Instruction Manual

scanCONTROL 27x0
Laser scanner
## 6. Operation of the Sensor with a PC

### 6.1 Displays

### 6.2 Operating and Demonstration Programs

### 6.3 Installation and Requirements

#### 6.3.1 Requirements

#### 6.3.2 Installation

### 6.4 Instructions for Operating

#### 6.4.1 Measuring Field Selection

#### 6.4.2 Calibration

#### 6.4.3 Automatic Exposure Time Regulation

### 6.5 Error Influences

#### 6.5.1 Reflection Factor of the Target Surface

#### 6.5.2 Color Differences

#### 6.5.3 Temperature Influences

#### 6.5.4 External Light

#### 6.5.5 Mechanical Vibrations

#### 6.5.6 Surface Roughness

#### 6.5.7 Shadowing Effects

### 6.6 Cleaning

## 7. scanCONTROL Output Unit

### 7.1 scanCONTROL Output Unit - Components

### 7.2 Connect the Supply Voltage

### 7.3 Commissioning scanCONTROL Output Unit

### 7.4 Specification of the Components

#### 7.4.1 Output Unit Basic (Ethernet)

#### 7.4.2 Supported Modules

#### 7.4.3 OU-DigitalOut/8-Channel/DC24 V/0.5 A/High-side Switching/8 Actuators

#### 7.4.4 OU-AnalogOut/4-Channel/0-10 V

## 8. Warranty

## 9. Service, Repair

## 10. Decommissioning, Disposal

## 11. Error Codes
## Appendix

<table>
<thead>
<tr>
<th>A 1</th>
<th>Accessories</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1.1</td>
<td>Recommended Accessories</td>
<td>65</td>
</tr>
<tr>
<td>A 1.2</td>
<td>Optional Accessories</td>
<td>66</td>
</tr>
</tbody>
</table>
1. Safety

Knowledge of the operating instructions is a prerequisite for equipment operation.

1.1 Symbols Used

The following symbols are used in the instruction manual:

- **CAUTION** Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
- **NOTICE** Indicates a situation which, if not avoided, may lead to property damage.
- **i** Indicates a user action.
- **i** Indicates a user tip.
- **Measure** Indicates a hardware or a button/menu in the software

1.2 Warnings

Caution - use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Avoid unnecessary laser radiation to be exposed to the human body
- Switch off the sensor for cleaning and maintenance.
- Switch off the sensor for system maintenance and repair if the sensor is integrated into a system.

The power supply and the display-/output device must be connected in accordance with the safety regulations for electrical equipment
- Danger of injury
- Damage to or destruction of the sensor

Avoid shock and vibration to the sensor.
- Damage to or destruction of the sensor

The power supply may not exceed the specified limits
- Damage to or destruction of the sensor
Avoid continuous exposure to dust and spray on the sensor by appropriate methods such as blowing or using a protective housing.

> Damage to or destruction of the sensor

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

Protect the cable against damage.

> Failure of the measuring device

Switch off the sensor always first before you connect or disconnect devices.

### 1.3 CE Compliance

The following applies to the scanCONTROL 27x0 sensor:

- EU directive 2014/30/EU
- EU directive 2011/65/EU, “RoHS” category 9

Products which carry the CE mark satisfy the requirements of the quoted EU directives and the European standards (EN) listed therein. The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

MICRO-EPSILON MESSTECHNIK GmbH & Co. KG
Königbacher Straße 15
94496 Ortenburg / Germany

The sensor is designed for use in industry and satisfies the requirements.
1.4 Proper Use
- The sensor is designed for use in industrial and laboratory areas.
- It is used for
  - Profile measurement
  - Length measurement
  - Quality monitoring and inspection of dimensions
- The system may only be operated within the limits specified in the technical data, see Chap. 3.2.
- The system should only be used in such a way that in case of malfunction or failure personnel or machinery are not endangered.
- Additional precautions for safety and damage prevention must be taken for safety-related applications.

1.5 Proper Environment
- Protection class sensor: IP 65 (applies only when connected output connectors respectively protective caps)
- Operating temperature: 0 to +50 °C (+32 to +122 °F)
- Humidity: 5 - 95% (non condensing)
- Ambient pressure: atmospheric pressure
- Vibration: according to DIN EN 60068-2-6 (sine shaped)
- Mechanical shock: according to DIN EN 60068-2-29 (continuous shock)

The protection class does not apply for the optical sections during operation as their soiling / contamination results in adversely affecting or failure of the function.

Only use screened cables or original cables from the range of accessories for the connection to a power supply and for the outputs.

Note also the assembly and installation instructions, see Chap. 5.

The IP 65 protection class is a specification which is limited to the protection with respect to dust and water. Oil, steam and emulsion penetration are not included in this protection class and must be tested separately.
2. Laser Safety

The scanCONTROL 27x0 sensors operate with a semiconductor laser having a wavelength of 660 nm (visible/red). The laser operation is indicated visually by the LED on the sensor. When operating the scanCONTROL 27x0 sensors, the relevant regulations according to EN 60825-1 (IEC 60825, Part 1 of 2015-07 and the applicable accident prevention regulations must be followed. The housing of the scanCONTROL 27x0 optical sensors must only be opened by authorized persons, see Chap. 8. For repair and service, the sensors should always be returned to the manufacturer.

2.1 Laser Class 2M

scanCONTROL 27x0 sensors with a maximum laser power up to 10 mW, see Chap. 3.2, are classified in Laser Class 2M (IIM).

Accordingly, the following applies:

With laser equipment of the Class 2M, the eye is not put in danger during random, short-term exposure to the laser radiation, i.e. exposure duration up to 0.25 s.

A direct glimpse into the beam can be dangerous if the eye-closure reflex is deliberately suppressed, e.g. during adjustment. Direct viewing into the beam with optical aids, e.g. a magnifying glass, is dangerous.

Laser equipment of the Class 2M can be employed without further protective measures, when deliberate viewing into the laser beam or into a beam reflected by mirrors is not longer than 0.25 s.

Since generally the presence of the eye-closure reflex should not be assumed, one should close the eyes or immediately turn away if the laser radiation impinges on the eye.

The following information labels are fitted to the sensor housing (front and rear side):

The laser labels for Germany are already printed on. The labels for the EU area and the USA are enclosed and must be fitted by the user for the region applicable in each case before the equipment is put into operation.
Lasers of Class 2M are not subject to notification and a laser protection officer is not required. Mark the laser area recognizable and everlasting.

If both information labels are hidden in the installed state, the user must ensure that additional labels are fitted at the point of installation.

**CAUTION**

Injury to the eye or the skin via laser radiation!
Consciously close the eyes or turn away if the laser radiation impinges on the eye or the skin.

*Fig. 1 True reproduction of the sensor with its actual location of the warning label*
2.2 Laser Class 3B

scanCONTROL 27x0 sensors with a maximum laser power up to 20 mW, see Chap. 3.2, are classified in Laser Class 3B (IIIB).

