



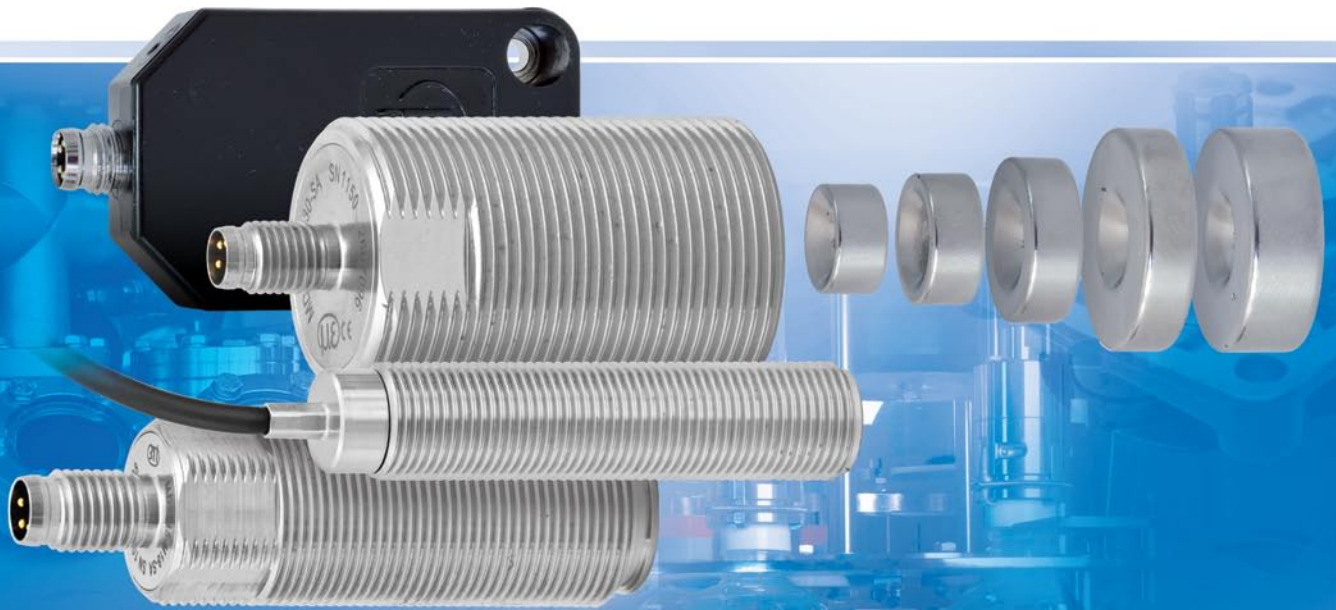
# More Precision

main**SENSOR**

Magneto-inductive displacement sensor



## Magneto-inductive sensors for non-contact linear displacement measurement



### Measuring principle

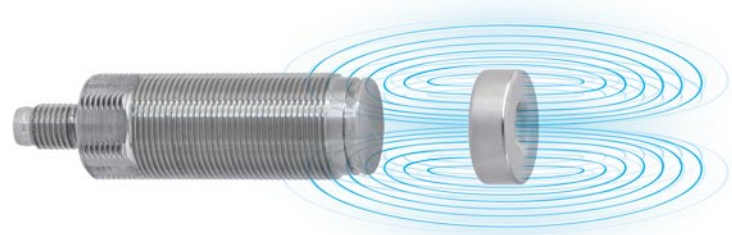
mainSENSOR is based on an innovative measuring principle, which has been developed by Micro-Epsilon in order to combine the advantages of both inductive and magnetic sensors. For the measuring, the magnet is fixed to the measuring object. The movement of the magnet results in a change of the magnetic flux within the sensor element, which is detected by a sensor coil. Due to countervailing physical effects in the sensor, a linear relationship between the displacement and output signal is achieved. As different strength magnets are applied, measuring ranges of up to 55mm can be realized. However, for changing measurement set up, it is only necessary to change the magnet. As well as distance and displacement measurement, the sensor can be used for rotational speed measurements of axes or toothed racks.

### Flexible sensor concept

Due to their flexible concept, the sensors are ideal for a wide range of applications, particularly where high volumes are required. The standard sensors are designed in a stainless steel M12, M18 and M30 or a flat plastic housing suitable for industrial applications. The integrated evaluation electronics is situated on a compact PCB. In high volume production, customer-specific modifications to the PCB and sensor housing can be easily implemented.

