MICRO-EPSILON

Operating Instructions

eddyNCDT 3060/3061

eddyNCDT 3070/3071

ES-S04-C-CAx/mB0
ES-U1-C-CAx/mB0
ES-U1-T-CAx/mB0
ES-S1-C-CAx/mB0
ES-U2-C-CAx/mB0
ES-S2-C-CAx/mB0
ES-U3-C-CAx/mB0
ES-U3-T-CAx/mB0
ES-S4-C-CAx/mB0
ES-U6-C-CAx/mB0
ES-U8-C-CAx/mB0

Non-contact Compact Displacement Measuring System Based on Eddy Currents

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Appendix

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.
➪	Indicates a user action.
i	Indicates a tip for users.
`Measure`	Indicates hardware or a software button/menu.
▲▲▲	Sensor measurement direction.

1.2 Warnings

⚠ CAUTION

Connect the power supply and the display/output device according to the safety regulations for electrical equipment.
> Risk of injury
> Damage to or destruction of the sensor and controller

NOTICE

Avoid shocks and impacts to the sensor and controller.
> Damage to or destruction of the sensor and/or controller

The supply voltage must not exceed the specified limits.
> Damage to or destruction of the sensor and controller

Protect the sensor cable against damage.
> Destruction of the sensor
> Failure of the measuring device

1.3 Notes on Product Marking

1.3.1 CE Marking

The following apply to the eddyNCDT 306x, 307x:

- EU Directive 2014/30/EU
- EU Directive 2011/65/EU

Products which carry the CE mark satisfy the requirements of the EU directives cited and the relevant applicable harmonized European standards (EN). The measuring system is designed for use in industrial and laboratory environments.
The EU Declaration of Conformity and the technical documentation are available to the responsible authorities according to the EU Directives.

1.3.2 UKCA marking

The following apply to the eddyNCDT 306x, 307x:

- SI 2016 No. 1091 (“EMC”)
- SI 2012 No. 3032 („RoHS”)

Products which carry the UKCA marking satisfy the requirements of the directives cited and the relevant applicable harmonized standards. The product is designed for use in industrial and laboratory environments.
The UKCA Declaration of Conformity and the technical documentation are available to the responsible authorities according to the UKCA Directives

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 must only be operated within the limits specified in the technical data, see Chap. 2.5.

➪ The 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 system/sensor/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-S04, ES-U1, ES-U1-T
      -20 ... +200 °C (-4 ... +392 °F)
    - Controller: 0 ... +50 °C (+32 ... +122 °F)
  - Storage:
    - Sensor, sensor cable: -20 ... +180 °C (-4 ... +356 °F), valid for sensor ES-S04, ES-U1, ES-U1-T
      -20 ... +200 °C (-4 ... +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, 307x 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, 307x (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

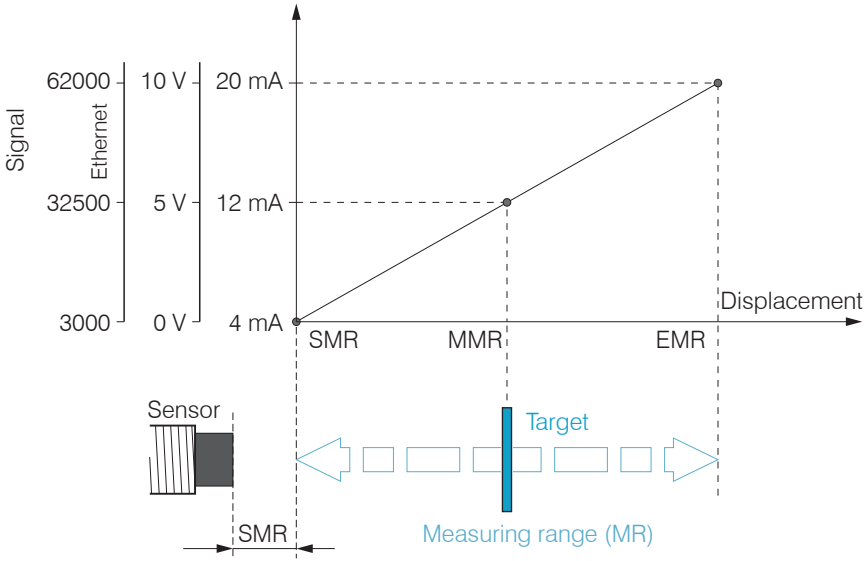
The eddyNCDT 306x, 307x non-contact single channel displacement measuring system consists of

- Sensor
- Sensor cable
- Connection cable
- Controller

i 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, 307x with controller and sensors

2.4 Glossary, Analog Output Displacement



SMR	Start of measuring range 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

2.5.1 DT306x

Controller Model		DT3060	DT3061
Resolution [1]	static (20 Hz)	0.002 % FSO	
	dynamic (20 kHz)	0.01 % 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 [2]		< ± 0.2 % FSO	< ± 0.1 % FSO
Temperature stability [3]		< 0.015 % FSO / K	
Temperature compensation		+10 … +50 °C	
Target material [4]		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; Ethernet: 5-pole M12 connector (cable see accessories)	
Mounting		through bores	
Temperature range	Operation	0 … +50 °C (+32 ... +122 °F)	
	Storage	-10 … +70 °C (+14 ... +158 °F)	

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	Die-cast aluminium
Weight	approx. 230 g

FSO = Full Scale Output

1) RMS noise relates to mid of measuring range

2) Value with 3-/5-point linearization

3) Relates to the mid of the measuring range, in the compensated temperature range

4) Steel: St37 steel DIN1.0037 / aluminum: AlMg3

2.5.2 Sensors DT306x

Sensor Model		ES-U1	ES-U1-T	ES-S1	ES-U2	ES-S2
Measuring range		1 mm		1 mm	2 mm	2 mm
Start of measuring range		0.1 mm		0.1 mm	0.2 mm	0.2 mm
Resolution [1,2,3]		0.02 µm		0.02 µm	0.04 µm	0.04 µm
Linearity [1 4]		< ±1 µm		< ±1 µm	< ±2 µm	< ±2 µm
Temperature stability [1 2]		< 0.15 µm / K		< 0.15 µm / K	< 0.3 µm / K	< 0.3 µm / K
Temperature compensation		+10 … +180 °C (+50 ... +356 °F)				
Sensor type		unshielded		shielded	unshielded	shielded
Minimum target size (flat)		Ø 18 mm		Ø 12 mm	Ø 24 mm	Ø 18 mm
Connection		integrated cable, axial, standard length 3 m; 1 m, 6 m, 9 m optional [5]				
Mounting	Thread	M6	-	M8	M8	M12
	Clamping	-	ø6f7	-	-	-
Temperature range	Storage	-20 … +180 °C (-4 ... +356 °F)		-20 … +200 °C (-4 ... +392 °F)		
	Operation	-20 … +180 °C (-4 ... +356 °F)		-20 … +200 °C (-4 ... +392 °F)		
Pressure resistance		20 bar (front); 5 bar (rear)				
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)		15 g / 49.85 … 2000 Hz in 3 axis | ±3 mm / 10 … 49.85 Hz in 3 axis				
Protection class (DIN-EN 60529)		IP68 (plugged)				
Material		stainless steel and plastic				
Weight [6]		approx. 2.4 g		approx. 2.4 g	approx. 4.7 g	approx. 11 g

1) Valid for operation with DT306x controller, referred to nominal measuring range

2) Relates to the mid of the measuring range, in the compensated temperature range

3) RMS value of the signal noise, static (20 Hz)

4) Only with DT3061 controller and 5-point linearization

5) Length tolerance cable: nominal value 0 % / + 30 %

6) Weight only sensor without nuts, without cable

Sensor Model		ES-U3	ES-U3-T	ES-S4	ES-U6	ES-U8
Measuring range		3 mm		4 mm	6 mm	8 mm
Start of measuring range		0.3 mm		0.4 mm	0.6 mm	0.8 mm
Resolution [1 2 3]		0.06 µm		0.08 µm	0.12 µm	0.16 µm
Linearity [1 4]		< ±3 µm		< ±4 µm	< ±6 µm	< ±8 µm
Temperature stability [1 2]		< 0.45 µm / K		< 0.6 µm / K	< 0.9 µm / K	< 1.2 µm / K
Temperature compensation		+10 … +180 °C (+50 ... +356 °F)				
Sensor type		unshielded		shielded	unshielded	unshielded
Minimum target size (flat)		Ø 36 mm		Ø 27 mm	Ø 54 mm	Ø 72 mm
Connection		integrated cable, axial, standard length 3 m; 1 m, 6 m, 9 m optional [5]				
Mounting	Thread	M12	-	M18	M18	M24
	Clamping	-	ø12f7	-	-	-
Temperature range	Storage	-20 … +200 °C (-4 ... +392 °F)				
	Operation	-20 … +200 °C (-4 ... +392 °F)				
Pressure resistance		20 bar (front); 5 bar (rear)				
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)		15 g / 49.85 … 2000 Hz in 3 axis asdf | sdf ±3 mm / 10 … 49.85 Hz in 3 axis				
Protection class (DIN-EN 60529)		IP68 (plugged)				
Material		stainless steel and plastic				
Weight [6]		approx. 12 g		approx. 30 g	approx. 33 g	approx. 62 g

1) Valid for operation with DT306x controller, referred to nominal measuring range

2) Relates to the mid of the measuring range, in the compensated temperature range

3) RMS value of the signal noise, static (20 Hz)

4) Only with DT3061 controller and 5-point linearization

5) Length tolerance cable: nominal value 0 % / + 30 %

6) Weight only sensor without nuts, without cable

2.5.3 Controller DT307x

Controller Model		DT3070	DT3071
Resolution [1]	static (20 Hz)	0.005 % FSO	
	dynamic (20 kHz)	0.025 % FSO	
Frequency response (-3dB)		selectable 20 kHz, 5 kHz, 20 Hz	
Measuring rate		50 kSa/s	
Linearity [2]		< ± 0.2 % FSO	< ± 0.1 % FSO
Temperature stability [3]		< 0.050 % FSO / K	
Temperature compensation		+10 … +50 °C	
Target material [4]		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; Ethernet: 5-pole M12 connector (cable see accessories)	
Temperature range	operation	0 … +50 °C (+32 ... +122 °F)	
	storage	-10 … +70 °C (+14 ... +158 °F)	

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	Die-cast aluminium
Weight	approx. 230 g

FSO = Full Scale Output
1) RMS noise relates to mid of measuring range, in the compensated temperature range
2) Value with 3-/5-point linearization
3) Relates to mid of measuring range
4) Steel: St37 Stahl DIN1.0037 / aluminum: AlMg3

2.5.4 Sensor DT307x

Sensor Model		ES-S04
Measuring range		0.4 mm
Start of measuring range		0.04 mm
Resolution [1, 2, 3]	static (20 Hz)	0.02 µm
Linearity [1, 4]		≤ ± 1 µm
Temperature stability [1, 2]		≤ 0.1 µm / K
Temperature compensation		+10 … +180 °C (+50 ... +356 °F)
Sensor type		unshielded
Minimum target size (flat)		ø 5 mm
Connection		integrated cable, axial, length 0.25 m, 0.5 m or 0.75 m [5] bending radius: static ≥ 10 mm, dynamic ≥ 20 mm
Mounting		screw connection M4
Temperature range	Operation	-20 … +180 °C (-4 ... +356 °F)
	Storage	-20 … +180 °C (-4 ... +356 °F)
Pressure resistance		100 bar front side
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)		IP50
Material		stainless steel and plastic
Weight		approx. 25 g

1) Valid for operation with DT307x controller, referred to nominal measuring range
2) Relates to the mid of the measuring range, in the compensated temperature range
3) RMS value of the signal noise, static (20 Hz)
4) Only with DT307x controller and 3-point or 5-point linearization
5) Length tolerance cable: ±0,03 m

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 the appendix, see Chap. A 1

3.2 Storage

- Temperature range storage:
  - Sensors: -20 ... +180 °C (-4 ... +356 °F), valid for sensor ES-S04, ES-U1, ES-U1-T
    -20 ... +200 °C (-4 ... +392 °F)
  - Controller: -10 ... +70 °C (+14 ... +158 °F)
- 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.

i 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 or ES-Ux-T
- Construction: The sensor cap with encapsulated coil consists of electrically non-conducting materials.

i 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.

