



Instruction Manual
optoNCDT ILR 102x/110x/115x

Non-contact laser optical distance sensors

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Certified acc. to DIN EN ISO 9001: 2008

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1. Safety

The handling of the system assumes knowledge of the instruction manual.

1.1 Symbols Used

The following symbols are used in the instruction manual:



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



Indicates a situation which, if not avoided, may lead to property damage.



Indicates a user action.



Indicates a user tip.

Measure

Indicates a hardware or a button/menu in the software.

1.2 Warnings



Connect the power supply and the display / output device in accordance with the safety regulations for electrical equipment.

> Danger of injury

> Damage to or destruction of the sensor



The power supply may not exceed the specified limits.

> Damage to or destruction of the sensor

Protect the cables against damage.

> Destruction of the sensor

> Failure of the measuring device

Avoid shock and vibration to the sensor.

> Damage to or destruction of the sensor

1.3 Notes on CE Identification

The following applies to the series optoNCDT 102x/110x/115x:

- EU directive 2004/108/EC
- EU directive 2011/65/EU, "RoHS" category 9

Products which carry the CE mark satisfy the requirements of the EU directives and the European standards (EN) listed therein. The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

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The optoNCDT 102x/110x/115x is designed for use in industry and satisfies the requirements of the standards

- EN 60 947-5-2: 2008
- EN 60825-1: 2008
- DIN EN ISO 11145: 2008

The system satisfies the requirements if they comply with the regulations described in the instruction manual for installation and operation.

1.4 Proper Use

- The optoNCDT 102x/110x/115x is designed for use in industrial areas.
- It is used for
 - distance measuring,
 - positioning and
 - robot control.
- The system may only be operated within the limits specified in the technical data, see Chap. [3.3](#).
- Use the optoNCDT 102x/110x/115x in such a way that in case of malfunctions or failure personnel or machinery are not endangered.
- Take additional precautions for safety and damage prevention for safety-related applications.

1.5 Proper Environment

- Protection class: IP 67
- Operating temperature: -10 ... +50 °C (+14 ... +122 °F)
-20 ° ... +50 °C (-4 ... +122 °F) continuous operation
- Storage temperature: -30 ... +75 °C (-22 ... +167 °F)
- Humidity: 5 - 95 % (non-condensing)
- Ambient pressure: Atmospheric pressure
- Electromagnetic compatibility (EMC): Acc. to EN 60 947-5-2: 2008
EN 60825-1: 2008
DIN EN ISO 11145: 2008

2. Laser Class


The optoNCDT 102x/110x/115x sensors operate with a semiconductor laser for measurements and adjustment of the sensor.

CAUTION

Never deliberately look into the laser beam! Consciously close your eyes or turn away immediately if ever the laser beam should hit your eyes.

		Laser type, wavelength		
	Laser class	ILR1020-6	ILR1021-30	ILR1100-6 / ILR1101-50 / ILR1150-10 / ILR1151-250
Measurement	1 (I)	Infrared, 905 nm		Infrared, 900 nm
Mounting/ adjustment	2 (II)	Red, 650 nm, P_{\max} : 3.8 mW	Red, 650 nm, P_{\max} : 3 mW	Red, 650 nm, P_{\max} : 3 mW

Class 1/2 (I, II) lasers do not require a laser safety officer or any additional laser indicator. The following warning label is attached to the sensor housing:

 Comply with all regulations on lasers!




During operation of the sensor the pertinent regulations acc. to EN 60825-1 on “radiation safety of laser equipment” must be fully observed at all times.

The sensor complies with all applicable laws for the manufacturer of laser devices.

This system is classified by the Center for Devices and Radiological Health (CDRH) as a Class I, II laser device.

Although the laser output is low looking directly into the laser beam must be avoided. Due to the visible light beam eye protection is ensured by the natural blink reflex.

The housing of the optical sensors optoNCDT 102x/110x/115x may only be opened by the manufacturer. For repair and service purposes the sensors must always be sent to the manufacturer, see Chap. 9.

<p>ILR1100-6 / ILR1101-50 / ILR1150-10 / ILR1151-250</p>	<p>ILR1021-30</p>	<p>ILR1020-6</p>								
<div style="text-align: center;">  </div> <p>Operating Mode Laser Class 1 (Infrared)</p> <hr/> <p>Adjust Mode Laser Class 2 (Visible - Red) Do not stare into beam</p> <p>λ: 650 nm t_p: 0,3μs; T: 1μs P_{max}: 3mW</p> <hr/> <p>EN 60825-1: 2008-5</p>	<div style="text-align: center;">  </div> <p>Operating Mode Laser Class 1 (Infrared)</p> <hr/> <p>Adjust Mode Laser Class 2 (Visible - Red) Do not stare into beam</p> <p>λ: 650 nm t_p: 0,25μs; T: 2,0μs P_{max}: 3mW</p> <hr/> <p>EN 60825-1: 2008-5</p>	<div style="text-align: center;">  </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>VISIBLE AND INVISIBLE LASER RADIATION DO NOT STARE INTO BEAM LASER PRODUCT</p> <table style="width: 100%; font-size: small;"> <tr> <td>Measuring LASER class 1</td> <td>Pilot LASER class 2</td> </tr> <tr> <td>wavelength: 905nm</td> <td>wavelength: 650nm</td> </tr> <tr> <td>peak power: 2,4W</td> <td>peak power: 3,8mW</td> </tr> <tr> <td>pulse duration: 8,75ns</td> <td>pulse duration: 9,25μs</td> </tr> </table> <p style="font-size: x-small;">IEC 60825-1: 2007 certified Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.</p> </div>	Measuring LASER class 1	Pilot LASER class 2	wavelength: 905nm	wavelength: 650nm	peak power: 2,4W	peak power: 3,8mW	pulse duration: 8,75ns	pulse duration: 9,25 μ s
Measuring LASER class 1	Pilot LASER class 2									
wavelength: 905nm	wavelength: 650nm									
peak power: 2,4W	peak power: 3,8mW									
pulse duration: 8,75ns	pulse duration: 9,25 μ s									
<p><i>Fig. 1 Laser warning label</i></p>	<p><i>Fig. 2 Laser warning label</i></p>	<p><i>Fig. 3 Laser warning label</i></p>								

3. Functional Principle, Technical Data

3.1 Sensor Models



Fig. 4 Front view
ILR1020/1021



Fig. 5 Front view
ILR110x/115x

The sensors of the series ILR102x/110x/115x use the principle of pulsed light runtime measurement. The sensors measure the distance to a target (ILR1020/1100/1150) or a reflector (ILR1021/1101/1151). The distance measuring is done with an infrared laser. An additional red target laser is used for mounting and adjustment purposes.

The measurements are provided with analog or digital standard interfaces.



Fig. 6 Rear view
ILR1020/1021



Fig. 7 Rear view
ILR110x/115x

The series ILR102x sensors contain:

- 2 buttons for complete on-site setup
- Analog output, 4 .. 20 mA
- 2 switching outputs

The series ILR11xx sensors contain:

- LCD display and 3 buttons for complete on-site setup
- RS422 interface
- SSI compatible interface (GRAY or BIN)
- 2 switching outputs, error and plausibility output
- Bus communication with external bus adapter
- Analog output, 4 .. 20 mA, (only ILR11x0)

3.2 Functional Principle

With pulse runtime measurement a short light pulse is sent, reflected and registered in the receiver. At the same moment the time is stopped. The outgoing pulse starts a clock and the received pulse stops the clock. The elapsed time (light runtime) is proportional to the light distance. The pulse runtime measurement suppress ambiguities in the received signal and enables well interfering light suppression.

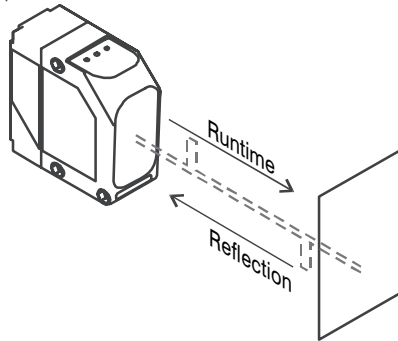


Fig. 8 Runtime measurement with pulsed laser light for distance measurement

3.3 Technical Data

The data apply to the specified surface at constant environment conditions with a minimum operating time of 15 minutes.

The switching outputs are short-circuit proof.

