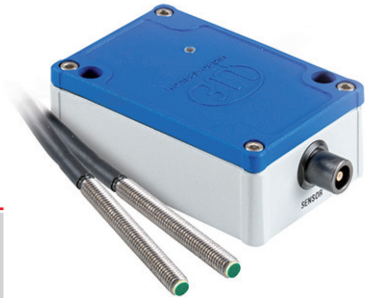
MICRO-EPSILON




Operating Instructions

# capaNCDT CST6110

CSE025/M5-CAm1,0/RS

Capacitive rotation speed measuring system

MICRO-EPSILON
MESSTECHNIK
GmbH & Co. KG
Königbacher Strasse 15

94496 Ortenburg / Germany

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

# Contents

# 1. Safety

System operation assumes knowledge of the operating instructions.

## 1.1 Symbols Used

The following symbols are used in these 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. |
| `Measurement` | Indicates hardware or a software button/menu. |

## 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

*NOTICE*

The supply voltage must not exceed the specified limits.

> Damage to or destruction of the sensor

Avoid shocks and impacts to the sensor.

> Damage to or destruction of the sensor

Protect the cable against damage.

> Failure of the measuring device

## 1.3 Notes on CE Marking

The following apply to the capaNCDT CST6110:
- 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 environments.
The EU Declaration of Conformity and the technical documentation are available to the responsible authorities according to the EU Directives

## 1.4 Intended Use

- The system is designed for use in industrial and laboratory applications.
- It is used for industrial counting tasks.
- The system must only be operated within the limits specified in the technical data, see Chap. 2.4
- 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 sensor.
- Take additional precautions for safety and damage prevention in case of safety-related applications.

## 1.5 Proper Environment

- Protection class (sensor): IP67 (when connected)
- Protection class (controller): IP67 (with closed lid and when connected)
- Temperature range (operation)
  - Sensor, sensor cable: -50 ... +125 °C (-58 ... +257 °F)
  - Controller: -40 ... +85 °C (-40 ... +185 °F), briefly up to 125 °C
- Temperature range (storage)
  - Sensor, sensor cable: -50 ... +125 °C (-58 ... +257 °F)
  - Controller: -40 ... +85 °C (-40 ... +185 °F)
- Humidity: 5–95% (non-condensing)
- Ambient pressure: Atmospheric pressure
- Power supply 11 ... 32 VDC

# 2. Functional Principle, Technical Data

## 2.1 Area of Application

The capaNCDT CST6110 is a capacitive measuring system for non-contact rotation speed measurement of conductive measurement objects such as metals and non-conductive objects such as ceramics or plastics.

## 2.2 Measuring Principle

The sensor reacts to approach or removal (depending on the initial state) of materials. The capacitive measuring principle is based on load shifts in the sensor. This change in capacitance is detected and analyzed by the controller. The rotational speed of measuring objects made of non-conductive materials is also measured. This requires a shorter distance between sensor and measuring object than with electrically conductive measuring objects.

## 2.3 Structure of the Complete Measuring System

The non-contact single channel measuring system consists of:

- Sensor with sensor cable
- Controller (installed in a compact aluminum housing)
- Power supply and signal cable SCAC3/6, see Chap. 4.3

Individual measuring system components can be replaced without limitations of their functionality.

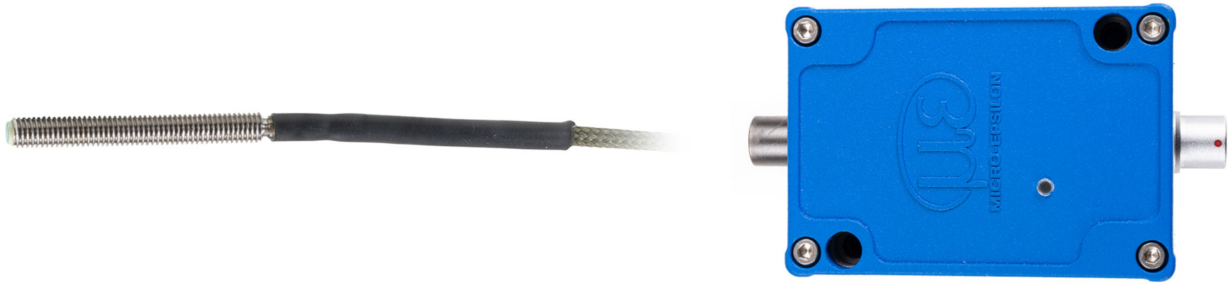


*Fig. 1 Components for counting measurement including sensor with cable and controller*

## 2.4 Technical Data

| Controller | | CST6110 |
|---|---|---|
| Speed range (measuring range) | | 1 ... 400,000 rpm |
| Start of measuring range | | max. sensor distance from measuring object 1 mm 1) |
| Frequency response (-3dB) | | 110 kHz |
| Linearity | | < ± 0.2 % FSO 2 |
| Target material | | Electrically conductive / non-conductive |
| Supply voltage | | 11 … 32 VDC, < 0.8 W |
| Digital output | | TTL level (1 pulse / detection with variable pulse duration or<br>1 pulse / rotation with 100 μs pulse duration) |
| Analog output | | 0...5 V (short circuit proof) |
| Connection | | Sensor: triax connector<br>Supply/signal: 6-pole connector (suitable connection cable SCAC3/6/IP included) |
| Temperature range | Storage | -40 … +85 °C (-40 ... +185 °F) |
| | Operation | -40 ... +85 °C (briefly up to 125 °C) |
| Shock (DIN EN 60068-2-27) | | 20 g / 5 ms in 3 axes, 1000 shocks each |
| Vibration (DIN EN 60068-2-6) | | 10 g / 10 … 2000 Hz in 3 axes, 10 cycles |
| Protection class (DIN EN 60529) | | IP67 (with closed lid and when connected) 3 |
| Material | | Aluminum die-cast |
| Weight | | approx. 165 g |
| Rotary switch | | 1 ... 16 (adjustable via rotary switch) |
| Control and display elements | | Color LED indicates mode and measurement (red, blue, green and mixed colors) |