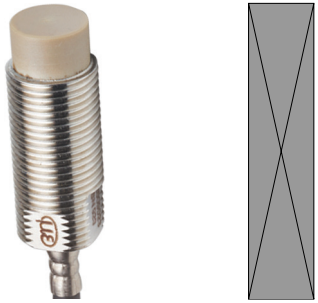


Fig. 2 Unshielded sensors with thread (left), without thread (right)

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

4.1.2 Start of Measuring Range

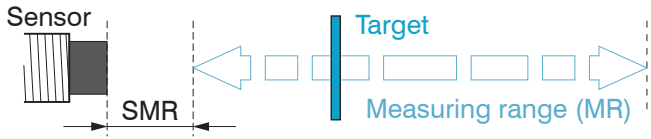


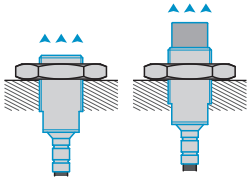
Fig. 4 Start of measuring range (SMR), the minimum distance between sensor face and target

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

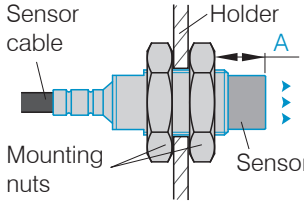


The sensors protrude beyond the metal holder.
The installation scenario depicted is used for factory calibration of the sensors at Micro-Epsilon.
The technical sensor data correspond to standard installation conditions.
If you want to achieve the values indicated in the data sheet, we recommend to install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

Sensors with a thread

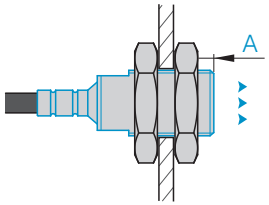
- Insert the sensor through the hole in the sensor holder.
- Screw the sensor tight.
- Turn the mounting nuts from the delivery on both sides on the thread protruding from the holder.
- Tighten the mounting nuts carefully to avoid damage, particularly to smaller sensors.

i Prefer the standard mounting of the sensor, because the optimum measurement results can be achieved with this method.
During calibration maintain the same relative position of the sensor to the holder as for the measurement!



Sensor	Dimension A
ES-U1	8 mm
ES-U2	8 mm
ES-U3	10 mm
ES-U6	20.4 mm
ES-U8	24.6 mm

Fig. 5 Unshielded sensor with thread in standard mounting



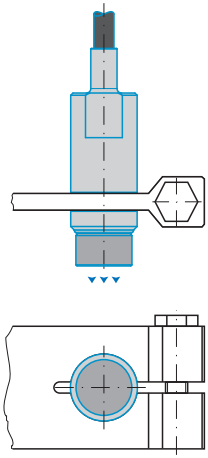
Sensor	Dimension A
ES-S04	2.4 mm
ES-S1	4 mm
ES-S2	4 mm
ES-S4	4 mm

Fig. 6 Shielded sensor with thread in standard mounting

During the factory-calibration of the sensors, the sensor front face is in a defined distance A from the mounting nut. Consider this distance A for the application in order to achieve maximum linearity.

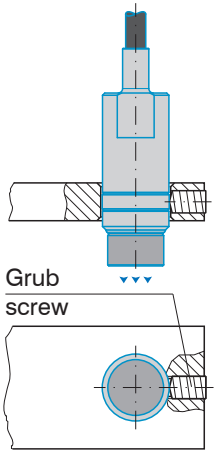
Sensors for clamping without thread

Mount sensors without thread preferably with a circumferential clamping. You can alternatively mount the sensors with a plastic grub screw.



This type of sensor installation ensures the highest level of reliability because the sensor's cylindrical cover is clamped over a relatively large area. It is imperative in complex installation environments such as machines and production plants.

Fig. 7 Circumferential clamping with clamping collet

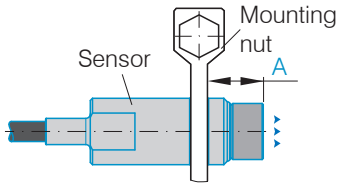


This simple type of fixture is only recommended for installation locations that are free of impact and vibration. The grub screw must be made of plastic so that it cannot damage or deform the sensor housing.

Fig. 8 Radial spot clamping with plastic grub screw

NOTICE

Do not use any grub screws made of metal.
> Risk of damage to the sensor

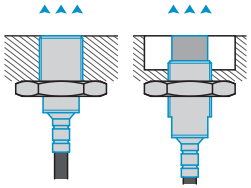


Sensor	Dimension A
ES-U1-T	7 mm
ES-U3-T	10 mm

During the factory-calibration of the sensors, the sensor front face is in a defined distance A from the mounting nut. Consider this distance A for the application in order to achieve maximum linearity.

Fig. 9 Distance between sensor front face and the sensor bracket without thread (standard mounting)

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.

i 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 unshielded sensors flush in a metal sensor holder, see Fig. 10. Make sure that a recess of a size three times the sensor diameter is used.
- Mount the shielded sensors flush in a metal sensor holder, see Fig. 11.
- 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.

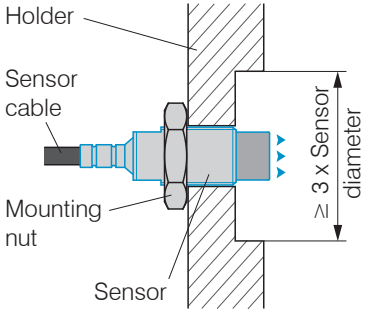


Fig. 10 Flush mounting of an unshielded sensor in a metal holder

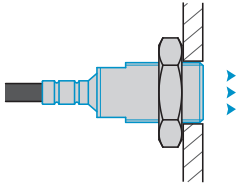


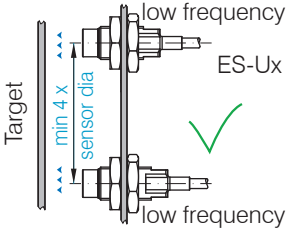
Fig. 11 Flush mounting of a shielded sensor in a metal holder

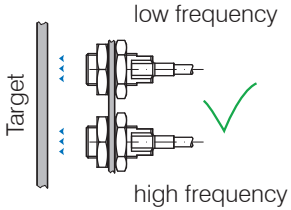
4.3 Measurement Setup, Operating Multiple Sensors

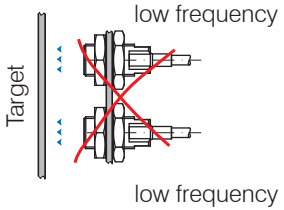
Eddy current sensors generate magnetic fields that can overlap if the sensors are placed too close to each other (so-called cross-talk). There are two solutions to avoid this:

- Mounting with sufficient minimum Distance
- Mounting sensors with different frequencies, LF (low frequency) and HF (high requency)

Sensor ES-Ux, unshielded



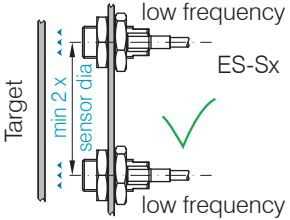


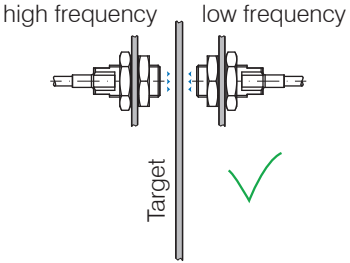


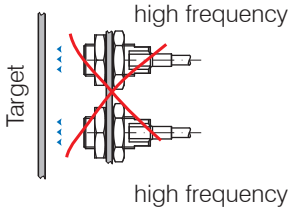
✓ No synchronization required

✗ Not possible

Sensor ES-Sx, shielded







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

If there are more than 2 sensors, the alternating sequence LF-HF-LF-HF- ... or HF-LF-HF-LF- ... must be observed.

The choice of LF or HF sensors only affects the frequency of the electric field and has no effect on the accuracy, max. frequency response or measuring rate of the controller.

4.4 Dimensional Drawings Sensors

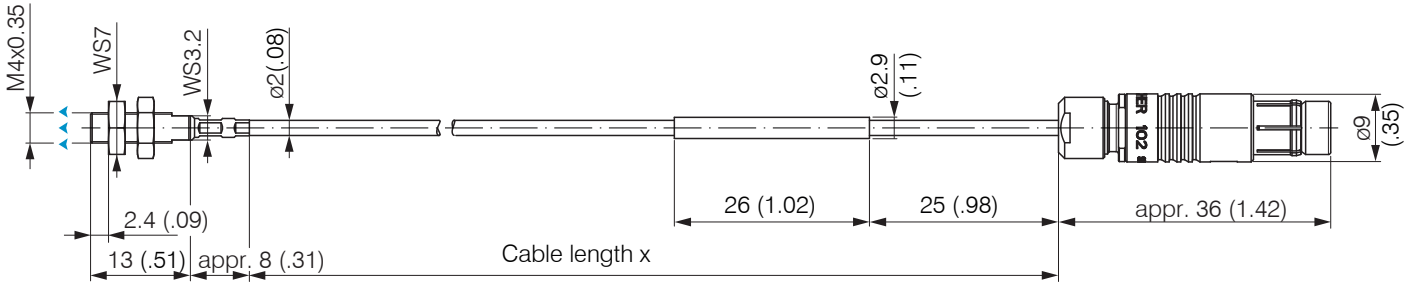


Fig. 12 Dimensional drawing sensors ES-S04-CAx/mB0, dimensions in mm (inches)

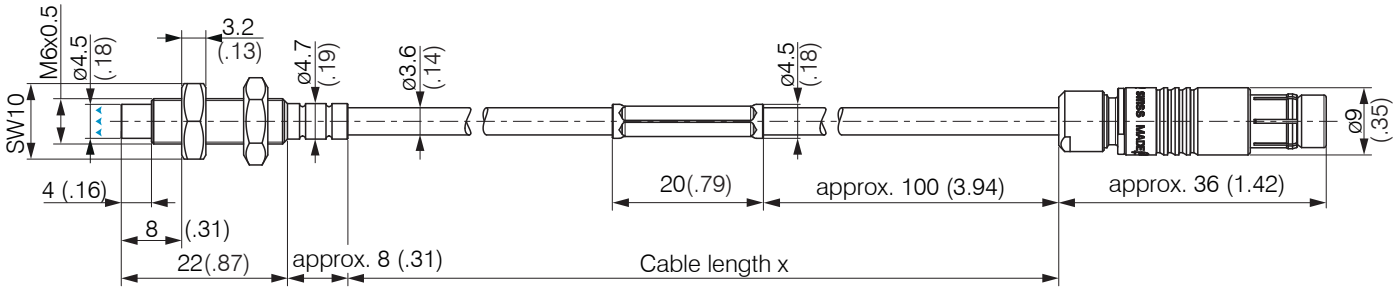


Fig. 13 Dimensional drawing sensors ES-U1-C-CAx/mB0, dimensions in mm (inches)

Measurement direction

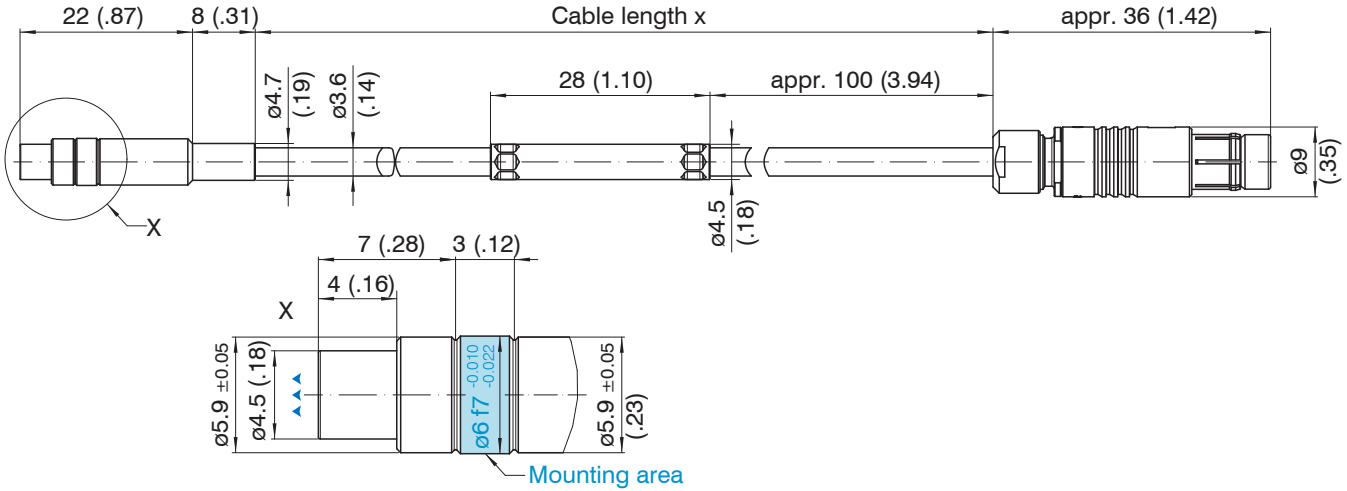


Fig. 14 Dimensional drawing sensors ES-U1-T-CAx/mB0, dimensions in mm (inches)

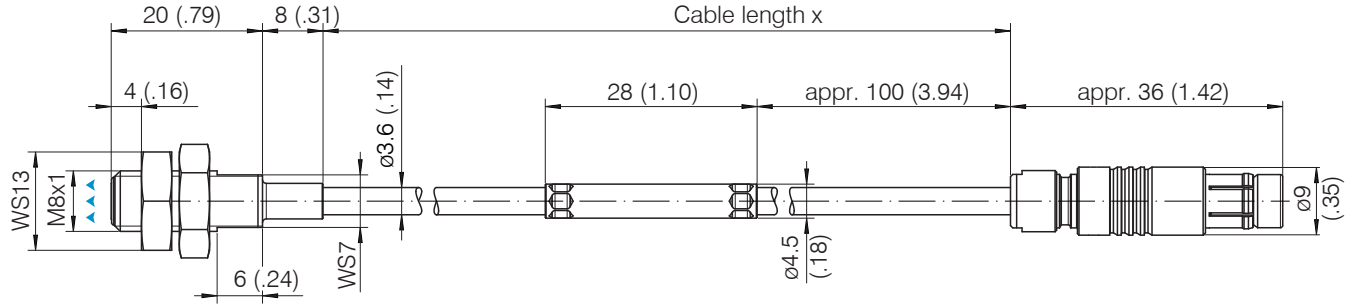


Fig. 15 Dimensional drawing sensors ES-S1-C-CAx/mB0, dimensions in mm (inches)