Model	ILR1020-6	ILR1021-30	ILR1100-6	ILR1101-50	ILR1150-10	ILR1151-250	
Measuring range	black 6 %	0.2 ... 2.5 m	-	0.5 m ... 2 m	-	0.5 m ... 3 m	-
	gray 10 %	0.2 ... 6 m	-	0.5 m ... 4 m	-	0.5 m ... 7 m	-
	white 90 %	0.2 ... 6 m	-	0.5 m ... 6 m	-	0.5 m ... 10 m	-
	-	0.2 m ... 30 m	-	0.5 m ... 50 m	-	0.5 m ... 250 m	
Linearity	±40 mm	±60 mm	±10 mm	±15 mm	±8 mm	±10 mm	
Repeat accuracy/resolution	±10 / 15 mm ¹	±5 / 10 mm ¹	±5 mm	±5 mm	±4 mm	±2 mm	
Resolution (digital output)	-	-	0.1 oder 0.125 mm				
Digital data rate	-	-	SSI: 1.4 ms (SSI cycle 80 µs ; RS 422: 2.9 ms at 57.6 kBaud)				
Response time	80/13 ms ¹	65/30 ms ¹	12 ms				
Temperature stability	≤ 1.2 mm/K		< 0.5 mm/K		< 5 mm absolute		
Laser class	Measuring	IR 905 nm, laser class 1 (II)		IR 900 nm, laser class 1 (II)			
	Mounting	red 650 nm, laser class 2 (II)		P _{max} : 3 mW; T: 1 µs; t _p : 0.3 µs			
		P _{max} : 3.8 mW; t _p : 0.25 µs	P _{max} : 3 mW; T: 2 µs; t _p : 0.25 µs				
Light spot diameter	3 x 10 mm @ 4 m	15 x 20 mm @ 10 m	3 x 10 mm @ 4 m	20 x 20 mm @ 10 m	3 x 10 mm @ 4 m	20 x 20 mm @ 10 m	
Operating temperature	-10 ° ... +50 °C (+14 ... +122 °F) (-20 ° ... +50 °C (-4 ... +122 °F) continuous operation)						
Humidity	5 ... 95 %, non-condensing						
Storage temperature	-40 ° ... +80 °C (-40 ... +176 °F)		-30 ° ... +75 °C (-22 ... +167 °F)				
Switching outputs	Q _A / Q _B (max. 100 mA)		Q ₁ / Q ₂ (max. 100 mA)				
Plausibility output	-		Q _p (max. 50 mA)				
Service output	-		Q _s (max. 50 mA)				

Model		ILR1020-6	ILR1021-30	ILR1100-6	ILR1101-50	ILR1150-10	ILR1151-250
Serial interface		-		RS 422 or SSI - compatible (GRAY / BINARY) selectable			
Bus interface		-		Profibus or DeviceNET, through gateway (accessory)			
Analog output		4 - 20 mA / max. load 500 Ohm			no	4 - 30 mA	no
Switching points		free adjustable (teach in)		adjustable in 1 mm steps			
Switching hysteresis		30 mm		min. 20 mm (adjustable)		min. 10 mm (adjustable)	
Power supply		18 - 30 VDC / current consumption (no load operation, $U_b = 24$ VDC) < 125 mA / with inverse-polarity protection					
Connection		5-pin connector, M12		12-pin connector, M16			
Protection class		IP 67					
Dimensions		93 mm x 93 mm x 42 mm					
Housing material		ABS shock-resistant					
Vibration		10 - 55 Hz, amplitude 1.5 mm, period 5 min. at resonant frequency or 55 Hz, stress time 30 min. per axis					
Shock	EN 60947-5-2	Acceleration 30 g, pulse duration 11 ms, half sinusoid, 3 shocks/axis					
Weight	EN 60947-5-2	approximately 200 g		approximately 230 g			

1) slow/fast, in the mode, the sensor reaches a higher repeat accuracy with a lower switching frequency.

4. Delivery

4.1 Unpacking

- 1 Sensor optoNCDT102x/110x/115x
- 1 Instruction manual
- 1 CD with configuration software (ILR11xx only)

Optional accessory, packed separately:

- 1 Power supply / output cable PC1000 respectively PC1100 with 2 m up to 30 m length
- 1 Female cable connector

You will find optional accessories in appendix, see Chap. [A 1](#).

- ➡ Check the delivery for completeness and shipping damage immediately after unpacking.
- ➡ In case of damage or missing parts, please contact the manufacturer or supplier immediately.

4.2 Storage

- Storage temperature: -30 to +75 °C (-22 up to +167 °F), ILR11xx
-40 to +80 °C (-40 up to +176 °F), ILR102x
- Humidity: 5 - 95 % (non-condensing)

5. Installation

The sensor optoNCDT102x/110x/115x is an optical sensor for measurements with millimeter accuracy.

- **i** Pay attention to careful handling during mounting and operation.

5.1 Sensor Mounting

- The sensor is mounted by means of 3 screws type M5
- The laser beam must be directed perpendicularly onto the surface of the target. In case of misalignment it is possible that the measurement results will not always be accurate.

- **i** To align the sensor, please comply with the Instructions for Operation, see Chap. 7.

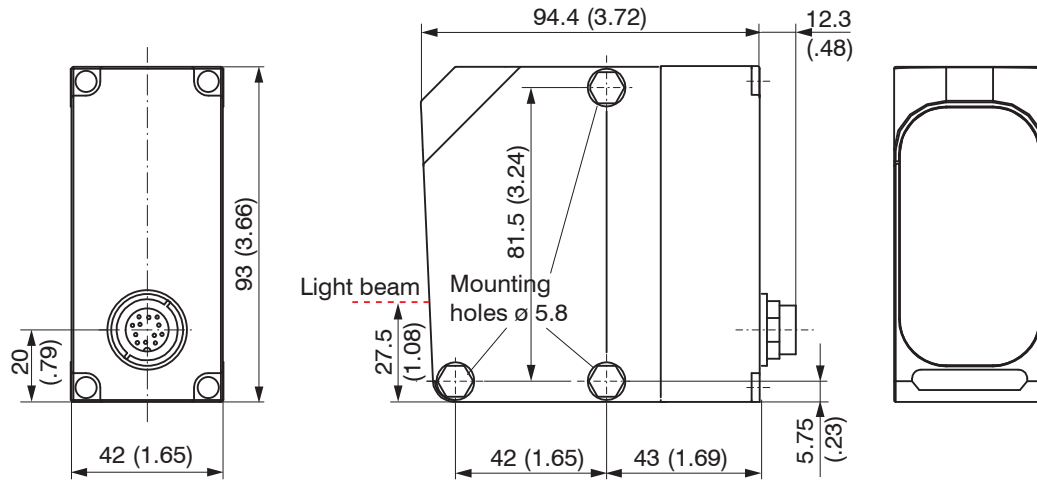


Fig. 9 Dimensional drawing sensor, dimensions in mm (inches), not to scale

5.2 Reflector Mounting

The series ILR1021/1101/1151 sensors measure the distance to a reflector. Direct measuring to a target is not possible. Depending on the measuring range different types of reflectors are used.

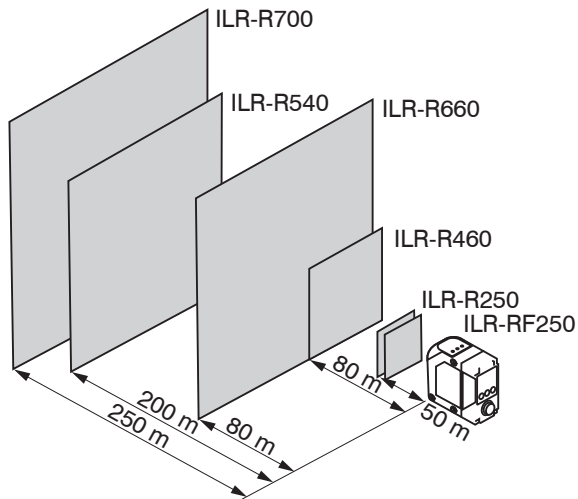


Fig. 11 Distances to the different reflectors to the sensor

i Measuring against a reflector only with series ILR1021/1101/1151 sensors.

