The program will now search for connected ILR2250 sensors on the available interfaces.

- Select a desired sensor. Click the Start Data Acquisition button.

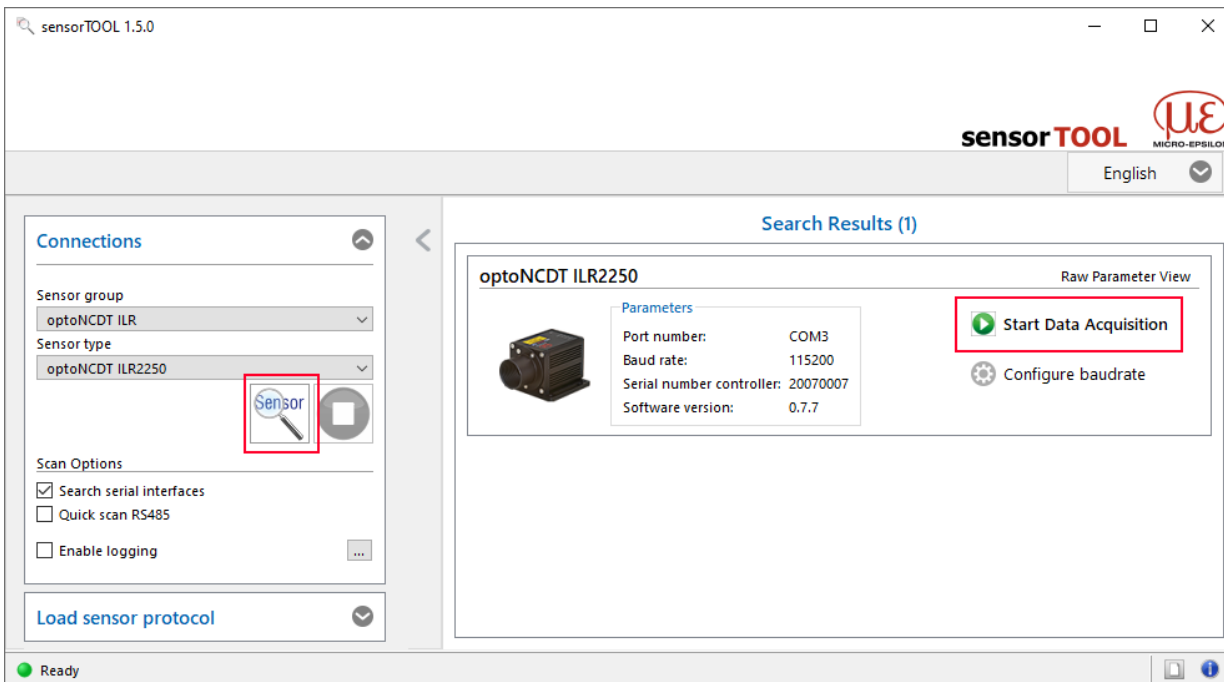


Fig. 20 Auxiliary sensor search program

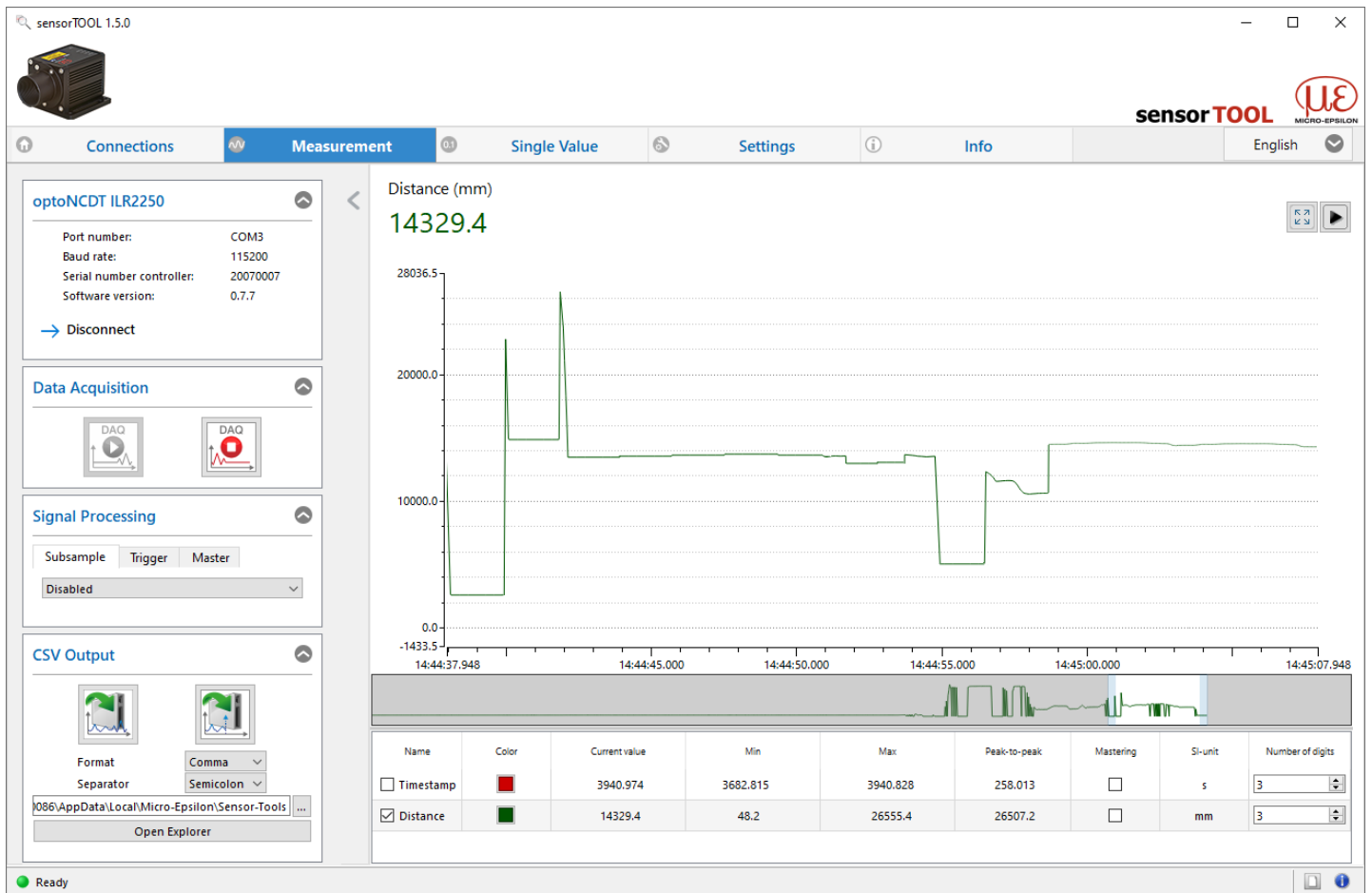


Fig. 21 Measurement view in the sensorTOOL program

You can access the functions (e.g. triggering, switching outputs and analog output) via the Settings tab.

