1. **Warnings**

Do not look directly into the light source of the sensor.

- Risk of injury, damage to the eyes and skin

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

Avoid shocks and impacts to the sensor.

The supply voltage must not exceed the specified limits.

Avoid constant exposure of the sensor to dust or splashes of water by appropriate methods such as blowing or using a protective housing.

The sensor housing may only be opened by authorized persons.

- Damage to or destruction of the sensor

Do not touch the protective windows of the optics. Wipe off any fingerprints immediately with pure alcohol and a clean cotton cloth with no streaks. Protect the cables against damage.

- Failure of the measuring device

Do not plug or unplug devices during the operation.

2. **Notes on Product Marking**

The product meets the requirements of CE and UKCA.

All specifications and safety instructions described in the operating instructions must be observed.
3. Proper Environment

- Protection class
  - Sensor: IP67 (only applies in the case of connected output connectors and/or installed protective caps)

Optical paths during operation are excluded from the protection class. Contamination of the paths causes impairment or failure of the function.

The IP67 protection class is a specification that is limited to protection from dust and water. Oil, steam and emulsion effects are not included in this protection class and must be evaluated separately.

- Temperature range
  - Operation: 0 ... +45 °C (32 ... 113 °F)
  - Storage: -20 ... +70 °C (-4 ... 158 °F)

- Humidity: 20 ... 80 % (non condensing)

- Ambient pressure: Atmospheric pressure

1) Max. permissible operating temperature depends on installation scenario, thermal connection and operating mode. If necessary, external heat dissipation must be used to ensure that the sensor’s internal temperature of 60 °C is not exceeded.

4. Delivery surfaceCONTROL 3D 35xx

- 1 Sensor surfaceCONTROL 3D 35xx
- 1 Assembly instructions
- 1 Calibration final inspection
- 3 Protective caps
- 1 ECR3000-5 supply cable 5 m
- 1 SCR3000X-5 Ethernet interface cable 5 m

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.
5. **Light Source**

The surfaceCONTROL 3D 35xx sensor works with an LED lighting unit. Measurement is performed using blue light at the dominant 459 nm wavelength. The sensor is included in risk group 2 according to EN 62471: 2008.

**CAUTION** Do not look into the lens. Consciously close your eyes or immediately turn away if the optical radiation enters the eye.

The warning sign below is attached to the sensor housing on the top and bottom:

![LED warning sign](image)

*Fig. 1 LED warning sign*

- If both warning labels are covered over when the unit is installed, the user must ensure that supplementary labels are applied.
6. Electrical Connections

![Arrangement of connections](image)

### Power Supply Voltage

The power supply connection in the form of a 4-pin M12 round connector has a current carrying capacity of up to 2 A per pin.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Pin no.</th>
<th>Cable color</th>
<th>Notes</th>
<th>Connection view</th>
</tr>
</thead>
<tbody>
<tr>
<td>+U_B</td>
<td>1</td>
<td>Brown</td>
<td>18 V ... 30 V DC (rated value 24 V)</td>
<td><img src="image" alt="View: Plug on housing side" /></td>
</tr>
<tr>
<td>+U_B</td>
<td>2</td>
<td>White</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td>3</td>
<td>Blue</td>
<td>0 V</td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td>4</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen</td>
<td></td>
<td>Housing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use only shielded lines or original cables from the accessories program for the power supply connection or the outputs.

Micro-Epsilon recommends the ECR3000-x shielded supply cable.
Multi-Function Connection I/O

Interfaces and signals for external control of the sensor or for outputting sensor states and data are provided via the multi-function connection. The four connections operate either as inputs or outputs.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Pin no.</th>
<th>Cable color PCR3000-x</th>
<th>Notes</th>
<th>Connection view</th>
</tr>
</thead>
<tbody>
<tr>
<td>reserved</td>
<td>9</td>
<td>Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>2</td>
<td>Blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>3</td>
<td>White</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>1</td>
<td>Brown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>12</td>
<td>Red-blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>11</td>
<td>Gray-pink</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>10</td>
<td>Purple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPIO1</td>
<td>4</td>
<td>Green</td>
<td>General purpose IO 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hardware trigger</td>
<td></td>
</tr>
<tr>
<td>GPIO2</td>
<td>6</td>
<td>Yellow</td>
<td>General purpose IO 2</td>
<td></td>
</tr>
<tr>
<td>GPIO3</td>
<td>8</td>
<td>Gray</td>
<td>General purpose IO 3</td>
<td></td>
</tr>
<tr>
<td>GPIO4</td>
<td>5</td>
<td>Pink</td>
<td>General purpose IO 4</td>
<td></td>
</tr>
<tr>
<td>GND GPIO</td>
<td>7</td>
<td>Black</td>
<td>Ground connection GPO</td>
<td></td>
</tr>
<tr>
<td>Screen</td>
<td>Housing</td>
<td>Black</td>
<td>Not electrically connected to GND GPIO</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 4 Pin assignment of the multi-function connection**

