# Product Guide

## Sensors and Measuring Systems

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<thead>
<tr>
<th>Displacement</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>Temperature</td>
</tr>
<tr>
<td>Position</td>
<td>Color</td>
</tr>
</tbody>
</table>

More Precision
As a technology leader of precision sensors, Micro-Epsilon pursues the need to develop high precision sensors, measurement devices and systems. This need is the drive for continuous high performance in measurement technology. As well as sensors for displacement, distance, position, color and temperature, we also focus on 3D sensors.

Continuous development efforts, extensive know-how and a wide cooperation network enable us to develop high precision sensors. Further development of measuring techniques and technical innovations is our basis for the creation of sensor products that provide our customers with significant added value.

**Why choose Micro-Epsilon?**

- More precision and innovation made in Germany
- Wide range of powerful and flexible products which are easy to integrate
- Consultation, development and production from a single source
- Hand in hand with our customers we create quality and solution competence in series & OEM
- Profound knowledge of industries & applications in automation, machine building and machine design
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Sensors and measurement devices from Micro-Epsilon are used in numerous industries. Whether it is for quality assurance, applications in maintenance, process and machine monitoring, automation or R&D - sensors make a vital contribution to the improvement of products and processes. From global major groups to medium-sized companies and engineering service providers - sensors and solutions from Micro-Epsilon ensure reliable measurement results with the highest precision all over the world. From machine building and automated production lines in the food industry, to integrated OEM solutions - almost all industries benefit from sensor technologies.

Micro-Epsilon has the experience and the required resources to provide solutions starting from the basic idea through to series production, all from one source – and at a convincing price/performace ratio. A team of specialist development and application engineers implements concepts and designs according to customer-specific requirements. All project members are involved in development, prototype construction and series production.
Laser triangulation sensors
for precise displacement distance measurements

**optoNCDT**
- Measurement of displacement, distance and position on numerous surfaces
- Detection of smallest parts due to point-shaped measurement
- Comprehensive product range with numerous measuring ranges
- High resolution and linearity
- Ideal for measurement tasks with high measuring rates
- Numerous interfaces, also for bus connection

optoNCDT sensors are designed for both measurement tasks in factory automation and integration into machines and systems. Despite their very compact dimensions, these robust laser sensors have a fully integrated controller. As a result, simple installation and wiring is possible in confined installation spaces or on a robot. Their high performance enables the sensors to provide precise measurement results at a high measuring rate.

Monitoring the metal sheet infeed during pressing
Measuring scribe lines on PCB panels
Distance control with laser welding
### optoNCDT 1220/1320
Compact laser triangulation sensor for high speed, precision measurements

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
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<tbody>
<tr>
<td>Linearity</td>
<td>$\leq 0.1%$ FSO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>from 1 $\mu$m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>1 kHz</td>
<td>2 kHz</td>
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### optoNCDT 1420/1420 CL1
Smart laser triangulation displacement sensor for fast and precise measurements

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<th>Measuring ranges (mm)</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>500</th>
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<tr>
<td>Linearity</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>from 0.5 $\mu$m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>4 kHz</td>
<td></td>
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### optoNCDT 1900
Innovative laser sensor for advanced automation

<table>
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<th>Measuring ranges (mm)</th>
<th>2</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>500</th>
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</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$&lt; 0.02%$ FSO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>from 0.1 $\mu$m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>10 kHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### optoNCDT 1750 / 1750-DR
Universal sensor with integrated controller for industrial applications

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>2</th>
<th>10</th>
<th>20</th>
<th>500</th>
<th>750</th>
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<tbody>
<tr>
<td>Linearity</td>
<td>$\leq 0.06%$ FSO</td>
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<td></td>
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<tr>
<td>Repeatability</td>
<td>from 0.1 $\mu$m</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
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### optoNCDT 1750BL / 2300BL / 2300-2DR
Laser sensor with Blue Laser Technology for metals and organic materials

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>2</th>
<th>5</th>
<th>20</th>
<th>50</th>
<th>200</th>
<th>500</th>
<th>750</th>
<th>1000</th>
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<tbody>
<tr>
<td>Linearity</td>
<td>$\leq 0.03%$ FSO</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0015 % FSO</td>
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<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>49 kHz</td>
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### optoNCDT 2300
Highly dynamic laser sensor in the 50 kHz class

<table>
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<tr>
<th>Measuring ranges (mm)</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$\leq 0.02%$ FSO</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0015 % FSO</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Measuring rate</td>
<td>49 kHz</td>
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</tbody>
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### optoNCDT 1710 / 2310
Long-range sensors for large distances

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>10</th>
<th>20</th>
<th>40</th>
<th>50</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$\leq 0.03%$ FSO</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Resolution</td>
<td>0.005 % FSO</td>
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<td></td>
<td></td>
<td></td>
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<td>Measuring rate</td>
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<td></td>
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### thicknessSENSOR
Sensor for non-contact thickness measurements of strip and plate materials

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>10</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>$\pm 0.01%$ FSO</td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>4 kHz</td>
<td></td>
</tr>
<tr>
<td>Measuring widths (mm)</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>
Confocal chromatic sensors
for high precision displacement & thickness measurements

confocalDT
- Distance measurement with extremely high resolution and measuring rate
- Precise thickness measurement of transparent materials with up to 5 layers
- Extremely high resolution
- Suitable for all surfaces
- Extremely small, constant spot size
- Compact beam path
- Vacuum-suitable sensor design
- Numerous interfaces, also for bus connection

The confocalDT product range stands for the highest precision and dynamics in confocal chromatic measurement technology. The measuring system includes the worldwide fastest controller currently available, which in combination with the sensors enables high precision measurement results in displacement and distance measurement tasks, as well as thickness measurement of transparent objects. A large number of sensors and different interfaces can be used in versatile measurement tasks, e.g., in the semiconductor industry, glass industry, medical engineering and machine building.