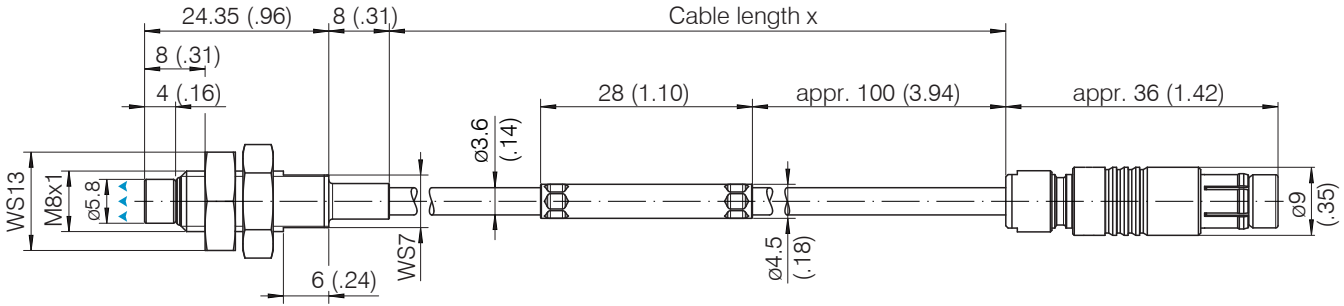


Fig. 16 Dimensional drawing sensors ES-U2-C-CAx/mB0, dimensions in mm (inches)

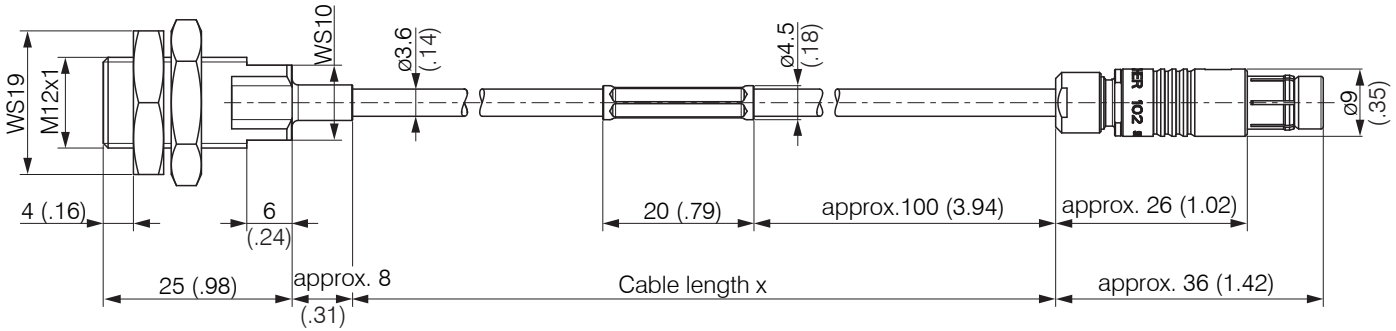


Fig. 17 Dimensional drawing sensors ES-S2-C-CAx/mB0, dimensions in mm (inches)

Measurement direction

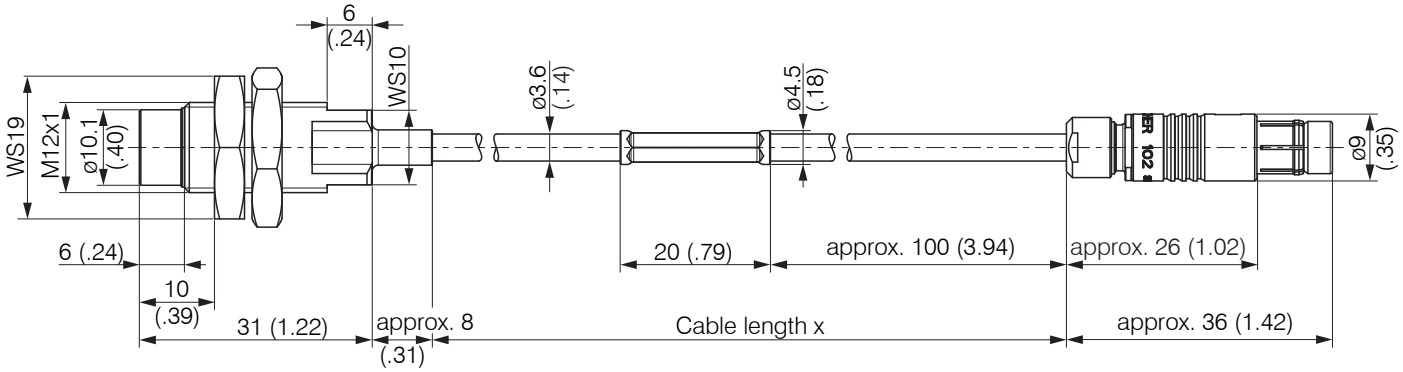


Fig. 18 Dimensional drawing sensors ES-U3-C-CAx/mB0, dimensions in mm (inches)

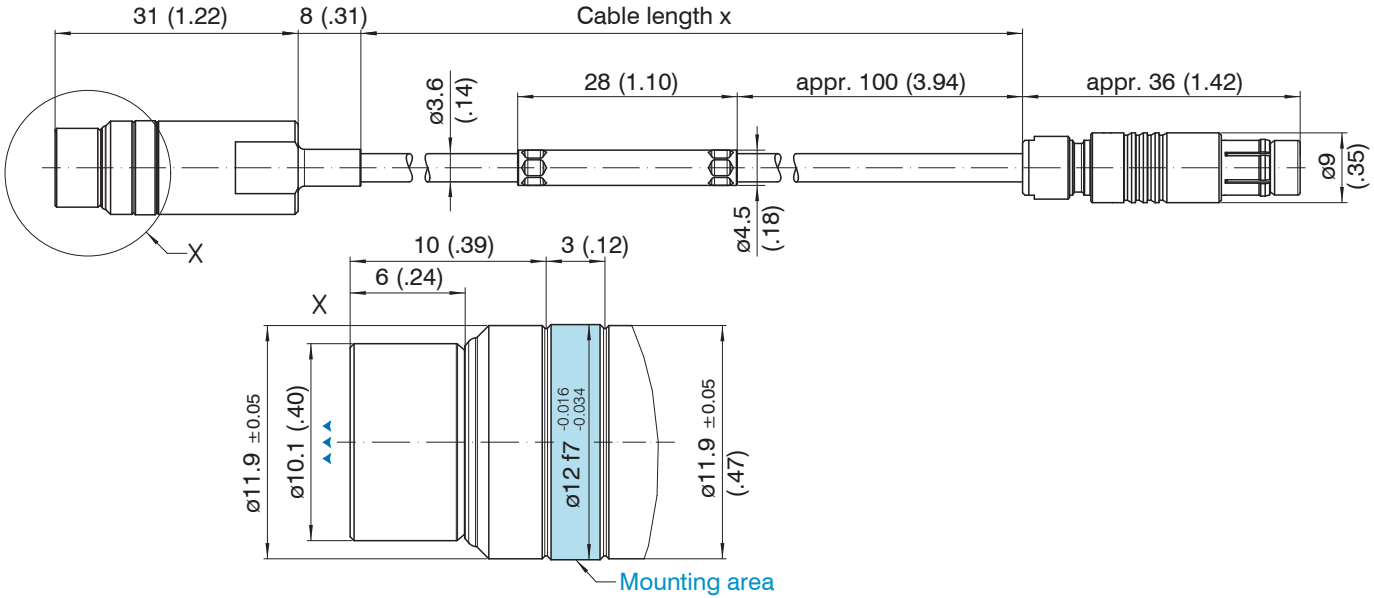


Fig. 19 Dimensional drawing sensors ES-U3-T-CAx/mB0, dimensions in mm (inches)

Measurement direction

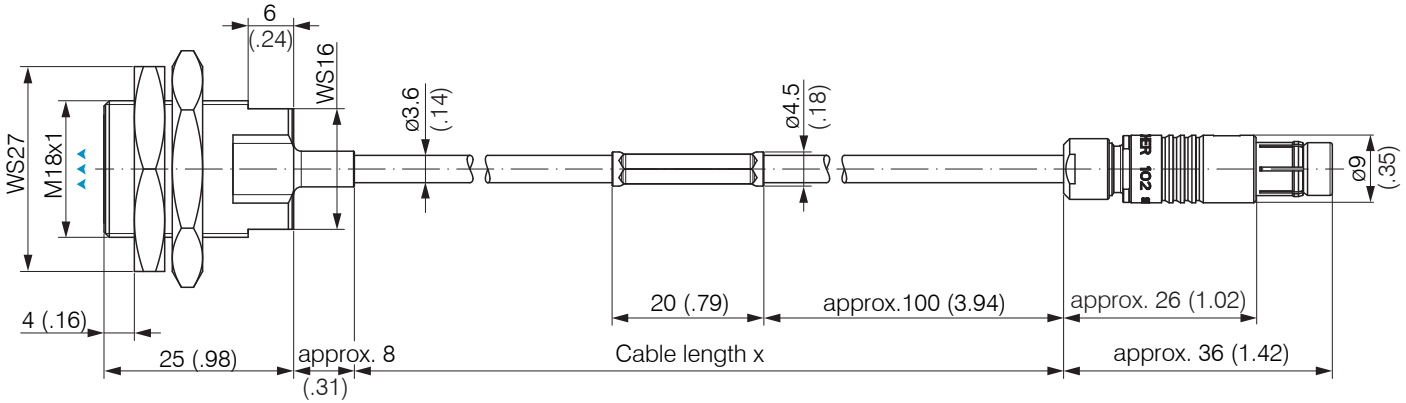


Fig. 20 Dimensional drawing sensors ES-S4-C-CAx/mB0, dimensions in mm (inches)

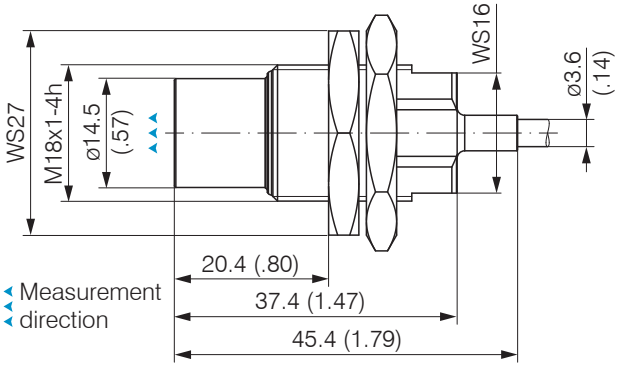


Fig. 21 Dimensional drawing sensors ES-U6-C-CAx/mB0

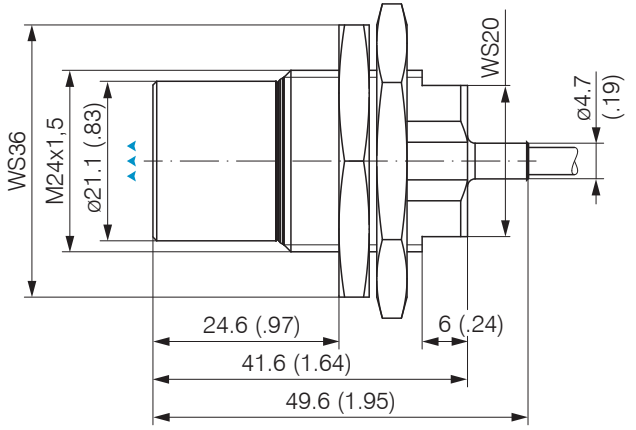


Fig. 22 Dimensional drawing sensors ES-U8-C-CAx/mB0

4.5 Sensor Cable

Do not kink the cable. Observe the minimum bending radii.

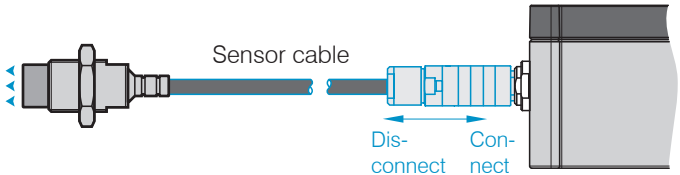
Cable-ø 2 mm		
ES-S04-CAx/mB0	fixed installation, static	10 mm
	dynamic	20 mm

Cable-ø 3,6 mm		
ES-U1-C-CAx/mB0 ES-S1-C-CAx/mB0 ES-U1-T-CAx/mB0 ES-U2-C-CAx/mB0 ES-S2-C-CAx/mB0 ES-U3-C-CAx/mB0 ES-U3-T-CAx/mB0 ES-S4-C-CAx/mB0 ES-U6-C-CAx/mB0 ES-U8-C-CAx/mB0	fixed installation, static	27 mm
	dynamic	54 mm

Fig. 23 Minimum bending radii of the sensor cables

Route the sensor cable in such a way that no sharp-edged or heavy objects can affect the cable sheath.

