MICRO-EPSILON

Laser Triangulation Displacement Sensors

optoNCDT

midrange

MICRO-EPSILON

LASERSTRAHLUNG
NICHT IN DEN STRAHL BLICKEN
LASER KLASSE 2
nach DIN EN 60825-1: 2001-11
P ≤ 1 mW; λ = 670 nm

- **Non-contact and wear-free**
- **Large stand off**
- **Tiny measuring spot for small targets**
- **High speed measurement**
- **High precision**
- **Almost all targets can be measured**

The optoNCDT product group represents the highest precision in laser-based optical displacement and position measurement.

Laser-based optical displacement sensors measure from a large distance to the target using a very small spot which enables measurements on the very small parts. The large measurement distance in turn enables measurements to be taken against difficult target surfaces such as hot metals.

The non-contact principle enables wear-free measurements as the sensors are not subject to any physical contact with the target.

Furthermore, the laser triangulation principle is ideal for very fast measurements with high accuracy and resolution.

Leadership in laser displacement measurement

Micro-Epsilon has a long-standing success of developing laser displacement sensors. Already a pioneer in the field of CCD sensors, Micro-Epsilon has continually raised the bar in industrial laser displacement measurement. The current optoNCDT range now offers five series, each of which is amongst the best in its class.
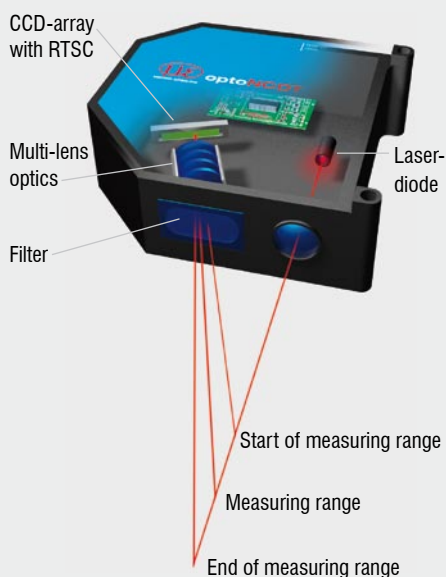
Measurement principle: Laser triangulation

Laser triangulation sensors operate with a laser diode which projects a visible light spot onto the surface of the measurement target. The light reflected from the spot is imaged by an optical receiving system onto a position-sensitive element. If the light spot changes its position, this change is imaged on the receiving element and evaluated. With the 1607 Series an analogue PSD module is used as the position-sensitive measuring element, whereas with the remaining sensors CMOS elements and CCD elements are used.

CCD-array with RTSC

Multi-lens optics

Filter

Laser-diode

Start of measuring range

Measuring range

End of measuring range

LASER RADIATION
Do not stare into the beam
CLASS 2 LASER PRODUCT
IEC 60825-1: 2001-11
P<1mW; λ=670nm

IEC - Standard

optoNCDT sensors uses a semiconductor laser with a wavelength of 670nm (visible/red). The maximum optical output power is 1mW. The sensor is classified as laser class II. A warning sign is attached to the sensor housing.
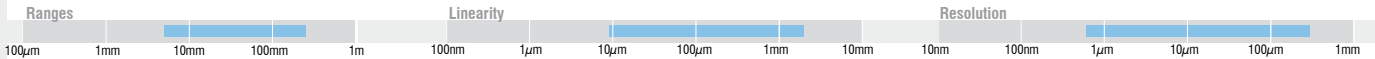
COMPACT & LOW COST Series 1300 / 1402

Ranges 5 - 250mm
Resolution from 3μm
For tiny installation rooms

→ CMOS sensor element
→ Output analogue / digital (series 1402)
→ Integrated controller
→ Auto Target Compensation (ATC)
→ Trigger input and teach in (series 1402)

→ DAQ and configuration software (series 1402)
→ Performance certificate (series 1402)
→ High flex cables rated for drag chain use
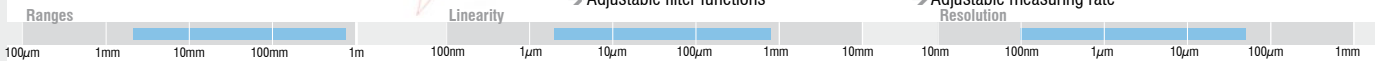→ Robot rated cable (optional)
→ Adjustable measuring rate (series 1402)

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

HIGH PERFORMANCE WITH INTEGRATED CONTROLLER Series 1700 / 1700LL / 1700DR

Ranges 2 - 750mm
Resolution from 0.1μm
No external controller

→ CCD sensor element
→ Output analogue / digital
→ Integrated controller
→ Auto Target Compensation (ATC)
→ Real-Time-Surface-Compensation (RTSC)
→ Adjustable filter functions

→ DAQ and configuration software
→ Performance certificate
→ Series for direct reflection or metal target
→ High flex cables for drag chain use
→ Robot rated cable
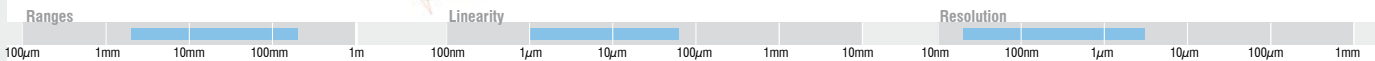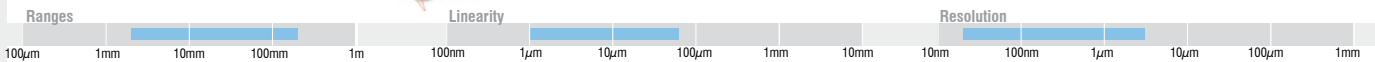→ Adjustable measuring rate

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

HIGHEST PRECISION SENSOR Series 2200 / 2200LL

Ranges 2 - 200mm
Resolution from 0.03μm
Unmatched accuracy

→ CCD sensor element
→ Output analogue / digital
→ Auto Target Compensation (ATC)
→ Real-Time-Surface-Compensation (RTSC)
→ Adjustable filter functions

→ DAQ and configuration software
→ Performance certificate
→ Series for direct reflection or metal target
→ High flex cables for drag chain use

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

HIGHEST PRECISION AT MAXIMUM SPEED Series 2220 / 2220LL

Ranges 2 - 200mm
Resolution from 0.03μm
Maximum speed

→ CCD sensor element
→ Output analogue / digital
→ Auto Target Compensation (ATC)
→ Real-Time-Surface-Compensation (RTSC)
→ Adjustable filter functions

→ DAQ and configuration software
→ Performance certificate
→ Series for direct reflection or metal target
→ High flex cables for drag chain use

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

LARGE STAND OFF Series 1810-50 / 2210

Ranges 10 - 50mm
Resolution from 0.5μm
Large stand off

→ CCD sensor element
→ Output analogue / digital
→ Auto Target Compensation (ATC)
→ Real-Time-Surface-Compensation (RTSC)

→ Adjustable filter functions
→ DAQ and configuration software
→ Performance certificate
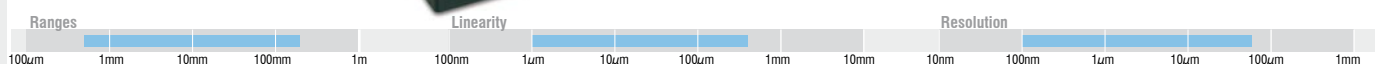→ High flex cables for drag chain use

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

THE HIGH SPEED TRUE ANALOGUE SENSOR Series 1607

Ranges 0.5 - 200mm
Resolution from 0.1μm
Selectable frequencies
up to 37kHz (-3dB)

→ PSD sensor element
→ Output analogue / digital
→ Auto Target Compensation (ATC)

→ Performance certificate
→ High flex cables for drag chain use

Ranges					Linearity					Resolution				
100μm	1mm	10mm	100mm	1m	100nm	1μm	10μm	100μm	1mm	10mm	10nm	100nm	1μm	10μm	100μm	1mm

Designed for industrial applications

The sensors in the optoNCDT product range are designed for industrial applications. Due to their robust construction and user friendly technical features, they achieve precise measurement results even in harsh ambient conditions. Each series is available in a number of measurement ranges, covering one of the widest laser measurement product ranges in the marketplace.

Analogue and digital output types
The optoNCDT sensors are equipped with a number of outputs to fulfil many industrial user requirements. Both analogue and digital interfaces are available, to maximise flexibility of sensor integration to your existing production environments. Sensors with USB interfaces can be configured using an external PC and software supplied as standard.

Compact with integrated controller
Despite their very compact dimensions, Series 1300, 1402, 1700, 1700LL and 1700DR have a fully integrated controller. As a result, simple, rapid installation and wiring is possible. The sensors can be integrated easily into the tightest installation space.

Cables suitable for drag chain systems
All sensor cables for optoNCDT sensors are rated for use in drag chains and are therefore suitable for various fields of applications. For integration with robot systems, robot-compatible cables for the 1300, 1402, 1700, 1700LL and 1700DR Series can be supplied as an option.

High measuring rate
High measuring rates are required for fast moving targets or measurements on difficult surfaces.
Sensors in the 2220 Series achieve a measuring rate of up to 20 kHz. The high-speed 1627 Series achieves measuring rates of up to 37kHz (-3dB).

Certified quality: Calibration certificate
To document the performance capability of the optoNCDT sensors, each sensor is calibrated before delivery and supplied with its own calibration certificate. This document is supplied with the sensor and is used as proof to the achieved measurement precision.
[available for all series except 1300]

Adjustable filter functions
A number of filters are available in order to obtain optimum results for each application: sliding mean, recursive mean and median. The filters are applied directly to the measurement results inside the controller before output.
[available for all series except 1300, 1607]
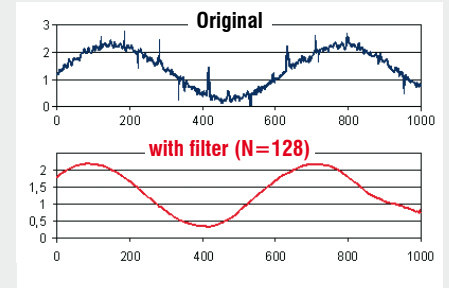
Vibration measurement with sliding mean
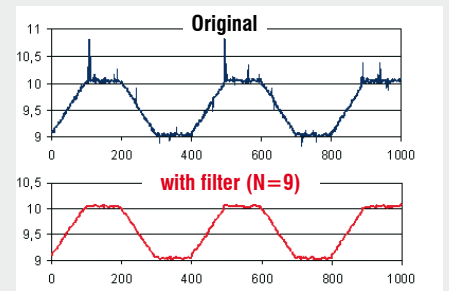
Profile measurement with median

# A world first: Real Time Surface Compensation (RTSC)

Through the unique RTSC function, the amount of reflection from the target surface is compensated during continuous exposure and in real-time. The exposure time or the amount of light produced by the laser is optimally matched to the reflection characteristics of the target surface. Unique to Micro-Epsilon sensors, this innovative real-time control always achieves optimum results, even with rapidly changing surface types.

Standard, commercially-available laser triangulation sensors normally operate with a time-shift control, which builds on previous measurement cycles. In this case, the amount of reflection from previous measurements is used to derive the degree of reflection for the next measurement. With changing or textured surfaces the measurement results therefore deviate noticeably from the actual measurement value, whereas optoNCDT is controlled in real time and as such, is adjusted to the optimum reflection conditions without needing to apply averaging filters.
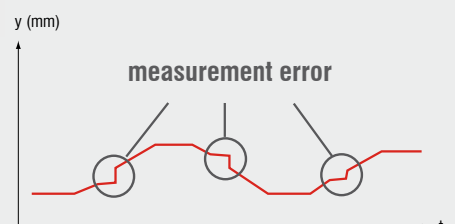[available for all series except 1300, 1402, 1607]

Comparison: optoNCDT with RTSC and conventional sensor

y (mm)

correct measurement
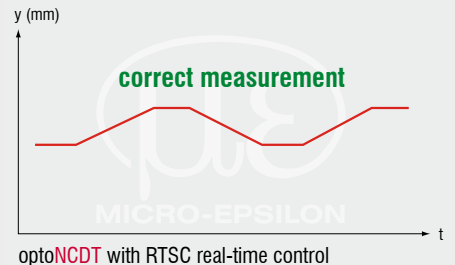
optoNCDT with RTSC real-time control

y (mm)

measurement error

Conventional laser sensors with time-shift control - noticeable errors in measurement during change of surface conditions.

# Measurement with multiple sensors

For many applications, it is necessary to measure or acquire data simultaneously using multiple sensors. The following range of functions are available to support synchronised measurements.

