MICRO-EPSILON

More Precision

Measurement Product Guide // 2016

Displacement
Distance
Position

Dimension
IR Temperature
Colour

More precision.
Sensors, measurement devices and systems

As a technological leader in its industry, Micro-Epsilon is constantly meeting the challenges of developing high precision sensors, measurement equipment and systems for its customers. This challenge represents the continued drive for high performance in the field of measurement technology.

Behind Micro-Epsilon is a powerful group of companies that provide strategies that focus on different sensor technologies, facilitating the group's leadership in this field. Along with a concentration of expertise in sensors for geometrical and dimensional measurement, our latest technology focuses on colour sensors and non-contact temperature measurement instruments. In combination, the different members of the Micro-Epsilon group interact with one another to meet every challenge and meet every customer requirement.

As well as physical resources, the accumulated knowledge within the company is regarded as the core capability that provides a technological lead and consolidates this for the future. It is only through consistent knowledge management that such sustainable high performance can be achieved and incorporated into all product groups.

From large global corporations through medium-sized companies to engineering service providers, sensors and solutions from Micro-Epsilon are regarded throughout the world as symbolic with reliable measurement results of the highest precision.

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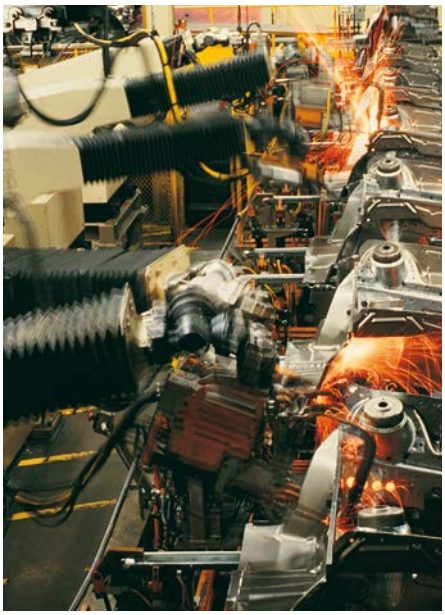
Application fields

The fields of application and demand for precision sensors and measuring equipment are ever increasing. Whether it is for quality assurance, for applications in maintenance and service, for process and machine monitoring, in automation or in research and development, sensors make a vital contribution to the improvement of products and processes.

From machine building, automated production lines in the food and beverage industry, to integrated OEM solutions for automotive and aerospace customers, almost all these fields benefit from the use of Micro-Epsilon sensors. A long list of satisfied customers, including BMW, Schenk, Jaguar Cars, NASA, 3L, Exxon, Siemens, Borg Warner, NIST, MIT, Frito Lay, MRSI, Braun, Newport, Boeing, Amat, GSK, LLNL, L3, Ford and many more, proves the success of these high performance quality products.



Automation

Quality control

Process monitoring

Process control

OEM-Integration

Finished products

Vehicles

Machines, tools

Sensors and systems for displacement, position, colour and temperature

Research and development

Product and process optimisation

Experimentation and testrigs

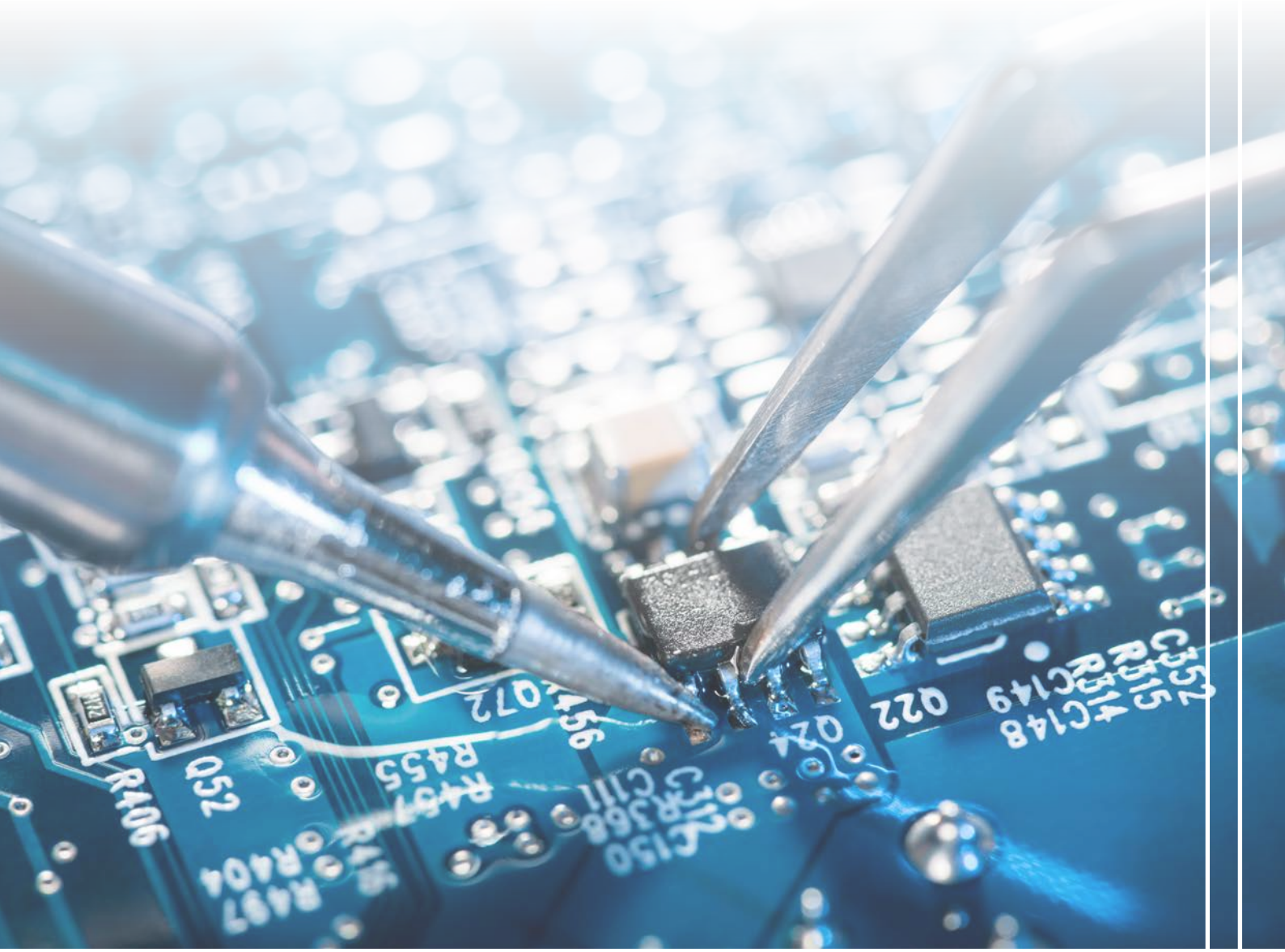
Fundamental research in industry

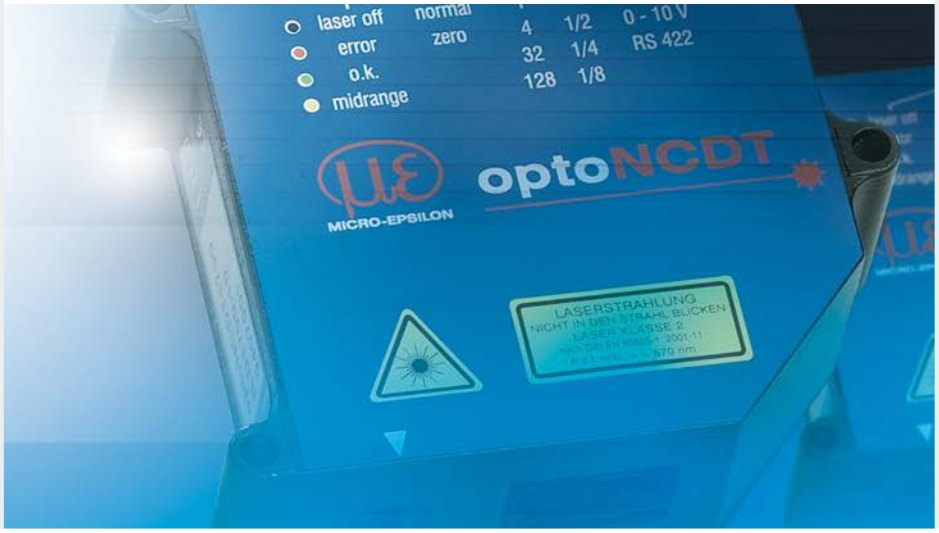
Machines and plants

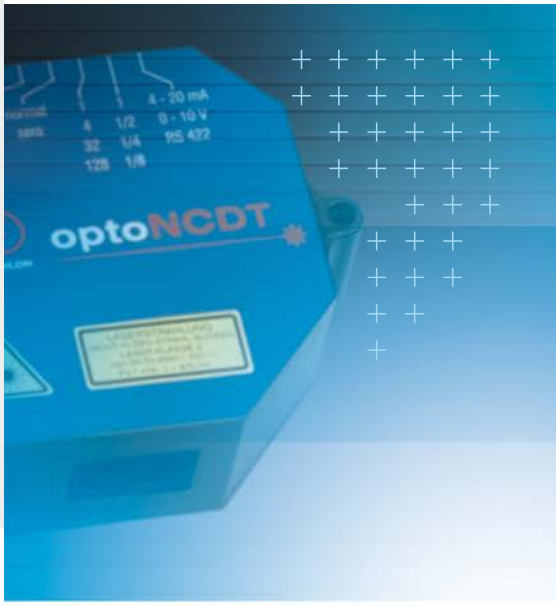
Machine control

Process control

Predictive maintenance







Laser triangulation:
Non-contact displacement and position sensors

The non-contact displacement optoNCDT product group utilises optical triangulation as a measuring principle. A laser diode projects a visible spot of light onto the target surface (laser class 2). The light reflected from this spot is directed through an optical receiving system onto a position-sensitive element. Optical displacement sensors measure with a large reference distance and a very small measuring spot diameter. Nearly all models work with a high-resolution CCD or CMOS line and a DSP.

Advantages

- Small targets through a tiny spot size
- Long measuring ranges
- Large stand off
- Extreme resolution
- Excellent linearity
- High measuring rates
- Synchronisation of two sensors
- Measurement of shiny metallic and rough surfaces

Largest range in the world
Starting with a low cost entry model through to high precision top end sensors – optoNCDT sensors are mostly used in process automation and quality assurance applications.