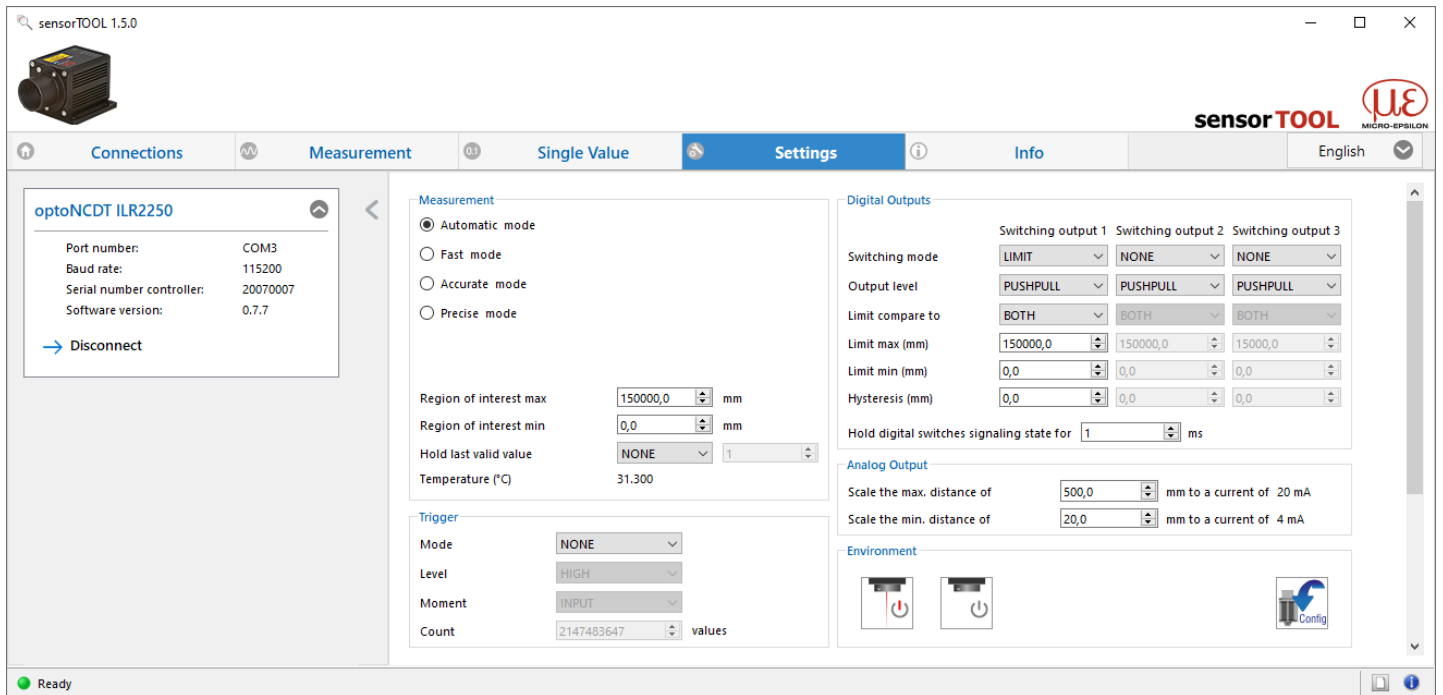


Fig. 22 Settings tab in the sensorTOOL program

### 6.3 Data Acquisition, Presets

By selecting a measurement mode in the Data Acquisition section, you can switch between the saved configurations (presets) for various target surfaces and target movement speeds. Selecting a target activates a predefined configuration of settings that will produce the best results for the material selected.

|                  |           |  |
|------------------|-----------|--|
| Data acquisition | Automatic | Recommended for measurements on poorly reflective or dark targets. The measuring rate depends on the reflectance of the target. The measuring rate is typically in the range of 3 ... 20 Hz. |
|                  | Fast      | Suitable for fast measurements on moving objects and quick distance jumps. The target movement speed is typically up to 1.6 m/s. The measured values are output at 20 Hz.                    |
|                  | Accurate  | Preset for high accuracy and tolerance in the event of distance changes. The measured values are output at 20 Hz.  |
|                  | Precise   | Preset for highest precision. Provides precise distance measurements on highly reflective targets. The measured values are output at 20 Hz.  |

➡ Switch to the Settings > Data acquisition menu and select the desired measurement mode.

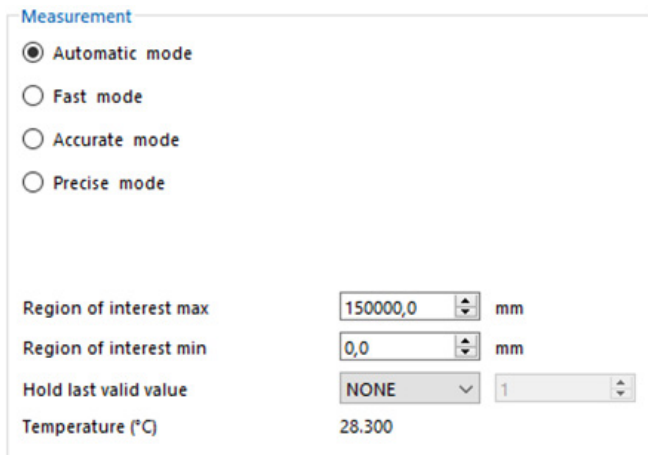


Fig. 23 Data acquisition menu, for selecting measurement mode, etc.

### 6.4 ROI Masking

Masking defines the ROI (region of interest) for the distance calculation. This function is used, for example, to suppress interfering reflections.

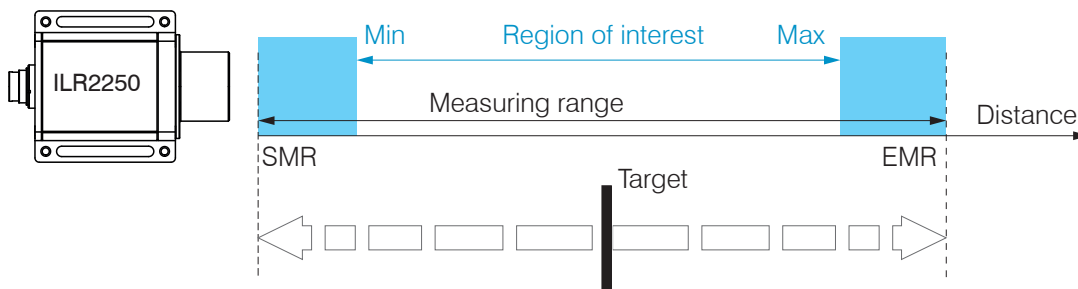


Fig. 24 Light-blue regions delimit the region of interest

➡ Switch to the Settings > Data acquisition menu and set the values for Region of interest min and Region of interest max.

The value ranges for the parameters

- upper and lower limit (digital outputs),
- analog output scaling,

must be within the region of interest.

Fields with gray background require a selection.

Fields with dark border require entry of a value.



## 6.5 Triggering

### 6.5.1 General

The acquisition and output of measured values by the ILR2250 can be controlled using an external electrical trigger signal or commands. Digital outputs are affected by this. The measured value at the time of the trigger event is output with a delay, see Chap. 6.5.

- Triggering has no effect on the preselected measuring rate or on the time response, and therefore there are always 4 cycles + 1 cycle (jitter) between the trigger event (level change) and the start of the output.
- The TRIG input is used as the external trigger input.
- Factory setting: no triggering, the sensor starts with the measured value output immediately after being switched on.
- The pulse duration of the “Trigger in” signal is at least 2 ms.

The triggering of the measured value acquisition and output have the same time response.

➡ Switch to the Settings > Trigger menu and select the desired triggering conditions.

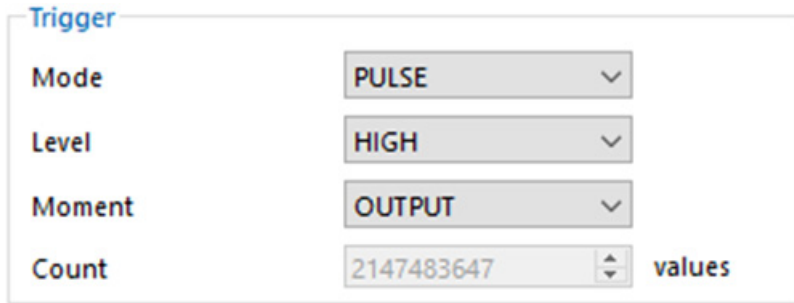


Fig. 25 Triggering menu

|        |                                       |   |
|--------|---------------------------------------|---|
| Mode   | <i>Pulse / Edge / Software / None</i> | <i>Selection for the desired type of triggering.<br/>Pulse = level triggering, Edge = edge triggering or pure Software triggering<br/>None: no triggering, continuous measured value output</i> |
| Level  | <i>High / Low</i>                     | <i>With edge triggering and High: rising edge<br/>With edge triggering and Low: falling edge</i>  |
| Moment | <i>Input / Output</i>                 | <i>Defines type of triggering<br/>Input = data acquisition, output = data output</i>  |
| Number | <i>Value</i>                          | <i>For edge and software triggering, the number of measured values to be output must be specified.</i>  |

The following applies for triggering:  $f_T < f_M$

$f_T$  Trigger frequency

$f_M$  Measuring rate

The following are used as triggering conditions:

**Level triggering** with high level / low level.

Continuous measured value acquisition/output as long as the selected level is present. Afterwards, the data acquisition/output stops.

