Operating Instructions

eddyNCDT 3060
eddyNCDT 3061
Non-contact Compact Displacement Measuring System Based on Eddy Currents

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<tr>
<td>A 2 Model Designation Sensor</td>
<td></td>
<td>54</td>
</tr>
<tr>
<td>A 3 Model Designation Sensor Cable</td>
<td></td>
<td>54</td>
</tr>
</tbody>
</table>
1. **Safety**

System operation assumes knowledge of the operating instructions.

1.1 **Symbols Used**

The following symbols are used in this operating instructions.

- **CAUTION**: Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

- **NOTICE**: Indicates a situation that may result in property damage if not avoided.

- **Measure**: Indicates hardware or a software button/menu.

- **†††**: Sensor measurement direction.

1.2 **Warnings**

Connect the power supply and the display/output device according to the safety regulations for electrical equipment.

- **CAUTION**: Risk of injury
- **CAUTION**: Damage to or destruction of the sensor and controller

Avoid shocks and impacts to the sensor and controller.

- **NOTICE**: Damage to or destruction of the sensor and/or controller

The supply voltage must not exceed the specified limits.

Protect the sensor cable against damage.

- **NOTICE**: Destruction of the sensor
- **NOTICE**: Failure of the measuring device
1.3 Notes on CE Marking
The following apply to the eddyNCDT 306x:
- EU Directive 2014/30/EU
- EU Directive 2011/65/EU, “RoHS” category 9
Products which carry the CE mark satisfy the requirements of the EU directives cited and the European harmonized standards (EN) listed therein.
The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, article 10, at:

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The measuring system is designed for use in industrial environments and meets the requirements.

1.4 Intended Use
- The measuring system is designed for use in an industrial environment. It is used for
  - measuring displacement, distance, movement and thickness,
  - measuring the position of parts or machine components.
- The system may only be operated within the limits specified in the technical data, see Chap. 2.5.

⇒ The measuring system must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the controller.
⇒ Take additional precautions for safety and damage prevention in case of safety-related applications.
1.5 Proper Environment

- Protection class:
  - Sensor, sensor cable: IP 68 (plugged)
  - Controller: IP 67 (plugged)

- Temperature range:
  - Operation:
    - Sensor, sensor cable: -20 ... +180 °C (-4 ... +356 °F), valid for sensor ES-U1
    -20 ... +200 °C (-4 ... +392 °F), valid for standard sensors
    - Controller: 0 ... +50 °C (+32 ... +122 °F)
  - Storage:
    - Sensor, sensor cable: -50 ... +180 °C (-58 ... +356 °F), valid for sensor ES-U1
    -50 ... +200 °C (-58 ... +392 °F), valid for standard sensors
    - Controller: -10 ... +70 °C (+14 ... +158 °F)

- Humidity: 5 - 95 % (non-condensing)

- Ambient pressure: Atmospheric pressure
2. **Functional Principle, Technical Data**

2.1 **Field of Application**

The eddyNCDT 306x non-contact, compact displacement measuring systems are designed for industrial applications in production plants, for machine supervision and for measuring and testing in in-process quality assurance.

2.2 **Measuring Principle**

The eddyNCDT 306x (Non-Contacting Displacement Transducers) displacement measuring system operates without contact using eddy current technology. It is used for making measurements on targets made of either ferromagnetic or non-ferromagnetic electrically conductive materials.

A high frequency alternating current is passed through a coil installed in a sensor housing. The electromagnetic coilfield induces eddy currents in the conductive target thus changing the AC resistance of the coil. This change in impedance is interpreted by demodulation electronics which generate an electrical signal proportional to the distance of the target from the sensor.

A patented electronic compensation technique reduces temperature-dependent measuring errors to a minimum.

2.3 **Structure of the Complete Measuring System**

The eddyNCDT 306x non-contact single channel displacement measuring system consists of:

- Sensor
- Sensor cable
- Connection cable
- Controller

The components are matched to one another. The allocation of the sensor and the controller is determined by the serial number.

![Fig. 1 eddyNCDT 306x with controller and sensors](image)
2.4 Glossary, Analog Output Displacement

<table>
<thead>
<tr>
<th>SMR</th>
<th>MMR</th>
<th>EMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of measuring range</td>
<td>Mid of measuring range</td>
<td>End of measuring range (Start of measuring range + measuring range) Maximum distance between sensor front and measuring object</td>
</tr>
</tbody>
</table>

**SMR**
Minimum distance between sensor front and measuring object, sensor specific

**MMR**
Mid of measuring range

**EMR**
End of measuring range (Start of measuring range + measuring range) Maximum distance between sensor front and measuring object