Sensors of laser class 3B (IIIB) need an external key switch to switch off the laser, see Chap. 5.2.4. Accordingly, the following applies: The available laser radiation is hazardous for the eyes and usually for the skin also. Looking directly into the laser beam is hazardous for the eyes. Also reflections on shining or mirroring surfaces can be hazardous to the eye. Hazards to the skin through the available laser radiation are given by class 3B (IIIB) laser equipment if the values of the maximum permissible exposure are exceeded.

If the sensor is on the laser output can be reduced to 10 mW with the software. Reducing the laser output to 1 mW is not possible. Reducing the laser output from 20 mW to 10 mW with a software affects not the laser class!

The following information label should be fitted to the sensor housing (front and rear side):

The laser labels for Germany are already printed on. The labels for the EU area and the USA are enclosed and must be fitted by the user for the region applicable in each case before the equipment is put into operation.

If both information labels are hidden in the installed state, the user must ensure that additional labels are fitted at the point of installation.
Laser products certified as Class 3B products (EN 60825-1) require a beam attenuator, see Fig. 2, see Fig. 3, other than the key-operated control. The beam attenuator prevents access to all laser and collateral radiation.

To open or close the aperture please follow the steps below:

1. Unscrew the knurled screw,
2. Change the attenuator position and tighten the knurled screw.

The laser aperture must be open during measurement.

> Injury of the eyes and the skin by laser radiation.
Fig. 4 True reproduction of the sensor with its actual location of the warning label

The user is responsible that the accident prevention regulations are observed. Class 3B (IIIB) laser sensors are notifiable and a laser protection officer is required either. Mark the laser area recognizable and everlasting. During operation the laser area has to be restricted and marked. Observe the instructions described, see Chap. 5.2.4.
3. Functioning Principle, Technical Data

3.1 Brief Description

3.1.1 Measurement Principle
The scanCONTROL 27x0 sensor operates according to the principle of optical triangulation (light intersection method):
- A laser line is projected onto the target surface via a linear optical system.
- The diffusely reflected light from the laser line is replicated on a sensor array by a high quality optical system and evaluated in two dimensions.

The laser line triangulation corresponds in principle to the triangulation of a laser point. In addition, during the measurement a row of lines are simultaneously illuminated by the laser line. Apart from the distance information (Z-axis), the exact position of each point on the laser line (X-axis) is also acquired and output by the system.

3.1.2 System Setup
The scanCONTROL 27x0 measuring system is a compact sensor with an integrated controller. All necessary integral parts are combined in one housing.

3.1.3 Special Performance Features
- scanCONTROL features speed and compact design with simultaneously high measurement accuracy. A special line-scanning optical system ensures uniform exposure of the measuring field.
- The sensor array is arranged in the sensor head according to the Scheimpflug condition which facilitates uniform image focusing over the whole depth of the measurement range (Z-axis).
- scanCONTROL works even without a PC in conjunction with saved configurations. The sensor runs the profile measurement internally and calculates default measured values such as angle or edge position. The measured values can be processed directly in a PLC via the digital inputs /outputs in connection with the scanCONTROL Output Unit. Furthermore, a determination of internal limit value with subsequent output of the evaluation results (good / bad) is possible via the switching outputs. This series with integrated profile evaluation is named scanCONTROL 2710.
3.1.4 Advantages of the Used Sensor Array (Difference to Conventional Line Scanners)
- A global shutter (high speed shutter) for the whole profile enables a high profile accuracy for fast applications.
- The array enables the simultaneous exposure and reading of the previous image. Thus the exposure time is longer at the same profile frequency. With it also dark objects can be measured with a high rate.

3.1.5 Further Features
- The sensors are available in two versions: Connectors on the front or on the rear side.
- External synchronization and triggering.
- Serial interface (RS422) for communication with PLCs or PCs.
- The automatic control of the exposure time enables consistent measurement results with changing surfaces. This function can be switched off on request.
- Ethernet 100/1000 Mbit as fast standard connection to the PC.
### 3.2 Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>LLT27x0-25</th>
<th>LLT27x0-50</th>
<th>LLT27x0-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range z-axis</td>
<td>25 mm</td>
<td>50 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>Start of measuring range</td>
<td>90 mm</td>
<td>175 mm</td>
<td>350 mm</td>
</tr>
<tr>
<td>End of measuring range</td>
<td>115 mm</td>
<td>225 mm</td>
<td>450 mm</td>
</tr>
<tr>
<td>Start of extended measuring range approx.</td>
<td>85 mm</td>
<td>160 mm</td>
<td>300 mm</td>
</tr>
<tr>
<td>End of extended measuring range approx.</td>
<td>125 mm</td>
<td>260 mm</td>
<td>600 mm</td>
</tr>
<tr>
<td>Line length midrange, x-axis</td>
<td>25 mm</td>
<td>50 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>Linearity ¹</td>
<td>± 0.2 % FSO (3σ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution x-axis</td>
<td>640 points/profile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile frequency</td>
<td>2700 / 2710 Hz</td>
<td>100 Hz</td>
<td>4000 Hz</td>
</tr>
<tr>
<td>Light source</td>
<td>Semiconductor laser 660 nm (red)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aperture angle laser line</td>
<td>20°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser power</td>
<td>Standard 10 mW (laser class 2M), reduced 2 - 3 mW</td>
<td></td>
<td>Optional 20 mW (laser class 3B)², reduced 10 mW</td>
</tr>
<tr>
<td>Integrated laser switch-off</td>
<td>Optional</td>
<td></td>
<td>Safety interlock, hardware switch-off</td>
</tr>
<tr>
<td>Cable length</td>
<td>Ethernet: Up to 50 m without restrictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP 64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Functioning Principle, Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>LLT27x0-25</th>
<th>LLT27x0-50</th>
<th>LLT27x0-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>0 °C to +50 °C (+32 °F to +122 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 °C to 70 °C (-4 °F to +158 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>2 g / 20 ... 500 Hz (acc. to DIN EN 60068-2-6, 10 cycles per axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>15 g / 6 ms (acc. to DIN EN 60068-2-29, 1000 cycles each axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output/Input</td>
<td>Ethernet, laser off (optional), 1x RS422 programmable (interface or synchronization or encoder input)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State display</td>
<td>1x laser, 1x power/error/status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>11 ... 30 VDC, 500 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight sensor</td>
<td>appr. 700 g</td>
<td>appr. 800 g</td>
<td>appr. 850 g</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>Only at RS422 and Ethernet, no isolation of 24V-supply, internal circuit If isolation necessary, external 24V-DC-DC-converter required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FSO = Full scale output
1) Based on a MICRO-EPSILON Optronic standard target with metallic finished surfaces.
2) Sensors need an external key switch to switch off the laser to be classified in Laser Class 3B (IIIB), see Chap. 5.2.4.
## 3.4 LED Indicators