Universal controller
Processing up to six sensor signals. A versatile controller for a wide range of applications that has extensive clearing functions and high speed bus systems.

Sensor with small laser-line compensates for varying reflections
The LL series is ideal for metallic shiny or rough surfaces. With a small laser line, this sensor compensates for varying reflections.

optoNCDT 1302
Compact low cost CMOS sensors
with analogue & digital output

Measuring ranges (mm)	20 I 50 I 100 I 200
Linearity	±0.2 % FSO
Resolution	0.02 % FSO
Measuring rate	750Hz

optoNCDT 1402
Compact industrial sensors
with analogue & digital output

Measuring ranges (mm)	5 I 10 I 20 I 50 I 100 I 200 I 250 I 400 I 600
Linearity	±0.18% FSO
Resolution	0.01% FSO
Measuring rate	1.5kHz
IP69K option with stainless steel housing (food grade standard)	

optoNCDT 1320/1420
Compact sensors for fast
and precise measurements

Measuring ranges (mm)	10 I 25 I 50
Linearity	0.12% FSO
Resolution	0.005% FSO
Measuring rate	4kHz

optoNCDT 1610/1630
High speed PSD sensors

Measuring ranges (mm)	4 I 10 I 20 I 50 I 100
Linearity	±0.2% FSO
Resolution	0.005% FSO
Frequency response	up to 100kHz (-3 dB)

optoNCDT 1700
Intelligent sensor with integrated controller
for industrial applications

Measuring ranges (mm)	2 I 10 I 20 I 40 I 50 I 100 I 200 I 250 I 500 I 750
Linearity	±0.08% FSO
Resolution	0.005% FSO
Measuring rate	2.5kHz

optoNCDT 1700BL/2300BL
Blue laser for improved performance
on shiny or red-hot metals

Measuring ranges (mm)	2 I 5 I 20 I 50 I 200 I 500 I 750 I 1000
Linearity	±0.03% FSO
Resolution	0.0015% FSO
Measuring rate	49kHz

optoNCDT 2300
49kHz laser displacement sensors
for extreme dynamic measurements

Measuring ranges (mm)	2 I 5 I 10 I 20 I 50 I 100 I 200
Linearity	±0.02% FSO
Resolution	0.0015% FSO
Measuring rate	49kHz
No external controller required	

optoNCDT 1700LL / 2300LL
Highly dynamic laser sensors
for shiny metal surfaces

Measuring ranges (mm)	2 I 10 I 20 I 50
Linearity	±0.02% FSO
Resolution	0.0015% FSO
Measuring rate	49kHz
No external controller required	

optoNCDT 1710 / 2310
Short measuring ranges at long
standoff distances

Measuring ranges (mm)	10 I 20 I 40 I 50 I 1000
Linearity	±0.03% FSO
Resolution	0.005% FSO
Measuring rate	49kHz
No external controller required	

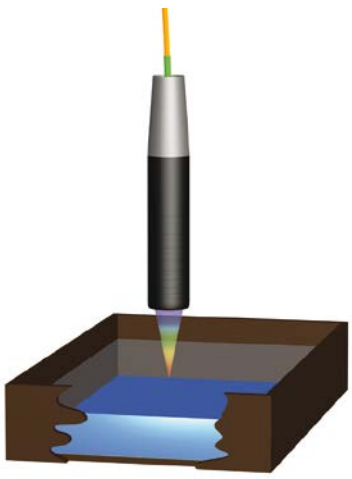
Confocal-chromatic principle:
Non-contact displacement sensors

The confocal chromatic confocalDT measurement system consists of a controller with an LED light source and a sensor. Both the sensor and the controller are connected via optical fibre up to a distance of 50m. The distance of the focal point varies due to the chromatic aber- ration of the sensor optics. A certain distance is assigned to each wavelength in the controller. The reflected light from the target surface is passed to the receiver optics, where the spectral intensity dispersion is evaluated. This unique measuring principle enables displacements and distances to be measured with the highest precision. Both diffuse and specular surfaces can be measured. With transparent materials, a one-sided thickness measurement, or gaps between multiple transparent layers, can be calculated along with the distance measurement using just one sensor.

Advantages

- Extreme high resolution
- Target independent measurement
- Tiny, constant measuring spot
- Compact course of beam
- One-sided thickness measurement of transparent materials

Thickness measurement of sleeves
Two synchronised sensors acquire the bottom thickness of sleeves in a double-sided layout.



Liquid level
The confocal measuring principle facilitates measurements against reflecting surfaces (glass, mirror), as well as liquids.

Surface scanning
The extreme spatial resolution in the x-axis and the submicron accuracy in the z-axis make it a perfect sensor for surface scanning.

confocalDT 2451/2471
Controller with integrated light source for confocal chromatic displacement sensors

Linearity	±0.025% FSO
Resolution	1nm
Measuring rate	10kHz /optional 70kHz with external light source

confocalDT 2461
Controller with integrated light source for measuring rates up to 25kHz

Linearity	±0.025% FSO
Resolution	1nm
Measuring rate	25kHz

IFS 2402
Miniature sensors (gradient index lens) for the inspection in tightest spaces

Measuring ranges (mm) 0.4 | 1.5 | 2.5 | 3.5 | 6.5
Sensors with axial and radial (90° deflection) optical path available

IFS 2403
Confocal hybrid sensors with narrow gradient index lens and relay optics

Measuring ranges (mm) 0.4 | 1.5 | 4 | 10
Enlarged base distances

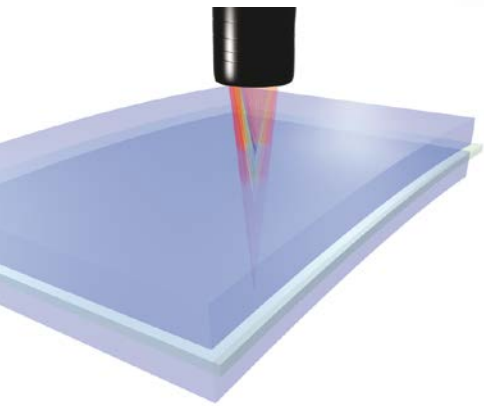
IFS 2405
Standard sensors for high precision distance and thickness measurements

Measuring ranges (mm) 0.3 | 1 | 3 | 10 | 28 | 30
Large base distance and tilt angle

IFS 2406
Compact confocal sensors for precise displacement and thickness measurement

Measuring ranges (mm) 2.5 | 10
Version with axial and radial optical path

One-sided thickness measurement transparent materials
The unique measuring principle enables a single-side thickness measurement on transparent materials even multi-layer materials. Here, just one sensor measures the thickness with nanometer accuracy



boreCONTROL
Non-contact and wear-free bore hole inspection

- High speed sampling rate up to 25kHz
- Use in small bore holes from 4mm
- Precise diameter detection
- Optical temperature compensation
- Measured diameters: 4mm - 10mm, 8mm - 12.8mm and 10mm - 16mm

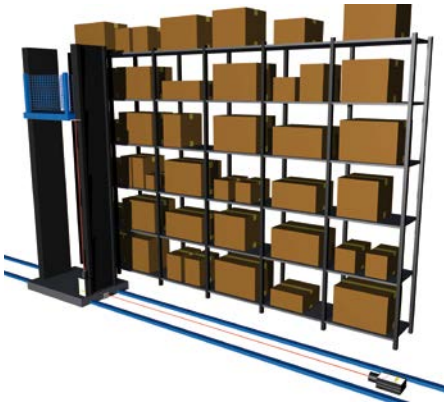
Time-of-flight principle:
Non-contact gauging and distance sensors

Optoelectronic sensors in the optoNCDT ILR series operate according to the time-of-flight principle and are designed for non-contact distance and displacement measurements. The 118x series functions according to the phase comparison principle. In doing so, modulated laser light is permanently transmitted to the object. The receiver compares the phase offset of the transmitted signal with the received signal, enabling the distance to be precisely calculated.

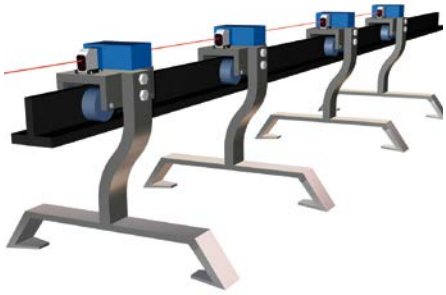
All remaining models in the optoNCDT ILR series operate according to the time-of-flight principle. Here, a laser pulse is transmitted and the time it takes for the reflected pulse to arrive back at the sensor is precisely measured. The distance can be measured based on the speed of light and the measured time period. Depending on the application and the required measuring range, the sensors operate on diffuse reflecting surfaces or on a special reflector plate.

Advantages

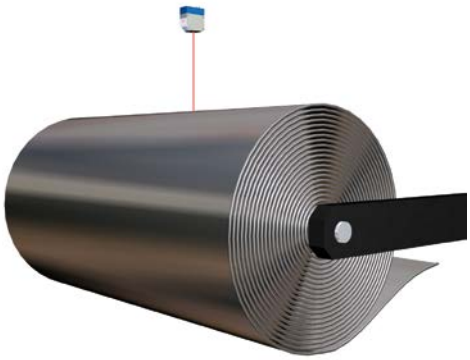
- Extreme long measuring ranges
- Outstanding repeatability
- Fast response time
- Excellent price/performance ratio
- Various interfaces



Position acquisition storage and retrieval units
Fast response time in combination with high measurement accuracy facilitate the exact positioning of storage and retrieval units.



Distance measurement on monorail conveyors
To control the flow of production and to prevent damage to the parts, the spacing between the conveyors is monitored.