**MR**
Measuring range
## 2.5 Technical Data

<table>
<thead>
<tr>
<th>Sensor</th>
<th>ES-U1</th>
<th>ES-S2</th>
<th>ES-U3</th>
<th>ES-S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>1 mm</td>
<td>2 mm</td>
<td>3 mm</td>
<td>4 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>0.1 mm</td>
<td>0.2 mm</td>
<td>0.3 mm</td>
<td>0.4 mm</td>
</tr>
<tr>
<td>End of measuring range</td>
<td>1.1 mm</td>
<td>2.2 mm</td>
<td>3.3 mm</td>
<td>4.4 mm</td>
</tr>
<tr>
<td>Resolution²³</td>
<td>static (20 Hz)</td>
<td>0.02 µm</td>
<td>0.04 µm</td>
<td>0.06 µm</td>
</tr>
<tr>
<td></td>
<td>dynamic (20kHz)</td>
<td>0.1 µm</td>
<td>0.2 µm</td>
<td>0.3 µm</td>
</tr>
<tr>
<td>Resolution²³</td>
<td>static (20 Hz)</td>
<td>0.02 µm</td>
<td>0.04 µm</td>
<td>0.06 µm</td>
</tr>
<tr>
<td></td>
<td>dynamic (20kHz)</td>
<td>0.1 µm</td>
<td>0.2 µm</td>
<td>0.3 µm</td>
</tr>
<tr>
<td>Frequency response</td>
<td>selectable 20 kHz, 5 kHz, 20 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>50 kSa/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>3-point linearization</td>
<td>≤ ± 2 µm</td>
<td>≤ ± 4 µm</td>
<td>≤ ± 6 µm</td>
</tr>
<tr>
<td></td>
<td>5-point linearization¹</td>
<td>≤ ± 1 µm</td>
<td>≤ ± 2 µm</td>
<td>≤ ± 3 µm</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>sensors²²⋅</td>
<td>≤ 0.15 µm / K</td>
<td>≤ 0.3 µm / K</td>
<td>≤ 0.45 µm / K</td>
</tr>
<tr>
<td></td>
<td>controller</td>
<td>≤ 0.015 % d.M. / K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>sensors</td>
<td>+10 °C ... +180 °C (+50 ... +356 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>controller</td>
<td>+10 °C ... +50 °C (+50 ... +122 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target material</td>
<td>ferromagnetic, non-ferromagnetic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum target size (flat)</td>
<td>operation</td>
<td>φ18 mm</td>
<td>φ36 mm</td>
<td>φ27 mm</td>
</tr>
<tr>
<td>Sensor type</td>
<td>unshielded</td>
<td>shielded</td>
<td>unshielded</td>
<td>shielded</td>
</tr>
<tr>
<td>Temperature range</td>
<td>sensors</td>
<td>operation</td>
<td>-20 °C ... +180 °C (-4 °C ... +356 °F)</td>
<td>-20 °C ... +200 °C (-4 °C ... +392 °F)</td>
</tr>
<tr>
<td></td>
<td>storage</td>
<td>-50 °C ... +180 °C (-58 °C ... +356 °F)</td>
<td>-50 °C ... +200 °C (-58 °C ... +392 °F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>controller</td>
<td>operation</td>
<td>0 °C ... +50 °C (+32 °C ... +122 °F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>storage</td>
<td>-10 °C ... +70 °C (+14 °C ... +158 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage (power consumption)</td>
<td>12 ... 32 VDC (2.5 W)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure resistance</td>
<td>front</td>
<td>20 bar</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rear</td>
<td>5 bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Functional Principle, Technical Data

<table>
<thead>
<tr>
<th>Sensor</th>
<th>ES-U1</th>
<th>ES-S2</th>
<th>ES-U3</th>
<th>ES-S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output</td>
<td>0 ... 10 V (short circuit proof); 4 ... 20 mA (load max. 500 Ohm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>sensors (without nuts)</td>
<td>2.4 g</td>
<td>11 g</td>
<td>12 g</td>
</tr>
<tr>
<td></td>
<td>controller</td>
<td></td>
<td></td>
<td>ca. 230 g</td>
</tr>
<tr>
<td>Shock (DIN-EN 60068-2-29)</td>
<td></td>
<td></td>
<td></td>
<td>15 g / 6 ms in 3 axes, 2 directions and 1000 shocks each</td>
</tr>
<tr>
<td>Vibration (DIN-EN 60068-2-6)</td>
<td></td>
<td></td>
<td></td>
<td>5 g / 10 ... 500 Hz in 3 axes, 2 directions and 10 cycles each</td>
</tr>
<tr>
<td>Protection class (DIN-EN 60529)</td>
<td>sensors</td>
<td></td>
<td></td>
<td>IP68 (plugged)</td>
</tr>
<tr>
<td></td>
<td>controller</td>
<td></td>
<td></td>
<td>IP67 (plugged)</td>
</tr>
</tbody>
</table>

**FSO = Full Scale Output**

1) Valid for operation with DT3061 controller
2) Relates to mid of measuring range
3) RMS value of the signal noise
3. Delivery

3.1 Unpacking, Included in Delivery

1 Sensor incl. sensor cable
1 Controller
1 Test log
1 Quick manual
1 PC3/8-M12 (analog output/ power supply)
1 SCD2/4/RJ45 Ethernet adapter cable

- Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.
- Check the delivery for completeness and shipping damage immediately after unpacking.
- If there is damage or parts are missing, immediately contact the manufacturer or supplier.

You will find optional accessories in appendix, see Chap. A 1.

3.2 Storage

- Temperature range storage:
  - Sensors: -50 ... +180 °C (-58 ... +356 °F), valid for sensor ES-U1
  - Controller: -50 ... +200 °C (-58 ... +392 °F), valid for standard sensors
  - Humidity: 5 - 95 % (non condensing)
4. Installation and Assembly

4.1 General

No sharp or heavy objects should be allowed to affect the cable sheath of the sensor cable, the supply cable and the output cable.

- A damaged cable cannot be repaired. Tension on the cable is not permitted!

4.1.1 Model

The eddyNCDT measuring system will be used with unshielded or shielded sensors.