The multi-function connection is a 12-pin M12 round connector. The connecting line is intended to be up to 35 m long; however, the cable must be shielded at any length. Micro-Epsilon recommends using the PCR3000-x multi-function cable.
Digital Signals

The four digital connections of the multi-function interface provided can operate optionally as inputs or outputs. They are configured using the software. All digital ports share a joint ground GND GPIO. External auxiliary power (max. 30 V) is required to use the outputs.

The digital signals are not suitable for brief signal pulses or time-critical signals. The exception is port 1, which, when configured correctly, can be used as a hardware trigger to start a measurement and is directly connected to the sequence control in the sensor.

The functionality of the digital signals can be programmed, see Fig. 5. In addition to direction, polarity can also be switched for the inputs and outputs. Internal sensor signals can be assigned to the digital outputs, for example, to control additional connected devices.

Fig. 5 Programmable inputs and outputs
The outputs can optionally be assigned the internal signals below:

<table>
<thead>
<tr>
<th>Internal signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UserOutput0</td>
<td>Digital output signal that can be set via Genicam</td>
</tr>
<tr>
<td>FrameTriggerWait</td>
<td>Sensor is ready for next measurement</td>
</tr>
<tr>
<td>FrameTriggerMissed</td>
<td>(External) trigger was missed (sensor was not yet ready for measurement)</td>
</tr>
<tr>
<td>FrameActive</td>
<td>3D measurement in sensor is active (start at exposure of first image, end at completion of data transmission via GigE)</td>
</tr>
<tr>
<td>ExposureActive</td>
<td>Image sequence recording is enabled for current frame (start at first image, end at last image transmission)</td>
</tr>
<tr>
<td>HardwareError</td>
<td>Critical error in sensor: Hardware error or sensor has become too hot.</td>
</tr>
</tbody>
</table>

Fig. 6 Internal signal for digital output

Output signal selection (software side)

- Trigger/GPIO1
  - (Output) Line 1
- GPIO2
  - (Output) Line 2
- GPIO3
  - (Output) Line 3
- GPIO4
  - (Output) Line 4

- FrameTriggerWait
- FrameTriggerMissed
- ExposureActive
- FrameActive
- UserOutput0
- HardwareError
Electrical Parameters of Digital Inputs, Multi-Function Connection

The switching levels of the digital inputs are defined based on HTL logic: Low 0 … 3 V, High 11 … 24 V (up to 30 V permitted). Maximum input current is internally limited to 5 mA. The GPIO_1 input can also be used as a trigger signal. The minimum pulse duration when used as a trigger signal is 50 µs. Switching delay until a measurement is triggered is at most 10 µs.

All inputs can be used as logical inputs, but not for time-critical tasks.

Electrical Parameters of Digital Outputs, Multi-Function Connection

The digital outputs require an external auxiliary voltage between 5 V and 30 V as well as a load resistance. They can be operated at a load current of at most 100 mA. This may occur, for example, by using an NPN-switching input module of a control. The outputs are switched using a SolidState relay and are low active.