Roughness measurement and geometry inspection in coordinate measuring machines
Measuring the curvature of lenses
Wall thickness of medical glass containers
confocalDT 2421/2422
Single and dual-channel controller with integrated light source for industrial applications and measuring rates up 6.5 kHz

confocalDT 2461
High-performance controller with integrated light source for measuring rates up to 25 kHz

IFS2402
Miniature sensors (gradient index lens) for the inspection of smallest inner bodies
Measuring ranges (mm) 0.4 | 1.5 | 2.5 | 3.5
available with axial / radial beam path

IFS2403
Confocal hybrid sensors with narrow gradient index lens and relay lens
Measuring ranges (mm) 0.4 | 1.5 | 4 | 10
Resolution 0.0015 % FSO
available with axial / radial beam path

IFS2404
Confocal chromatic sensors for high precision applications in restricted spaces
Measuring ranges (mm) 2
Resolution (µm) 0.04
available with axial / radial beam path

IFS2405
Standard sensors for precise distance and thickness measurements
Measuring ranges (mm) 0.3 | 1 | 3 | 6 | 10 | 28 | 30
Large offset distance and tilt angle

IFS2406
Confocal chromatic compact sensors for displacement & thickness measurements
Measuring ranges (mm) 2.5 | 3 | 10
available with axial / radial beam path

IFS2407
Confocal sensors for precise displacement, thickness & roughness measurements
Measuring ranges (mm) 0.1 | 0.3 | 0.8 | 3
Small measurement spot and large tilt angle
available with axial / radial beam path
High-precision white light interferometer
for non-contact distance and thickness measurements

interferoMETER
- Absolute distance measurement with nanometer accuracy
- Distance-independent thickness measurements
- Best-in-Class: resolution < 30 picometers and outstanding linearity
- High signal stability due to new evaluation algorithms and active temperature compensation
- Simple parameter set up via web interface
- Numerous interfaces, also for bus connection

The innovative white light interferometers from Micro-Epsilon set a benchmark in high-precision distance and thickness measurements. These sensors enable stable measurement results with sub-nanometer resolution offering a comparatively large measuring range and offset distance. The interferometers are available in 3 series: the IMS5400-DS for high-precision industrial distance measurements, the IMS5400-TH for accurate thickness measurements and the vacuum-suitable IMS5600-DS for distance measurements with picometer resolution.

Inspection of wafer tilt angle
Inspecting the axial runout of hard drives
Thickness measurement of flat glass
Integration in industrial environments

Robust sensors and a controller enclosed in metal make the interferometer ideal for integration into production lines and machines. These compact sensors are extremely space-saving and can also be integrated in confined spaces. The controller is installed in the control cabinet via DIN rail mounting and provides very stable measurement results due to active temperature compensation and passive cooling.

Ease of use via web interface

Due to a user-friendly web interface, no additional software is necessary to configure the controller and the sensors. The web interface is accessible via Ethernet connection and enables quick and easy setting of, e.g., averaging, measuring rate and presets.

Absolute measurement of step profiles

Unlike interferometers based on relative measurements, the IMS-DS also enables the measurement of step profiles. Thanks to the absolute measurement, the scanning is performed with high signal stability and precision. When measuring on moving objects, the differences in height of heels, steps and depressions can thus be reliably detected.

Thickness measurement of plastic films
Laser distance sensors
for the precise measurement of large distances

**optoNCDT ILR**
- Precise measurement of displacement, distance & position on different surfaces
- Very large measuring range
- High repeatability
- Fast response time
- Excellent price/performance ratio
- Open interfaces

Optoelectronic optoNCDT ILR sensors are designed for non-contact distance and displacement measurements with large measuring ranges. Depending on the application and the required measuring range, the sensors detect diffuse reflecting surfaces or special reflector plates. Thanks to their robust design, optoNCDT ILR sensors are suitable for measurement tasks indoors and also outdoors.

Position detection for robots
Diameter monitoring on seamless rolled rings
Acquisition of coil diameters
optoNCDT ILR 1030/LC1 and 1031/LC1
Compact laser distance sensors

<table>
<thead>
<tr>
<th>Feature</th>
<th>1030/LC1</th>
<th>1031/LC1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range no reflector</td>
<td>0.2 - 15 m</td>
<td>0.2 - 50 m</td>
</tr>
<tr>
<td>Linearity</td>
<td>±20 mm</td>
<td>±20 mm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; 3 mm</td>
<td>&lt;20 mm</td>
</tr>
<tr>
<td>Response time</td>
<td>10 ms</td>
<td>0.5 ms</td>
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Measuring range with reflector

<table>
<thead>
<tr>
<th>Measuring range with reflector</th>
<th>1030/LC1</th>
<th>1031/LC1</th>
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<tbody>
<tr>
<td>15 m</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>50 m</td>
<td>&lt;3 mm</td>
<td>&lt;20 mm</td>
</tr>
<tr>
<td>100 m</td>
<td>&lt;3 mm</td>
<td>&lt;20 mm</td>
</tr>
<tr>
<td>300 m</td>
<td>&lt;3 mm</td>
<td>&lt;20 mm</td>
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optoNCDT ILR 1191
Laser distance sensors

<table>
<thead>
<tr>
<th>Feature</th>
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</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0.5 - 3000 m</td>
</tr>
<tr>
<td>Linearity</td>
<td>±20 mm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt;20 mm</td>
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<tr>
<td>Response time</td>
<td>0.5 ms</td>
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Measuring range with reflector

<table>
<thead>
<tr>
<th>Measuring range with reflector</th>
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<tbody>
<tr>
<td>50 m</td>
<td>±</td>
</tr>
<tr>
<td>150 m</td>
<td>±</td>
</tr>
<tr>
<td>3000 m</td>
<td>±</td>
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optoNCDT ILR 2250
Compact laser distance sensors

<table>
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<th>Feature</th>
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<tbody>
<tr>
<td>Measuring range</td>
<td>0.5 - 150 m</td>
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<tr>
<td>Linearity</td>
<td>±1 mm</td>
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<tr>
<td>Repeatability</td>
<td>&lt;300 µm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>20 Hz</td>
</tr>
</tbody>
</table>

Measurement is performed directly onto the target

Measurement against a reflector which is installed on the target

optoNCDT ILR sensors are particularly suitable for filling level measurement, safety applications, height measurement of lifting systems, overhead conveyors, crane systems and for positioning lifts.
Capacitive sensors
for non-contact displacement & distance measurements

capaNCDT

- Non-contact measurement of displacement, distance and thickness as well as on electrical conductors and insulators
- Resolution down to the nanometer range
- Temperature stability over a large temperature range
- World’s most modern product portfolio for a wide range of laboratory and industrial applications
- Numerous interfaces, also for bus connection

Capacitive sensors are designed for non-contact displacement and distance measurements with the highest precision and are used for measurement tasks in the laboratory as well as in industrial applications. Their special sensor design, triaxial sensor cables and innovative controller technology result in a perfectly matched measuring system. For this reason, capacitive sensors from Micro-Epsilon stand for the highest precision and signal stability. Even in industrial applications, capacitive sensors achieve resolutions in the submicrometer range.