<table>
<thead>
<tr>
<th>LED “laser on”</th>
<th>green: laser on</th>
</tr>
</thead>
</table>
| LED “state”: two-color LED (red / green) | green: measurement  
green flashing: data transmission  
red flashing: error code, see Chap. 11. |

**Note:**

The state LED flashes green; long during active data transmission and short for controller accesses.
4. Delivery

4.1 Standard Equipment

- 1 Sensor LLT27x0
- 1 Assembly Instructions
- 1 Sensor inspection log
- 1 Bag of accessories, containing:
  ▪ 1 ODU male cable connector 6-pin (RS422), S31BQC-P06MFG0-6000,
  ▪ 2 Protective caps for ODU socket (6 or 8-pin),
- PC2700-4.5; Power cable 4.5 m long; 2-core, shielded, with mounted ODU round connector and free cable ends
- PC2700(002)-4.5; Power cable 4.5 m long for external laser switching; 6-core, shielded, with mounted ODU round connector and free cable ends for the sensor options 002...005 and 502...505.
- 1 Data carrier (CD-ROM) with scanCONTROL Software CD (only scanCONTROL 2700 and 2750), demonstration programs and documents from MICRO-EPSILON Messtechnik.
- 1 Data carrier (CD-ROM) with scanCONTROL Configuration Tools (only scanCONTROL 2710)

➡️ Check the delivery for completeness and shipping damage immediately after unpacking.
➡️ In case of damage or missing parts, please contact the manufacturer or supplier.

You will find recommended and optional accessories in Appendix, see Chap. A 1.1, see Chap. A 1.2.

4.2 Storage

Storage temperature: -20 to +70 °C (-4 to +158 °F)
Humidity: 5 - 95 % (non-condensing)
5. Mounting

5.1 Attachment and Mounting of the Sensor

The sensor can be mounted in two different ways:
1. with 3 threaded holes M4 on the front side or
2. with 3 threaded holes M4 on the side surfaces.

All threaded holes are 5 mm deep blind holes.

Refer to the dimension drawings for the mounting dimensions.

Pay attention to careful handling during mounting and operation.

> Damage to or destruction of the sensor

Pay attention to the depth of the blind holes during selection of the fixing screws
> Damage to the thread due to screws resting on it.

The laser beam should strike the target surface at right angles. Otherwise, inaccurate measurements cannot be ruled out.

<table>
<thead>
<tr>
<th>Direct fastening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw depth</td>
</tr>
<tr>
<td>min approx. 5.5 mm</td>
</tr>
</tbody>
</table>

Fig. 6 Mounting conditions

The bearing surfaces surrounding the fastening holes (through-holes) are slightly raised.

Mount the sensor only to the existing mounting holes / threaded holes on a flat surface. Clamps of any kind are not permitted. Do not exceed torques.
> Inaccurate, erroneous measuring values
Mounting

Fig. 7 Dimensional drawing LLT27xx-25, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 8 Dimensional drawing LLT27xx-25, connectors on the rear side, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 9 Measuring field assignment LLT27xx-25, dimensions in mm, not to scale
Fig. 10 Dimensional drawing LLT27xx-50, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 11 Dimensional drawing LLT27xx-50, connectors on the rear side, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 12 Measuring field assignment LLT27xx-50, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 13 Dimensional drawing LLT27xx-100, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 14 Dimensional drawing LLT27xx-100, connectors on the rear side, dimensions in mm, not to scale

Every three mounting holes M4x5 on three levels A, B, C
Fig. 15 Measuring field assignment LLT27xx-100, dimensions in mm, not to scale
5.2 Connections

**Fig. 16 Output sockets arrangement**

The sensors are available in two versions: Sockets on the top side or on the rear side.
5.2.1 Power Supply

Connector “24 VDC“, see Fig. 16

Range: 11 ... 30 VDC (rated value 24 VDC); maximum current 500 mA

Cable shield is connected to connector case and should be connected using the protective earth connector PE of the main power supply.

The power cable PC2700-4.5 is recommended.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
<th>Standard Color PC2700; old version in ( )</th>
<th>Options 502, 503, 504, 505 Color PC2700(002)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 V+ white</td>
<td></td>
<td>24 V+ pink</td>
</tr>
<tr>
<td>2</td>
<td>Laser help n.c.</td>
<td></td>
<td>LH+ gray</td>
</tr>
<tr>
<td>3</td>
<td>Laser on/off n.c.</td>
<td></td>
<td>Laser off+ yellow</td>
</tr>
<tr>
<td>4</td>
<td>Laser on/off n.c.</td>
<td></td>
<td>Laser off- green</td>
</tr>
<tr>
<td>5</td>
<td>Laser help n.c.</td>
<td></td>
<td>LH- brown</td>
</tr>
<tr>
<td>6</td>
<td>GND brown (black or blue)</td>
<td></td>
<td>24 V GND white</td>
</tr>
</tbody>
</table>

View on solder pin side, male cable connector, counting direction anticlockwise

Fig. 17 Pin assignment 6-pole power connector, “24 VDC“

External Laser Switching, see Chap. 5.2.4, too.
5.2.2 RS422, Synchronization, Switching Signals

Connector “RS422”, see Fig. 16. The RS422 port can be used with either of the following configurations.
- RS422: Programs can be loaded with a PC and measurement results transmitted via the RS422 interface. However, the lower data rate allows only lower measuring rates than Ethernet connection.
- Synchronization / triggering: The RS422 port is used for synchronization and triggering using switch signals. All switching signals are potential-separated.

<table>
<thead>
<tr>
<th>PIN No.</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rx+</td>
</tr>
<tr>
<td>2</td>
<td>Rx-</td>
</tr>
<tr>
<td>3</td>
<td>GND1</td>
</tr>
<tr>
<td>4</td>
<td>Tx+</td>
</tr>
<tr>
<td>5</td>
<td>Tx-</td>
</tr>
<tr>
<td>6</td>
<td>GND2</td>
</tr>
</tbody>
</table>

View on solder pin side, male cable connector, counting direction anticlockwise

The PIN numbers refer to the scanCONTROL 27x0 unit. Micro-Epsilon recommends the use of the interface cable SC2700-4.5 RS422 from the optional accessories.

Fig. 18 Pin assignment 6-pole RS422 connector

1) Optional RS422 interface cable (SC2700-4.5RS422) from Micro-Epsilon, compatible to the RS422 to USB converter. The pins 4, 6, 7 and 8 are not connected.

All outputs or inputs are designed symmetrically and wired with 120 Ohm internal terminating resistors. The signals must be operated symmetrically.
Fig. 19 RS422 internal circuitry (switching signals)

All switching signals are built in the same way. The programming specifies the assignment as inputs or outputs. The switching circuits used have internal potential isolation.

No potential isolation between 24 V supply ground and internal circuitry, see Fig. 19 (left side). A ground connection (GND1 and GND2) is assigned to each channel. The ground connections are connected with each other and must be connected with the ground connector of a synchronization/trigger source or a serial device.