**Unshielded sensors**
- Type designation: ES-Ux
- Construction: The sensor cap with encapsulated coil consists of electrically non-conducting materials.

- In the radial direction metal parts in the vicinity may behave similar to the measuring object, rendering the measurement result inaccurate. Please note this by selection of material for sensor mounting and their setup.

![Fig. 2 Unshielded sensor](image)

**Shielded sensors**
- Type designation: ES-Sx
- Construction: The sensor enclosed up to its front face with a steel housing with a mounting thread. With it the sensor is shielded from interference through radially near located metal parts.

![Fig. 3 Shielded sensor](image)
4.1.2 Start of Measuring Range

Fig. 4 Start of measuring range (SMR), the minimum distance between sensor face and target

For each sensor a minimum distance to the measuring object must be maintained. This avoids a measurement uncertainty due to the sensor pressing on the measuring object and mechanical damage to the sensor/target.

Eddy current displacement sensors can be affected in their measurement properties by a metallic holder. Depending on the sensor type, the following sensor mounting should be preferred:

- unshielded sensors: Standard mounting
- shielded sensors: Flush mounting
4.2 Installation Scenario Sensor

4.2.1 Standard Mounting

The sensors protrude beyond the metal holder.
The installation scenario depicted is used for factory calibration of the sensors at Micro-Epsilon.
The technical sensor data correspond to standard installation conditions.
If you want to achieve the values indicated in the data sheet, we recommend to install the sensor in the same way as it was during calibration.

**Sensors with a thread**

1. Insert the sensor through the hole in the sensor holder.
2. Screw the sensor tight.
3. Turn the mounting nuts from the delivery on both sides on the thread protruding from the holder.
4. Tighten the mounting nuts carefully to avoid damage, particularly to smaller sensors.

> Prefer the standard mounting of the sensor, because the optimum measurement results can be achieved with this method!

Fig. 5 Unshielded sensor with thread in standard mounting

<table>
<thead>
<tr>
<th>Sensor</th>
<th>ES-U1</th>
<th>ES-U3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension A</td>
<td>8 mm</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

Fig. 6 Shielded sensor with thread in standard mounting

<table>
<thead>
<tr>
<th>Sensor</th>
<th>ES-S2</th>
<th>ES-S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension A</td>
<td>4 mm</td>
<td>4 mm</td>
</tr>
</tbody>
</table>

During calibration maintain the same relative position of the sensor to the holder as for the measurement!
4.2.2 Flush Mounting

Flush mounting does not correspond to factory calibration. Micro-Epsilon recommends to carry out at least a 3-point field linearization.

- Linearize the measuring system, if possible, when it is exactly arranged (in the same way as it will be arranged later during the measurement process).

**Sensors with a thread**
- Mount shielded or unshielded sensors flush in a sensor holder of insulating material (plastic, ceramic, et cetera).
- Mount the shielded sensors flush in a metal sensor holder, see Fig. 8.
- Mount unshielded sensors flush in a metal sensor holder, see Fig. 7. Make sure that a recess of a size three times the sensor diameter is used.
- In all mounting cases screw the sensor into the threaded hole and lock it with the mounting nut.
- Tighten carefully to avoid damage, particularly to smaller sensors.

- Calibrate the measuring system in the measuring setup with actual mounted sensor.

---

**Fig. 7 Flush mounting of an unshielded sensor in a metal holder**

**Fig. 8 Flush mounting of a shielded sensor in a metal holder**
4.3 **Measurement Setup, Operating Multiple Sensors**

Sensors of the eddyNCDT 306x series cannot be synchronized. Observe the following installation information regarding the minimum distance between two sensors:

- 3x sensor diameter distance between two unshielded sensors with equal carrier frequency (e.g., low frequency)
- 1.5x sensor diameter distance between two shielded sensors with equal carrier frequency (e.g., low frequency)
- Two nearby mounted sensors only as low frequency and high frequency models

No synchronization required

Not possible
4.4 Dimensional Drawings Sensors

Fig. 9 Dimensional drawing sensors ES-U1-C-CAx/mB0, dimensions in mm (inches)

Fig. 10 Dimensional drawing sensors ES-S2-C-CAx/mB0, dimensions in mm (inches)
**Fig. 11** Dimensional drawing sensors ES-U3-C-CAx/mB0, dimensions in mm (inches)

**Fig. 12** Dimensional drawing sensors ES-S4-C-CAx/mB0, dimensions in mm (inches)
4.5 Sensor Cable

- Do not kink the cable - the minimum bending radius is 20 mm (static) or 40 mm (moved).
- Route the sensor cable in such a way that no sharp-edged or heavy objects can affect the cable sheath.
- Connect the sensor cable to the controller.

To release the plug-in connection, hold the plug-in connector on the grooved grips (outer sleeves) and pull apart in a straight line.

- Pulling on the cable and the clamping nut locks the connector and does not release the connection.
- Avoid excessive pulling of the cables.

- Check the plugged connections for firm seating.

- Do not shorten the sensor cable. Loss of the technical data specified.
The controller DT306x is installed in an aluminum casing.
- The oscillator electronics feeds the sensor with a frequency and amplitude-stable AC voltage.
- The demodulator electronics demodulates, linearizes and amplifies the distance dependent measuring signal.
The controller is already factory-calibrated to the included sensor and sensor cable.

