More Precision

eddyNCDT // Inductive sensors based on eddy currents
The eddyNCDT 3300 eddy current measuring system is considered one of the most powerful displacement measuring systems in the world. Due to a mature technical design, the system offers numerous benefits to customers in multiple application areas such as manufacturing automation, machine monitoring and quality control.

Multifunctional controller
The eddyNCDT 3300 controllers are equipped with high performance processors for reliable signal processing and further processing. The three-point linearization feature enables almost fully automatic linearization, which provides high accuracies for any metallic target and installation environment. The operation is supported by a dialog-aided graphical display.

Linearization and calibration
eddyNCDT 3300 systems can be individually linearized and calibrated by the user. Therefore, optimum measurement accuracies will always be achieved, even in the case of difficult target materials or harsh ambient conditions. The adjustment is made using three distance points (1, 2, 3) which are defined by a reference standard.

Field calibration ensures highest precision
In order to achieve maximum precision, eddyNCDT 3300 provides the field calibration function for achieving extremely precise measurement results. The following influences are taken into account:
A: Different target materials
B: Different target sizes (measuring spot)
C: Target shape
D: Side preattenuation
E: Target tilt angle
The measuring range can also be extended using the field calibration.
Controller DT3300 DT3301

<table>
<thead>
<tr>
<th>Feature</th>
<th>DT3300</th>
<th>DT3301</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>≤ ± 0.2% FSO</td>
<td>≤ ± 0.2% FSO</td>
</tr>
<tr>
<td>Resolution ²</td>
<td>≤ 0.005 % FSO</td>
<td>≤ 0.01 % FSO</td>
</tr>
<tr>
<td>Frequency response</td>
<td>selectable 25 kHz / 2.5 kHz / 25 Hz (-3 dB); 100 kHz for measuring ranges ≤ 1 mm</td>
<td></td>
</tr>
<tr>
<td>Temperature compensation range</td>
<td>10 ... 100 °C (option TCS: -40 ... 180 °C) ³</td>
<td></td>
</tr>
<tr>
<td>Temperature range Controller</td>
<td>+5 ... +50 °C</td>
<td></td>
</tr>
<tr>
<td>Outputs</td>
<td>selectable 0 ... 5 V / 0 ... 10 V / ± 2.5 V / ± 5 V / ± 10 V (or inverted) / 4 ... 20 mA (load 350 Ohm)</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>± 12 VDC / 100 mA, 5.2 VDC / 220 mA ¹</td>
<td>11 ... 32 VDC / 700 mA</td>
</tr>
<tr>
<td>Synchronization</td>
<td>via cable PSC 30 (accessories)</td>
<td>via cable E SC 30 (accessories)</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>according to EN 50081-2 / EN 61000-6-2</td>
<td></td>
</tr>
<tr>
<td>Controller functions</td>
<td>limit value monitoring, auto-zero, peak-to-peak, minimum, maximum, average, storage of 3 characteristics (calibrations)</td>
<td></td>
</tr>
</tbody>
</table>

FSO = Full Scale Output

Reference material: aluminum (non-ferromagnetic) or steel DIN 1.0037 (ferromagnetic)

Reference temperature for reported data is 20 °C (70 °F); resolution and temperature stability refer to midrange

Data may differ with magnetic inhomogeneous materials.

¹ Additionally 24 VDC for external reset and limit switch

² Resolution data are based on noise peak-to-peak values

³ Temperature stability may differ with TCS option

Controller dimensions

Quadruple limit switch
- Two freely definable minimum and maximum limit values
- Individual switching threshold
- LED display for upper and lower limit warnings

Automatic calibration
- Three-point linearization for optimum on-site calibration

Four configurations can be stored
- Factory calibration and three individual characteristic curves can be stored
- Simple microprocessor-controlled single-cycle calibration
### Sensors eddyNCDT 3300

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>ES04</th>
<th>EU05</th>
<th>ES08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>shielded</td>
<td>unshielded</td>
<td>shielded</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.4 mm</td>
<td>0.4 mm</td>
<td>0.8 mm</td>
</tr>
<tr>
<td>Offset distance</td>
<td>0.04 mm</td>
<td>0.05 mm</td>
<td>0.08 mm</td>
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<tr>
<td>Linearity</td>
<td>≤ ± 0.8 µm</td>
<td>≤ ± 1 µm</td>
<td>≤ ± 1.6 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 µm</td>
<td>0.025 µm</td>
<td>0.04 µm</td>
</tr>
<tr>
<td>Temperature stability (MMR)</td>
<td>≤ ± 0.06 µm/°C</td>
<td>≤ ± 0.075 µm/°C</td>
<td>≤ ± 0.12 µm/°C</td>
</tr>
<tr>
<td>Temperature (max.)</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Pressure resistance (sensor front)</td>
<td>100 bars</td>
<td>-</td>
<td>20 bars</td>
</tr>
<tr>
<td>Integrated cable/length</td>
<td>approx. 0.25 m</td>
<td>approx. 0.25 m</td>
<td>approx. 0.25 m</td>
</tr>
<tr>
<td>Temperature (sensor cable)</td>
<td>180 °C</td>
<td>180 °C</td>
<td>180 °C</td>
</tr>
<tr>
<td>Material (sensor housing)</td>
<td>stainless steel</td>
<td>stainless steel and ceramics</td>
<td>stainless steel and plastic</td>
</tr>
</tbody>
</table>