The channels Ch1 and Ch2 can be used for the following functions:
- Serial interface RS422 in duplex or simplex mode (Rx and Tx).
- Synchronization: Using the synchronization signals, several sensors can be synchronized with each other or individual profiles (scans) can be triggered.
Mounting

- Optional additional functions (trigger, encoder).
- External wiring must be performed according to the RS422 standard. Primarily use RS422 driver circuits or converters. Alternatively use devices with RS422 connectors, e.g. sensors, encoders or SPC's.

Channel settings

<table>
<thead>
<tr>
<th>Interface function (operating mode)</th>
<th>Function Ch1</th>
<th>Function Ch2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial communication (RS422)¹</td>
<td>RX</td>
<td>TX</td>
</tr>
<tr>
<td>External synchronization</td>
<td>Sync In</td>
<td>Sync Out</td>
</tr>
<tr>
<td>Triggering</td>
<td>Trigger IN</td>
<td>Trigger OUT</td>
</tr>
</tbody>
</table>

Synchronizing several sensors with each other:

1. Connect the output Ch2+ (Pin 3) of sensor 1 with the correct polarity to the input Ch1+ (Pin 1) of sensor 2.
2. Connect the output Ch2- (Pin 4) of sensor 1 with the correct polarity to the input Ch1- (Pin 2) of sensor 2.
3. Also connect both the GND1 pins (Pin 5) of the sensors to each other.

The cable connection must preferably be made using a shielded, twisted-wire cable whereby the cable shield is connected to the connector cases. The sensor 1 as master then synchronizes sensor 2.

1) Default settings

- Use a shielded cable; connect the shield to the connector case.
- Use a cable with twisted wires.
- Use the recommended interface cable RS422.
5.2.3 Ethernet Connection

The Ethernet connection is the standard connection to the PC for all current scanCONTROL 27xx models. The sensor supports the transmission at 100 Mbit/s and 1 GBit/s.

We recommend the Ethernet connection cable SC2700-5/ET or another length included in the optional accessory, see Chap. A 1.2, for the Ethernet connection.

For the power supply a corresponding voltage, see Chap. 3.2, has to be connected to the socket 24 VDC.

Due to a high data rate, we recommend using a high-quality Ethernet PC plug-in card, for example Intel-Pro/1000 PT. The sensors are to be preferably connected directly to the network connection or by means of a high-quality switch. As a hub would result in a massive data collision it cannot be used. The PC should have one or more network cards only for the sensors.

The operation of the sensor via Ethernet does not require any driver installation. However, the network settings have to be done correctly:

- If more network cards are used, they have to belong to different networks, for example different Class-C-sub networks, however they may not belong to the same Class-B sub network.
- The sensors are supported by an automatically, sensor-adapted IP address in the link-local-net (169.254.x.x). No collision testing is effected. This is the standard setting, too.
- The sensor supports the DHCP protocol. This setting is activated by default and has priority over the retrieval in the link-local-net.
- A fixed IP address can be given.
- Various network settings can interfere the connection to the sensor (for example Firewall or packet filter).
- We recommend using a packet size of 1024 Bytes/packet (payload) which can be set in the demonstration program or the sensor SDK.
The PIN numbers refer to the scanCONTROL 27x0 unit.

Micro-Epsilon recommends using the ethernet connection cable SC2700-5/ET from the optional accessories, see Chap. A 1.2.

<table>
<thead>
<tr>
<th>RJ45 connector</th>
<th>8-pin. connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN no.</td>
<td>Color stranded hook-up wire</td>
</tr>
<tr>
<td>1</td>
<td>white (orange)</td>
</tr>
<tr>
<td>2</td>
<td>orange</td>
</tr>
<tr>
<td>3</td>
<td>white (green)</td>
</tr>
<tr>
<td>4</td>
<td>blue</td>
</tr>
<tr>
<td>5</td>
<td>white (blue)</td>
</tr>
<tr>
<td>6</td>
<td>green</td>
</tr>
<tr>
<td>7</td>
<td>white (brown)</td>
</tr>
<tr>
<td>8</td>
<td>brown</td>
</tr>
</tbody>
</table>

View: pin side male cable connector

View on solder pin side, ODU
5.2.4 External Laser Switching

Series LLT2700-x(002), LLT2700-x(003), LLT2700-x(004), LLT2700-x(005), LLT2700-x(502), LLT2700-x(503), LLT2700-x(504) and LLT2700-x(505) sensors offer this function.

<table>
<thead>
<tr>
<th>PIN No.</th>
<th>Assignment options 002, 003, 004, 005, 502, 503, 504 and 505 Color PC2700(002)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24V+ pink</td>
</tr>
<tr>
<td>2</td>
<td>LH+ grey</td>
</tr>
<tr>
<td>3</td>
<td>Laser off+ yellow</td>
</tr>
<tr>
<td>4</td>
<td>Laser off- green</td>
</tr>
<tr>
<td>5</td>
<td>LH- brown</td>
</tr>
<tr>
<td>6</td>
<td>24V GND white</td>
</tr>
</tbody>
</table>

![View on solder pin side, male cable connector, counting direction anticlockwise](image)

*Fig. 20 Pin assignment 6-pole power connector, “24 VDC”*

Sensors of laser class 3B (IIIB) need an external key switch to switch off the laser.

Use a serial key switch inside the control circuit to switch off the laser.

![Options to power off the laser](image)

*Fig. 21 Options to power off the laser*
If the voltages between pin 3 and pin 4 are < 0.8 V, the laser is off. The external laser switching is a hardware solution and has the highest priority. The laser can also be disabled by software.

5.3 Installation Instructions

- The operating voltage can be supplied via a separate power source. Power supply via the Ethernet connection (PoE) is not permitted.
- The operating voltage is protected against reverse polarity.
- The operating voltage for the scanCONTROL 27x0 measuring device should come from a 24 V power supply which is only used for measuring equipment and not simultaneously for drives, contactors or similar pulse interference sources.
- Only use shielded cables for all connection cables. Connector and cable must be matched to each other for hermetically sealed versions. Paired data cables with colored cores and copper shielding are recommended for self-made cables.
- Connect the cable shields to the potential equalization on the evaluation unit (switch cabinet, PC case, connector case) and avoid ground loops.
- Lay all connection cables in accordance with the generally applicable measuring technology regulations, i.e. for example not directly next to pulse-carrying lines, preferably in a separate cable duct.
- The minimum bending radii of the recommended cables for flexible laying must not be less, see Fig. 22.
- MICRO-EPSILON recommends the use of the optionally available power supply PS2020, DIN rail mounting, input 230 VAC, output 24 VDC/2.5 A.
### 5.4 Recommended Connector and Cable Types

