More Precision

capaNCDT // Capacitive displacement sensors and systems
In its sensor housing, the combiSENSOR combines an eddy current displacement sensor and a capacitive displacement sensor. This unique sensor concept enables one-sided thickness measurement of electrically non-conductive materials on metallic objects. Its field of application is the absolute thickness measurement of plastic film or of plastic coating on metal plates. Connected to the sensor via a cable, the controller processes and calculates the signals in order to put them out via interfaces. Calculation of the two sensor signals provides compensation of mechanical changes such as thermal expansion, deflections or eccentricity in the measurement device. Due to the redundancy of this combined sensor principle, the measured thickness value remains unaffected by any changes in the measurement setup. Due to the high temperature stability, the combiSENSOR provides high measurement accuracy even with fluctuating temperatures.

**Fields of application**
- Non-contact thickness measurement of plastic films
- Non-contact thickness measurement of coated metals
- Measurement of the applied adhesive
- Lateral profile due to a traversing axis

**Measuring principle**
The construction of the eddy current measurement coil and the capacitive measurement electrodes is concentric. Both sensors measure against the same spot. The signal of the capacitive displacement sensor is a function of the working distance, the thickness of the insulator (\(D\)) and the dielectric constant of the insulator material (\(\varepsilon_r\)). At the same time the eddy current displacement sensor measures the distance to the ground electrode (e.g. metal sheet or metal roller positioned behind the film). The controller outputs both single signals as well as the difference between capacitive sensor and eddy current sensor. Also the dielectric constant can be calculated with known thickness and working distance.

**Calculation of the dielectric constant:**
If the thickness of the Insulator \(D\) and the working distance from the ground electrode are known, the controller calculates the dielectric constant of the insulator.

**Thickness measurement:**
If the dielectric constant \(\varepsilon_r\) and the working distance from the ground electrode are known, the controller calculates the insulator thickness \(D\) from the sensor signals.

**Web interface**
The web interface for sensor and controller configuration opens via Ethernet.
One-sided thickness measurement in one axis
- Integrated temperature measurement
- Special plug for fast sensor connection

Controller KSS6420 KSS6430 KSS6420(01) KSS6430(01)

- Sensor KSH5(01) KSH10
- Target thickness (insulator thickness) 1) 40 µm ... 3 mm 40 µm ... 6 mm
- Working distance 2 mm ... 5 mm 4 mm ... 10 mm
- Min. diameter measurement surface 45 mm 65 mm
- Resolution 2)
  static, 100 Hz 0.0018 % FSO 0.0004 % FSO 0.0030 % FSO 0.0006 % FSO
  dynamic, 3.9 kHz 0.0075 % FSO 0.0015 % FSO 0.0120 % FSO 0.0025 % FSO
- Bandwidth analog: 1 kHz (3 dB) 3), digital: 2.6 ... 3900 Sa/s (adjustable)
- Linearity ≤ 0.05 % FSO
- Temperature stability
  Sensor (+10 ... +50 °C) ± 50 ppm
  Controller (+10 ... +50 °C) ± 50 ppm
- Temperature range
  Operation controller: +10 ... +60 °C; sensor: -10 ... +85 °C; sensor cable: -10 ... +125 °C
  Storage sensor, cable: -10 ... +100 °C; controller: 0 ... +75 °C
- Supply 12 ... 36 VDC (5.5 W)
- Output Analog capacitive, eddy current and differential signal: 0 ... 10 V (short circuit proof); internal sensor temperature signal (not scaled)
  Ethernet capacitive, eddy current, differential and internal temperature signal: 24 Bit
  EtherCAT capacitive, eddy current, differential and internal temperature signal: float
- Trigger TTL, 5 V
- Target geometry straight surface or min. diameter 200 mm 4)
- Protection class sensor: IP54, controller: IP40
- Weight sensor: 80 g; controller: 750 g

FSO = Full Scale Output
1) Insulator thickness below 40 µm on request
2) Difference signal of the digital output, measured with working distance = 50 % FSO
3) only valid when sampling rate = 3900 Sa/s
4) Reference material ground electrode: VA steel (1.4571) or aluminum. Changes of the ground electrode (material or geometry) require a recalibration of sensor and controller by the manufacturer.