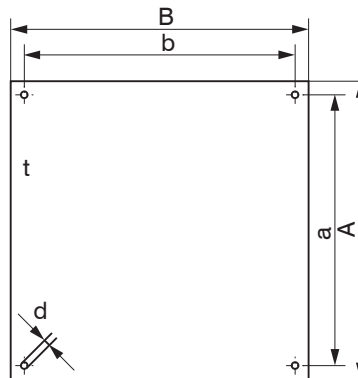


Fig. 10 Dimensional drawing reflector, dimensions in mm, not to scale

	A	B	a	b	d	t
ILR-RF250	250	250	-	-	-	0.5
ILR-R250	248	248	218	218	6.5	4.5
ILR-R460	460	460	430	430	6.5	4.5
ILR-R660	660	660	630	630	6.5	4.5
ILR-R540	540	540	510	510	6.5	6.8
ILR-R700	700	700	670	670	6.5	6.8

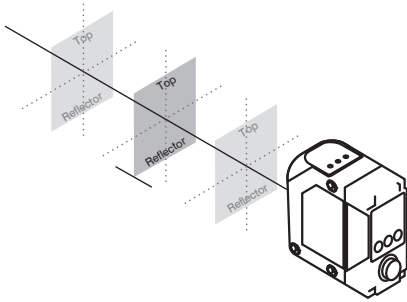


Fig. 12 Reflector orientation

It is possible to align the sensor over a max. distance of approximately 50 m using the integrated red light target laser.

i For larger distances, use the aligning aid (ILR-AA1) listed in the accessories, see Chap. [A 1](#).

This aligning aid, makes it possible to check the position of the red light target laser spot on the reflector at very long ranges (>100 m). When aligning first check that the light spot is in the center of the reflector at a very short distance (e. g. < 1 m). The reflector is then moved to its final position with the longest range and the position of the light spot is checked again and adjusted if necessary. Finally, check the position of the light spot again close-up. The light spot must always be in the center of the reflector whatever the position. The fine adjustment set (LR-FA1) available as an accessory can be used for finer adjustment, see Chap. [A 1](#).

5.3 Light Spot Geometry

5.3.1 ILR102x

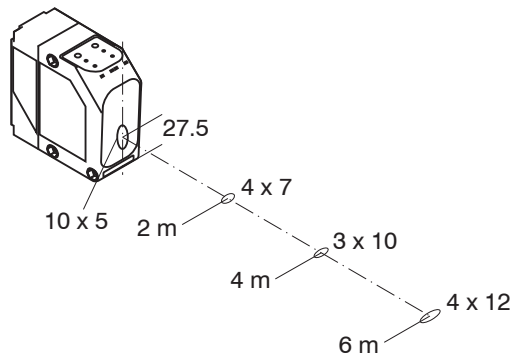


Fig. 13 Light spot geometry ILR1020, dimensions in mm, not to scale

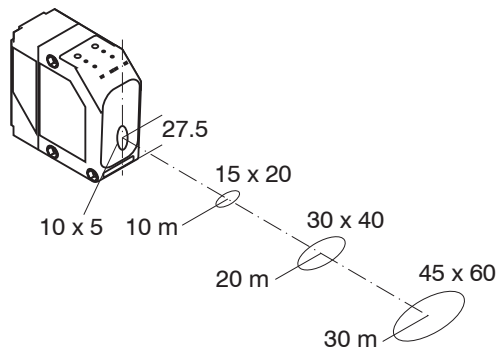


Fig. 14 Light spot geometry ILR1021, dimensions in mm, not to scale

5.3.2 ILR11xx

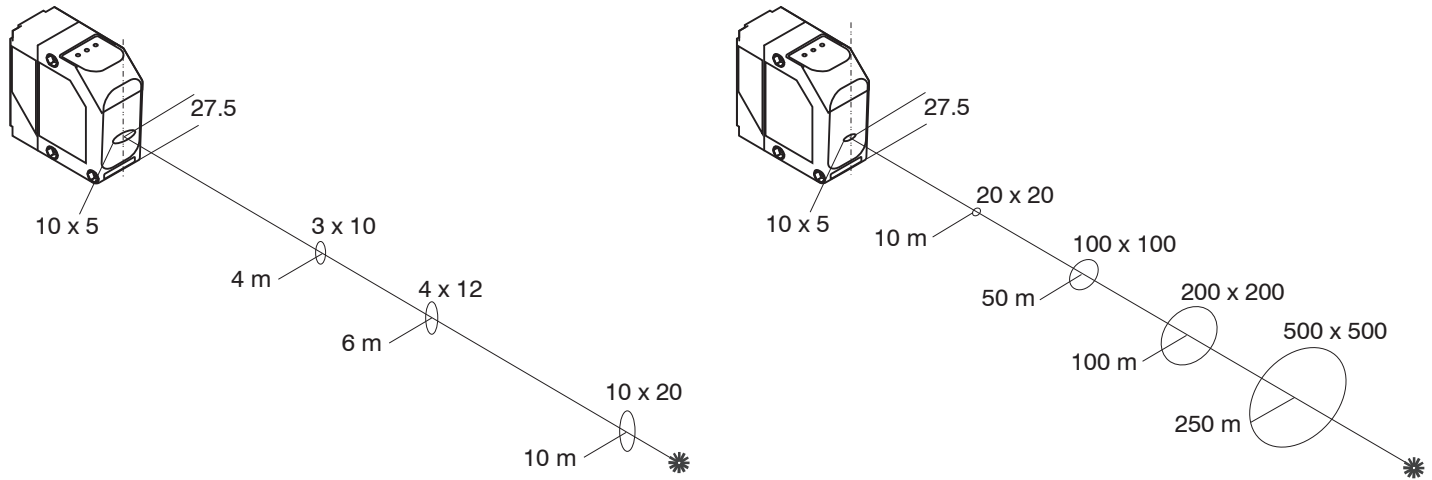


Fig. 15 Light spot geometry ILR11x0, dimensions in mm, not to scale

5.4 Electrical Connection

The sensors contain 5-pin connectors (ILR102x) or 12-pin connectors (ILR11xx). Bending radius of the supply and output cable (available as an optional accessory, see Chap. A 1):

PC1x 34 mm (once), 84 mm (permanent)

PC11x 47 mm (once), 116 mm (permanent)

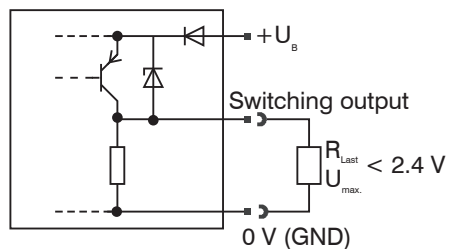


Fig. 16 Wiring diagram switching outputs

5.4.1 ILR102x

Pin	Color PC1000	Specification
1	brown	$U_b + 18 \dots 30 \text{ V}$
2	white	Switching output Q_B , $I_{\text{max}} 100 \text{ mA}$
3	blue	0 V (GND)
4	black	Switching output Q_A , $I_{\text{max}} 100 \text{ mA}$
5	gray	Analog output 4 .. 20 mA

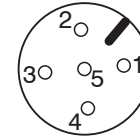


Fig. 17 Female cable connector, view on solder pin side

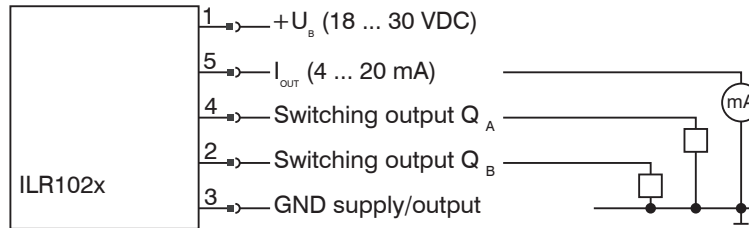


Fig. 18 Pin assignment

5.4.2 ILR11xx

Pin	Designation	Color PC1100	Description
A	TX+	white	RS422: transmitted data / SSI: Data+
B	Q1	brown	Switching output Q1, I_{max} : 100 mA
C	RX+	green	RS422: received data / SSI: Clock+
D	analog	yellow	Analog output 4 .. 20 mA (ILR11x0 only)
E	Q _s	gray	Service output Qs, I_{max} : 50 mA
F	Q _B	pink	Plausibility output Qp, I_{max} : 50 mA
G	U _B	red	U _B + 18 ... 30 V
H	RX-	black	RS422: received data / SSI: Clock-
J	NC	violet	-
K	TX-	gray/pink	RS422: transmitted data / SSI: Data-
L	Q2	red/blue	Switching output Q2, I_{max} : 100 mA
M	GND	blue	0 V (GND)