<table>
<thead>
<tr>
<th>Female connector</th>
<th>Connector characteristics</th>
<th>Connector type ¹ (see standard equipment)</th>
<th>Cable diameter ²</th>
<th>Bending radius (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 VDC</td>
<td>ODU MiniSnap, Series B, size 1, hermetically sealed version (IP 68), 6-pole, coding A (30 °), solderable</td>
<td>S31BAC-P06MFG0-5000 or S31BAC-P06MFG0-6000</td>
<td>4.8 mm or 5.4 mm</td>
<td>35 mm</td>
</tr>
<tr>
<td>RS422</td>
<td>ODU MiniSnap, Series B, size 1, hermetically sealed version (IP 68), 6-pole, coding Q (120 °), solderable</td>
<td>S31BQC-P06MFG0-6000</td>
<td>5.6 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td>Ethernet</td>
<td>ODU MiniSnap, Series B, size 1, hermetically sealed version (IP 68), 8-pole, coding J (90 °), solderable</td>
<td>Connector mounted on the cable SC2700-5/ET</td>
<td>7 mm</td>
<td>84 mm</td>
</tr>
</tbody>
</table>

*Fig. 22 Recommended connector and cable types*


2) Applies for recommended cable, see Chap. A 1.1.

- Using the plug connector characteristics, see *Fig. 22*, other connector types (angled connectors or cable parts) can also be ordered from the manufacturer.

- Use connectors with chucks accordingly to the cable diameter.
5.5 Mounting the Connectors

Mount the cylindrical connectors according to the manufacturer's instructions. Further information you will find in the catalog of the manufacturer (www.odu.de >> “ODU MINI-SNAP“ >> “Download“ >> “MINI-SNAP Series LKB“).

5.6 Getting Ready for Operation, Commissioning

Mount the sensor according to the installation instructions. Connect the sensor to the computer or the controller using the Ethernet cable. Connect the sensor to downstream display or monitoring units and to the power supply if necessary.

The connectors for the operating voltage, switching signals and Ethernet are fitted with push-pull locking. Pull apart at the grip to release the connection. Connect the shield of the power supply cable to the PE protective earth conductor of the main power supply. Close plug-in connections not needed with the supplied protective caps for ODU sockets, see Chap. 4.1.

Switch on the power supply.

The sensor must only be connected to the peripheral equipment when disconnected from the power supply, i.e. only when the operating voltage is switched off.
6. **Operation of the Sensor with a PC**

6.1 **Displays**

After getting ready for operation, switch on the external direct current power supply (24 VDC). The state LED indicates different error conditions by flashing. If several errors occur at the same time, it indicates two of them alternately. Therefore the LED can continue to flash for some time after the rectification of an error. If no flashing occurs for several seconds, no error has occurred.

- The scanCONTROL 27x0 sensor needs a running-in time of typically 20 minutes for high precision measurements.

6.2 **Operating and Demonstration Programs**

A CD-ROM is provided for the operation of the sensor: As well as the installation instructions mentioned above, the CD-ROM also contains various documentation and programs:

- The demonstration program “DeveloperDemo.exe” in the directory [CD]:\Program\Developer Demo is used for scanner parameterization and simple display of profile data. A screenshot of the standalone demonstration program can be seen, see Chap. 6.4.3.
- The directory [CD]:\Development\SDK contains a sensor-specific DLL and descriptions and examples for creating your own user programs with the C++ programming language. It can also be used with C, Delphi or other programming languages. The associated descriptions for the DLL in German and in English can be found in the same directory.
- scanCONTROL Configuration Tools is used to analyze typical measurement tasks for scanCONTROL 27x0.
- scanCONTROL 3D-View visualizes three dimensional point data, which are recorded with scanCONTROL 27x0.

The measuring fields, see Chap. 6.4.1, are partially used in the demonstration programs.
6.3 Installation and Requirements

6.3.1 Requirements
The following minimum system specification is necessary for the operation of the scanCONTROL software packages:
- Windows 7 (32 bit and 64 bit), Windows 8 or 8.1 (32 bit and 64 bit), Windows 10 (32 bit and 64 bit)
- 1-GHz or faster (32 bit and 64 bit) processor / 1 GB RAM
- Screen resolution: 1024x768

6.3.2 Installation
To be able to use the software the following steps must be followed:
1. Install the software according to the instructions on the CD.
2. Connect the scanCONTROL measuring system to the computer via Ethernet.
   In order to connect scanCONTROL via Ethernet to the PC, proceed as follows:
   - Finish the installation of the scanCONTROL software packages completely.
   - Connect scanCONTROL via the Ethernet interface to the PC and switch on the power supply.
   - Please wait until the device is recognized by the PC. This may take a few seconds.

The system is now ready to operate the scanCONTROL measurement system with the scanCONTROL software packages.

- Connect scanCONTROL directly with the PC. Do not use hubs or switches.
6.4 Instructions for Operating

6.4.1 Measuring Field Selection

The optical design of the sensor satisfies the so-called “Scheimpflug condition” which ensures optimum mapping over the complete measuring range. In doing so, the measuring range is mapped on a rectangular matrix. The distortions resulting from this are shown, see Fig. 23. The usable measuring range is always trapezoidal.

The assigned maximum x-values for the z-coordinates can be found, see Fig. 9, see Fig. 12, see Fig. 15. Please refer to the sensor acceptance report of your sensor. A slight range shifting of a measuring field is possible and depends on the sensor.

The top edge corresponds to the start of the measuring range and the bottom edge to the end of the measuring range. The corners of the read image field are on a grid with grid spacing of 1/8 of the matrix. An image field change is only possible in this raster.

The sensor matrix used in the scanCONTROL 27x0 supports the reading of a restricted measuring field. The following picture shows the predefined view areas and the associated measuring fields.
Operation of the Sensor with a PC

Fig. 23 Supported measuring fields
The measuring field can be restricted by omitting complete matrix areas in order to suppress interfering image ranges.

No correlation of the measuring field size to the speed of the reading process can be made.

The following measuring fields are used in the demonstration program, see Chap. 6.2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>0</td>
</tr>
<tr>
<td>Standard</td>
<td>2</td>
</tr>
<tr>
<td>Small</td>
<td>7</td>
</tr>
</tbody>
</table>

*Fig. 24 Measuring fields used*

Measuring field and measuring range must be clearly differentiated in practical use. The measuring field is related to the matrix and the measuring range is related to the measuring object (the object space).

Both do not have to match on account of the optical mapping and the definitions.

- The measuring field “Standard” is larger than the measuring range “Standard”. The minimum dimensions can be found, see Fig. 9, see Fig. 12, see Fig. 15.

The scanCONTROL 27x0 sensors are distinguished by
- a laser line with 20° opening angle.
- the receiver has a smaller opening angle (view angle) than the laser line.
- centered measuring field (symmetrical to the center axis).
- the high resolution sensor image matrix has 640 x 480 pixels. The measuring field geometry is fixed.
- reference for the distance (Z-axis) is the lowest body edge of the sensor, see Fig. 9, see Fig. 12, see Fig. 15.
- Use of the DCAM standard 1.3, however with re dedication of the parameters:
  - camera parameter in triangulation parameters
  - image in profile

Further information for this can be found in the file “OpManPartB.html” on the CD-ROM.
- Standard digital video camera driver according to DCAM 1.30 from different manufacturers can be used.
6.4.2 Calibration

The calibration of the sensor is performed using the complete matrix and is independent from the selected measuring field.

The trapeze form of the measuring field is produced from the projection onto the sensor matrix. The standard measuring range is framed in the center.

A sensor acceptance report is enclosed for each sensor. Three diagrams for the linearity measurement which are briefly explained in the report are included in the sensor acceptance report. The key diagram in the sensor acceptance report is shown again below, see Fig. 25.

![Diagram showing linearity deviation](image)

Fig. 25 Linearity deviation of an LLT2700-25

The black points show the places where the measurement error exceeds the linearity limit of 0.05 mm.

The picture on the top left and bottom right in the acceptance report show sections through the picture, see Fig. 25 (blue lines).
All measuring points in the center of the measuring range (vertical section where x=0) and bottom right of the horizontal section, also in the (vertical) center of the measuring range (midrange) are shown on the top left of the acceptance report.

The measurement error increases at both ends of the depth range and particularly in the remote corners. These areas should therefore be avoided for the measurement.

6.4.3 Automatic Exposure Time Regulation

The automatic exposure time regulation facilitates the recording of the profile with optimum exposure time (shutter time). The available brightness information for each point of the profile is used for this.

The "shutter time" preset by the user is used as the starting value for the automatic exposure time regulation. It should be selected so large that still valid measured values can be output at the darkest place of the profile. One of the supplied demonstration programs can be used for determining this. The automatic exposure time regulation can also be deactivated if required.

If there is no object in the measuring range, the "shutter time" stored in the shutter register of the sensor will be used as exposure time. This value must also guarantee reliable recognition of the darkest measurement object.

A previous test is recommended if the target is very dark or has very high contrast. The various demonstration programs are suitable for adjusting and testing the exposure time. In doing so, it is by all means sensible to work with several different exposure times and to observe the effect in the diagrams.

The current exposure time can be calculated from the timestamps of the measured values. It is displayed as "Shutter time", see Fig. 26.
Operation of the Sensor with a PC

"Shutter time" preset by the user: 0.10 ms
Automatic shutter time is active
Result: Sensor operates with a shutter time of 0.16 ms

Fig. 26 Screenshot of the developer demonstration program with automatic shutter
6.5 Error Influences

6.5.1 Reflection Factor of the Target Surface
The sensor basically evaluates the diffuse portion of the laser line reflections. Any statement about a minimum reflection factor is only possible with reservations. A preliminary examination is necessary for using the sensor on transparent or reflecting objects.

The method of direct reflection on reflecting surfaces as it is successfully applied for the point triangulation cannot be used for the line triangulation on account of the fan-shaped form of the laser line (central projection). Here, the receiving lens would only be able to reach a narrow area near the center. As usually curved surfaces should also be measured for the profile measurement, this range will be further narrowed.

6.5.2 Color Differences
Color differences of measurement objects have effects. However, these color differences are often also combined with different penetration depths of the laser light into the material. Different penetration depths in turn result in apparent changes of the line thickness. Therefore, color changes, combined with penetration depth changes, can result in inaccurate measurements.

As the exposure parameters can only be changed as a whole for one profile, careful matching of the exposure to the target surface is recommended.

6.5.3 Temperature Influences
A running-in time of at least 20 minutes during start-up is required in order to achieve a uniform temperature spread in the sensor.

If measurements with accuracy in the $\mu$m range are made, the effect of temperature fluctuations on the mounting must also be observed by the user.

Due to the damping effect of the thermal capacity of the sensor, fast temperature changes are only measured after a delay.
6.5.4 External Light
An interference filter in the sensor is present for suppression of external light. In general, the shielding of external light directly emitted on the target or reflected in the sensor must be ensured using protective covers or similar.

Pay particular attention to unwanted reflections of the laser line outside the measuring object range (background, object holder or similar) which can be reflected back again into the view area of the receiver.

Matt black surface coatings are recommended for all objects outside the measuring range (object holders, transport apparatus, grippers or similar).

6.5.5 Mechanical Vibrations
If high resolutions in the µm range should be achieved with the sensor, particular attention must be paid to stable or vibration-damped sensor and measuring object mounting.

6.5.6 Surface Roughness
Surface roughness of 5 µm and more results in „surface noises“ due to interference of the laser light.

Direct reflections of the laser light to the receiver can also occur at the finest grooves (e.g. abrasion marks on the surface) particularly if these run in the line direction. This can result in inaccurate measured values. Prevention of this effect might be possible by adjusting several sensor settings e.g. exposure time, filter.
6.5.7 Shadowing Effects
- Receiver: The laser line can disappear completely or partially behind steep edges. The receiver then does not "see" these areas.
- Laser line: The fan-shaped form of the laser line inevitably results in partial shadowing at vertical edges. In order to make these areas visible, only changing the sensor or object position helps.

As a general rule, measuring objects with steep edges cannot be one hundred percent measured using laser triangulation. The missing areas can only be supplemented or interpolated using suitable software.

Fig. 27 Shadowings
6.6 Cleaning

A periodically cleaning of the protective housings is recommended.

Dry cleaning
This requires a suitable optical antistatic brush or blow off the panels with dehumidified, clean and oil free compressed air.

Wet cleaning
Use a clean, soft, lint-free cloth or lens cleaning paper and pure alcohol (isopropanol) for cleaning the protective housing.
Do not use commercial glass cleaner or other cleansing agents.
7. **scanCONTROL Output Unit**

The measurement system scanCONTROL 2710 measures and evaluates profile data of a measurement target and supplies analog and digital control signals. scanCONTROL Output Unit
- outputs digital and analog signals,
- is based on the WAGO®-I/O-System 750
- uses Ethernet.

Setup and operation of scanCONTROL Output Unit are exemplarily described below.

7.1 **scanCONTROL Output Unit - Components**
- Output Unit Basic consisting of
  - Ethernet Fieldbus Coupler with System Supply (OU-Fieldbus Coupler/Ethernet)
  - 24 VDC Power Supply Filter (OU-Filter module) and End Module (OU-Bus-termination module)
- Digital output module
- Analog output module

![Diagram of scanCONTROL Output Unit](image)

*Fig. 28 Example configuration Ethernet with an analog output module and a digital output module*
The components of a scanCONTROL Output Unit have to be mounted on a top hat rail (TS35) in the described order. Without using a top hat rail a robust installation cannot be guaranteed. Ensure that each module is locked securely on the top hat rail. The bus has to be terminated with the bus termination, see Fig. 28. Each module of scanCONTROL Output Unit is described, see Chap. 7.4. Further informations can be found in the data sheet and manual of the respective module in the supplied scanCONTROL Software CD.