FSO = Full Scale Output

1) Depends on sensor and target geometry; reference value for CS025/M5-CAm1,0/RS (capacitive rotary speed sensor) and electrically conductive target; with non-conductive materials, shorter measurement distances are required depending on the material

2) Relates to analog output; digital output without limitation

3) Up to an ambient temperature of max. 50 °C

| **Sensor** | | **CS025/M5-CAm1,0/RS** |
|---|---|---|
| Measuring range | | 0.25 mm |
| Linearity | | < ± 0.2 % FSO |
| Connection | | Integrated cable with thermal protection hose, length 1 m;<br>minimum bending radius: static 7 mm, dynamic 25 mm |
| Mounting | | Screw connection via M5 thread |
| Temperature range | Storage | -50 … +125 °C (-58 ... +257 °F) |
| | Operation | -50 … +125 °C |
| Humidity | | 0 … 95 % r.H. (non-condensing) |
| Shock (DIN EN 60068-2-27) | | 50 g / 5 ms in 3 axes, 1000 shocks each |
| Vibration (DIN EN 60068-2-6) | | 30 g / 10 … 2000 Hz in 3 axes, 10 cycles |
| Protection class (DIN EN 60529) | | IP67 (when connected) |
| Material | | 1.4301 (non-magn.) |
| Weight | | approx. 32 g |
| Compatibility | | Compatible with capacitive CST controllers from Micro-Epsilon |

# 3. Delivery

## 3.1 Unpacking/Included in Delivery

1x CST6110 Controller
1x Power supply and signal cable SCAC3/6/IP
1x Quick Manual

Separately available:
CS025/M5-CAm1,0/RS sensor including integrated sensor 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.

Other optional accessories are listed in the appendix.

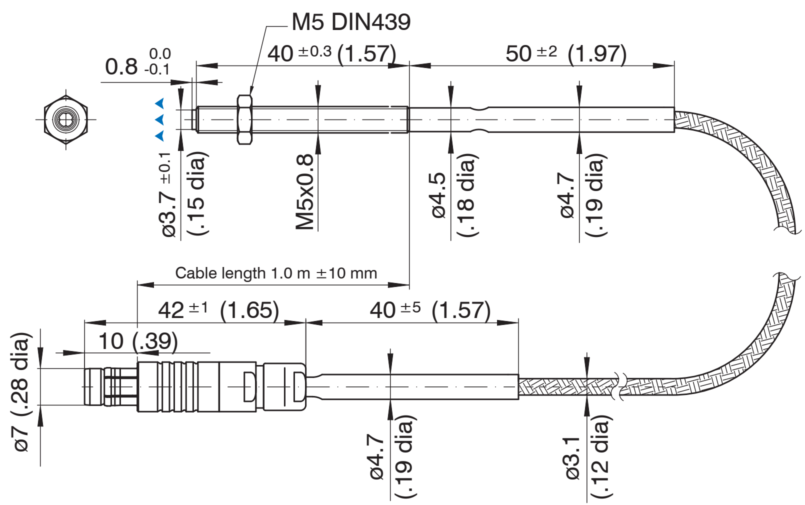
## 3.2 Storage

- Storage temperature:
  - Sensor and sensor cable: -50 ... +125 °C (-58 ... +257 °F)
  - Controller: -40 ... +85 °C (-40 ... +185 °F)
- Humidity: 5 - 95 % (non-condensing)

# 4. Mounting

## 4.1 Sensor, Sensor Cable

The sensor features an M5 x 0.8 thread, which can be used to install it.




i Never bend the sensor cable more tightly than the permitted bending radius:

10 x diameter for dynamic use,
5 x diameter for static use

i The calibrated sensor cables must not be shortened, because this changes the calibration of the measuring system.

*Fig. 2 CSE025 sensor featuring integrated cable with thermal protection sleeve*

- Lay the sensor cable in such a way that no sharp or heavy objects affect the cable sheath. Do not kink the cable.
- Always fasten the sensor position with a locknut.

Active measuring surface

## 4.2 Controller

The controller can be fastened by using two M4 screws.