### No calibration required

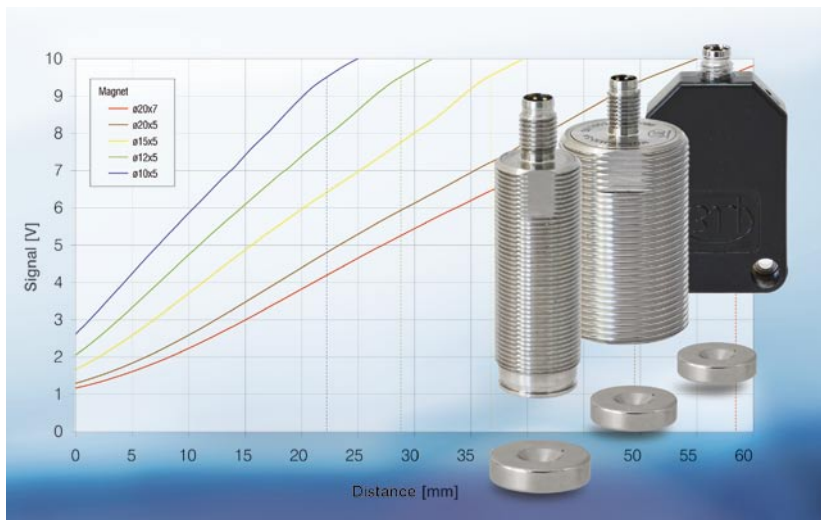
Due to the automatic linearisation of the sensor, no calibration is required. This offers a decisive benefit when installing multiple sensors. Before starting the operation, a zero point has to be set by positioning the sensor and the magnet.



### Benefits of the measuring principle

- Selectable measuring ranges up to 55mm
- Linear output signal
- High basic sensitivity and temperature stability
- Completely non-contact
- Wear-free
- High dynamics

## Simple change of the measuring range by exchanging the magnet



## Robust sensor design:

- Stainless steel housing, insensitive to dirt, dust, oil etc.
- Protection class up to IP67
- Pressure resistant
- Suitable for use in food processing



## Mounting options

Micro-Epsilon's magneto-inductive sensors can be applied in many different applications. In the case of non-ferromagnetic objects, the sensor can either be flush mounted to the sensor, or protruding without any effects on the measurements. The magnet is mounted to the measurement object using a stainless steel screw, which is supplied with the sensor.

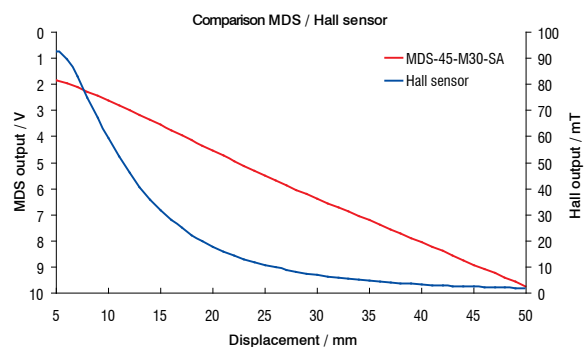
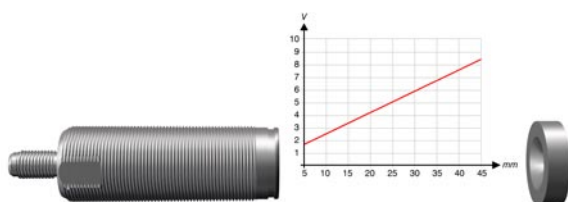


## Advantages over inductive sensors

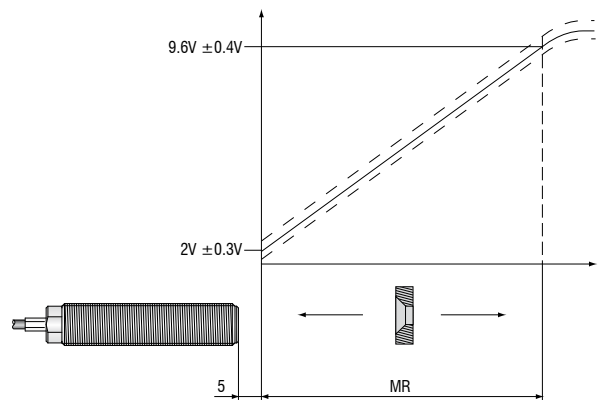
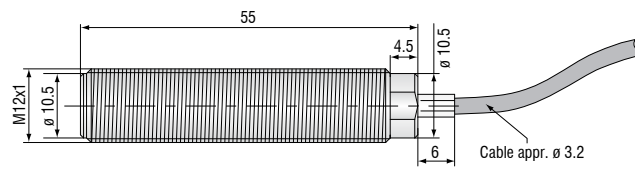
- Constant high sensitivity, even at the end of measuring range
- High protection class (fully metal housing)
- Compact design for large measuring ranges (e.g. M18 at 55mm measuring range)
- Flush mounting in non-magnetic materials
- Measurements on electrically conductive and non-magnetic materials (stainless steel, aluminium...)

