



# More Precision

**eddyNCDT** // Inductive sensors based on eddy currents



# Powerful eddy current measuring system for miniature sensors

## eddyNCDT 3070

-  Wide range of applications with multiple sensor models
-  Extremely high temperature stability
-  High resolution and linearity
-  Frequency response 20 kHz (-3dB)
-  Measuring rate 200 kSa/s
-  Versions for ferromagnetic and non-ferromagnetic targets
-  Analog output (U/I) digital output
-  Intuitive configuration via web interface



### High performance for the industry

The eddyNCDT 3070 is a powerful, inductive sensor system based on eddy currents for measuring ranges smaller than 1 mm. The system comprises a compact controller, a sensor and an integrated cable and is factory-calibrated either for ferromagnetic or non-ferromagnetic materials.

### Integration into plant and machinery

As sensor and controller are temperature-compensated, a high measurement accuracy can be achieved even in fluctuating temperatures. The sensors are designed for ambient temperatures up to a maximum of +200 °C and an ambient pressure up to 700 bar. The compact controller design as well as the sensor robustness make the measuring system ideal for integration into plant and machinery.

### New benchmark in controller technology

The industrial-grade M12 Ethernet interface offers a modern fieldbus connection. Configurable analog outputs enable to output the measured values as voltage or current. For multi-system operation, the systems offer a new kind of frequency separation (LF/HF) which enables to operate several sensors next to one another without requiring any synchronization.

| Features  | Controller type |        |
|---|-----------------|--------|
|   | DT3070          | DT3071 |
| Active temperature compensation for sensor and controller                     | ✓               | ✓      |
| Frequency separation (LF & HF)  | ✓               | ✓      |
| Ethernet interface  | ✓               | ✓      |
| Intuitive web interface   | ✓               | ✓      |
| Multipoint calibration regardless of the distance (up to 3-point calibration) | ✓               | ✓      |
| Scalable measuring range via analog output (teach function)                   | ✓               | ✓      |
| Scalable analog output  | ✓               | ✓      |
| Switching and temperature outputs   | -               | ✓      |
| 5-point calibration   | -               | ✓      |
| Storage of multiple characteristic curves                                     | -               | ✓      |



When connecting a PC via the Ethernet interface, a modern web interface can be accessed without any further installation and enables the parameterization of sensor and controller. The DT3071 controller provides enhanced features such as 5-point calibration, setting of switching and temperature outputs, as well as storage of multiple characteristic curves.

| Model                                | DT3070   | DT3071  |
|--------------------------------------|--|---|
| Resolution <sup>[1]</sup>            | Static (20 Hz)   | 0.005 % FSO   |
|                                      | Dynamic (20 kHz)   | 0.025 % FSO   |
| Frequency response (-3dB)            | selectable (20 kHz, 5 kHz, 20 Hz)  |   |
| Measuring rate                       | Analog output  | 200 kSa/s (16 bit)  |
|                                      | Digital interface  | 50 kSa/s (16 bit)   |
| Linearity <sup>[2]</sup>             | < ±0.2 % FSO   | < ±0.1 % FSO  |
| Temperature stability <sup>[3]</sup> | < 0.05 % FSO / K   |   |
| Temperature compensation             | +10 ... +50 °C   |   |
| Target material <sup>[4]</sup>       | Steel, aluminum  |   |
| No. of characteristic curves         | 1  | max. 4  |
| Supply voltage                       | 12 ... 32 VDC  |   |
| Power consumption                    | typ. 2.5 W (max. 2.8 W)  |   |
| Digital interface                    | Ethernet   | Ethernet / selectable: switching output (TTL), temperature output (0...5 V) |
| Analog output                        | 0 ... 10 V; 4 ... 20 mA (short circuit proof)  |   |
| Connection                           | Sensor: plug connector triaxial socket; supply/signal: 8-pole M12 connector;<br>Ethernet: 5-pole M12 connector (cable see accessories) |   |
| Mounting                             | Through bores  |   |
| Temperature range                    | Storage  | -10 ... +70 °C  |
|                                      | Operation  | 0 ... +50 °C  |
| Shock (DIN EN 60068-2-27)            | 15 g / 6 ms in 3 axes, 2 directions and 1000 shocks each   |   |
| Vibration (DIN EN 60068-2-6)         | 5 g / 10 ... 500 Hz in 3 axes, 2 directions and 10 cycles each   |   |
| Protection class (DIN EN 60529)      | IP67 (plugged)   |   |
| Material                             | Aluminum die-cast  |   |
| Weight                               | approx. 230 g  |   |

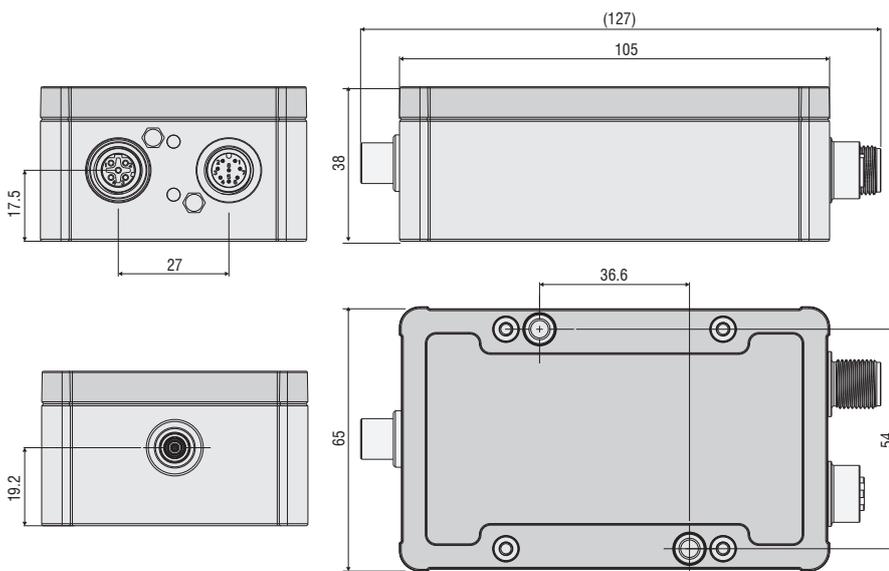
FSO = Full Scale Output

<sup>[1]</sup> RMS noise relates to mid of measuring range

<sup>[2]</sup> Value with 3-/5-point linearization

<sup>[3]</sup> Values are referenced to the mid of the measuring range within the compensated temperature range

<sup>[4]</sup> Steel: St37 steel DIN1.0037, aluminum: AlMg3

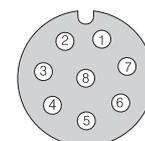


#### Pin assignment IN/OUT/24V IN

| Pin | Assignment                                   | Color (cable: PCx/8-M12) |
|-----|--|--------------------------|
| 1   | Analog output U <sub>Displacement</sub>      | White                    |
| 2   | Supply +24 V                                 | Brown                    |
| 3   | Limit value 1 / U <sub>Temp</sub> sensor     | Green                    |
| 4   | Limit value 2 / U <sub>Temp</sub> controller | Yellow                   |
| 5   | GND Temperature, limit value                 | Gray                     |
| 6   | GND analog output                            | Pink                     |
| 7   | GND supply                                   | Blue                     |
| 8   | Analog output I <sub>Displacement</sub>      | Red                      |



8-pole M12x1 housing connector  
View on pin side

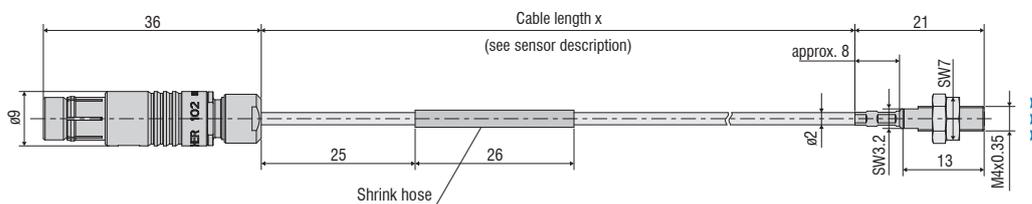


All dimensions in mm, not to scale

# Standard sensors

## eddyNCDT 3070

▲▲▲  
Measurement direction



| Model   | ES-S04-C-CAx  |                 |
|---|---|-----------------|
| Measuring range   | 0.4 mm  |                 |
| Start of measuring range                                | 0.04 mm   |                 |
| Resolution <sup>[1]</sup> <sup>[2]</sup> <sup>[3]</sup> | 0.02 $\mu$ m  |                 |
| Linearity <sup>[1]</sup> <sup>[4]</sup>                 | < $\pm 1$ $\mu$ m   |                 |
| Temperature stability <sup>[1]</sup> <sup>[2]</sup>     | < 0.14 $\mu$ m / K  |                 |
| Temperature compensation                                | +10 ... +180 °C   |                 |
| Sensor type   | shielded  |                 |
| Min. target size (flat)                                 | $\varnothing$ 5 mm  |                 |
| Connection  | integrated cable, axial, length 0.25 m, 0.5 m or 0.75 m <sup>[5]</sup><br>bending radius: static $\geq$ 10 mm, dynamic $\geq$ 20 mm |                 |
| Mounting  | Screw connection (M4)   |                 |
| Temperature range                                       | Storage   | -20 ... +180 °C |
|   | Operation   | -20 ... +180 °C |
| Pressure resistance                                     | 100 bar (front)   |                 |
| Shock (DIN EN 60068-2-27)                               | 30 g  |                 |
| Vibration (DIN EN 60068-2-6)                            | 15 g  |                 |
| Protection class (DIN EN 60529)                         | IP50  |                 |
| Material  | Stainless steel and ceramic   |                 |
| Weight  | approx. 25 g  |                 |

<sup>[1]</sup> Valid for operation with DT307x referenced to the nominal measuring range

<sup>[2]</sup> Relates to the mid of the measuring range within the compensated temperature range

<sup>[3]</sup> RMS value of the signal noise, static (20 Hz)

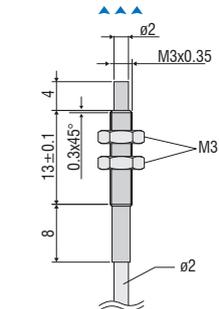
<sup>[4]</sup> Only with DT307x controller and 3-/5-point linearization

<sup>[5]</sup> Length tolerance cable:  $\pm 0.03$  m

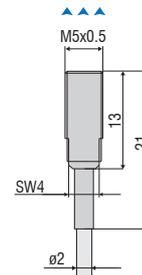
# Special sensors

## eddyNCDT 3070

▲▲▲▲  
Measurement direction



Cable length 0.25 m ± 0.04 m  
1:1



Cable length 0.25 m  
1:1

| Model  | EU05  | ES08  |
|--|---|---|
| Measuring range                              | 0.5 mm  | 0.8 mm  |
| Start of measuring range                     | 0.05 mm   | 0.08 mm   |
| Resolution <sup>[1] [2] [3]</sup>            | 0.025 μm  | 0.04 μm   |
| Linearity <sup>[1] [4]</sup>                 | < ±0.5 μm   | < ±0.8 μm   |
| Temperature stability <sup>[1] [2] [4]</sup> | < 0.175 μm / K  | < 0.28 μm / K   |
| Temperature compensation <sup>[4]</sup>      | 0 ... +150 °C   | 0 ... +150 °C   |
| Sensor type                                  | unshielded  | shielded  |
| Min. target size (flat)                      | Ø 9 mm  | Ø 7.5 mm  |
| Connection                                   | integrated cable, axial, length approx. 0.25 m <sup>[5]</sup> | integrated cable, axial, length approx. 0.25 m <sup>[5]</sup> |
| Mounting                                     | Screw connection (M3)   | Screw connection (M5)   |
| Temperature range                            | Storage   | -20 ... +150 °C   |
|  | Operation   | 0 ... +150 °C   |
| Pressure resistance                          | -   | 20 bar (front)  |
| Protection class (DIN EN 60529)              | IP64 (plugged)  | IP64 (plugged)  |
| Material                                     | Stainless steel and ceramic                                   | Stainless steel and plastic                                   |

Operation with DT307x requires special calibration (LC)

<sup>[1]</sup> Valid for operation with DT307x referenced to the nominal measuring range

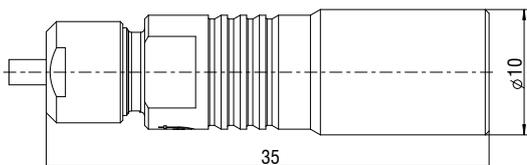
<sup>[2]</sup> Relates to the mid of the measuring range within the compensated temperature range

<sup>[3]</sup> RMS value of the signal noise, static (20 Hz)

<sup>[4]</sup> Only with DT307x controller and 3-point or 5-point linearization

<sup>[5]</sup> Length tolerance cable: ±10 %

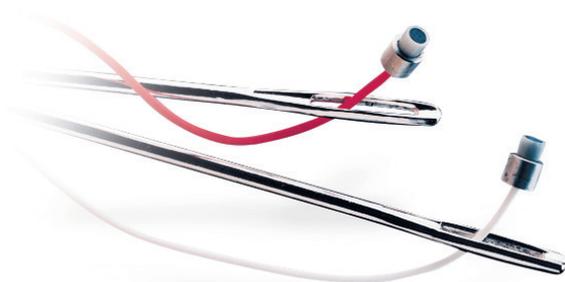
### Dimensions cable sockets ES05 and ES08



All dimensions in mm, not to scale

# Special sensors

## eddyNCDT 3070



### 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. These 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:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable, 1 m ( $\varnothing 0.5$  mm), short silicone tube at the cable outlet  
 Pressure resistance (static): front side 100 bar  
 Max. operating temperature: 180 °C  
 Housing material: stainless steel

2:1

**ES04/180(102) Shielded miniature sensor**  
 Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable 0.8 m ( $\varnothing 0.5$  mm) with adapter PCB  
 Pressure resistance (static): front side 100 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: stainless steel and ceramic  
 Connection cable: ECx/1, length  $\leq 6$  m

3:1

**ES04(34) Shielded sensor**  
 Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable 0.25 m ( $\varnothing 2$  mm) with protected triaxial socket  
 Pressure resistance (static): front side 100 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: stainless steel and ceramic

1:1

**ES04(35) Shielded sensor**  
 Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable 0.25 m ( $\varnothing 1.5$  mm) with protected triaxial socket  
 Pressure resistance (static): front side 100 bar / rear side 5 bar  
 Max. operating temperature: 150 °C  
 Housing material: stainless and ceramic

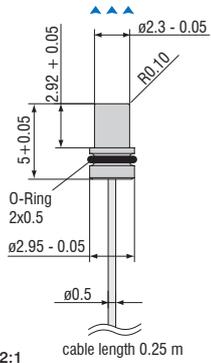
2:1

**ES04(70) Shielded sensor**  
 Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable 0.25 m ( $\varnothing 0.5$  mm) with adapter PCB  
 Pressure resistance (static): front side 100 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: stainless and ceramic

3:1

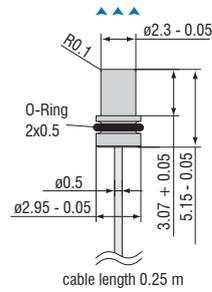
**ES05/180(16) Shielded sensor**  
 Measuring range 0.5 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable 0.25 m ( $\varnothing 0.5$  mm) with adapter PCB  
 Max. operating temperature: 180 °C  
 Housing material: stainless steel and epoxy

3:1



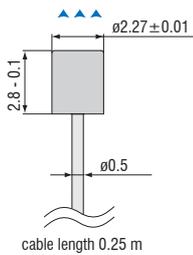
#### EU05(65) Unshielded sensor

Measuring range 0.5 mm  
 Connection: integrated coaxial cable  
 0.25 m ( $\varnothing$  0.5 mm) with adapter PCB  
 Pressure resistance (static):  
 front side 700 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: ceramic



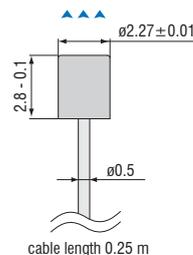
#### EU05(93) Unshielded sensor

Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable  
 0.25 m ( $\varnothing$  0.5 mm) with adapter PCB  
 Pressure resistance (static):  
 front side 2000 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: ceramic



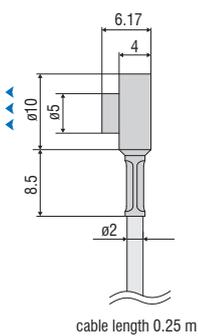
#### EU05(66) Unshielded sensor

Measuring range 0.5 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable  
 0.25 m ( $\varnothing$  0.5 mm) with adapter PCB  
 Pressure resistance (static):  
 front side 400 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: ceramic



#### EU05(72) Unshielded sensor

Measuring range 0.4 mm  
 Temperature stability:  $\leq \pm 0.035\%$  FSO/°C  
 Connection: integrated coaxial cable  
 0.25 m ( $\varnothing$  0.5 mm) with adapter PCB  
 Pressure resistance (static):  
 front side 2000 bar / rear side splash water  
 Max. operating temperature: 150 °C  
 Housing material: ceramic

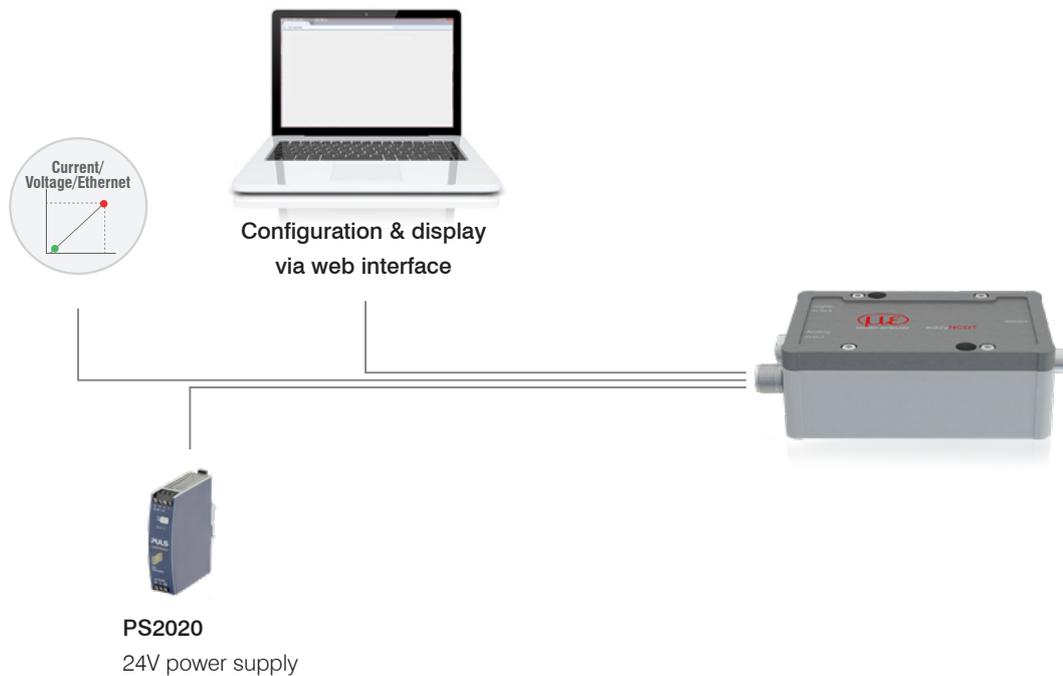


#### EU1FL Unshielded flat sensor

Measuring range 1 mm  
 Temperature stability:  $\leq \pm 0.025\%$  FSO/°C  
 Connection: integrated coaxial cable  
 0.25 m ( $\varnothing$  2 mm) with protected triaxial socket  
 Max. operating temperature: 150 °C  
 Housing material:  
 stainless steel and epoxy molding

# Connection possibilities

## eddyNCDT 3070



### Plug/Socket

#### 1 Plug Triax 0323118:

Type S 102 A014-120 D4,1  
Triaxial plug: type bB0  
Connection: push-pull  
Temperature resistance: 200 °C



#### 4 Plug Triax 0323174:

Type S101 A005-120 D4,1  
Triaxial plug: type mA0  
Connection: push-pull  
Temperature resistance: 150 °C



#### 2 Socket Triax 0323141:

Type KE102 A014-120 D4,1  
Triaxial socket: type fB0  
Connection: push-pull  
Temperature resistance: 200 °C



#### 5 Socket Triax 0323173

Triaxial socket: type fA0  
Connection: push-pull  
Temperature resistance: 150 °C



#### 3 Plug Triax 0323727:

Type S 102 A014-120 D2,1  
Triaxial plug: Type: mB0  
Connection: push-pull  
Temperature resistance: 200 °C



#### 3 Socket Triax 0323121:

Type KE102 A014-120 D2,1  
Triaxial socket: type fB0  
Connection: push-pull  
Temperature resistance: 130 °C



**Sensors with socket:** cable type EC-x/mB0/mB0



| Coaxial cable with Viton sheath |  |
|---------------------------------|--|
| Cable diameter:                 | 3.6 mm                                       |
| Minimum bending radius:         | static approx. 27 mm / dynamic approx. 54 mm |
| Temperature resistance:         | up to 200 °C                                 |
| Available lengths:              | 1 m / 3 m (6 m on request)                   |

**Sensors with integrated cable:** ES-S04-C-CAx/mB0/D2,0  
**and extension cable:** ECE-x/fB0/mB0/D3,6



|                        | Coaxial cable (extension cable)                 | Coaxial cable (sensor cable)                    |
|------------------------|---|---|
| Cable diameter         | 3.6 mm  | 2 mm  |
| Minimum bending radius | static approx. 27 mm /<br>dynamic approx. 54 mm | static approx. 10 mm /<br>dynamic approx. 20 mm |
| Temperature resistance | up to 200 °C                                    | static up to 200 °C                             |
| Available lengths      | 1 m / 3 m (6 m on request)                      | 0.25 m / 0.5 m / 0.75 m                         |

**Sensors with integrated cable and open ends**  
**for solder connection via adapter cable:** ECA-x/OE/mB0/D3,6



| Coaxial cable with Viton sheath |  |
|---------------------------------|--|
| Cable diameter:                 | 3.6 mm                                       |
| Minimum bending radius:         | static approx. 27 mm / dynamic approx. 54 mm |
| Temperature resistance:         | up to 200 °C                                 |
| Available lengths:              | 1 m / 3 m (6 m on request)                   |

**Sensors with integrated cable and A0 plug via**  
**adapter cable:** ECA-x/mA0/mB0/D3,6



| Coaxial cable with Viton sheath |  |
|---------------------------------|--|
| Cable diameter:                 | 3.6 mm                                       |
| Minimum bending radius:         | static approx. 27 mm / dynamic approx. 54 mm |
| Temperature resistance:         | up to 200 °C                                 |
| Available lengths:              | 1 m / 3 m (6 m on request)                   |

| Item          | Description  | DT3001 | DT3005 | DT3020 | DT3060 | DT3070 | DZ140 | SGS |
|---------------|--|--------|--------|--------|--------|--------|-------|-----|
| PCx/5-M12     | <b>Power supply and signal cable</b><br>5-pole with M12 connector<br>Standard length: 5 m<br>Optionally available: 10 m/20 m/40 m/80 m<br>as drag-chain suitable variant   | X      | X      |        |        |        |       |     |
| PCx/8-M12     | <b>Power supply and signal cable</b><br>8-pole with M12 connector<br>Standard length: 3 m<br>Optionally available: 5 m/ 10 m / 15 m /<br>10 m also as drag-chain suitable variant  |        |        | X      | X      | X      |       |     |
| PC5/8-M12/105 | <b>Power supply and signal cable</b><br>Increased temperature resistance up to 105 °C<br>8-pole with M12 connector<br>Length: 5 m as drag-chain suitable variant   |        |        | X      | X      | X      |       |     |
| PC4701-x      | <b>Power supply and signal cable</b><br>8-pole with M12 connector<br>Standard length: 10 m<br>Optionally available: 15 m<br>10 m also available as drag chain–suitable variant   |        |        |        |        |        |       | X   |
| SCD2/4/RJ45   | <b>Ethernet cable</b><br>4-pole with M12 connector<br>on RJ45 connector<br>Standard length: 2 m  |        |        |        | X      | X      |       |     |
| PC140-x       | <b>Power supply and signal cable</b><br>8-pole connector<br>Standard length: 3 m<br>Optionally available: 6 m  |        |        |        |        |        | X     |     |
| PS2020        | <b>Power supply unit</b><br>Input 100-240 VAC<br>Output 24 VDC / 2.5 A;<br>installation on symmetrical standard rail<br>35 mm x 7.5 mm, DIN 50022  | X      | X      | X      | X      | X      | X     | X   |
| IF2035        | <b>Interface module for Industrial Ethernet connection</b><br>Connection of RS422 or RS485 interfaces to PROFINET /<br>Ethernet/IP / EtherCAT<br>2 network connections for different network topologies<br>Ideal for confined spaces due to a compact housing and<br>DIN rail mounting |        | X      | X      |        |        |       |     |
| IF1032        | <b>Interface module for Ethernet/EtherCAT connection</b><br>1x RS485<br>2x analog-in (14 bit, max. 4 ksps), voltage<br>1x analog-in, (14 bit, max. 4 ksps), current  |        | X      | X      |        |        |       |     |
| IF7001        | <b>Single-channel converter cable from RS485 to USB</b><br>Conversion from RS485 to USB<br>Easy sensor connection via USB<br>Integration into plant and machinery  |        | X      | X      |        |        |       |     |

# Plug system for vacuum applications

## Vacuum feedthrough eddy/fB0/fB0/triax

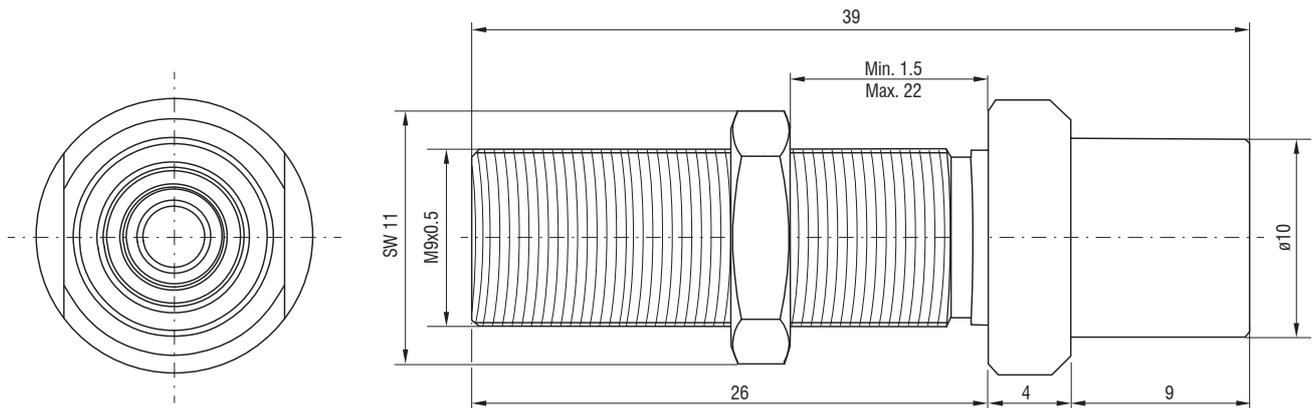
The eddyNCDT series delivers high-precision measurement results even in airless rooms. The eddy/fB0/fB0/triax vacuum feedthrough also enables eddyNCDT products to be used in vacuum applications.

- Application in vacuums
- Application as a wall duct
- Pluggable version
- Compatible with all common eddyNCDT products



| Vacuum feedthrough eddy/fB0/fB0/triax          |   |
|--|---|
| Housing material                               | CuZn39Pb3   |
| O-ring material                                | FPM (Viton®)  |
| Max. leakage rate (IEC standard 60068-2-17)    | $<10^{-8}$ mbar $\cdot$ l/s   |
| Operating temperature <sup>[1]</sup>           | from -20 °C to 150 °C   |
| Mating cycles (IEC 60512-5-9a)                 | 10,000  |
| Vibration (MIL-STD-202 Method 204 Condition B) | 10 to 2,000 Hz, 1.5 mm or 15 g, 12 pass cycles per axis, 20 minutes per 10-2000-10 Hz pass cycle, no discontinuity $>1 \mu$ s |
| Insulation resistance                          | $10^{10} \Omega$  |

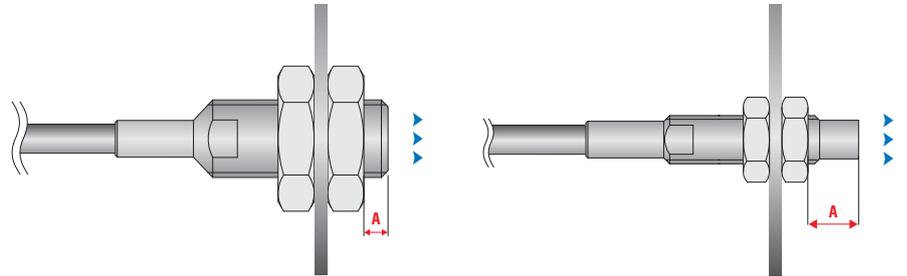
<sup>[1]</sup> Min. connection temperature: 0 °C



### Standard installation situation

#### Distance between the nut and the measuring area

eddyNCDT sensors are mounted using the two mounting nuts included in the delivery. During the factory-calibration of the sensors, these were mounted in a defined distance A and included in the calibration. In order to achieve maximum linearity, the nut must be mounted in the defined distance indicated in the table.



Please note the respective distances recommended in the table below when mounting the sensors:

| Series          | Model   | Distance A          |
|-----------------|---------|---------------------|
| DT3001-         | U2-A-SA | 22 mm (±0.2 mm)     |
|                 | U2-M-SA | 22 mm (±0.2 mm)     |
|                 | U4-A-SA | 22 mm (±0.2 mm)     |
|                 | U4-M-SA | 22 mm (±0.2 mm)     |
|                 | U4-A-Cx | 22 mm (±0.2 mm)     |
|                 | U4-M-Cx | 22 mm (±0.2 mm)     |
|                 | U6-A-SA | 22 mm (±0.2 mm)     |
|                 | U6-M-SA | 22 mm (±0.2 mm)     |
|                 | U8-A-SA | 22 mm (±0.2 mm)     |
|                 | U8-M-SA | 22 mm (±0.2 mm)     |
| DT3005-         | U1-A-C1 | 8 mm (±0.2 mm)      |
|                 | U1-M-C1 | 8 mm (±0.2 mm)      |
|                 | S2-A-C1 | 4 mm (±0.2 mm)      |
|                 | S2-M-C1 | 4 mm (±0.2 mm)      |
|                 | U3-A-C1 | 10 mm (±0.2 mm)     |
|                 | U3-M-C1 | 10 mm (±0.2 mm)     |
|                 | U6-A-C1 | 13 mm (±0.2 mm)     |
|                 | U6-M-C1 | 13 mm (±0.2 mm)     |
| DT3020 / DT3060 | ES-U1   | 8 mm (±0.2 mm)      |
|                 | ES-S1   | 4 mm (±0.2 mm)      |
|                 | ES-U2   | 8 mm (±0.2 mm)      |
|                 | ES-S2   | 4 mm (±0.2 mm)      |
|                 | ES-U3   | 10 mm (±0.2 mm)     |
|                 | ES-S4   | 4 mm (±0.2 mm)      |
|                 | ES-U6   | 20.4 mm (±0.2 mm)   |
|                 | ES-U8   | 24.6 mm (±0.2 mm)   |
|                 | ES04    | 2.1 mm (±0.2 mm)    |
|                 | EU05    | 5.5 mm (±0.2 mm)    |
|                 | ES08    | 2.7 mm (±0.2 mm)    |
|                 | ES1     | 4 mm (±0.2 mm)      |
|                 | EU1     | 6.7 mm (±0.2 mm)    |
|                 | ES2     | 4 mm (±0.2 mm)      |
|                 | EU3     | 10 mm (±0.2 mm)     |
|                 | ES4     | 4 mm (±0.2 mm)      |
|                 | EU6     | 10.125 mm (±0.2 mm) |
|                 | EU8     | 12.8 mm (±0.2 mm)   |
| DT3070-         | ES-S04  | 2.4 mm (±0.2 mm)    |

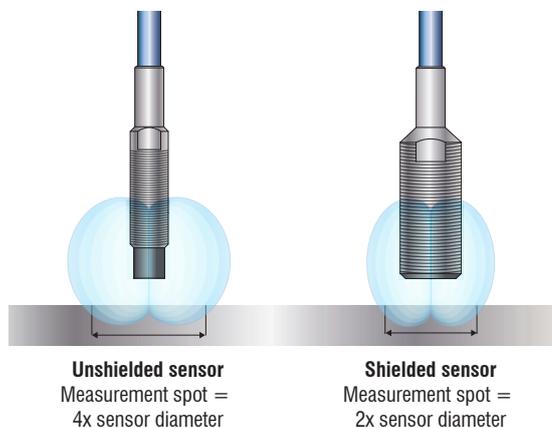
### Influences on the measurement signal

#### Sensor installation

The notes mentioned under "Standard installation situation" for correct sensor installation affect the measurement signal.

#### Minimum diameter of the target (flat)

The relative size of the target has effects on the linearity deviation. Ideally, the target size with shielded sensors is at least 2 times the sensor diameter, with unshielded sensors it is 4 times the sensor diameter. From this size on, almost all field lines run from the sensor to the target. Here, nearly any field line penetrates the target via the front surface and therefore contributing to the formation of eddy currents. With smaller target diameters, field linearization is recommended.



-  **∅ Target = 4x or 2x sensor diameter**  
recommended (no linearization is required)
-  **∅ Target = 3x or 1.5x sensor diameter**  
requires field linearization (DT306x / DT3300)



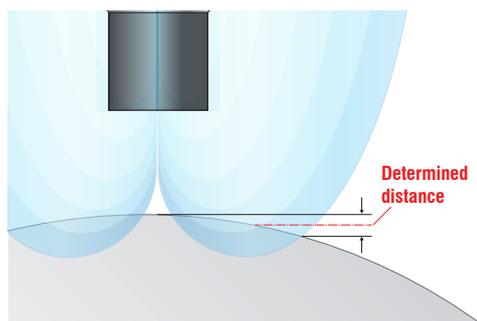
#### Minimum diameter of round targets

As well as the minimum size for flat geometries, a minimum diameter for round measuring objects is required.

-  **Diameter > 10x sensor diameter**  
requires field linearization (DT306x / DT3300)
-  **Diameter < 10x sensor diameter**  
requires factory calibration

#### Compensating the distance with curved measuring objects

When measuring on curved surfaces such as shafts, the sensors use the medium distance which results from the closest and the most distant field line range. However, this is not the distance between the vertex of the curved target and the sensor. For this reason, eddy current measuring systems from Micro-Epsilon enable the storage of the actual distance in the controller. This is how measurements can be performed on cylindrical objects such as rolls or shafts.



### Material and thickness of the target

Stable measurement results require a certain target minimum thickness that depends on the target material used. For one-sided distance measurements, the following standard values are recommended:

| Target material  | Recommended target thickness |
|------------------|------------------------------|
| Aluminum         | 0.504 mm                     |
| Lead             | 1.377 mm                     |
| Gold             | 0.447 mm                     |
| Graphite         | 8.100 mm                     |
| Copper           | 0.402 mm                     |
| Magnesium        | 0.627 mm                     |
| Brass            | 0.747 mm                     |
| Nickel           | 0.081 mm                     |
| Permalloy        | 0.012 mm                     |
| Phosphor Bronze  | 0.906 mm                     |
| Silver           | 0.390 mm                     |
| Steel DIN 1.1141 | 0.069 mm                     |
| Steel DIN 1.4005 | 0.165 mm                     |
| Steel DIN 1.4301 | 2.544 mm                     |



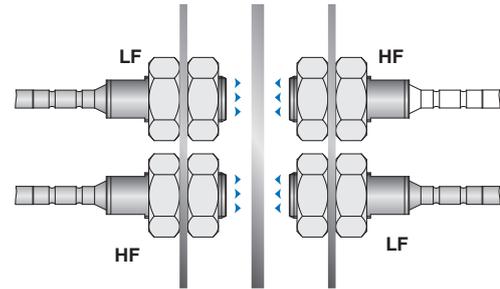
### Tilt angle

The high accuracy of the eddyNCDT sensors is only achieved with vertical sensor installation. When the sensor or the target are tilted, the measured results slightly deviate from those measured in the vertical position.

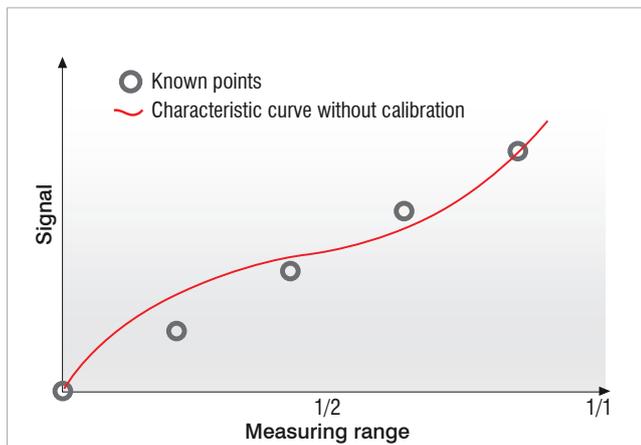
The extent of deviation differs from sensor to sensor. The tilt angle of  $\pm 3^\circ$  can be neglected for most of the measurement tasks. With a tilt angle of larger than  $6^\circ$ , factory calibration is recommended. With a 3-point calibration, the tilt angle can be stored in the controller. This compensates for all influences affecting the signal.

### Frequency separation

For the simultaneous operation of several eddyNCDT measuring systems, these are available with a new type of frequency separation (LF/HF). The frequency separation enables multi-channel operation without mutual influence. This function makes a synchronization cable superfluous.

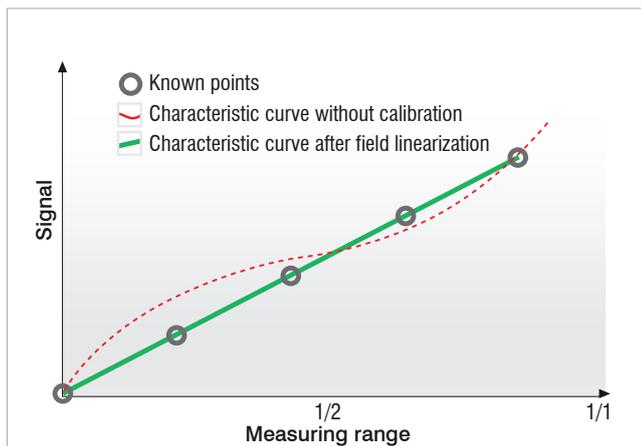


### Field calibration



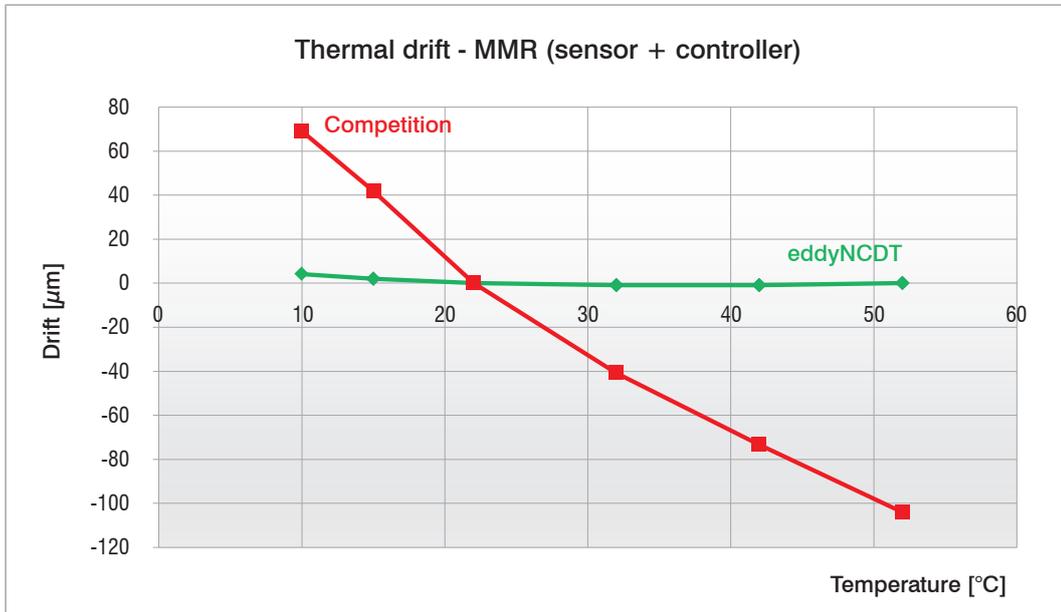
If the installation situation does not correspond to the standard installation conditions, field linearization is recommended (available with eddyNCDT 3060 and eddyNCDT 3300). This on-site calibration compensates for influences which result from the installation scenario or the target materials and shapes. Therefore, optimum measurement accuracies will always be achieved even in the case of difficult installation conditions.

For machine integration, linearization with 2 fixed points (start and end point) is sufficient in most cases. Using 3 or 5 points for linearization enables to increase the accuracy again.



For a linearization with 2 or more points, this applies only within the selected edge points. Outside this range, there may be larger linearity deviations.

## Thermal drift of a Micro-Epsilon eddy current system compared with the competitors



All eddyNCDT sensors and controllers are actively temperature-compensated (sensors up to max. 180 °C, controllers up to max. 50 °C). This means that the temperatures of the sensor and the controller are recorded during operation and considered in the measurement result. This results in an extremely stable measurement signal.

The figure shows a Micro-Epsilon sensor (green) compared with competing products (red). The maximum deviation over the entire temperature range is significantly below the 150 ppm/°C specified in the data sheet. Occasionally the deviation for the temperature increase of one degree amounts to a maximum of 150 ppm.

Conclusion: In order to keep precise measurement values in the μm range constant and reliable, the resolution to be achieved and the temperature influence are crucial factors. The temperature stability of the Micro-Epsilon system achieves such a high level that temperature fluctuations are actively compensated for. Due to the higher temperature influence of the competitor system, even daily temperature fluctuations of ±2.5 °C can cause a deviation of >20 μm. Measurements with micrometer accuracy are therefore not possible with the competitor system without active temperature compensation, even in normal environments.

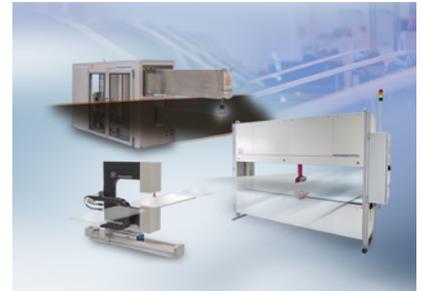
## Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



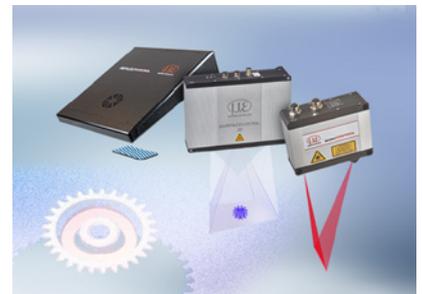
Measuring and inspection systems for metal strips, plastics and rubber



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