Measuring the bearing gap in roll drives
Positioning of precision stages
Checking the tilt angle of lens carriers
### 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
- **Frequency response:** up to 20 kHz (-3dB)

### CapaNCDT 61x0/IP
Measuring system for industrial applications
- **Measuring ranges (mm):** 0.5 | 1 | 1.25 | 2 | 3 | 4 | 6
- **Linearity:** ≤ ±0.1 % FSO
- **Resolution:** 0.01 % FSO
- **Frequency response:** 1 kHz (-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
- **Frequency response:** up to 20 kHz (-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:** 0.00075 % FSO
- **Frequency response:** 8.5 kHz (-3dB)

### CapaNCDT 61x4
Active sensor system, ideal for long signal transmission paths up to 15 m
- Sensor cable for use on drag chains and robots
- Easy integration due to flexible cable routing
- Robust sensor design

### CapaNCDT DTV
Measuring the Disc Thickness Variation of brake discs
- Multi-channel controller for multi-track thickness measurements
- High dynamics up to 20 kHz
- Robust sensor design for long-life operation
- Comprehensive software package for ease of use and real-time evaluation of measurement results
- Analog interfaces, Ethernet, EtherCAT

### Large range of capacitive sensors
Capacitive displacement sensors from Micro-Epsilon are available in different designs and versions. They differ with respect to measuring range, design and manufacturing technology. Capacitive sensors are available in a cylindrical design (with integrated cable or socket) or as flat sensors (with integrated cable). These sensors can be exchanged without recalibration; the sensor replacement can be completed rapidly. Most sensors can be used in clean rooms as well as in ultra-high vacuums.

### Adaption of sensors to OEM serial applications
- Shape & size
- Sensor material
- Cable
- Vacuum suitability
- Cryogenic or high temperatures
- Integrated controller with sensor for OEM design

### Other capacitive sensors for special measurement tasks on page 37
Inductive sensors (eddy current)
for high precision displacement & distance measurements

**eddyNCDT**
- Non-contact and wear-free
- High resolution and linearity
- Stable measurement signals
- High dynamics
- Excellent temperature range and temperature stability
- For industrial applications
- Numerous interfaces, also for fieldbus connection

For many years, Micro-Epsilon has been a pioneer in displacement measurement using eddy current technology. eddyNCDT displacement sensors are designed for non-contact measurement of displacement, distance, position, oscillation, vibrations etc. Considered as extremely robust and precise, eddy current sensors from Micro-Epsilon are preferably used in industrial environments. eddyNCDT sensors are based on the eddy current principle and are used for measurements on metallic targets. They enable non-contact and wear-free measurements without exerting any forces onto the measuring object. The insensitivity to, e.g., oil, dirt, water or electromagnetic interference fields makes eddyNCDT sensors ideal for measurement tasks in which precise measurements are required despite harsh industrial environments.

**Extreme temperature stability**
Eddy current sensors from Micro-Epsilon can be used in a wide temperature range, some models from -50 °C to +350 °C. Their wide temperature range and insensitivity to dirt or dust enable a variety of applications in industrial environments. Active temperature compensation ensures the highest signal stability with fluctuating ambient temperatures.

Measuring the radial runout of clutch discs
Measuring the spindle runout
Monitoring the oil gap of drive shafts
For special requirements that are not met by standard models, the standard sensors can be modified accordingly. Cost-effective implementation can already be achieved with medium-sized quantities. For special applications where large quantities are required, Micro-Epsilon develops sensors that are precisely tailored to the customer’s requirements.

<table>
<thead>
<tr>
<th>eddyNCDT 3001</th>
<th>eddyNCDT 3005</th>
<th>eddyNCDT 3060/3070</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compact eddy current sensor with integrated controller</strong></td>
<td><strong>Miniature eddy current measuring system ideal for integration into plant and machinery</strong></td>
<td><strong>A new performance class in inductive displacement measurements</strong></td>
</tr>
<tr>
<td>Measuring ranges (mm)</td>
<td>Measuring ranges (mm)</td>
<td>Measuring ranges (mm)</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Linearity</td>
<td>Linearity</td>
<td>Linearity</td>
</tr>
<tr>
<td>&lt; ±0.7 % FSO</td>
<td>&lt; ±0.25 % FSO</td>
<td>&lt; ±0.1 % FSO</td>
</tr>
<tr>
<td>Resolution</td>
<td>Resolution</td>
<td>Resolution</td>
</tr>
<tr>
<td>0.1 % FSO</td>
<td>0.05 % FSO</td>
<td>0.002 % FSO</td>
</tr>
<tr>
<td>Frequency response</td>
<td>Frequency response</td>
<td>Frequency response</td>
</tr>
<tr>
<td>5 kHz</td>
<td>5 kHz (3dB)</td>
<td>20 kHz (3dB)</td>
</tr>
</tbody>
</table>

**Largest sensor range worldwide**

Our long-term technology leadership in the field of eddy current sensor technology is reflected by the range of products - more than 400 sensors are available in different designs for different applications. The range includes miniature sensors which achieve high precision measurement results with the smallest possible dimensions.

**Adaption of sensors for small and large series**
- Shape & size
- Sensor material
- Cable
- Connector
- Vacuum suitability
- Sensor with integrated controller

Other eddy current sensors for special measurement tasks on page 37
Linear inductive displacement sensors
for industrial measurement tasks

InduSensor

- More than 250 different models with measuring ranges from 1 to 630 mm
- Integrated or separate controller
- High accuracy
- Extreme stability and durability
- Different designs with plunger, tube or measuring ring
- Analog output, digital interfaces and fieldbus connection
- Ideal for customer-specific designs and serial applications

For decades, Micro-Epsilon has been renowned for its inductive displacement sensors and gauges and has extended the range of proven measurement techniques such as, e.g., LVDT by further innovative developments. InduSensor displacement sensors from Micro-Epsilon are used extensively in applications for automated processes, quality assurance, test rigs, hydraulics, pneumatic cylinders, and building monitoring. Typical measurement tasks require a long service life and reliability.

The InduSensor models stand out due to their robustness and reliability under harsh conditions. As they provide high signal quality, temperature stability, resistance to shocks and vibrations as well as insensitivity to dirt and humidity, these sensors are the preferred choice for industrial measurement tasks. InduSensor systems are universally applicable and have been tried and tested in various industries. When several measuring points are required, the 2-channel controllers or multi-channel systems are used that are equipped with digital interfaces and, in addition, enable integration into fieldbus environments.
For special requirements that are not met by standard models, the standard sensors can be modified accordingly. Cost-effective implementation can already be achieved with medium-sized quantities. For special applications where large quantities are required, Micro-Epsilon develops sensors that are precisely tailored to the customer’s requirements.