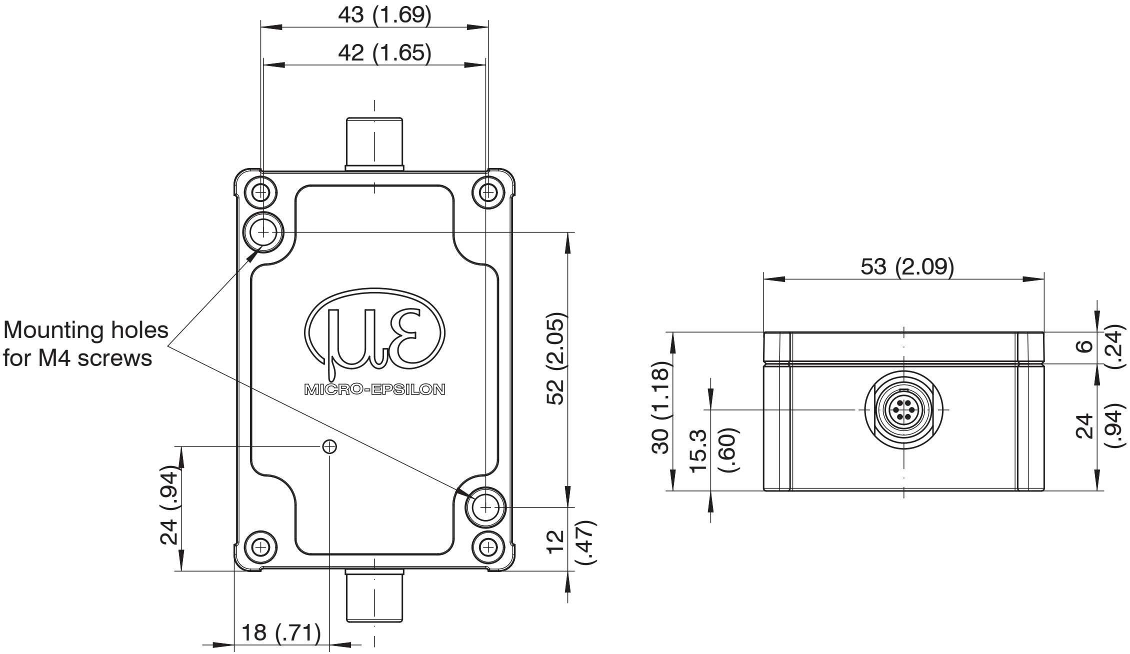



*Fig. 3 Dimensional drawing of controller*

## 4.3 Power Supply and Signal Cable SCAC3/6/IP68

SCAC3/6 is a ready-made 6-wire power supply and signal cable.

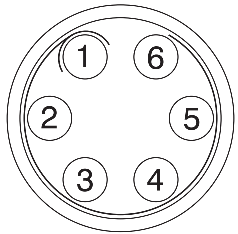
i Never bend the power supply and signal cable more tightly than the permitted bending radius: 5 x outer diameter of cable

## 4.4 Electrical Connections

### 4.4.1 Power Supply, Outputs

| Signal | Pin | Wire color SCAC3/6/IP | Description |
|---|---|---|---|
| +24 V | 1 | White | +24 V supply, 11 ... 32 VDC, reverse polarity protection |
| 0 V | 2 | Gray | Supply ground |
| Analog $_{out}$ | 3 | Pink | Signal output 0 ... 5 V |
| AGND | 4 | Green | Analog ground of signal output |
| TTL $_{out}$ | 5 | Brown | Counting pulses, digital |
| RAW SIGNAL | 6 | Blue | Analog signal (load > 5 kOhm) |
| Housing | | Black | |

*Fig. 5 Pin assignment for POWER/SIGNAL socket and SCAC3/6*




View on solder pin side, 6-pole cable connector


*Fig. 4 Supply voltage connection*

The socket housing is connected to the controller housing.

➡ Connect the controller housing to the grounding of the test bench or protective ground.

The outputs are briefly resistant to short circuits.

### 4.4.2 Supply Voltage

Supply voltage $+U_B$: 11 ... 32 VDC

Power consumption: $P_{max}$ < 0.8 W

The controller is protected against polarity reversal.

i Power supply only for measuring devices, not to be used for drives or similar sources of impulse interference at the same time. MICRO-EPSILON recommends the PS2020 power supply unit, see Optional Accessories in the Appendix.

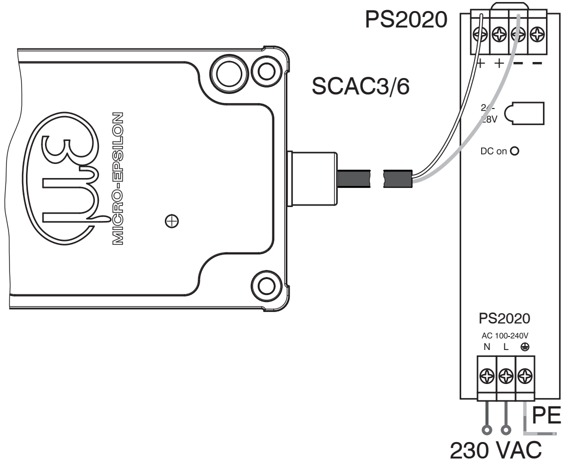



*Fig. 6 Supply voltage connection*

| Wire color SCAC3/6/IP | Assignment |
|---|---|
| White | +11 … 32 VDC |
| Gray | GND |

### 4.4.3 Raw Signal

The controller provides 0 ... 5 V analog voltage for sensor adjustment using the RAW SIGNAL, see Chap. 5.4.
Load resistance > 5 kOhm.