Acquisition of coil diameters
The quantities of steel, paper and fabric wound on and off are monitored via the acquisition of coil diameters using laser probes.

optoNCDT ILR 1030/1031
Distance sensors

Measuring ranges (mm)	no reflector 0.2 - 15m
	with reflector 0.2 - 50m
Linearity	±20mm
Repeatability	<5mm
Response time	10ms

optoNCDT ILR 102x/110x/115x
Gauging sensors / Distance sensors

Measuring ranges (mm)	no reflector 0.2 - 10m
	with reflector 0.2 - 250m
Linearity	±3mm
Repeatability	±2mm
Response time	12ms

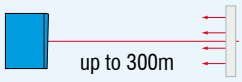
optoNCDT ILR 1181/1182/1183
Distance sensors

Measuring ranges (mm)	0.1 - 150m
Linearity	±2mm
Repeatability	<0.5mm
Response time	20ms

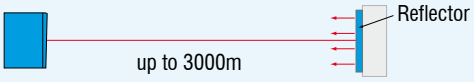
optoNCDT ILR 1191
Distance sensors

Measuring ranges (mm)	0.5 - 3000m
Linearity	±20mm
Repeatability	<20mm
Response time	0.5ms

Measurements against target (without reflector)

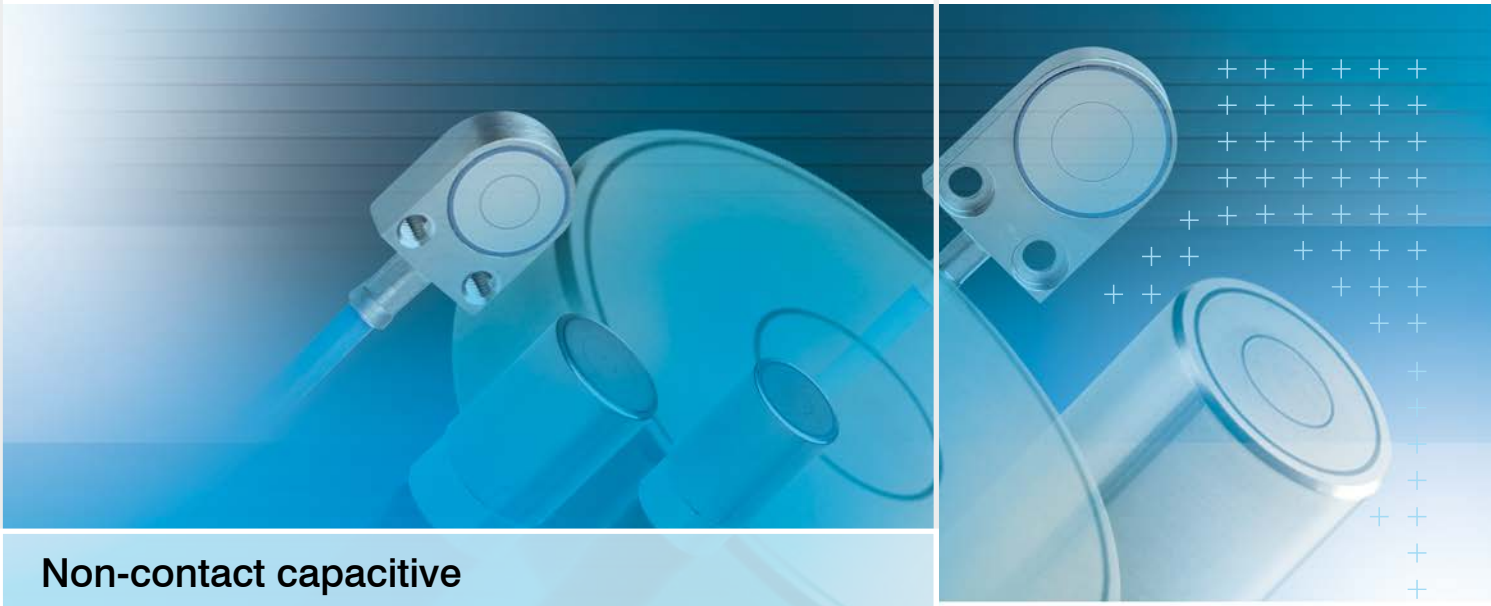


Measurements against a reflector, which is installed on the target



	ILR	1020	1030	1100	1150	1021	1031	1101	1151	1181	1182	1183	1191
Measuring range in gauging mode (without reflector)	6m	•		•									
	8m		•										
	10m				•								
	15m		•										
	50m									•	•	•	
	300m												•
Measuring range in reflector mode	30m					•							
	50m						•	•					
	150m									•	•	•	
	250m								•				
	3000m												•

Time-of-Flight sensors are particularly useful in filling level measurement, for safety applications, height measurement of lifting systems, overhead conveyors, crane systems and for positioning lifts. The optoNCDT ILR 1191 is specially designed for outdoor use and in port systems.



Non-contact capacitive
displacement and position sensors

Due to the unique active tri-electrode guard-ring-capacitor principle, capacitive displacement sensors are linear for all metals. The sensor acts as an electrode; the opposite electrode is the target.

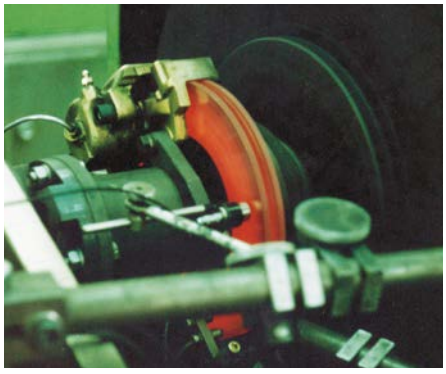
The measurement technique enables measurements against all conducting and semiconducting objects. Micro-Epsilon has extended the capacitive measuring principle with some innovative functions, which enable highly linear output characteristics, nanometer precise resolution and very stable measurements to be obtained. The linear characteristic of the measurement signal is obtained for measurements with respect to target objects of electrically-conducting materials without any additional electronic linearisation.

The sensors, which measure without making contact with the target, are ideal for industrial applications in production systems and in-process quality assurance, but are also used for test rig applications.

Advantages

- Superior precision and resolution
- Excellent temperature stability
- Outstanding long-term stability
- Material-independent for metallic targets
- For any conductive / semiconductive target

Capacitive displacement sensors are used for wafer thickness measurement with two capacitive sensors.



Even under extreme conditions on a test rig, capacitive sensors supply the highest precision here, the wear on a brake disc is being measured.

Capacitive displacement sensors measure with the highest precision the alignment of the lens system used for semiconductor wafer lithography.

capaNCDT 6110
Compact single-channel system

Measuring ranges (mm)	0.05 | 0.2 | 0.5 | 0.8 | 1 | 2 | 3 | 5 | 10
Linearity	±0.05% FSO
Resolution	0.01% FSO
Bandwidth	1kHz (-3dB)

capaNCDT 6200
Modular multi-channel system

Measuring ranges (mm)	0.05 | 0.2 | 0.5 | 0.8 | 1 | 2 | 3 | 5 | 10
Linearity	±0.025% FSO
Resolution	0.0005% FSO
Bandwidth	up to 20kHz (-3dB)

capaNCDT 6500
Modular multi-channel system

Measuring ranges (mm)	0.05 | 0.2 | 0.5 | 0.8 | 1 | 2 | 3 | 5 | 10
Linearity	±0.025% FSO
Resolution	0.000075% FSO
Bandwidth	8.5kHz (-3dB)

Web interface
Configuration of capaNCDT 6200 and 6500 is carried out using a web browser interface

Large selection of capacitive sensors
Capacitive displacement sensors from Micro-Epsilon are available in different designs and versions. The sensors are differentiated by their measuring range, their design and by the technology used to manufacture them. The capacitive sensors are available in a cylind- rical design (with integrated cable or socket) or as flat sensors (with integrated cable). The displacement sensors can be exchanged without recalibration; the sensor replacement can be completed rapidly. The majority of sensors can be used in clean rooms; use in ultra-high vacuums is also possible.

Specific sensors for OEM applications
Micro Epsilon tailors sensors to your individual needs:

- Adjusting the body shape and size for mounting
- Modify the sensor material
- Cable arrangements
- Miniaturizing
- Cryogenic or high temperature environment
- Integrated electronic and sensor for OEM design

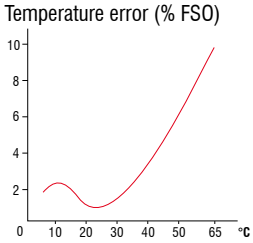
Eddy current principle:
Non-contact displacement and position sensors

Eddy current displacement sensors measure distances, displacements or positions of any electrically conductive target. The principle enables non-contact and wear free measurements. The measurement objects can have either ferromagnetic or non-ferromagnetic properties. Due to its immunity to oil, dirt, dust, moisture, interference fields, etc. the eddy current principle is ideally suited to applications in harsh industrial environments.
Micro-Epsilon's eddy current sensors are the only ones with active temperature compensation and field calibration capabilities.

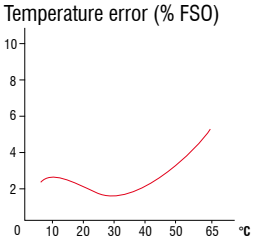
Advantages

- Non-contact and wear free
- Highest resolution and linearity
- Very stable measurements
- High measuring rates
- Excellent temperature range and temperature stability
- For industrial applications

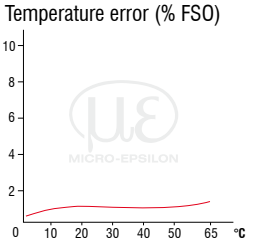
Temperature error by comparison



Common inductive sensor with ferrite core

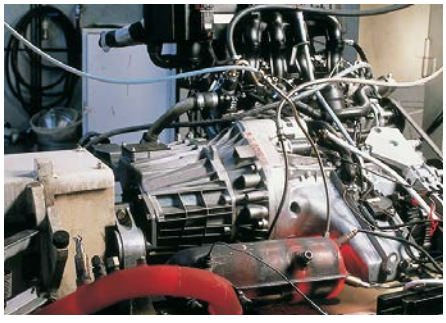


Common eddy current sensor without temperature compensation



Best practice: eddyNCDT 3100 with temperature compensation

OEM integration in textile machines
Eddy current sensors measure the thickness variation of thread in textile machines.



Application in test rigs
In the automotive industry these systems measure internal dimensional changes inside a running engine.