The pulse duration must be at least as long as one cycle. The subsequent pause must also be at least as long as one cycle.

$U_1$  = Trigger signal

$W$  = Displacement signal

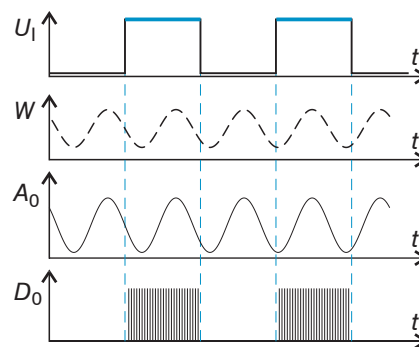


Fig. 26 High trigger level (top) with analog output  $A_0$  and RS422 output signal  $D_0$  (bottom)

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

**Edge triggering** with rising or falling edge.

Starts the measured value acquisition as soon as the selected edge is detected at the trigger input. The sensor outputs the specified number of measured values when the triggering condition is met.

Value range of 1 ... 2.147.483.646.

The pulse duration must be at least 2 ms.

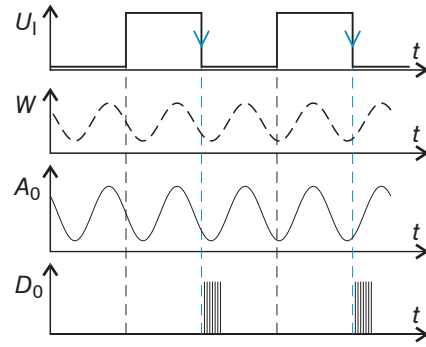


Fig. 27 HL trigger edge (top) with analog output  $A_0$  and RS422 output signal  $D_0$  (bottom)

**Software triggering.** The measured value acquisition is triggered by the command TRIGGERSW. After the trigger event, the sensor outputs the previously defined number of measured values or starts continuous measured value output. The measured value output can also be stopped using a command.

**6.5.2 Triggering Measured Value Acquisition**

Measured value acquisition triggering processes measurements that are taken after the trigger event. Previously acquired measured values are discarded. Acquisition triggering therefore has a direct impact on the further processing of measured values. The sensor corrects errors internally based on the settings in the saved configurations. In the case of moving targets and data acquisition triggering, Micro-Epsilon recommends the Auto and Fast modes.

**6.5.3 Triggering Measured Value Output**

The measured values are computed continuously and independently of the trigger event. A trigger event merely triggers output of the values via the RS422 interface.

- Acquisition triggering requires data acquisition to be active in the sensor.

## 6.6 Analog output

### 6.6.1 Scaling

The distance value is output via the analog output. The resolution of the analog output is 16 bit.

|              |                                       |                           |       |
|--------------|---------------------------------------|---------------------------|-------|
| Output range | 4 ... 20 mA, error value approx. 3 mA |                           |       |
| Scaling      | Standard scaling                      | Scaling to 50 ... 8000 mm |       |
|              | Two-point scaling                     | Min. distance (in mm):    | Value |
|              |                                       | Max. distance (in mm):    | Value |

The following applies for two-point scaling:

- min distance < max distance

The value `min distance` corresponds to the new start of the measuring range, the value `max distance` corresponds to the new end of the measuring range. Two-point scaling allows for user-defined specification of the measuring range to be output.

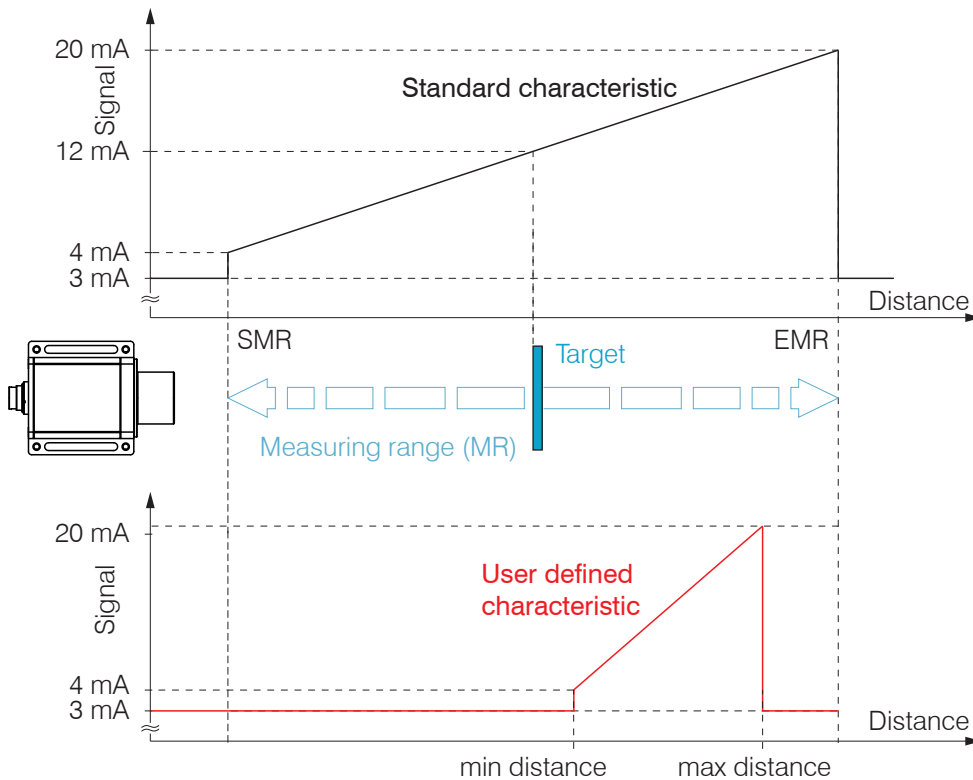


Fig. 28 Scaling the analog signal

### 6.6.2 Calculating Measured Value from Current Output

Current output

| Variables                  | Value range             | Formula                             |
|----------------------------|-------------------------|-------------------------------------|
| $I_{OUT}$ Current in mA    | [4; 20] Measuring range | $d = \frac{(I_{OUT} - 4)}{16} * MR$ |
| $MR$ Measuring range in mm | {150000} <sup>1</sup>   |                                     |
| $d$ Distance in mm         |                         |                                     |

Current output with scaling

| Variables                  | Value range             | Formula                                  |
|----------------------------|-------------------------|--|
| $I_{OUT}$ Current in mA    | [4; 20] Measuring range | $d = \frac{(I_{OUT} - 4)}{16} *  n - m $ |
| $MR$ Measuring range in mm | {150000} <sup>1</sup>   |  |
| $m, n$ Teach range in mm   | [0; MR]                 |  |
| $d$ Distance in mm         | [m; n]                  |  |

1) The actual value for the measuring range depends, inter alia, on the reflectivity of the target and on whether a reflector film is used.

Fields with gray background require a selection.

Value Fields with dark border require entry of a value.

### 6.7 Switching Outputs, Limit Value Monitoring

The switching outputs can be used independently of one another to monitor

- the analog output,
- limit values.

|  |                         |   |  |
|--|-------------------------|---|--|
| Switching output 1<br>Switching output 2<br>Switching output 3 | Switching mode          | Teach / Limit / None                      | Teach: Target is outside the scaled analog range<br>Limit: Distance greater/less than the limit value<br>None: Switching output not active   |
|  | Output level            | NPN / PNP / Push-pull / Push-pull negated | NPN: Active during limit value monitoring, load against supply<br>PNP: Active during limit value monitoring, load against supply ground<br>Push-pull: Switching output is high when limit value is exceeded<br>Push-pull negated: Switching output is low when limit value is exceeded |
|  | Range check             | Lower / Upper / Both                      | Lower: Check if measured value below limit<br>Upper: Check if measured value above limit<br>Both: Check if measured value above or below limit   |
|  | Upper limit in mm       | Value                                     | Sets the upper limit value for the switching output.   |
|  | Lower limit in mm       | Value                                     | Sets the lower limit value for the switching output.   |
|  | Hysteresis in mm        | Value                                     | Value by which the measured value must be above or below the limit in order for the switching output to be triggered or deactivated again.   |
|  | Hold signal level in ms | Value                                     | Specification of the minimum time for which the switching output should remain active. The time begins with the activation of the switching output.  |

➡ Switch to the Settings > Digital outputs menu and select the desired conditions.