Fig. 19 Pin assignment

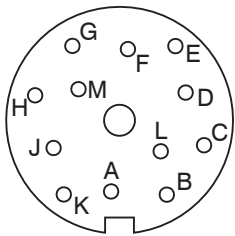


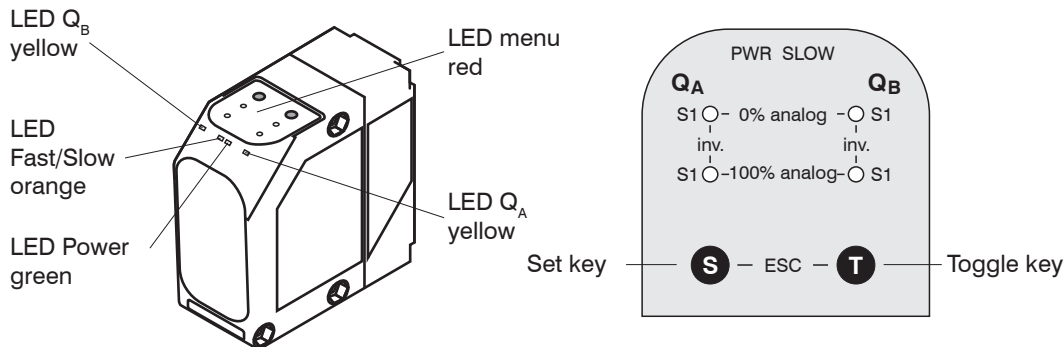
Fig. 20 Female cable connector, view on solder pin side

6. Operation

6.1 ILR102x

Once the sensor has been connected to the power supply the green POWER LED lights up.

6.1.1 Control and Display Elements



i The sensor needs a warm-up time of about 15 min for repeatable measurements.

LED		Description	Operation is done with the keys Set and Toggle. Set : Setting or resetting the selected function. The value is stored if the menu LED flashes 3 times. Toggle : Switches through the menu functions.
Q _A	lights	Switching output Q _A active	
Q _B	lights	Switching output Q _B active	
Fast/Slow	flashes slow flashes fast	Sensor response time: Slow Sensor response time: Fast	
Power	lights	Power supply ok	
Menu	lights	Menu navigation	

6.1.2 Switching Point, Analog Output, SLOW/FAST Mode

Open control menu

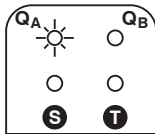
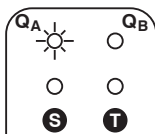
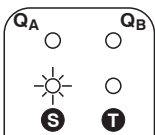
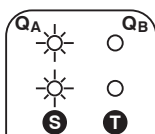
➡ Press the **Set** key for 3 seconds.
 For all settings given below, the sensor has to be in the control menu.
 During this time, the target laser used for mounting the sensor is switched on automatically. In this mode the sensor works only with a reduced switching frequency.

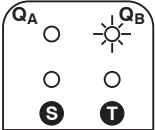
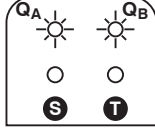
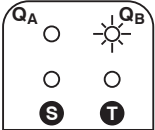
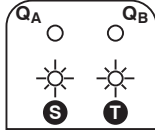
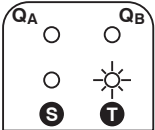
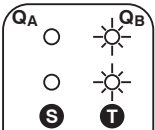
Leave control menu (ESC)

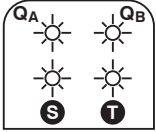
The menu can be left at any point.

➡ Press the **Set** and **Toggle** keys simultaneously for 1 second.

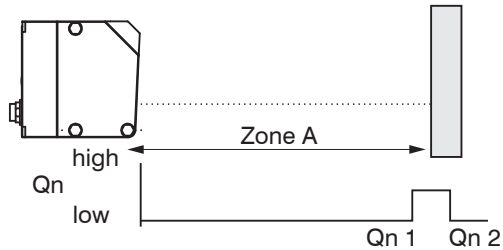
When leaving the control menu the target laser is switched off automatically.

Q_A Setup	
	<p>Setting switching point Q_A</p> <p>➡ Press the Toggle key until the menu LED SA1 lights up.</p> <p>➡ Position the reflector at the desired switching point and press the Set key.</p>
	<p>Setting switching window Q_A</p> <p>➡ Press the Toggle key until the menu LED SA1 lights up.</p> <p>➡ Position the reflector at the desired first switching point and press the Set key.</p>
	<p>➡ Press the Toggle key until the menu LED SA2 lights up.</p> <p>➡ Position the reflector to the desired second switching point and press the Set key.</p>
	<p>Invert switching output Q_A</p> <p>➡ Press the Toggle key until the menu LEDs SA1 and SA2 light up.</p> <p>➡ Press the Set key. The output signal is inverted.</p>

Q_B-Setup		Analog-Setup	
	<p>Setting switching point Q_B</p> <ul style="list-style-type: none"> ➤ Press the Toggle key until the menu LED SB1 lights up. ➤ Position the reflector at the desired switching point, then press the SET key. 		<p>Setting analog output</p> <ul style="list-style-type: none"> ➤ Press the Toggle key until the menu LEDs SA1 and SB1 light up. ➤ Position the reflector at the desired 0 % point (4 mA), then press the Set key.
	<p>Setting switching window Q_B</p> <ul style="list-style-type: none"> ➤ Press the Toggle key until the menu LED SB1 lights up. ➤ Position the reflector at the desired first switching point, then press the Set key. 		<ul style="list-style-type: none"> ➤ Press the Toggle key until the menu LEDs SA2 and SB2 light up. ➤ Position the reflector at the desired 100 % point (20 mA), then press the Set key.
	<ul style="list-style-type: none"> ➤ Press the Toggle key until the menu SB2 lights up. ➤ Move the reflector to the desired second switching point, then press the Set key. 		<p>If the set distance between the 0 % and the 100 % point is less than 600 mm the sensor sets the analog output automatically to 600 mm. The middle of the measuring range is placed automatically between the two set positions.</p>
	<p>Invert switching output Q_B</p> <ul style="list-style-type: none"> ➤ Press the Toggle key until the menu LEDs SB1 and SB2 light up. ➤ Press the Set key. <p>The output signal is inverted.</p>		

	<p>Factory setting</p> <p>➡ Press the Toggle key for 15 seconds until the menu LEDs flash.</p> <p>The sensor is set to factory setting.</p>
---	---

6.1.3 Automatic Reflector Mode ILR1020

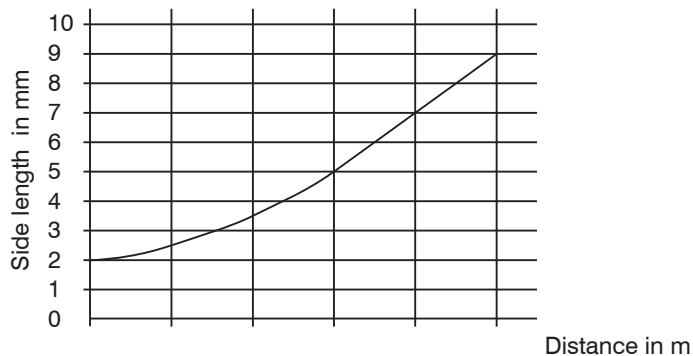


i Function for ILR1020 only.

With this mode a scanning zone (window) is set for a signal output so that the detected surface of the background object (automatic reflector) is approximately in midway between the switching points Qn 1 and Qn 2. The background object can also be moved (e.g. a conveyor belt). The sensor now operates like a reflection light barrier. All objects are detected in zone A (regardless of their degree of reflection or possible mirroring surfaces, exception: transparent objects).

➡ Set a window with the switching points Qn 1 and Qn 2 for activating this mode.

6.1.4 Target Dimensions ILR1020



Smallest detectable part in relation to the distance.

This chart shows typical values measured on a square, white object.





6.1.5 Factory Setting

	ILR1020	ILR1021
Analog output 0 %	4 mA (6000 mm)	4 mA (30000 mm)
Analog output 100 %	20 mA (200 mm)	20 mA (200 mm)
Switching output Q _A	600 mm N.O.	
Switching output Q _B	2500 mm N.O.	

6.2 ILR11xx

Once the device has been connected to the power supply the display shows the measured value if a target or a reflector is in the path of the beam. The green POWER LED lights up. The sensor needs a warm-up time of about 15 min for repeatable measurements.