Fig. 13 Dimensional drawing of the controller DT306x, dimensions in mm (inches)
4.7 **Target Size**

The relative size of the target object compared with the sensor affects the linearity and slope deviation for eddy current sensors.

![Diagram of sensor target sizes](image)

*Fig. 14 Minimum target size for unshielded sensors*

*Fig. 15 Minimum target size for shielded sensors*

If the required object minimum size cannot be complied with, the following aspects must be taken into account for a sufficiently high linearity:

- The size of the target must not change.
- The target must not be moved laterally to the sensor face.

A successful calibration is a prerequisite to minimize linearity errors.

In order to achieve an optimal result, Micro-Epsilon recommends a linearity calibration on the corresponding measuring object. A change of the measuring object size has significant effects on the quality of the measurement results.
4.8 Electrical Connections

4.8.1 Connection Options

Power supply and signal output are provided via plug connectors on the front of the controller.
### 4.8.2 Pin Assignment

<table>
<thead>
<tr>
<th>PIN</th>
<th>Wire color</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>brown</td>
<td>+24 VDC supply, polarity protection</td>
</tr>
<tr>
<td>7</td>
<td>blue</td>
<td>GND supply</td>
</tr>
<tr>
<td>1</td>
<td>white</td>
<td>$U_{\text{displacement}}$ (load min. 30 kOhm)</td>
</tr>
<tr>
<td>6</td>
<td>pink</td>
<td>GND displacement</td>
</tr>
<tr>
<td>8</td>
<td>red</td>
<td>$I_{\text{displacement}}$ (load max. 500 Ohm)</td>
</tr>
<tr>
<td>3</td>
<td>green</td>
<td>Temperature and switching output 1&lt;sup&gt;1&lt;/sup&gt; $U_{\text{temp sensor}}$ / limit value 1</td>
</tr>
<tr>
<td>4</td>
<td>yellow</td>
<td>Temperature and switching output 2&lt;sup&gt;1&lt;/sup&gt; $U_{\text{temp controller}}$ / limit value 2</td>
</tr>
<tr>
<td>5</td>
<td>gray</td>
<td>GND temperature, threshold</td>
</tr>
</tbody>
</table>

**Shield**

![Fig. 16 Pin side 8-pin. housing plug](image1)

**Fig. 16 Pin assignment and color codes**

The PCx/8-M12 is a fully assembled power- and output cable; length is 3, 5 or 10 m. The GND analog grounds are connected internally. The outputs are short circuit proof.

1) Only available with controller DT3061

![Fig. 18 Supply and analog output controller, 8-pin male connector](image2)
4.8.3 Supply Voltage
Nominal value: 24 V DC (12 ... 32 V, P < 2,5 W)

Switch on the power supply unit once wiring is completed.

Connect the inputs „2“ and „7“ at the controller with a 24 V voltage supply.

<table>
<thead>
<tr>
<th>Controller Pin</th>
<th>PCx/8-M12 Color</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>brown</td>
<td>+U_B</td>
</tr>
<tr>
<td>7</td>
<td>blue</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Use the supply voltage for measurement instruments only and not for drive units or similar sources of pulse interference at the same time. MICRO-EPSILON recommends using an optional available power supply unit PS2020 for the controller.

Fig. 19 Connection of supply voltage

4.8.4 Analog Output, Displacement

The controller provides a current output 4 ... 20 mA, voltage output 0 ... 10 V.

Voltage output:

Connect the output 1 (white) and 6 (pink) on the controller to a measuring device.

Controller

<table>
<thead>
<tr>
<th>8-pin M12 cable connector</th>
<th>Color PCx/8-M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_OUT (Pin 1)</td>
<td>white</td>
</tr>
<tr>
<td>I_OUT (Pin 8)</td>
<td>red</td>
</tr>
<tr>
<td>GND (Pin 6)</td>
<td>pink</td>
</tr>
</tbody>
</table>

Fig. 20 Wiring for voltage supply

Current output:

Connect the output 8 (red) and 6 (pink) on the controller to a measuring device.

Fig. 21 Wiring for current output
4.8.5 Temperature and switching output

4.8.5.1 General
These functions are possible with the DT3061 controller. Depending on the programming, an output can be used as temperature or switching output.

4.8.5.2 Analog Output, Temperature
The temperature output enables to output the controller or sensor temperature. This function is possible with the DT3061 controller.

<table>
<thead>
<tr>
<th>Controller</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8-pol. M12 cable connector</td>
<td>Color PCx/8-M12</td>
</tr>
<tr>
<td>$U_{\text{OUT}}$ (Pin 3), Temperature sensor</td>
<td>green</td>
</tr>
<tr>
<td>$U_{\text{OUT}}$ (Pin 4), Temperature controller</td>
<td>yellow</td>
</tr>
<tr>
<td>GND (Pin 5)</td>
<td>gray</td>
</tr>
</tbody>
</table>

*Fig. 22 Circuit of temperature measurement*

4.8.5.3 Switching Output for Limit Value
Both switching outputs can be used for limit value monitoring of the displacement signal.

Electrical properties of the switching outputs:
- 0 ... 5V (TTL), short circuit proof
- Load at least 10 kOhm

*Pin assignment of limit value outputs, reference mass pin 5*
5. Operation

5.1 Checking the Measuring System Setup

1) Is the sensor adjusted for the application (target material)?
2) Are the sensor, sensor cable length and controller aligned (type and serial number)?
3) Is the sensor connected? Are the cable connections tight?