**Digital Outputs**

|   | Switching output 1 | Switching output 2 | Switching output 3 |
|---|--------------------|--------------------|--------------------|
| Switching mode                            | LIMIT              | TEACH              | NONE               |
| Output level                              | NPN                | PNP                | PUSHPULL           |
| Limit compare to                          | BOTH               | BOTH               | BOTH               |
| Limit max (mm)                            | 60000,0            | 150000,0           | 15000,0            |
| Limit min (mm)                            | 1200,0             | 0,0                | 0,0                |
| Hysteresis (mm)                           | 50,0               | 20,0               | 0,0                |
| Hold digital switches signaling state for | 100 ms             |                    |                    |

**Analog Output**

Scale the max. distance of 5700,0 mm to a current of 20 mA

Scale the min. distance of 2050,0 mm to a current of 4 mA

Fig. 29 Digital outputs menu, for monitoring limit values, etc.

Fields with gray background require a selection.

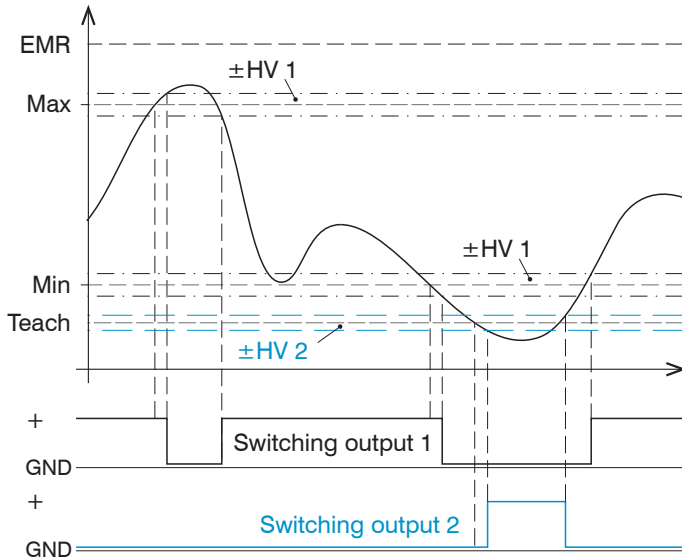
Value Fields with dark border require entry of a value.

The switching outputs are activated depending on the output level set (switching behavior) and the range check.

The switching outputs are activated if the target is outside

- the measuring range (analog output),
- the range limits (upper/lower limit).

A lower and an upper limit value (in mm) need to be entered in order for the range limits to be monitored. Notes about switching behavior are available under Electrical Connections, see Chap. 5.4.7.



Example

- Switching output 1: Monitoring of upper and lower limit
- Switching output 2: Measuring range error

EMR = End of measuring range

Teach = Distance is outside the scaled analog output

UL = Upper limit

LL = Lower limit

HV 1 = Hysteresis switching output 1

HV 2 = Hysteresis switching output 2

Fig. 30 Switching output 1 with range limits (NPN), switching output 2 with measuring range error (PNP)

If you want to monitor whether the target leaves the measuring range limits (SMR and EMR), you can do this using the Limit function. You will need to set the values for the upper and lower limit to the value for the SMR and EMR; the hysteresis value is not taken into account.

If you want to monitor whether the target leaves the region of interest (min and max), you can do this using the Limit function. You will need to set the values for the upper and lower limit to the min and max values; the hysteresis value is not taken into account.

### 6.8 Measured Value Holding Mode, Error Handling

The error handling function regulates the behavior of the analog output and RS422 interface in the event of an error.

|                |          |  |  |
|----------------|----------|--|--|
| Error handling | None     | The analog output delivers approx. 3 mA instead of the measured value. The RS422 interface outputs an error value. |  |
|                | Infinite | The analog output and RS422 interface remain on the last valid value.  |  |
|                | Count    | Value  | Value range [1 ... 2147483645], last value held for n cycles, then an error value is output. |

If no valid measured value can be determined, an error is output. Alternatively, if this interferes with further processing, the last valid value can be held, i.e. output repeatedly, for a certain amount of time. After the selected number of cycles have elapsed, an error value is output.

## 6.9 System Settings

### 6.9.1 Saving the Settings

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

➤ Switch to the Settings > Environment menu and click on the  button.

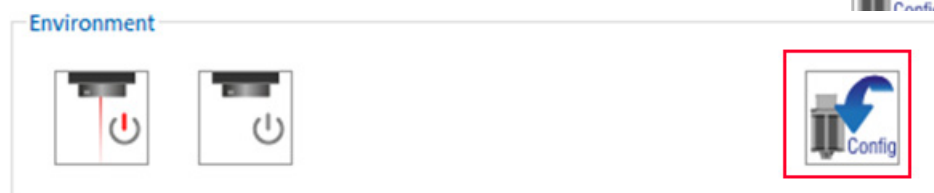


Fig. 31 Settings menu with the Save button

### 6.9.2 Language

The following languages are available in the sensorTOOL:

- German
- English
- Chinese
- Korean
- Japanese.

➤ Switch the language in the menu bar.

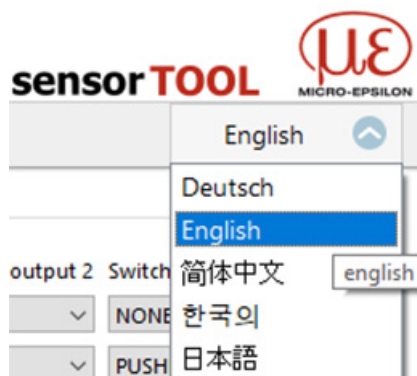


Fig. 32 Language selection in the menu bar

## 7. Operation ILR2250-100-IO

### 7.1 Getting Ready for Operation

- ▶ Install the ILR2250 sensor as per the installation instructions, see Chap. 5.1.
- ▶ Connect the system to the downstream display or monitoring units and to the voltage supply.

**HINWEIS** The sensor may only be connected to peripherals when it does not carry power, that is, only when the supply voltage has been switched off.

The measurement laser starts when the supply voltage is applied if an active measurement (see `LASER MEASURE ON`) has previously been saved in the sensor.

The sensor is ready to use after approx. 2 s, digital accuracy is immediate.

- The sensor can be put in an autostart state. To do this, all desired parameters must be set and saved on the sensor. If the sensor is then switched off during an active measurement, it immediately resumes the saved measurement task once the power supply is connected again.

If the `POWER` LED is off, no power is being supplied.

### 7.2 Operation using IO-Link

The sensor exchanges process data and parameters via IO-Link. For this purpose, connect the sensor with a suitable IO-Link master.

|   |                                       |
|---|---------------------------------------|
| IO-Link specification                           | V 1.1                                 |
| Minimum cycle time                              | 4.0 ms (COM2)                         |
| Transmission speed                              | COM2 (38.4 kBaud)                     |
| Process data width                              | 32 bit output (from device to master) |
| Process data type                               | Mixed (27 bit integer + 3 Boolean)    |
| Parameterization server function (data storage) | Yes                                   |

Fig. 33 IO-Link interface properties

### 7.3 Process Data

The factory settings ensure that the process data telegram of the sensor receives the measured distance value. The distance value is output in tenths of a millimeter (27 bit signed integer). In addition, the logical state of the three switching outputs is transmitted by the last three bits.

|                |                                |
|----------------|--------------------------------|
| Bit 0 – bit 26 | Measurement value              |
| Bit 29         | ErrorOut3 (switching output 3) |
| Bit 30         | ErrorOut2 (switching output 2) |
| Bit 31         | ErrorOut1 (switching output 1) |

Fig. 34 Factory-set process data format

### 7.4 Device Data

The device data include

- parameters,
- identification data and
- diagnosis data.