Inline quality control
Eddy current sensors measure the flatness in rolling mills.

eddyNCDT 3001
Compact eddy current sensor
with integrated electronics

Measuring ranges (mm)	2 | 4
Linearity	±0.7% FSO
Resolution	0.1% FSO
Frequency response	5kHz

eddyNCDT 3005
Compact eddy current sensor system
Ideal for integration into plant and machinery

Measuring ranges (mm)	1 | 2 | 3 | 6
Linearity	± 0.25% FSO
Resolution	0.05% FSO
Frequency response	5kHz (-3dB)

eddyNCDT 3010
Low cost single channel system
for industrial applications

Measuring ranges (mm)	0,5 | 1 | 2 | 3 | 6 | 15
Linearity	±0.25% FSO
Resolution	0.005 % FSO
Frequency response	25kHz (-3dB)

eddyNCDT 3100
Smart eddy current displacement sensor
system for industrial applications

Measuring ranges (mm)	0.5 | 0.8 | 1 | 2 | 3 | 6 | 15
Linearity	±0.25% FSO
Resolution	0.005% FSO
Frequency response	25kHz (-3dB)
Configuration via web browser (Ethernet)	

eddyNCDT 3300
Intelligent eddy current system (single-channel)
for very precise measurements

Measuring ranges (mm)	0.4 | 0.8 | 1 | 2 | 3 | 4 | 6 | 8 | 15 | 22 | 40 | 80
Linearity	±0.2% FSO
Resolution	0.005% FSO
Frequency response	100kHz (-3 dB)
Standard and miniature sensors available	

Worldwide the largest selection of sensors

The technological leadership in eddy current sensors, which spans many years, is reflected in the sensor range - more than 400 sensors are available in different versions for the most varied applications.

Revolutionary eddy current sensors

Our eddyNCDT ECT sensors feature innovative Embedded Coil Technology (ECT). This innovative sensor design helps to achieve outstanding precision, signal stability and robustness. This means that ECT sensors are ideally suited to even the harshest application conditions, such as high vibration environments, high temperatures, electromagnetic fields or vacuums.

Suitable for extreme temperatures

The sensors can be used from -50°C to +350°C. The wide temperature range and the insensitivity to soiling or dust gives an enormous range of applications in industrial environments.Whereas currently available eddy current sensors exhibit extreme drift with variations in the ambient temperature, an active temperature compensation with the eddyNCDT sensors ensures the highest signal stability. Consequently, measurements can be carried out over large temperature ranges with extreme signal stability.

Subminiature sensors for confined installation space

Apart from standard sensors in popular styles, miniature sensors can also be supplied which achieve high precision measurement results with the smallest possible dimensions. Pressure-resistant versions, screened housings, ceramic types and other special features characterize these sensors, which achieve highly accurate measurement results despite the small dimensions. The miniature sensors are employed in high pressure applications, e.g. in internal combustion engines.

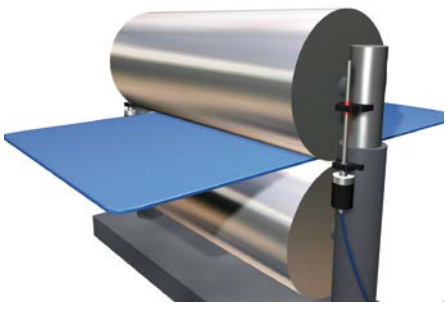
Smallest sensors worldwide

Linear inductive
displacement and position sensors

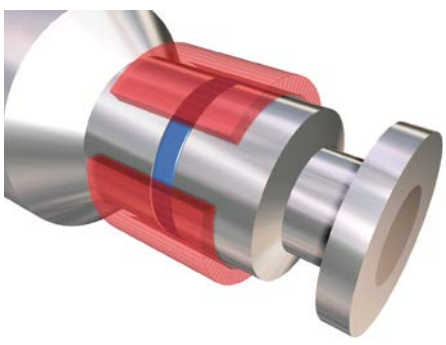
Electromagnetic displacement sensors are used extensively in applications for automated processes, quality assurance, test rigs, hydraulics, pneumatic cylinders, and automotive engineering. The advantages of these displacement sensors are well known and highly valued, and include ruggedness, reliability under harsh conditions, high signal quality and good temperature stability. The electromagnetic sensors of the induSENSOR series are based on the well-proven inductive and eddy current principle. They are used successfully both in single and high volume OEM applications.

Advantages

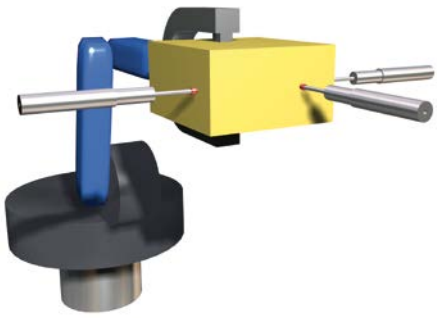
- More than 250 different models with measuring ranges from 1 to 630mm
- Controller integrated or separate
- High accuracy classes
- Extreme stability and robustness
- Different constructions with plunger, tube or measuring ring
- High temperature stability



In automated production plants, inductive sensors monitor the production tolerance of the products while the process is running.



To monitor the clamping position of tools, a VIP series sensor is integrated into the chuck and directly measures the clamping stroke of the drawbar.



Inductive gauging sensors measure the geometry of workpieces in quality assurance and production.

induSENSOR Serie VIP
Displacement sensors with integral electronics

Measuring ranges (mm)	50 | 100 | 150
Linearity	±0.25% FSO
Resolution	0.03 % FSO
Frequency response	300Hz (-3dB)
Target	measuring ring

induSENSOR Serie LVP - DC
Displacement sensors with integral electronics

Measuring ranges (mm)	50 | 100 | 200
Linearity	±0.25% FSO
Resolution	0.03% FSO
Frequency response	300Hz (-3dB)
Target	plunger

induSENSOR Serie EDS
Displacement sensors with integral electronics

Measuring ranges (mm)	75 | 100 | 160 | 200 | 250 | 300 | 370 | 400 | 500 | 630
Linearity	±0.3% FSO
Resolution	0.05% FSO
Frequency response	150Hz (-3dB)
Target	tube
Pressure resistance	450bar

induSENSOR Serie LVDT
Gauging sensor with external electronics

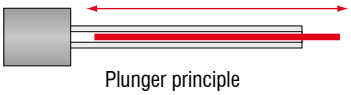
Measuring ranges (mm)	± 1 | 3 | 5 | 10
Linearity	±0.3% FSO
Frequency response	300Hz (-3dB)
Target	plunger with return spring

induSENSOR Serie LVDT
Gauging sensor with external electronics

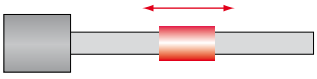
Measuring ranges (mm)	± 1 | 3 | 5 | 10 | 15 | 25
Linearity	±0.15% FSO
Frequency response	300Hz (-3dB)
Target	plunger

induSENSOR Serie LDR
Linear displacement sensors with external electronics of high temperature (up to 160°C)

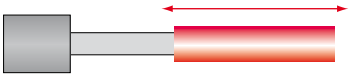
Measuring ranges (mm)	10 | 25 | 50
Linearity	±0.30% FSO
Frequency response	300Hz (-3dB)
Target	plunger



Plunger principle



Measuring ring principle



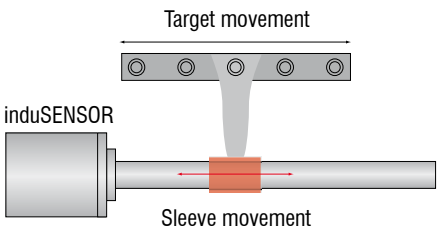
Tube principle

Extended functionality

The induSENSOR product group offers extended functionality and properties as a substantial advantage compared to conventional inductive probes and sensors. The versions in the series differ from one another in construction, accuracy class and therefore also in their fields of application. The sensors are designed with integral or external electronics and use a plunger, measuring sleeve and measuring tube as the target. As a result, new fields of application are opening up due to the versatile methods of installation. This is particularly noticeable with the VIP Series: the difference from conventional LVDT sensors is that with the VIP Series, the measurement object is mounted parallel to the sensor. Parallel mounting is primarily suitable for confined installation spaces.

Through the short measuring sleeve concept, the sensors can be integrated to form a mechanical unit with dampers, valves, automatic screw driving units, clutches or pedals.

Compactness due to parallel mounting



Magneto-inductive
displacement Sensors

Magneto-inductive sensors measure distances, positions or displacements of a defined magnetic target. The measuring range is 45mm as standard, but can be adjusted from 20mm to 55mm by changing the magnet. This physical measuring principle means the output signal is linear (2 - 10V and 4 - 20mA) and is independent of the measuring range.

Due to this physical effect, measurements can be taken without any interference from non-ferrous materials between the sensor and the target such as aluminium, plastic or ceramics. This is very useful when measuring in a closed system. A flush mounting option in non-ferrous material is also possible.

The flexible design offers many options in terms offers of sensor design. The sensor is available as a simple PCB, in a plastic housing or in housings made from stainless steel, which is resistant to most chemicals, oil or dirt.

Advantages

- Large measuring range
- Analogue, digital, PWM outputs
- High measuring rate
- High resolution
- Compact sensor design
- High volume OEM custom solutions

OEM integration in damper of washing machines
Magnet integrated in the damper and sensor mounted externally

Uhlmann Pac-Systeme GmbH & Co. KG

Foreign body detection in medical technology
MDS sensor recognises foreign bodies in blister machines during the tablet packaging process.

SIG Combibloc Group AG

Valve lift measurement in the food industry
The sealed stainless steel housings of the MDS-45-Mxx series are ideal for the food industry.

MDS-45-M18-SA

Measuring ranges (mm)	20 - 55mm
Output	2 - 10V
Linearity	±3% FSO
Resolution	0.05% FSO
Pressure resistance	up to 400bar (front)
Frequency response	1kHz (-3dB)

MDS-45-M12-CA

Measuring ranges (mm)	20 - 55mm
Output	2 - 10V
Linearity	±3% FSO
Resolution	0.05% FSO
Axial cable exit	
Frequency response	1kHz (-3dB)

MDS-45-M30-SA

Measuring ranges (mm)	20 - 55mm
Output	2 - 10V / 4 - 20mA
Linearity	±3% FSO
Resolution	0.05% FSO
Pressure resistance	50bar (front)
Frequency response	1kHz (-3dB)

MDS-45-K-SA

Measuring ranges (mm)	20 - 55mm
Output	2 - 10V / 4 - 20mA
Linearity	±3% FSO
Resolution	0.05% FSO
Frequency response	1kHz (-3dB)

MDS-40-MK

Measuring ranges (mm)	approx.40, depending on the magnet
Output	different kinds
Linearity	±3% - 5% FSO
Resolution	0.05% FSO
Quantity	preferred types 1/10pcs Freely configurable from 200pcs

MDS-40-LP

Measuring ranges (mm)	approx.40, depending on the magnet
Output	PWM
Linearity	±6% FSO
Resolution	0.05% FSO
Quantity	> 2000/ 5000 pcs/year

Accessories

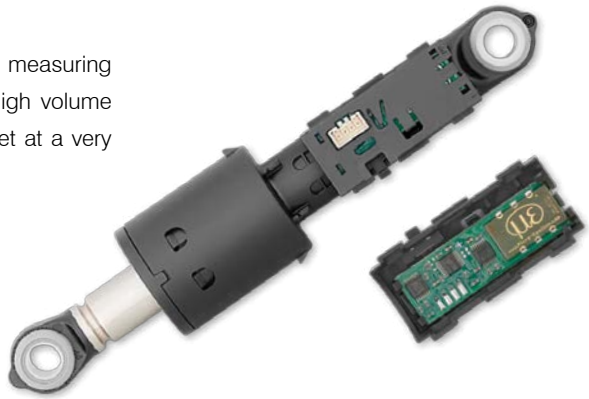
Measuring ranges of magnets: 20mm, 27mm, 35mm, 45mm, 55mm

Standard cables with M8x1 connector in different types

Flexible sensor design for OEM applications

Due to the flexible sensor design and the significant advantages of this physical measuring principle, various possibilities are available for adjusting the sensor to specific high volume applications. In OEM projects, the requirements of certain applications can be met at a very competitive price level.