5.2 LED Controller

<table>
<thead>
<tr>
<th>LED State</th>
<th>green</th>
<th>orange</th>
<th>red</th>
<th>off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller in operation, measurement runs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software update</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor or target outside measuring range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No sensor connected, limit value or warning threshold exceeded, error</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No power supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend LED

- on
- flashes
- off
5.3 Control via Web Interface

5.3.1 Requirements

The controller generates dynamic web pages, that contain the current settings of the controller and the peripherals. The operation is only possible as long as there is an Ethernet connection to the controller.

You need a web browser that supports HTML5 (e.g. Firefox ≥ 3.5 or Internet Explorer ≥ 10) on a PC with a network connection. Use a LAN cable with M12 screw connection and RJ-45 connector, e.g. as SCD2/4/RJ45 cable available as optional accessory.

Start the SensorFinder V2.x.x program and click the button.

The tool searches for connected DT306x controller on available interfaces.

The controller is factory-set to direct connection with a static IP address to facilitate initial operation of the control.

![Search Settings](image)

**Fig. 23 Auxiliary program for sensor search and to start web interface**

If your browser is set to access the Internet via a proxy server, please add the controller IP address to the IP addresses in the browser settings, which are not to be routed over the proxy server. The MAC address of the measuring device is given on the controller rating plate.

“Javascript” and “CSS” must be enabled in the browser so that measurement results can be displayed graphically.
## Direct connection to PC

<table>
<thead>
<tr>
<th>PC with static IP</th>
<th>PC with DHCP</th>
<th>Controller with dynamic IP, PC with DHCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect the controller to a PC via a direct Ethernet connection (LAN).</td>
<td>Connect the controller to a switch.</td>
<td></td>
</tr>
</tbody>
</table>

### Network

- Start the SensorFinder.exe program.
- Click the button ![ ] and select the designated controller from the list. In order to change the address settings, click the button ![ ].
  - Address type: static IP-Address
  - IP address: 169.254.168.150
  - Subnet mask: 255.255.0.0
- Click the button ![ ] and transmit the changes to the controller.
- Click the button ![ ] to start the SensorFinder.exe program.
- Enter the controller in the DHCP / register the controller in your IT department.
- Enter the controller in the DHCP / register the controller in your IT department.

### Interactive websites

1) Requires that the LAN connection on the PC uses, for example, the following IP address: 169.254.168.1.

Interactive websites for programming the controller and peripherals now appear in the web browser.
5.3.2 Access via Web Interface

Additional help functions (e.g. Settings) are available in the top navigation bar. All settings on the web page are implemented in the controller immediately. Parallel operation with web browser and Telnet commands is possible; the last setting applies. The appearance of the web pages can change depending on the functions and the peripherals. Each page contains parameter descriptions and thus tips for configuring the controller.

Fig. 24 Interactive website after selection of the web interface

5.3.3 Operating Menu, Setting Controller Parameters

You can program eddyNCDT 306x using different methods simultaneously:

- using the web browser via the sensor web interface
- using the ASCII command set and the terminal program via Ethernet (Telnet).
5.4 Characteristics and Linearization

5.4.1 General

- Before the measurement, calibrate the measurement channel for the installation environment of the sensor and the measurement object, see Chap. 5.4.4.

The distance points for the linearization types are defined by comparison standards or micrometers calibration devices.

5.4.2 Select Characteristic

- Menu Settings > Characteristics/Linearization > Current characteristic.

The DT3060 can save one field characteristic curve. The DT3061 can save up to four different field characteristic curves, which are based on one factory calibration respectively.

Therefore, you can e.g. store different target or installation scenarios as individual characteristic curve and load them into the controller for the desired application. The Type field informs you about the underlying linearization type.

- Via the menu Select characteristic, choose the desired characteristic curve or linearization for your measurement.
5.4.3 Scaling Measuring Range

There are two ways to scale the measuring range of the eddyNCDT 306x:
- by using the mouse function directly in the graphic
- using the fields Current measuring range begin and Current measuring range end.

Fig. 25 Scaling the measuring range using the pointer

Scaling of the measuring range has an effect on the analog and digital outputs without increasing the resolution. The reference to the scaling of the analog output remains, i.e. the selected start of measuring range corresponds to 0 V on the voltage output.

With the Nominal measuring range button, you can reset a manual scaling.
5.4.4 Calibration and Linearization

5.4.4.1 Offset

Before a calibration is performed, the measuring device should warm up for about 30 minutes.

The system is linearized, the mechanical zero point in the installed state should be redefined.

- **Menu Settings > Characteristics/Linearization >**
  Carry out field linearization.
- **Choose Offset** for linearization and the desired unit.

You can freely choose the zero point within the sensor measuring range.

**Fig. 26 Exemplary zero point shifting using an ES-U3 sensor**

You can permanently store the linearization result.

- **Select a memory location with Select field characteristic.**
- **Enter a description for the linearization in the field Set name.**
- **Click on the button Save & activate.**
5.4.4.2 2-Point Linearization

Choose 2-point for linearization and the desired unit. The system is linearized and should be adapted to the ambient conditions in the machine.

Menu Settings > Characteristics/Linearization > Carry out field linearization.

Before a calibration is performed, the measuring device should warm up for about 30 minutes.

Fig. 27 Exemplary 2-point-linearization using an ES-U3 sensor

You can freely choose the linearization points within the sensor measuring range. A linear slope and offset correction of the characteristic curve is performed.

- Place the measurement object to the sensor in point 1.
- Enter the measurement value (1).
- Confirm point 1 with Submit.
- Repeat this procedure for the linearization point 2.
- Click on the button Linearize. The system executes the linearization.

You can permanently store the linearization result.

- Select a memory location with Select field characteristic.
- Enter a description for the linearization in the field Set name.
- Click on the button Save & activate.
5.4.4.3 3-Point Linearization

- **Menu** Settings > Characteristics/Linearization > Carry out field linearization.

If the sensor or the measurement object is changed by the user, a calibration must be carried out before the measurement. Here, use the following if possible:
- the original sensor mounting,
- the original measurement object.

Before a calibration is performed, the measuring device should warm up for about 30 minutes.

Choose 3-point for linearization and the desired unit.

**Fig. 28 Exemplary linearization using an ES-U3 sensor**

Sensor balancing occurs via three distance points which are specified by a comparison standard. You can freely choose the linearization points within the sensor measuring range.

- Place the measurement object to the sensor in point 1.
- Enter the measurement value (1).
- Confirm point 1 with **Submit**.
- Repeat this procedure for the linearization points 2 and 3.
- Click on the button **Linearize**. The system executes the linearization.
- You can permanently store the linearization result.
- Select a memory location with **Select field characteristic**.
- Enter a description for the linearization in the field **Set name**.
- Click on the button **Save & activate**.
5.4.4 5-Point Linearization

This function is available with controller DT3061.

Menu Settings > Characteristics/Linearization > Carry out field linearization.

If the sensor or the measurement object is changed by the user, a calibration must be carried out before the measurement. Here, use the following if possible:
- the original sensor mounting,
- the original measurement object.

Before a calibration is performed, the measuring device should warm up for about 30 minutes.

Choose 5-point for linearization and the desired unit.

Sensor balancing occurs via five distance points which are specified by a comparison standard. You can freely choose the linearization points within the sensor measuring range.

Fig. 29 Exemplary linearization using an ES-U3 sensor

You can permanently store the linearization result.

Select a memory location with Select field characteristic.

Enter a description for the linearization in the field Set name.

Click on the button Save & activate.
5.4.5 Manage characteristics

The menu `Settings > Characteristics/Linearization > Manage characteristic` enables the import/export of factory-set characteristics and field characteristics. In addition, the field characteristics can be deleted, renamed or overwritten. Importing the factory-set characteristics is possible only to a limited extent if these have been protected by the manufacturer.

### Manage factory-set characteristics

<table>
<thead>
<tr>
<th>Name</th>
<th>Export</th>
<th>Import</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 W0_0002082070_0000_000099</td>
<td>![Up]</td>
<td>![Down]</td>
</tr>
<tr>
<td>2 W0_00000000-1_001_0000-1</td>
<td>![Up]</td>
<td>![Down]</td>
</tr>
<tr>
<td>3 W0_00000000-1_001_0000-1</td>
<td>![Up]</td>
<td>![Down]</td>
</tr>
<tr>
<td>4 W0_00000000-1_001_0000-1</td>
<td>![Up]</td>
<td>![Down]</td>
</tr>
</tbody>
</table>

### Manage field characteristics

<table>
<thead>
<tr>
<th>Name</th>
<th>Reference factory-set characteristic</th>
<th>Rename</th>
<th>Export</th>
<th>Import</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td>F068 MaT1</td>
<td>1: W0_0002082070_0000_000099</td>
<td>![Aa]</td>
<td>![Up]</td>
<td>![Down]</td>
<td>![X]</td>
</tr>
<tr>
<td>F14 1.3441</td>
<td>1: W0_0002082070_0000_000099</td>
<td>![Aa]</td>
<td>![Up]</td>
<td>![Down]</td>
<td>![X]</td>
</tr>
<tr>
<td>F2:1 St37</td>
<td>1: W0_0002082070_0000_000099</td>
<td>![Aa]</td>
<td>![Up]</td>
<td>![Down]</td>
<td>![X]</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
<td>![Aa]</td>
<td>![Up]</td>
<td>![Down]</td>
<td>![X]</td>
</tr>
</tbody>
</table>

*Fig. 30 Characteristic management in the controller*
5.5 Processing

5.5.1 Hardware filter
The Hardware filter parameter in the tab Settings > Processing influences the bandwidth of the analog low-pass filter. This affects the analog outputs and the digital output. No data rate reduction.

| Hardware filter | 20 / 5,000 / 20,000 Hz |

5.5.2 Sensor Temperature, Controller Temperature

The warning threshold parameters enable the monitoring of sensor or controller. Output of values exceeding/not reaching the thresholds is carried out via the switching outputs, see Chap. 4.8.5, or as warning message in the web interface.

<table>
<thead>
<tr>
<th>Sensor temperature</th>
<th>Lower warning limit</th>
<th>+10 ... +180 °C&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper warning threshold</td>
<td>(+50 ... +356 °F)</td>
<td>Value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controller temperature</th>
<th>Lower warning limit</th>
<th>+10 ... +50 °C&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper warning threshold</td>
<td>(+50 ... +122 °F)</td>
<td>Value</td>
</tr>
</tbody>
</table>

1) Typical range of values. The actual range depends on the sensor/controller used.