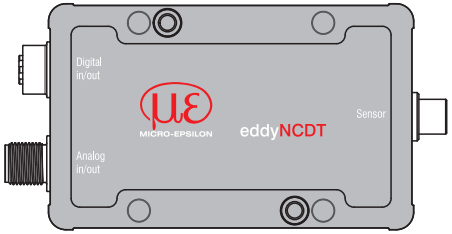
Connect the sensor cable to the controller.



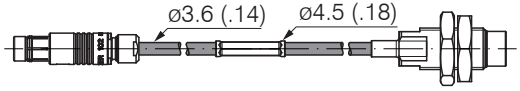
To release the plug-in connection, hold the plug-in connector on the grooved grips (outer sleeves) and pull apart in a straight line.

i Pulling on the cable and the clamping nut locks the connector and does not release the connection. Avoid excessive pulling of the cables. Do not shorten the sensor cable. Loss of the technical data specified

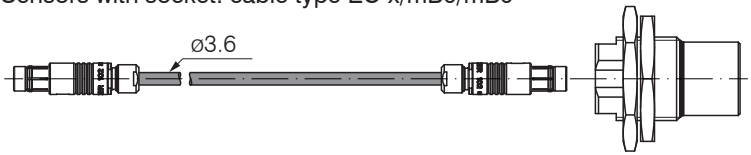
Check the plugged connections for firm seating.



Sensors with integrated cable: cable type ES-xx-C-CAx



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



Extension cable: cable type ECE-x/fB0/mB0

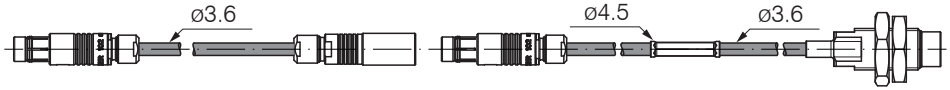
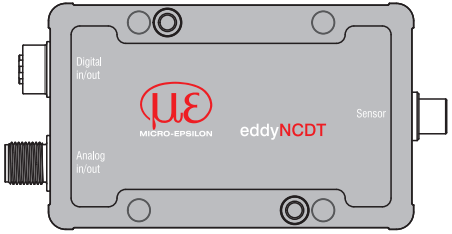
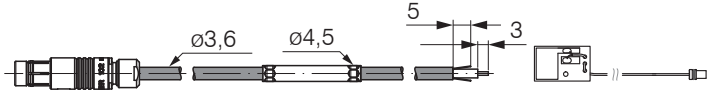


Fig. 24 Connection cable for DT3060 sensors



Sensors with integrated cable: ES-S04-C-CAx/mB0 and extension: ECE-x/fB0/mB0

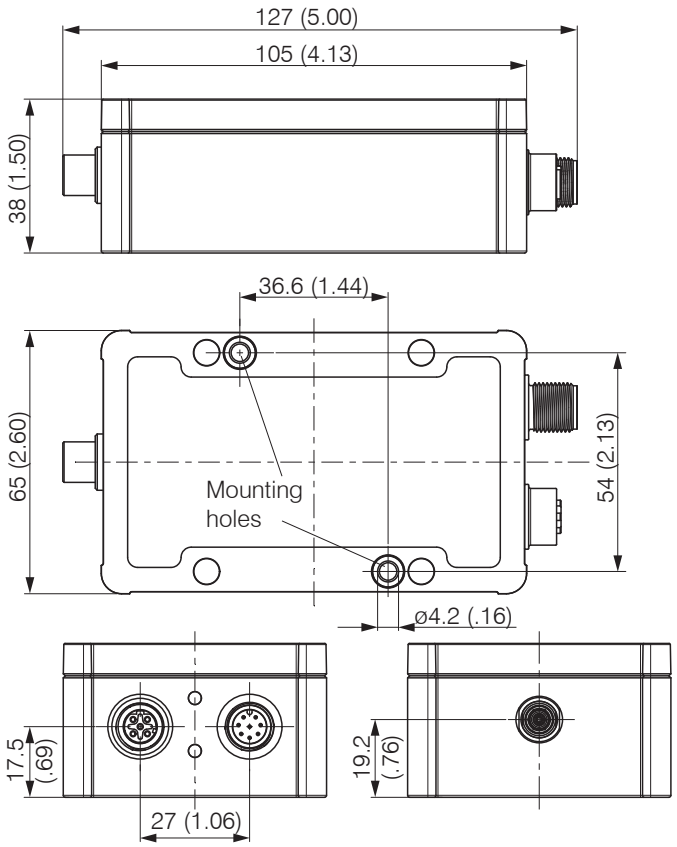
Sensors with integrated cable and open ends for solder connection via adapter cable ECA-x/OE/mB0/D3,6



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

Fig. 25 Connection cable for DT3070 sensors

4.6 Dimensional Drawing Controller



The controller DT306x, DT307x 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. 26 Dimensional drawing of the controller DT306x and DT307x, 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.

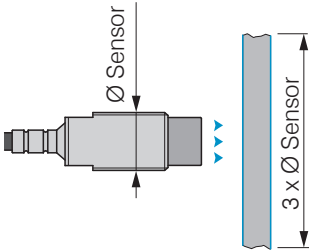


Fig. 27 Minimum target size for unshielded sensors

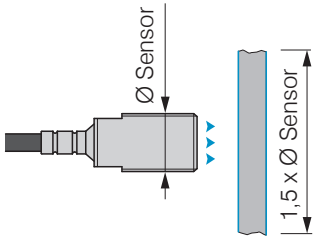


Fig. 28 Minimum target size for shielded sensors

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

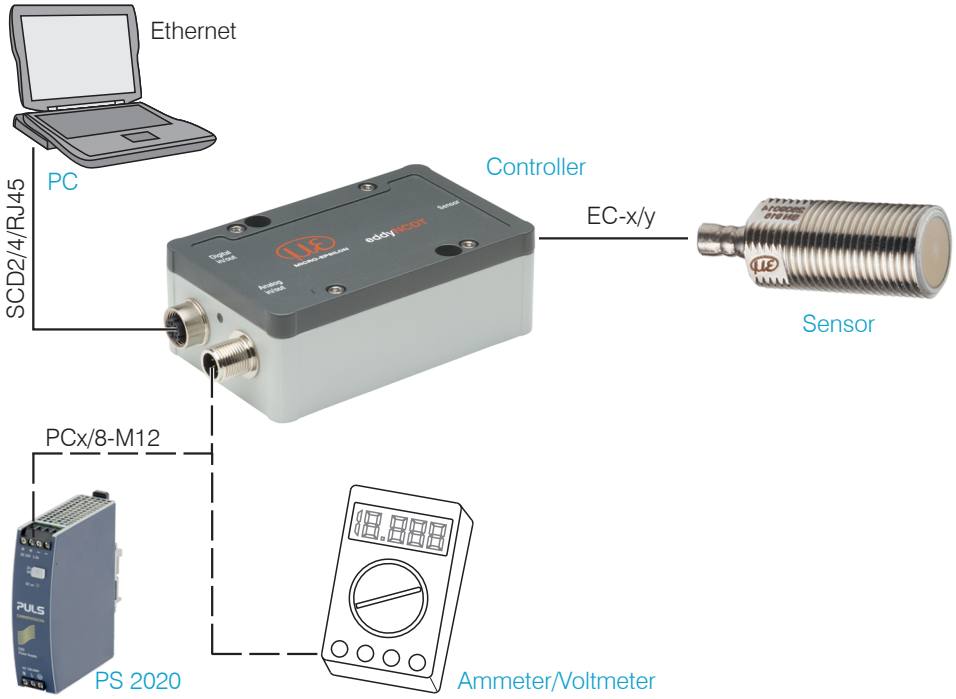
- The size of the target must not change.
- The target must not be moved laterally to the sensor face.

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

PIN	Wire color PCx/8-M12	Signal
2	brown	+24 VDC supply, polarity protection
7	blue	GND $_{supply}$
1	white	Displacement V_{out} (load min. 30 kOhm)
6	pink	GND $_{displacement}$
8	red	Displacement I_{out} (load max. 500 Ohm)
3	green	Temperature and switching output 1 [1] $V_{temp\ sensor}$ / limit value 1
4	yellow	Temperature and switching output 2 [1] $V_{temp\ controller}$ / limit value 2
5	gray	GND $_{temperature,\ threshold}$
Shield		

Fig. 30 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, DT3071

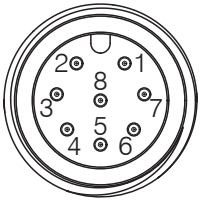


Fig. 29 Pin side 8-pin. housing plug

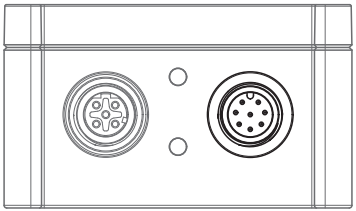


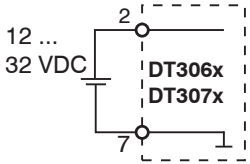
Fig. 31 Supply and analog output controller, 8-pin male connector

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.



Controller Pin	PCx/8-M12 Color	Supply
2	brown	V_+
7	blue	GND supply

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. 32 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	
8-pin M12 cable connector	Color PCx/8-M12
V_{OUT} (Pin 1)	white
I_{OUT} (Pin 8)	red
GND (Pin 6)	pink

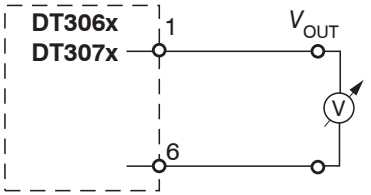


Fig. 33 Wiring for voltage supply

Current output:

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

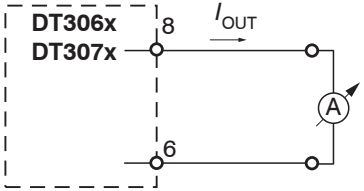


Fig. 34 Wiring for current output

4.8.5 Temperature and switching output

4.8.5.1 General

These functions are possible with the DT3061 and DT3071 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.

Controller	
8-pol. M12 cable connector	Color PCx/8-M12
V_{OUT} (Pin 3), Temperature sensor	green
V_{OUT} (Pin 4), Temperature controller	yellow
GND (Pin 5)	gray

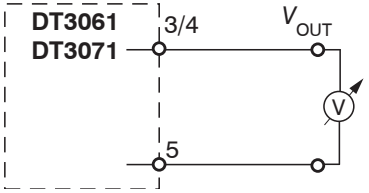
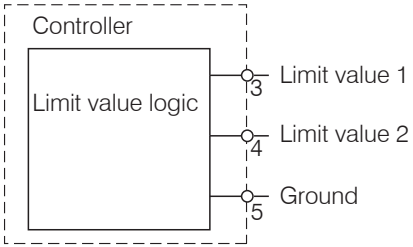


Fig. 35 Circuit of temperature measurement

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

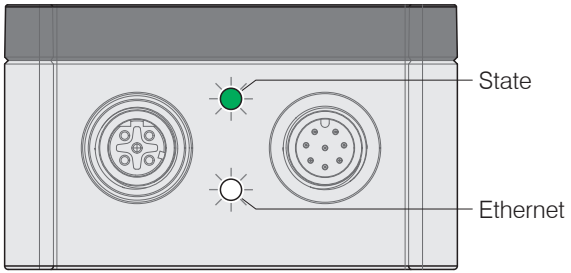
5.1 Checking the Measuring System Setup

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?

Let warm up the measuring system for about 30 up to 60 minutes before you run a measuring or calibration. This avoids measuring inaccuracies.

5.2 LED Controller

	LED State			
	green	orange	red	off
Controller in operation, measurement runs	●			
Software update	☼			
Sensor or target outside measuring range		☼		
No sensor connected, limit value or warning threshold exceeded, error			●	
No power supply				○



Legend LED

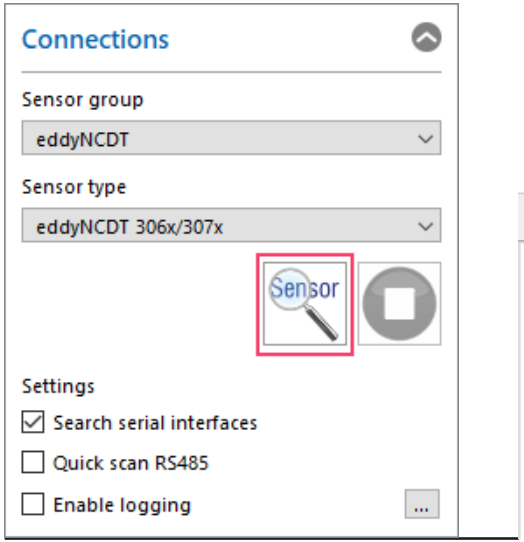
● on ☼ flashes ○ off

5.3 Control via Web Interface

5.3.1 Requirements

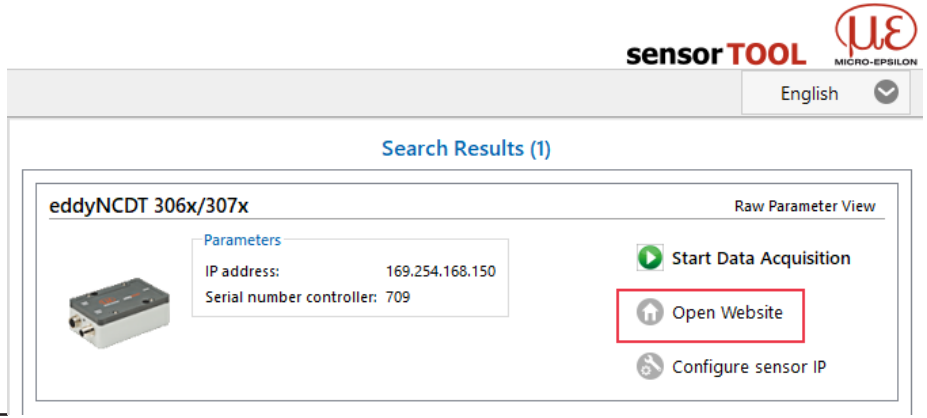
The controller generates dynamic web pages, that contain the current settings of the controller and the peripherals. The operation is only possible as long as there is an Ethernet connection to the controller. You need a web browser that supports HTML5 (e. g. Firefox ≥ 3.5 or Internet Explorer ≥ 10) 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 `SensorTOOL` program and click the button .