MMR = midrange

#### ECx sensor cable, length is selectable up to x≤15m

![ECx sensor cable diagram]

#### ECx/1 extension cable for solder connection, length is selectable up to x≤15 m

![ECx/1 extension cable diagram]

#### ECx/2 extension cable for plug connection, length is selectable up to x≤15 m

![ECx/2 extension cable diagram]
<table>
<thead>
<tr>
<th>Sensor type</th>
<th>ES1</th>
<th>EU1</th>
<th>ES2</th>
<th>EU3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>shielded</td>
<td>unshielded</td>
<td>shielded</td>
<td>unshielded</td>
</tr>
<tr>
<td>Measuring range</td>
<td>1 mm</td>
<td>1 mm</td>
<td>2 mm</td>
<td>3 mm</td>
</tr>
<tr>
<td>Offset distance</td>
<td>0.1 mm</td>
<td>0.1 mm</td>
<td>0.2 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>$\leq \pm 2 \mu m$</td>
<td>$\leq \pm 2 \mu m$</td>
<td>$\leq \pm 4 \mu m$</td>
<td>$\leq \pm 6 \mu m$</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.05 $\mu m$</td>
<td>0.05 $\mu m$</td>
<td>0.1 $\mu m$</td>
<td>0.15 $\mu m$</td>
</tr>
<tr>
<td>Temperature stability (MMR)</td>
<td>$\leq \pm 0.15 \mu m/°C$</td>
<td>$\leq \pm 0.15 \mu m/°C$</td>
<td>$\leq \pm 0.3 \mu m/°C$</td>
<td>$\leq \pm 0.45 \mu m/°C$</td>
</tr>
<tr>
<td>Temperature (max)</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Pressure resistance (sensor front)</td>
<td>-</td>
<td>-</td>
<td>20 bars</td>
<td>20 bars</td>
</tr>
<tr>
<td>Integrated cable/length</td>
<td>approx. 0.25 m</td>
<td>approx. 0.25 m</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature (sensor cable)</td>
<td>180 °C</td>
<td>180 °C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Material (sensor housing)</td>
<td>stainless steel and plastic</td>
<td>stainless steel and plastic</td>
<td>stainless steel and plastic</td>
<td>stainless steel and plastic</td>
</tr>
<tr>
<td>MMR = midrange</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Cable**
- **Cable design**: coaxial with sheath wire
- **Sheath material**: FEP/Fluoropolymer thermoplastics
- **Temperature resistance**: -30 °C to +200 °C
- **Outer diameter**: 3.9 mm ± 0.1 mm
- **Bending radius**: One-time bending during installation: 2 x cable diameter
  Minimum bending radius for movement: 5 x cable diameter
  Optimum bending radius at continuous movement: 10 x cable diameter
- **Suitable for use with robots**: no

**Plug**
- **Type**: 5-pin socket, cable socket screw
- **Locking method**: IP67
- **Protection class**: -30 °C to +85 °C
- **Temperature stability**: brass nickel-plated
- **Materialhousing**: > 500 mating cycles
- **Mechanical service life**: 1:1

**Plug Model**
- **Controller side**
  - ECx: plug (male), triaxial push-pull
  - ECx/1: open ends
  - ECx/2: plug (male), triaxial push-pull

**Sensor side**
- ES1: brass nickel-plated, mat > 5,000 mating cycles
- ES2: brass nickel-plated, mat > 500 mating cycles
Sensors eddyNCDT 3300