---

- **Gray shaded fields** require a selection.
- **Value** fields require you to specify a value.

eddyNCDT 306x
## 5.6 Outputs

### 5.6.1 Displacement, analog

- **Menu** Settings > Outputs > Displacement, analog.

Max. output range: 4 mA ... 20 mA or 0 V ... 10 V

Output amplification $\Delta I_{\text{OUT}} : 16$ mA or $\Delta U_{\text{OUT}} : 10$ V; corresponds to 100 % MR

In every case, two points are used which characterize the start and the end of the analog output.

Together with the **Change scaling measuring range** function, you can adapt the analog output to your individual requirements.
5.6.2 Temperature and Limit Value Outputs

5.6.2.1 General

These functions are possible with the DT3061 controller. Depending on the configuration, an output can be used as temperature or switching output.

5.6.2.2 Temperature Output

Menu Settings > Outputs > Temperature

Via the temperature outputs, the sensor and controller temperatures can be scaled and output as analog voltage.

<table>
<thead>
<tr>
<th>Sensor temperature</th>
<th>Temperature output Sensor / Limit value output 1 / Off</th>
<th>Start of range</th>
<th>End of range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit value 1</td>
<td></td>
<td>0 ... +5 V</td>
<td>for temperatures from +10 ... +180 °C 1 (+50 ... +356 °F)</td>
</tr>
<tr>
<td>Electronics temperature (controller)</td>
<td>Temperature output electronics / Limit value output 2 / Off</td>
<td>Start of range</td>
<td>End of range</td>
</tr>
<tr>
<td>Limit value 2</td>
<td></td>
<td>0 ... +5 V</td>
<td>for temperatures from +10 ... +50 °C 1 (+50 ... +122 °F)</td>
</tr>
</tbody>
</table>

The accuracy of the temperature measurement depends on the installation scenario. Reproducibility is high.

1) Typical range of values. The actual range depends on the respective temperature compensation.
5.6.2.3 Limit Output

This function is available with controller DT3061.

The eddyNCDT 3061 can check the measurement result to adjustable limits. This means that threshold values can be monitored, impermissible tolerances detected and sorting criteria realized. Type and reference for the limit monitoring are selectable and apply to the current characteristic.

Type: Relative | Peak-To-Peak | Dynamic.

### Relative
The threshold values A/B refer to the set Reference value.

### Peak-To-Peak
The threshold values A/B refer to the peak-to-peak value calculated in blocks (Peak-to-Peak $\Delta t$ parameter).

### Dynamic
The threshold values A/B refer to a continuously calculated, moving average (Average $\Delta t$).

*Fig. 31 References for limit monitoring*
Operation

**Fig. 32** Timing limit monitoring, event (E) < hold time, logic: positive

**Fig. 33** Timing limit monitoring, event (E) > hold time, logic: negative

- $t$: Duration of limit infringement
- $t_1$: Delay time
- $t < t_1$: Limit output passive
- $t \geq t_1$: Limit output active

**Fig. 34** Parameters for limit monitoring
5.7 System Settings

5.7.1 Language Selection
The web interface promotes the units millimeter (mm) when displaying measuring results. You can choose Chinese, German, English, Japanese or Korean in the web interface. You can also change the language in the menu bar.

5.7.2 Login, Change of the User Level

Menu Settings > System settings > Switch user

In the delivery state, the controller is set to Expert level. Change to the User level by clicking the Logout button. Enter the password into the Password field, and confirm with Login in order to switch to the Expert user level.

In Professional mode, you can use the system settings to assign a user-defined password, see Chap. 5.7.3.

Fig. 35 Change in the professional user level

The current user level remains after leaving the web interface of restarting the controller.

<table>
<thead>
<tr>
<th>The following functions are accessible for the user:</th>
<th>User</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password required</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>View settings</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Change settings, linearization, anolog output, password</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Start measuring, scaling diagrams</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Fig. 36 Permissions within the user hierarchy
5.7.3 Password
Assigning passwords and the User level prevent unauthorized changes to controller settings. In the delivery state, no password is deposited in the controller.

A firmware update will not change a custom password.

After the controller has been configured, you should enable password protection.

Change to the menu Settings > System settings > Change password.

| Password | Value | All passwords are case-sensitive. Letters and numbers are allowed, but special characters are not permitted. A password consists of max. 16 characters. |

When a password is assigned for the first time, the field Old password remains empty.

5.7.4 Ethernet Settings

Menu Settings > System settings > Settings Ethernet.

The IP address of the controller is factory-set to 169.254.168.150. Communication with the controller is performed via a data port (factory-set 10001) for measurement data transmission.

You can change the IP settings and the data port at any time:
- using the web browser,
- using the SensorFinder Software.

| Address type | Static IP address / Dynamic (DHCP) | When using a static IP address it is necessary to enter the values for the IP address, netmask and gateway; this is not required when DHCP is used. When DHCP is activated, the controller is accessible in the network under its DHCP Host name. It contains the name and serial number and is unchangeable, see Chap. 5.3.1. With DHCP it may be necessary to enable the controller MAC address. |
| IP address | Value | | |
| Netmask | Value | | |
| Gateway | Value | | |
| MAC address | Value | | |
| UUID | Value | | |
| Data port | Value | Setting the port on the measurement value server |
5.7.5  Import, Export

Menu Settings > System settings > Manage settings.

Here you can export all controller settings in a file or reimport them from a file.

- **Controller settings**
  - e.g. hardware filter, limit value settings

- **Ethernet settings**
  - e.g. IP address, subnet mask

When importing settings, consider if you want to replace the current controller and/or Ethernet settings.