**Adapted to ambient conditions**

Depending on the location of use, environment, and application, different influences prevail to which the sensors are adapted.

- Ambient temperature
- Pressure
- Interference fields
- Dirt, dust, and moisture
- Vibration, shock
- Seawater, IP69K

---

**Miniature sensor controller for inductive displacement sensors**

The MSC controllers are designed to be operated with LVDT and LDR measuring gauges and displacement sensors. Due to the robust and compact aluminum housing, the controllers are ideal for industrial measurement tasks. A wide variety of compatible, inductive displacement sensors and gauges combined with an optimized price/performance ratio opens up numerous fields of applications in automation technology and machine building.

---

**Specifications**

**induSENSOR LVDT series**

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

**induSENSOR LDR series**

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

**induSENSOR EDS series**

- **Measuring ranges (mm)**: 75 | 100 | 160 | 200 | 250 | 300 | 370 | 400 | 500 | 630
- **Linearity**: ±0.3 % FSO
- **Resolution**: 0.05 % FSO
- **Frequency response**: 150 Hz (-3dB)
- **Target**: Measuring tube
- **Pressure resistance**: 450 bar
Magneto-inductive distance sensors
for industrial measurement tasks

**mainSENSOR**
- Ideal alternative to inductive sensors and proximity sensors
- Linear output signal, high basic sensitivity and temperature stability
- High dynamics
- Measuring range can be adjusted via magnets
- Ideal for customer-specific designs and serial applications

mainSENSOR distance sensors use an innovative measuring principle, which combines the advantages of both inductive and magnetic sensors. Measuring the distance to a magnet which is attached to the measuring object, the sensor outputs a continuous, linear output signal. By using magnets of different strengths, measuring ranges between 20 mm and 55 mm can be achieved. In order to adapt the measuring range, you only have to change the magnet.

Magneto-inductive sensors are frequently used as an alternative to inductive sensors and proximity sensors in process automation, the packaging industry and in machine monitoring. Their sensor design brings numerous application possibilities, especially for OEM series applications. The sensor is available as simple PCB, in a plastic housing or in housings made from stainless steel, which are resistant to many chemicals as well as oil or dirt.

**Ideal alternative to inductive sensors and proximity sensors**
- Linear output signal, high basic sensitivity and temperature stability
- High dynamics
- Measuring range can be adjusted via magnets
- Ideal for customer-specific designs and serial applications

Load measurement in washing machines
Foreign body detection in blister packs
Valve lift measurement in the food industry
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.

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

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Measuring range</th>
<th>Output</th>
<th>Linearity</th>
<th>Resolution</th>
<th>Pressure resistance</th>
<th>Frequency response</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDS-45-M18-SA</td>
<td>20 - 55 mm*</td>
<td>2 - 10 V</td>
<td>&lt; ±3 % FSO</td>
<td>0.05 % FSO</td>
<td>up to 400 bar</td>
<td>3 kHz (-3dB)</td>
</tr>
<tr>
<td>MDS-45-M12</td>
<td>20 - 55 mm*</td>
<td>2 - 10 V</td>
<td>&lt; ±3 % FSO</td>
<td>0.05 % FSO</td>
<td></td>
<td>3 kHz (-3dB)</td>
</tr>
<tr>
<td>MDS-45-M30-SA</td>
<td>20 - 55 mm*</td>
<td>2 - 10 V / 4 - 20 mA</td>
<td>&lt; ±3 % FSO</td>
<td>0.05 % FSO</td>
<td>50 bar</td>
<td>1 kHz (-3dB)</td>
</tr>
<tr>
<td>MDS-35-M12-HT</td>
<td>20 - 55 mm*</td>
<td>2 V ±0.4 V…9.6 V ±0.4 V</td>
<td>&lt; ±5 % FSO</td>
<td>&lt; 0.05 % FSO</td>
<td></td>
<td>5 kHz (-3dB)</td>
</tr>
<tr>
<td>MDS-40-MK</td>
<td>approx. 40 mm*</td>
<td>different kinds</td>
<td>&lt; ±3 … &lt; ±5 % FSO</td>
<td>0.05 % FSO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDS-40-LP</td>
<td>approx. 40 mm*</td>
<td>square</td>
<td>&lt; ±9 % FSO</td>
<td>0.05 % FSO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Accessories**

- Measuring ranges of magnets: 20 mm, 27 mm, 35 mm, 45 mm, 55 mm
- Power and output cables with M8x1 connector in different types

*depends on the magnet
Draw-wire sensors
for displacement, position and length

wireSENSOR
- Measuring displacement, distance and position up to 50,000 mm
- Compact sensor housing combined with a large measuring range
- Ideal for difficult-to-access positions
- Easy, fast and flexible mounting
- Robust design, also for outdoors
- Excellent price/performance ratio
- Ideal for customized OEM series

Draw-wire sensors from Micro-Epsilon enable the measurement of long displacements with a small sensor size. Draw-wire displacement sensors measure the linear movement of a component using a wire made from highly flexible stainless steel strands, which is wound onto a drum by means of a long-life spring motor. The wire is attached directly to the measuring object and can also be guided over deflection pulleys to reach installation spaces that are difficult to access. The winding drum is axially coupled with a multi-turn potentiometer, an incremental encoder, or an absolute encoder.

Different sensor designs range from easy low-cost models to extremely robust designs for industrial applications. wireSENSOR models stand out due to their optimized ratio between measuring range and size, easy installation and handling. Their robust sensor design enables reliable measurements even in challenging ambient conditions.