### Genuine synchronisation of two sensors

A „true synchronous" measurement is required to precisely acquire moving or oscillating objects during thickness or differential measurements. In this case, one optoNCDT acts as the master, which provides the corresponding cycle pulse for the second sensor (slave). This function facilitates the genuine synchronous pulsing of two sensors.
[available for all series except 1300, 1402, 1607]

Synchronisiation at thickness measurements of two sensors
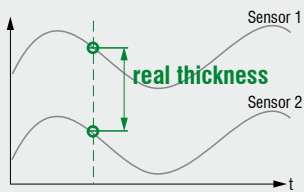
Genuine synchronisation during thickness measurement using two optoNCDT sensors with simultaneous data acquisition
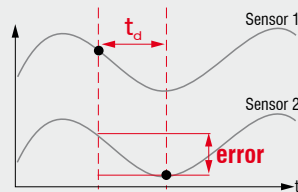
Conventional laser sensor with usual time offset erroneous measurement

IF2008 Interface Card for synchronous data acquisition

The IF2008 Interface Card is designed for the data acquisition of up to eight sensors (6x digital, 2x analog) and two encoder. This enables the simultaneous evaluation of multiple signals. Here, the sensors can be located opposite one another, e.g. for thickness measurement, or mounted in one plane, e.g. for differential height measurement. The interface card reads out the data from all the connected devices simultaneously and passes them to an external PC for further processing. Whereas the simultaneous measurement method is intended for opaque targets, alternating synchronisation, which prevents possible interference, can be set up for transparent objects.
[technical data on page 30]

CSP 2008: Controller for up to six sensors

The CSP2008 controller can be used to process between two and six digital or analogue input signals (2 x internal plus 4 x external via Ethercat modules from Beckhoff) of almost all Micro-Epsilon displacement sensors. Ethercat can also be used as an external interface for connecting further sensors and I/O modules. The controller has a high luminance display so that measured values can be easily read, even from a long distance.
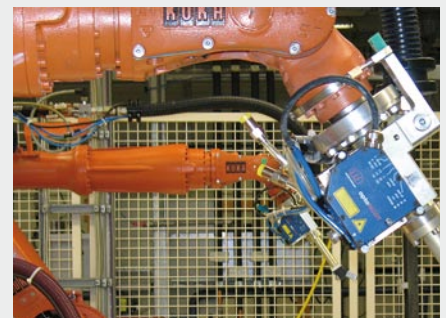[technical data on page 31]
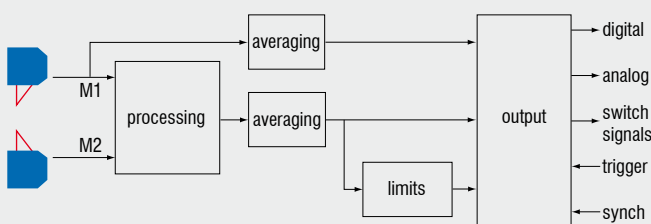
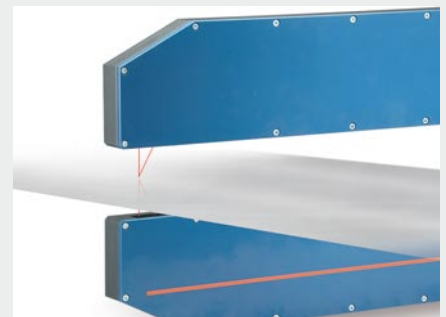Thickness measurement with 2 optoNCDT laser sensors

optoNCDT on trimming systems of saw mills
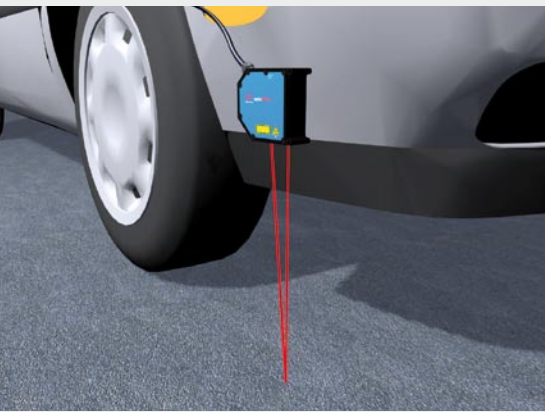

Profile measurement of marine propellers

optoNCDT on robots in car production


Strip thickness measurement with two sensors

High speed measurement of black rubber

Distance of vehicle to road surface

In road tests, pitching and rolling movements, spring compression during braking and other quantities are measured with optoNCDT sensors. optoNCDT is particularly suitable here due to its compact construction and the possibility of powering the sensor from the vehicle power supply. For these applications, special models with increased resistance to extraneous light and vibration are available.
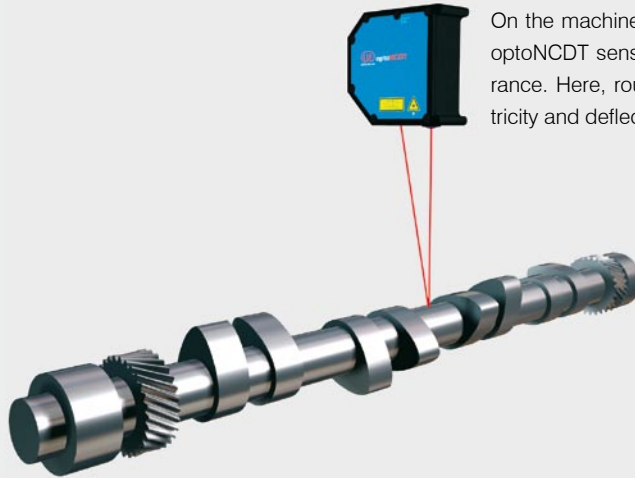
Measurement of automotive parts

On the machined surfaces of metal products, optoNCDT sensors are used for quality assurance. Here, roundness, concentricity, eccentricity and deflection can be acquired.
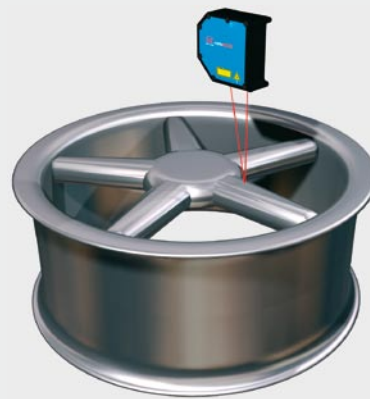
Shape conformance on aluminum wheels

After casting, aluminum wheels are measured for a range of properties, e.g. hub depth, roundness and bulging.

Car Body positioning in production lines

For automated processing of car bodies or vehicles, an exact determination of the position relative to the processing tool is necessary (drilling, punching, fitting, subassemblies). With its Real Time Surface Compensation, the optoNCDT sensor is ideally suited to the high-precision acquisition of sprayed surfaces.
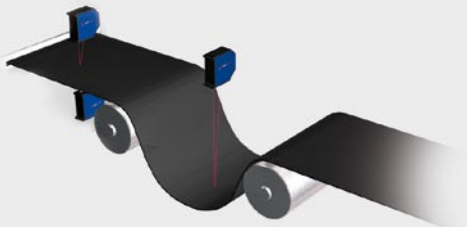
Deflection

Black rubber, an extremely difficult material to measure, is already measured directly after the calender with optoNCDT sensors. The sensors provide an error-free production of the rubber web.
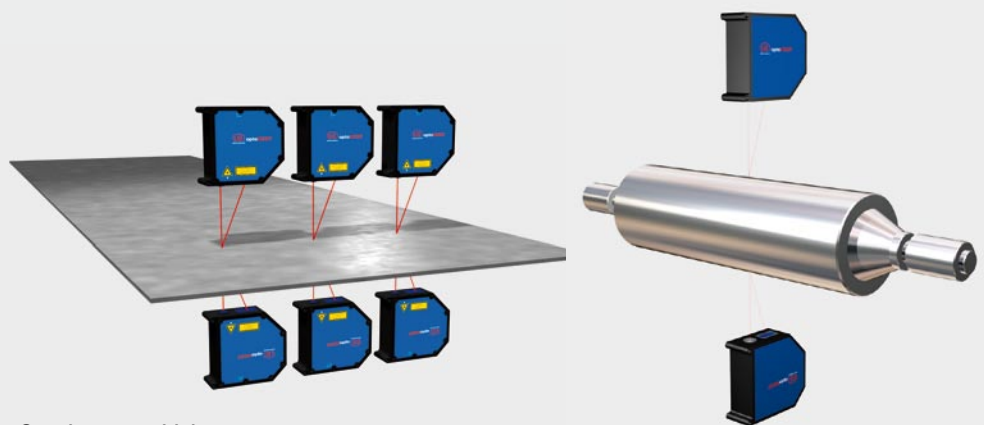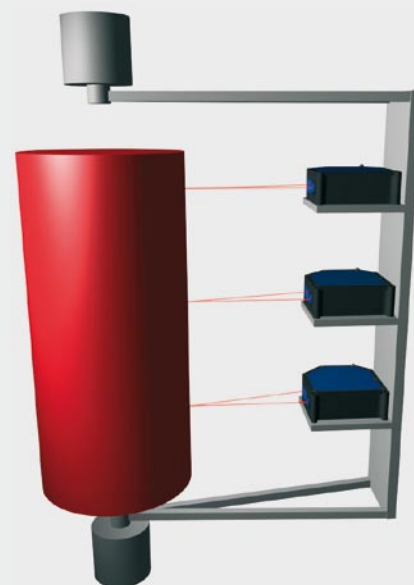

Synchronous thickness measurement

optoNCDT sensors are ideally suited to the thickness measurement of a variety of (web) materials. Due to the high measuring rate and the possibility of synchronising multiple sensors, even moving and oscillating targets can be reliably acquired.
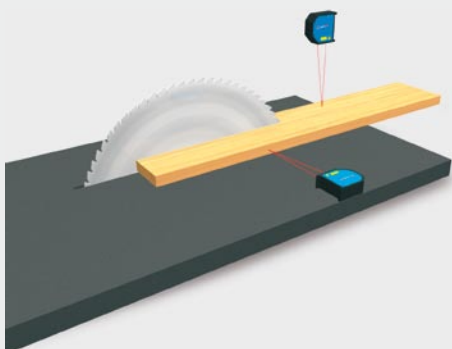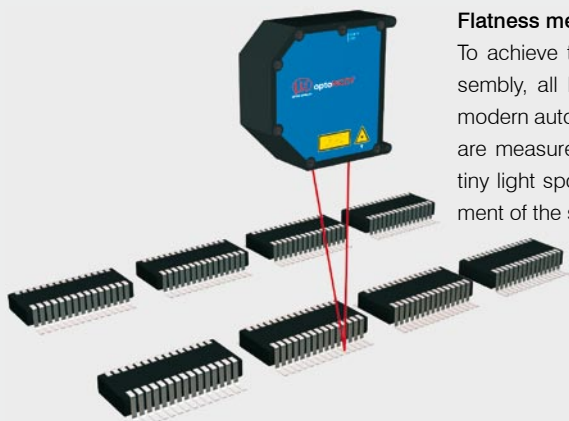
Dimension measurement in wood production

optoNCDT sensors are used in woodworking plants to ensure the dimensional conformance of the work pieces. Here, both treated and untreated pieces are acquired.


### Flatness measurement of IC pins

To achieve the best quality during board assembly, all IC pins must lie in one plane. In modern automatic placement systems, the ICs are measured directly before placement. The tiny light spot diameters enable the measurement of the smallest pin geometries.

Contour measurement

During the production of ceramic catalytic converters for the automotive industry the billets are measured for roundness and diameter at multiple radial tracks for classification. Using the IF2004 interface card, the encoder and sensor signals are synchronised and mapped to obtain precise profile.
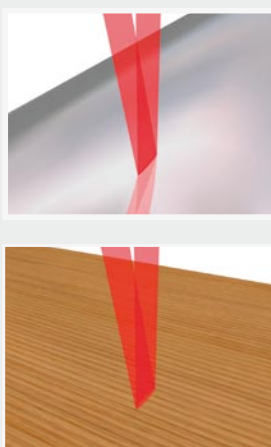
optoNCDT LL series - Anti speckle sensor

The distance information for the triangulation principle is obtained via the reflection of the laser beam. Thereby, surface roughness in the sub-micrometre range causes interference in the laser spot, whereby false measurement results can be obtained. This physical effect is particularly predominant in shiny, highly polished objects and cannot be avoided using currently available products on the market. Micro-Epsilon, as a specialist in measurement technology, announces its new optoNCDT LL, which also makes reliable measurements on shiny metallic objects thanks to an oval light spot. The point-shaped laser beam has now been widened using a special cylindrical lens and projected onto the target. The light spot is absorbed by a receiving array and evaluated. As the light spot is averaged using a special software algorithm, interference is completely filtered out.

Another application area for the optoNCDT LL is structured surfaces, where the distance and not the structure itself needs to be measured. The distance information is not influenced by the structure of the surface but instead provides a constantly reliable value of the distance from the target. The optoNCDT 2200LL is based on the successful optoNCDT 2200 model and therefore has all the other advantages of the series, such as fast measured data evaluation or automatic exposure regulation in real-time. The optoNCDT 1700LL has the advantages of the integrated controller, thus making mounting of the sensor in confined spaces, or on robots much more practical.
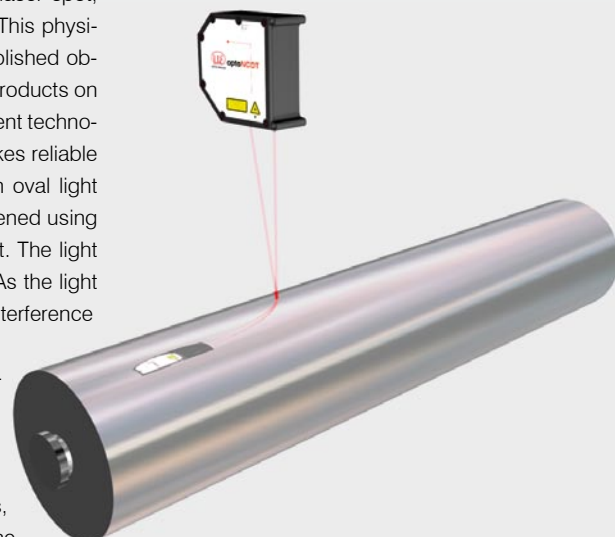
Four models with measuring ranges from 20mm to 200mm

Compact design with integrated controller

*A*nalog **Analogue output (U/I)**

High flex cables for dragchain use (robot version optional)

Ideal for OEM applications

The miniature optoNCDT 1300 is a compact, low cost sensor for standard applications. Due to its very small construction, integration into restricted areas is possible. The optoNCDT 1300 Series has an analogue output. Due to its compact design, the sensor is ideally suited for integration into machines and automation applications.

optoNCDT 1300
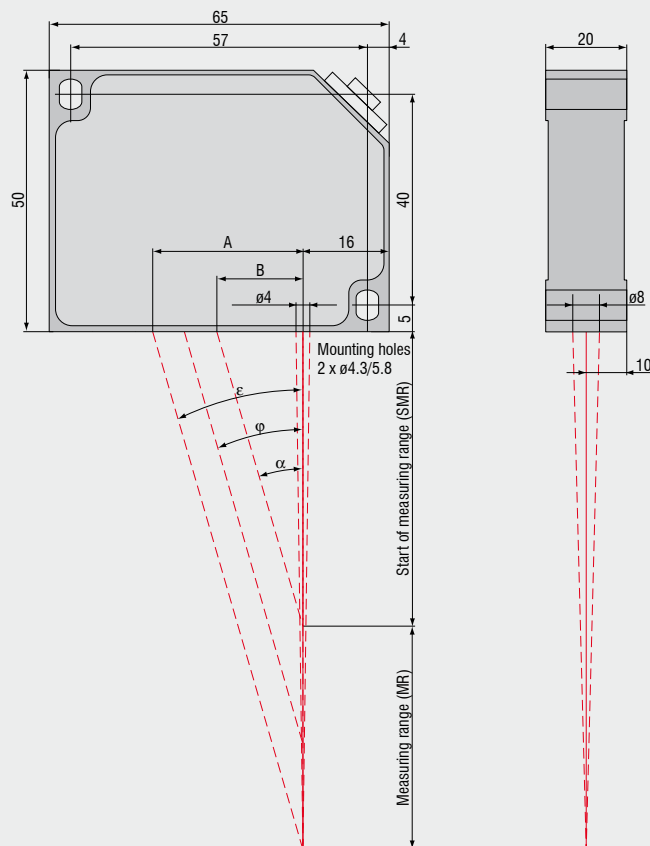
MR	SMR	α	φ	ε	A	B
20	30	28.6°	27.1°	26.4°	24.8	16.3
50	45	24.4°	19.8°	16.8°	28.6	21.4
100	50	24.3°	15.0°	11.4°	30.3	22.6
200	60	21.1°	9.6°	6.8°	30.8	23

(Dimensions in mm, not to scale. All CAD files are available online.)

Model	ILD1300-20	ILD1300-50	ILD1300-100	ILD1300-200
Measuring range	20mm	50mm	100mm	200mm
Start of measuring range	30mm	45mm	50mm	60mm
Midrange	40mm	70mm	100mm	160mm
End of measuring range	50mm	95mm	150mm	260mm
Linearity	40μm	100μm	200μm	400μm
	≤0.2% FSO typically			
Resolution · static*	4μm	10μm	25μm	50μm
Resolution · dynamic	10μm	25μm	100μm	200μm
Measuring rate	500Hz			
Light source	semiconductor laser <1mW, 670nm (red)			
Laser safety class	class 2 IEC 60825-1 : 2001-11			
Spot diameter · MMR	335μm	110μm	130μm	2200μm
Protection class	IP 67			
Shock	15g / 6ms (IEC 68-2-29)			
Vibration	2g / 20Hz... 500Hz (IEC 68-2-6)			
Weight	appr. 100g (without cable)			
Temperature stability	0.03 % FSO/°C		0.08 % FSO/°C	
Operation temperature	0…+55°C			
Storage temperature	-20…+70°C			
Output	4 ... 20mA (1 ... 5 V with cable PC 1401-3/U)			
Supply	11…30VDC			
Controller	integrated signal processor			
Electromagnetic compatibility (EMC)	EN 61000-6-3 EN 61000-6-2			

FSO = Full scale output   All specifications apply for a diffusely reflecting matt white ceramic target
*) with averaging factor 32
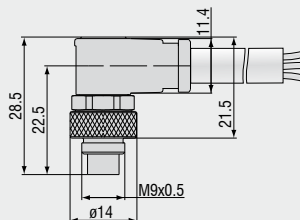SMR = Start of measuring range; MMR = Midrange; EMR = End of measuring range
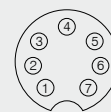
Connector axial
Article Number: 0323142

M9.0 x 0.5
ø14
~40
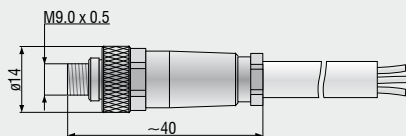
Connector radial
Article Number: 0323203

11.4
28.5
22.5
21.5
M9x0.5
ø14

**7-pin-connector**
(view on solder termination side of male inserts)

Pin assignment voltage 7x1x0.14		
Pin-Nr.	Function	Cable colors
1	Error	green
2	Laser on/off	yellow
3	n.c.	-
4	n.c.	-
5	4 ... 20 mA	grey
6	GND	brown
7	Supply 11 ... 30 VDC	white

Seven models with measuring ranges from 5mm to 250mm

Ideal for OEM applications

Compact design with integrated controller

312Hz
375Hz
1000Hz
Adjustable measuring rate up to 1.5kHz

Analog
Digital
Analogue (U/I) and digital output

Trigger
TeachIn
Trigger input and teach-in

Filter
inside
Adjustable filter functions Peak selection (firmware)

High flex cables for dragchain and robot use

Certified
Calibration certificate included

//www.
Configuration via software www.micro-epsilon.com/download

The miniature optoNCDT 1402 series is the leading sensor in this price/performance category. The compact construction enables integration inside small areas. The optoNCDT 1402 series is ideally suited for integration into machines and automation applications.

optoNCDT 1402
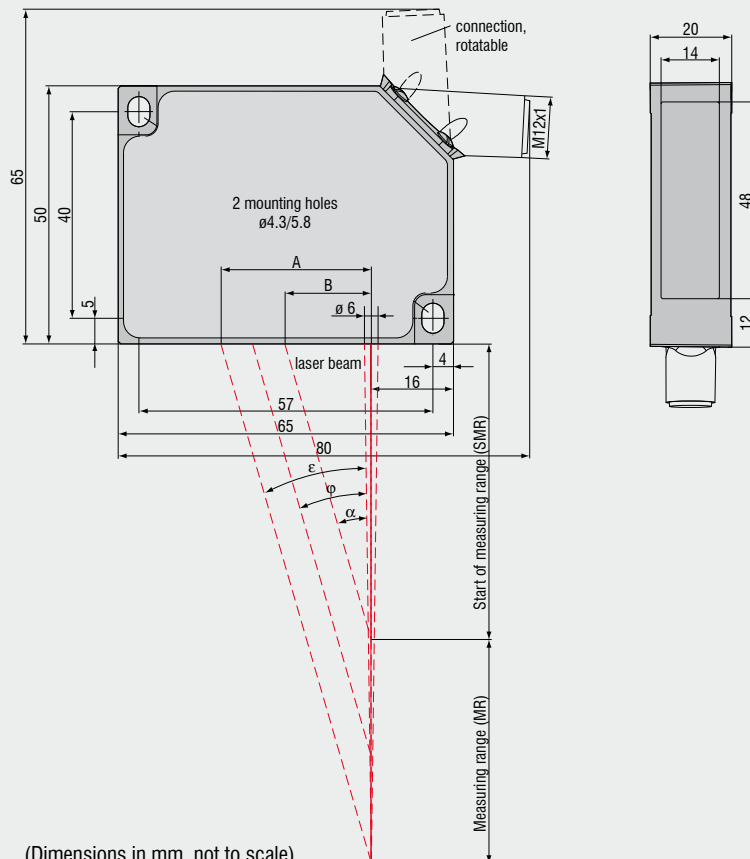
(Dimensions in mm, not to scale)

MR	SMR	α	φ	ε	A	B
5	20	33.5°	35.5°	37.1°	18.9	13.2
10	20	33.5°	32.9°	32.4°	19.1	13.2
20	30	31.2°	27.9°	25.8°	24.2	18.2
50	45	25.1°	19.6°	16.9°	28.9	21.1
100	50	23.1°	14.4°	11.3°	30.1	21.3
200	60	20.1°	9.4°	6.8°	30.8	22.0
250VT	100	14.7°	7.6°	5.5°	33.9	26.2

Model	ILD1402-5	ILD1402-10	ILD1402-20	ILD1402-50	ILD1402-100	ILD1402-200	ILD1402-250VT
Measuring range	5mm	10mm	20mm	50mm	100mm	200mm	250mm
Start of measuring range SMR	20mm	20mm	30mm	45mm	50mm	60mm	100mm
Midrange MMR	22.5mm	25mm	40mm	70mm	100mm	160mm	225mm
End of measuring range EMR	25mm	30mm	50mm	95mm	150mm	260mm	350mm
Linearity	$9\mu m$	$18\mu m$	$36\mu m$	$90\mu m$	$180\mu m$	$500\mu m$	1.2mm
			$\leq$0.18% FSO			$\leq$0.25% FSO	$\leq$0.5% FSO
Resolution static [1] [2]	$0.6\mu m$	$1\mu m$	$2\mu m$	$5\mu m$	$10\mu m$	$20\mu m$	$50\mu m$
			0.01% FSO				0.02% FSO
Resolution dynamic [1] 1.5kHz	$3\mu m$	$5\mu m$	$10\mu m$	$25\mu m$	$50\mu m$	$100\mu m$	$300\mu m$
			0.05% FSO				0.12% FSO
Measuring rate, programmable	1.5kHz; 1kHz; 750Hz; 375Hz						
Light source	semiconductor laser <1mW, 670nm (red)						
Laser safety class	class 2 IEC 60825-1 : 2001-11						
Spot diameter SMR	$110\mu m$	$110\mu m$	$210\mu m$	$1100\mu m$	$1400\mu m$	$2300\mu m$	$5000\mu m$
Spot diameter MMR	$380\mu m$	$650\mu m$	$530\mu m$	$110\mu m$	$130\mu m$	$2200\mu m$	$5000\mu m$
Spot diameter EMR	$650\mu m$	$1200\mu m$	$830\mu m$	$1100\mu m$	$1400\mu m$	$2100\mu m$	$5000\mu m$
Protection class	IP 67						
Vibration	15g / 10Hz … 1kHz						20g / 10Hz…1kHz
Weight (without cable)	appr. 83g						appr. 130g
Temperature stability	0.03 % FSO/°C				0.08 % FSO/°C		
Operation temperature	0 … +50°C						
Storage temperature	-20 ... +70°C						
Output analog	4 ... 20mA (1 ... 5V with cable PC 1402-3/U)						
Output digital	RS422						
Supply	11 ... 30VDC, 24VDC / 50mA						
Controller	integrated signal processor						
Electromagnetic compatibility (EMC)	EN 61326-1:2006 / EN 55011 Class B (Interface emission) EN 61326-1:2006 / EN 61000-4-2:1995 + A1:1998 + A2:2001 (Interference resistance)						

FSO = Full scale output   All specifications apply for a diffusely reflecting matt white ceramic target
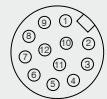[1] resolution digital output 14bit   [2] with averaging factor 64
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range

Connector axial

45.4
Ø15
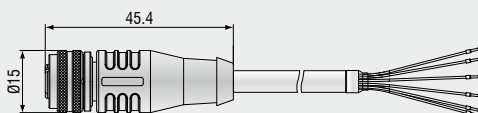
12-pin-connector
(view on solder termination side of male inserts)

Pin	Description		colour PC1402-x/I
3	RS422 Rx+	serial input	green
4	RS422 Rx-	serial input	yellow
5	RS422 Tx+	serial output	grey
6	RS422 Tx-	serial output	pink
7	$+U_B$		red
8	Laser off	switch input	black
9	Teach in	switch input	violet
10	Error	switch output	brown
11	I_{OUT}	4 ... 20 mA	white
12	GND		blue
1/2	n.c.		

The cable screen is connected with the sensor housing. The interface and power supply cable are robot rated and UL certfied. At one end there is a 12pin M12 connector, the other end is open.

- **Ten models with measuring ranges from 2mm to 750mm**
- **Compact design with integrated controller**
- *RTSC* **Real Time Surface Compensation**
- 312Hz 375Hz 1000Hz **Adjustable measuring rate up to 2.5kHz**
- *Analog Digital* **Analogue (U/I) and digital output**
- *Filter inside* **Adjustable filter functions (firmware)**
- **High flex cables for dragchain and robot use**
- *Certified* **Calibration certificate included**
- //www. **Configuration via software www.micro-epsilon.com/download**

The benchmark
in laser triangulation sensors

The optoNCDT 1700 series is truly a world leading laser displacement sensor. Featuring Real Time Surface Compensation (RTSC), remote software programming and excellent linearity & resolution the optoNCDT 1700 is difficult to match at this price level. Integrated conditioning electronics allows the sensor to have a very unique and compact design.

Adjustable limit switches

As well as for precise measurement, the optoNCDT 1700 sensors are also used for tolerance or limit monitoring. Two switching points are available which can be configured and adjusted via the remote software (USB connection). The switching hysteresis can also be individually adjusted for each limit point.

Adjustable exposure time/measuring rate

For poor reflecting targets, the measuring rate can be reduced to enable a longer exposure time. The set measurement rate always remains constant so that with closed-loop control the system response time is always the same.
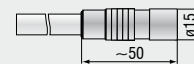
optoNCDT 1700 (2/10/20/50/100/200/250VTmm)
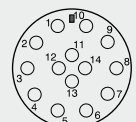

optoNCDT 1700 (40/500/750mm)
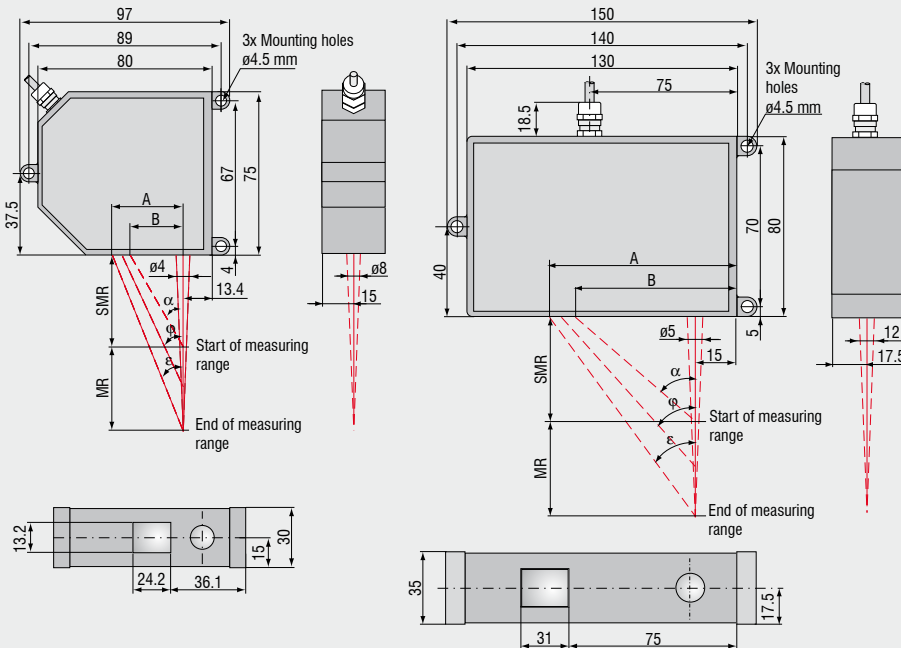
MR	SMR	α	φ	ε	A	B
2	24	35°	40°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22.0
50	45	26.5°	23.0°	18.3°	31.5	22.5
100	70	19.0°	15.4°	10.9°	32.6	24.1
200	70	19.0°	9.78°	6.97°	33.1	24.1
250VT	70	19.0°	8.4°	6.0°	33.5	24.1
40	175	22.1°	21.9°	21.8°	101	86
500	200	19.3°	9.8°	7.0°	101	85
750	200	19.3°	7.7°	5.0°	101	85

Connector (sensor side)
Article Number: 0323243

Connector (sensor cable)
Article Number: 0323272

14-pin-connector
(Pin side female cable connector or solder-pin side male cable connector)

(Dimensions in mm, not to scale. All CAD files are available online.)

Model	ILD 1700-2	ILD 1700-10	ILD 1700-20	ILD 1700-40	ILD 1700-50	ILD 1700-100	ILD 1700-200	ILD 1700-250VT	ILD 1700-500	ILD 1700-750
Measuring range	2mm	10mm	20mm	40mm	50mm	100mm	200mm	250mm	500mm	750mm
Start of measuring range	24mm	30mm	40mm	175mm	45mm	70mm	70mm	70mm	200mm	200mm
Midrange	25mm	35mm	50mm	195mm	70mm	120mm	170mm	195mm	450mm	575mm
End of measuring range	26mm	40mm	60mm	215mm	95mm	170mm	270mm	320mm	700mm	950mm
Linearity	2µm	8µm	16µm	32µm	40µm	80µm	200µm	630µm	400µm	750µm
FSO	≤0.1%	≤0.08%					≤0.1%	≤0.25%	≤0.08%	≤0.1%
Resolution (at 2.5kHz without averaging)	0.1µm	0.5µm	1.5µm	4µm	3µm	6µm	12µm	50µm	30µm	50µm
Measuring rate	2.5kHz / 1.25kHz / 625Hz / 312.5Hz (adjustable)									
Light source	semiconductor laser <1mW, 670nm (red)									
Permissable ambient light (at 2.5kHz)	10,000lx							15,000lx	10,000lx	
Laser safety class	class 2 acc. DIN EN 60825-1 : 2001-11									
Spot diameter SMR	80µm	110µm	320µm	230µm	570µm	740µm	1300µm	1500µm	1500µm	1500µm
MMR	35µm	50µm	45µm	210µm	55µm	60µm	1300µm	1500µm	1500µm	1500µm
EMR	80µm	110µm	320µm	230µm	570µm	700µm	1300µm	1500µm	1500µm	1500µm
Temperature stability*	0.025% FSO/°C	0.01 % FSO/°C						0.025% FSO/°C	0.01 % FSO/°C	
Operation temperature	0 ...+50°C							0 ...+55°C	0 ...+50°C	
Storage temperature	-20 ... +70°C									
Output measurements	selectable: 4 ... 20mA / 0 ... 10V / RS 422 / USB (optional with cable PC1700-3/USB)									
switching outputs	1 x error or 2 x limit (each pogrammable)									
Switch Input	laser ON-OFF / zero									
Operation	via touch screen on sensor or via PC with ILD 1700 tool									
Power supply	24VDC (11 ... 30VDC), max. 150mA									
Electromagnetic compatibility (EMC)	EN 61000-6-3 EN 61000-6-2									
Sensor cable length (with connector)	0.25m (integrated cable with connector) option: 3m or 10m									
Synchronisation	possible for simultaneous or alternating measurements									
Protection class	IP 65									
Vibration	2g / 20 ... 500Hz									
Shock	15g / 6ms									
Weight (with 0.25m cable)	~ 550g		~ 600g		~ 550g				~ 600g	

FSO = Full Scale Output   All specifications apply for a diffusely reflecting white ceramic target
* based on digital output
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options
- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Laser Line averages across shiny metallic or structured surfaces

**Four models with measuring ranges from 2mm to 50mm**

Compact design with integrated controller

RTSC **Real Time Surface Compensation**

312Hz 375Hz 1000Hz **Adjustable measuring rate up to 2.5kHz**

*A*nalog *D*igital **Analogue (U/I) and digital output**

*F*ilter inside **Adjustable filter functions (firmware)**

High flex cables for dragchain and robot use

Certified **Calibration certificate included**

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Designed for shiny and rough surfaces where high accuracy measurements are required. The optoNCDT 1700LL provides precision accuracy with an integrated controller. The laser spot is optically enlarged to make an oval point thus reducing the physical interference making measurements on rough surfaces considerably easier to perform. The 1700LL combines the advantages of both the 1700 and the 2200LL series offering high precision and flexibility with a compact sensor size.

optoNCDT 1700LL (2/10/20/50mm)
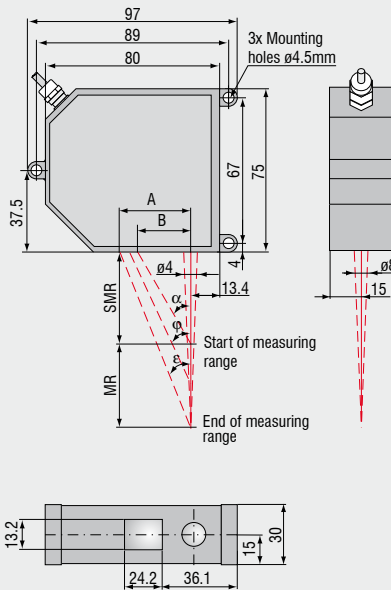
MR	SMR	α	φ	ε	A	B
2	24	35°	40°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22.0
50	45	26.5°	23.0°	18.3°	31.5	22.5

Connector (sensor side)
Article Number: 0323243
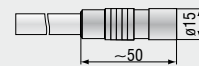
Connector (sensor cable)
Article Number: 0323272
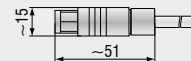
(Dimensions in mm, not to scale. All CAD files are available online.)

Model	ILD1700-2LL	ILD 1700-10LL	ILD 1700-20LL	ILD 1700-50LL
Measuring range	2mm	10mm	20mm	50mm
Start of measuring range	24mm	30mm	40mm	45mm
Midrange	25mm	35mm	50mm	70mm
End of measuring range	26mm	40mm	60mm	95mm
Linearity	2μm	8μm	16μm	40μm
FSO	≤0.1%		≤0.08%	
Resolution [1] (at 2.5kHz without averaging)	0.1μm	0.5μm	1.5μm	3μm
Measuring rate	2.5kHz / 1.25kHz / 625Hz / 312.5Hz (adjustable)			
Light source	semiconductor laser <1mW, 670nm (red)			
Permissable ambient light at 2.5kHz	10,000lx			
Laser safety class	class 2 acc. DIN EN 60825-1 : 2001-11			
Spot diameter SMR	85 x 240μm	120 x 405μm	185 x 485μm	350 x 320μm
MMR	24 x 280μm	35 x 585μm	55 x 700μm	70 x 960μm
EMR	64 x 400μm	125 x 835μm	195 x 1200μm	300 x 1940μm
Temperature stability [2]	0.025% FSO/°C	0.01 % FSO/°C		
Operation temperature	0 ...+50°C			
Storage temperature	-20 ... +70°C			
Output measurements	selectable: 4 ... 20mA / 0 ... 10V / RS 422 / USB (optional with cable PC1700-3/USB)			
switching outputs	1 x error or 2 x limit (each pogrammable)			
Switch Input	laser ON-OFF / zero			
Operation	via touch screen on sensor or via PC with ILD 1700 tool			
Power supply	24VDC (11 ... 30VDC), max. 150mA			
Electromagnetic compatibility (EMC)	EN 61000-6-3 EN 61000-6-2			
Sensor cable length (with connector)	0.25m (integrated cable with connector) option: 3m or 10m			
Synchronisation	possible for simultaneous or alternating measurements			
Protection class	IP 65			
Vibration	2g / 20 ... 500Hz			
Shock	15g / 6ms			
Weight (with 0.25m cable)	~ 550g			

FSO = Full Scale Output   All specifications apply for a diffusely reflecting white ceramic target
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range
[1] for measurements against high glossy surfaces (targets), resolution depends on the material
[2] based on digital output

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options

- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Precise measurement of direct reflecting surfaces (glass and mirror)

Three models with measuring ranges from 2mm to 20mm

Compact design with integrated controller

RTSC **Real Time Surface Compensation**

312Hz 375Hz 1000Hz **Adjustable measuring rate up to 2.5kHz**

Analog *Digital* **Analogue (U/I) and digital output**

Filter inside **Adjustable filter functions (firmware)**

High flex cables for dragchain and robot use

Certified **Calibration certificate included**

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Specular Model for direct reflecting targets (glass and mirror)

optoNCDT 1700DR is designed for use with direct reflective materials, such as mirrored surfaces that are traditionally difficult to measure with laser technology. The sensor compensates for the high intensity of the reflected light by using patented, high speed software algorithms that dramatically reduce signal noise. The unit size is identical to the standard optoNCDT 1700 series and is therefore ideal for use in small areas (mounting device included).

A different tilt angle is necessary for each sensor depending on the measuring range. Therefore, mounting stencils for easy alignment of the sensors to the target are included as standard.

Mounting direct reflection
(tilt tolerance <0.1°)

Mirror-like surface
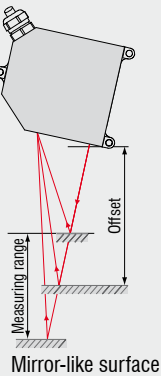
Precision alignment accessory
(Mounting device included with delivery)

① Mounting the alignment

② Orientation of the sensor

③ Fixing the sensor
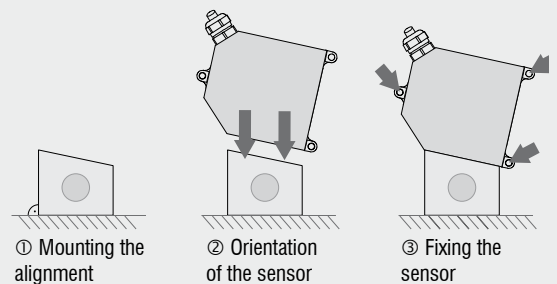
optoNCDT 1700DR (2mm)
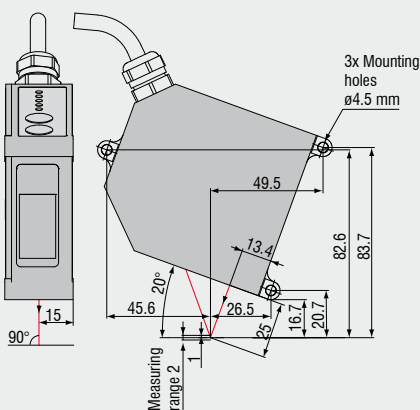
optoNCDT 1700DR (10mm)
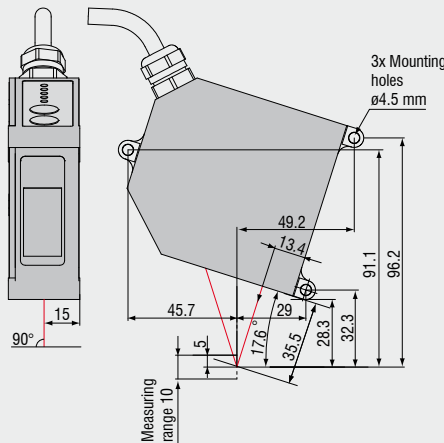
optoNCDT 1700DR (20mm)
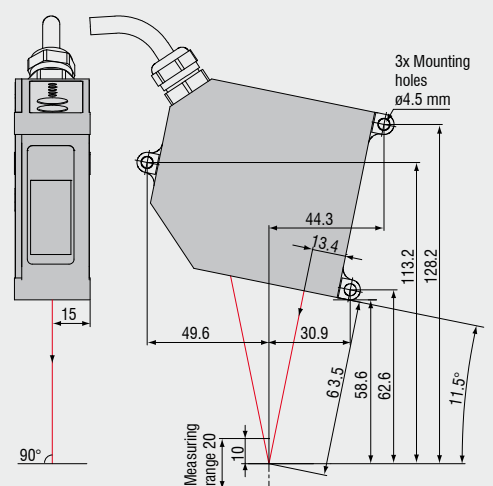
(Dimensions in mm, not to scale. All CAD files are available online.)

Model	ILD1700-2DR	ILD1700-10DR	ILD1700-20DR
Measuring range	2mm	10mm	20mm
Start, mid, end of measuring range	see engineering drawing		
Linearity	$2\mu m$	$10\mu m$	$40\mu m$
	≤0.1% FSO		≤0.2% FSO
Resolution (at 2.5kHz without averaging)	$0.1\mu m$	$0.5\mu m$	$3\mu m$
Measuring rate	2.5kHz / 1.25kHz / 625Hz / 312.5Hz (adjustable)		
Light source	semiconductor laser <1mW, 670nm (red)		
Permissable ambient light	10,000lx (at 2.5kHz)		
Laser safety class	class 2 acc. DIN EN 60825-1 : 2001-11		
Spot diameter SMR	$80\mu m$	$110\mu m$	$320\mu m$
MMR	$35\mu m$	$50\mu m$	$45\mu m$
EMR	$80\mu m$	$110\mu m$	$320\mu m$
Temperature stability	0.025 % FSO/°C	0.01 % FSO/°C (based on digital output)	
Operation temperature	0 … +50°C		
Storage temperature	-20 … +70°C		
Output measurements	selectable: 4 ... 20mA / 0 ... 10V / RS 422 / USB (option with cable PC1700-3/USB)		
switching outputs	1 x error or 2 x limit (each pogrammable)		
Switch input	laser ON-OFF / zero		
Operation	via touch screen on sensor or via PC with ILD 1700 tool		
Power supply	24VDC (11 ... 30VDC), max. 150mA		
Electromagnetic compatibility (EMC)	EN 61000-6-3; EN 61000-6-2		
Sensor cable length (with connector)	0.25m (integrated cable with connector) option: 3m or 10m		
Synchronisation	possible for simultaneous or alternating measurements		
Protection class	IP 65		
Vibration	2g / 20 ... 500Hz		
Shock	15g / 6ms		
Weight (with 0.25m cable)	~ 550g		

FSO = Full Scale Output   All specifications are valid for polished and planar surfaces.
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options

- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Seven models with measuring ranges from 2mm to 200mm

Sensor head and separate controller

10 kHz   **Measurement rate up to 10kHz**

RTSC   **Real Time Surface Compensation**

A nalog   *D* igital   **Analogue and digital output**

F ilter inside   **Adjustable filter functions (firmware)**

Certified   **Calibration certificate included**

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At the head of the Micro-Epsilon laser family stands the optoNCDT 2200 series. Extreme accuracy, high measuring rate and constant signal stability, can be achieved at maximum speed without any signal averaging. This is world's first in terms of capability, enabling the sensor to solve the most demanding measurement applications. The digital output signal can be combined with the IF2008 PCI card (also designed and supplied by Micro-Epsilon) to synchronise multiple sensors at full measurement rate for easy data acquisition direct to a PC.
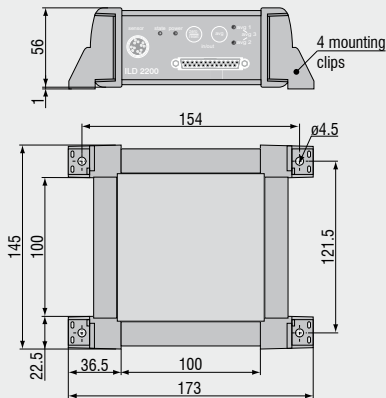
optoNCDT 2200 (2/10/20/50/100mm)
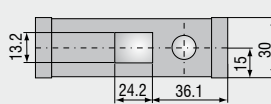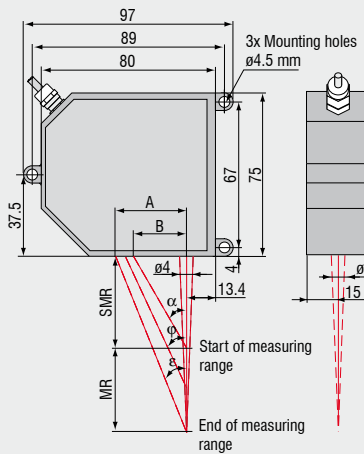
optoNCDT 2200 (40/200mm)
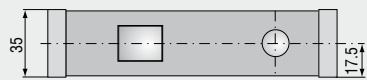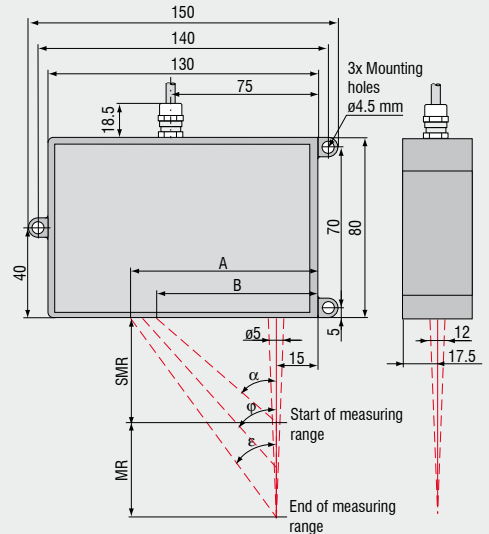
Controller

(Dimensions in mm, not to scale. All CAD files are available online.)

MR	SMR	α	φ	ε	A	B
2	24	35.0°	40.0°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22
50	45	26.5°	23.0°	18.3°	31.5	22.5
100	70	19.0°	15.4°	10.9°	32.6	24.1
40	175	22.1°	21.9°	21.8°	101	86
200	130	25.1°	16.7°	13.1°	91.6	76

Model	ILD 2200-2	ILD 2200-10	ILD 2200-20	ILD 2200-40	ILD 2200-50	ILD 2200-100	ILD 2200-200
Measuring range	2mm	10mm	20mm	40mm	50mm	100mm	200mm
Start of measuring range	24mm	30mm	40mm	175mm	45mm	70mm	130mm
Midrange	25mm	35mm	50mm	195mm	70mm	120mm	230mm
End of measuring range	26mm	40mm	60mm	215mm	95mm	170mm	330mm
Linearity	1μm	3μm	6μm	12μm	15μm	30μm	60μm
	≤0.05% FSO	≤0.03% FSO					
Resolution [1] (at 10 kHz without averaging)	0.03μm	0.15μm	0.3μm	0.6μm	0.8 μm	1.5μm	3μm
		0.0015% FSO					
Measuring rate	10kHz						
Permissable ambient light	30,000lx						
Spot diameter SMR	80μm	110μm	160μm	230μm	215μm	350μm	1300μm
MMR	35μm	50μm	60μm	210μm	80μm	130μm	1300μm
EMR	80μm	110μm	160μm	230μm	215μm	350μm	1300μm
Light source	semiconductor laser <1mW, 670nm (red)						
Laser safety class	class 2 acc. DIN EN 60825-1/A1 12.99 / IEC 825-1/A1 12.99 / FDA						
Protection class	sensor: IP 65 / controller: IP 50						
Temperature stability	0.025% FSO/°C	0.01% FSO/°C					
Operation temperature	0 ... +50°C						
Storage temperature	-20 ... +70°C						
Output	analogue: ±5V digital: RS 422 / 691.2kBaud						
Power supply	24VDC (±15%), max. 500mA						
Sensor cable length	standard: 2m - integrated option: 5m/10m						
Controller	functions: auto zero / signal averaging dimensions: 143mm x 145mm x 52mm - without mounting clips						
Electromagnetic compatibility (EMC)	EN 55011/12.1998 and EN 50082-2/ 02.1996						
Vibration	2g / 20 ... 500Hz						
Shock	15g / 6ms / 3 axis						
Weight sensor	~550g			~600g		~550g	~600g
controller	~1000g						

FSO = Full Scale Output   All specifications apply for a diffusely reflecting matt white ceramic target
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range
[1] resolution digital output 16bit

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options

- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Measuring rate 2.5 / 5 / 10 / 20kHz
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Laser line averages across shiny metallic or structured surfaces

Four models with measuring ranges from 2mm to 50mm

Sensor head and separate controller

10 kHz **Measurement rate up to 10kHz**

RTSC **Real Time Surface Compensation**

Analog **Analogue** Digital **and digital output**

Filter inside **Adjustable filter functions (firmware)**

Certified **Calibration certificate included**

//www. **Configuration via software www.micro-epsilon.com/download**

The optoNCDT 2200LL series uses a small laser line, instead of a spot, to provide accurate measurement against shiny metallic surfaces. The use of the laser line allows the sensor to perform an average across the line. This makes it possible to measure rough surfaces with greater accuracy than before. The sensor can also be used for measuring directly reflecting surfaces without the need to angle the sensor.

MR	SMR	α	φ	ε	A	B
2	24	35.0°	40.0°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22
50	45	26.5°	23.0°	18.3°	31.5	22.5

optoNCDT 2200LL (2/10/20/50mm)
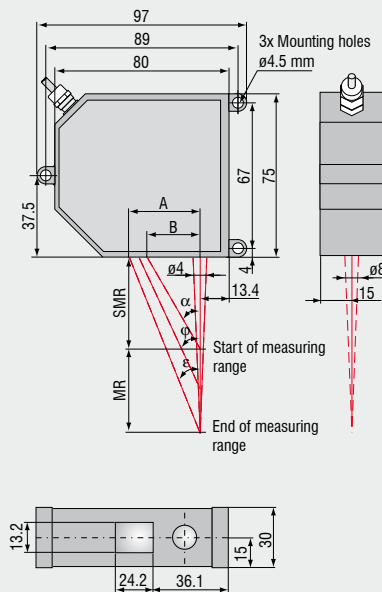
Controller
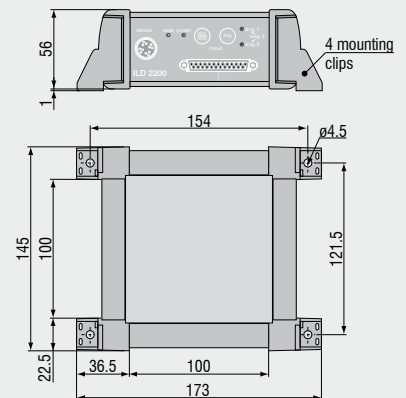
(Dimensions in mm, not to scale. All CAD files are available online.)

Model	ILD 2200-2LL	ILD 2200-10LL	ILD 2200-20LL	ILD 2200-50LL
Measuring range	2mm	10mm	20mm	50mm
Start of measuring range	24mm	30mm	40mm	45mm
Midrange	25mm	35mm	50mm	70mm
End of measuring range	26mm	40mm	60mm	95mm
Linearity	$1\mu m$	$3\mu m$	$6\mu m$	$15\mu m$
	≤0.05% FSO		≤0.03% FSO	
Resolution [1] [2] (at 10kHz without averaging)	$0.03\mu m$	$0.15\mu m$	$0.3\mu m$	$0.8\mu m$
			0.0015% FSO	
Measuring rate			10kHz	
Permissable ambient light			30.000lx	
Spot diameter — SMR	$85 \times 240\mu m$	$120 \times 405\mu m$	$185 \times 485\mu m$	$350 \times 320\mu m$
Spot diameter — MMR	$24 \times 280\mu m$	$35 \times 585\mu m$	$55 \times 700\mu m$	$70 \times 960\mu m$
Spot diameter — EMR	$64 \times 400\mu m$	$125 \times 835\mu m$	$195 \times 1200\mu m$	$300 \times 1940\mu m$
Light source			semiconductor laser <1mW, 670nm (red)	
Laser safety class			class 2 acc. DIN EN 60825-1/A1 12.99 / IEC 825-1/A1 12.99 / FDA	
Protection class			sensor: IP 65 / controller: IP 50	
Temperature stability	0.025% FSO/°C		0.01 % FSO/°C	
Operation temperature			0 ... +50°C	
Storage temperature			-20 ... +70°C	
Output			analogue: ±5V digital: RS 422 / 691.2kBaud	
Power supply			24VDC (±15%), max. 500mA	
Sensor cable length			standard: 2m - integrated option: 5m/10m	
Controller			functions: auto zero / signal averaging dimensions: 143mm x 145mm x 52mm - without mounting clips	
Electromagnetic compatibility (EMC)			EN 55011/12.1998 and EN 50082-2/02.1996	
Vibration			2g / 20 ... 500Hz	
Shock			15g / 6ms / 3 axis	
Weight			sensor: ~550g controller: ~1000g	

FSO = Full Scale Output   SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range
All specifications apply for a diffusely reflecting white ceramic target
[1] for measurements against high glossy surfaces (targets), resolution depends on the material
[2] resolution digital output 16bit

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options
- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Measuring rate 2.5 / 5 / 10 / 20kHz
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Six models with measuring ranges from 2mm to 200mm

Sensor head and separate controller

20kHz **20kHz measurement rate over the full working range**

RTSC **Real Time Surface Compensation**

*A*nalog *D*igital **Analogue and digital output**

*F*ilter inside **Adjustable filter functions (firmware)**

Certified **Calibration certificate included**

//www. **Configuration via software www.micro-epsilon.com/download**

The optoNCDT 2220 provides a genuine 20kHz measurement rate for every measurement task. The series is ideally suited to superfast, complex applications and offers a high speed measurement with excellent resolution. In addition, the optoNCDT 2220 incorporates all the popular Micro-Epsilon benefits including the RTSC function for changing surfaces or the specific CCD-line for high resolution measurements.

Controller
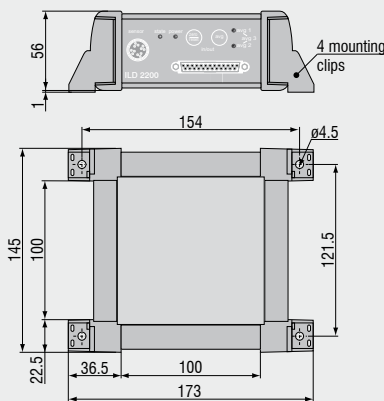
optoNCDT 2220 (2/10/20/50/100mm)
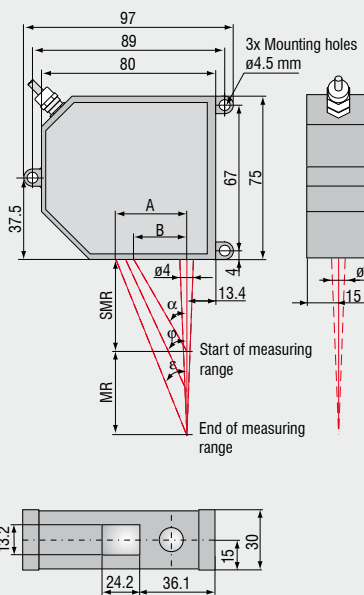
optoNCDT 2220 (200mm)
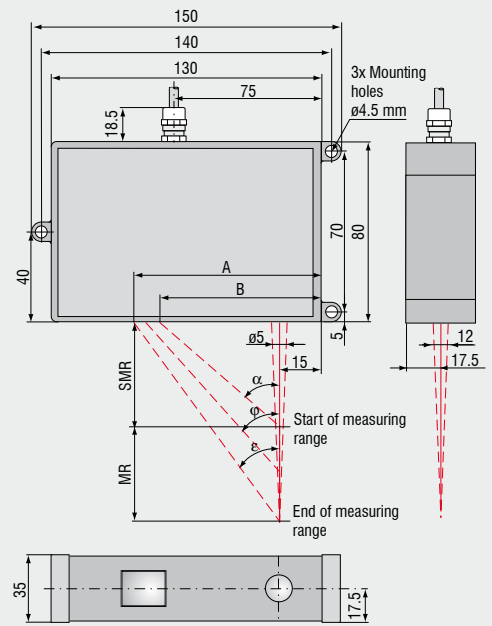
(Dimensions in mm, not to scale. All CAD files are available online.)

MR	SMR	α	φ	ε	A	B
2	24	35.0°	40.0°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22
50	45	26.5°	23.0°	18.3°	31.5	22.5
100	70	19.0°	15.4°	10.9°	32.6	24.1
200	130	25.1°	16.7°	13.1°	91.6	76

Model	ILD 2220-2	ILD 2220-10	ILD 2220-20	ILD 2220-50	ILD 2220-100	ILD 2220-200
Measuring range	2mm	10mm	20mm	50mm	100mm	200mm
Start of measuring range	24mm	30mm	40mm	45mm	70mm	130mm
Midrange	25mm	35mm	50mm	70mm	120mm	230mm
End of measuring range	26mm	40mm	60mm	95mm	170mm	330mm
Linearity	$1\mu m$ ≤0.05% FSO	$3\mu m$	$6\mu m$	$15\mu m$ ≤0.03% FSO	$30\mu m$	$60\mu m$
Resolution [1] (at 20 kHz without averaging)	$0.03\mu m$	$0.15\mu m$	$0.3\mu m$ 0.0015% FSO	$0.8\mu m$	$1.5\mu m$	$3\mu m$
Measuring rate			20kHz			
Permissable ambient light			30.000lx			
Spot diameter — SMR	$80\mu m$	$110\mu m$	$160\mu m$	$215\mu m$	$350\mu m$	$1300\mu m$
Spot diameter — MMR	$35\mu m$	$50\mu m$	$60\mu m$	$80\mu m$	$130\mu m$	$1300\mu m$
Spot diameter — EMR	$80\mu m$	$110\mu m$	$160\mu m$	$215\mu m$	$350\mu m$	$1300\mu m$
Light source			semiconductor laser <1mW, 670nm (red)			
Laser safety class			class 2 acc. DIN EN 60825-1/A1 12.99 / IEC 825-1/A1 12.99 / FDA			
Protection class			sensor: IP 65 / controller: IP 50			
Temperature stability	0.025 % FSO/°C			0.01 % FSO/°C		
Operation temperature			0 ... +50°C			
Storage temperature			-20 ... +70°C			
Output			analogue:±5V digital: RS 422 / 691.2kBaud			
Power supply			24VDC (±15%), max. 500mA			
Sensor cable length			standard: 2m - integrated option: 5m/10m			
Controller			functions: auto zero / signal averaging dimensions: 143mm x 145mm x 52mm - without mounting clips			
Electromagnetic compatibility (EMC)			EN 55011/12.1998 and EN 50082-2/ 02.1996			
Vibration			2g / 20 ... 500Hz			
Shock			15g / 6ms / 3 axis			
Weight — sensor		~550g				~600g
Weight — controller			~1000g			

FSO = Full Scale Output
All specifications apply for a diffusely reflecting matt white ceramic target
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range
[1] resolution digital output 16bit

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options

- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Measuring rate 2.5 / 5 / 10 / 20kHz
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

	Laser line averages across shiny metallic or structured surfaces
	Four models with measuring ranges from 2mm to 50mm
	Sensor head and separate controller
20kHz	20kHz measurement rate over the full working range
RTSC	Real Time Surface Compensation
Analog Digital	Analogue and digital output
F ilter inside	Adjustable filter functions (firmware)
Certified	Calibration certificate included
//www.	Configuration via software www.micro-epsilon.com/download

The optoNCDT 2220LL series uses a small laser line, instead of a spot, to provide accurate measurement against shiny metallic surfaces all at high speed. The optoNCDT 2220LL provides a 20kHz measurement rate across its entire measurement range for any type of situation. The use of the laser line allows the sensor to perform an average across the line which makes it possible to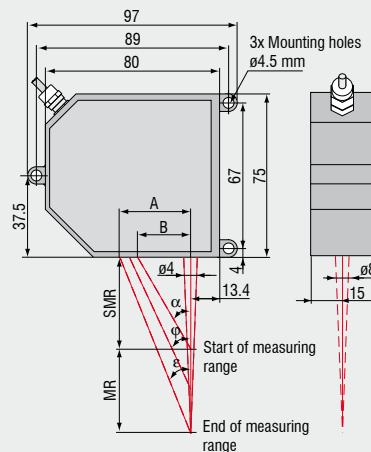 measure rough surfaces with greater accuracy than before. The sensor can also be used for measuring directly reflecting surfaces without the need to angle the sensor. The high measurement rate and excellent resolution allow measurements to be taken on very fast applications with challenging or reflecting surfaces.

optoNCDT 2220LL (2/10/20/50mm)

Controller
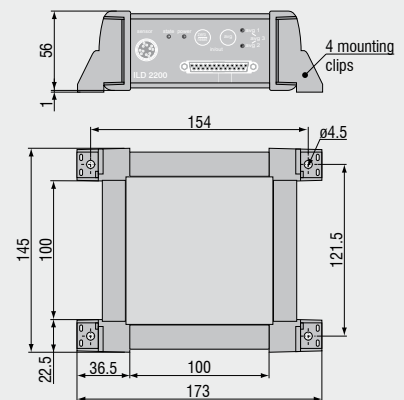
(Dimensions in mm, not to scale. All CAD files are available online.)

MR	SMR	α	φ	ε	A	B
2	24	35.0°	40.0°	44.8°	25.8	16.8
10	30	34.3°	35.2°	35.6°	28.7	20.5
20	40	28.8°	27.5°	26.7°	30.1	22
50	45	26.5°	23.0°	18.3°	31.5	22.5
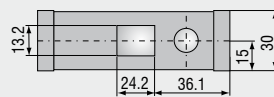
Model	ILD 2220-2LL	ILD 2220-10LL	ILD 2220-20LL	ILD 2220-50LL
Measuring range	2mm	10mm	20mm	50mm
Start of measuring range	24mm	30mm	40mm	45mm
Midrange	25mm	35mm	50mm	70mm
End of measuring range	26mm	40mm	60mm	95mm
Linearity	1µm ≤0.05% FSO	3µm	6µm ≤0.03% FSO	15µm
Resolution [1] [2] (at 20 kHz without averaging)	0.03µm	0.15µm 0.0015% FSO	0.3µm	0.8µm
Measuring rate	20kHz			
Permissable ambient light	30.000lx			
Spot diameter — SMR	85 x 240µm	120 x 405µm	185 x 485µm	350 x 320µm
Spot diameter — MMR	24 x 280µm	35 x 585µm	55 x 700µm	70 x 960µm
Spot diameter — EMR	64 x 400µm	125 x 835µm	195 x 1200µm	300 x 1940µm
Light source	semiconductor laser <1mW, 670nm (red)			
Laser safety class	class 2 acc. DIN EN 60825-1/A1 12.99 / IEC 825-1/A1 12.99 / FDA			
Protection class	sensor: IP 65 / controller: IP 50			
Temperature stability	0.025 % FSO/°C	0.01 % FSO/°C		
Operation temperature	0 ... +50°C			
Storage temperature	-20 ... +70°C			
Output	analogue:±5V digital: RS 422 / 691.2kBaud			
Power supply	24VDC (±15%), max. 500mA			
Sensor cable length	standard: 2m - integrated option: 5m/10m			
Controller	functions: auto zero / signal averaging dimensions: 143mm x 145mm x 52mm - without mounting clips			
Electromagnetic compatibility (EMC)	EN 55011/12.1998 and EN 50082-2/ 02.1996			
Vibration	2g / 20 ... 500Hz			
Shock	15g / 6ms / 3 axis			
Weight	sensor: ~550g controller: ~1000g			

FSO = Full Scale Output
All specifications apply for a diffusely reflecting matt white ceramic target
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range
[1] for measurements against high glossy surfaces (targets), resolution depends on the material
[2] resolution digital output 16bit

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options

- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Measuring rate 2.5 / 5 / 10 / 20kHz
- Non standard signal interfaces
- Special cable length of electrical connector
- 90° beam deflection
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

	High accuracy and long standoff distances
	Three models with measuring ranges from 10mm to 50mm
	Sensor head and separate controller
10 kHz	**Measurement rate up to 10kHz**
RTSC	**Real Time Surface Compensation**
*A*nalog *D*igital	**Analogue and digital output**
*F*ilter inside	**Adjustable filter functions (firmware)**
Certified	**Calibration certificate included**
//www.	**Configuration via software www.micro-epsilon.com/download**

In contrast to conventional laser sensors, the Long-Range series allows accurate measurements to be taken at much longer stand off distances than normal. This is an important advantage, especially if the sensor cannot be mounted close to the target due to the environment the target is within. The long stand off is particularly useful if you need to look through a window at a target in a pressure chamber or similar vessel. A special CMOS line and the Real Time Surface Compensation enable the sensor to be used even on changing surfaces.

Controller

optoNCDT 1810-50 (50mm)
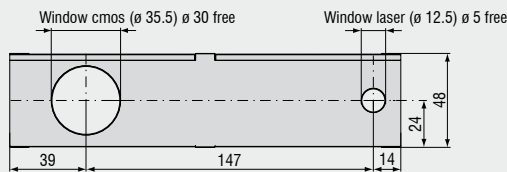
optoNCDT 2210 (10/20mm)
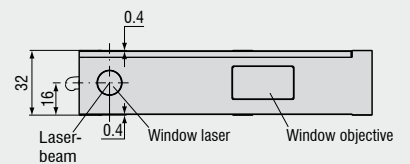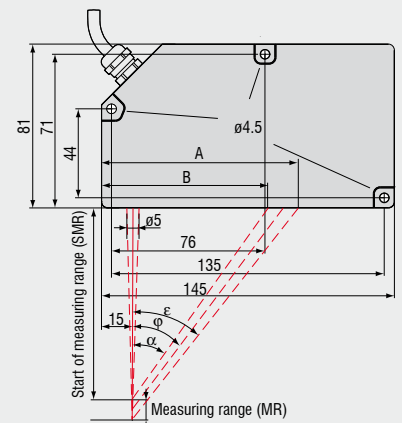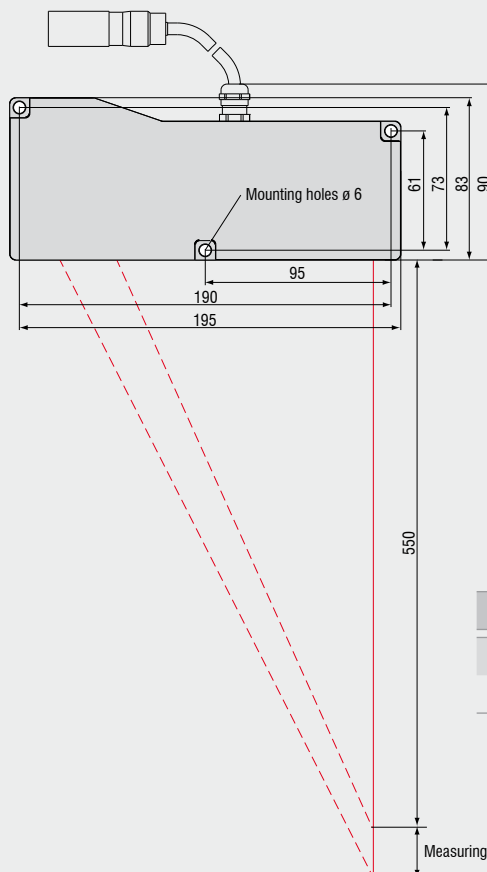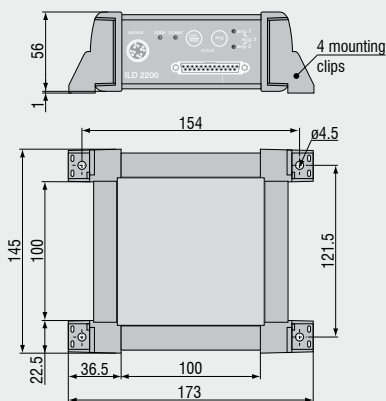
(Dimensions in mm, not to scale.)

MR	SMR	α	φ	ε	A	B
10	95	34.6°	36.9°	38.8°	99.4	80.6
20	90	36.1°	36.9°	37.5°	99.4	80.6

Model	ILD 1810-50	ILD 2210-10	ILD 2210-20
Measuring range	50mm	10mm	20mm
Start of measuring range	550mm	95mm	90mm
Midrange	575mm	100mm	
End of measuring range	600mm	105mm	110mm
Linearity	50µm ≤0.1% FSO	3µm ≤0.03% FSO	6µm
Resolution dynamic [1]	5µm 0.01% FSO	0.5µm 0.005% FSO	1µm
Measuring rate	2.5kHz	10kHz	
Permissable ambient light	10.000lx	30.000lx	
Spot diameter SMR	400 x 500µm	130µm	200µm
MMR	400 x 500µm	60µm	60µm
EMR	400 x 500µm	130µm	200µm
Light source	semiconductor laser <1mW, 670nm (red)		
Laser safety class	class 2 acc. DIN EN 60825-1 : 2001-11 / Class 2 (IEC 60825-1) Class II (FDA)		
Protection class	sensor: IP 65 controller: IP 50		
Temperature stability	0.01 % FSO/℃		
Operation temperature	0 ... 50℃		
Storage temperature	-20 ... 70℃		
Output analogue	±5V (-10V ... +10V)		
digital	option: RS232 or RS422	RS422 / 687.5kBaud	
Power supply	24VDC (±15%), max. 500mA		
Sensor cable length	standard: 2m - integrated option: 5m/10m on request		
Controller	functions: auto zero / signal averaging dimensions: 143mm x 145mm x 52mm - without mounting clips		
Electromagnetic compatibility (EMC)	EN 50081-1 and EN 50082-2		
Vibration	2g / 20 ... 500Hz		
Shock	15g / 6ms / 3 axis		
Weight sensor	~800g	~500g	
controller	~1000g		

FSO = Full Scale Output
All specifications apply for a diffusely reflecting matt white ceramic target
[1] series 1810: at 2.5 kHz without averaging, series 2210: at 10 kHz without averaging
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range

Custom Sensor Modifications

For applications where the above standard sensors do not meet your requirements, it may be possible to supply a sensor with modified specification. Please contact us for further information.

Options
- Non standard measuring range and stand off
- Custom housing or mounting geometry
- Measuring rate 2.5 / 5 / 10 / 20kHz
- Non standard signal interfaces
- Special cable length of electrical connector
- Vacuum suitability
- Reduced mass
- Increased shock and vibration resistance

Eight models with measuring ranges from 0.5mm to 200mm

Sensor head and separate controller

37kHz **Up to 37kHz true analogue frequency response**

*A*nalog *D*igital **Analogue (U/I) and digital outputs**

*F*ilter inside **Adjustable filter functions (firmware)**

Certified **Calibration certificate included**

The true analogue optoNCDT 1607 is ideal for high speed measurements such as vibration amplitude, impact and drop tests. The 37kHz frequency response is available for all the measurement ranges from 0.5mm to 200mm and is most suited for tasks where targets move quickly and can be of fixed colour.

MR	Angle	A	B
0.5	SMR 1.75 mm, measures are not relevant		
2	45°	13	5
4	45°	13	5
10	29°	12	5
20	23°	12	5
50	28°	22	8
100	18°	22	8
200	12°	22	8

optoNCDT 1607 (0.5mm)
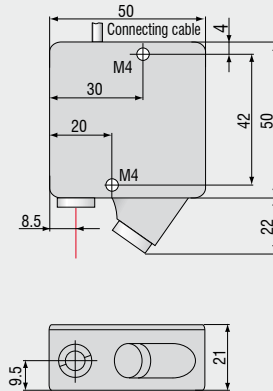
optoNCDT 1607 (2/4/10/20mm)
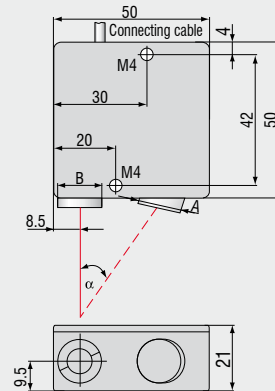
optoNCDT 1607 (50/100/200mm)
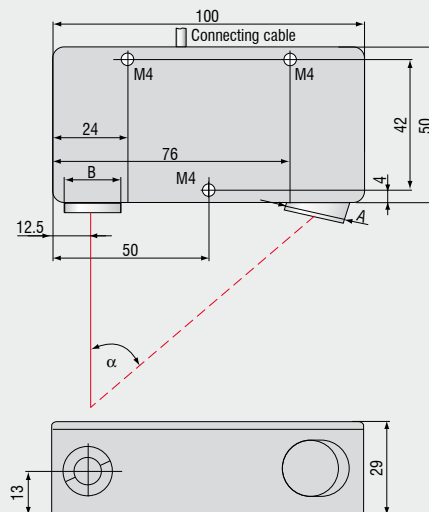
Controller
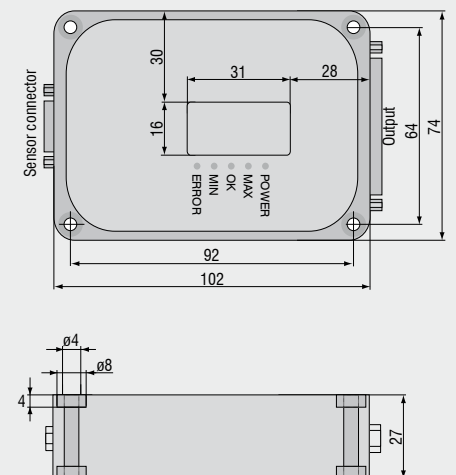
(Dimensions in mm, not to scale. CAD files are available online)