This information can be transmitted to or from the sensor in parallel with the process data. For this purpose, the IO-Link master requires a sensor-specific device description file (IODD).

The current device description file is available at:

[www.micro-epsilon.de/displacement-position-sensors/laser-distance-sensor/optoNCDT-ILR-2250/](http://www.micro-epsilon.de/displacement-position-sensors/laser-distance-sensor/optoNCDT-ILR-2250/).

## 8. RS422 Digital Interface

### 8.1 Preliminary Remarks

Function only possible in connection with the ILR2250-100 sensor.

The RS422 interface has a maximum baud rate of 115200 baud. The baud rate is set to 115200 as default. The measuring rate is at most 20 Hz.

Data format: Binary format for measured values, commands as ASCII character string

Interface parameters: 8 data bits, no parity, one stop bit (8N1)

**i** Only disconnect or connect the sub-D connection between the RS422 and USB converter when no voltage is flowing.

### 8.2 Measurement Data Format

For the ILR2250:

- Transmission is always done in complete data frames, the format does not change.
- Each data frame consists of the timestamp in ms and the distance in 1/10 mm, followed by a footer byte.
- Each value is transmitted in 4 bytes; the lower 7 bits are used for the data.
- The 4\*7 bits are combined into a 28 bit value.
- The measured value bytes are coded in the uppermost bit:
  - 1 Another byte or other bytes follow,
  - 0 Last byte of the measured value.

| Description   | Bit 7<br>(order bit) | Bit 6 | Bit 5 | Bit 4 | Bit 3  | Bit 2 | Bit 1 | Bit 0    |
|---------------|----------------------|-------|-------|-------|--------|-------|-------|----------|
| LSB Timestamp | 1                    | D6    | D5    | D4    | D3     | D2    | D1    | D0       |
|               | 1                    | D13   | D12   | D11   | D10    | D9    | D8    | D7       |
|               | 1                    | D20   | D19   | D18   | D17    | D16   | D15   | D14      |
| MSB Timestamp | 0                    | D27   | D26   | D25   | D24    | D23   | D22   | D21      |
| LSB Distance  | 1                    | D6    | D5    | D4    | D3     | D2    | D1    | D0       |
|               | 1                    | D13   | D12   | D11   | D10    | D9    | D8    | D7       |
|               | 1                    | D20   | D19   | D18   | D17    | D16   | D15   | D14      |
| MSB Distance  | 0                    | D27   | D26   | D25   | D24    | D23   | D22   | D21      |
| Footer        | 0                    | 0     | 0     | 1     | Change | 0     | 0     | Overflow |

Fig. 35 Structure of data value with max. 28 bits

- 0: Bit 5 must be 0 in order to distinguish the footer from the ">" symbol.
- C (change bit): Change to the sensor configuration; always zero.
- O (overflow), always zero:

The conversion must always be done in the user program.

#### Distance Value Example

The distance bytes are received in little-endian format.

|     |   |     |     |     |     |     |     |     |
|-----|---|-----|-----|-----|-----|-----|-----|-----|
| LSB | 1 | D6  | D5  | D4  | D3  | D2  | D1  | D0  |
|     | 1 | D13 | D12 | D11 | D10 | D9  | D8  | D7  |
|     | 1 | D20 | D19 | D18 | D17 | D16 | D15 | D14 |
| MSB | 0 | D27 | D26 | D25 | D24 | D23 | D22 | D21 |

Then, they are reformatted into big-endian format. The result can then be assigned to an unsigned integer with 32 bits. The first 4 bits are 0, as the ILR2250 transmits the distance with 28 bits.

|     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 0   | 0   | 0   | 0   | D27 | D26 | D25 | D24 |
| D23 | D22 | D21 | D20 | D19 | D18 | D17 | D16 |
| D15 | D14 | D13 | D12 | D11 | D10 | D9  | D8  |
| D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  |

Fig. 36 Distance bytes in the correct order (big endian)



Example with real measurement data.

|           |      |      |      |                |      |      |      |        |
|-----------|------|------|------|----------------|------|------|------|--------|
| 0xc0      | 0xa6 | 0xb3 | 0x05 | 0xed           | 0xdd | 0x80 | 0x00 | 0x10   |
| Timestamp |      |      |      | Distance value |      |      |      | Footer |

Fig. 37 Received data frame

|                                |             |           |           |           |
|--------------------------------|-------------|-----------|-----------|-----------|
| Distance hex format            | 0xed        | 0xdd      | 0x80      | 0x00      |
| Distance binary, little endian | 1110 1101   | 1101 1101 | 1000 0000 | 0000 0000 |
| Binary, without flag bit       | 110 1101    | 101 1101  | 000 0000  | 000 0000  |
| Binary, big endian             | 000 0000    | 000 0000  | 101 1101  | 110 1101  |
| As unsigned integer            | (0000) 0000 | 0000 0000 | 0010 1110 | 1110 1101 |
| Decimal                        | 12013       |           |           |           |
| As distance                    | 1201.3 mm   |           |           |           |

Fig. 38 Transformed distance value

**I** The sensor can continue to supply measured values to the RS422 output even while the sensor is communicating.

The IF2001 converter from MICRO-EPSILON, which is connected to the sensor via the PC1100-x standard cable (also optional), is suitable for data exchange with a PC, see Chap. A 1. The IF2008/ETH is suitable for recording data in a synchronized manner from multiple sensors. You can find more information in the descriptions of the IF2008/ETH interface card and the relevant MEDAQLib driver program.

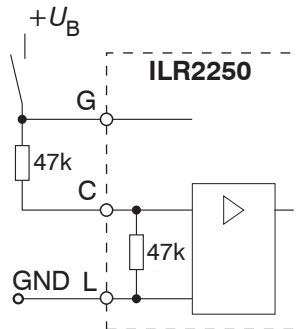
You can find the current program routine at: [www.micro-epsilon.de/link/software/medaqlib](http://www.micro-epsilon.de/link/software/medaqlib).

### 8.3 Resetting the Baud Rate

You can reset the baud rate to the factory setting when you start the sensor. To do this, half the supply voltage must be applied to the trigger input. This will reset the sensor to 115200 baud.

This means that, with the 47 kOhm internal pull-down resistor, you simply have to connect the TRIG connection to  $U_B$  via a 47 kOhm resistor.

Fig. 39 Resetting the baud rate to factory setting



## 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 blasting 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. Software Support with MEDAQLib

MEDAQLib is a documented driver DLL. You can use it to integrate optoNCDT ILR laser sensors into existing or client-owned software in conjunction with

- an IF2001/USB 1-channel converter and PC1100-x connection cable
- the IF2001/USB 4-channel converter and PC1100-x connection cable
- the IF2008 ETH and PCE2250-x connection cable.

MEDAQLib

- contains a DLL that can be imported into C, C++, VB, Delphi and many other programs,
- takes care of data conversion for you,
- works regardless of the type of interface used,
- uses the same functions for communication (commands),
- provides a single transmission format for all MICRO-EPSILON sensors.

For C/C++ programmers, an additional header file and a library file are integrated into MEDAQLib.

You can find the current driver routine including documents at:

[www.micro-epsilon.de/service/download/](http://www.micro-epsilon.de/service/download/)  
[www.micro-epsilon.de/link/software/medaqlib/](http://www.micro-epsilon.de/link/software/medaqlib/)

## 11. Liability for Material Defects

All components of the device have been checked and tested for functionality at the factory. However, if defects occur despite our careful quality control, MICRO-EPSILON or your dealer must be notified immediately.