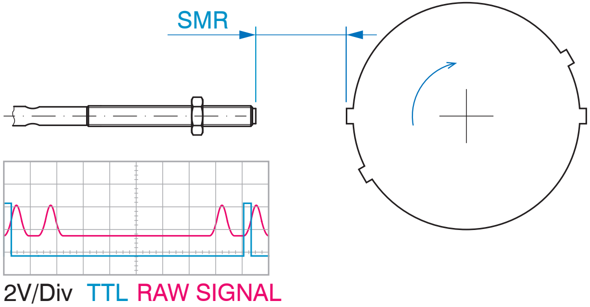



*Fig. 7 Distance between sensor and measuring object (ridge) too large*

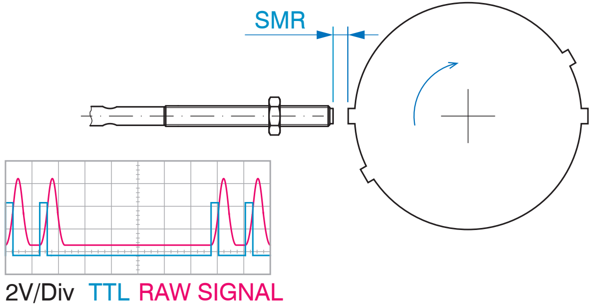



*Fig. 8 Distance between sensor and measuring object (ridge) OK*

The system detects ridges and grooves.

| | |
|---|---|
| **NOTICE** | The sensor front may not touch the measuring object/ridge!<br>> Damage to or destruction of the sensor |

i The vibrations of a rotating mechanical shaft cause slightly larger distances between sensor and measuring object. To ensure that the RAW signal can be reliably evaluated over the entire measuring range, the signal conversion requires a sufficient buffer in the switching thresholds. You achieve this with an optimal distance between the sensor and the measuring object or by increasing the sensitivity of the controller.

# 5. Operating

## 5.1 Connecting the Measuring System Structure

The voltage supply for the controller is provided via the SUPPLY/OUTPUT socket; signals are concurrently output via that socket.

- Install the sensor in the measurement environment.
- Connect the sensor to the controller, see Fig. 1.
- Connect the controller to power supply; use the SCAC3/6/IP-3 connection and signal cable, cable length 3 m, see Chap. 4.4.2.

The connection and signal cable has a push-pull latch on the plug side, as does the sensor cable. Push-pull connections feature a very user-friendly latching mechanism. If the plug connector is pushed into the device, latching claws on the plug connector snap into the device component and create a reliable connection between the two components. It cannot be separated by pulling on the plug connector's cable. By contrast, the plug connector can easily be separated from the device component, if the outer sleeve is pulled back.

- If necessary, connect measuring signal displays or recording equipment to the controller via the 6-pole cable connector.
- Switch on the supply voltage at the power supply unit.

The controller initializes itself when the supply voltage is applied. This is indicated by the Status LED, see Chap. 5.2. Depending on the operating mode set, the Status LED changes.

- Set the desired operating mode and the measuring object divider, see Chap. 5.2, see Chap. 5.3.
- Position the sensor, see Chap. 5.4.

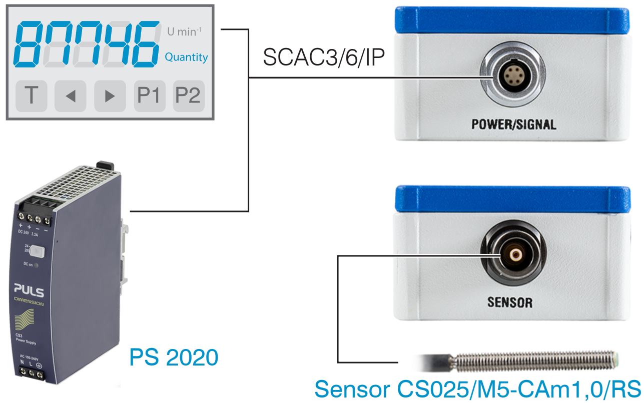



*Fig. 9 Connection examples for CST6110*

## 5.2 LEDs Controller, Operating Modes

<table>
<tr><th>Operating mode</th><th>LED</th><th colspan="4">Meaning</th></tr>
<tr><td rowspan="3">0</td><td>Turquoise</td><td colspan="3">Not enough movement detected, ridges/grooves not identified</td><td rowspan="3">Signal test RAW SIGNAL</td></tr>
<tr><td>Green</td><td colspan="3">Signal test without error</td></tr>
<tr><td>Red</td><td colspan="3">Error, irregular pulse pattern</td></tr>
<tr><td>1</td><td>Green ...</td><td>Blue ...</td><td>Red</td><td colspan="2">Test for Analog $_{OUT}$ and TTL $_{OUT}$, changing color pattern</td></tr>
<tr><td>2</td><td>Purple</td><td colspan="4">TTL pulse per measuring object divider (blade)</td></tr>
<tr><td>3</td><td>Blue</td><td colspan="4">TTL pulse per rotation or per X measuring object dividers (blades)</td></tr>
<tr><td rowspan="3">4 … 9</td><td>Turquoise</td><td colspan="3">No movement detected / ridges/grooves not identified</td><td rowspan="3">Rotational speed mea-surement</td></tr>
<tr><td>Green</td><td colspan="3">Measurement inside the measuring range</td></tr>
<tr><td>Orange</td><td colspan="3">Measurement outside the measuring range</td></tr>
</table>