6.2.1 Control and Display Elements

Key	Description
	<ul style="list-style-type: none"> - Select function, switch down one menu level - Save value, switch up one menu level - In operating mode: Switch to menu level (If password function is active, changes to password entry. Measuring mode remains active until correct password has been entered.) - When editing e.g. switching points: Switches cursor position from right to left or stops entry if cursor is at the far left.
	<ul style="list-style-type: none"> - Scrolls to the next function (right) - Editing: Increase current digit by 1 - In QuickSet menu it enables the teach-in of Q2, - In measuring mode: Press this key to light up the display.
	<ul style="list-style-type: none"> - Scrolls to the next function (left) - Editing: Decrease current digit by 1 - In QuickSet menu it enables the teach-in of Q1 - In measuring mode: Press this key to light up the display.
	<p>Cancels active function and switches to next menu level above (important: keys must be pressed simultaneously, previous value is maintained unaltered)</p>

The ILR11xx sensors are equipped with an LCD display and 3 keys which control all instrument functions.

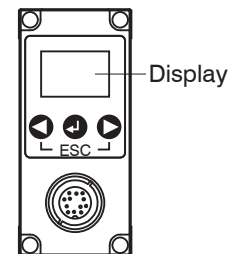
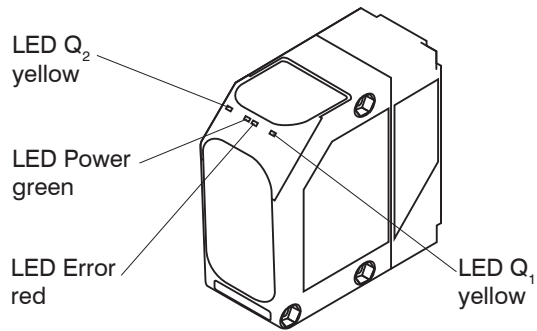


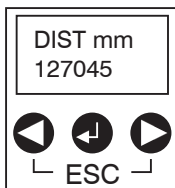
Fig. 21 Front view - Display



LED		Description
Q1	lights	Switching output Q ₁ active
Q2	lights	Switching output Q ₂ active
Power	lights	Power supply OK
Error	lights	Error

Fig. 22 Display elements LEDs

All parameters can be adjusted and measured values can be read via the integrated serial interface using PC software or your own special application program. Parameters of the RS422 interface can only be altered on the sensor.



In measuring mode the text DIST mm or DIST INCH (depending on unit selected) and the actual measured value are displayed.

Selecting menu items:

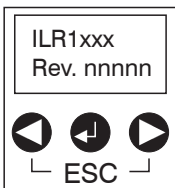
Menu items are displayed on the display:

1. < Menu item >

With this display it is possible to switch to another menu item with ◀ ▶, or select the menu point with ⏴.

2. → Menu item

With this display the keys ◀ ▶ can be used to alter the value.



When the sensor is switched on the sensor type and the software revision number appears for approximately 2 sec.

The software revision number must always be quoted when contacting the manufacturer with technical queries.

i The red target laser and the display background lighting are always active in set up mode.

6.2.2 Menu Structure

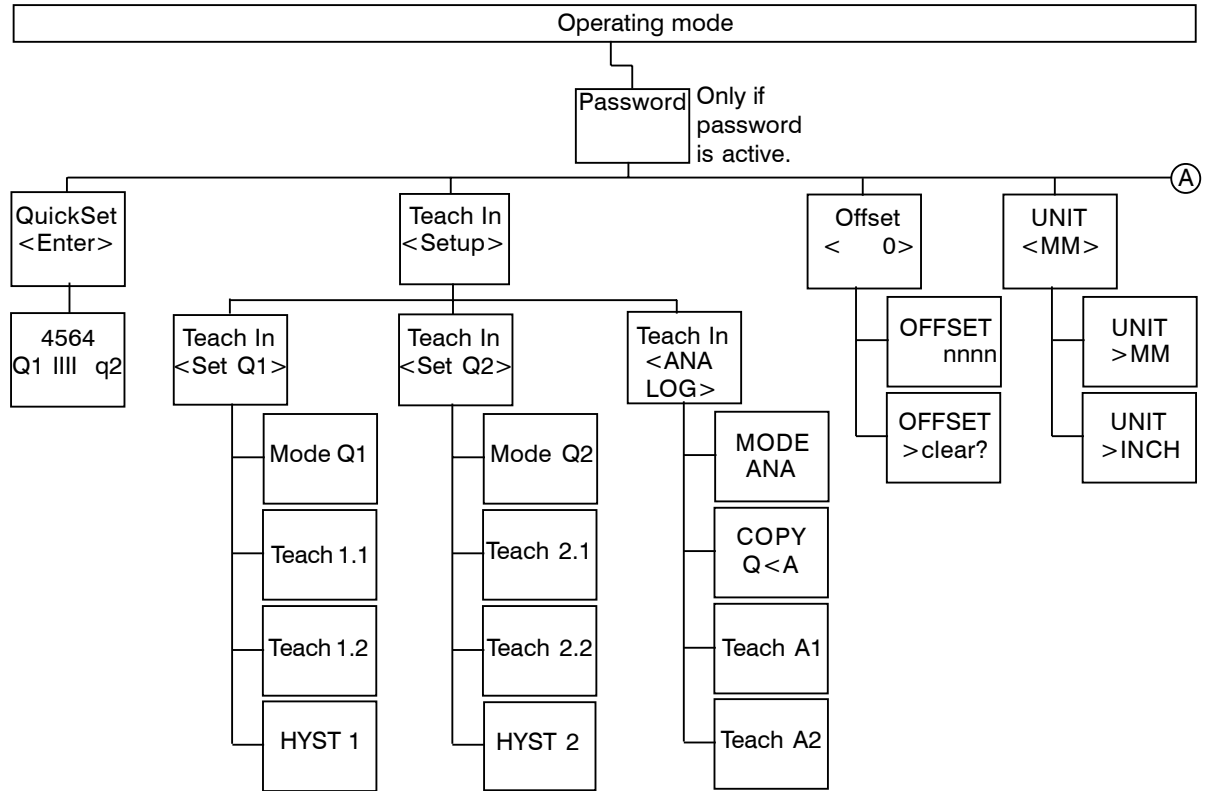


Fig. 23 Table menu structure

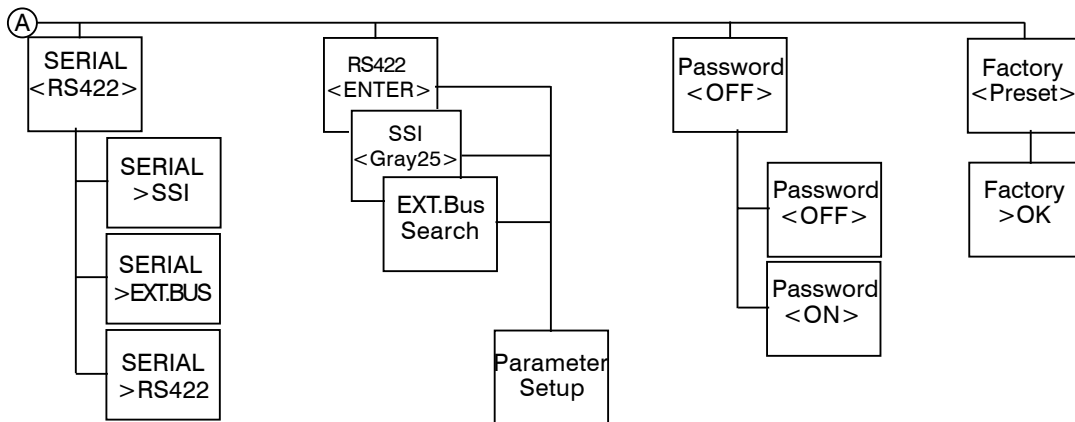
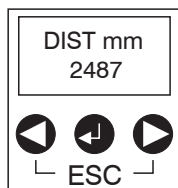




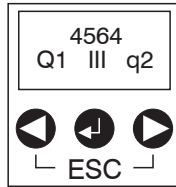
Fig. 24 Proceeding table menu structure

6.2.3 Operation Mode



In operating mode `DIST mm` or `DIST INCH` appears in the first line depending on the active unit. The current measured value is displayed in the second line. When the keys  or  are pressed the screen lights up.

6.2.4 QuickSet



Example: QuickSet
 current value:
 4564,
 Q1 = ON,
 Q2 = OFF,
 Incoming energy:
 ca. 50 %

Meaning of the display symbols:

Q1 = Output 1 ON
 q1 = Output 1 OFF
 Q2 = Output 2 ON
 q2 = Output 2 OFF

The appropriate LEDs (yellow) on the front of the sensor indicate the state of the switching points also. Quit the menu with the **Enter** key or the **ESC** function.