7.2 Connect the Supply Voltage

Fig. 29 Separated power units for system and field supply (Ethernet)
After mounting of the modules, the required wiring has to be installed:

- Connect the “System supply (out)” terminals of the OU-Filter module to the “System supply (in)” terminals of the OU-Fieldbus Coupler (0 V and 24 V, see Fig. 29).
- Connect the system supply (in) of the OU-Filter module to the power supply (0 V and 24 V, see Fig. 29).
- Connect the field supply (in) of the OU-Filter module to the power supply (0 V and 5 V/24 V, see Fig. 29).

The system supply and field supply should be separated to ensure the bus operation and electrical isolation in case of a short-circuit of an actor.

7.3 Commissioning scanCONTROL Output Unit

After having installed the required wiring of the modules of scanCONTROL Output Unit, you have to parameterize the measurement system according to your measurement task to get the desired signals at the digital and analog output ports.

- Connect the sensor to the PC using the supplied Ethernet cable.

Alternatively, scanCONTROL Output Unit can be connected simultaneously to the PC and to the sensor.

- Parameterize the measurement system using scanCONTROL Configuration Tools and assign the desired signals to the digital and analog output ports.

When the parameterization is finished, save the settings to a user mode of the sensor.

scanCONTROL Configuration Tools > Menu > Parameters > Save parameters to scanCONTROL..

Refer to scanCONTROL Configuration Tools manual, Chapter 3.14.4.

- Exit scanCONTROL Configuration Tools and disconnect scanCONTROL 2710, PC and if necessary scanCONTROL Output Unit.

- Connect the scanCONTROL 2710 to the Output Unit using the supplied Ethernet cable.

The sensor and the output unit operate now as an independent measurement system and the digital and analog signals are output via the assigned ports.
7.4 Specification of the Components

7.4.1 Output Unit Basic (Ethernet)

Micro-Epsilon order No. 6414073

Consists of
- OU-Fieldbus Coupler/Ethernet
- OU Filter module
- OU-Bus termination module

- Interfaces: 2x Ethernet to connect scanCONTROL 2710 sensors.
- Indicators (state LED’s, for detailed description refer to the manual of the Ethernet Fieldbus Coupler)
- The System Supply is already mounted to the Ethernet Fieldbus Coupler.

Fig. 30 OU-Fieldbus Coupler/Ethernet with power supply module
<table>
<thead>
<tr>
<th>System data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. number of bus sharing unit</td>
<td>Limited by Ethernet specification</td>
</tr>
<tr>
<td>Max. length of fieldbus segment</td>
<td>100 m</td>
</tr>
<tr>
<td>Baud rate</td>
<td>10/100 Mbit/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of I/O modules</td>
<td>64</td>
</tr>
<tr>
<td>with bus extension</td>
<td>250</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>DC 24 V (-25 % ... +30 %)</td>
</tr>
<tr>
<td>Max. input current</td>
<td>280 mA at 24 V</td>
</tr>
<tr>
<td>Internal current consumption</td>
<td>450 mA at 5 V</td>
</tr>
<tr>
<td>Total current for I/O modules</td>
<td>700 mA at 5 V</td>
</tr>
<tr>
<td>Voltage drop at I&lt;sub&gt;max&lt;/sub&gt;</td>
<td>&lt; 1 V at 64 I/O modules</td>
</tr>
</tbody>
</table>

*Fig. 31 Technical data Fieldbus Coupler/Ethernet*

**7.4.2 Supported Modules**

- 8-Channel digital output module; DC 24 V; 0.5 A; high-side switching; 8 actors; short-circuit-proofed; Micro-Epsilon order no. 0325115, see Chap. 7.4.3; power supply through power jumper contacts
- 8-Channel digital output module; DC 24 V; 0.5 A; low-side switching; 8 actors; short-circuit-proofed; Micro-Epsilon order no. 0325131; power supply through power jumper contacts
- 4-Channel analog output module; 0 - 10 V; Micro-Epsilon order no. 0325135, see Chap. 7.4.4
- 4-Channel analog output module; ±10 V; Micro-Epsilon order no. 0325116
- 4-Channel analog output module; 0 – 20 mA; Micro-Epsilon order no. 0325132
- 4-Channel analog output module; 4 – 20 mA; Micro-Epsilon order no. 0325133
7.4.3 OU-DigitalOut/8-Channel/DC24 V/0.5 A/High-side Switching/8 Actuators

- Micro-Epsilon order No. 0325115
- The 8-channel digital output module DC 24 V 0.5 A is short-circuit-proofed, high-side switching, for TS35, CAGE CLAMP®-Connection (8 actuators)
- The field level is galvanically isolated to the system level
- The indicators (state LED’s) additionally show the status of the digital output ports (IO/NIO), for detailed description refer to the manual of the 8-channel digital output module DC 24 V 0.5 A, 8 actuators, high-side switching
- For each digital port actuators can be directly wired via DO 1/2/3/4/5/6/7/8.
- scanCONTROL 2710 supports eight digital outputs

Fig. 32 8-Channel digital out module

| Number of outputs | 8 |
| Current consumption (internal) | 25 mA |
| Voltage via power jumper contacts | DC 24 V (-25 % / + 30 %) |
| Type of load | resistive, inductive, lamps |
| Switching rate \( \text{max.} \) | 2 kHz |
| Output current | 0.5 A short-circuit-proofed |
| Energy dissipation \( W_{\text{max.}} \) (unique switching off) | 0.9 J |
| \( L_{\text{max.}} = 2 W_{\text{max.}} / I^2 \) |
| Current consumption typ. (field side) | 15 mA (per module) + load |

Fig. 33 Technical data of the digital output module
7.4.4 OU-AnalogOut/4-Channel/0-10 V

- Micro-Epsilon order No. 0325135
- 4-channel analog output module DC 0-10 V
- Indicators (state LED’s, for detailed description refer to the manual of the 4-channel Analog Output Module DC 0-10 V)
- The voltage range of the module is restricted to 0-10 V and can not be extended by changing the appropriate setting in scanCONTROL Configuration Tools.
- The output signal is output galvanically isolated to the system level.
- The resolution of this module is limited to 12 bit.
- scanCONTROL 2710 supports four analog outputs

![Image of 2-channel analog output module](image)

Fig. 34 2-channel analog out module

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of outputs</td>
<td>4</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>via system voltage DC/DC</td>
</tr>
<tr>
<td>Signal voltage</td>
<td>0 ... 10 V</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&gt; 5 kΩ</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 Bit</td>
</tr>
<tr>
<td>Conversion time</td>
<td>typ. 10 ms</td>
</tr>
<tr>
<td>Output filter settle time</td>
<td>typ. 100 µs</td>
</tr>
<tr>
<td>Measurement error at 25 °C</td>
<td>&lt; ± 0.1 % of full scale output</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>&lt; ± 0.01 %/°K of the full scale value</td>
</tr>
</tbody>
</table>

Fig. 35 Technical data of the analog output module
8. **Warranty**

All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON. The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON.