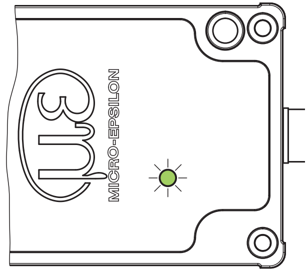
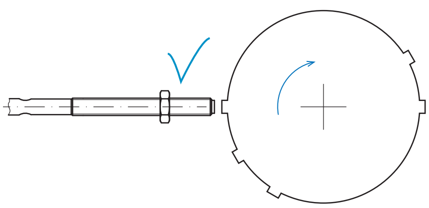
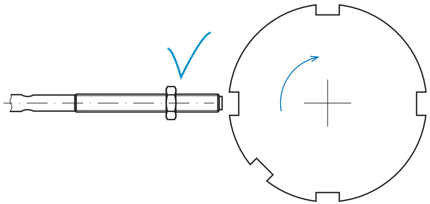
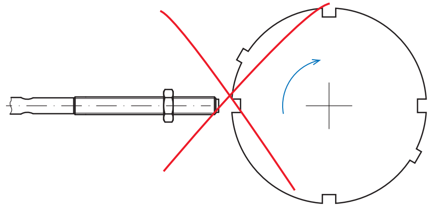



*Fig. 10 Status LED on the Controller*

| MODE rota-ry switch | Description | Measuring range | Number of blades X | Output signals | |
|---|---|---|---|---|---|
| | | | | Analog | TTL |
| 0 | Signal Test | up to 110 kHz | Adjust measuring object divider (BLADES) | 0…5V VDC RAW SIGNAL | Pulse (variable) per ridge or groove |
| 1 | Output Test | | | | |
| 2 | TTL pulse per blade | | Not used | | |
| 3 | TTL pulse per rotation or per X blades | 10 … 400,000 rpm (@ 16 blades) | Adjust measuring object divider (BLADES) 1 ... 16 | - | Pulse 100 $\mu$s per rotation/ all X ridges or grooves |
| 7 | Rotational speed measurement | 0 ... 100,000 rpm | | 0…5V VDC | Pulse (variable) per ridge or groove |
| 8 | | 0 ... 200,000 rpm | | | |
| 9 | | 0 ... 400,000 rpm | | | |
| 4 | Frequency measurement | 0 ... 10,000 Hz | Not used | | |
| 5 | | 0 ... 50,000 Hz | | | |
| 6 | | 0 ... 100,000 Hz | | | |

## 5.3 Measuring Object Divider

Adjusting the measuring object divider with the BLADES switch provides the controller with the information about the nature of the measuring object. It does not matter whether you measure against ridges or grooves.

| | | |
|---|---|---|
|  |  |  |
| Measurement against ridges: possible | Measurement against grooves: possible | Measurement against ridges/grooves: not possible |

The controller evaluates the pulses provided by the sensor. For the `Rotational speed measurement` modes (MODES 7, 8, 9) and `TTL pulse per rotation` (MODE 3), the controller must know the number of ridges or grooves of the measuring object. For the `Signal Test` and the `Output Test`, the measuring object divider must also be defined.

The controller can evaluate measuring objects with up to 16 ridges or grooves.

➡ Define the number of ridges or grooves of your measuring object. Therefore, use the `BLADES` switch on the controller, see Fig. 11.

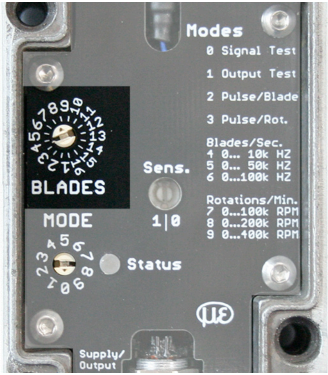



*Fig. 11 BLADES switch, set to 8 ridges or grooves*

## 5.4 Positioning the Sensor

### 5.4.1 With Open Housing

The sensor is best installed when the inside of the measuring object and the sensor front are visible.

➡ Install the sensor incl. locknut flush to the housing wall. Connect the sensor to the controller.

➡ Check the RAW SIGNAL from the controller and optimize the distance between the sensor and the measuring object. There are two options for this:

| | |
|---|---|
| **Possibility 1:**<br>**Status LED** | ➡ Open the controller housing.<br>➡ Use the MODE switch to select operating mode `0`.<br>➡ Use the `BLADES` switch to define the measuring object divider. |
| ➡ Start to rotate the measuring object and carefully screw the sensor onto the thread of the housing during running operation.<br>The sensor position should always be fastened by the locknut, except while it is being screwed onto the thread.<br>➡ Observe how the color of the `Status` LED changes. | |
| `Status` LED: turquoise<br>Too few pulses to check the signal transformation | - Measuring object does not turn/turns very slowly, see Fig. 10<br>➡ Increase rotational speed<br>- Sensor identifies too few signal peaks<br>➡ Continue to carefully screw in the sensor or increase the controller's sensitivity using the `Sens` potentiometer (sensitivity).<br>If sensitivity is at the maximum, continue to screw in the sensor. |
| `Status` LED: red<br>Signal faulty | - Ridges/grooves are not identified as such<br>➡ Carefully continue to screw in the sensor or increase the sensitivity<br>- Sensitivity is at the maximum, faults are detected as ridges/grooves<br>➡ Reduce the sensitivity and continue to carefully screw in the sensor |
| `Status` LED: green<br>Signal faultless | Pulses are detected at regular time intervals. The RAW signal is correctly transformed into digital pulses without faults or pulse drops. |