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>ES4</th>
<th>EU6</th>
<th>EU8</th>
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</thead>
<tbody>
<tr>
<td>Design</td>
<td>shielded</td>
<td>unshielded</td>
<td>unshielded</td>
</tr>
<tr>
<td>Measuring range</td>
<td>4 mm</td>
<td>6 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>Offset distance</td>
<td>0.4 mm</td>
<td>0.6 mm</td>
<td>0.8 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>≤ ± 8 µm</td>
<td>≤ ± 12 µm</td>
<td>≤ ± 16 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.2 µm</td>
<td>0.3 µm</td>
<td>0.4 µm</td>
</tr>
<tr>
<td>Temperature stability (MMR)</td>
<td>≤ ± 0.6 µm/°C</td>
<td>≤ ± 0.9 µm/°C</td>
<td>≤ ± 1.2 µm/°C</td>
</tr>
<tr>
<td>Temperature (max.)</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Pressure resistance (sensor front)</td>
<td>20 bars</td>
<td>20 bars</td>
<td>20 bars</td>
</tr>
<tr>
<td>Integrated cable/length</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature (sensor cable)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Material (sensor housing)</td>
<td>stainless steel and plastic</td>
<td>stainless steel and plastic</td>
<td>stainless steel and plastic</td>
</tr>
</tbody>
</table>

MMR = midrange

**ECEx sensor cable extension**, length is selectable up to x ≤ 15 m

**ECx/90 sensor cable** with 90° connector (sensor-sided), length is selectable up to x ≤ 15 m
### Sensor Specifications

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>EU15</th>
<th>EU22</th>
<th>EU40</th>
<th>EU80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>unshielded</td>
<td>unshielded</td>
<td>unshielded</td>
<td>unshielded</td>
</tr>
<tr>
<td>Measuring range</td>
<td>15 mm</td>
<td>22 mm</td>
<td>40 mm</td>
<td>80 mm</td>
</tr>
<tr>
<td>Offset distance</td>
<td>1.5 mm</td>
<td>2.2 mm</td>
<td>4 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>≤ ± 30 µm</td>
<td>≤ ± 44 µm</td>
<td>≤ ± 80 µm</td>
<td>≤ ± 160 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.75 µm</td>
<td>1.1 µm</td>
<td>2 µm</td>
<td>4 µm</td>
</tr>
<tr>
<td>Temperature stability (MMR)</td>
<td>≤ ± 2.25 µm/°C</td>
<td>≤ ± 3.3 µm/°C</td>
<td>≤ ± 6 µm/°C</td>
<td>≤ ± 12 µm/°C</td>
</tr>
<tr>
<td>Temperature (max.)</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Pressure resistance (sensor front)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Integrated cable/length</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature (sensor cable)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Material (sensor housing)</td>
<td>epoxy</td>
<td>epoxy</td>
<td>epoxy</td>
<td>epoxy</td>
</tr>
</tbody>
</table>

**MMR = midrange**

### Cable Specifications

Cable design: coaxial with sheath wire
Sheath material: FEP/Fluoropolymer thermoplastics
Temperature resistance: -30°C to +200°C
Outer diameter: 3.9 mm ± 0.1 mm
Bending radius:
- One-time bending during installation: 2 x cable diameter
- Minimum bending radius for movement: 5 x cable diameter
- Optimum bending radius at continuous movement: 10 x cable diameter

Suitable for use with robots: no

### Plug Model Specifications

**Controller side**
- Type: 5-pin socket, cable socket screw
- Protection class: IP67
- Temperature stability: -30°C to +85°C
- Material housing: brass nickel-plated
- Mechanical service life: > 500 mating cycles

**Sensor side**
- Type: 5-pin plug (male) screw
- Protection class: IP67 (when connected)
- Temperature stability: -30°C to +85°C
- Material housing: brass nickel-plated
- Mechanical service life: > 500 mating cycles

**ECEx/90**
- Type: plug (male), triaxial, angle push-pull
- Protection class: IP67 (when connected)
- Temperature stability: -65°C to +135°C
- Material housing: brass nickel-plated, mat
- Mechanical service life: > 5000 mating cycles
Subminiature sensors for restricted spaces

As well as standard sensors in conventional designs, miniature sensors with the smallest possible dimensions that achieve high precision measurement results are also available. Pressure-resistant versions, screened housings, ceramic types and other special features characterize these sensors, which achieve highly accurate measurement results despite their small dimensions. The miniature sensors are primarily used in high pressure applications, for example, in combustion engines.

**ES04/180(25) Shielded Sensor**
- Measuring range 0.4 mm
- Temperature stability: $\pm 0.025\%$ FSO/°C
- Connection: integrated coaxial cable 1 m (ø 0.5 mm), short silicon tube at cable exit
- Pressure resistance (static): front 100 bar
- Max. operating temperature: 180 °C
- Housing material: stainless steel
- Sensor cable: ECx/1, length ≤ 6 m

**ES04(34) Shielded Sensor**
- Measuring range 0.4 mm
- Temperature stability: $\pm 0.025\%$ FSO/°C
- Connection: integrated coaxial cable 0.25 m (ø 2 mm) with sealed triaxial connector
- Pressure resistance (static): front 100 bar / rear side splash water
- Max. operating temperature: 150 °C
- Housing material: stainless steel and ceramic
- Sensor cable: ECx, length ≤ 6 m