➡ Click the button .

The tool searches for connected DT306x and DT307x controller on available interfaces.



➡ Choose the desired sensor. Click on the button `Open Website`.

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

Fig. 36 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.

<table>
<tr><th colspan="2">Direct connection to PC</th><th>Network</th></tr>
<tr><td>PC with static IP</td><td>PC with DHCP</td><td>Controller with dynamic IP, PC with DHCP</td></tr>
<tr><td colspan="2">➡ Connect the controller to a PC via a direct Ethernet connection (LAN).</td><td>➡ Connect the controller to a switch.</td></tr>
<tr><td>➡ Start the SensorTool program.
➡ Click the button  . Select the designated controller from the list. In order to change the address settings, click the button <code>Change IP... .</code>
▪ Address type: static IP-Address
▪ IP address: 169.254.168.150 [1]
▪ Subnet mask: 255.255.0.0
➡ Click the button <code>Apply</code>, to transmit the changes to the controller.
➡ Click the button <code>Open website</code>, to connect the controller with your default browser.

1) Requires that the LAN connection on the PC uses, for example, the following IP address: 169.254.168.1.</td><td>➡ Wait until Windows has established a network connection (connection with limited connectivity).
➡ Start the SensorTool program.
➡ Click the button  . Select the designated controller from the list.
➡ Click the button <code>Open website</code>, to connect the controller with your default browser.</td><td>➡ Enter the controller in the DHCP / register the controller in your IT department.
The controller gets assigned an IP address from your DHCP server. You can check this IP address with the SensorTool program.
➡ Start the SensorTool program.
➡ Click the button  . Select the designated controller from the list.
➡ Click the button <code>Open website</code> to connect the controller with your default browser.
Alternatively: If DHCP is used and the DHCP server is linked to the DNS server, access to the controller via a host name of the structure „DT3060_<serial number>“ is possible.
➡ Start a web browser on your PC. Type „DT3060_<serial number>“the address bar of your web browser.</td></tr>
<tr><td colspan="3">Interactive websites for programming the controller and peripherals now appear in the web browser.</td></tr>
</table>

5.3.2 Access via Web Interface

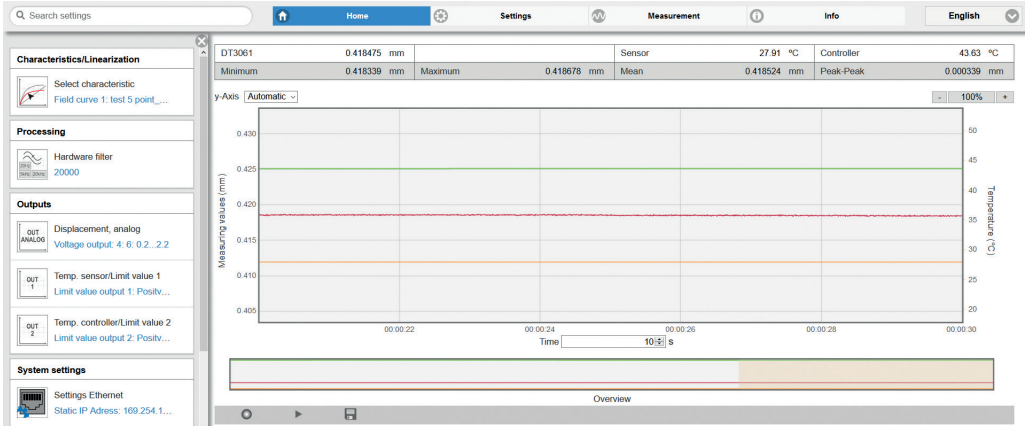


Fig. 37 Interactive website after selection of the web interface

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.

5.3.3 Operating Menu, Setting Controller Parameters

You can program eddyNCDT 306x, 307x using different methods simultaneously:

- using the web browser via the sensor web interface
- using the ASCII command set and the terminal program via Ethernet.

5.4 Characteristics and Linearization

5.4.1 General

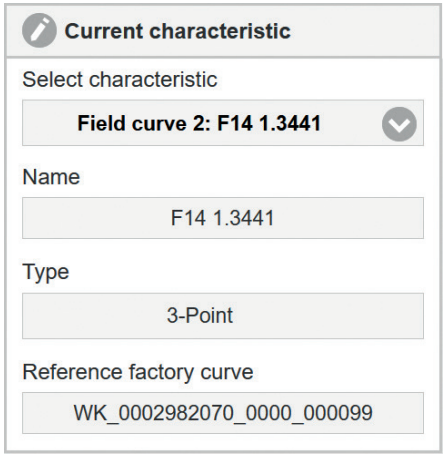
Before the measurement, calibrate the measurement channel for the installation environment of the sensor and the measurement object, see Chap. 5.4.4.

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 and DT3070 can save one field characteristic curve.
The DT3061 and DT3071 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

Menu `Settings` > `Characteristics/Linearization` > `Scale measuring range`

There are two ways to scale the measuring range of the eddyNCDT 306x, 307x:

- by using the mouse function directly in the graphic
- using the fields `Current measuring range begin` and `Current measuring range end`.

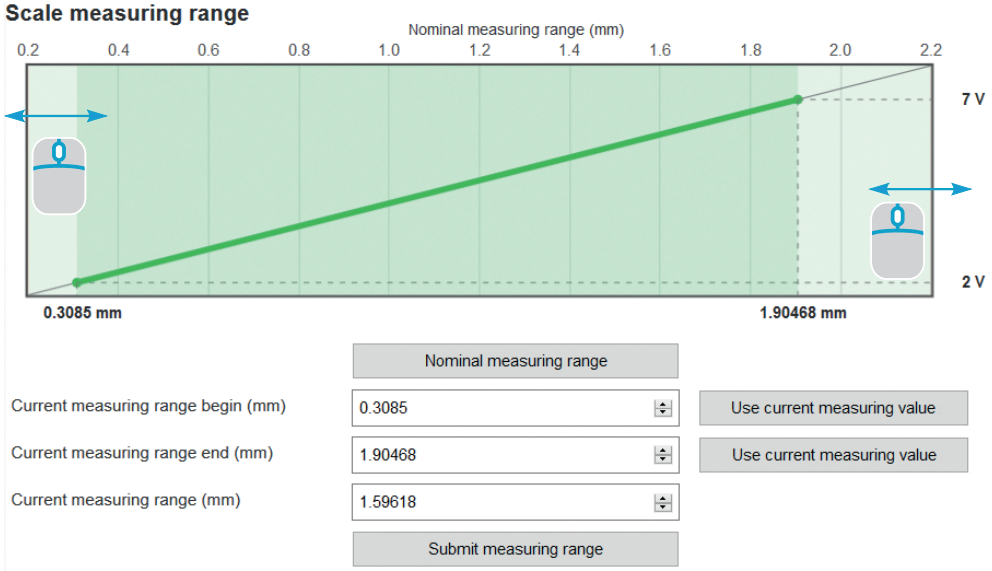


Fig. 38 Scaling the measuring range using the pointer

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 up to 60 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`.

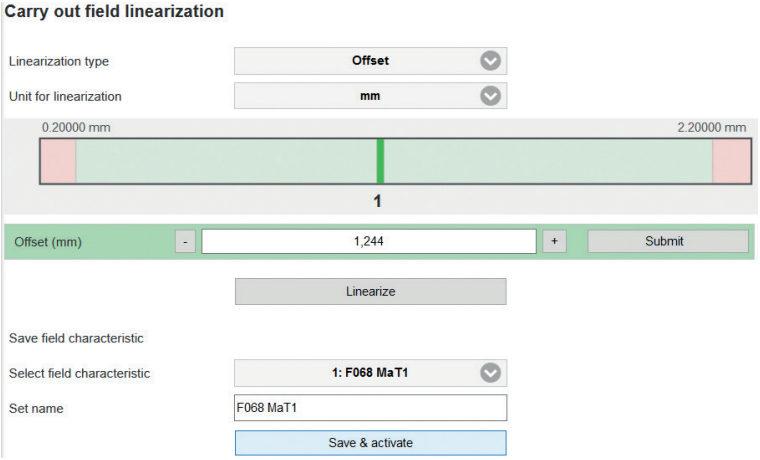
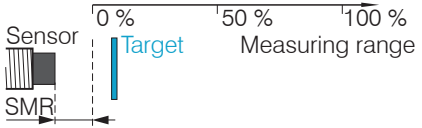


Fig. 39 Exemplary zero point shifting using an ES-U3 sensor

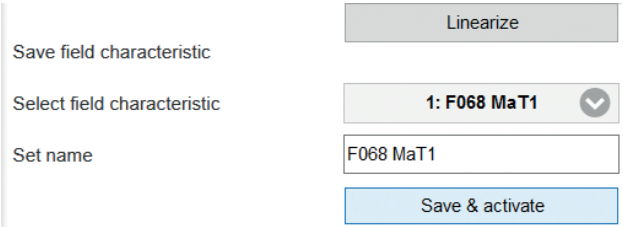
You can freely choose the zero point within the sensor measuring range.



➡ Place the measurement object to the sensor in offset.

➡ Enter the measurement value (offset).

➡ Confirm offset with `Submit`.



➡ 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.`

5.4.4.2 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.`

ℹ Before a calibration is performed, the measuring device should warm up for about 30 up to 60 minutes.

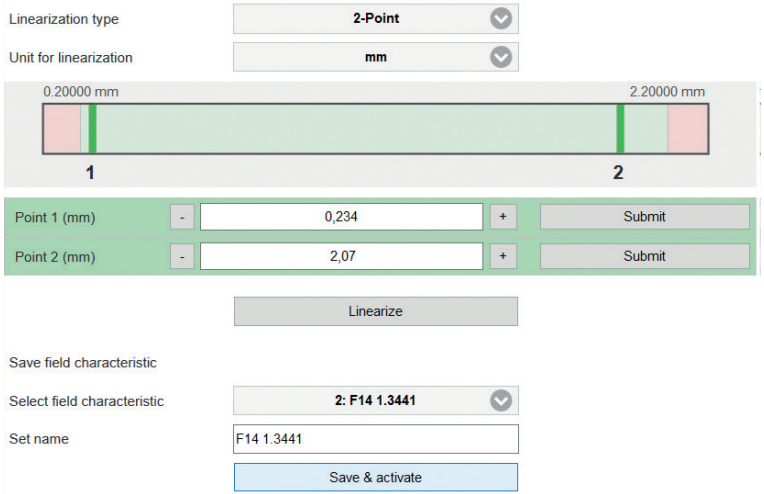
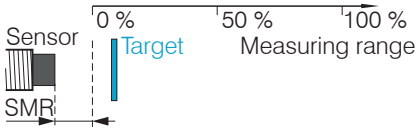


Fig. 40 Exemplary 2-point-linearization using an ES-U3 sensor

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

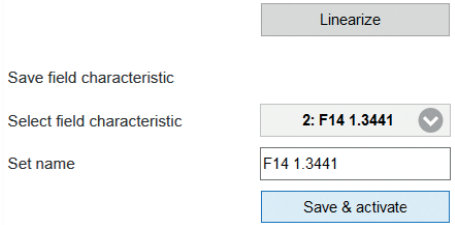


➡ Place the measurement object to the sensor in point 1.

➡ 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.

i Before a calibration is performed, the measuring device should warm up for about 30 up to 60 minutes.

➨ Choose `3-point` for linearization and the desired `unit`.

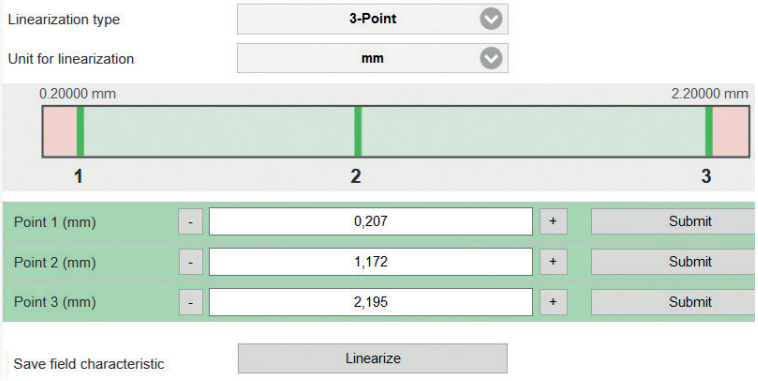
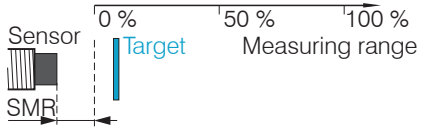


Fig. 41 Exemplary linearization using an ES-U3 sensor

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.