## Advantages over magnetic sensor based on Hall Effect components

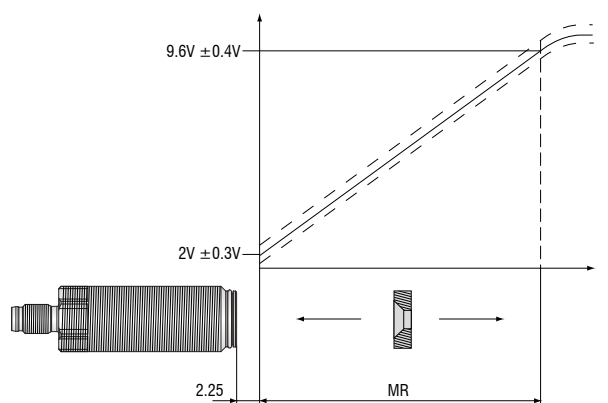
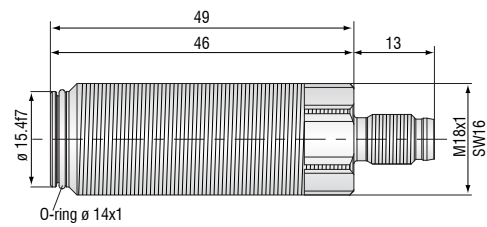
- Significantly longer measuring range
- Permanent output signal that is linear to the distance due to the measuring principle
- Significant advantages with regard to price for large measuring ranges
- Signal stability when magnet is not centered



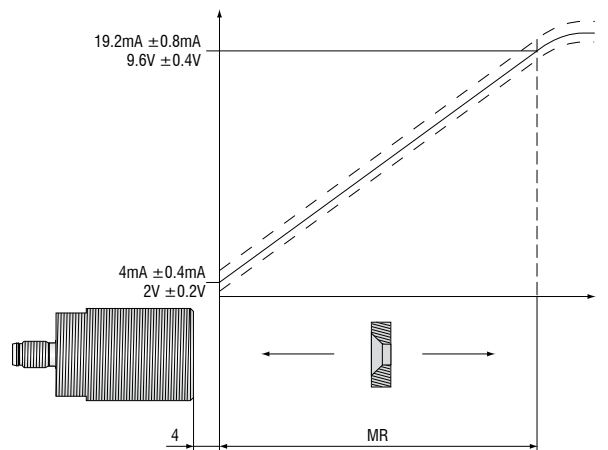
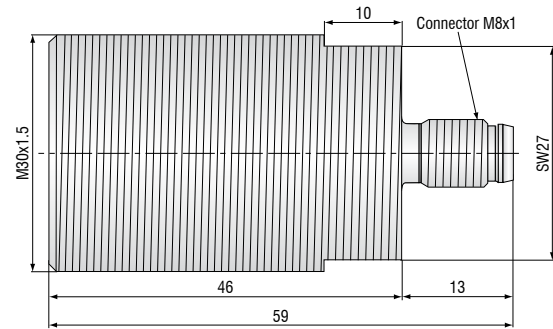
### MDS-45-M12-CA