**ES04(44) Shielded Sensor**
- Measuring range 0.4 mm
- Temperature stability: $\pm 0.025\%$ FSO/°C
- Connection: integrated coaxial cable 0.2 m (ø 1.2 mm) with sealed triaxial connector
- Pressure resistance (static): front 100 bar / rear side splash water
- Max. operating temperature: 150 °C
- Housing material: stainless steel and ceramic
- Sensor cable: ECx, length ≤ 6 m

**ES04(70) Shielded Sensor**
- Measuring range 0.4 mm
- Temperature stability: $\pm 0.025\%$ FSO/°C
- Connection: integrated coaxial cable 0.25 m (ø 0.5 mm) with solder connection board
- Pressure resistance (static): front 100 bar / rear side splash water
- Max. operating temperature: 150 °C
- Housing material: stainless steel and ceramic
- Sensor cable: ECx/1, length ≤ 6 m
EU05(93) Unshielded Sensor
Measuring range 0.4 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Max. operating temperature: 150 °C
Housing material: ceramic
Sensor cable: ECx/1, length ≤ 6 m

EU05(10) Unshielded Sensor
Measuring range 0.5 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Max. operating temperature: 150 °C
Housing material: stainless steel and ceramic
Sensor cable: ECx/1, length ≤ 6 m

ES05(36) Shielded Sensor
Measuring range 0.5 mm
Connection: integrated coaxial cable 0.5 m (Ø 0.5 mm) with solder connection board
Max. operating temperature: 150 °C
Housing material: stainless steel and epoxy
Sensor cable: ECx/1, length ≤ 6 m

EU05(65) Unshielded Sensor
Measuring range 0.5 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Pressure resistance (static): front 700 bar / rear side splash water
Max. operating temperature: 150 °C
Housing material: ceramic
Sensor cable: ECx/1, length ≤ 6 m

EU05(66) Unshielded Sensor
Measuring range 0.5 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Pressure resistance (static): front 400 bar / rear side splash water
Max. operating temperature: 150 °C
Housing material: ceramic
Sensor cable: ECx/1, length ≤ 6 m

ES05/180(16) Shielded Sensor
Measuring range 0.5 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Max. operating temperature: 180 °C
Housing material: stainless steel and epoxy
Sensor cable: ECx/1, length ≤ 6 m

EU05(72) Unshielded Sensor
Measuring range 0.4 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Pressure resistance (static): front 2000 bar / rear side splash water
Max. operating temperature: 150 °C
Housing material: ceramic
Sensor cable: ECx/1, length ≤ 6 m

EU05(73) Unshielded Sensor
Measuring range 0.4 mm
Temperature stability ≤ ±0.025 % FSO/°C
Connection: integrated coaxial cable 0.25 m (Ø 0.5 mm) with solder connection board
Pressure resistance (static): front 2000 bar / rear side splash water
Max. operating temperature: 150 °C
Housing material: ceramic
Sensor cable: ECx/1, length ≤ 6 m
## Accessories

<table>
<thead>
<tr>
<th>Article</th>
<th>Description</th>
<th>eddyNCDT 3001</th>
<th>eddyNCDT 3005</th>
<th>eddyNCDT 3060</th>
<th>eddyNCDT 3300</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCx/8-M12</td>
<td>Supply and signal cable, 8-pin, lengths: 3 / 5 / 10 / 15 m</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>PCx/5-M12</td>
<td>Supply and signal cable, 5-pin, 5 m / 20 m</td>
<td>•</td>
<td>•</td>
<td></td>
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</tr>
<tr>
<td>SCD2/4/RJ45</td>
<td>Industrial Ethernet cable with M12 connector, 4-pin, 2 m</td>
<td></td>
<td></td>
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<td>•</td>
</tr>
<tr>
<td>PS2020</td>
<td>Power supply 24 V / 2.5 A, input 100 - 240 VAC, output 24 VDC / 2.5 A, mounting onto symmetrical standard rail 35 mm x 7.5 mm, DIN 50022;</td>
<td>•</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>SCAx/5</td>
<td>Signal cable, analog, 3 / 6 / 9 m</td>
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<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>SCDx/8</td>
<td>Signal cable for switching inputs and outputs, 3 / 6 m (also for 11 - 32 VDC supply); for DT3301</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>PSCx</td>
<td>Supply and synchronization cable 0.3 / 1 m, for DT3300</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>ESCx</td>
<td>Synchronization cable 0.3 / 1 m, for DT3301</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>
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)

Optical micrometers, fiber optic sensors and fiber optics

Color recognition sensors, LED analyzers and color online spectrometer

Measurement and inspection systems