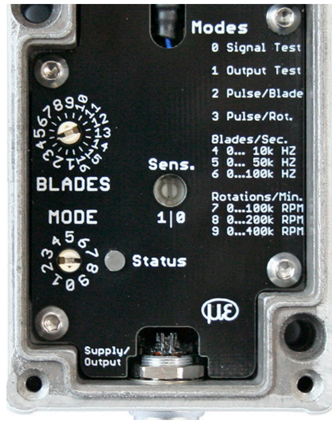
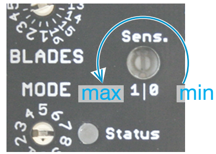
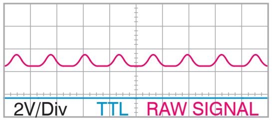
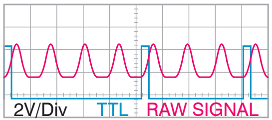
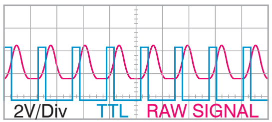
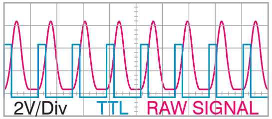



*Fig. 12 Controller electronics with adjusting elements*

| | | |
|---|---|---|
| **Possibility 2:**<br>**RAW SIGNAL**<br>**and**<br>**Oscilloscope** | ➡ Open the controller housing. Use the MODE switch to select the operating mode `0`.<br>➡ Use the `BLADES` switch to define the measuring object divider.<br>➡ Connect the TTL (channel ) and RAW (channel II) signals to an oscilloscope.<br>➡ Start to rotate the measuring object and carefully screw the sensor onto the thread of the housing.<br>The sensor position should always be fastened by the locknut, except while it is being screwed onto the thread. | <br>*Fig. 13 Sensitivity potentiometer* |
| `Status` LED: turquoise<br><br>Measurement not possible | <br>*Fig. 14 Screenshot of oscilloscope; long distance, low sensitivity* | The raw signal on the oscilloscope should already show a small signal boost for each ridge/groove, distance between sensor and ridge approx. 5 mm.<br>➡ Carefully continue to screw in the sensor.<br>**i** The connector on the sensor cable can be turned in the socket without needing to be pulled off. You can continue to screw in the sensor while it is plugged in without the cable being twisted. |
| `Status` LED: red<br><br>Measurement not possible | <br>*Fig. 15 Screenshot of oscilloscope; medium distance, low sensitivity* | Once the raw signal includes clear signal boosts per ridge/groove, pulse transformations can occur. However, if the controller's sensitivity is too low, the raw signal is not transformed correctly. Pulse drops in the TTL signal are gaps.<br>➡ Continue to carefully screw in the sensor and/or increase the sensitivity using the `Sens` potentiometer. |
| `Status` LED: green<br><br>Measurement possible | <br>*Fig. 16 Screenshot of oscilloscope; medium distance, high sensitivity* | Pulses are detected at regular time intervals.<br>The RAW signal is correctly transformed into digital pulses without faults or pulse drops. |

| | | |
|---|---|---|
| Status LED: green<br><br>Measurement possible | <br>*Fig. 17 Screenshot of oscilloscope; short distance, low sensitivity* | Signals on oscilloscope after distance between sensor and measured object has been reduced without changing sensitivity. |

The RAW SIGNAL is exclusively used for sensor installation. Signal range: 0 ... 5 V.

### 5.4.2 With Closed Housing

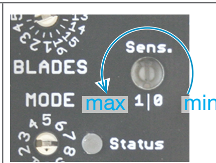
The distance between the sensor and the measuring object is not visible. You can determine the optimal distance between the sensor and the measuring object using the `RAW` signal or the `Status` LED. Sensor and controller are connected with each other.

**Possibility 1: RAW SIGNAL and Oscilloscope**

- Open the controller housing. Use the MODE switch to select the operating mode `0`.
- Use the `BLADES` switch to define the measuring object divider.
- Connect the TTL (channel ) and RAW (channel II) signals to an oscilloscope.
- Start to rotate the measuring object.
- Screw a locknut on the sensor and carefully turn the sensor onto the thread of the housing.

The sensor position should always be fastened by the locknut, except while it is being screwed onto the thread.

- Check the RAW SIGNAL from the controller and optimize the distance between the sensor and the measuring object.




Sensitivity potentiometer

`Status` LED: turquoise

Measurement not possible

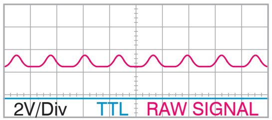



*Fig. 18 Screenshot of oscilloscope; long distance, low sensitivity*

The raw signal on the oscilloscope should already show a small signal boost for each ridge/groove, distance between sensor and ridge approx. 5 mm.

- Carefully continue to screw in the sensor.

i The connector on the sensor cable can be turned in the socket without needing to be pulled off. You can continue to screw in the sensor while it is plugged in without the cable being twisted.