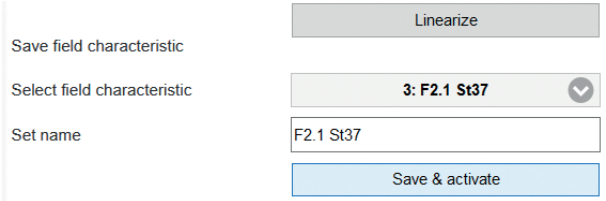


➨ Place the measurement object to the sensor in point 1.

➨ 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.`

5.4.4.4 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.

i Before a calibration is performed, the measuring device should warm up for about 30 up to 60 minutes.

➡ Choose `5-point` for linearization and the desired `unit`.

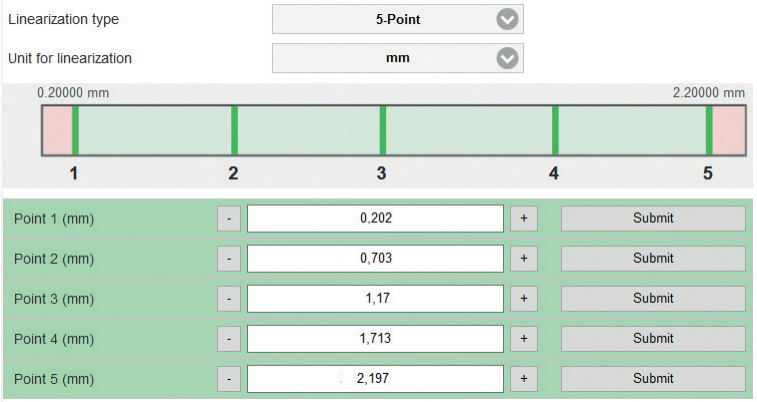
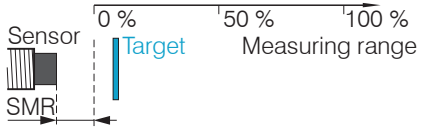


Fig. 42 Exemplary linearization using an ES-U3 sensor

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.

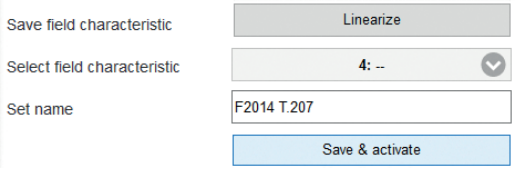


➡ Place the measurement object to the sensor in point 1.

➡ Enter the measurement value (1).

➡ Confirm point 1 with `Submit`.

➡ Repeat this procedure for the linearization points 2 until 5.



➡ 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.`

5.4.5 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

	Name	Export	Import
1	WK_0002982070_0000_000099		
2	WK_00000000-1_00-1_0000-1		
3	WK_00000000-1_00-1_0000-1		
4	WK_00000000-1_00-1_0000-1		

Manage field characteristics

Name	Reference factory-set characteristic	Rename	Export	Import	Delete
F068 MaT1	1: WK_0002982070_0000_000099				
F14 1.3441	1: WK_0002982070_0000_000099				
F2.1 St37	1: WK_0002982070_0000_000099				
--	--				

Fig. 43 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

➡ Tab `Settings` > `Processing` > `Sensor/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.

Sensor temperature	Lower warning limit	+10 ... +180 °C [1] (+50 ... +356 °F)	*Value*
	Upper warning threshold		*Value*
Controller temperature	Lower warning limit	+10 ... +50 °C [1] (+50 ... +122 °F)	*Value*
	Upper warning threshold		*Value*

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

Gray shaded fields require a selection.

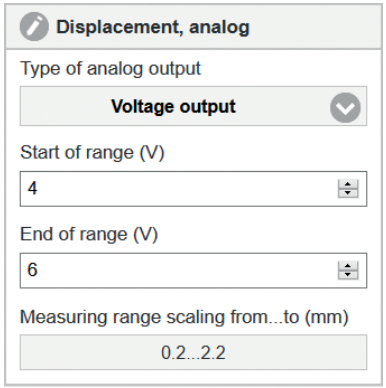
Value Dark-bordered fields require you to specify a value.

5.6 Outputs

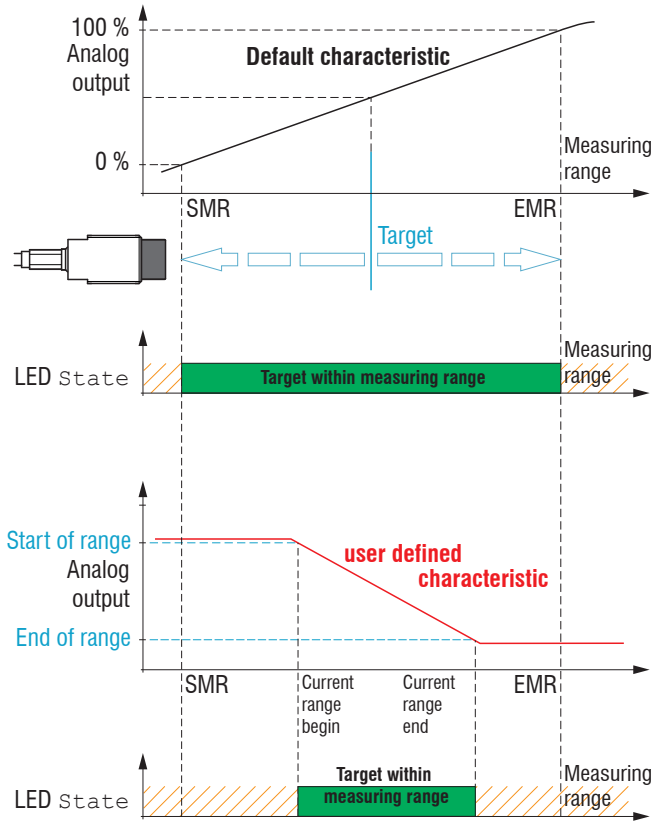
5.6.1 Displacement, analog

Menu `Settings` > `Outputs` > `Displacement, analog`.

Max. output range: 4 mA ... 20 mA or 0 V ... 10 V
Output amplification ΔI_{OUT} : 16 mA or ΔU_{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.



Default characteristic (black), reverse user defined characteristic (red)

5.6.2 Temperature and Limit Value Outputs

5.6.2.1 General

These functions are possible with the DT3061, DT3071 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.

Sensor temperature Limit value 1	*Temperature output Sensor* / *Limit value output 1* / *Off*	Start of range	0 ... +5 V for temperatures from +10 ... +180 °C [1] (+50 ... +356 °F)	*Value*
		End of range		*Value*
Electronics temperature (controller) Limit value 2	*Temperature output electronics* / *Limit value output 2* / *Off*	Start of range	0 ... +5 V for temperatures from +10 ... +50 °C 1 (+50 ... +122 °F)	*Value*
		End of range		*Value*

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.

Gray shaded fields require a selection.

Value Dark-bordered fields require you to specify a value.

5.6.2.3 Limit Output

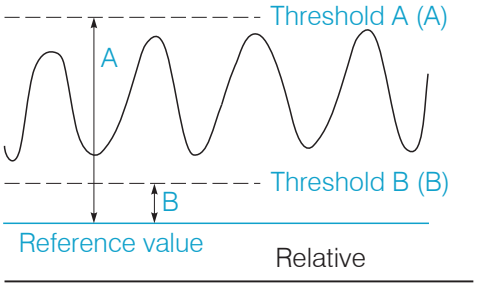
This function is available with controller DT3061, DT3071.

➡ Menu `Settings` > `Outputs` > `Limit value 1/2`.

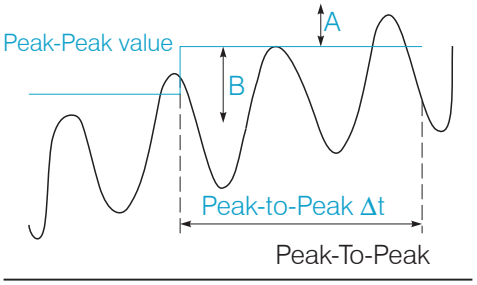
The eddyNCDT 3061 can check the measurement result to adjustable limits. This means that threshold values can be monitored, impermissible tolerances detected and sorting criteria realized.

Type and reference for the limit monitoring are selectable and apply to the current characteristic.

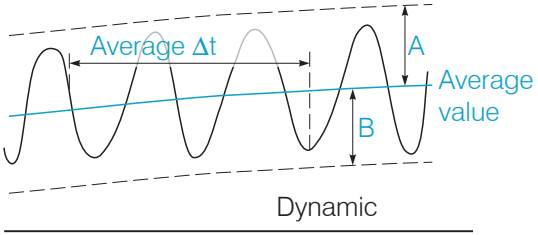
Type: Relative | Peak-To-Peak | Dynamic.



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 Δt` parameter).



Dynamic — The threshold values A/B refer to a continuously calculated, moving average (`Average Δt`).

Fig. 44 References for limit monitoring

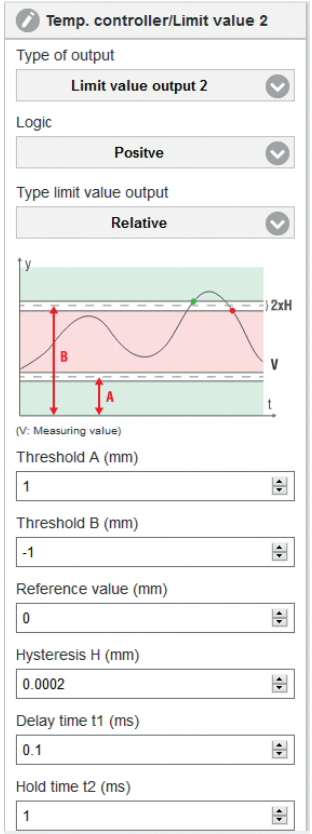


Fig. 47 Parameters for limit monitoring

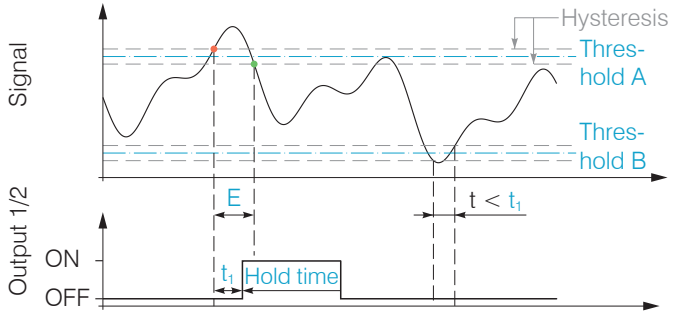


Fig. 45 Timing limit monitoring, event (E) < hold time, logic: `positive`

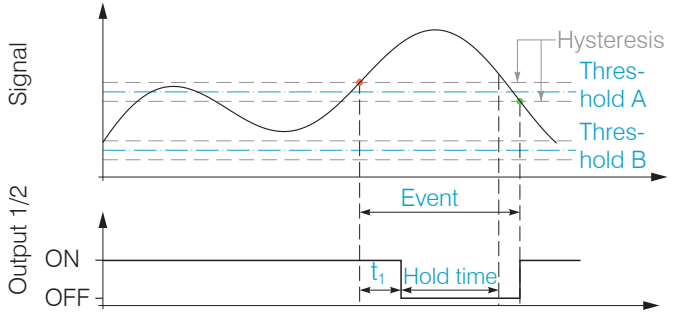


Fig. 46 Timing limit monitoring, event (E) > hold time, logic: `negative`

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

5.7 System Settings

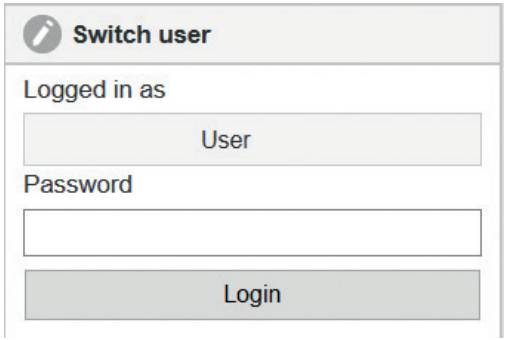
5.7.1 Language Selection

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. 48 Change in the professional user level

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

The following functions are accessible for the user:

	User	Professional
Password required	no	yes
View settings	yes	yes
Change settings, linearization, anolog output, password	no	yes
Start measuring, scaling diagrams	yes	yes

Fig. 49 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.

i 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.

Adress 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*

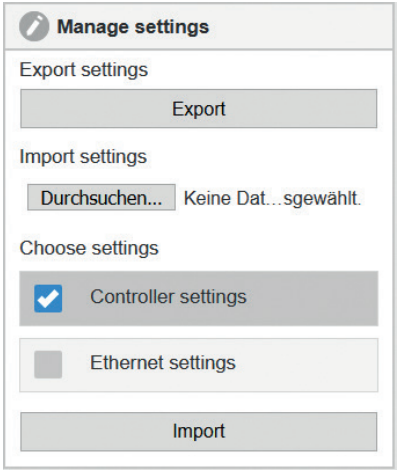
Gray shaded fields require a selection.