- Higher dynamics
- Different housing shapes and materials
- Various output signals
- Special features such as pressure resistance, integrated cables, etc.



Draw-wire sensors
for displacement, position and length

Draw-wire displacement and position sensors are essentially electronic tape measures and measure the linear movement of a component using a wire made of highly flexible stainless steel strands, which is wound onto a drum by means of a long-life spring motor. The measuring drum is axially coupled with a multi-turn potentiometer, an incremental encoder, or an absolute encoder. With the draw-wire principle, a linear movement is transformed into a rotary movement and then converted into a resistance change or into countable increments.

Advantages

- Very accurate
- Long measuring ranges
- Robust and compact
- Easy installation and handling
- Compact design
- Excellent price/performance ratio

Draw-wire displacement sensors measure the lifting height on forklift trucks. With its compact construction, users can acquire lifting heights of up to 30m.

Miniature draw-wire sensors monitor the satellite release process from the Ariane booster rocket.

Draw-wire sensors monitor the height of lifting platforms on automobile production lines.

wireSENSOR
MK30 / MK46 / MK77 / MK88 / MK120
OEM miniature sensors

Measuring ranges (mm)	50 | 150 | 250 | 500 | 750 | 1000 | 1250 | 2100 | 2300 | 3000 | 3500 | 5000 | 7500
Analogue output	potentiometer, voltage, current
Digital output	encoder

wireSENSOR MPM
Subminiature sensors

Measuring ranges (mm)	50 | 150 | 250
Analogue output	potentiometer
Option with wire acceleration up to 100g	

wireSENSOR MP/MPW
Miniature sensors

Measuring ranges (mm)	100 | 300 | 500 | 1000
Analogue output	potentiometer
Option with protection class IP67	

wireSENSOR P60/P96
Industrial sensors

Measuring ranges (mm)	100 | 150 | 300 | 500 | 750 | 1000 | 1500 | 2000 | 2500 | 3000
Analogue output	potentiometer, voltage, current
Digital outputs	HTL, TTL, SSI, PB, CO

wireSENSOR P115
Industrial sensors

Measuring ranges (mm)	3000 | 4000 | 5000 | 7500 | 10,000 | 15,000
Analogue output	potentiometer, voltage, current
Digital outputs	HTL, TTL, SSI, PB, CO

wireSENSOR P200
ong-range sensors

Measuring ranges (mm)	30,000 | 40,000 | 50,000
Digital outputs	HTL, TTL, SSI, PB, CO

wireSENSOR mechanics

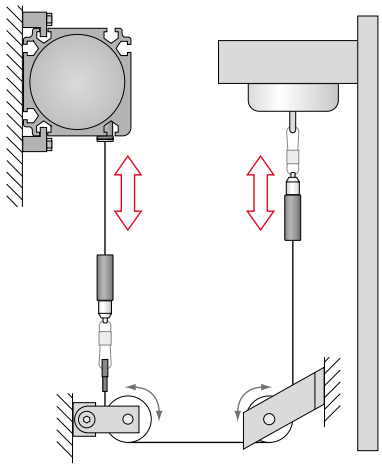
The mechanical options P96, P115 and P200 series are designed for easy mounting of a customer-specific encoder.

Compact, dependable and economical

The different sensor model ranges cover the complete application spectrum of draw-wire sensors. The miniature sensors are very favourably priced and are suitable for integration in tight installation spaces due to the miniaturised design. The industrial sensors are of extremely rugged construction and are employed in applications with large measuring ranges. A clear advantage of this draw-wire measuring principle is that the measuring cable can be diverted over deflection pulleys. This property differentiates draw-wire sensors from other measuring principles which normally only measure on one axis.

The sensor housings are kept extremely compact. The well-conceived sensor design enables large measuring ranges to be realised in a space-saving manner. Since only high quality components are used, the rugged sensors have an extremely long life - even in continuous use under industrial conditions.

Application with pulley wheel

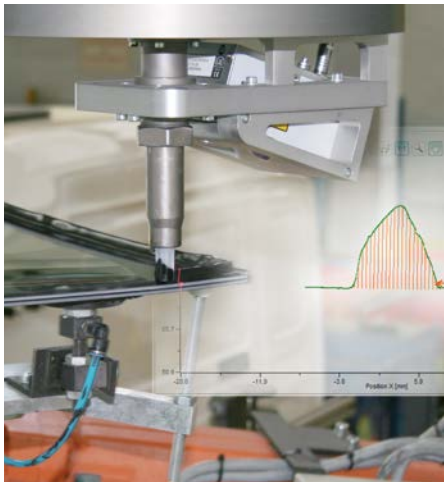


Laser line triangulation:
Non-contact 2D/3D profile sensor

The scanCONTROL laser line profile sensor makes use of the triangulation principle for the two-dimensional acquisition of profiles on the most varied of target surfaces. In contrast to familiar point laser sensors, a line optical system projects a laser line onto the surface of the object to be measured. The back-scattered light from the laser line is registered on a sensor matrix. Along with distance information (z-axis), the controller also calculates the true position along the laser line (x-axis) from the camera image and outputs both values in the sensor two-dimensional coordinate system. A moving object or sensor will generate a three-dimensional representation of the object.

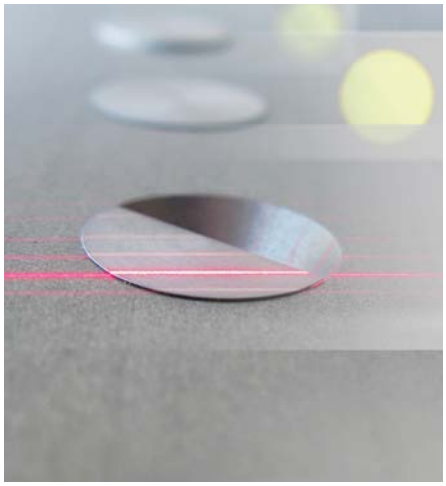
Advantages

- High accuracy and profile frequency
- High performance signal processor
- Trigger and synchronisation options
- Different types for customised integration available
- Complete solution from Micro-Epsilon



Inspection of adhesive beads on windscreens

Measuring gaps / flushness for vehicle body parts



Rivet verification in aircraft construction

scanCONTROL 26xx
Laser profile sensor ideal for automation

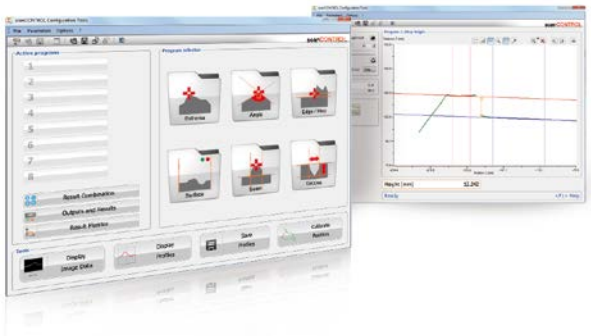
Measuring ranges	z-axis	up to 265mm
	x-axis	up to 143.5mm
Resolution	x-axis	640 points/profile
Profile frequency		up to 4000Hz

scanCONTROL 27xx
For long offset distances

Measuring ranges	z-axis	up to 300mm
	x-axis	up to 148mm
Resolution	x-axis	640 points/profile
Profile frequency		up to 4000Hz

scanCONTROL 29xx
High performance laser profile sensor

Measuring ranges	z-axis	up to 265mm
	x-axis	up to 143.5mm
Resolution	x-axis	1280 points/profile
Profile frequency		up to 2000Hz



scanCONTROL Configuration Tools

Configuring various measuring programs through simple mouse interactions

Dynamic tracking of evaluations in the profile

Configuring outputs and displaying measured values

Output of measured values across a large number of interfaces

gapCONTROL Setup Software

Sophisticated software for automated gap/flush measurements

Evaluation of different gap types

Simple configuration of measuring tasks

Configuring outputs and displaying measured values

scanCONTROL 3D-View

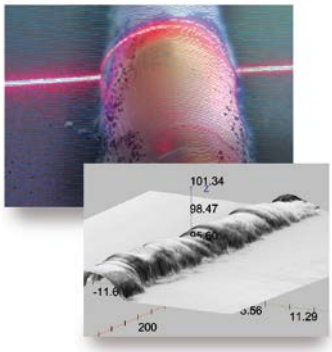
Can be used with all scanCONTROL sensors

Viewing online and offline sensor data in 3D

2D export of profile sequences (png)

3D export (asc, stl) for CAD programs

Intensity of each point can be displayed and exported

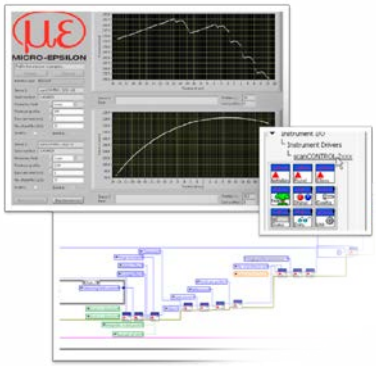


scanCONTROL Softwareintegration

Ethernet GigE Vision

SDK for integration in C/C++ (Linux and Windows) or C# (Windows) applications

Example VIs for NI LabVIEW for integration using LLT.DLL or NI IMAQdx



Optical micrometers and fibre optic sensors

Optical micrometers in the optoCONTROL series are based on various measuring principles. Apart from the CCD camera technique using laser or LED lighting, the principle of light quantity measurement is used. The micrometers consist of a light source and a receiver or a CCD camera. The light source produces a parallel, continuous light curtain, which is lined up with the receiver. If an object interrupts the light curtain, this shadow or darkening is detected at the receiver unit.