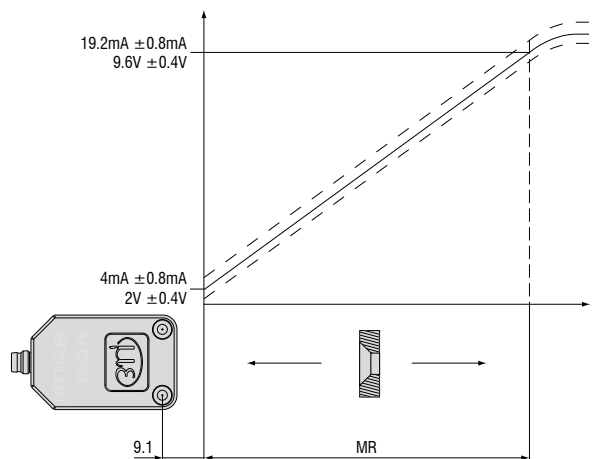
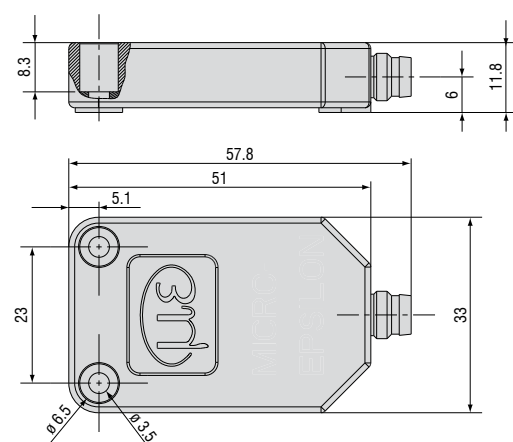
### MDS-45-M18-SA / MDS-45-M18-HP-SA



### MDS-45-M30-SA



### MDS-45-K-SA



Model	MDS-45-M12-CA <sup>3)</sup>	MDS-45-M18-SA	MDS-45-M18-HP-SA	MDS-45-M30-SA	MDS-45-K-SA
Measuring range (standard)	45mm (further measuring ranges see accessories)				
Offset distance	5mm	2.25mm		4mm	appr. 4mm
Linearity <sup>1)</sup>	< ±3% FSO				
Temperature stability	±0.025% FSO/K				
Resolution <sup>2)</sup>	<0.05% FSO				
Frequency response (-3dB)	1000Hz				
Electrical connection	integr. cable 3m	M8x1, 4 pin, connector (screw and snap-on)			
Voltage	2V ±0.3V ...9.6V ±0.4V		2V ±0.2V ...9.6V ±0.4V		2V ±0.4V ...9.6V ±0.4V
Output	load (11.5V supply) ≥30KΩ load (24V supply) ≥10KΩ				
Current	-		4mA ±0.4mA ... 19.2mA ±0.8mA		4 mA ±0.8 mA ... 19.2mA ±0.8mA
	resistance (11.5V supply) ≤400Ω resistance (24V supply) ≤ 800Ω				
Storage temperature	-20°C ... +80°C				
Operating temperature	-20°C ... +80°C				
Power supply	11.5V <sub>DC</sub> ... 30V <sub>DC</sub>				
Current consumption	max. 20mA		max. 20mA (with voltage output); max. 40mA (with current output)		
Protection class	IP67 when plugged				
Pressure resistance (static)	on request	100 bar (at the front)	400 bar (at the front)	40 bar (at the front)	-
Vibration	DIN EN 60068-2-6 (20g, 58 - 500Hz)				
Shock	DIN EN 60068-2-29 (40g, 6ms, 1000 cycles) DIN EN 60068-2-27 (100g, 6ms, 3 cycles)				
EMC	EN 61326-1:2006; EN 61326-2-3:2007				-
Housing material	Stainless steel				Plastics / nickel plated brass
Weight (excluding screw nuts)	appr. 60g	appr. 40g		appr. 110g	appr. 25g

FSO = Full Scale Output

External magnetic fields and/or ferromagnetic material in the measuring range of the sensor system affect the sensor characteristic line and the measuring range.

<sup>1)</sup> Deviation to the regression curve according to the method of the least squares

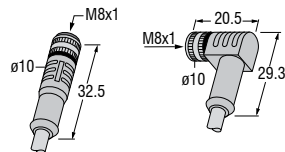
<sup>2)</sup> Peak-Peak; external low pass; frequency response 5kHz

<sup>3)</sup> Available from August 2012; subject to change without notice

## Accessories

### Power and output cable for fully metal sensors

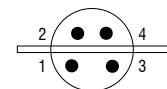
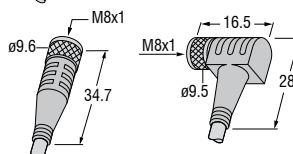
PC5/4 (5m, shielded, straight connector)	Art.No. 2901617
PC5/4/90 (5m, shielded, 90° connector)	Art.No. 2901600



**Pin assignment**  
View connector side

### Power and output cable for sensors made from plastics

PC5/4(01) (5m, unshielded, straight connector)	Art.No. 2901599
PC5/4/90(01) (5m, unshielded, 90° connector)	Art.No. 2901600.01



### Magnets for adapting the measuring range

(nickel-plated surface, mounting using a countersunk head screw M4, non-magnetisable, application temperature max. 80°C, higher temperatures on request)