Synchronization monitoring with draw-wire sensors in telescopic platforms
Measuring the deformation of rotor blades for wind turbines
Vibration monitoring of cranes
wireSENSOR MK30 / MK46 / MK77 / MK60 / MK88 / MK120
OEM miniature sensors with plastic housing

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>50</th>
<th>150</th>
<th>250</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1250</th>
<th>1500</th>
<th>2100</th>
<th>2300</th>
<th>2400</th>
<th>3000</th>
<th>3500</th>
<th>5000</th>
<th>7500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

wireSENSOR P60/P96/ P115
Industrial sensors with aluminum housing

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>100</th>
<th>150</th>
<th>300</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
<th>7500</th>
<th>10,000</th>
<th>15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

wireSENSOR K
OEM industrial sensors with plastic housing

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>1500</th>
<th>2500</th>
<th>3500</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideal for serial applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

wireSENSOR MT
Miniature draw-wire sensors with aluminum housing

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>40</th>
<th>80</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miniature sensor size</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

wireSENSOR P200
Long-range industrial sensors with aluminum housing

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>30,000</th>
<th>40,000</th>
<th>50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital outputs</td>
<td>HTL, TTL, SSI, PB, CO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WDS mechanics
Draw-wire sensor mechanics for encoder installation

<table>
<thead>
<tr>
<th>Measuring ranges (mm)</th>
<th>1,500</th>
<th>3,000</th>
<th>5,000</th>
<th>7,500</th>
<th>10,000</th>
<th>15,000</th>
<th>30,000</th>
<th>40,000</th>
<th>50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Plastics / aluminum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output types</td>
<td>depending on encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

wireSENSOR P60/P96/ P115
Industrial sensors with aluminum housing

wireSENSOR mechanics are designed in such a way that they ensure easy mounting of an incremental or absolute encoder. Therefore, the user can individually choose the interface, resolution and connection type. Due to the robust housing, the draw-wire mechanisms are ideal for industrial use.
2D/3D Laser profile sensors
with high accuracy and profile frequency

scanCONTROL

- Compact size with integrated evaluation: no external controller required
- High profile resolution for the detection of finest details
- High profile rate for dynamic measurement tasks
- Patented Blue Laser Technology
- Powerful software for parameterization and visualization
- SDKs for integration in individual software environments
- SMART design with integrated evaluation

Laser scanners from Micro-Epsilon are among the highest performing profile sensors with respect to accuracy and measuring rate. They detect, measure and evaluate profiles on different object surfaces without contact. The available models are suitable for numerous industrial applications. The integrated intelligence in their sensor head (scanCONTROL SMART) solves versatile measurement tasks. Models for the customer’s own programming are available for system integrators. scanCONTROL profile scanners do not require any external controller, which considerably simplifies the installation effort.

Equipped with powerful processors and highly sensitive optical components, these scanners ensure precise profile measurements on almost any type of surface. While they can be integrated in numerous environments, the laser scanners also impress with their compact design which includes an integrated controller.
### scanCONTROL 25xx
Laser scanner for serial applications

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range z-axis</td>
<td>up to 265 mm</td>
</tr>
<tr>
<td>Measuring range x-axis</td>
<td>up to 143.5 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>640 points/profile</td>
</tr>
<tr>
<td>Profile frequency</td>
<td>up to 2,000 Hz</td>
</tr>
</tbody>
</table>

### scanCONTROL 29xx
Laser scanner with high precision

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range z-axis</td>
<td>up to 265 mm</td>
</tr>
<tr>
<td>Measuring range x-axis</td>
<td>up to 143.5 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>1,280 points/profile</td>
</tr>
<tr>
<td>Profile frequency</td>
<td>up to 2,000 Hz</td>
</tr>
</tbody>
</table>

### scanCONTROL 30x2
Powerful 2D/3D laser scanners

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range z-axis</td>
<td>up to 300 mm</td>
</tr>
<tr>
<td>Measuring range x-axis</td>
<td>up to 290 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>1,024 points/profile</td>
</tr>
<tr>
<td>Profile frequency</td>
<td>up to 5,000 Hz</td>
</tr>
</tbody>
</table>

### scanCONTROL 30x0
High-performance laser scanner

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range z-axis</td>
<td>up to 300 mm</td>
</tr>
<tr>
<td>Measuring range x-axis</td>
<td>up to 290 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>2,048 points/profile</td>
</tr>
<tr>
<td>Profile frequency</td>
<td>up to 10,000 Hz</td>
</tr>
</tbody>
</table>

### scanCONTROL 3D-View
Can be used with all scanCONTROL sensors

- Offline or real-time display of 3D profiles
- 2D export of profile sequences (.png)
- 3D export (.asc, .stl) for CAD programs
- Intensity per point can be displayed and exported

### scanCONTROL Configuration Tools
- Configuration of different measuring programs by mouse click
- Dynamic tracking of evaluations in the profile
- Parameterizing outputs and displaying measured values
- Output of measured values across a large number of interfaces

### scanCONTROL Software integration
- Ethernet GigE Vision
- SDK for fast 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 & fiber optic sensors

**optoCONTROL**
- Various models for different applications
- Large working distance
- Compact designs with integrated controller
- High accuracy
- Large measuring ranges up to 95 mm
- Detection of edges, gaps, positions and diameters of round objects
- Inspection and detection of positions and presence

Optical micrometers are primarily used for production control and quality monitoring, and continuously measure both endless material and single parts. The technologies used are suitable for a wide range of applications. The compact optoCONTROL models are suitable for applications in production lines, as well as for integration in testing machines and automated production systems. The high measuring rates ensure a high and continuous cycle rate in the production process.

All optoCONTROL models work without rotating mirrors and are therefore completely wear-free. The parallel light curtain is created by special optics in the light source. High quality components in the receiving optics, e.g. filters and lenses, enable the high accuracy of the micrometers. This is why optoCONTROL micrometers are particularly suitable for fields where high precision and reliability are required.
optoCONTROL CLS-K  
Fiber optic sensors 

Applications:  
Edge detection  
Counting tasks  
Assembly control  
Gap recognition  
Scanning tasks in Ex areas  
Presence monitoring and position control  
Recognition of brightness and reflection

<table>
<thead>
<tr>
<th>optoCONTROL 1200</th>
<th>Compact high-speed micrometer (laser)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring ranges (mm)</td>
<td>2</td>
</tr>
<tr>
<td>Linearity</td>
<td>±40 µm (independent)</td>
</tr>
<tr>
<td>Resolution</td>
<td>10 µm</td>
</tr>
<tr>
<td>Frequency response</td>
<td>100 kHz</td>
</tr>
<tr>
<td>Integrated controller</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>optoCONTROL 1220</th>
<th>Optical inline micrometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (mm)</td>
<td>28</td>
</tr>
<tr>
<td>Linearity</td>
<td>±22 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>typ. 2 µm</td>
</tr>
<tr>
<td>Working distance</td>
<td>up to 2000 mm</td>
</tr>
<tr>
<td>Integrated controller</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>optoCONTROL 2500</th>
<th>High-resolution micrometer (laser)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (mm)</td>
<td>34</td>
</tr>
<tr>
<td>Linearity</td>
<td>±10 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 µm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2.3 kHz</td>
</tr>
<tr>
<td>External controller</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>optoCONTROL 2520</th>
<th>Compact laser micrometer (class 1M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (mm)</td>
<td>46</td>
</tr>
<tr>
<td>Linearity</td>
<td>±12 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 µm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2.5 kHz</td>
</tr>
<tr>
<td>Integrated controller (web interface)</td>
<td></td>
</tr>
</tbody>
</table>