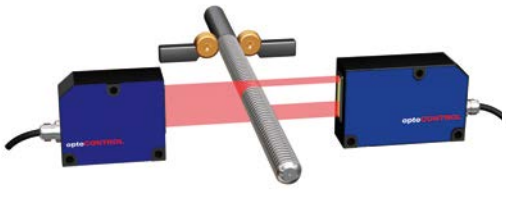
The optoCONTROL 1200 series acquires the incident quantity of light, whereas the 1202, 25x0 and 2600 Series measure the exact shadow via a CCD array. In this way, dimensional quantities such as diameter, gap, position and segment can be acquired. These units use state-of-the-art, high speed CCD cameras with solid state technology, which eliminate measurement errors caused by traditional scanning laser micrometers.

The optoCONTROL CLS-K fibre optic sensors are used for applications in harsh environments. Using sophisticated optical fibres near to the target object, the electronic unit can be mounted at a safe distance away.

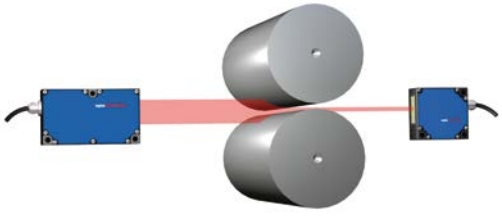
The optoCONTROL CLS-K test and measurement amplifiers are offered as infrared types, enabling measurement frequencies of 4kHz.

Advantages

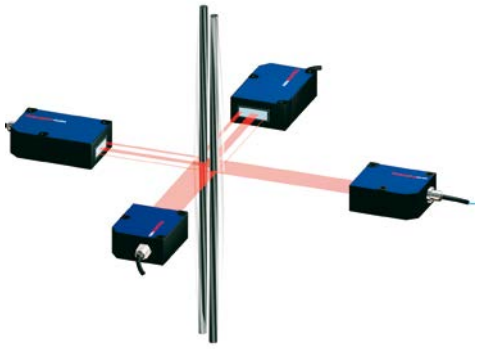
- Various models for different applications
- Laser or LED light source
- Extremely compact construction
- Very accurate measurements
- High speed measurements
- Perfect detection of edges, gaps, positions and diameters of round objects
- Inspection and detection of position and presence



During the stamping of threaded rods, micrometers are used for quality assurance in order to determine the exact thread guidance.



Optical micrometers are used for acquiring roller gaps to ensure a constant gap height.



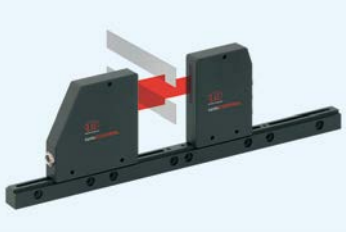
Synchronised micrometers acquire the vibration of tensioned steel lift cables in order to control the vibration behaviour.

optoCONTROL 1200
Miniature high-speed micrometer (laser)

Measuring ranges (mm)	2 | 5 | 10 | 16 | 20 | 30
Linearity	±40µm (independent)
Resolution	10µm
Frequency response	100kHz
Integrated controller	

optoCONTROL 1202
Compact high-speed micrometer with large measuring range (laser)

Measuring ranges (mm)	75 | 98
Linearity	±150µm
Resolution	8µm
Measuring rate	800Hz
Integrated controller	



optoCONTROL 1220
Optical online micrometer

Measuring range (mm)	28
Linearity	±22µm
Resolution	typ. 2µm
Working distance	up to 2,000mm
Integrated controller	

optoCONTROL 2500
High-resolution micrometer (laser)

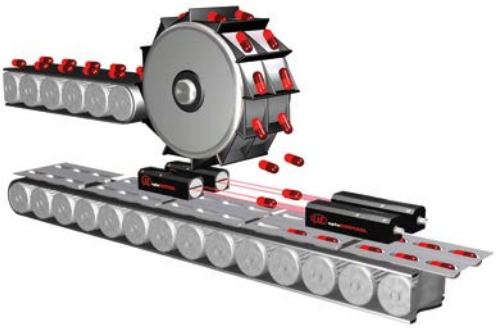
Measuring range (mm)	34
Linearity	±10µm
Resolution	1µm
Measuring rate	2.3kHz
External controller	

optoCONTROL 2520
Compact laser micrometer (class 1M)

Measuring range (mm)	46
Linearity	±12µm
Resolution	1µm
Measuring rate	2.5kHz
Integrated controller (web interface)	

optoCONTROL 2600
High-resolution micrometer (LED)

Measuring range (mm)	40
Linearity	±3µm
Resolution	0.1µm
Measuring rate	2.3kHz
External controller	



Detecting fast-moving parts in processes
Apart from measurement tasks, the 1200 series can be employed for ascertaining the presence of components. The versatile concept with enormously high frequency response and compact design opens up numerous fields of application

optoCONTROL CLS-K
Fibre optic sensors
Applications:
Edge detection
Counting tasks
Monitoring and control of the mounting procedure
Gap detection
Scanning tasks in potentially explosive atmospheres
Presence monitoring and position control
Recognition of brightness and reflection

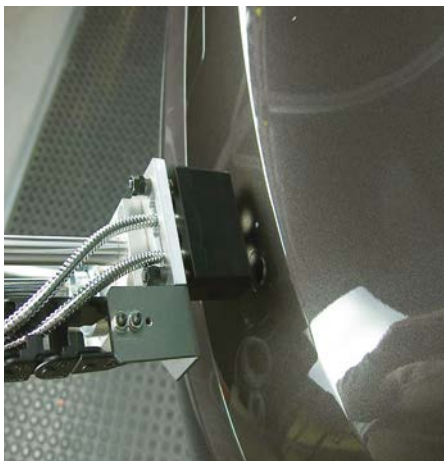
Colour sensors, colour measuring system and LED Analyzers

Colour recognition sensors of the colorSENSOR series are applied to colour detection applications. The sensors compare the current colour of the measured object with the target colours that were set up via the sensor's Teach-In function. colorSENSOR LT sensors operate using optical fibres directly on the target object, which therefore minimises any adverse environmental effects on measurements. The colour sensor can be placed at a safe distance using highly developed fibre optics close to the target object.

The colorSENSOR OT series enables measurements at longer distances by means of fixed optics. The new non-contact colour measurement system, colorCONTROL ACS7000, detects slightest colour differences ($\Delta E < 0.08$) with measurement frequencies of up to 2000Hz. The sensors are applied in a wide range of applications, including automation technology, packaging systems for pharmaceuticals, quality assurance, painting technology, surface labelling and printing technology. The LED Analyzer colorCONTROL MFA provides function, colour and intensity measurement of LEDs, lamps or illuminants simultaneously during the production process on up to 20 different detection positions.

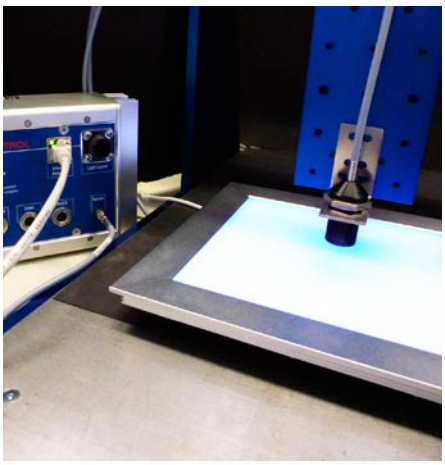
Advantages

- Simple quality checks
- Simple and fast set up
- Many sensors to suit any application
- Optical fibre close to the object to be measured
- Measurement at a safe distance from the object if required



Detection of the colour identity of painted attachments or body parts in automotive manufacturing.

Colour and intensity tests of vehicle lights.



Colour and homogeneity measurements of LED/lighting panel.

colorSENSOR LT
Colour recognition using optical fibres close to the target object

Colour difference	≥ ΔE 0.8
Software teach	1 - 255 colours can be saved
Button teach	1 - 31 colours can be saved

colorSENSOR OT
Colour recognition using fixed optics at a distance from 10 - 800mm

Colour difference	≥ ΔE 0.5
Colour sensor for different surfaces such as matt, shiny or structured surfaces	

colorCONTROL MFA
Colour recognition of LEDs and self-luminous objects

5 to 20 measuring points
Test of function, intensity colour
Colour test in HSI and RGB

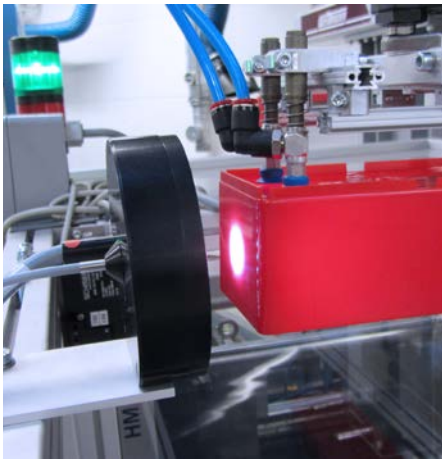
Optical fibres
High precision optical fibres can be adapted to work with colorSENSOR LT colour sensors

Ambient temperatures	-40°C to 400°C
Distances	8 - 200mm
Detection ranges	0.6 - 30mm

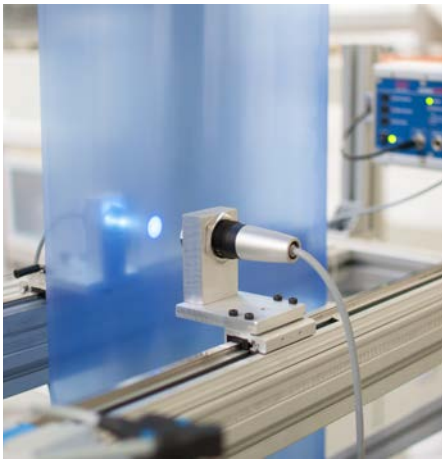
colorCONTROL ACS7000
Inline colour measurement system for non-contact measurement

Measurement geometrics	Transmission sensor, circular sensor, 30°/0° sensor
Colour difference	< ΔE 0.08
Spectral measuring range	390 - 780nm
Spectral resolution	5nm
Colour recognition from a taught reference list	