Art.No.	Meas. Range	Dimensions.	A	B	C
2969002	55mm <sup>*)</sup>		20	4	7
2969001 (included)	45mm		20	4	5
2969003	35mm <sup>*)</sup>		15	4.3	5
2969004	27mm <sup>*)</sup>		12	4.3	5
2969005	20mm <sup>*)</sup>		10	4.3	5

<sup>\*)</sup> By exchanging the magnet the output characteristic line changes (pitch and zero point)

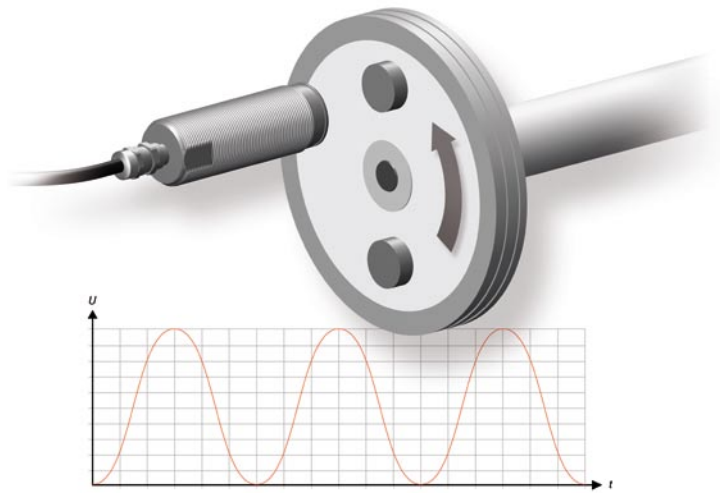
Pin	Function	Colour	Description
1	V <sub>cc</sub>	brown	Power supply 11.5V...30V
2*	I <sub>out</sub>	white	Output signal 4 mA...20 mA
3	GND	blue	Ground
4	U <sub>out</sub>	black	Output signal 2V...10V
Shield			Please connect the shield to the ground

\* Pin only used for sensors with current output



### Measuring through non-ferromagnetic materials

Unlike conventional measuring methods, the magneto-inductive sensors enable measurements through non-ferromagnetic materials such as aluminium or stainless steel. A clear benefit is provided here as the sensor and the magnet can be installed separately in applications with closed systems or housings. It is therefore possible to mount the magnet safely in harsh environments and the sensor in protected areas.

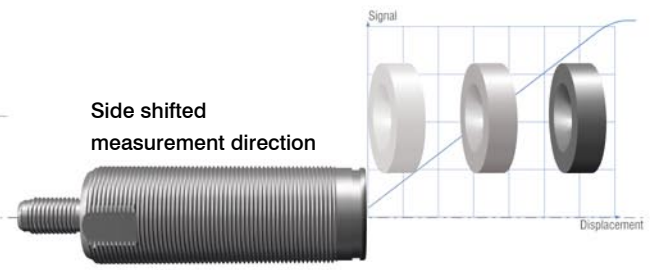
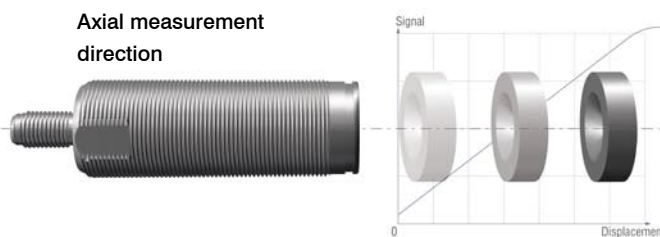


### Rotational speed measurement

As well as distance and displacement measurement, mainSENSOR is also used for rotational speed measurement. In order to do so, one or two magnets are mounted on the rotating measuring object. Regardless of the direction of rotation, the sensor measures the speed of the target object. In the case of customer-specific solutions, the direction of rotation itself can also be detected. Therefore, two sensor components that detect and evaluate the direction of rotation increase are installed.

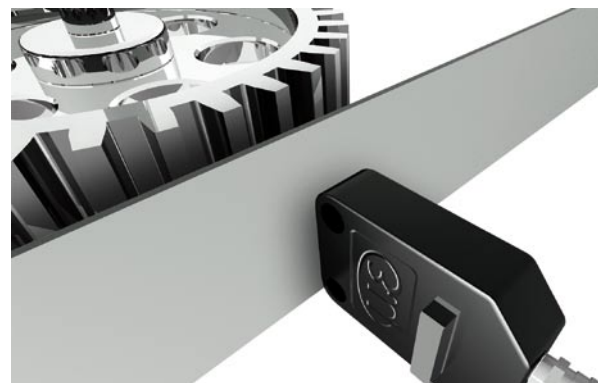
### Axial and side shifted distance and displacement measurement

mainSENSOR detects the position of a magnet, which is fixed to the measurement object. The magnet can be applied to the sensor either axially or side on. Especially in the case of limited installation spaces, side shifted measurement offers a space-saving alternative.