| optoCONTROL 2520-46(090) and optoCONTROL 2520-95 (270) |  
| Micrometers offer a receiver equipped with a lens that is turned by 90°. The flat design of the receiver simplifies the installation process in restricted spaces. |

| optoCONTROL 2520-46(090) and optoCONTROL 2520-95 (270) |  
| Micrometers offer a receiver equipped with a lens that is turned by 90°. The flat design of the receiver simplifies the installation process in restricted spaces. |

| optoCONTROL 2520-46(090) and optoCONTROL 2520-95 (270) |  
| Micrometers offer a receiver equipped with a lens that is turned by 90°. The flat design of the receiver simplifies the installation process in restricted spaces. |

<table>
<thead>
<tr>
<th>optoCONTROL 2600</th>
<th>High-resolution micrometer (LED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (mm)</td>
<td>40</td>
</tr>
<tr>
<td>Linearity</td>
<td>±3 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 µm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2.3 kHz</td>
</tr>
<tr>
<td>External controller</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>optoCONTROL 2600</th>
<th>High-resolution micrometer (LED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range (mm)</td>
<td>40</td>
</tr>
<tr>
<td>Linearity</td>
<td>±3 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 µm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2.3 kHz</td>
</tr>
<tr>
<td>External controller</td>
<td></td>
</tr>
</tbody>
</table>
High precision 3D measurement & surface inspection

With the surfaceCONTROL, reflectCONTROL and scanCONTROL sensor systems, Micro-Epsilon presents a new generation of 3D sensors which are based on a common software platform. These 3D sensors are used for high-resolution geometry and surface measurements and detect the measuring object by scan or by single snapshot, allowing fast inspection of matt and glossy surfaces. In contrast to conventional 3D systems with 2.5D evaluation, Micro-Epsilon’s Valid3D technology enables a complete representation and precise evaluation of the 3D point cloud.

These 3D sensors are used, e.g., for geometric component testing, position determination, presence checks and the measurement of flatness or planarity. Thanks to their high performance, the sensors are used for inline applications, on robots and also for offline inspection.
**surfaceCONTROL 3D 3500**
3D sensor for the inspection of geometry, shape and surfaces
Highest precision in z up to < 0.4 µm
Complete 3D images from 0.2 s
Micrometer-accurate snapshots with large measuring fields

**surfaceCONTROL 3D 2500**
3D inspection of large format surfaces
Large measuring fields
Detecting surface shape defects
Detection and evaluation of 3D surface data within a few seconds

**reflectCONTROL SENSOR**
Complete inspection of reflecting and shiny surfaces
Highest z-accuracy < 1 µm
Detection and evaluation of 3D surface data within a few seconds

**reflectCONTROL Automotive**
Fully automatic surface inspection of painted car bodies
Ideal for large-surface and curved objects
Recognition of defects, inclusions, craters etc.

**scanCONTROL**
Precise laser line scanners for 3D point clouds
Red laser & patented Blue Laser Technology
Up to 2048 points per profile
Measuring rates up to 10,000 kHz
One design for all measuring ranges

**3DInspect software for 3D measurement tasks and inspection tasks**
3Dinspect is a user-friendly software tool for all 3D sensors from Micro-Epsilon. Parameter setting of the sensors and recording of the measurement data are done directly in the 3Dinspect software. The 3D point cloud generated in this way can be further processed and exported as desired. High compatibility to image processing environments is enabled via the GenICam standard.
Precise color sensors, color measuring systems & LED Analyzers

colorSENSOR / colorCONTROL

- Non-contact color measurement for industrial applications
- Precise and fast measurements even on poorly reflecting surfaces
- Numerous sensors for all tasks
- Measurement accuracies ΔE up to 0.08
- Measurement frequencies up to 30 kHz
- Intuitive operation and configuration
- Ethernet and RS232 process interfaces

Color sensors from Micro-Epsilon are used for precise color measurements and color recognition. The sensors measure color values, intensities and functions on different surfaces. As a result, they are used in a variety of applications and stand for high productivity and cost reduction in manufacturing, automation and quality assurance.

colorSENSOR and colorCONTROL sensors are used for numerous measurement tasks. In addition to print mark recognition or batch testing, the sensors are used for measurement tasks that cannot be solved with other measurement processes. For example, the sensors check the presence of transparent coatings or determine the orientation of bottles based on an embossing mark. The MFA LED Analyzer also checks the function, color and intensity of LEDs, lamps or light sources. Thanks to the high accuracy and measuring rate, the range of applications is extremely diverse and can be found in numerous industries.
colorSENSOR CFO
Precise True Color Sensors for industry and automation

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability</td>
<td>$\Delta E \leq 0.3$</td>
</tr>
<tr>
<td>Measurement speed</td>
<td>max. 30 kHz</td>
</tr>
<tr>
<td>Color memory</td>
<td>320 colors in 254 color groups</td>
</tr>
<tr>
<td>Numerous sensors for all surfaces</td>
<td></td>
</tr>
</tbody>
</table>

CFS sensors
with integrated optical glass fibers for adaptation to colorSENSOR CFO controller

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-40 ... 400 °C</td>
</tr>
<tr>
<td>Working distance</td>
<td>5 ... 320 mm</td>
</tr>
<tr>
<td>Measurement spot diameter</td>
<td>0.8 ... 70 mm</td>
</tr>
</tbody>
</table>

colorSENSOR OT-3-LD
Color sensors with fixed lens for large measurement distances

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatability</td>
<td>$\Delta E \leq 0.9$</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>max. 35 kHz</td>
</tr>
<tr>
<td>Color recognition from a large distance up to 900 m</td>
<td></td>
</tr>
</tbody>
</table>

colorCONTROL MFA
Color recognition of LEDs and self-luminous objects

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 495 measuring points</td>
<td></td>
</tr>
<tr>
<td>LED tests of function, color and intensity</td>
<td></td>
</tr>
<tr>
<td>Color inspection in HSI and RGB color spaces</td>
<td></td>
</tr>
</tbody>
</table>

colorCONTROL ACS7000
Inline color measuring system for non-contact color measurements