Model	LD 1607-0.5	LD 1607-2	LD 1607-4	LD 1607-10	LD 1607-20	LD 1607-50	LD 1607-100	LD 1607-200
Measuring range	0.5mm	2mm	4mm	10mm	20mm	50mm	100mm	200mm
Start of measuring range	23.75mm	23mm	22mm	40mm	55mm	95mm	170mm	240mm
Midrange	24mm	24mm	24mm	45mm	65mm	120mm	220mm	340mm
End of measuring range	24.25mm	25mm	26mm	50mm	75mm	145mm	270mm	440mm
Linearity	$1\mu m$	$4\mu m$	$8\mu m$	$20\mu m$	$40\mu m$	$100\mu m$	$200\mu m$	$400\mu m$
				$\leq$0.2% FSO				
Resolution (Noise) [1] static	$0.1\mu m$	$0.5\mu m$	$1\mu m$	$3\mu m$	$6\mu m$	$20\mu m$	$30\mu m$	$60\mu m$
Frequency response	10kHz, 7kHz, 4kHz, 1kHz, 250Hz, 100Hz, 25Hz or 15Hz (-3dB), selectable with DIP switches optional: Model LD1627: 37kHz (-3dB)							
Temperature stability	$\pm$0.03 % FSO/°C							
Light source	laser <1mW, wavelength: 670nm (red)							
Life cycle typ.	100,000h (laserdiode)							
Laser safety class	class 2 (DIN EN 60825-1:2001-11)							
Spot diameter MMR	0.1mm	0.3mm	0.3mm	0.6mm	0.9mm	1.5mm	1.5mm	4mm
Permissible ambient light	20,000lx							
Output	displacement: $\pm$10V / 4 - 20mA / RS232 intensity: 0 ... 10V							
Vibration	2g (IEC 68-2-6)							
Shock	15g (IEC 68-2-6)							
Operation temperature	0 ... +50°C							
Storage temperature / humidity	-20 ... +70°C / up to 90% RH							
Protection class	sensor: IP 64 / electronics: IP 40							
Supply	+ 24VDC / 200mA (10 ... 30VDC)							
Connector	25-pin Sub-D connector							
Weight Sensor	250g		240g			400g		
Weight Controller	275g							
Sensor cable length	2m							

FSO = Full Scale Output   All specifications apply for a diffusely reflecting matt white ceramic target
[1] Frequency response 15 Hz
SMR = Start of measuring range   MMR = Midrange   EMR = End of measuring range

| switching outputs (connector) 24 V logic	
MIN	+24V / 10mA
OK	+24V / 10mA
MAX	+24V / 10mA
Hysteresis	appr. 0.4% FSO

Output of errors (connector)	
Too little light	+24V / 10mA
Too much light	+24V / 10mA

LED - indicators		
POWER	GREEN	power on
MAX	RED	adjustable MAX value is exceeded
OK	GREEN	LED level indicator OK shows the position of the target within the set limits
MIN	YELLOW	adjustable value drops below the set MIN
ERROR	RED	too little light is reflected

Pin assignment controller		
Pin	Function	Cable Colors
1	Displacement output, $\pm$10V	green
2	Too little light, +24V	-
3	Laser OFF Input +15 - 30V	white
4	TXD (RS232)	-
5	OK in range, +24V	-
6	4 ... 20mA	-
7	RXD (RS232)	-
8	0 V supply	brown
9-13	n.c.	-
14	Analogue ground	blue screen
15	Too much light +24V	-
16	MAX, +24V	-
17	n.c.	-
18	RTS (RS232)	-
19	MIN, +24V	-
20	Light intensity 0 - 10V	red
21	+24V supply (10 - 36V)	green
22-25	n.c.	-

Accessories for all optoNCDT Series

Power supply

PS 2010 (for top-hat rail mounting;
L/W/H 120x120x40mm; Input 115 / 230VAC
selectable; output 24VDC / 2.5A)

Controller

CSP 2008 (controller for processing of
multiple sensor signals; analog and digital
interfaces)

Interface card

IF2008 (Interface card for individual signal
processing; analog and digital interfaces)

- -

Accessories optoNCDT 1300

Supply and output cable,
rated for moving cable tracks
(available in 90° version / robot rated)

PC 1401-3/I (3 m)

PC 1401-6/I (6 m)

PC 1401-3/U (3 m, with integral resistance,
output 1 ... 5VDC)

PC 1401-6/U (6 m, with integral resistance,
output 1 ... 5VDC)

Protective housing

SGH 1800

- -

Accessories optoNCDT 1402

Supply and output cable
(drag chain rated / robot rated)

PC 1402-3/I (3 m)

PC 1402-6/I (6 m)

PC 1402-3/U (3 m, with integral resistance,
output 1 ... 5VDC)

PC 1402-6/U (6 m, with integral resistance,
output 1 ... 5VDC)

PC 1402-3/I/RS422 (3 m, for analog and
digital output)

PC 1402-3/USB (3 m, with USB and power
supply)

Protective housing

SGH 1800

- -

Accessories optoNCDT 1607 / 1627

Supply and output cable

PC 1605-3 (3 m)

PC 1605-6 (6 m)

PC 1607-3/RS232 (3 m, with 9-pin
Sub-D connector for RS232)

Protective housing

SGF 1605-20 (for LD1607-2/4/10/20)

SGF 1605-200 (for LD1607-50/100/200)

SGL with connection for compressed air

Accessories
optoNCDT 1700/1700LL/1700DR

Supply and output cable
(drag chain rated / robot rated)

PC 1700-3 (3 m)

PC 1700-10 (10 m)

PC 1700-10/3/IF2008 (10 m, for use with
interface card IF2008)

PC 1700-3/T (3 m, for use with trigger box)

PC 1700-10/T
(10 m, for use with trigger box)

PC 1700-3/USB (3 m, with USB-RS422-
converter, power supply 90 ... 230 VAC)

Protective housing

SGH 1800
(for ILD 1700-2/10/20/50/100/200/250VT
and ILD 1700-2LL/10LL/20LL/50LL)

SGH 2200-200 (for ILD 1700-40/500/750)

SGxF 1800
(option with compressed air clean setup)

SGxF 2200-200
(option with compressed air clean setup)

External trigger

Triggerbox 1700 (Electronics for triggering
optoNCDT 1700 sensors. Acceptable
trigger levels from +2.4VDC to +24VDC,
L/W/H 98x64x34mm)

- -

Accessories
optoNCDT 2200(LL) / 2220(LL) /
1810-50 / 2210

Supply and output cable (drag chain rated)

PC 1800-3 (3 m)

PC 1800-8 (8 m)

PC2200-3/10/RS485 (3 m, RS 485 for use
with interface card IF2008)

PC 2200-3/3/RS422 (3 m, for IF2008/
RS422/USB-converter)

Sensor cable extension (drag chain rated)

CE 1800-3 (3 m)

CE 1800-8 (8 m)

Protective housing
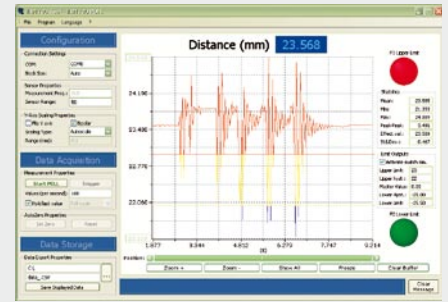(only for series 2200, 2200LL, 2220, 2220LL)

SGx 1800 (for ILD 2200-2/10/20/50/100,
ILD 2200-2LL/10LL/20LL/50LL,
ILD 2220-2/10/20/50/100,
ILD 2220-2LL/10LL/20LL/50LL)

SGH 2200-200
(for ILD 2200-40/200, ILD 2220-200)

SGxF 1800 (option with compressed air
clean setup)

SGxF 2200-200 (option with compressed
air clean setup)

Setup and configuration software

ILD Tools is the software included for easy
sensor configuration. All the settings can be
implemented conveniently via a Windows user
interface on the PC. The sensor parameters
are sent to the sensor via the serial port and
can also be saved if required. ILD Tools also
includes a module which can display and
save measurement results. The link to the PC
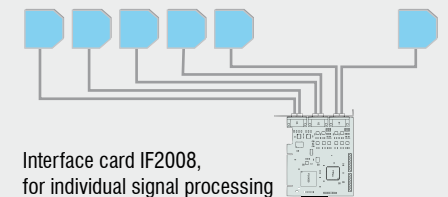is made via the sensor cable with a USB con-
verter.

[available for all series except 1300 and 1607]

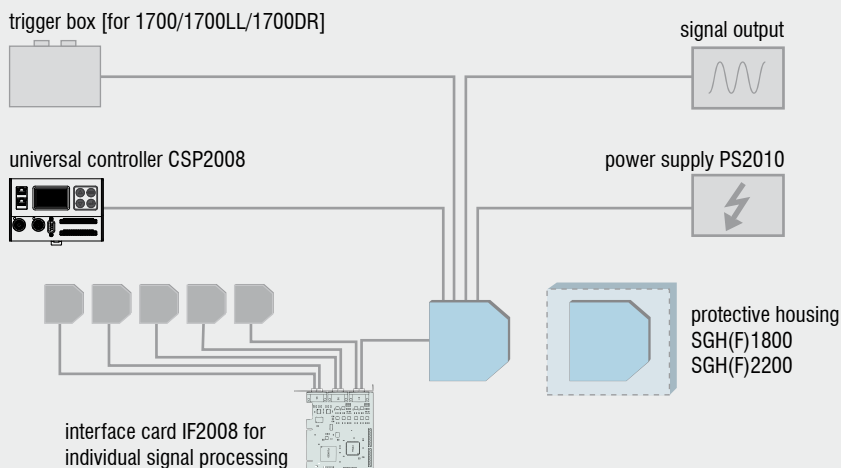**Driver support for customer software**

For the optoNCDT sensors documented DLL
drivers are available free of charge, which ena-
bles easy integration of the sensors into exis-
ting software.

**Software download free of charge from
www.micro-epsilon.com/download**

- -

IF 2008 Interface card

The Interface card IF 2008 enables a synchro-
nous data acquisition of up to six digital signals
and two encoder. The data is stored in a FIFO
memory to generate a ressource-conserving
processing in blocks. The IF2008E board offers
two sensor inputs, two AD-Converter inputs,
four opto-coupler inputs and four opto-coupler
outputs. The boards IF2008 and IF2008E can
operate independently of each other or coup-
led. In sum, eight sensors and two encoders
can be connected with the boards.

Interface card IF2008,
for individual signal processing

trigger box [for 1700/1700LL/1700DR]

signal output

universal controller CSP2008

power supply PS2010

protective housing
SGH(F)1800
SGH(F)2200

interface card IF2008 for
individual signal processing

CSP 2008: Universal controller for multiple sensor signals

Inputs/Outputs sensors
  2 sensor connectors (16 pin)
Digital
  1x ethernet (PC 100 MBit)
  1x ethercat
  1x RS422 (PLC max. 1,5 Mbaud)
  2 terminal strips (13 pins)
Analog
  voltage 0…5 V, scaleable via software
  0…10 V, -5…5 V, -10…10 V),
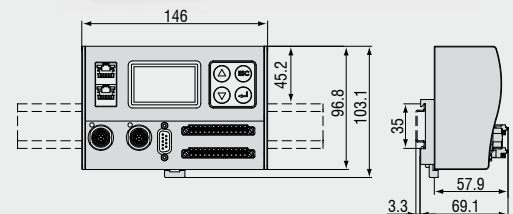 electrically isolated, 100 kHz, 16 Bit

Functions
  filter: moving average 1…1024 /
  recursive 1...32768 / median 3/5/7/9
  zero, master
  trigger (measuring value, edge, gate,
  software)
  automatic sensor detection
  (digital interface)
  scaleable measuring ranges
  synchronisation
Limits
  OG, UG, OW, UW, OK
Calculation
  A,B; A+B; A-B; -A-B; K-A-B; K+A+B;
  K+A-B; K+A; K+B; K(A+B); K(A+k*B)

146

45.2

96.8

103.1

35

57.9

3.3 69.1

Universal controller with DIN rail TS 35
(dimensions not to scale)

Protective housing for harsh environment

To protect the laser sensors in extreme environments individual pro-
tective housings are available for all sensor models. Three options
for the protective housing are offered.

Option SGH:

Completely enclosed housing with an integrated front window, whe-
re the sensor measures through the window. The water resistant housing (IP68) provides protection
against aggressive solvents and detergents.

Option SGHF:

The SGHF version offers optimum protection for the sensor with integrated compressed air cooling
and provides protection against fluids.

Option SGL:

Protective housing with open slot for air purging of the measurement gap and cooling purpose.

Dimensions
SGx 16x7/20: 74x80x58mm for
ILD 16x7-2/4/10/20

SGx 16x7/200: 125x80x58mm for
ILD16x7-50/100/200

SGx 1800: 140x140x71 mm for
ILD 1300 and ILD 1402
ILD 1700-2/10/20/50/100/200/250VT,
ILD 1700-2LL/10LL/20LL/50LL,
ILD 2200-2/10/20/50/100,
ILD 2200-2LL/10LL/20LL/50LL,
ILD 2220-2/10/20/50/100,
ILD 2220-2LL/10LL/20LL/50LL

SGx 2200: 140x180x71 mm for
ILD 1700-40/500/750,
ILD 2200-40/200,
ILD 2220-200

High performance sensors made by Micro-Epsilon

Sensors and systems for displacement, position and dimension
Eddy current sensors
Optical and laser sensors
Capacitive sensors
Inductive sensors
Draw-wire sensors
Optical micrometers
2D/3D profile sensors
Image processing

Sensors and measurement devices for non-contact temperature sensors
Online instruments
Handheld devices

Measuring systems for quality control
for plastic and film
for tire and rubber
for web material
for automotive components
for glass