The current measured value is displayed in the first line. In the center of the second line the energy value is displayed as an alignment aid in the form of a bar graph. Q1 and Q2 can be taught directly by pressing the appropriate button (the teach-in function is not possible if SSI mode is active).

Depending on the selected mode of the switching outputs (see teach-in menu), see Chap. 6.2.5,

- the rising or falling edge of the switching output is taught with the set hysteresis in *Single* switching mode.
- In *Double* switching mode the teach-in point (LP) marks the center of the switching points (rising or falling edge). The switching points are located symmetrically in a distance of 100 mm around LP with the set hysteresis.

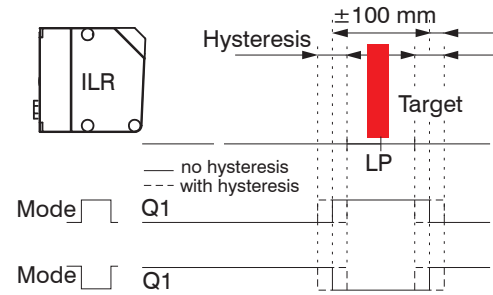
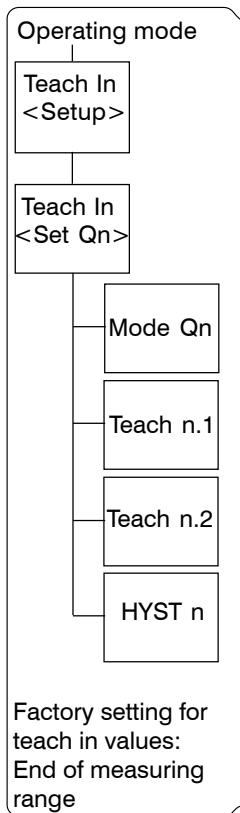






Fig. 25 Switching points in the *Double* switching mode, with and without hysteresis



6.2.5 Switching Behavior, Hysteresis and Analog Output

You can adapt the switching behavior to the local condition when reaching the switching point. The settings for Q1 and Q2 can be done independently of each other.

See the listed switching states below (Mode Qn menu):

-  Qn single switching
-  Qn single switching (factory setting)
-  Qn double switching
-  Qn double switching (factory setting)

Teach-in or manual input of switching points is possible (Teach n.1, n.2 menu). Teach n.2 is used for a double switching output.

The hysteresis of the switching outputs prevents frequent or unmeant switching of the output if the target moves slightly around the switching point.

Range of the hysteresis: ILR115x = 5 mm, ILR110x = 10 .. 254 mm

Step size: ±1 mm. The hysteresis is located symmetrically around the switching point. If the upper limit is reached the limit value of measuring range is valid as upper limit.

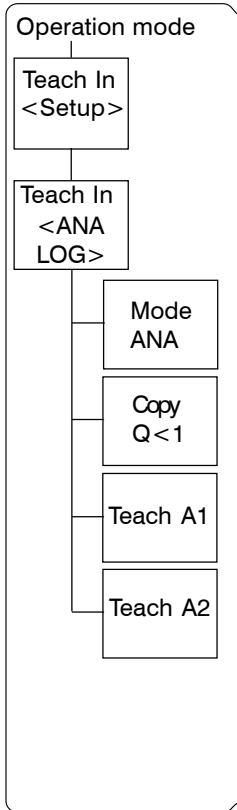
Analog output (ILR11x0 only)

Range: 4 ... 20 mA

Characteristic curve (mode Ana menu):

Mode 1 = rising characteristic (factory setting),

Mode 2 = falling characteristic



Variable measuring range (Teach A1, A2 menu)

Start of measuring range and end of measuring range can be free chosen within the legal measuring range, see Fig. 27, point A1 and A2. Therewith you change the gradient of the characteristic. Teach-in of A1 and A2 or manual input is possible. A minimal distance of 300 mm between A1 and A2 must be observed.

The switching points can be set on the start of measuring range and end of measuring range.

➡ Change to the COPY Q>A menu

Q1 & Q2: Switching point Q1.1 at A1; Q2.1 at A2.

Q2 & Q1: Switching point Q1.1 at A2; Q2.1 at A1.

Editing:

When the teach-in function has been completed with the value measured at this moment is stored and the sensor switches one level up. If the teach-in function is completed with the key or the edit mode is activate. The cursor flashes below the digit on the far right-hand side which can be increased or reduced by using the keys or . The key is used to switch to the next digit to the left and each digit can now be altered. Once you have reached the last digit on the left-hand side press again the key to adopt the manually edited value and switch one menu level up.

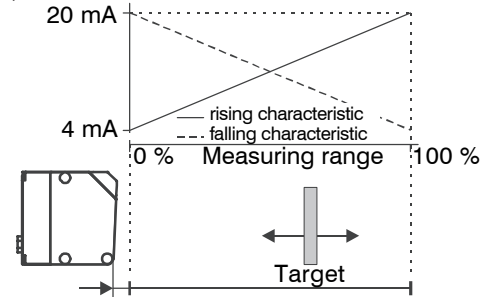


Fig. 26 Measuring range and current output, ILR11x0

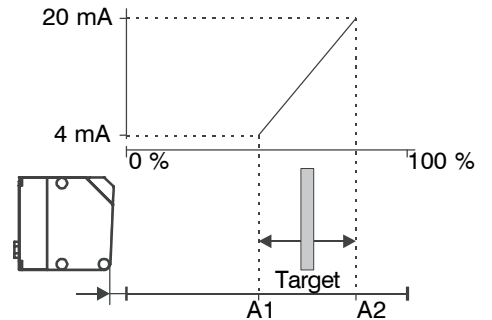


Fig. 27 Variable measuring range, ILR11x0

6.2.6 Offset

An offset value can be entered or taught-in in the range $\pm 100,000$ mm (or corresponding inch value). The measured value is then increased or decreased by the programmed offset value depending on the preceding sign. This can compensate a mounting position which does not correspond with the zero point of the plant. If an offset value is taught-in it is stored with a negative sign, i.e. the teach-in position corresponds with the zero point. The preceding sign can also be set manually.

The offset value can be set back to "0" with the **CLEAR** function.

Example: Actual distance:	3000 mm
Offset value:	-1200 mm
Output value:	1800 mm

Factory setting:

Offset = 0

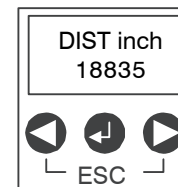
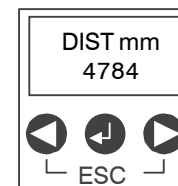
6.2.7 Unit

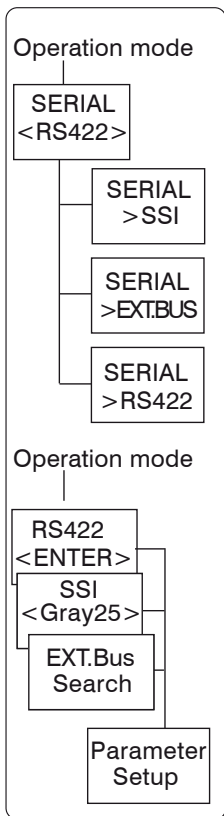
Unit makes it possible to choose between millimeters and inches as the display and output unit. The inch display and output via the interface is value * 100 Inch, i.e. a displayed value of "18835" is equivalent to 188.35 Inch.

Factory setting is mm.

6.2.8 Interface and Parameter

The series ILR11xx sensors contain RS422 / SSI1/10, SSI1/8 - compatible or **EXTernal BUS** adapter interfaces. Select the interface in the **Serial** menu. When **EXT BUS** is selected, **SEARCH BUS . . .** appears in the display until the connection is established. Bus adapters are available as an optional accessory, see Chap. [A 1](#). Once the connection has been successfully established the above mentioned text disappears. If the connection cannot be established the text remains in the display and the process must be cancelled with the **ESC** key. The process can be restarted once the electrical connection has been restored.





Interface parameter (RS422 menu)

Depending of the setting made in Serial Select the appropriate interface parameters are displayed or altered. The following settings are possible:

- **RS422 (Factory setting):**

Baud rate: 4.8 or 9.6 or 19.2 or 38.4 (Factory setting) or 57.6 kBaud

Data bit: 8 or 7 (Factory setting)

Stop bit: 2 or 1 (Factory setting), Parity: even

REPEAT or SINGLE: REPEAT (Factory setting) means that the sensor continuously sends measured data via the serial interface without waiting for a request. In SINGLE mode, a string of measured data is only supplied on request.