Webinterface - colorCONTROL ACS 7000

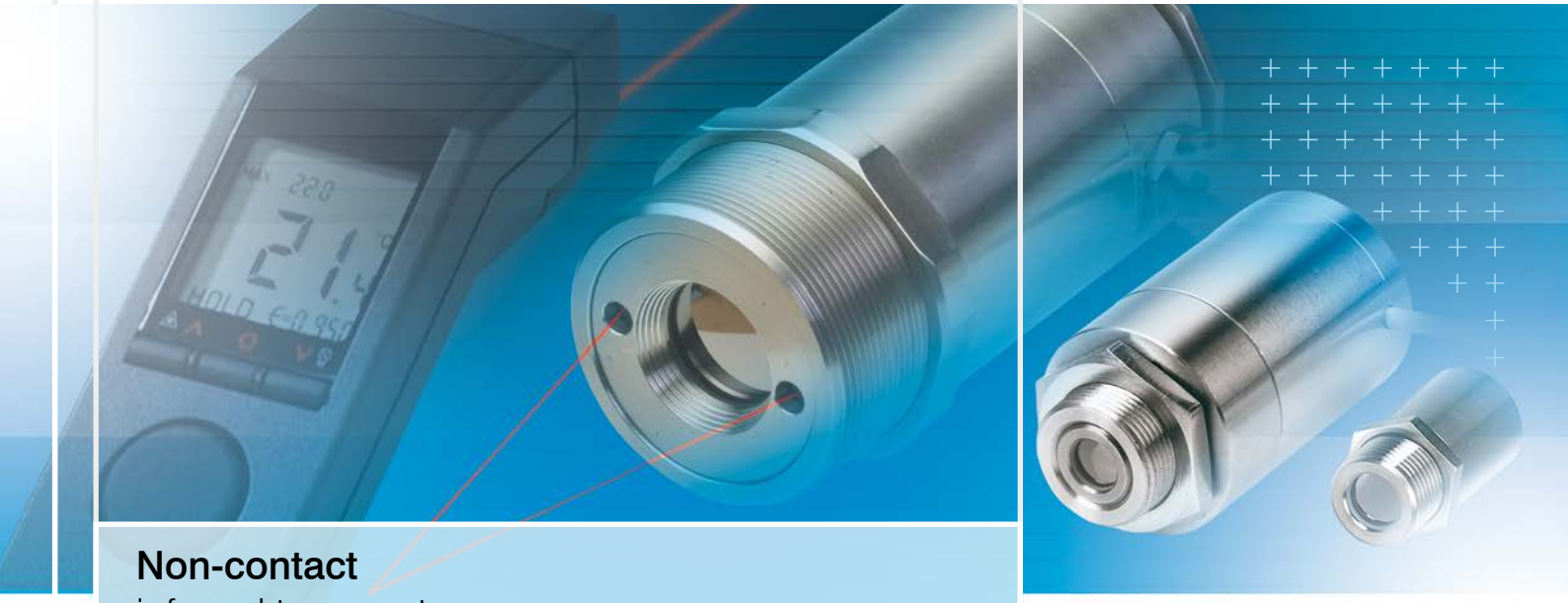


Inline colour measurement of plastic injection-moulded parts directly after demoulding.



Inline colour gradient measurement of transparent film and acrylic glasses.

Colour measurement of continuous strip coating such as aluminium, zinc and paper during production.



Non-contact
infrared temperature sensors

Infrared thermometers determine the temperature of objects by non-contact measurement of the infrared radiation emitted by the object's surface. A detector converts the incoming infrared radiation into an electrical signal. This results in an aligned temperature value, which can be used for further processing. The use of either portable or inline infrared thermometry sensors opens up various opportunities to measure and display temperature processes in the fields of quality control, automation systems and maintenance of machines and large plants.

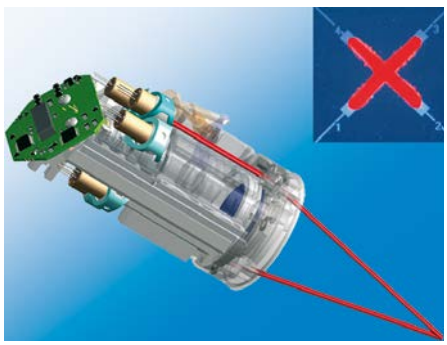
Trend setting infrared sensor technology for process automation

Miniaturized IR sensors thermoMETER combine high accuracy of the sensor parameters, ruggedness up to 250°C ambient temperature, a state of the art stainless steel mechanical design and an affordable price.

New developed IR detectors with high sensitivity and small dimensions make outstanding measuring parameters such as response times of 1ms possible. Sophisticated infrared thermometers support a high quality level in the production process.

Advantages

- Ease of use
- Non-contact measurement without contaminating the object
- Enables inspections of hot, fast moving or hard to reach objects in hazardous environments



Crosshair precision module
Optomechanical device of the LS and mapping of the laser line generators.

Industrial automation
Control and monitoring of process temperatures and product quality.

Electrical and mechanical maintenance, R&D
Inspections of electrical systems, switch cabinets, bearings and motors.

thermoMETER CX

Two wire IR sensor for industrial applications

Temperature range: -30°C to 900°C

22:1 optical resolution

Power range 5-30 V DC

Optional USB programming interface and software

thermoMETER CS / CSmicro / CSLaser

Compact or micro sized IR sensors, low-cost, fully integrated

Temperature range: -40°C to 1600°C

Rugged coated silicon optics

Integrated electronics

Scalable analogue output: 0 - 10V or 0 - 5V

Smallest integration, ideal for OEM

High-resolution models available

thermoMETER CTratioM1

Glass fibre ratio thermometer

Temperature range: 700°C to 1800°C

Ambient temperatures up to 250°C continuous without cooling

Insensitive to changes in emissivity of the target

5ms response time for fast readings

thermoMETER CTlaser

Most precise sensor with laser aiming

Temperature range: -50°C to 975°C

Infrared sensors with 75:1 optical resolution

Smallest spot size 0.9mm

Double laser aiming marks real spot location and spot size at any distance

Measuring times from 9 ms

thermoMETER CTlaser M1/M2/M3

For metal processing with reduced wavelength: 50°C to 2200°C

thermoMETER CTlaser M5 (525nm)

For liquid metals: 1000°C - 2000°C

thermoMETER CTlaserGLASS

For glass measurement: 100°C to 1650°C

thermoMETER CTlaserCOMBUSTION

For measurement of flames: 200°C to 1450°C

thermoMETER MS/LS

Portable IR thermometers

Temperature range: -35°C - 900°C

Fast 0.3 second scanning of cold and hot spots

Laser sighting with narrow beam aiming for accurate readings

Crosshairs mark real spot size at any distance (LS)

thermoMETER CT

Most economic and accurate

Temperature range: -50°C to 975°C

One of the smallest infrared sensors worldwide with 22:1 optical resolution

Up to 180°C ambient temperature without cooling

thermoMETER CTP7

For thin plastic film materials from 0°C to 500°C

thermoMETER CTM1/M2/M3

For metal processing,
Temperature range: 50°C to 2200°C

thermoMETER CThot

For extreme environmental conditions up to 250°C ambient temperature without cooling

thermoMETER CTXL

Non-contact temperature measurement from 100°C to 1800°C in laser processing applications

thermoMETER CT Video/CS Video

Infrared temperature sensors with crosshair laser sighting and video output

Temperature range: 50°C up to 2200°C

Measurements on hot metals, ceramics and composite materials

Use video output and crosshair laser sighting in parallel

USB thermal imagers

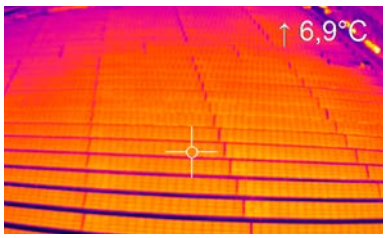
Plug&Play thermal imager

Powered from a single USB cable, the system is truly plug-and-play. Data is streamed in real time from the camera to the software via USB 2.0. This process and analysis tool, provided with every camera, enables the user to capture, record and monitor real time thermal process images at 128Hz. The software will store the data to a file, which enables playback at user-defined speeds, e.g. in slow motion, or frame-by-frame if required. The images can be viewed and monitored either online with the camera connected, or off line at a later time without the camera being connected. A perfect tool for R&D applications, failure diagnostics or process monitoring. In addition, the software can be used as a runtime application where the user is able to programme and configure a custom environment (multiple monitoring windows, alarms, hot spot localisation, line profiling etc.) A programmable process interface, hard wired input and output, (PIF in) enables external control and communication for the emissivity of the target material, trigger functions, shutter control or alarm outputs and other useful features.

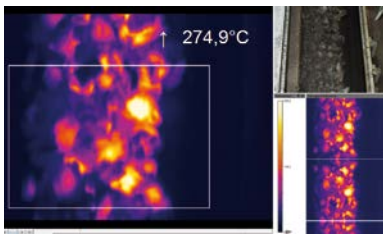
Advantages

- Ease of use
- Non-contact measurement without influencing the target object
- Enables inspection of hot, fast moving or hard to access objects in hazardous environments
- Rapid detection of weak points in power distribution systems, machines and production processes
- Software Developer Kit incl. examples such as C, C++, C#

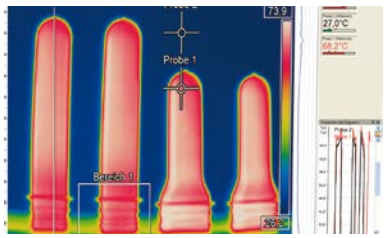
Applications



Surface measurements in industrial applications

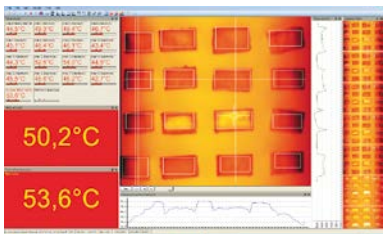


Monitoring a coal conveyor belt



Thermal image shots of preforms in PET bottle production

Sharp infrared pictures and videos for process optimisation e.g. in the automotive industry



Exact temperature measurement on moving glass surfaces due to line scan feature

Temperature monitoring for building thermography

thermoIMAGER TIM 160

Temperature ranges:
-20°C to 900°C (special edition 1500°C)

Excellent thermal sensitivity of 0.08K (NEDT)

Exchangeable lenses with
6°FOV, 23°FOV, 48°FOV or 72° FOV

Real time video recording at 120Hz frame rate with slow motion playback capability