The liability for material defects is 12 months from delivery. During this period any defective parts, with the exception of parts subject to wear, will be repaired or replaced at no cost when sent to MICRO-EPSILON. Any damage that is caused by improper handling, the use of force or by repairs or modifications by third parties is not covered by the liability for material defects. Repairs are carried out exclusively by MICRO-EPSILON.

Further claims can not be made. Claims arising from the purchase contract remain unaffected. In particular, MICRO-EPSILON shall not be liable for any consequential, special, indirect or incidental damage. In the interest of further development, Micro-Epsilon reserves the right to make design changes without notification. For translations into other languages, the German version shall prevail.

## 12. Service, Repair

If the sensor or sensor cable is defective:

- If possible, save the current sensor settings in a parameter set, see > *Save parameters to a file*, to reload them into the sensor after the repair, see [Chap. 6.9.1](#).
- 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 Eltrotec GmbH  
Manfred-Wörner-Straße 101  
73037 Göppingen / Germany

Tel. +49 (0) 7161 / 98872-300  
Fax +49 (0) 7161 / 98872-303  
e-mail [info@micro-epsilon.de](mailto:info@micro-epsilon.de)  
[www.micro-epsilon.com](http://www.micro-epsilon.com)

## 13. Decommissioning, Disposal

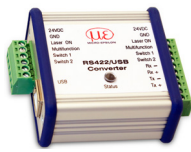



➡ Remove the connection cables from the sensor.

Incorrect disposal may cause harm to the environment.

➡ Dispose of the device, 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.

## Appendix

## A 1 Optional Accessories

|                             |   |  |
|-----------------------------|---|--|
| IF2001/USB                  |  | Converter from RS422 to USB, type: IF2001/USB, suitable for PC1100-x cable, including driver, Connections: 1x 10-pin socket strip (cable clamp), type: Würth 691361100010; 1x 6-pin socket strip (cable clamp), type: Würth 691361100006 |
| IF2004/USB                  |  | 4-channel converter from RS422 to USB, suitable for PCF2250-x/IF2004 cable, including driver, Connections: 2 x sub-D, 1 x terminal block   |
| IF2008/ETH                  |  | 8-fold RS422/Ethernet converter with industrial M12 plug/socket suitable for PCE2250-x cable   |
| PS2020                      |  | Power supply for DIN rail installation, input 230 VAC, output 24 VDC/2.5 A   |
| PC1100-x <sup>1</sup>       |   | Supply/output cable, x m long, for optoNCDT ILR 2250 series, straight plug, M16 12-pin plug; 3, 5, 10, 20, 25, 30, 40, 50 m long with open ends (not tin-plated)   |
| PC1100/90-x <sup>1</sup>    |   | Supply/output cable, x m long, for optoNCDT ILR2250 series, with 90° angle socket; M16 12-pin plug; 3, 5, 10, 20, 30, 40 m long with open ends (not tin-plated)  |
| PCF2250-3/IF2004            |   | Supply/output cable, 3 m long, for 4-channel IF2004/USB converter, with M16 connector and 15-pin Sub-HD plug   |
| PCE2250-x                   |   | Supply/output cable, x m long, for 8-channel IF2008/ETH converter, with M16 and M12 connectors   |
| PC1000-x IO-Link            |   | Supply/output cable, x = 5, 10 or 15 m long, 5-pin M12 connector on both sides, connection to IO-Link  |
| ILR-PG2250 protective glass |   | Optical glass, with anti-reflection coating and high transmission  |
| ILR-NDF2250 filter glass    |   | Optical gray filter, reduces maximum laser power. Enables measurement on strongly reflecting surfaces. It is possible to reduce the measuring range. Ask your regional sales contact before you use the filter glass.                    |

1) All lengths are also available in a drag chain-compatible design.

## A 2 Factory Settings

### A 2.1 ILR2250-100

|                        |  |  |
|------------------------|--|--|
| Preset                 | Automatic  |  |
| Baud rate              | 115200 baud  |  |
| Laser                  | Measure  |  |
| Region of interest     | 0.0 mm (min)<br>150000.0 mm (max)  |  |
| Analog output scaling  | 50 mm (min)<br>8000 mm (max)   |  |
| Trigger                | Inactive   |  |
| RS422                  | Timestamp and distance value   |  |
| Switching output 1/2/3 | Inactive<br>Output level: push-pull<br>Lower limit: 0.0 mm<br>Hysteresis: 0.0 mm | Range check: both<br>Upper limit: 150000.0 mm<br>Signal level hold: 1 ms |

### A 2.2 ILR2250-100-IO

|                    |                                   |  |
|--------------------|-----------------------------------|--|
| Preset             | Automatic                         |  |
| Transmission speed | COM2 (38.4 kBaud)                 |  |
| Laser              | Measure                           |  |
| Region of interest | 0.0 mm (min)<br>150000.0 mm (max) |  |

## A 3 ASCII Communication with Sensor

### A 3.1 General

The ASCII commands can be sent to the sensor via the RS422 interface. All commands, inputs and error reports are in English. A command always consists of the command name and zero or several parameters that are separated with a space and end in LF. If spaces are used in parameters, the parameter must be placed in quotation marks, e.g. "Password with space".

Example: Switching on output via RS422

OUTPUT RS422 ↵

Note: ↵ Must contain LF, but can also be CR LF.

Explanation: LF Line feed (hex 0A)

CR Carriage return (hex 0D)

↵ Enter (depending on system, hex 0A or hex 0D0A)

The currently set parameter value is reset if a command is invoked without parameters.

The entry formats are:

```
<Command name> <Parameter1> [<Parameter2> [...]]
```

```
<Command name> <Parameter1> <Parameter2> ... <Parameter...>
```

or a combination thereof.

Parameters in [] brackets are optional and require you to enter the preceding parameter.

Successive parameters without [] brackets are required, i.e. no parameter can be omitted. Alternative entries for parameter values are separated by "|", e.g. the values "a", "b" or "c" can be set for "a|b|c". Parameter values in <> brackets can be selected from a value range.

Explanations on the format:

|                 |   |
|-----------------|---|
| "a   b"         | Parameter value can be set to the value "a" or "b".   |
| " P1 P2"        | Both parameters "P1" and "P2" must be set.  |
| " P1 [P2 [P3]]" | The parameters "P1", "P2" and "P3" can be set, whereby "P2" can only be set if "P1" is set and "P3" can only be set if "P1" and "P2" are set. |
| "<a>"           | Parameter value is within a value range of "... to ...", see parameter description.   |

Parameter values without angle brackets can only be discrete values, see parameter description. Round brackets should be interpreted as a grouping, i.e. for better comprehensibility, "P1 P2|P3" is written as "(P1 P2)|P3".

Example without []:

```
„PASSWD <Old password> <New password> <New password>“
```

- All 3 parameters must be entered in order to change the password.

The output format is:

```
<Command name> <Parameter1> [<Parameter2> [...]]
```

The response can be used again without changes as a command for setting the password. Optional parameters are only returned as well if this is necessary. For example, for the data selection additional values command, only the activated output values are returned.

After a command is processed, a line break and a prompt ("->") is always returned. In the event of an error, an error message beginning with "Exxx", where xx stands for a unique error number, comes before the prompt. Moreover, instead of error messages, warning messages ("Wxxx") may be output. Warnings are structured analogously to error messages. In the case of warning messages, the command has been executed.

For support requests regarding the sensor, the responses to the commands GETINFO and PRINT are helpful because they contain the sensor settings.