The RS422 interface is a reliable full duplex serial interface with a transfer rate up to 10 MBaud and a cable length of 1,000 m. The screened connection cable is connected to the sensor connector and the ground terminal of the control cabinet.

- **SSI:**

1/10 = LSB = 0.1 mm (10 MIL) or

1/8 = LSB = 0.125 mm (8 MIL)

Codes: BINÄR24, BINÄR25, GRAY24 or GRAY25 (Factory setting) are possible.

For a reliable data transfer the maximum clock speed depends on the cable length. The screened connection cable is connected to the sensor connector and the ground terminal of the control cabinet.

Cable length /m	< 25	< 50	< 100	< 200	< 400
Clock speed	< 500 kHz	< 400 kHz	< 300 kHz	< 200 kHz	< 100 kHz

- **BUS-ADDR:**

Address for external bus adapter. Here you can set for external bus adapter.

6.2.9 Serial Interface (RS422 Protocol)

All commands have the following structure: <STX><Command><[Data]><EOT>

All commands are answered by the ILR11xx as follows:

<NAK> = the command was not recognized or the data are outside the limit values, or

<ACK> = the command was recognized and executed, the command requires no return data, or

<Data> = the command was recognized and the requested data has been sent.

Definitions:

STX = start transmission = 02h = CTRL B

EOT = end of text = 04h = CTRL D

NAK = no acknowledge = 15h = CTRL U

ACK = acknowledge = 06h = CTRL F

Command = 3 digit command (ASCII text)

[Data] = whole numbers (ASCII text)

In ASCII text (command + data) spaces and capitals/small letters are ignored.

User commands and their meaning

Command	Name	Data to ILR11xx	Data from ILR11xx	Specification
„GAP“	get all parameters	-	<p>All parameters in text format „Fx9xILA \$Revision X.XX\$“ „pilot is on/off/xx seconds on“ Uart mode</p> <p>„Q1: AA Mode=BB Limit1=CC Limit2=DD Hyst=EE INV=ON/OFF“</p> <p>„Q2: AA Mode=BB Limit1=CC Limit2=DD Hyst=EE INV=ON/OFF“</p> <p>(nur ILR11x0: „Quana: VALUE=FF LIMIT1=CC LIMIT2=DD INV=ON/OFF)</p> <p>„output = GG“ „offset = YYYY“ „password dis/enabled“ „Error-Status = DDDDDDDD“</p>	<p>All parameters of the ILR11xx are read: X.XX: Revision number YYYY: User offset [mm] or [10 MIL] AA: „ON“ = Output HIGH, „OFF“ = Output LOW BB: Mode: „0“ = Output off, „1“ = 1 switching point „2“ = 2 switching points CC: Switching point 1, Offset. 12000+Offset DD: Switching point 2, Offset. 12000+Offset EE: Hysteresis, 0..254 [mm] GG: Unit, „10MIL“ or „MM“ DDD: Error state: FF: Analog value, 0..4095</p> <p>Output of the error state, D=“0“: no error, D=“1“: Error</p> <p>D7: Transmitter faulty D6: Receiver blinded or faulty D5: Temperature error: T < -10 °C or T > +70 °C D4: Target out of range or receiver faulty D3: Temperature error: T > +80 °C D2: Supply voltage to low D1: PLL unlocked D0: always „0“</p>
„ECM“	execute continuous measurement		ACK	Continuous measurement output is set and triggered by the next request for measured values.

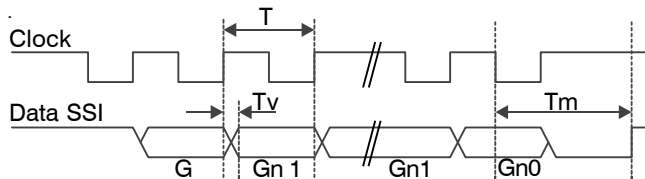
Command	Name	Data to ILR11xx	Data from ILR11xx	Specification
„GDB“	get energy		Energy value 0.. 120 dB	Indicates the amount of receiving energy.
„GNR“	get serial number		„xxxxxxxx“	Serial number is sent as ASCII text (max. 24 characters).
„GSI“	get error status		„DDDDDD“ 76543212	Output of the error state, D = “0“: no error D = “1“: error D7: Transmitter faulty D6: Receiver blinded or faulty D5: Temperature warning: T < 10 °C or +70 °C D4: Target out of range or receiver faulty D3: Temperature error: T > +85 °C D2: Supply voltage to low D1: PLL unlocked D0: always „0“
„GTE“	get temperature		„±DDD“	DDD = Internal temperature in C°
„GVE“	get version		„Fx9x \$Revision X.XX\$“	Software version is sent.
„GCM“	help command get commands		All available commands	All available commands are sent in text format.
„ICM“	input continuous mode	„0“, „1“	ACK	Measurement mode setting: „0“ = continuous measurement output, „1“ = single measurement output
„IDO“	input offset	12000 +12000 respectively 48000.. +48000	ACK	Offset setting in [mm] or in [INCH * 100]

Command	Name	Data to ILRxx	Data from ILR11xx	Specification
„IH1“	input hysteresis Q1	„000“.. „254“ respectively 0“..“999“ (INCH)	ACK	Hysteresis setting around the switching points Q1 in [mm] or [INCH * 100]
„IH2“	input hysteresis Q2	„000“.. „254“ respectively 00“..“999“ (INCH)	ACK	Hysteresis setting around the switching points Q2 in [mm] or [INCH * 100]
„IL1“	input limit Q1 1	Offset ... +12000+Off- set respec- tively Offset .. 48000+Off- set	ACK	Setting of the first switching point Q1 in [mm] or [INCH * 100]
„IL2“	input limit Q2 1	Offset ... +12000+Off- set bzw Offset .. 48000+Off- set	ACK	Setting of the first switching point Q2 in [mm] or [INCH * 100]
„IL3“	input limit Q analog 1	Offset ... +12000+Off- set bzw Offset .. 48000+Off- set	ACK	ILR11x0 only: Setting of the 0 % point of the analog characteristic, see Chap. 6.2.5

Command	Name	Data to ILRxx	Data from ILR11xx	Specification
„IL4“	input limit Q1 2	Offset ... +12000+Off- set respec- tively Offset .. 48000+Off- set	ACK	Setting of the second switching point of Q1 in [mm] or [INCH * 100]
„IL5“	input limit Q2 2	Offset ... +12000+Off- set respec- tively Offset .. 48000+Off- set	ACK	Setting of the second switching point of Q2 in [mm] or [INCH * 100]
„IL6“	input limit Q analog 2	Offset ... +12000+Off- set	ACK	ILR11x0 only: Setting of the 100 % point of the analog characteristic, see Chap. 6.2.5
„IM1“	input mode Q1	„0“, „1“, „2“	ACK	„0“ = not active, „1“ = 1 switching point, „2“ = 2 switching points
„IM2“	input mode Q2	„0“, „1“, „2“	ACK	„0“ = not active, „1“ = 1 switching point, „2“ = 2 switching points
„IM3“	input norm Q analog	„0“, „1“	ACK	ILR11x0 only: „0“ = Q, „1“ = Q inverted
„IN1“	input norm Q1	0“, „1“	ACK	„0“ = Q, „1“ = Q inverted
„IN2“	input norm Q2	0“, „1“	ACK	„0“ = Q, „1“ = Q inverted
„IVL“	input visible laser	0“, „1“	ACK	„0“ = Target laser on „1“ = Target laser off
„ISB“	input stand by	0“, „1“	ACK	„0“ = Operation „1“ = Stand by

Command	Name	Data to ILRxx	Data from ILR11xx	Specification
„ESM“	trigger single measurement/ Execute sing. m.		< meas. value >	Request for measured value with single measurement output
„EPW“	write parameter page/ execute parameter write		ACK	Parameter are stored.