This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties. No other claims, except as warranted, are accepted. The terms of the purchasing contract apply in full.

MICRO-EPSILON will specifically not be responsible for eventual consequential damages.

MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.
9. **Service, Repair**

In the case of a defect on the scanCONTROL 27x0:
- If possible, save the current sensor settings in a parameter set, see Configuration Tools, menu / parameters / Save parameters to scanCONTROL, in order to load the settings back again into the sensor after the repair.
- Please send us the effected parts for repair or exchange.

In the case of faults the cause of which is not clearly identifiable, the whole measuring system must be sent back to:

**MICRO-EPSILON Optronic GmbH**
Lessingstraße 14
01465 Dresden - Langebrück / Germany
Tel. +49 (0) 35201 / 729-0
Fax +49 (0) 35201 / 729-90
mail to: optronic@micro-epsilon.de
http://www.micro-epsilon.com

10. **Decommissioning, Disposal**

- Disconnect all cables between the sensor and the following control or evaluation units.

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.
## 11. Error Codes

— LED „error“ lights for long time, • LED „error“ lights briefly

<table>
<thead>
<tr>
<th>Flasing sequence</th>
<th>Cause</th>
<th>Remedy</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group: Loading / saving configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>..-</td>
<td>Mode not found</td>
<td>Select different one</td>
<td>only previously stored modes can be called up</td>
</tr>
<tr>
<td>2x short</td>
<td>Write error flash</td>
<td>Contact manufacturer, return sensor</td>
<td>should not occur in normal operation</td>
</tr>
<tr>
<td>..-</td>
<td>Flash full</td>
<td>none, contact manufacturer</td>
<td>should not occur in normal operation</td>
</tr>
<tr>
<td>3x short</td>
<td>Loading suppressed due to active data transmission</td>
<td>Stop active data transmission</td>
<td>prevents PC software crashes; however, mode number will continue to be counted</td>
</tr>
<tr>
<td>....-</td>
<td>Data overflow in the sensor</td>
<td>Select smaller measuring field, reduce profile frequency, select less complex measuring program</td>
<td>Data can be impaired; exposure time can be longer than expected</td>
</tr>
<tr>
<td>4x short</td>
<td>Data overflow during receipt of the data from the sensor</td>
<td>Select smaller measuring field, reduce profile frequency, select less complex measuring program</td>
<td>Data can be impaired</td>
</tr>
<tr>
<td>Group: Data processing and transmission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--.</td>
<td>Data overflow for serial port RS422</td>
<td>Reduce profile frequency, select less complex measuring program</td>
<td>Data can be impaired</td>
</tr>
</tbody>
</table>
## Error Codes

<table>
<thead>
<tr>
<th>Flashing sequence</th>
<th>Cause</th>
<th>Remedy</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group: Data processing and transmission</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--- 2x long, 3x short</td>
<td>Data overflow during transmission of the data</td>
<td>Reduce profile frequency</td>
<td>Data can be impaired</td>
</tr>
<tr>
<td>--- 2x long, 5x short</td>
<td>Error during calculation</td>
<td>Reduce profile frequency, select faster calculation mode</td>
<td>Data can be impaired</td>
</tr>
<tr>
<td>--- 2x long, 6x short</td>
<td>Error during transmission</td>
<td>Reduce profile frequency</td>
<td>Data can be impaired</td>
</tr>
</tbody>
</table>

| **Group: Output Unit** | | | |
| --- 3x long | scanCONTROL Output Unit not found | Connect the sensor with the scanCONTROL Output Unit | --- |
| --- 3x long, 1x short | Connected modules of scanCONTROL Output Unit are not supported | Use the supported modules only, see Chap. 7.4.2 | --- |
| --- 3x long, 2x short | Communication error (scanCONTROL Output Unit) | Reduce profile frequency | --- |
| --- 3x long, 3x short | Output overflow (scanCONTROL Output Unit) | Reduce profile frequency | --- |

| **Group: Ethernet interface** | | | |
| --- 4x long | IP address conflict | Check the Ethernet configuration of device and the host PC Choose another IP address for the device | If the problem persists, please contact the manufacturer |

The state LED flashes green; long during active data transmission and short for controller accesses. A controller access can cause various data overflows particularly if the measuring frequency is near its maximum.
### Appendix

#### A 1 Accessories

#### A 1.1 Recommended Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS2020</td>
<td>Power supply PS2020, power supply for DIN rail mounting, input 230 VAC, output 24 VDC/2.5 A</td>
</tr>
<tr>
<td>SC2700-X/ET</td>
<td>Ethernet connection cable $X$ m; optional lengths: $X = 2$ m, 5 m, 10 m, 15 m, 20 m. With mounted ODU round connector and 8-pin Ethernet cable connector RJ45. Version compatible for cable carriers also available.</td>
</tr>
</tbody>
</table>
## A 1.2 Optional Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC2700-4.5</td>
<td>Power supply cable, 4.5 m long</td>
</tr>
<tr>
<td>SC2700-4.5/RS422</td>
<td>RS422 interface cable, 4.5 m long; with mounted ODU round connector and 9-pin D-SUB cable socket, fits converter from RS422 to USB from MICRO-EPSILON.</td>
</tr>
<tr>
<td>SC2700-0.5/SYNC</td>
<td>Synchronisation cable for two scanCONTROL 2700 sensors</td>
</tr>
<tr>
<td>Connector/8-pin/LLT2700/Ethernet</td>
<td>Connector for Ethernet socket for scanCONTROL series 27xx</td>
</tr>
<tr>
<td>Connector/6-pin/LLT2700/power supply</td>
<td>Connector for power supply socket for scanCONTROL series 27xx</td>
</tr>
<tr>
<td>Connector/6-pin/LLT2700/RS422</td>
<td>Connector for RS422 socket for scanCONTROL series 27xx</td>
</tr>
<tr>
<td>PS2700</td>
<td>Power supply unit for scanCONTROL 2700</td>
</tr>
<tr>
<td>Suitcase scanCONTROL 26/27/29 MR 10-100</td>
<td>Transport suitcase for scanCONTROL sensors, inclusive measuring stand</td>
</tr>
<tr>
<td>PS-LLT2700-25</td>
<td>Key of replacement kit for loosening the locking rings</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>PS-LLT2700-50</td>
<td></td>
</tr>
<tr>
<td>PS-LLT2700-100</td>
<td></td>
</tr>
<tr>
<td>PS-LLT2700-25/AIR</td>
<td>Key of replacement kit for loosening the locking rings</td>
</tr>
<tr>
<td>PS-LLT2700-50/AIR</td>
<td></td>
</tr>
<tr>
<td>PS-LLT2700-100/AIR</td>
<td></td>
</tr>
</tbody>
</table>