Choose the desired import option in the settings section.
5.8 Positioning the Target

Position the target within the sensor measuring range. The value for the start of the measuring range (SMR) depends on the sensor. This value can be found in the technical data of the sensor, see Chap. 2.5. If the user restricts the measuring range, this possibly results in new values for SMR, MMR and EMR.

Factory-scaling of analog output
5.9 Distance Measurements

Switch to the Measurement menu.

Click the Start measuring button.

Statistic values are calculated in the web interface. Clicking onto the start/stop measuring button starts/stops the calculation. At the beginning of measurement, the statistic values are reset. During a measurement, the statistic values are updated with each new package received by the controller.
# 6. Elimination Errors

<table>
<thead>
<tr>
<th>Error</th>
<th>Cause and solution</th>
</tr>
</thead>
</table>
| Output signal in positive or negative saturation, depends on the scaling of the analog output. | - Cable and/or sensor not connected.  
- Sensor has open loop.  
- Cable is defective.  

⇒ Please note the remarks in the web interface.  
Replace cable and/or sensor. |
| Output signal oscillates at low frequency in multi-channel mode.     | - Interference between sensors  

⇒ Please note the remarks for sensor arrangement with LF and HF band, see Chap. 4.3. |
| No change in output signal                                           | ⇒ Check supply voltage.  

⇒ Check allocation of sensor type and cable length.  

⇒ Check sensor and cable. |
7. Liability for Material Defects

All components of the device have been checked and tested for functionality at the factory. However, if defects occur despite our careful quality control, MICRO-EPSILON or your dealer must be notified immediately. The liability for material defects is 12 months from delivery. Within this period, defective parts, except for wearing parts, will be repaired or replaced free of charge, if the device is returned to MICRO-EPSILON with shipping costs prepaid. Any damage that is caused by improper handling, the use of force or by repairs or modifications by third parties is not covered by the liability for material defects. Repairs are carried out exclusively by MICRO-EPSILON. Further claims can not be made. Claims arising from the purchase contract remain unaffected. In particular, MICRO-EPSILON shall not be liable for any consequential, special, indirect or incidental damage. In the interest of further development, MICRO-EPSILON reserves the right to make design changes without notification. For translations into other languages, the German version shall prevail.

8. Service, Repair

If the sensor, sensor cable or controller is defective please send us the affected parts for repair or exchange. If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

MICRO-EPSILON MESSTECHNIK GmbH & Co. KG
Koenigbacher Str. 15
94496 Ortenburg / Germany
Tel. +49 (0) 8542 / 168-0
Fax +49 (0) 8542 / 168-90
info@micro-epsilon.com
www.micro-epsilon.com

9. Decommissioning, Disposal

- Remove the power supply and all output cables from the controller. Incorrect disposal may cause harm to the environment.
- Dispose of the device, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.
## Appendix

### A 1 Optional Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS2020</td>
<td>Power supply unit&lt;br&gt;Input: 100-240 VAC&lt;br&gt;Output: 24 VDC / 2.5 A&lt;br&gt;Mounting onto symmetrical standard rail 35 mm x 7.5 mm DIN 50022</td>
</tr>
<tr>
<td>MC25D(01)</td>
<td>Micrometer calibration unit&lt;br&gt;Setting range: 0-2.5 mm, with digital position reading and adjustable zero, for sensors type ES04-ES2 resp. type U05-S2</td>
</tr>
<tr>
<td>SCD2/4/ RJ45</td>
<td>Industrial Ethernet cable&lt;br&gt;4-pin with M12 connector on RJ45 connector&lt;br&gt;Standard length: 2 m</td>
</tr>
</tbody>
</table>
| PCx/8-M12 | Supply and signal cable  
|-----------|--------------------------------------------------|
|           | 8-pin with M12 connector  
|           | Standard length: 3 m  
|           | Optionally available: 3 / 10 / 15 m  
|           | 10 m as drag-chain suitable variant |
## Model Designation Sensor

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Measuring range</th>
<th>Connector</th>
<th>Cable</th>
<th>Length [m]</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eddy</td>
<td>1 / 2 / 3 / 4 mm</td>
<td>S</td>
<td>C</td>
<td>2.0</td>
<td>A = mini</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B = normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C = large</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option</th>
<th>ES - S 3 - C - S A 2.0 / m B 0 /</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S = shielded</td>
<td>m = male</td>
</tr>
<tr>
<td></td>
<td>U = unshielded</td>
<td>f = female</td>
</tr>
</tbody>
</table>

### Option
- **S**: S = shielded
- **U**: U = unshielded
- **C**: C = cylindric
- **F**: F = flat
- **A**: A = axial
- **R**: R = radial
- **OE**: OE = open ends

### Controller side
- **EC**: EC = eddy cable
- **ECE**: ECE = eddy cable extension

<table>
<thead>
<tr>
<th>Nominal</th>
<th>Cable</th>
<th>Option</th>
<th>Length [m]</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC</td>
<td>3.0</td>
<td>A 90</td>
<td>f</td>
<td>OE = open ends C = groß</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal</td>
<td>Cable</td>
<td></td>
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### Sensor side
- **m**: m = male
- **f**: f = female
- **A**: A = mini
- **B**: B = normal
- **OE**: OE = open ends
- **D**: D = nominal cable diameter [mm]