Scope of supply:
- KSH sensor
- Sensor cable 1m
- Controller
- PC6200 3/4 supply and trigger cable (3m)

Accessories:
- SCAC3/5 signal output cable analog (3m)
Accessories

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Cable with connector type C

<table>
<thead>
<tr>
<th>Design</th>
<th>for sensors CS005 / CS02 / CS05 / CSE05 / CS08 / CSE1</th>
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</thead>
<tbody>
<tr>
<td>Model</td>
<td>Cable CCx / CCx/90</td>
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<tr>
<td>Standard 1 m</td>
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<tr>
<td>1.4 m</td>
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<td>3 m</td>
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<td>4 m</td>
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<td>4.2 m</td>
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<td>6 m</td>
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<td>8 m</td>
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Sensor cable with connector type C

- Low-outgassing cable up to 4 m length, for applications in clean rooms
- Low-outgassing cable up to 4.2 m length, for applications in clean rooms, UHV and EUV
- Robust cable up to 8 m length, for industrial applications

Bending radius: 3x cable diameter during installation; 7x cable diameter for movement; 12x cable diameter recommend at continuous movement

Connector types: C and C/90

Cable with connector type B

<table>
<thead>
<tr>
<th>Design</th>
<th>for sensors CS1 / CS1HP / CSE1.25 / CS2 / CSE2 / CS3 / CSE3 / CS5 / CS10</th>
</tr>
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<tbody>
<tr>
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Sensor cable with connector type B

- Connector types: B and B/90

Connector types: C and B/90

Accessories

- MC2.5 Micrometer for sensor calibration, range 0 - 2.5 mm, Resolution 0.1 µm. Suitable for sensors CS005 to CS2
- MC25D Digital micrometer for sensor calibration, range 0 - 25 mm, adjustable offset (zero). Suitable for all sensors.
- HV/B Vacuum feed through triaxial
- UHV/B Vacuum feed through triaxial for ultra-high vacuum
- PC6200-3/4 Power/trigger cable, 4 pin, 3 m
- SCAC3/4 Signal output cable, (necessary for multi-channel applications), 4 pin, 3 m
- SCAC3/5 Signal output cable, analog, 5 pin, 3 m
- SC6000-1.0 Synchronization cable, 5 pin, 1 m
- CA5 Preamplifier cable 5 pin, 5 m
- PS2020 Power supply for DIN rail mounting; Input 230 VAC (115 VAC); Output 24 VDC / 2.5 A; L/W/H 120x120x40 mm
Max. leak rate 1x10^{-7} \text{ mbar} \cdot \text{l s}^{-1}, compatible with connector type B

**UHV/B Vacuum feed through** (Art.-no. 0323050)

Max. leak rate 1x10^{-9} \text{ mbar} \cdot \text{l s}^{-1}, compatible with connector type B

**UHV/B Vacuum feed triax weldable** (Art.-no. 0323346)

Max. leak rate 1x10^{-9} \text{ mbar} \cdot \text{l s}^{-1}, compatible with connector type B

**UHV/B Vacuum feed triax screwable** (Art.-no. 0323370)

Max. leak rate 1x10^{-9} \text{ mbar} \cdot \text{l s}^{-1}, compatible with connector type B

**UHV/B Vacuum feed triax with flange CF16** (Art.-no. 0323349)

**SCAC3/4 Signal output cable** (Art.-no. 2902104)

**SCAC3/5 Signal output cable** (Art.-no. 2902112)

**PC6200-3/4 Power-/trigger cable** (Art.-no. 2901881)

**SC6000-1,0 Synchronization cable** (Art.-no. 2903473)

**CAS Preamplifier cable** (Art.-no. 2903180)
Sensors and Systems from Micro-Epsilon

- Sensors and systems for displacement, distance and position
- Sensors and measurement devices for non-contact temperature measurement
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- Optical micrometers and fiber optics, measuring and test amplifiers
- Color recognition sensors, LED analyzers and inline color spectrometers
- 3D measurement technology for dimensional testing and surface inspection