### Customer-specific versions for rotational speed measurement with pre-tensioned sensors

For rotational speed measurements of ferromagnetic objects such as toothed racks, the sensor can be pre-tensioned. This means that the magnet is integrated to the housing. For this customer-specific solution a factory calibration is required. The movement of the toothed racks affects the magnetic field, which is required for the speed measurement. The speed measurement can also be carried out through non-ferromagnetic materials.



Pre-tensioned sensor for speed measurement of toothed racks

## Sensors for customer-specific requirements

Sensors can be adapted in many different ways to suit customer-specific applications. Particularly in the case of high volume orders, customised sensors can be produced efficiently, which results in considerable cost reductions.

The compact PCB which contains the sensor element and the evaluation electronics, is responsible for the signal preparation, signal evaluation and signal output. Furthermore, the PCB is adapted to customer-specific requirements. This means that the measurement mode (distance or speed measurement) and the accuracy requirements, as well as the required cut-off frequency, can be selected. In addition, the interfaces offer numerous connectivity options. There are several outputs such as current, voltage, PWM and further digital outputs.

The design of the housing, the material and the protection class can be adapted to the specific requirements. In cases where space is limited, the side shifted measurement offers a space-saving alternative. For harsh environments, the sensor is designed with a fully sealed stainless steel housing that withstands high pressure, dirt, aggressive chemicals (acids) and solvents.

## Overview of customer-specific solutions

- High cost efficiency in the case of high-volume production
- Ideal for miniature applications
- Flexible design (sensor on PCB)
- Quasi side shifted measurement (dampers arrangement)
- Output signal (current, voltage, PWM...)
- Increased pressure resistance
- Cut-off frequency up to 20kHz



The PCB can be easily integrated and modified for customer-specific solutions – even in limited spaces.

Example for OEM model	* MDS-40-OEM
Measuring range <sup>1)</sup>	40mm
Linearity <sup>2)</sup>	±6% FSO
Temperature stability	±0.06% FSO/K
Resolution	<0.05% FSO
Output parameter	Measuring signal H-L / PWM Frequency 370Hz to 580Hz (other frequency on request)
Operating temperature	-20°C ... +85°C
Power supply <sup>3)</sup>	3,6V <sub>DC</sub> ... 5,3V <sub>DC</sub>
Current consumption <sup>4)</sup>	typ. 14mA (at 5V) 10mA (at 3.6V)
Electrical connection	connector mounted direct to PCB; grid 2.5;
Minimum unit quantity	5,000 pcs

FSO = Full Scale Output

<sup>1)</sup> Measuring range depends on the magnet used.

<sup>2)</sup> Deviation to straight line according to least maximal deviation.

<sup>3)</sup> Without inverse-polarity and electrical surge protection

<sup>4)</sup> Without output load

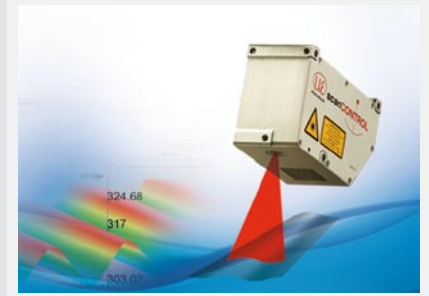
## High performance sensors made by Micro-Epsilon



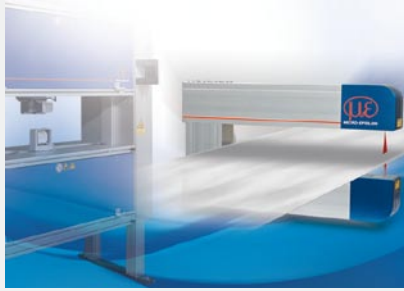
Sensors and systems for displacement and position



Sensors and measurement devices for non-contact temperature measurement



2D/3D profile sensors (laser scanner)



Measurement and inspection systems for quality assurance



Optical micrometers, fiber optic sensors and optical fibers



Color recognition sensors, LED analyzers and color online spectrometer