## A 3.2 Commands Overview

| Group                                 | Chapter                       | Command                  | Brief information                                     |
|---------------------------------------|-------------------------------|--------------------------|---|
| <b>General</b>                        |                               |                          |   |
|                                       | <a href="#">Chap. A 3.3.1</a> | HELP                     | Help on commands                                      |
|                                       | <a href="#">Chap. A 3.3.2</a> | GETINFO                  | Request sensor information                            |
|                                       | <a href="#">Chap. A 3.3.3</a> | GETTEMP                  | Determine sensor temperature                          |
|                                       | <a href="#">Chap. A 3.3.4</a> | RESET                    | Reboot sensor   |
|                                       | <a href="#">Chap. A 3.3.5</a> | RESETCNT                 | Reset counter   |
|                                       | <a href="#">Chap. A 3.3.6</a> | PRINT                    | Output of all measurement settings                    |
|                                       | <a href="#">Chap. A 3.3.7</a> | PRINT ALL                | Output of measurement settings and sensor information |
| <b>Triggering</b>                     |                               |                          |   |
|                                       | <a href="#">Chap. A 3.4.1</a> | TRIGGER                  | Set trigger mode                                      |
|                                       | <a href="#">Chap. A 3.4.2</a> | TRIGGERAT                | Effect of trigger input                               |
|                                       | <a href="#">Chap. A 3.4.3</a> | TRIGGERLEVEL             | Select level for switching input                      |
|                                       | <a href="#">Chap. A 3.4.4</a> | TRIGGERCOUNT             | Number of measured values to be specified             |
|                                       | <a href="#">Chap. A 3.4.5</a> | TRIGGERSW                | Software trigger pulse                                |
| <b>Interfaces</b>                     |                               |                          |   |
|                                       | <a href="#">Chap. A 3.5.1</a> | BAUDRATE                 | Set transmission rate of RS422                        |
|                                       | <a href="#">Chap. A 3.5.2</a> | ERROROUT1/2/3            | Activate switching outputs                            |
|                                       | <a href="#">Chap. A 3.5.3</a> | ERRORLEVELOUT1/2/3       | Output level of switching outputs                     |
|                                       | <a href="#">Chap. A 3.5.4</a> | ERRORLIMITCOMPARETO1/2/3 | Switching output monitoring function                  |
|                                       | <a href="#">Chap. A 3.5.5</a> | ERRORLIMITVALUES1/2/3    | Switching output limit value                          |
|                                       | <a href="#">Chap. A 3.5.6</a> | ERRORHYSTERESIS1/2/3     | Switching output hysteresis value                     |
|                                       | <a href="#">Chap. A 3.5.7</a> | ERROROUTHOLD             | Min. switching time of active switching output        |
|                                       | <a href="#">Chap. A 3.5.8</a> | OUTHOLD                  | Error handling  |
| <b>Setup and Measurement Settings</b> |                               |                          |   |
|                                       | <a href="#">Chap. A 3.6.1</a> | MEASSETTINGS             | Load/save measurement settings                        |
|                                       | <a href="#">Chap. A 3.6.2</a> | BASICSETTINGS            | Load/save device settings                             |
|                                       | <a href="#">Chap. A 3.6.3</a> | SETDEFAULT               | Factory settings                                      |
|                                       | <a href="#">Chap. A 3.6.4</a> | LASER                    | Switch on measurement laser, start measurement        |
|                                       | <a href="#">Chap. A 3.6.5</a> | ROI                      | Region of interest masking                            |
| <b>Data Output</b>                    |                               |                          |   |
|                                       | <a href="#">Chap. A 3.7.1</a> | OUTPUT                   | Measured value output selection                       |
|                                       | <a href="#">Chap. A 3.7.2</a> | GETOUTINFO_RS422         | List intended data for RS422                          |
|                                       | <a href="#">Chap. A 3.7.3</a> | OUTADD_RS422             | Data selection of additional values                   |
|                                       | <a href="#">Chap. A 3.7.4</a> | ANALOGSCALERANGE         | Analog output scaling limits                          |

### A 3.3 General Commands

#### A 3.3.1 HELP

```
HELP [<command>]
```

Output help for each command.

Command without parameters

```
<Command> // Command is executed
```

Command with parameters

```
<Command> // Show current parameter values
<Command> <Parameter1> [<Parameter2> [...]] // Set the parameters; the number of
// parameters varies
<Command> <Parameter1> <Parameter2> ... <Parameter...> // Set the parameters; the number of
// parameters stays the same
```

Response to a command

```
-> Cursor; the sensor is waiting for an entry
E<ddd> Error message; execution rejected
<ddd> Error code
```

Format explanation

```
() Grouping
[] Optional parameters
<> Placeholders
| Alternative
```

If a parameter contains spaces, they must be placed in quotation marks.

Examples:

```
a|b // Use a or b
a b // Both parameters are required
a [b [c]] // Non-fixed number of parameters: a, a b, or a b c
```

#### A 3.3.2 GETINFO, Sensor Information

```
GETINFO
```

Request sensor information. Output see example below:

|                  |            |                             |
|------------------|------------|-----------------------------|
| ->GETINFO        |            |                             |
| Name:            | ILR2250    | //Model name of sensor      |
| Serial:          | 1252       | //Serial number             |
| Option:          | 000        | //Sensor option number      |
| Article:         | 7112015    | //Sensor article number     |
| Measuring range: | 150000.0mm | //Measuring range of sensor |
| Version:         | 1.0        | //Software version          |
| Hardware-rev:    | 00         |                             |
| ->               |            |                             |

#### A 3.3.3 GETTEMP

```
GETTEMP
```

Reports the inner temperature of the sensor in °C with one decimal place.



### A 3.3.4 RESET, Rebooting Sensor

RESET

The sensor is restarted.

### A 3.3.5 RESETCNT, Resetting Counter

RESETCNT TIMESTAMP

Resets the internal timestamp in the sensor.

### A 3.3.6 PRINT, Sensor Settings

PRINT

Print is used to output all measurement settings. Example of a response:

|                              |                                  |
|------------------------------|----------------------------------|
| BAUDRATE 115200              | ERRORHYSTERESIS1 0.0             |
| LASER MEASURE                | ERRORHYSTERESIS2 0.0             |
| ROI 0.0 150000.0             | ERRORHYSTERESIS3 0.0             |
| OUTPUT RS422                 | ERRORLIMITCOMPARETO1 BOTH        |
| ANALOGSCALERANGE 50.0 8000.0 | ERRORLIMITCOMPARETO2 BOTH        |
| TRIGGER NONE                 | ERRORLIMITCOMPARETO3 BOTH        |
| TRIGGERAT INPUT              | ERRORLIMITVALUES1 0.0 150000.0   |
| TRIGGERCOUNT 1               | ERRORLIMITVALUES2 0.0 150000.0   |
| TRIGGERLEVEL HIGH            | ERRORLIMITVALUES3 0.0 150000.0   |
| ERROROUT1 NONE               | ERROROUTHOLD 0                   |
| ERROROUT2 NONE               | OUTHOLD NONE                     |
| ERROROUT3 NONE               | MEASSETTINGS PRESETMODE AUTO     |
| ERRORLEVELOUT1 PUSH/PULL     | GETOUTINFO_RS422 TIMESTAMP DIST1 |
| ERRORLEVELOUT2 PUSH/PULL     |                                  |
| ERRORLEVELOUT3 PUSH/PULL     | ->                               |

### A 3.3.7 PRINT ALL

PRINT ALL

This command combines the two `GETINFO` and `PRINT` commands. In addition to the current measurement settings, the sensor information is also output.

## A 3.4 Triggering

The TRIG switching output serves as the trigger input.

### A 3.4.1 TRIGGER

TRIGGER [NONE | EDGE | PULSE | SOFTWARE]

Selection of trigger type.

- NONE: No triggering
- EDGE: Edge triggering
- PULSE: Level triggering
- SOFTWARE: Software triggering

### A 3.4.2 TRIGGERAT

TRIGGERAT [INPUT | OUTPUT]

Defines the type of triggering for data acquisition or data output.

- INPUT: Triggers measured value acquisition.
- OUTPUT: Triggers measured value output.

**A 3.4.3 TRIGGERLEVEL**

TRIGGERLEVEL [HIGH|LOW]

Defines the active level of a trigger event.

- HIGH: HIGH: Edge triggering: Rising edge, level triggering: High active
- LOW: Edge triggering: Falling edge, level triggering: Low active

**A 3.4.4 TRIGGERCOUNT**

TRIGGERCOUNT [&lt;n&gt; | INFINITE]

Sets the number of measured values to be output during triggering.

- INFINITE: Start of continuous output after first trigger event
- <n>: Number of values to be output after each trigger event n = 1 to 2147483646.