6.2.10 Timing SSI Compatible Interface



T = Duration of clock signal,
 min. $2 \mu\text{Sec} = 500 \text{ kHz}$; max. $13 \mu\text{Sec} = 77 \text{ kHz}$
 T_v = Delay time max. 360 ns
 T_m = Minimum time between last rising edge and reloading of SSI approx. $24 \mu\text{Sec}$.
 G_n = MSB (here Gray Code)
 24 bit transmission: G_1 = second LSB, G_0 = LSB
 24+E transmission: G_1 = LSB, G_0 = Error bit
 25 bit transmission: G_1 = second LSB, G_0 = LSB

Attention: With SSI compatible transmission data are updated synchronous with the readout cycle. The data are as up to date as the time interval between two readouts. A periodical readout is therefore recommended. After a longer readout break the data contents of the first readout can be out of date and should be ignored.

6.2.11 Error Messages

In the event of errors the corresponding error messages appear on the display and the error outputs Qs and Qp (active low) are set according to the following table. The error state can be questioned via the GSI command. In principle a combination of several errors can exist. e.g. a too low supply voltage can cause a counter error. In this case the GSI command would report "00000110" (via RS422).

Error Message on LCD	Output (active Low)		Answer to GSI command (get error status)	Specification
	QS	QP		
„BLINDING“	active		„01000000“	External light too strong or internal error
„LAS.ERR.“	active	active	„10000000“	Measurement laser faulty
„LOW VOLT“			„00000100“	Error in supply voltage: voltage too low (or error in measurement of supply voltage).
„NO VALUE“			„00000000“	First measurement after switching on not yet ready. This message disappears after a short time.
„SEARCH BUS...“			Not possible	Connection to external bus adapter canceled. The sensor automatically tries to restore the connection. This message disappears if connection is restored.
„PILL UNLOCKED“	active	active	„00000010“	Counter error
	active		„00000010“	Temperature warning (below 10 °C or above 70 °C)
„OVERTEMP“	active (Laser off)	active (Laser off)	„00101000“	Temperature too high (above 85 °C inside); Measurement switched off
„Dist (mm) >Maximum“		active	„00010000“	No target in range or sensor badly aligned.

6.2.12 Factory Preset

All settings are reset to delivery state. Go to the `Factory Preset` menu, see Chap. A 2.

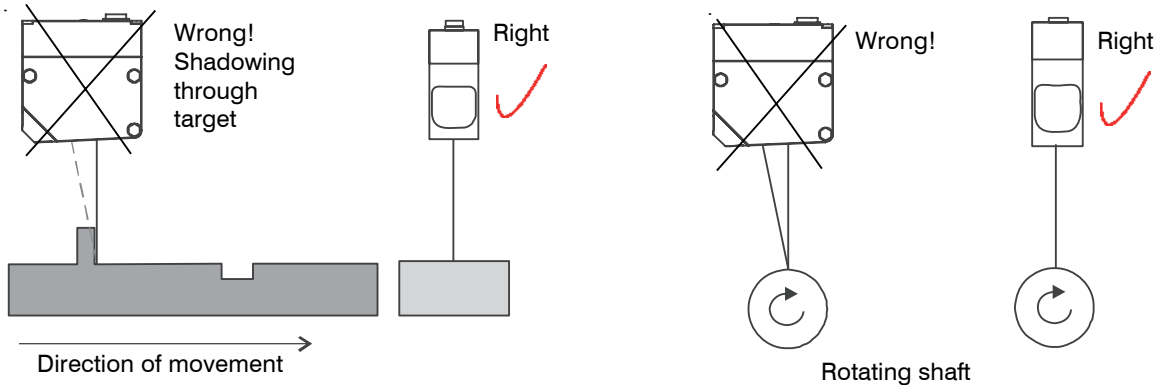
6.2.13 Password

Go to the `Password` menu to activate/deactivate the password protection. With delivery the password protection is not active.

The password is permanently 1234 and cannot be changed. When the sensor is set to `Password ON` it is only possible to quit operating mode when 1234 has been entered as password. Measuring mode continues in the background while the password is being entered. Should no entry be made in the password input menu over a period of approximately 10 seconds the operating mode reappears on the display.

7. Instructions for Operation

Alignment can be carried out with the aid of the integrated visible target laser. Observe the information pictured below when aligning the sensors.



8. Warranty

All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON. This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranted, are accepted. The terms of the purchasing contract apply in full.

MICRO-EPSILON will specifically not be responsible for eventual consequential damages. MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment.

Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved. For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.

9. Service, Repair

In the event of a defect on the sensor or sensor cable please send us the affected parts for repair or exchange.

In the case of faults the cause of which is not clearly identifiable, the whole measuring system must be sent back to:

MICRO-EPSILON MESSTECHNIK
GmbH & Co. KG
Königbacher Str. 15
94496 Ortenburg / Germany

Tel. +49 (0) 8542/ 168-0
Fax +49 (0) 8542/ 168-90
info@micro-epsilon.de
www.micro-epsilon.com

10. Decommissioning, Disposal

- ➡ Disconnect the power supply and output cable from the sensor.
- ➡ Do the disposal according to the legal regulations (see directive 2002/96/EC).

Appendix

A 1 Optional Accessories

Accessories for optoNCDT ILR 102x

PC1000-x



Power supply and output cable;
2 and 5 m long, connector
straight

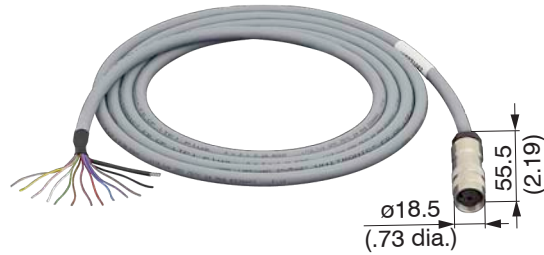
PC1000/90-x



Power supply and output cable;
2. 5 and 10 m long, angle plug

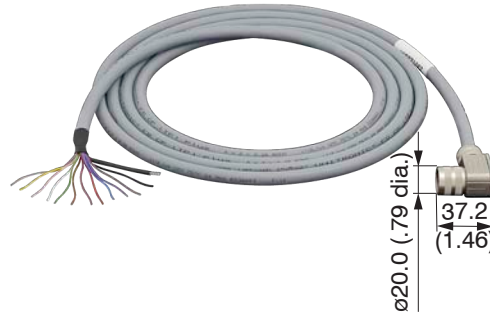
Accessories for optoNCDT ILR 110x/115x

PC1100/-x



Power supply and output cable;
3, 5, 10, 20, 30 m long

PC1100/90-x



Power supply and output cable;
3, 5, 10, 20, 30 m long,
angle plug

PC1100-x/
USB



USB power supply and output
cable; 3 m long
Sensor cable with connector;
with integrated RS422/USB
converter; USB connector for
PC; integrated power supply
100 ... 240 VDC

FC1100

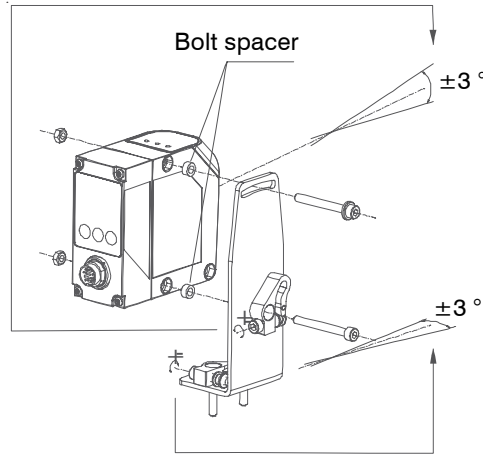
Female connector for ILR11xx

FC1100/90

Female connector for ILR11xx

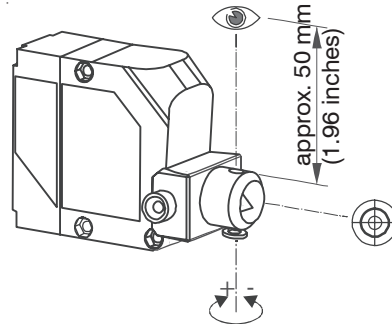


LR-FA1



Fine adjustment set for mounting bracket, $\pm 3^\circ$ range of rotation in both directions

ILR-AA1



Aligning aid for positioning the sensor on great distances

A 2 Factory Setting

	ILR1020	ILR1021
Analog output 0 %	4 mA (6000 mm)	4 mA (30000 mm)
Analog output 100 %	20 mA (200 mm)	20 mA (200 mm)
Switching output Q _A	600 mm N.O.	
Switching output Q _B	2500 mm N.O.	
Offset	0	
Unit	mm	
Reset	In the menu Factory Preset	

You will find other factory settings, see Chap. 6.2.5, see Chap. 6.2.8.



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