`Status` LED: red

Measurement not possible

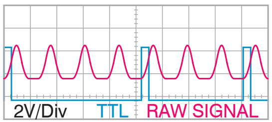
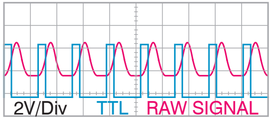
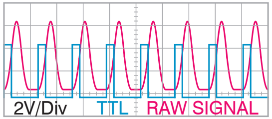


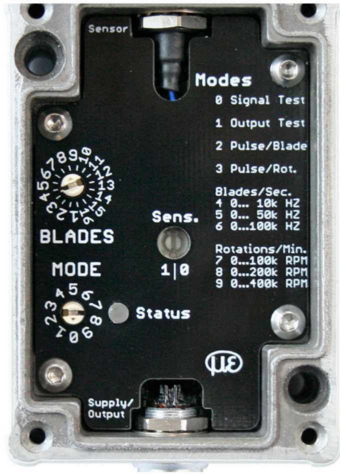

*Fig. 19 Screenshot of oscilloscope; medium distance, low sensitivity*

Once the raw signal includes clear signal boosts per ridge/groove, pulse transformations can occur. However, if the controller's sensitivity is too low, the raw signal is not transformed correctly. Pulse drops in the TTL signal are gaps.

- Continue to carefully screw in the sensor and/or increase the sensitivity using the `Sens` potentiometer.

| | | |
|---|---|---|
| `Status` LED: green<br><br>Measurement possible | <br>*Fig. 20 Screenshot of oscilloscope; medium distance, high sensitivity* | Pulses are detected at regular time intervals. The RAW signal is correctly transformed into digital pulses without faults or pulse drops. |
| `Status` LED: green<br><br>Measurement possible | <br>*Fig. 21 Screenshot of oscilloscope; short distance, low sensitivity* | Signals on oscilloscope after distance between sensor and measured object has been reduced without changing sensitivity. |

The `RAW SIGNAL` is exclusively used for sensor installation. Signal range: 0 ... 5 V.

<table>
<tr><td>Possibility 2:<br>Status LED</td><td>➡ Open the controller housing.<br>➡ Use the MODE switch to select operating mode 0.<br>➡ Use the BLADES switch to define the measuring object divider.</td><td rowspan="3">

Controller electronics with adjusting elements</td></tr>
<tr><td colspan="2">➡ Start to rotate the measuring object.<br>➡ Screw a locknut on the sensor and carefully turn the sensor onto the thread of the housing.<br>The sensor position should always be fastened by the locknut, except while it is being screwed onto the thread.<br>➡ Observe how the color of the Status LED changes.</td></tr>
<tr><td>Status LED: turquoise<br>Too few pulses to check the signal transformation</td><td>- Measuring object does not turn/turns very slowly, see Fig. 10<br>➡ Increase rotational speed<br>- Sensor identifies too few signal peaks<br>➡ Continue to carefully screw in the sensor or increase the controller’s sensitivity using the Sens potentiometer (sensitivity).<br>If sensitivity is at the maximum, continue to screw in the sensor.</td></tr>
<tr><td>Status LED: red<br>Signal faulty</td><td colspan="2">- Ridges/grooves are not identified as such<br>➡ Carefully continue to screw in the sensor or increase the sensitivity<br>- Sensitivity is at the maximum, faults are detected as ridges/grooves<br>➡ Reduce the sensitivity and continue to carefully screw in the sensor</td></tr>
<tr><td>Status LED: green<br>Signal faultless</td><td colspan="2">Pulses are detected at regular time intervals. The RAW signal is correctly transformed into digital pulses without faults or pulse drops.</td></tr>
</table>

## 5.5 Output Test

The controller provides a test signal at Pin 3 and 5 of the installed 6-pole `POWER/SIGNAL` socket. The measuring object does not have to move in this operating mode.
The signal can be used to check the wiring of the measuring system structure.

Procedure:

➡ Set the `MODE` switch to position 1.

The Status LED blinks Green – Blue – Red ... in sequence

The Analog $_{out}$ and TTL $_{out}$ outputs provide signals corresponding to the measuring object divider (BLADES) setting.

| | | |
|---|---|---|
| Pin 3, analog output | {1 V / 1.5 V / 2 V ... 5 V} for measuring object dividers from 1 ... 10 | |
| | {0 V} for measuring object dividers from 11 ... 16 | |
| Pin 5, TTL pulses | $t_i$ approx. 100 µs, $t_p$ varies depending on the measuring object divider | |

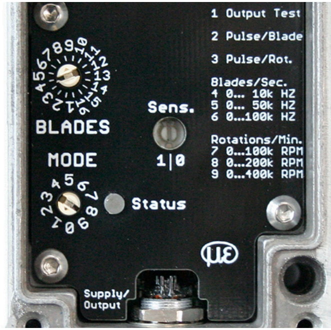
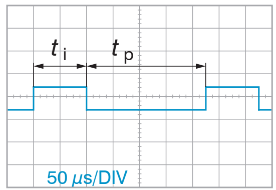