Value Dark-bordered fields require you to specify a value.

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.



The Export feature generates a text file which you can either store or display with an editor.

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.

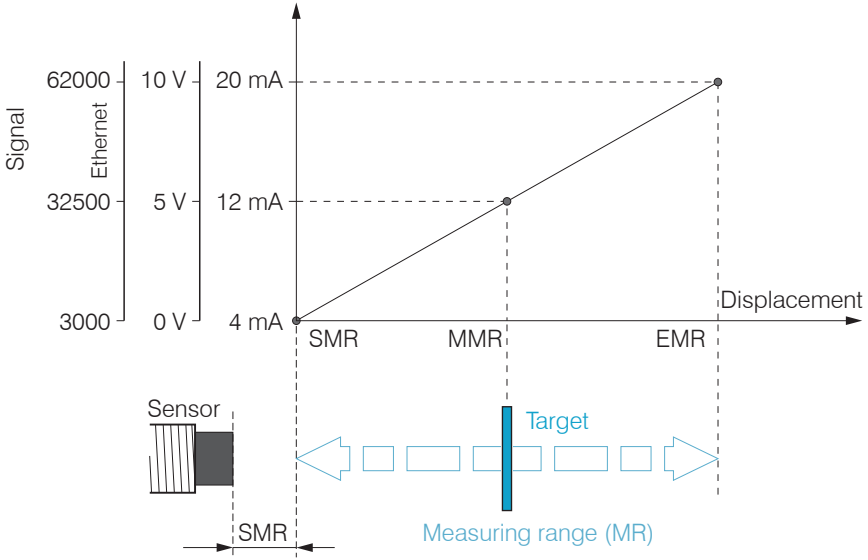
Choose the desired import option in the settings section.

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.



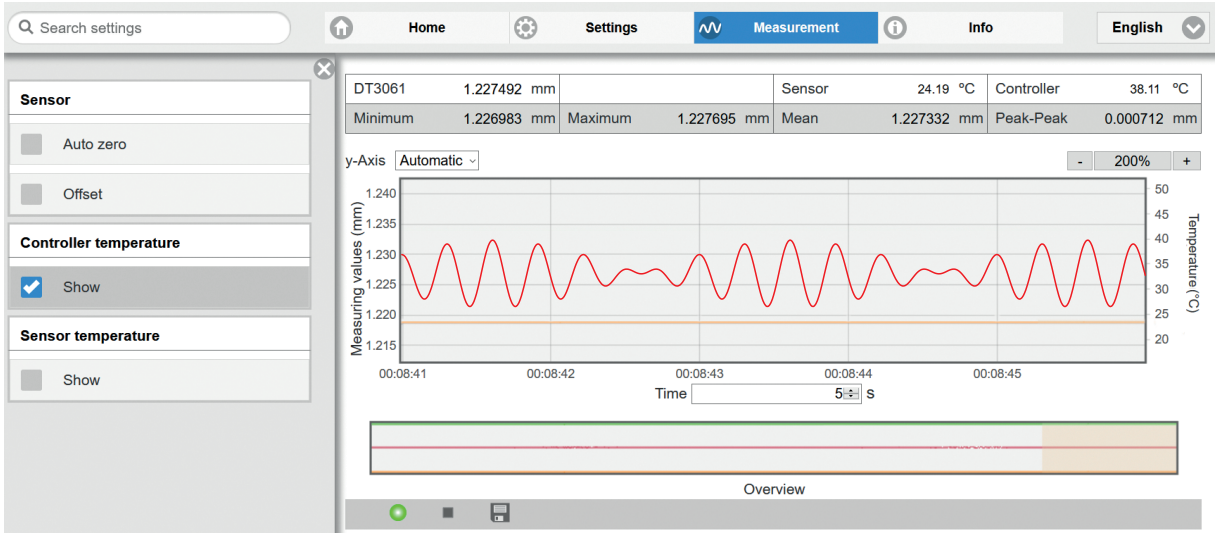
SMR	Start of measuring range
MMR	Mid of measuring range
EMR	End of measuring range

Factory-scaling of displacement 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. Ethernet Interface

6.1 General

You can achieve particularly high resolutions if you read out the measured values in digital form via the Ethernet interface.
f you use your own program for this, Micro-Epsilon can support you with the free MEDAQLib library:

- contains all commands for the eddyNCDT 306x, 307x,
- contains program examples in several programming languages.

You can find the current library including documents at:
www.micro-epsilon.de/download
www.micro-epsilon.de/download/software/MEDAQLib.zip

6.2 Hardware, Interface

➡ Connect the eddyNCDT 306x, 307x to a free Ethernet interface on the PC. To do so, use an Ethernet cable.

To establish a connection to the eddyNCDT 306x, 307x, you need a defined IP address of the network card in the PC. Go to `Control panel\Network connections`. If necessary, create a new LAN connection. Ask your network administrator about this.

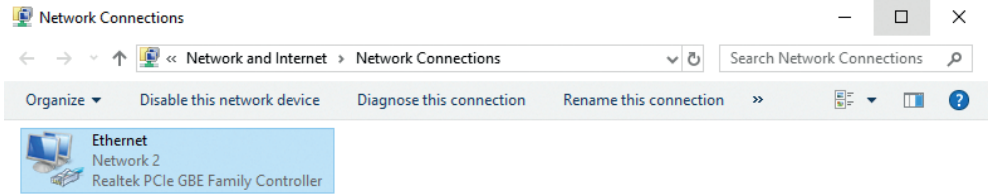
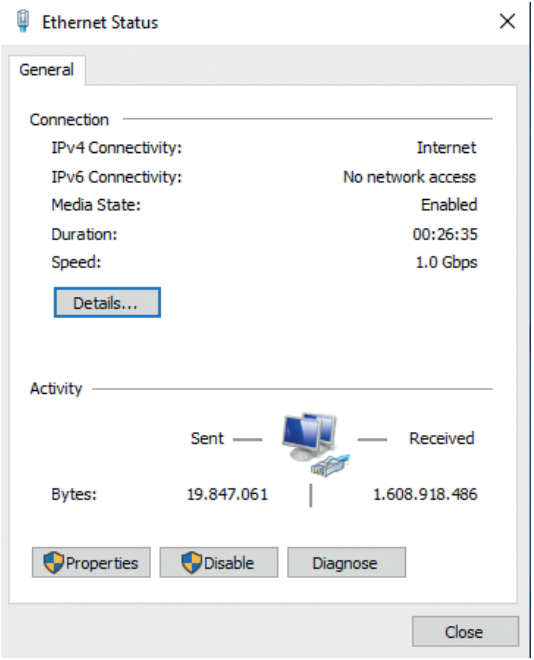


Fig. 50 Computer LAN connection

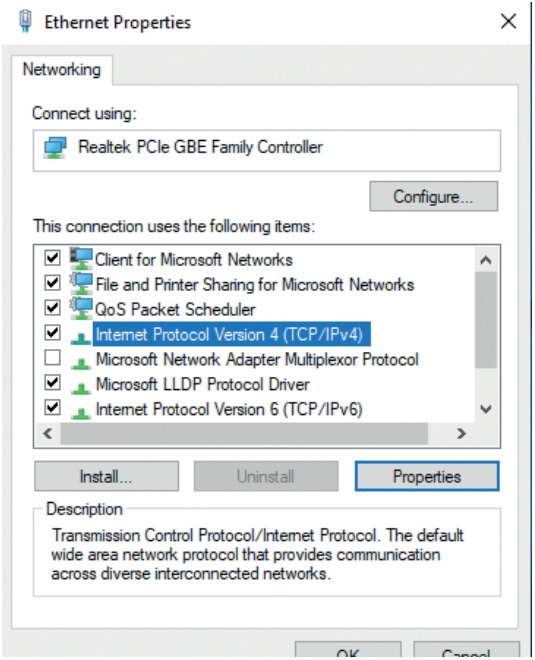
➡ Define the following address in the properties of the LAN connection:

IP address: 169.254.168.1

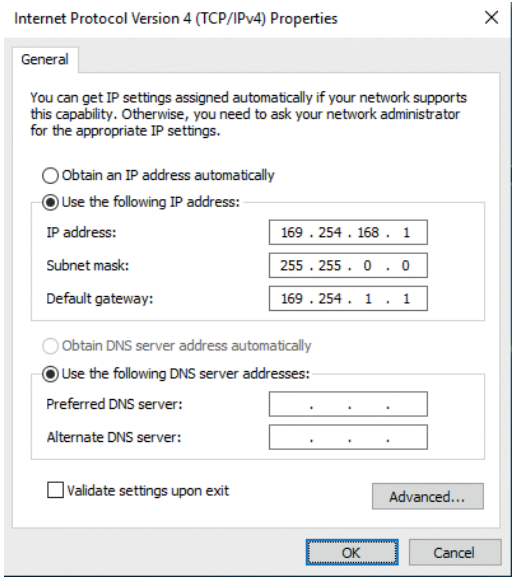
Subnet mask: 255.255.0.0



➡ Go to `Properties`.



➡ Select `Internet Protocol (TCP/IP) > Properties`.



The IP address of the controller is factory-set to 169.254.168.150.
You can change the IP settings and the data port at any time:

- using the web browser. Enter the current IP address in the address line. Via the menu `Settings` you reach the submenu `Digital interfaces` and then `Ethernet settings`. Here you can set a new IP address, enable DHCP or change the data port.
- via software commands.
- with the `sensorTOOL` software.

If you enable DHCP, the device is also accessible in the network via its DHCP host name. This is composed of the device name and serial number: NAME_SN (e.g. DT3061_1001).

The controller supports UPnP. If you have an operating system where the UPnP service is enabled, e.g. by default in Windows 10, the controller is automatically listed in Explorer under network devices and can be accessed from there, e.g. if you have forgotten its IP address.

Communication with the Controller

Port 10001 [1]	continuous measurement data output,
Port 23, Telnet	Commands

1) Default setting, port can be changed.

6.3 Data Format of the Measurement Values

Measurement data transmission is via a data port (factory-set 10001).
Several measurement values are combined into a measured value block and then transmitted together with a header as a TCP data packet.
All measured values and the header are transmitted in little-endian format.

Contents	Size	Description	Data type
Preamble	32 Bit	„MEAS“ as ASCII text	Int32
Article number	32 Bit	Article number of the sensor as integer	Int32
Serial number	32 Bit	Serial number of sensor as int	Int32
Reserved	64 Bit	0x01	Int64
Status (bit field)	32 Bit	see Chap. 6.4	Int32
Number of measured values M	16 Bit	Number of measured values per TCP data packet	Int16
Bytes per measurement value	16 Bit	0x04	Int16
Measured value counter	32 Bit	Measured value counter	Int32
Measurement value 1	32 Bit	Measuring value	Int32
Measurement value 2	32 Bit	Measuring value	Int32
…			
Measurement value M	32 Bit	Measuring value	Int32

Scaling of measured values:
If the measured value is transmitted as Int32 or UInt32, the formula is:

$$\text{Measured value} = \frac{(\text{Digital value (Int32/Uint32)} - \text{DataRangeMin}) * \text{Measuring range}}{\text{DataRangeMax} - \text{DataRangeMin}} + \text{Offset}$$

➡ Call up the unit of the measured value, as well as the parameters Measuring range, Offset, DataRangeMin, DataRangeMax before a conversion. Use the $CHI and $MDF sensor commands for this.

Example: Measuring range = 2000, Offset = 200, DataRangeMin = 3000, DataRangeMax = 62000

Unit = µm

Digital value = 32500

⇨ $$\text{Measured value} = \frac{(32500 - 30000) \times 2000}{62000 - 3000} + 200 = 1200\ \mu\text{m}$$

By default, the measured values are output continuously via the data port at the respective data rate set.

6.4 Structure State Bits

Bit	Meaning
31 ... 9	Reserved
8	Status switching output 2
7	Status switching output 1
6	Controller temperature fallen short of/exceeded
5	Sensor temperature fallen short of/exceeded
4	Critical controller temperature
3	Critical sensor temperature
2	Broken cable at current output
1	Broken sensor cable / no sensor available
0	Measurement signal outside the measuring range

6.5 Ethernet Commands

All commands are sent via port 23 (Telnet). Each command starts with a $ character, all characters sent before the $ character are ignored by the controller.
The controller returns all sent characters immediately as an echo.
Commands are transmitted in ASCII format.
Except for the linearization types and points, the respective settings apply to all eight channels in the same way.
A timeout is reached approximately 10 s after the last character entry.
Commands must end with <CR> (0x0D). A response ends with <CRLF> (0x0D 0x0A).

6.5.1 Version (VER)

Query of the current software version with date.

	VER	
Command	$VER<CR>	
Response	$VER<NAME>;<VERSION>;<STOCKNUMBER>OK<CRLF>	
Example	$VERDT3060;V1.2a;8010134OK<CRLF>	
Index	NAME	Name Controller
	VERSION	Software version
	STOCKNUMBER	Part number controller

6.5.2 Retrieve State and Temperature (GMD1 = Get Measured Data 1)

Retrieve one value each for sensor and controller temperature and status bits.