Extremely lightweight (195g) and rugged (IP67)

Very compact 45x45x62mm

Analogue input and output, trigger interface

thermoIMAGER TIM 200/230

BI-SPECTRAL technology

Temperature ranges:
-20°C to 900°C (special edition 1500°C)

Excellent thermal sensitivity of 0.08K (NEDT)

Exchangeable lenses with
6°FOV, 23°FOV, 48°FOV or 72° FOV

Real time video recording at 128Hz frame rate with slow motion playback capability

Time synchronic visual image recording with 32 Hz (640 x 480 pixel)

thermoIMAGER TIM 400/450

Detector with 382 x 288 pixels

Temperature ranges:
-20°C to 900°C (special edition 1500°C)

Excellent thermal sensitivity
of 0.08K resp. 0.04K (NETD)

Exchangeable lenses 13°, 38° or 62° FOV
and industrial accessories

Fast real-time thermal imager with up to 80Hz

Analogue input and output, trigger interface

thermoIMAGER TIM 640

Thermography in VGA resolution

640 x 480 pixels

Temperature ranges: -20°C to 900°C

Excellent thermal sensitivity of 0.075K (NEDT)

Radiometric video recording with 32Hz

Analogue input and output, trigger interface

thermoIMAGER TIM G7

Thermal imaging camera with line scan feature for the glass industry

Image frequency of 80Hz

Excellent thermal sensitivity of 0.13K (NEDT)

Robust against ambient temperatures up to 70°C without requiring additional cooling, up to 315°C with cooling jacket

thermoIMAGER TIM M1

Thermal imaging camera for hot metal surfaces

Measuring ranges: 450 to 1800°C /
500 to 1800°C / 600 to 1800°C

Excellent thermal sensitivity of <1K (NETD)

Optical resolution: 764 x 480 pixels

Spectral range: 0.92 – 1.1μm

thermoIMAGER NetPC

Embedded, industrial PC solution with passive cooling for thermoIMAGER applications

Supports all thermoIMAGER TIM models

Integrated watchdog feature

Special edition:
TIM LightWeight

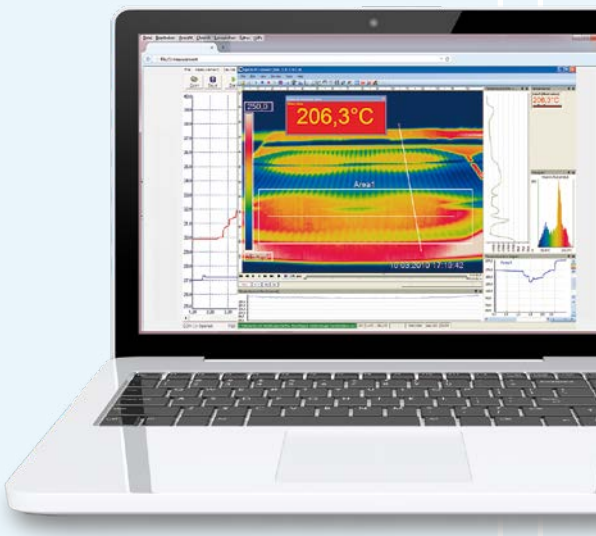
Miniature lightweight PC for flight applications with thermoIMAGER series

Total weight 350g incl. camera

Recording button on camera housing

Free software

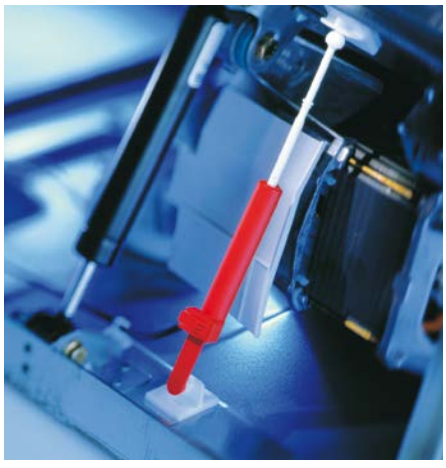
Complex image analysis and process monitoring software with custom configuration



Innovative sensor solutions
for specific applications

Apart from standard sensors utilising the various measuring principles, Micro-Epsilon has developed numerous sensor solutions for special applications, which go beyond pure displacement and position measurement.
These application-specific sensors have been developed and optimised for special measurement tasks at the request of customers. These developments incorporate the company's expertise gained from more than thirty years designing, developing and applying sensor systems. Here, the developments always focus on high performance and reliability - at favourable price/performance ratios for OEMs.

Thickness measurement of yarn



Load detection in washing machines

Non-contact inline film thickness measurement

DZ140

Sensors for measuring the rotational speed of turbochargers - for vehicle and test cell use.

Optimised for modern, thin compressor blades made from aluminium or titanium.

Speed range from 200 to 400,000rpm

Wide operating temperature range

High measuring distance of sensor to blade

No rotor modification necessary

ILU-50 series sensor

Integrated load and imbalance sensor for washing machines

Measuring ranges 50mm

For OEM applications

combiSENSOR

Non-contact displacement and thickness measurement with just one sensor

Every combiSENSOR combines two measuring principles in one housing.

Non-contact thickness measurement of plastic films

Non-contact layer thickness measurement of insulator materials

Lateral profile by using a traversing axis

SGS Spindle Growth System

Measurement system developed for measuring the extension of high speed milling spindles

Measuring ranges 500μm

Resolution 0.5μm

High temperature range

NLS Needle Lift System

Miniature sensor system for measuring the needle lift in fuel injectors

Innovative measurement concept

Wide temperature range

Extreme pressure environment

idiamCONTROL

Non-contact inspection of extruder bores

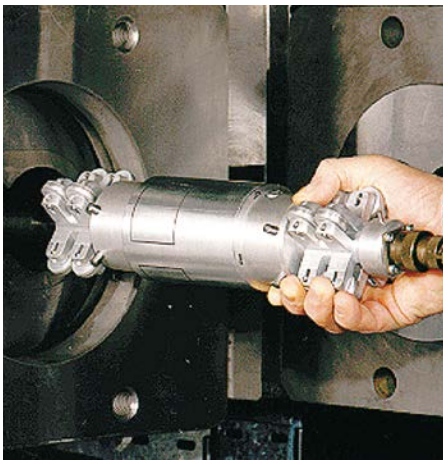
Non-contact and wear-free measurement

Suitable for all metals without additional calibration

Exact, non-destructive inspection

Turbocharger speed measurement

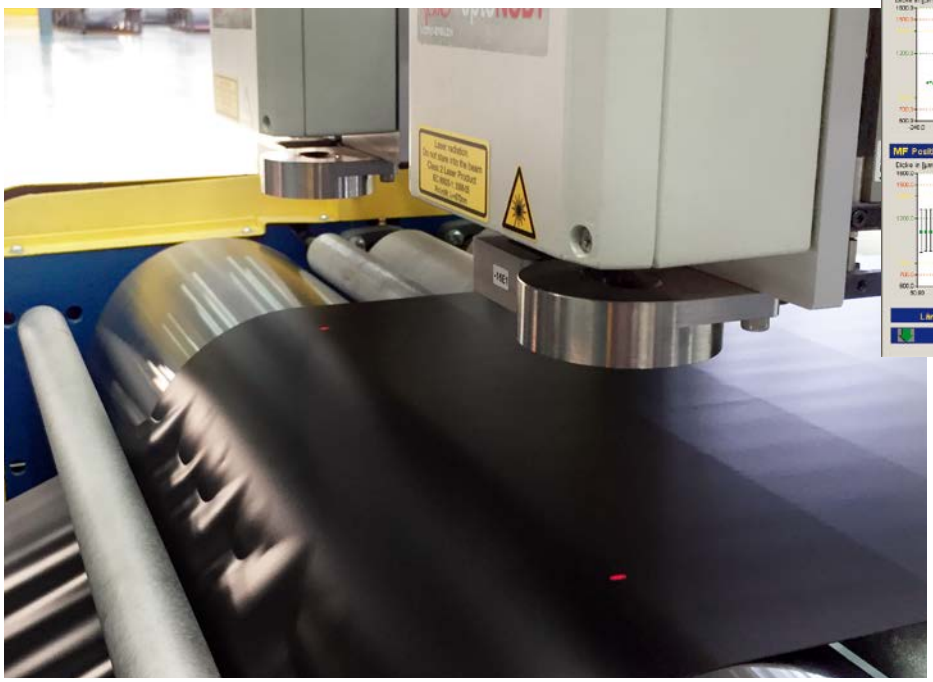
Measurement of thermal extension in spindles



Inspection of extruder bores

Measurement and inspection systems

System solutions from Micro-Epsilon are measurement systems that go beyond pure sensor systems. In this respect, sensors, software and the mechanical system are blended together to form one integrated overall system, which is used for process monitoring and quality assurance on production lines. The sensor and software modules used originate from the Micro-Epsilon group, enabling optimum and efficient component matching.
These turnkey automated measurement systems are integrated into existing or newly designed process lines to execute fully automated applications, such as thickness measurement, surface inspection and parts classification.



For each measurement task there is a suitable measurement concept. As well as laser sensors, micrometers, eddy current and capacitive sensors, image processing solutions, special combined sensors are also used.
The signal representation can be arranged to suit the application requirements. The measurement systems communicate with existing environments over various interfaces and can therefore also be integrated retrospectively into existing production lines.

C-frame for metal thickness measurement

For fast measurements

Laser point or innovative laser line

All alloys without calibration

Powerful C-frames for harsh environments

Different measuring ranges

Proven protection and cleaning concepts

Several C-frames with only one IPC

O-frame systems for the metals industry

Modern thickness profile measurement

Without isotopes or X-rays

Reliable measurement independent from strip movement, tilt, surface type and alloys

Systems for the preparation area in the rubber and tire production

Profilometer

Colour code

Length measurement

Final finishing systems in the rubber and tire production

Tire geometry

Tire marking

Tire identity

Systems for plastics inspection

C-frames for thickness measurement of flat film

O-frame systems for profile thickness measurement

Reverse frame system for profile thickness measurement of blown film

surfaceCONTROL

3D inspection of matt surfaces

Detection and evaluation of 3D surface data within a few seconds

reflectCONTROL Automotive

Fully automatic surface inspection of painted car bodies

Recognition of defects, bumps, scratches etc.

reflectCONTROL Compact

Inspection of shiny surfaces

Defect detection & 3D reconstruction

Modifications reserved / Y9761185-H031056GKE

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