**A 3.4.5 TRIGGERSW**

TRIGGERSW

Generates a software trigger pulse.

**A 3.5 Interfaces****A 3.5.1 BAUDRATE**

BAUDRATE [9600|115200]

Sets the baud rate for the RS422 interface.

**A 3.5.2 ERROROUT1/2/3, Activating Switching Output**

ERROROUT1 [NONE|TEACH|LIMIT]

ERROROUT2 [NONE|TEACH|LIMIT]

ERROROUT3 [NONE|TEACH|LIMIT]

Select error signal for switching outputs.

- NONE: Switching output is not active.
- TEACH: Switching output responds if an error current of approx. 3 mA is output.
- LIMIT: Switching output responds if the upper limit is exceeded or the lower limit is undershot.

**A 3.5.3 ERRORLEVELOUT1/2/3**

ERRORLEVELOUT1 [NPN|PNP|PUSHPULL|PUSHPULLNEG]

ERRORLEVELOUT2 [NPN|PNP|PUSHPULL|PUSHPULLNEG]

ERRORLEVELOUT3 [NPN|PNP|PUSHPULL|PUSHPULLNEG]

Selection of output level for the error outputs.

- NPN: Switching output is passive in event of error.
- PNP: Switching output is active in event of error.
- PUSHPULL: Switching output is high in event of error.
- PUSHPULLNEG: Switching output is low in event of error.

**A 3.5.4 ERRORLIMITCOMPARETO1/2/3**

ERRORLIMITCOMPARETO1 [LOWER|UPPER|BOTH]

ERRORLIMITCOMPARETO2 [LOWER|UPPER|BOTH]

ERRORLIMITCOMPARETO3 [LOWER|UPPER|BOTH]

Sets the monitoring function for the switching outputs.

- LOWER: The measured value is monitored to check whether it is less than the limit value.
- UPPER: The measured value is monitored to check whether it is greater than the limit value.
- BOTH: The measured value is monitored to check whether it is less than or greater than the limit value.

**A 3.5.5 ERRORLIMITVALUES1/2/3**

ERRORLIMITVALUES1 [<lower> <upper>]

ERRORLIMITVALUES2 [<lower> <upper>]

ERRORLIMITVALUES3 [<lower> <upper>]

Sets the lower and upper limit value for the switching outputs.

Value range:

<lower> Value range between 0.0 and 150,000.0 (mm, one decimal place)

<lower> Value range between 0.0 and 150,000.0 (mm, one decimal place)

**A 3.5.6 ERRORHYSTERESIS1/2/3**

ERRORHYSTERESIS1 [<hysteresis>]

ERRORHYSTERESIS2 [<hysteresis>]

ERRORHYSTERESIS3 [<hysteresis>]

Value by which the measured value must be above or below the limit in order for the switching output to be triggered or deactivated again.

<hysteresis>: Value range between 0.0 and 150,000.0 (mm, one decimal place)

**A 3.5.7 ERROROUTHOLD**

ERROROUTHOLD [<time>]

Specification of the minimum time in ms for which the switching output should remain active if the limit value is exceeded. The time period begins when the limit value is exceeded.

<time> Value range between 0 and 10000 ms.

**A 3.5.8 OUTHOLD, Error Handling**

OUTHOLD [NONE|0|<count>]

Sets the measured value output behavior in the event of an error.

- NONE: Last measured value not held; error value output.
- 0: Last measured value held indefinitely
- <count> Last measured value held for n measurement cycles, afterwards an error value is output.  
n = (1 ... 2147483645).

**A 3.6 Setup and Measurement Settings****A 3.6.1 MEASSETTINGS**

MEASSETTINGS [READ|STORE|PRESETLIST|PRESETMODE [<mode>]]

Settings for measurement task. Loads manufacturer-defined presets or user-specific setups from the sensor or saves user-specific setups in the sensor.

- READ: Read measurement settings from non-volatile memory.
- STORE: Write measurement settings to non-volatile memory.
- PRESETLIST: Lists all existing configurations
- PRESETMODE: Sets a configuration
- <mode>: Name of a configuration listed with the subcommand PRESETMODE.

**A 3.6.2 BASICSETTINGS**

BASICSETTINGS [READ|STORE]

- READ: Loads the saved device settings from the sensor.
- STORE: Saves the current device settings in the sensor.

### A 3.6.3 SETDEFAULT, Factory Settings

```
SETDEFAULT MEASSETTINGS
```

Resets the sensor to factory settings.

- ALL: Deletes the measurement and device settings and loads the standard presets for the measurement settings and default parameters for the device settings.
- MEASSETTINGS: Deletes the measurement settings and loads the standard presets.
- BASICSETTINGS: Deletes the device settings and loads the default parameters.

### A 3.6.4 LASER

```
LASER [OFF|ON|MEASURE]
```

- OFF: Switches the laser off, ends the measurement.
- ON: Switches the laser on for installation purposes; no measurement.
- MEASURE: Starts a measurement.

### A 3.6.5 ROI, Region of Interest

```
ROI [<lower> <upper>]
```

Sets the region of interest; the value range for min and max is between the SMR and EMR. The value “min <lower>” is less than the value “max <upper>”.

<lower> Value range between SMR and EMR (mm, one decimal place)

<upper> Value range between SMR and EMR (mm, one decimal place)

## A 3.7 Data Output

### A 3.7.1 OUTPUT

```
OUTPUT [NONE|RS422|RS422_ASCII]
```

Output of measurement results to serial interface.

- NONE: No output of measured values.
- RS422: Binary output of measured values via RS422.
- RS422\_ASCII: Output of measured values via RS422 using ASCII.

### A 3.7.2 GETOUTINFO\_RS422, Data Selection Query

```
GETOUTINFO_RS422
```

The command lists all output data selected for the RS422 interface. The order shown corresponds to the output order.

### A 3.7.3 OUTADD\_RS422, Data Selection of Additional Values

```
OUTADD_RS422 NONE| ([TIMESTAMP])
```

Selection of additional values to be transmitted.

- NONE: No output of any further values
- TIMESTAMP: Output of the time stamp

### A 3.7.4 ANALOGSCALERANGE

```
ANALOGSCALERANGE [<lower> <upper>]
```

Sets the scaling limits for the analog output during two-point scaling.

Value range:<limit 1> = (-2 ... +2) \* Measuring range [mm] <limit 2> = (-2 ... +2) \* Measuring range [mm]

The scaling limits must not be identical; <lower> is less than <upper>.

<lower> Value range between SMR and EMR (mm, one decimal place)

<upper> Value range between SMR and EMR (mm, one decimal place)

**A 3.8 ASCII Error Codes**

| Error code | Description   |
|------------|---|
| E104       | Timeout   |
| E110       | Processing of configuration failed                    |
| E111       | Measurement result invalid                            |
| E112       | Error while executing command                         |
| E180       | Internal error in laser module communication          |
| E181       | Timeout in laser module communication                 |
| E182       | Laser module command interrupted                      |
| E183       | Device busy   |
| E184       | Command error in laser module communication           |
| E185       | Tracking measurement time too short                   |
| E186       | Error in laser module communication                   |
| E187       | Distance not in measurement range                     |
| E188       | Temperature too high                                  |
| E189       | Temperature too low                                   |
| E190       | Signal too low or distance not in range               |
| E191       | Signal too high                                       |
| E192       | Signal too noisy                                      |
| E193       | Laser module voltage too low                          |
| E194       | Signal too unstable                                   |
| E195       | Laser not in measurement mode                         |
| E196       | Temperature gradient too high                         |
| E204       | Invalid character in input                            |
| E210       | Unknown command keyword                               |
| E214       | Entered command is too long to be processed           |
| E215       | Input or command buffer overflow                      |
| E232       | Wrong parameter count                                 |
| E234       | Missing/unexpected parameters or wrong parameter type |
| E236       | Invalid parameter value                               |
| E363       | Setting is invalid                                    |
| E600       | ROI begin is greater than roi end                     |
| E616       | Software triggering is not active                     |



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