	GMD1	
Command	$GMD1<CR>	
Response	$GMD1:<STATE>,<SENSORTEMPERATURE>,<CONTROLLERTEMPERATURE>OK<CRLF>	
Example with disconnected sensor cable	$GMD1:43,577.292297,28.721247OK<CRLF>	
Index	STATE	Status bits decimal, e. g. 43 corresponds with 101011; so Bit 0, 1, 3 and 5 are set, see Chap. 6.4
	SENSORTEMPERATURE	Sensor temperature in °C
	CONTROLLERTEMPERATURE	Controller temperature in °C

6.5.3 Retrieve Distance and Temperature (GMD2 = Get Measured Data 2)

Retrieve one value each for distance, sensor and controller temperature and status bits.

	GMD2	
Command	$GMD2<CR>	
Response	$GMD2:<STATE>,<DISTANCE>,<SENSORTEMPERATURE>,<CONTROLLERTEMPERATURE>OK<CRLF>	
	Example: $GMD2:0,1300.923,44.4515,35.7212OK<CRLF>	
Index	STATE	Status bits, see Chap. 6.4
	DISTANCE	Distance value in µm
	SENSORTEMPERATURE	Sensor temperature in °C
	CONTROLLERTEMPERATURE	Controller temperature in °C

6.5.4 Ethernet Settings (IPS = IP Settings)

Changes the IP settings of the controller.

	IPS
Command	$IPSm,<IP-ADDRESS>,<SUBNET>,<GATEWAY><CR>
Example	$IPS0,169.254.168.150,255.255.0.0,169.254.168.1<CR>
Response	$IPSm,<IP address>,<Subnet address>,<Gateway address>OK<CRLF>
Index	m = 0: static IP address m = 1: activates DHCP* * If DHCP is enabled, there is no need to transmit IP subnet and gateway address.
Settings query	
Command	$IPS?<CR>
Response	$IPS?0,169.254.168.150,255.255.0.0,169.254.168.1OK<CRLF>

6.5.5 Query Dataport (GDP = Get Dataport)

Queries the port number of the data port.

Command	$GDP<CR>
Response	$GDP<PORTNUMBER>OK<CRLF> Example: $GDP10001OK<CRLF>

6.5.6 Set Dataport (SDP)

Sets the port number of the data port. Value range: 1024 ...65535.

Command	$SDP<PORTNUMBER><CR> Example: $SDP10001OK<CR>
Response	$SDP<PORTNUMBER>OK<CRLF>

6.5.7 Retrieve Channel Information (CHI = Channel Info)

Reads out channel-specific information (e.g. serial number of the sensor).

Command	$CHIm<CR>
Response	$CHImANOa,NAMb,SNOc,OFSd,RNGe,UNTf,DTYgOK<CRLF>
Example	$CHI1<CR>
Response	$CHI1:ANO2601129,NAMES-S2-C-CA3,0/fB0,SNO5,OFS0.2,RNG2,UNTmm,DTY1OK<CRLF>
Index	m = 1: Distance m = 2: Temperature range sensor m = 3: Temperature range controller a = Article number b = Name c = Serial number d = Start of measuring range e = Measuring range f = Unit of measuring range (e.g. µm) g = Data type of measurement values (1 = value as INT, 0 = no value) [1]

1) Applies to to a transmission on the data port (ex factory 10001), not for queries with GMD1 or GMD2.

6.5.8 Retrieve Controller Information (COI = Controller info)

Reads out information of the controller (e.g. serial number).

Command	$COI<CR>
Response	$COIANOa,NAMb,SNOc,OPTd,VEReOK<CRLF>
Example	$COI<CR>
Response	$COIANO4107067,NAMDT3061,SNO718,OPT0,VER1.4bOK<CRLF>
Index	a = Article number b = Name c = Serial number d = Option e = Firmware version

6.5.9 Login for Web Interface (LGI = Login)

Changes the user level for the web interface from User to `Professional`.

Command	$LGI<PASSWORD><CR>
Response	$LGI<PASSWORD><OK><CRLF>
Example	$LGI1234<CR>
Response	$LGIOK
Index	PASSWORD = password of the device. In the delivery state, no password is assigned. Therefore, this field can remain empty. A password may only contain the symbols: A ... Za ... z0 ... 9

6.5.10 Logout for Web Interface (LGO = Logout)

Changes the user level for the web interface to `User`.

Command	$LGO<CR>
Response	$LGOOK<CRLF>

6.5.11 Change Password (PWD = Password)

Changes the password of the device (required for web interface and `sensorTOOL`).

Command	$PWD<OLDPASSWORD>,<NEWPASSWORD>,<NEWPASSWORD><CR>
Response	$PWD<OLDPASSWORD>,<NEWPASSWORD>,<NEWPASSWORD>OK<CRLF> A password may contain 0-16 characters. A password may only contain the symbols: A ... Za ... z0 ... 9 In the delivery state, no password is assigned. Therefore, this field can remain empty.

6.5.12 Change Web Interface Language (LNG = Language)

Changes the language of the web interface.

Command	$LNGn<CR>
Response	$LNGnOK<CRLF>
Index	n = 0: System n = 1: English n = 2: German n = 3: Chinese n = 4: Japanese n = 5: Korean
Settings query	
Command	$LNG?<CR>
Response	$LNG?1OK<CRLF>

6.5.13 Measured Data Format (MDF)

Query of the measured values data format (DataRangeMin/DataRangeMax) is required for the scaling of the measured values.

Command	$MDF1<CR>
Response	$MDF1<DataRangeMin>, <DataRangeMax><CRLF>
Example	$MDF1:3000,62000OK<CRLF>

6.5.14 Error Messages

- Unknown command: (ECHO) + $UNKNOWN COMMAND<CRLF>
  Exmple: 123UNKNOWN COMMAND<CRLF>
- Wrong parameter after command: (ECHO) + $WRONG PARAMETER<CRLF>
  Example: $CHI8$WRONG PARAMETER<CRLF>
- Timeout (approx. 15 s after last entry) (ECHO) + $TIMEOUT<CRLF>

7. Elimination Errors

Error	Cause and solution
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 multichannel 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.

8. Disclaimer

All components of the device have been checked and tested for functionality in the factory. However, should any defects occur despite careful quality control, these shall be reported immediately to Micro-Epsilon or to your distributor / retailer.
Micro-Epsilon undertakes no liability whatsoever for damage, loss or costs caused by or related in any way to the product, in particular consequential damage, e.g., due to

- non-observance of these instructions/this manual,
- improper use or improper handling (in particular due to improper installation, commissioning, operation and maintenance) of the product,
- repairs or modifications by third parties,
- the use of force or other handling by unqualified persons.

This limitation of liability also applies to defects resulting from normal wear and tear (e.g., to wearing parts) and in the event of non-compliance with the specified maintenance intervals (if applicable).
Micro-Epsilon is exclusively responsible for repairs. It is not permitted to make unauthorized structural and / or technical modifications or alterations to the product. In the interest of further development, Micro-Epsilon reserves the right to modify the design.
In addition, the General Terms of Business of Micro-Epsilon shall apply, which can be accessed under
Legal details | Micro-Epsilon https://www.micro-epsilon.com/legal-details.
For translations into other languages, the German version shall prevail.

9. Service, Repair

If the measuring system is defective:

- If possible, save the current settings in a parameter set to reload them into the controller after the repair.
- Please send us the affected parts for repair or exchange.

If the cause of a fault cannot be clearly identified, please send the entire system with cables to:

MICRO-EPSILON MESSTECHNIK
GmbH & Co. KG
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94496 Ortenburg / Germany

Tel. +49 (0) 8542 / 168-0
Fax +49 (0) 8542 / 168-90
info@micro-epsilon.com
www.micro-epsilon.com

10. Decommissioning, Disposal

In order to avoid the release of environmentally harmful substances and to ensure the reuse of valuable raw materials, we draw your attention to the following regulations and obligations:

- Remove all cables from the sensor and/or controller.
- Dispose of the sensor and/or the controller, 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.
- You are obliged to comply with all relevant national laws and regulations.

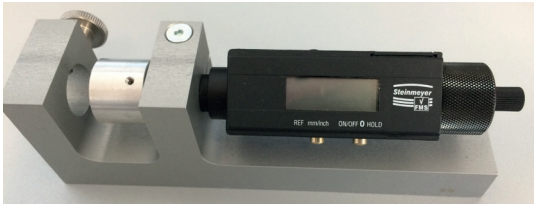
For Germany / the EU, the following (disposal) instructions apply in particular:

- Waste equipment marked with a crossed garbage can must not be disposed of with normal industrial waste (e.g. residual waste can or the yellow recycling bin) and must be disposed of separately. This avoids hazards to the environment due to incorrect disposal and ensures proper recycling of the old appliances.

- A list of national laws and contacts in the EU member states can be found at https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en. Here you can inform yourself about the respective national collection and return points.
- Old devices can also be returned for disposal to Micro-Epsilon at the address given in the imprint at https://www.micro-epsilon.com/legal-details/.
- We would like to point out that you are responsible for deleting the measurement-specific and personal data on the old devices to be disposed of.
- Under the registration number WEEE-Reg.-Nr. DE28605721, we are registered at the foundation Elektro-Altgeräte Register, Nordostpark 72, 90411 Nuremberg, as a manufacturer of electrical and/or electronic equipment.

Appendix

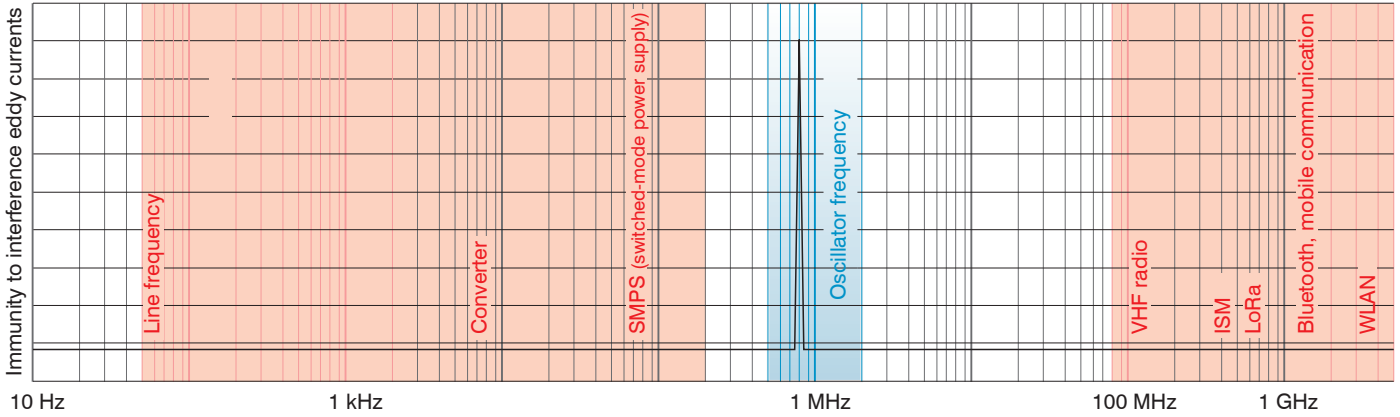
A 1 Optional Accessories

PS2020		Power supply unit Input: 100-240 VAC Output: 24 VDC / 2.5 A Mounting onto symmetrical standard rail 35 mm x 7.5 mm DIN 50022
MC25D(01)		Micrometer calibration unit Setting range: 0-2.5 mm, with digital position reading and adjustable zero, for sensors type ES04-ES2 resp. type U05-S2
Vacuum feedthrough eddy/fB0/fB0/triax		Plug system for vacuum applications. Compatible with all common eddyNCDT products. Application as a wall duct Pluggable version Mounting thread M9x0,5 / length 39 mm Wall strength for mounting max. 22 mm Max. leakage rate (IEC standard 60068-2-17) <10^-8 mbar l/s

SCD2/4/RJ45		Industrial Ethernet cable 4-pin with M12 connector on RJ45 connector Standard length: 2 m
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

A 2 Interference Immunity

Eddy current sensors from Micro-Epsilon are characterized by a high resistance to interference according to EN 610004-6 (conducted) and EN61000-4-3 (high frequency electromagnetic fields). Typical sources of interference, such as mains applications, are far removed from the carrier frequency of an oscillator.



A 3 Model Designation Sensor

Eddy Sensor		Measuring range 04[1] / 1 / 2 / 3 / 4 6 / 8 mm			S = male connector C = integrated cable		Cable length [m]			A = mini B = normal C = large		Option
ES	-	S	3	-	C	-	S	A	2,0	/ m	B	0 /	▯
		S = shielded U = unshielded			C = cylindric F = flat T = Clamping flange			A = axial R = radial		m = male f = female OE = open ends		0 = straight 90 = right angle	

A 4 Model Designation Sensor Cable

								Controller side			
								m = male f = female OE = open ends	A = mini B = normal C = large	0 = straight 90 = right angle	
EC = eddy cable ECE = eddy cable extension											
EC	-	3,0 /	m		A		90 /	f	B	0 /	D3,9
		Nominal cable length [m]	m = male f = female OE = open ends		A = mini B = normal C = large		0 = straight 90 = right angle				D = nominal cable diameter [mm]
			Sensor side								

1) The ES-S04 is only available with the DT307x

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