*Fig. 22 Settings of the MODE switch for the output test*

| Measuring object divider | $t_i$ in µs | $t_p$ in µs | Frequency in Hz |
|---|---|---|---|
| 1 | 100 | 4364 | 224 |
| 2 | 100 | 3965 | 246 |
| 3 | 100 | 3688 | 264 |
| 4 | 100 | 3397 | 286 |
| 5 | 100 | 3105 | 312 |
| 6 | 100 | 2815 | 343 |
| 7 | 100 | 2532 | 380 |
| 8 | 100 | 2242 | 427 |

| Measuring object divider | $t_i$ in µs | $t_p$ in µs | Frequency in Hz |
|---|---|---|---|
| 9 | 100 | 1953 | 487 |
| 10 | 100 | 1667 | 566 |
| 11 | 100 | 1377 | 677 |
| 12 | 100 | 1090 | 840 |
| 13 | 100 | 802 | 1109 |
| 14 | 100 | 513 | 1630 |
| 15 | 100 | 225 | 3073 |
| 16 | 100 | 12 | 8944 |




TTL signal with measuring object divider = 15

*Fig. 23 Intervals of pulse pause for measuring object divider (BLADES)*

## 5.6 Analog output

- Range 0 ... +5 V
- Linearly depending on the rotational speed

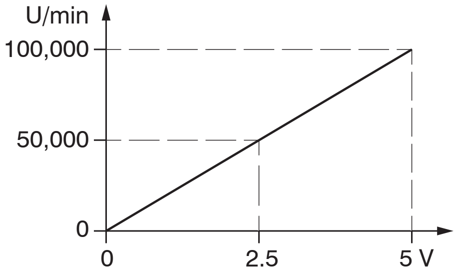



*Fig. 24 Signal for max. 100,000 rpm*

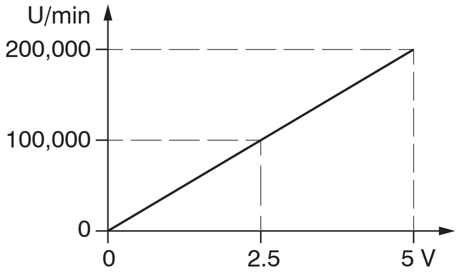



*Fig. 25 Signal for max. 200,000 rpm*

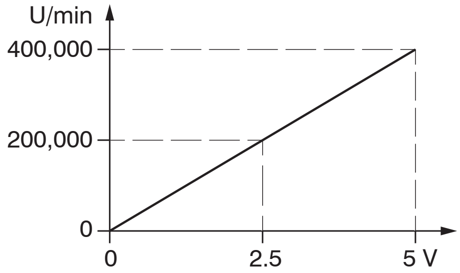



*Fig. 26 Signal for max. 400,000 rpm*

The controller outputs an analog signal for the operating modes

- 0 Signal test
- 1 Output Test
- 4, 5, 6 Frequency measurement
- 7, 8, 9 Rotational speed measurement

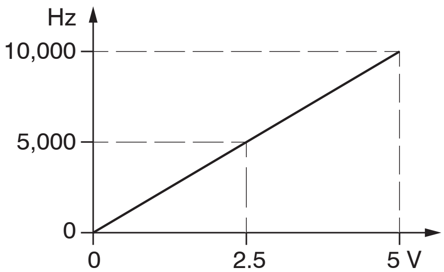



*Fig. 27 Signal for max. 10,000 Hz*

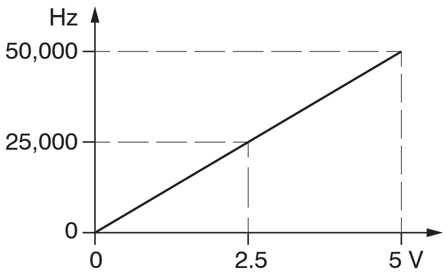



*Fig. 28 Signal for max. 50,000 Hz*

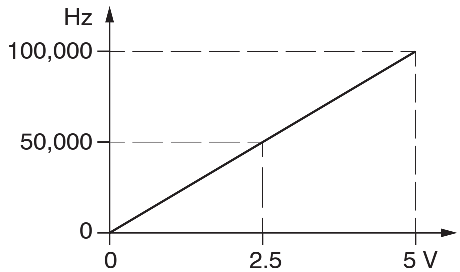



*Fig. 29 Signal for max. 100,000 Hz*

# 6. Troubleshooting

If faults occur during measuring (possibly only at different rotational speeds) despite complying with the items above, use the possibilities below:

- Optimize signal transformation as described, see Chap. 5.4.
- Change the sensitivity on the controller.
- Change the distance between sensor and measured object.
- Provide the controller with its own power supply.
- If you use measuring devices (e.g., an oscilloscope) whose signal ground (GND) is connected to the protective ground of the power socket, insert an galvanic isolation (e.g., by using an isolating transformer).
- Ensure that possible interference from other components is minimized (e.g., by shielding).

# 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

In the event of a defect in the sensor, sensor cable, power supply and signal cable or controller, please send in the affected parts for repair or replacement.
If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

MICRO-EPSILON MESSTECHNIK
GmbH & Co. KG
Königbacher 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 signal cable 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

## Optional Accessories

PS2020

Power supply unit for DIN rail mounting,
Input 230 VAC,
Output 24 VDC/2.5 A

MICRO-EPSILON

MICRO-EPSILON MESSTECHNIK GmbH & Co. KG
Königbacher Str. 15 · 94496 Ortenburg/Germany
Phone +49 8542 168 0 · Fax +49 8542 168 90
info@micro-epsilon.de · www.micro-epsilon.de
Your local contact: www.micro-epsilon.com/contact/worldwide/

X9751420-A012031MSC