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement geometries</td>
<td>Transmission sensor, circular sensor, 30°/0° sensor</td>
</tr>
<tr>
<td>Repeatability</td>
<td>$\Delta E \leq 0.08$</td>
</tr>
<tr>
<td>Spectral measuring range</td>
<td>390 ... 780 nm</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2 kHz</td>
</tr>
<tr>
<td>Color recognition from a taught reference list</td>
<td></td>
</tr>
</tbody>
</table>

Inline color measurement of plastic injection-molded parts directly after demolding

Inline color gradient measurement of transparent film and acrylic glasses

Color measurement of continuous strip coating such as aluminum, zinc and paper during production
Non-contact infrared pyrometers
for industrial measurement tasks

thermoMETER

- Infrared pyrometer for non-contact temperature measurement
- Temperature ranges from -50 °C to 3000 °C
- Compact design for non-contact temperature measurement without influencing the object
- Monitoring of hot, fast moving or difficult-to-access objects
- Robust, wear-free and reliable

Infrared pyrometers from Micro-Epsilon determine the object temperature without contact based on the infrared radiation emitted by the object. The thermoMETER series opens up numerous possibilities for measuring and displaying temperature curves in industrial fields of application. As this measurement is a non-contact technology, the pyrometers perform wear-free and can therefore be reliably used over long periods of time. Selectable models and optical systems enable the cameras to be installed in different distances from the surface. This allows for the target to be measured from a safe distance in critical areas of use.

Pioneering infrared technology for industrial applications

thermoMETER pyrometers combine high accuracy with measurements in ambient temperatures of up to 250 °C without cooling. New infrared sensor elements with small dimensions and high sensitivity enable outstanding sensor characteristics with high measurement accuracy and short response time. Temperature sensors are mainly used in machine building, research and development, maintenance and process monitoring.
thermoMETER CS / CSmicro / CSLaser
Compact, miniature and low cost
Temperature ranges from -40 °C to 1600 °C
Robust, silicon-coated lens
Integrated controller
Scalable analog output: 0 - 10V / 0 - 5V
Ideal for OEM, also available as two-wire version and high-resolution models

thermoMETER CTRatioM1/M2
Glass fiber ratio thermometer
Temperature ranges from 250 °C to 3000 °C
Ambient temperatures up to 200 °C without cooling
Insensitive to disturbances such as smoke, fog and partially concealed or moving objects
Extremely short response time of 1 ms

thermoMETER CTLaser / CTLaserFAST
Precise pyrometer with laser sighting
Temperature ranges from -50 °C to 975 °C
Infrared sensor heads with optical resolution up to 75:1, from a measurement spot of 0.9 mm
Double laser marks the exact spot location from a spot size of 1 mm
Response time from 9 ms

thermoMETER CTLaser M1/M2/M3
Version for metal production with reduced wavelength: 50 °C to 2200 °C
thermoMETER CTLaser M5 (525 nm)
for liquid metals: 1000 °C to 2000 °C
thermoMETER CTLaserGLASS
for measurement of glass: 100 °C to 1650 °C
thermoMETER CTLaserCOMBUSTION
for measurement of flames: 200 °C to 1450 °C

thermoMETER CT / Cfast
Extremely low cost and high accuracy
Temperature ranges from -50 °C to 975 °C
Short response times from 3 ms
Up to 180 °C ambient temperature without cooling
thermoMETER CTP7 / CTP3
for thin plastic films from 0 to 500 °C

thermoMETER CTM1/M2/M3
Version for metal production, temperature ranges from 50 °C to 2200 °C
thermoMETER CTM4
Fast measurement of metals and non-metals due to large, short-wave spectral range
thermoMETER CThot
for difficult ambient conditions up to 250 °C ambient temperature without cooling
thermoMETER CTM-3XL
for laser welding processes from 100 °C to 1800 °C

thermoMETER CT Video/CS Video
Infrared temperature sensors with crosshair laser sighting and video module
Temperature ranges from 50 °C to 2200 °C
Parallel use of video module and crosshair laser sighting for measuring field adjustment
Measurement of hot metals, ceramics and composite materials
Automatic snapshot feature for process monitoring and documentation

thermoMETER TIM 8
Intelligent spotfinder pyrometer
Temperature ranges from -20 °C to 900 °C
Robust and compact pyrometer with motorized focus
Excellent optical resolution
Autonomous operation with automatic spotfinder and direct analog output
For temperature measurements in machine building and in automation

License-free evaluation software
Sensors with digital interfaces include the license-free compactCONNECT software for easy parameter set up, analysis and documentation purposes of measured temperature values.
Compact thermal imaging cameras for industrial measurement tasks

thermoIMAGER

- Compact thermal imaging cameras for non-contact temperature measurement without affecting the object
- Temperature range from -20 °C to 2450 °C
- Monitoring of hot, fast moving or difficult-to-access objects
- Fast recognition of temperature deviations in power distribution systems, machines and production processes
- Powerful software included in delivery
- Software Developer Kit with examples, C, C++, C# included

thermoIMAGER infrared cameras are designed for industrial use. The cameras impress with their compact design and favorable price/performance ratio. They are available with different wavelengths optimized for different industries. Data is streamed in real time from the camera to the software via a USB interface. The powerful process and analysis software is included and enables the acquisition of thermal images at up to 128 Hz. The data can be stored in an image or video file and viewed and analyzed offline without a camera at a later time. In addition, the software can be used as a runtime application where the user is able to program and configure a custom environment (e.g. multiple monitoring windows, alarms, hot spot localization, line profiles). Advanced interface concepts enable integration into networks and automated systems.
**thermoIMAGER TIM QVGA-G7/VGA-G7**
Thermal imaging camera for the glass industry
- Frame rate up to 125 Hz
- Excellent thermal sensitivity (NETD) of 0.13 K
- Line scan feature
- Ambient temperature up to 70 °C without additional cooling housing, up to 315 °C with cooling housing

**thermoIMAGER TIM QVGA/QVGA-HD**
Detector with 382 x 288 pixels
- Temperature ranges:
  - -20 °C to 900 °C (special variant 1500 °C)
- Excellent thermal sensitivity (NETD) of up to 0.04 K
- Exchangeable lenses & industrial accessories
- Image recording in real time at 80 Hz
- Analog input and output, trigger interface

**thermoIMAGER TIM 160S**
Temperature ranges:
- -20 °C to 900 °C (special variant 1500 °C)
- Excellent thermal sensitivity (NETD) of 0.08 K
- Exchangeable lenses 12°/30°/55°/80° FOV
- Real-time thermography with 120 Hz frame rate via USB 2.0 interface
- Extremely lightweight (195 g) and robust (IP67)
- Extremely compact, 45 x 45 x 62 - 77 mm
- Analog input and output, trigger interface

**thermoIMAGER TIM 40**
Compact OEM thermal imaging camera
- Optical resolution: 382 x 288 pixels
- Temperature ranges: -20 °C to 900 °C (special variant 1500 °C)
- Excellent thermal sensitivity (NETD) of 0.075 K
- Radiometric video recording with 32 Hz
- Analog input and output, trigger interface

**thermoIMAGER TIM QVGA**
Detector with 382 x 288 pixels
- Temperature ranges:
  - -20 °C to 900 °C (special variant 1500 °C)
- Excellent thermal sensitivity (NETD) of 0.13 K
- Exchangeable lenses & industrial accessories
- Image recording in real time at 80 Hz
- Analog input and output, trigger interface

**thermoIMAGER TIM 640 VGA**
Thermography with VGA resolution
- 640 x 480 pixels
- Temperature ranges: -20 °C to 900 °C (special variant 1500 °C)
- Excellent thermal sensitivity (NETD) of 0.075 K
- Radiometric video recording with 32 Hz
- Analog input and output, trigger interface

**thermoIMAGER Microscope lens**
Thermal imager with microscope lens
- Measuring ranges:
  - -20 °C to 100 °C / 0 °C to 250 °C / 150 °C to 900 °C
- Excellent thermal sensitivity (NETD) 90 mK or 120 mK
- Optical resolution: 382x288 or 640x480 pixels
- Smallest spot size: 42 µm / 28 µm
- Spectral range: 7.5 to 13 µm

**thermoIMAGER NetPCQ**
Embedded, industrial PC solution with passive cooling for thermoIMAGER applications
- Supports all thermoIMAGER TIM models
- Integrated watchdog feature

**thermoIMAGER NetPCQ**
Embedded, industrial PC solution with passive cooling for thermoIMAGER applications
- Supports all thermoIMAGER TIM models
- Integrated watchdog feature

**Cooling Jacket Advanced**
Universal cooling housing up to 315 °C
- Ambient temperatures up to 315 °C
- Air/water cooling with integrated air purging and optional protective windows
- Modular concept for easy fitting of different cameras and lenses
As well as standard sensors based on various measuring principles, Micro-Epsilon has developed numerous sensors for special applications, which go beyond pure displacement and position measurements.

These application-specific sensors were developed for special measurement tasks and have proven themselves there many times. These developments incorporate the many years of know-how that Micro-Epsilon has accumulated in the design and application of sensor technology. High performance, precision and reliability at cost-effective OEM conditions are the main focus.
### DZ140
Sensor for rotational speed measurement during driving operations and tests
- Optimized for modern, thin blades made from aluminum or titanium
- Speed range from 200 to 400,000 rpm
- Wide operating temperature range
- Large distance between sensor & blade
- No rotor modification required

### SGS Spindle Growth System
Sensor system developed for measuring the thermal extension of milling spindles
- Measuring range 500 µm
- Resolution 0.5 µm
- High temperature range

### idiamCONTROL
Non-contact inspection of extruder bores
- Non-contact and wear-free measurement technique for all metals without calibration
- Exact, non-destructive inspection

### combiSENSOR
One-side thickness measurement of plastic films and coated metals (battery film)
- Thickness of the target 40 µm to max. 6 mm
- Working distance 2 to 10 mm
- Resolution 0.0018 % FSO
- Frequency response 1 kHz (-3dB)

### capaNCDT MD6-22
Mobile handheld gauge for precise, capacitive gap measurements
- Gap max. 12 mm
- Linearity $\leq 0.2\%$ FSO
- Resolution 0.02 % FSO
- Frequency response 100 Hz (-3dB)

### capaNCDT CST6110
Capacitive rotation speed measuring system for industrial counting tasks
- Material independent rotation speed measurement from 1 ... 400,000 rpm
- Easy integration due to compact sensor size
- Ideal for industrial environments with electromagnetic radiation

### FSC1/7 / FSC1000 / ISC1000
Measuring device for the detection of coating thickness on CFRP and other substrates
- Quick & easy coating thickness measurement
- Non-destructive principle - no influence on coating or substrate
- No coupling medium required
- Configurable, dynamic tilt prevention
- Qualified by renowned aircraft manufacturers
Measuring and testing systems from Micro-Epsilon combine sensors, software and mechanics in an integrated overall solution. The systems are used for process monitoring and quality assurance in the production line and impress with high precision and ease of integration. The sensor and software modules used originate from the Micro-Epsilon group, enabling optimum and efficient component matching.

These measuring and inspection systems are integrated into existing or newly designed production lines to carry out fully automatic applications such as thickness measurements, surface inspections and parts classification. The systems are used, for example, in metal rolling mills, battery production, the plastics industry, and in the manufacture of tires and technical rubber.

The appropriate measurement concept depends on the measurement task. In addition to laser, eddy current, profile and capacitive sensors, micrometers and special combination sensors are used. The latter are free of X-rays or isotope radiation and provide highly accurate readings. Signal processing and output can be arranged to suit the application requirements. The measuring systems communicate with existing environments via various interfaces and can therefore also be retrofitted into existing production lines.
thicknesGAUGE
Sensor system for precise inline thickness measurements
For many types of surfaces / materials due to different sensor technologies
Traversing sensors on linear axis
Fully automatic calibration

thicknesGAUGE.laser
Sensor technology used:
Laser triangulation displacement sensors

thicknesGAUGE.confocal
Sensor technology used:
Confocal chromatic displacement sensors

thicknesGAUGE.laser profile
Sensor technology used:
Blue Laser profile sensors

Systems for the preparation area in the rubber and tire production
Profiometer
Color code
Measuring length

Final finishing systems in the rubber and tire production
Tire geometry
Tire marking
Tire identity

Systems for the plastics inspection
C-frames for thickness measurement of flat film
O-frame systems for profile thickness measurement
Reverse-frame systems for the profile measurement of blown films

C-frame for metal thickness measurement
For high speed measurements
Laser point or innovative laser line
All alloys without calibration

Powerful C-frames for harsh environments
Various measuring ranges
Proven protection and cleaning concepts
Several C-frames with only one IPC

O-frame systems for the metals industry
Most modern thickness profile measurement
Without isotopes and X-rays
Measurement independent from strip movement, tilt, surface type and alloys