---

**Fig. 7** Example for the timing behavior of an output at VCC GPIO = 24 V, $I_{Out} = 10$ mA, $R_L = 2.4 \, k\Omega$

**Fig. 8** Switching times of digital output

$t_{on} < 0.1 \, ms \quad t_{off} < 1.0 \, ms$
## 7. LED Displays

<table>
<thead>
<tr>
<th>LED LED</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>LED not active</td>
</tr>
<tr>
<td>Constant green</td>
<td>LED active</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED State</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashing orange</td>
<td>Initialization of sensor hardware</td>
</tr>
<tr>
<td>Flashing green</td>
<td>Initialization of communications interface</td>
</tr>
<tr>
<td>Constant green</td>
<td>Sensor is ready for operation</td>
</tr>
<tr>
<td>Flashing orange-green</td>
<td>Error during initialization of sensor hardware</td>
</tr>
<tr>
<td></td>
<td>Communication with sensor possible</td>
</tr>
<tr>
<td>Constant red</td>
<td>Error during initialization</td>
</tr>
<tr>
<td></td>
<td>No communication with sensor possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED Power</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No supply voltage or supply voltage too low</td>
</tr>
<tr>
<td>Constant green</td>
<td>Supply voltage applied</td>
</tr>
<tr>
<td>Constant red</td>
<td>Error, supply voltage too high</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED Data (Link / Act)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link LED (left):</td>
<td></td>
</tr>
<tr>
<td>Constant orange</td>
<td>Gigabit Ethernet connection established</td>
</tr>
<tr>
<td>Constant green</td>
<td>100 Mbit Ethernet connection established</td>
</tr>
<tr>
<td>Off</td>
<td>10 Mbit Ethernet connection established</td>
</tr>
<tr>
<td>Act LED (right):</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>Active data transmission</td>
</tr>
<tr>
<td>Off</td>
<td>No data transmission</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED I/O</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>reserved</td>
<td></td>
</tr>
</tbody>
</table>
8. Operation

Commissioning

**NOTICE** The sensor may only be connected to peripherals when it does not carry power, that is, only when the supply voltage has been switched off.

- Mount the sensor according to the installation instructions.
- Connect the sensor to the Ethernet cable.
- Connect the Ethernet cable to the PC.
- Connect the sensor to the power supply.

Read the detailed operating instructions before operating the sensor. These instructions are available online at [www.micro-epsilon.com](http://www.micro-epsilon.com).

**Turning On**

- Turn on the external DC voltage supply (24 VDC).

The Power LED is constantly illuminated green if sufficient supply voltage is applied. The State LED flashes orange and green during hardware connection and initialization. After completion, it is constantly illuminated green. For more information, see the “LED Displays” section, see Chap. 7.

- The surfaceCONTROL 3D 35xx sensor requires a warm-up time of typically 60 minutes for precise measurements.

**Operating Programs**

Various programs are provided for operation of the sensor.

- 3D View visualizes in space three-dimensional point data that have been detected with surfaceCONTROL 3D 35xx.
- 3DInspect solves industrial 3D measurement tasks.
- You can use surfaceCONTROL DefMap3D 7.0 for the analysis of individual surfaces with surfaceCONTROL 3D 35xx.

9. Installation

**Requirements**

The following minimum system requirements are necessary for the operation of the operating programs:

- Windows 8 or 8.1 (64 bit), Windows 10 (64 bit)
- 1-GHz or higher processor (64 bit) with 4 GB RAM
- Screen resolution: 1280 x 1024
- Graphic card / GPU with OpenGL 3.1 or higher

- Connect the sensor directly to the PC. Do not use hubs.
10. Positioning of Sensor and Test Object

General

Note the following instructions for optimum positioning of the sensor and test object.

- Observe an optimum distance between the sensor and the surface of the test object, see Operating instructions, Chap. 3.2.
- Align the sensor with predominantly diffusely reflecting surfaces almost perpendicular to the surface. To avoid direct reflection, we recommend that you tilt the sensor by a few degrees.
- In the case of partially glossy surfaces, reflections from the test object can be reduced by inclining the sensor by up to 30° with respect to the surface of the test object.

Alignment with Crosshair

You will achieve the best results in the mid of the measuring range (focal range of cameras).

Use the positioning pattern to easily and optimally align the sensor in the mid of the measuring range. Align the pattern of the projection with the superimposed pattern.

Fig. 10 Result of camera images when aligned with crosshair

You will find further details
- in the respective operating instructions of the software provided by Micro-Epsilon,
- or in the sensors operating instructions, chapter GenICam parameter description.
11. **Further Information**
For details on the individual programs or on setting the sensor parameters, please refer to the respective software operating manuals or the operating instructions of this sensor.

12. **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/impressum/](https://www.micro-epsilon.com/impressum/).
13. **Service, Repair**

If the sensor or sensor cable is defective:
- If possible, save the current sensor settings in a parameter set, see 3D-View, menu Parameters > Save parameters to file, in order to load the settings back again into the sensor 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 measuring system to:

MICRO-EPSILON Optronik GmbH
Lessingstraße 14
01465 Langebrück / Germany

Tel. +49 (0) 35201 / 729-0
Fax +49 (0) 35201 / 729-90
optronic@micro-epsilon.de
www.micro-epsilon.com
14. **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-ee_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.de/impressum/.

  - 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.

You can find more information about the sensor in the operating instructions. They are available online at:
