



## Operating Instructions **scanCONTROL 25xx**

Laser scanner

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## 1. Safety

Sensor operation assumes knowledge of the operating instructions.

### 1.1 Symbols

The following symbols are used in these operating instructions.



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



Indicates a situation that may result in property damage if not avoided.



Indicates a user action.



Indicates a tip for users.

Measure

Indicates hardware or a software button/menu.

### 1.2 Warnings

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.

Caution - use of controls or adjustments or performance of procedures other than those specified may cause harm.



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**

Avoid shocks and impacts to the sensor.

> Damage to or destruction of the sensor

The supply voltage must 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. Immediately wipe off any fingerprints, see Chap. 6.6.

Protect the cable against damage.

> Failure of the measuring device

Do not plug or unplug devices during the operation.

### **1.3 Notes on CE Marking**

The following apply to the scanCONTROL 25xx 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 EU directives cited and the European harmonized standards (EN) listed therein. The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, article 10, at:

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The sensor is designed for use in industry and satisfies the requirements.



## 1.4 Intended Use

- The scanCONTROL 25xx 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 sensor must only be operated within the limits specified in the technical data, see Chap. 3.2.
- The sensor 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 for sensors: IP 65 (applies only when connected output connectors or protective caps)
- Operating temperature: 0 ... +45 °C (+32 ... +113 °F) (with free air circulation)
- Ambient pressure: Atmospheric pressure
- Storage temperature: -20 ... +70 °C (-4 ... +158 °F)
- Humidity: 5 - 95 % (non condensing)

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 shielded 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 25xx sensors operate with a semiconductor laser having a wavelength of 658 nm (visible/red). The laser operation is indicated visually by the LED on the sensor.

When operating the scanCONTROL 25xx sensors, the relevant regulations according to IEC 60825, Part 1 of 05/2014 and the applicable accident prevention regulations must be followed.

The housings of the scanCONTROL 25xx optical sensors must only be opened by authorized persons, see Chap. 9. For repair and service, the sensors should always be returned to the manufacturer.

scanCONTROL 25xx sensors with a maximum laser power up to 8 mW 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):



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

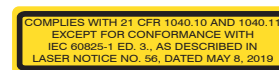
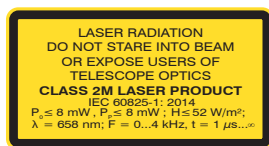
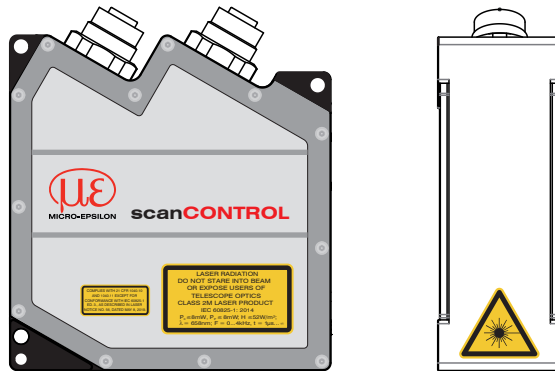


Fig. 1 IEC label scanCONTROL 25xx-25, 25xx-50, 25xx-100

Fig. 2 Only for USA

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.

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



*Fig. 3 True reproduction of the sensor with its actual location of the warning label*

Lasers of Class 2M are not subject to notification and a laser protection officer is not required. Mark the laser area recognizable and everlasting.

### 3. Functional Principle, Technical Data

#### 3.1 Short Description

##### 3.1.1 Measuring Principle

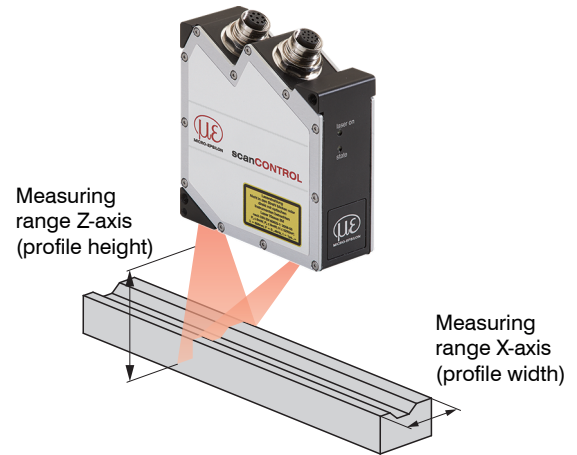
The scanCONTROL 25xx sensor operates according to the principle of optical triangulation (light intersection method):

- 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 25xx sensor is a compact sensor with an integrated controller. All necessary integral parts are combined in one housing.



### **3.1.3 Special Performance Features**

- scanCONTROL 25xx stands out due to its compact design. 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).
- The scanCONTROL 2510 series with integrated profile analysis 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.

Besides measurement value output via Ethernet (Modbus TCP protocol, UDP protocol) and RS422 (Modbus RTU protocol or ASCII format), additional switching signals (results of the determination of limit values) and analog measurement values can be output. This is done by an optional scanCONTROL Output Unit, which transforms the determined measurement signals in switching and analog signals for further processing in a PLC.

- scanCONTROL Gateway allows for scanCONTROL SMART sensors to be integrated into various fieldbus systems (Profinet, Ethernet, EtherCat).

### **3.1.4 Advantages**

- External synchronization and triggering
- Serial interface (RS422) for communication with PLC or PC
- Digital switching inputs, selectable TTL or HTL
- 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 PC

### 3.2 Technical Data

<b>Model</b>	<b>scanCONTROL</b>	<b>25xx-25</b>	<b>25xx-50</b>	<b>25xx-100</b>
Measuring range Z-axis		25 mm	50 mm	100 mm
Start of measuring range		53.5 mm	70 mm	190 mm
End of measuring range		78.5 mm	120 mm	290 mm
Start of measuring range, extended, approx.		53 mm	65 mm	125 mm
End of measuring range, extended, approx.		79 mm	125 mm	390 mm
Line length midrange (X-axis)		25 mm	50 mm	100 mm
Linearity <sup>1</sup>		$\pm 0.10\%$ FSO (2 $\sigma$ )		
Reference resolution <sup>2 3</sup>		2 $\mu\text{m}$	4 $\mu\text{m}$	12 $\mu\text{m}$
Resolution X-axis		640 points/profile		
Profile frequency (depending on the sensor type)		300 Hz		
Light source laser		Semiconductor laser, approx. 658 nm (red)		
Laser power		$\leq 8\text{ mW}$ (laser class 2M), reduced 2 mW		
Protection class (DIN EN 60529 )		IP 65		
Temperature range	operation	0 ... +45 °C (+32 ... +113 °F)		
	storage	-20 ... +70 °C (-4 ... +158 °F)		
Outputs/inputs		Ethernet, Laser on/off (optional), 1 x RS422 programmable (half-duplex) 3 switching inputs programmable HTL/TTL, all inputs and outputs galvanically isolated		

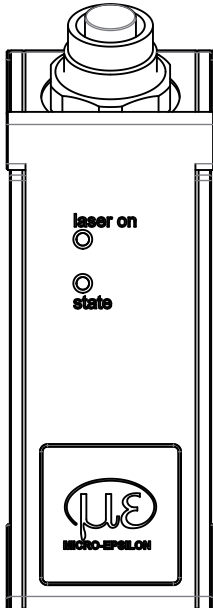
Model		scanCONTROL	25xx-25	25xx-50	25xx-100
Interfaces		Ethernet GigE Vision	Output of measurement values Sensor control, profile data transmission		
	Multi function port	Digital inputs	Mode switching Encoder, Trigger		
		RS422 (half duplex)	Output of measurement values, sensor control Trigger, synchronization		
Output of measurement values			Ethernet (UDP) / Modbus (TCP); RS422 (ASCII / Modbus RTU) <sup>4</sup> Analog <sup>5</sup> ; switching signal <sup>5</sup> PROFINET <sup>6</sup> , ETHERCAT <sup>6</sup> , ETHERNET/IP <sup>6</sup>		
Displays (LED)			1x state (error) / 1x laser on		
Supply			11 ... 30 VDC, 500 mA IEEE 802.3af Power over Ethernet, class 2		
Dimensions			96 x 85 x 33 mm		
Sensor weight (without cable)			380		

FSO = Full Scale Output | MMR = Mid of measuring range

- 1) Based on a MICRO-EPSILON Optronic standard target with metallic finished surfaces
- 2) Measuring object: Micro-Epsilon standard object (metallic, diffusely reflecting material)
- 3) According to a one-time averaging across the measuring field (640 points)
- 4) RS422 interface, programmable as serial interface or input for triggering / synchronisation
- 5) Only with Output Unit
- 6) Only with scanCONTROL Gateway

3.3 LED Displays

LED laser on	Meaning
Green	Laser on
LED state	Meaning
Green	Measurement is active
Green, flashes long	Controller accesses
Green, flashes short	Data transmission is active
Red, flashes	Error code, see Chap. 12.





## **4. Delivery**

### **4.1 Unpacking**

- 1 Sensor scanCONTROL 25xx
- 1 Assembly instructions
- 1 Calibration final inspection
- 2 Protective caps
- 1 PCR3000-5 Multifunction cable; 5 m long; for power supply, trigger and RS422; M12x1 screw connector and free cable ends

➡ Check the delivery for completeness and shipping damage immediately after unpacking.

➡ If there is damage or parts are missing, immediately contact the manufacturer or supplier.

You will find recommended and optional accessories in appendix, see Chap. [A 1.1](#), see Chap. [A 1.2](#).

### **4.2 Storage**

Storage temperature: -20 ... +70 °C (-4 ... +158 °F)

Humidity: 5 - 95 % (non condensing)

## 5. Mounting and Installation

### 5.1 Attachment and Mounting

- using 2 or 3 screws M5, screwed directly
- using 2 or 3 screws M4, screwed pushed through

Depending on the installation position it is recommended to determine the position of the sensor for example by adjusting screws on the specially marked attachment points.

The pin hole  $\varnothing 3H11$  is provided for a position locking pin. The sensor can be mounted reproducibly and replaceable together with an attachment point, see [Fig. 5](#).


 The mounting dimensions refer to the dimensional drawings.

#### NOTICE

Pay attention to careful handling during mounting and operation.

> Damage to or destruction of the sensor

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

 Mount the sensor by means of screws type M5 or by means of through bores for M4 with the screws from the accessories.

Bolt connection			
Through length	Screw	Washer	Torque
33 mm	M4 x ISO 4762-A2	A 4,3 ISO 7089-A2	2 Nm ( $\mu = 0,12$ )

Direct fastening		
Screw depth	Screw	Torque
min 8 mm, max 10 mm	M5 x ISO 4762-A2	3,5 Nm ( $\mu = 0,12$ )

*Fig. 4 Mounting conditions*

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

Mount the sensor only to the existing holes on a flat surface. Clamps of any kind are not permitted. Do not exceed torques.

> Inaccurate, erroneous measuring values

#### NOTICE

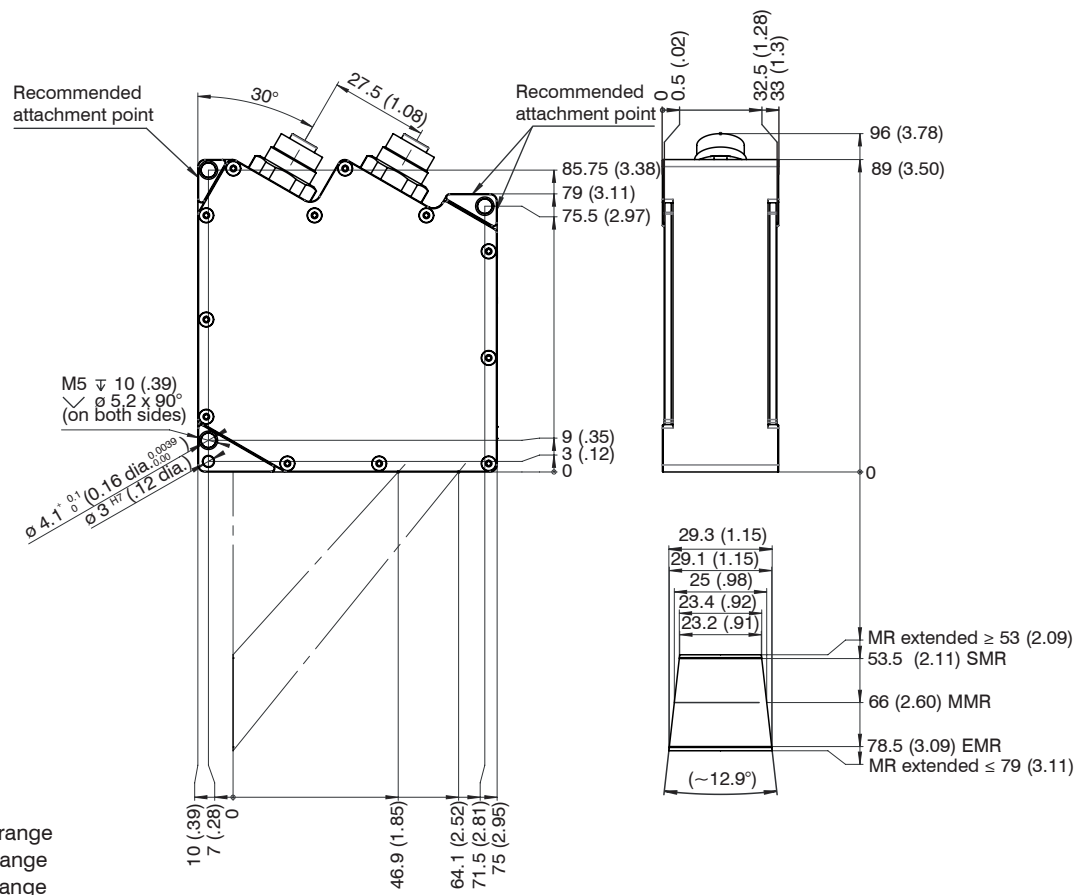
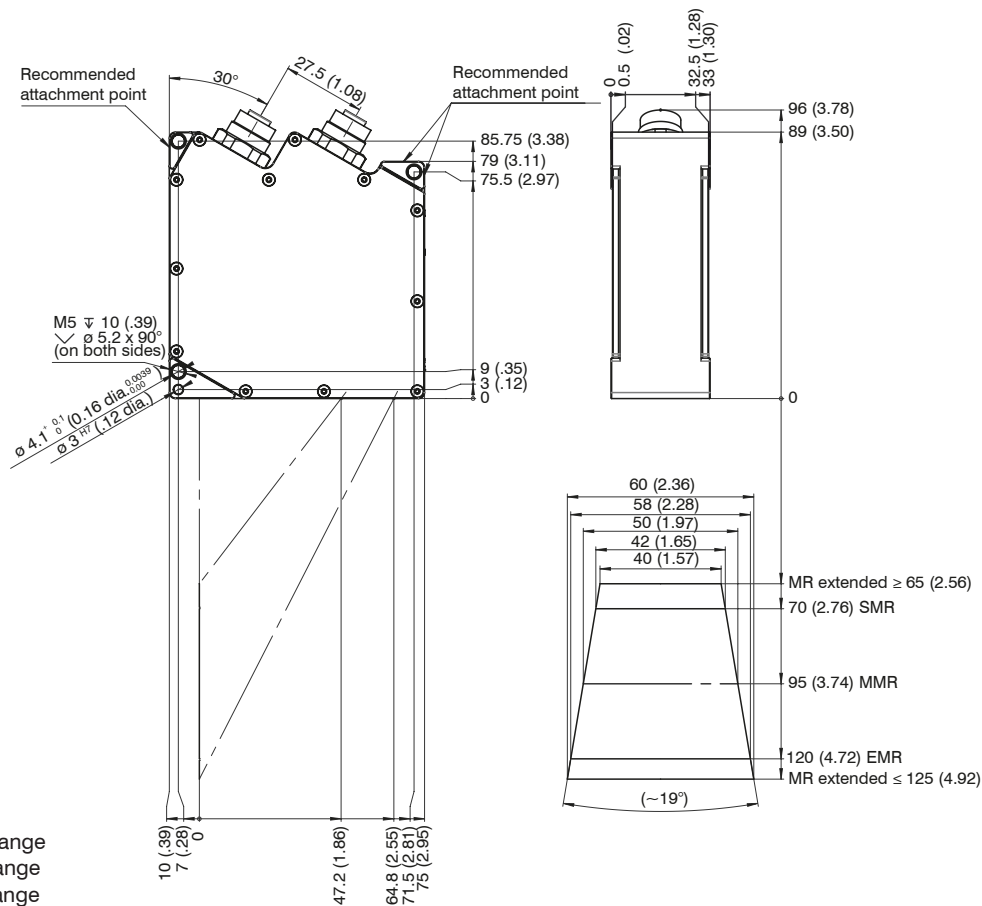


Fig. 5 Dimensional drawing sensor scanCONTROL 25xx-25, dimensions in mm (inches), not to scale



MR = Measuring range  
 SMR = Start of measuring range  
 MMR = Mid of measuring range  
 EMR = End of measuring range

Fig. 6 Dimensional drawing sensor scanCONTROL 25xx-50, dimensions in mm (inches), not to scale

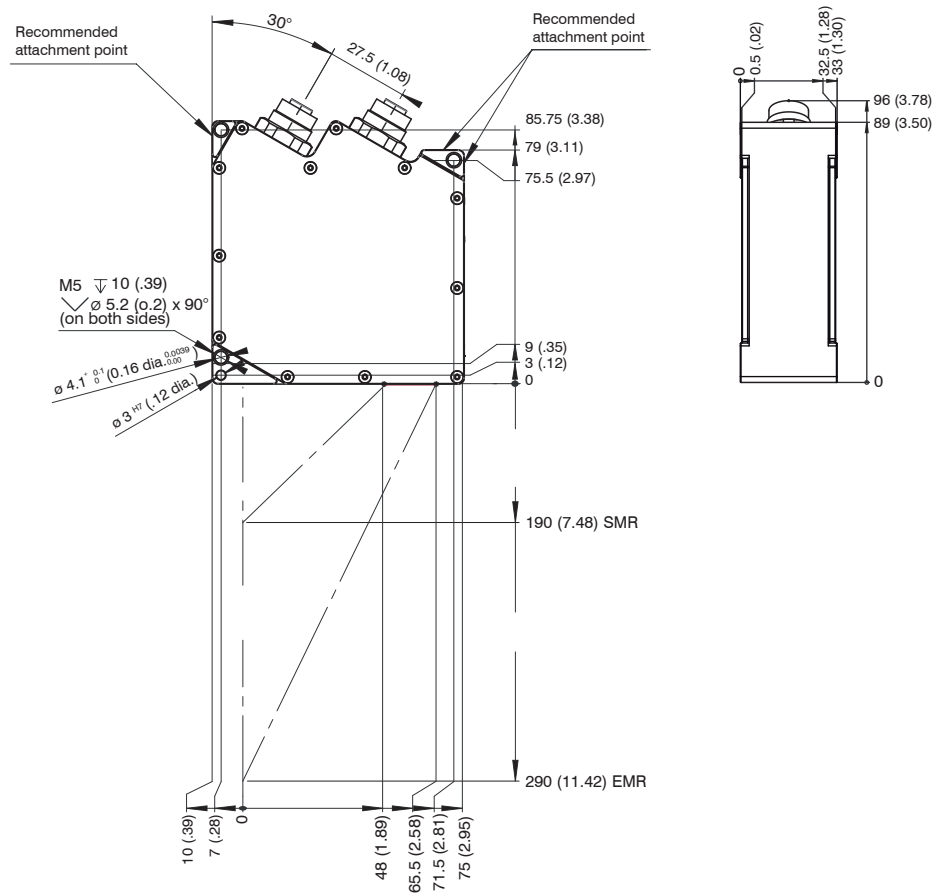
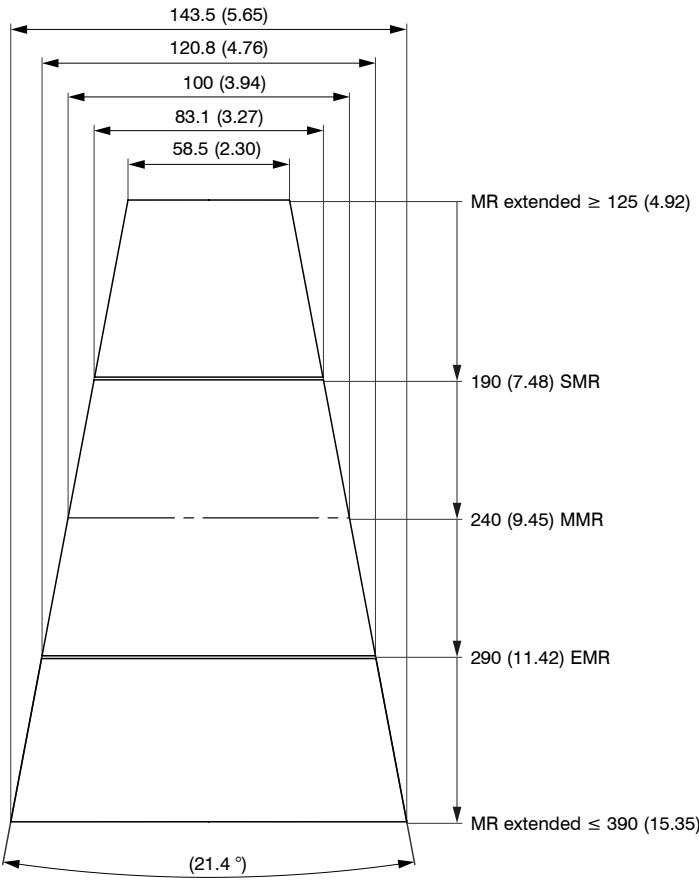


Fig. 7 Dimensional drawing sensor scanCONTROL 25xx-100, dimensions in mm (inches), not to scale

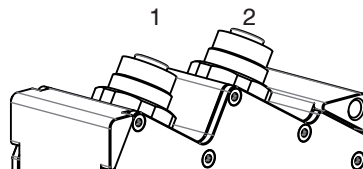


MR = Measuring range  
SMR = Start of measuring range  
MMR = Mid of measuring range  
EMR = End of measuring range

Fig. 8 Measuring field sensor scanCONTROL 25xx-100, dimensions in mm (inches), not to scale

## 5.2 Connections

### 5.2.1 General



1 Ethernet socket

2 Multifunction socket (Power supply, IO)

Fig. 9 Output sockets arrangement

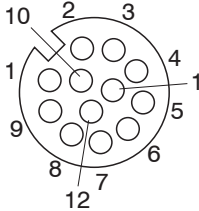
Designation	Sensor connector Pin	Cable color PCR3000-x	Notes	Connection view
+Ub	9	red	+ 11 V ... 30 V DC (rated value 24 V); max. 500 mA	
GND	2	blue	0 V	
+Laser on/off	3	white	optional	
-Laser on/off	1	brown		
RS422	12	red-blue	RS422 input or output	
/RS422	11	gray-pink		
In1	6	yellow	Switching input In1	
GND-In1	4	green	Ground connection In1	
In2	5	pink	Switching input In2	
GND-In2	8	gray	Ground connection In2	
In3	10	purple	Switching input In3	
GND-In3	7	black	Ground connection In3	
Screen	Housing	black	Not electrically connected to GND	

Fig. 11 Assignment of the multifunction socket on scanCONTROL 25xx

GND: Galvanically isolated from IN1, 2, 3, RS422, Laser on/off

Laser on/off: Input galvanically isolated from GND, IN1...3, RS422

IN1, IN2, IN3, RS422: Inputs galvanically isolated from GND and Laser on/off

### **NOTICE**

Connect the multifunction socket only when switched off the power supply is switched off.

- > Damage to or destruction of the sensor

#### **5.2.2 Power Supply**

Connector multifunction socket, see [Fig. 9](#), pin assignment, see [Fig. 11](#).

Range: 11 V – 30 V (rated value 24 V) DC; load maximal 500 mA

The operating voltage is protected against reverse polarity.

The cable shield is connected with the connector housing and should be connected to the protective conductor PE of the power supply.

The shielded multifunction cable PCR3000-x is recommended.

The operating voltage for the scanCONTROL 25xx 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. Use a power supply with galvanic isolation.



**NOTICE**

scanCONTROL 25xx supports Power over Ethernet. If the sensor is connected to a network adapter/switch that is capable of POE and if you also use the power supply of the multifunction port, these two power supplies have to be galvanically isolated.

**5.2.3 RS422, Synchronization**

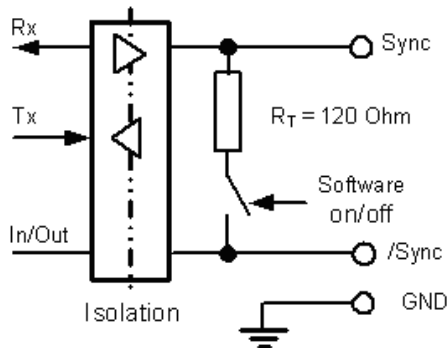
Connector multifunction socket, see [Fig. 9](#), pin assignment, see [Fig. 11](#).

The scanCONTROL 25xx sensor has a RS422 port according to EIA standards, which can be parameterized as input or output via software.

The RS422 port can be used to synchronize multiple sensors with each other, triggering or measured value output (for example Modbus).

The internal terminating resistor (termination  $R_T = 120 \text{ Ohm}$ , see [Fig. 12](#)) can be activated or switched off via software. The signals must be operated symmetrically according to the RS422 standard. Primarily use RS422 driver circuits or converters. Alternatively use devices with RS422 connectors, e.g. sensors or PLC's.

The RS422 port is galvanically isolated from GND and Laser on/off, but not from GND-In1 ... 3. When used one of the GND-In1 ... 3 should be connected to the GND of the remote station in order to avoid potential differences.



*Fig. 12 RS422 synchronization internal circuitry*

The multifunction socket can be used with either of the following configurations:

	Configuration	Direction	Standard setting for terminating resistor $R_T$
0	Half-duplex, serial communication with 115200 Baud	input/output	On
1	Half-duplex, serial communication with 57600 Baud	input/output	
2	Half-duplex, serial communication with 38400 Baud	input/output	
3	Half-duplex, serial communication with 19200 Baud	input/output	
4	Half-duplex, serial communication with 9600 Baud	input/output	
5	External trigger input	input	On
6	External trigger output	output	Off
7	CMM trigger output	output	Off

Synchronizing several sensors with each other:

- ➡ Connect the output RS422+ (Pin 12) of sensor 1 with the input RS422+ (Pin 12) of sensor 2.
- ➡ Connect the output RS422- (Pin 11) of sensor 1 with the input RS422- (Pin 11) of sensor 2.
- ➡ Also connect both the GND-In1 - pins (Pin 4) of the sensors to each other.

Software settings:

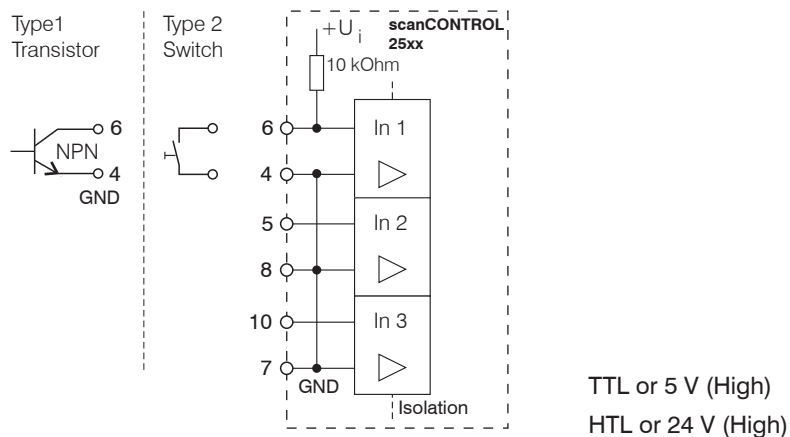
Setting	Sensor 1	Sensor 2	Sensor 3
RS422 mode	External trigger output	External trigger input	External trigger input
No RS422 termination	No (terminating resistor not active)	Yes (terminating resistor not active)	No (terminating resistor active)

*Fig. 13 External synchronization settings*

The sensor 1 then synchronizes the sensor 2 and further sensors as master.

### 5.2.4 Switching Inputs

Connector multifunction socket, see [Fig. 9](#), pin assignment, see [Fig. 11](#).



*Fig. 14 Switching Inputs*

The switching inputs In1 up to In3 can be used for triggering or for connecting an encoder. All switching inputs are identical. The used circuits have an internal electrical isolation. The inputs are galvanically isolated from the GND and Laser on/off.

Each switching input has its own ground connection (Gnd-In1 to 3), which has to be connected with the external ground (synchronization/trigger source or another device).

The multifunction socket can be used with either of the following configurations:


	Configuration	In1	In2	In3
0	Encoder with index, positive edge works with the index <sup>1</sup>	N	A	B
1	Encoder without index, additionally external trigger possible <sup>1</sup>	Trigger	A	B
2	External trigger	Trigger		
3	External trigger, load up to 4 user modes	Trigger	Mode Bit 0	Mode Bit 1
4	Load up to 8 user modes	Mode Bit 0	Mode Bit 1	Mode Bit 2
5	Transmit in time stamp, (only LLT2510)	Bit 0, ppc 0	Bit 1, ppc 1	Bit 2, ppc 2
6	Frametrigger and encoder	Start container	A	B
7	Frametrigger and encoderline A	Start container	A	

Signal level (switching level):

The signal levels are switchable for all switching inputs together via software between LLL (low-voltage-, TTL logic) and HLL (high-voltage-, HTL logic):

- LLL level: Low 0 V... 0.8 V, High 2.4 V... 5 V, internal pull-up 10 kOhm to 5 V
- HLL level: Low 0 V... 3 V, High 11 V... 24 V (permitted up to 30 V), internal pull-up 10 kOhm to 24 V
- Pulse duration:  $\geq 5 \mu\text{s}$

**i** Use a shielded cable with twisted wires, especially the recommended connection cable PCR3000-x from the accessories, see Chap. A 1.2.

 Connect the cable shield with the potential equalization PE or the connector housing.

1) The encoder input counts each edge. Encoder output typically 4 edges per encoder step.

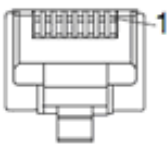
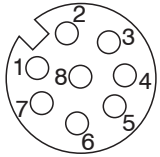
### 5.2.5 Ethernet Connection

Connector “Ethernet“, see [Fig. 9](#).

The Ethernet connection is the standard connection to the PC. The sensor supports the transmission with 100 Mbit and 1 Gbit.

RJ45 connector		8-pin. screw connector (sensor side)		
Pin no.	Color stranded hook-up wire SCR3000A-x	Pin no.	100BaseTX	1000BaseT
1	white (orange)	5	Tx+	D1+
2	orange	6	Tx-	D1-
3	white (green)	8	Rx+	D2+
4	blue	1		D3+
5	white (blue)	2		D3-
6	green	7	Rx-	D2-
7	white (brown)	3		D4+
8	brown	4		D4-

 <p>View on pin side male cable connector</p>	 <p>View on solder pin side screw connector (A-coded)</p>
--	---

*Fig. 15 Pin assignment Ethernet connection*

We recommend the Gigabit-Ethernet connection cable SCR3000A-x for the Ethernet connection; cable length x in meters. Characteristics: 4 x 2 x 0.14 mm<sup>2</sup>; shielded.

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.

**NOTICE**

scanCONTROL 25xx supports Power over Ethernet. If the sensor is connected to a network adapter/switch that is capable of POE and if you also use the power supply of the multifunction port, these two power supplies have to be galvanically isolated.

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 sensor supports an automatically, sensor-adapted IP address in the link-local-net (169.254.x.x). No collision testing is effected.
- 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), because network components support such packages by default. The sensor supports jumbo frames up to 4096 bytes/packet (payload), but then all the network components must also support jumbo frames of this size.

Use the program `SensorFinder.exe` for network configuration. This program is available online at <https://www.micro-epsilon.com/download/software/SensorFinder.zip>.

### 5.2.6 External Laser Switching (optional)

Connector multifunction socket, see Fig. 9, pin assignment, see Fig. 11.

Function

- Laser on: Voltage between +laser on/off and -laser on/off 2.8 V... 31 V,  $I < 5 \text{ mA}$
- Laser off: Voltage between +laser on/off and -laser on/off  $< 0.8 \text{ V}$  or open

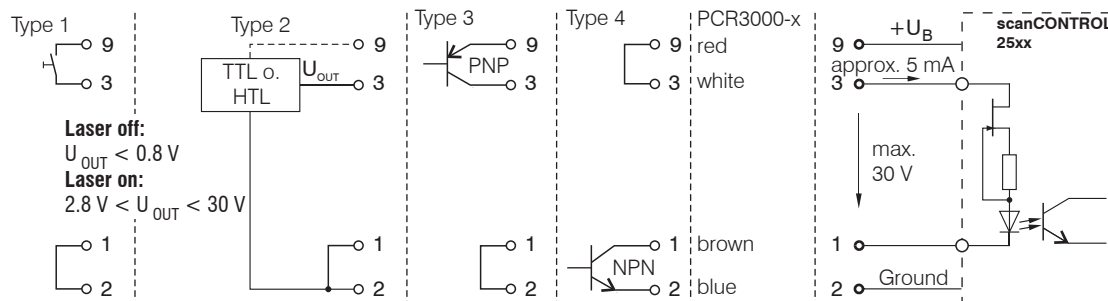


Fig. 16 Options to switch off the laser

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

If the voltages between pin 3 and pin 1 are  $< 0.8 \text{ V}$ , the laser is off. No external resistor is necessary to the current limitation. Connect pin 1 with 2 and pin 3 with 9 for permanent **Laser on**.

The external laser switching-off is implemented as a hardware solution and is a top priority. The laser can be switched off, in addition, also by software.





### 5.3 Installation Instructions

- Only use shielded cables from the accessories for all connection cables, see Chap. [A 1.2](#).
- Connect the cable shields to the potential equalization on the evaluation unit (switch cabinet, PC housing, connector housing) 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 80 mm.
- MICRO-EPSILON recommends the use of the optionally available power supply PS2020, Din rail mounting, input 230 VAC, output 24 VDC/2.5 A.

#### **NOTICE**

The sensor must only be connected to the peripheral equipment when disconnected from the power supply.

### 5.4 Getting Ready for Operation, Commissioning

-  Mount the sensor according to the installation instructions, see Chap. [5.1](#).
-  Connect the sensor to the Ethernet cable.
-  Connect the sensor to downstream display or monitoring units and to the power supply.
-  Switch on the power supply.



## 6. Operation of the Measuring System 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, see Chap. 12. 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 25xx sensor needs a running-in time of typically 20 minutes for high precision measurements.

### 6.2 Operating and Demonstration Programs

For sensor operation, several programs are available. You will find them online on the sensor product website or in the Download area: [https://www.micro-epsilon.com/2D\\_3D/laser-scanner/Software/downloads/](https://www.micro-epsilon.com/2D_3D/laser-scanner/Software/downloads/)

- The scanCONTROL Developer Tool program supports scanner parameterization and user-friendly visualization of profile data.
- scanCONTROL Configuration Tools is used to analyze typical measurement tasks for scanCONTROL 25xx.
- scanCONTROL 3D-View visualizes three dimensional point data, which are recorded with scanCONTROL 25xx.

The measuring fields are partially used in the demonstration programs, see Chap. 6.4.1.

## **6.3 Installation**

### **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 10 (32 Bit und 64 Bit)
- Pentium III  $\geq$  800 MHz
- 512 MB RAM
- Screen resolution: 1024x768

To be able to use the software the following steps must be followed:

1. Install the Ethernet interface hardware, if not already installed.
2. Install the software.
3. Connect the scanCONTROL 25xx measurement system to the PC via Ethernet.

### **6.3.2 Connecting scanCONTROL 25xx to the PC**

Proceed as follows in order to connect scanCONTROL 25xx via Ethernet with the PC.

-  Finish the installation of the software completely.
-  Connect scanCONTROL 25xx via the Ethernet interface to the PC and switch on the power supply.
-  Please wait until the scanCONTROL 25xx device is recognized by the PC.

This may take a few seconds.

The system is now ready to operate the scanCONTROL 25xx measurement system with the scanCONTROL software packages.

## **6.4 Instructions for Operation**

### **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. 17](#). The usable measuring range is always trapezoidal.

The assigned maximum x-values for the z-coordinates can be found, see [5.1](#).

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 predefined measuring fields are on a grid with grid spacing of 1/8 of the matrix. The sensor matrix used in the scanCONTROL 25xx supports the reading of a restricted measuring field. The following picture, see [Fig. 17](#), shows the predefined view areas and the associated measuring fields.

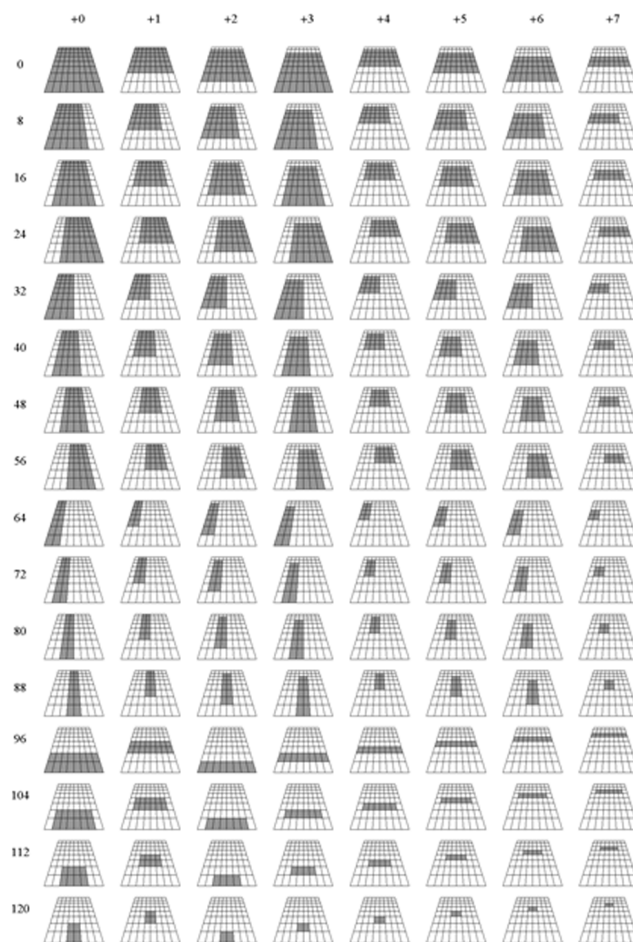


Fig. 17 Predefined measuring fields

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

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

Name	Index
Large	0
Standard	2
Small	7

*Fig. 18 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.

•  
1

The measuring field “standard” is larger than the measuring range “standard”. The minimum dimensions can be found in the dimensional drawing, see Chap. 5.1.

Characteristics of the sensors:

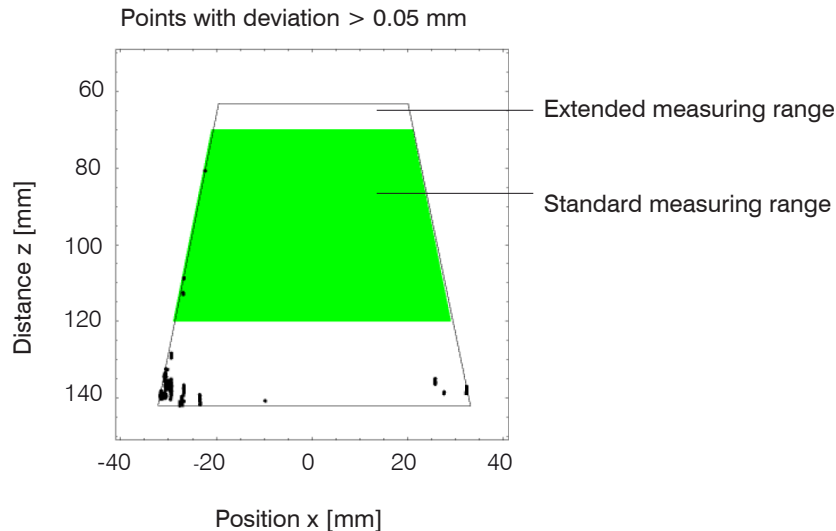
- a laser line with 20 ° opening angle (measuring range 25 mm)  
or 25 ° opening angle (measuring ranges 50 mm and 100 mm).
- The receiver has a smaller opening angle (view angle) than the laser line.
- Centered measuring field (symmetrical to the center axis).
- The sensor imaging matrix evaluates 640 x 512 pixels. The measuring field geometry is fixed.
- Reference for the distance (Z-axis) is the lowest body edge of the sensor, see Chap. 5.1.
- Use of the GigE-Vision standard. The description is contained in the documentation of the scanCONTROL Configuration Tools.

### 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 calibration final inspection is enclosed for each sensor. Three diagrams for the linearity measurement which are briefly explained in the report are included in the calibration final inspection. The key diagram in the calibration final inspection is shown again below, see [Fig. 19](#).



*Fig. 19 Linearity deviation, example of an scanCONTROL 25xx-50*

The black points show the places where the measurement error exceeds the linearity limit of 0.05 mm (depending on sensor model). 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 `Exposure 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. The scanCONTROL Configuration Tools program can be used to determine it. The automatic exposure time regulation can also be deactivated if required.

If there is no object in the measuring range, the `Exposure 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 `Exposure time`, see [Fig. 20](#).

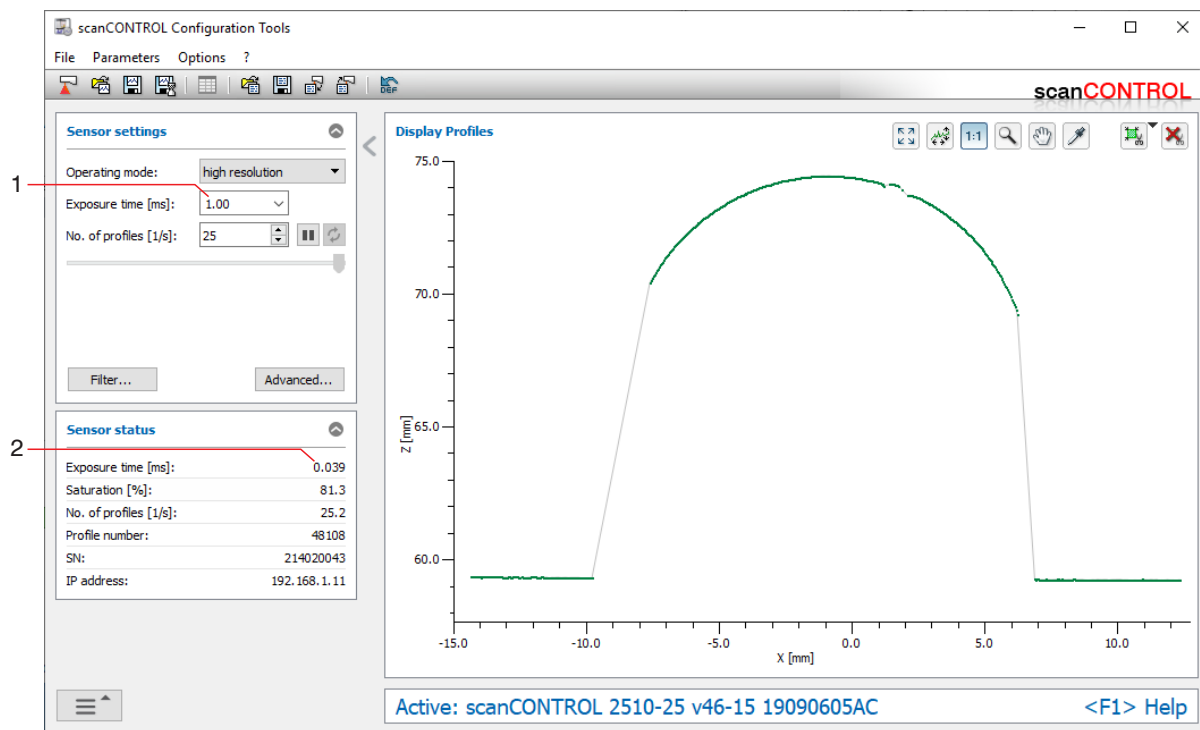


Fig. 20 Screenshot of the developer demonstration program with automatic shutter

- 1 Exposure time preset by the user
- 2 Result of auto exposure



## **6.5 Error Influences**

### **6.5.1 Reflection 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  $\mu\text{m}$  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  $\mu\text{m}$  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  $5\ \mu\text{m}$  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.

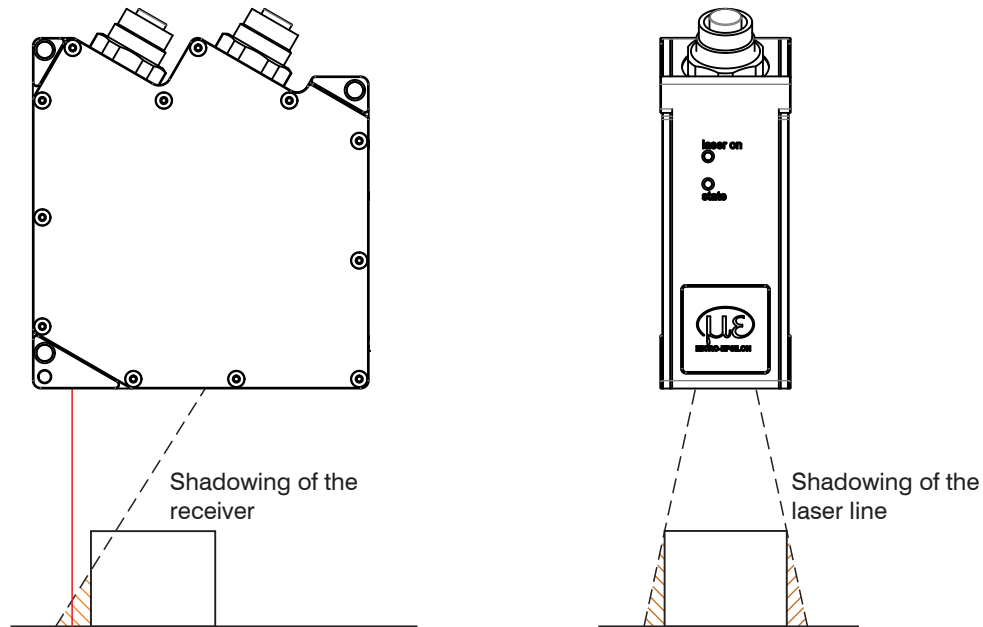


Fig. 21 Shadowings

## **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.

Use a dry, clean, soft, lint-free, antistatic lens cloth to clean the protective glass.

### **Wet cleaning**

Use a clean, soft, lint-free cloth or lens cleaning paper and pure alcohol (isopropanol) for cleaning the protective housing.

- i** Do not use commercial glass cleaner or other cleaning agents.

## **7. scanCONTROL Output Unit**

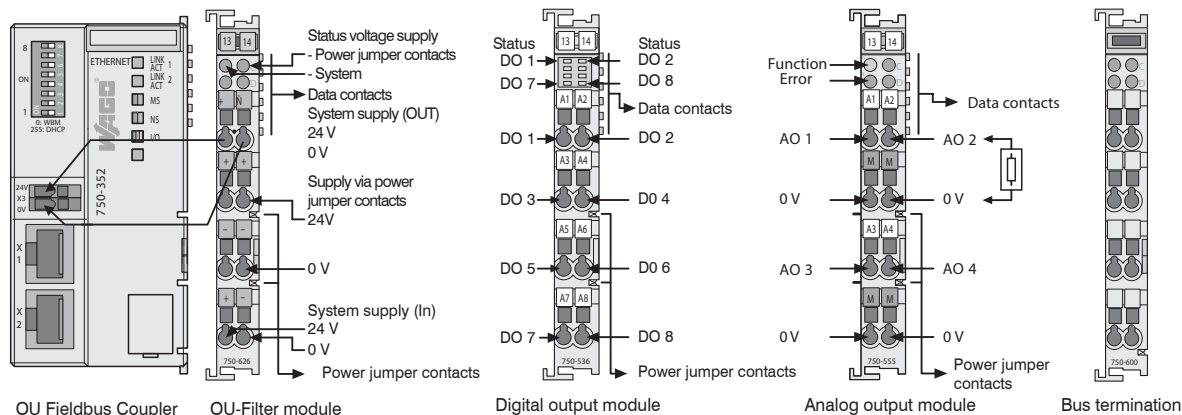
The measurement system scanCONTROL 2510 measures and evaluates 2D profile data of a surface and supplies analog and digital control signals. scanCONTROL Output Unit

- 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 unit (OU-Fieldbus Coupler/Ethernet)
  - 24V DC power supply filter (OU-Filter module) and termination module (OU-Bus termination module)
- Digital output terminal
- Analog output terminal



*Fig. 22 Example configuration Ethernet with analog and digital output module*

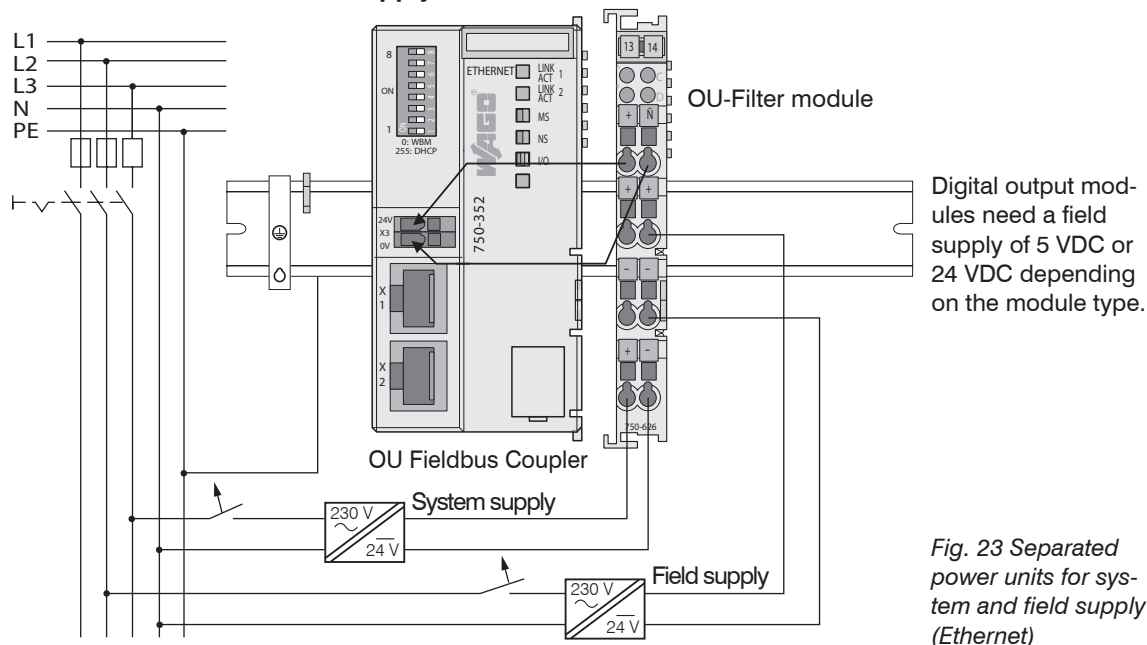
➡ Mount the components of a scanCONTROL Output Unit on a top hat rail (TS35) in the described order.

Without using a top hat rail a robust installation cannot be guaranteed. Ensure that each module is locked securely on the top hat rail.

➡ Terminate the bus with the bus termination, see [Fig. 22](#).

For a description of the individual components of the scanCONTROL Output Unit, please refer to Chap. 7.4, the respective datasheets and the manuals for scanCONTROL Configurations Tools.

## 7.2 Connect the Power Supply



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. 23](#)).
- ➡ Connect the system supply (in) of the OU-Filter module to the power supply (0 V and 24 V, see [Fig. 23](#)).
- ➡ Connect the field supply (in) of the OU-Filter module to the power supply (0 V and 5 V/24 V, see [Fig. 23](#)).

**i** 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 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, Chapter 3.14.4.

➡ Exit scanCONTROL Configuration Tools and disconnect scanCONTROL 2510, PC and if necessary scanCONTROL Output Unit.

➡ Connect the scanCONTROL 2510 sensor to the Output Unit by using the Ethernet cable.

scanCONTROL 2510 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

Micro-Epsilon order no. 6414073

Consists of

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



- Interfaces: 2x Ethernet to connect scanCONTROL 2510 sensors.
- Indicators (Status LED's, for detailed description refer to the manual of the OU-Fieldbus Coupler/Ethernet)
- The system supply is already mounted to the Fieldbus Coupler.

*Fig. 24 OU-Fieldbus Coupler/Ethernet with system supply module*

<b>System data</b>	
Max. number of bus sharing unit	Limited by Ethernet specification
Max. length of fieldbus segment	100 m
Baud rate	10/100 Mbit/s
<b>Technical Data</b>	
Number of bus terminals	64
With bus extension	250
Power supply	DC 24 V (-25 % ... +30 %)
Max. input current	280 mA at 24 V
Internal current consumption	450 mA at 5 V
Total current for I/O modules	700 mA at 5 V
Voltage drop at $I_{max.}$	< 1 V at 64 I/O modules

*Fig. 25 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;  $\pm 10$  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 24V 0.5 A is short-circuit-proofed, high-side switching, for TS35, CAGE CLAMP® connections, 8 actuators.
- The field level is galvanically isolated to the system level.
- The indicators (Status LED's) additionally show the status of the digital outputs (IO/NIO), for detailed description refer to manual of the 8-Channel digital output modules DC 24 V 0.5A, 8 actuators, high-side switching
- Actuators can be operated at all digital outputs and be wired directly via DO 1/2/3/4/5/6/7/8.
- scanCONTROL 2510 supports eight digital outputs.

*Fig. 26 8-Channel DigitalOut-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 <sub>max.</sub>	2 kHz
Output current	0.5 A short-circuit-proofed
Energy dissipation W <sub>max.</sub> (unique switching off)	0.9 J $L_{max.} = 2 W_{max.} / I^2$
Current consumption typ. (field side)	15 mA (per module) + load

*Fig. 27 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 (Status-LED's, for detailed description refer to manual of the 4-Channel analog output module DC 0-10 V)
- Voltage range is terminal-related 0 to +10 V and can not be extended by changing the appropriate setting in scanCONTROL Configuration Tools.
- The output signal is galvanically isolated output from the system level.
- The resolution is limited to 12 bits.
- scanCONTROL 2510 supports four analog outputs.

*Fig. 28 4-Channel-AnalogOut-Modul*

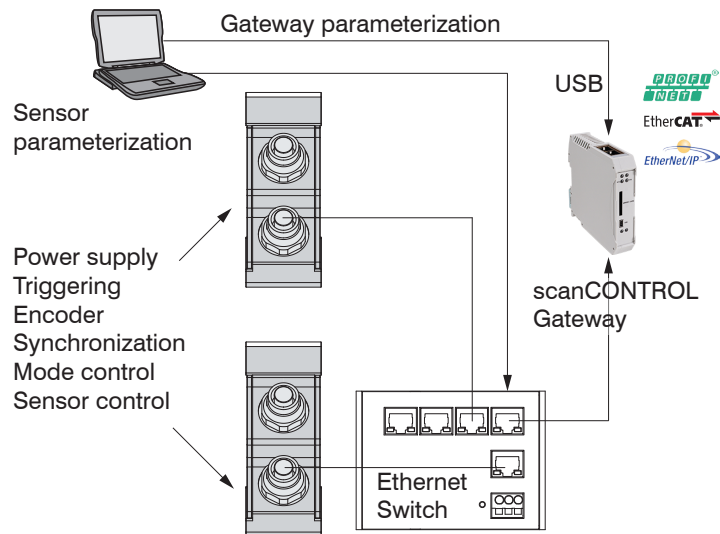
Number of outputs	4
Power supply	via system voltage DC/DC
Signal voltage	0 V ... 10 V
Load	> 5 k $\Omega$
Resolution	12 bit
Conversion time	typ. 10 ms
Setting time	typ. 100 $\mu$ s
Measurement error at 25 °C	< $\pm$ 0.1 % of full scale (FS)
Temperature coefficient	< $\pm$ 0.01 % /K of full scale (FS)

*Fig. 29 Technical data of analog output module*

## 8. scanCONTROL Gateway

scanCONTROL Gateway allows for scanCONTROL SMART sensors to be integrated into various fieldbus systems:

- Profinet
- Ethernet IP
- EtherCat



All measurement results obtained from the profile evaluation carried out of a scanCONTROL SMART sensor can be transmitted to a PLC via one of these fieldbus systems.

Furthermore, all scanCONTROL sensor settings can be set via scanCONTROL Gateway (e.g. Laser on/off or switch User Mode).

*Fig. 30 Network layout for using scanCONTROL Gateway*

The scanCONTROL Gateway can connect up to four scanCONTROL SMART sensors to the fieldbus. The transmission rate of measurement values is up to 500 Hz.

Please refer to the TechNote T026 (scanCONTROL fieldbus integration) for more details.

## 9. 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.

## 10. Service, Repair


If the scanCONTROL 25xx is defective:

- If possible, save the current sensor settings in a parameter set, see Configuration Tools, menu `Parameters > Save parameters to file...`, 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  
optronic@micro-epsilon.com  
www.micro-epsilon.com

## 11. Decommissioning, Disposal

-  Remove all cables between the scanCONTROL 25xx 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.

## 12. Error Codes

(— LED state lights for a long time lang, • LED state lights briefly)

Flashing sequence	Cause	Remedy	Notes
<b>Group: Loading / saving configuration</b>			
•• 2x short	Mode not found.	Select different one.	Only previously stored modes can be called up.
••— 2x short, 1x long	White error flash	Contact manufacturer, return sensor.	Should not occur in normal operation.
••• 3x short	Flash full	None, contact manufacturer.	Should not occur in normal operation.
•••• 4x short	Loading suppressed due to active data transmission.	Stop active data transmission.	Prevents PC software crashes.
<b>Group: Data processing and transmission</b>			
— 2x long	Data overflow in the sensor	Select smaller measuring field, reduce profile frequency, select less complex measuring program.	Data can be impaired; exposure time can be longer than expected.
—• 2x long, 1x short	Data overflow during receipt of the data from the sensor.	Select smaller measuring field, reduce profile frequency, select less complex measuring program.	Data can be impaired.
—•• 2x long, 2x short	Data overflow for serial port RS422	Reduce profile frequency, select less complex measuring program.	Data can be impaired.



Flashing sequence	Cause	Remedy	Notes
--.. 2x long, 3x short	Data overflow during transmission of the data via Ethernet	Reduce profile frequency, increase packet size.	Data can be impaired.
--..... 2x long, 5x short	Error during calculation	Reduce profile frequency, select faster calculation mode.	Data can be impaired.
--..... 2x long, 6x short	Error during Ethernet transmission	Reduce profile frequency.	Data can be impaired.
<b>Group: Output Unit</b>			
--- 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.	---
<b>Group: Ethernet interface</b>			
---- 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.

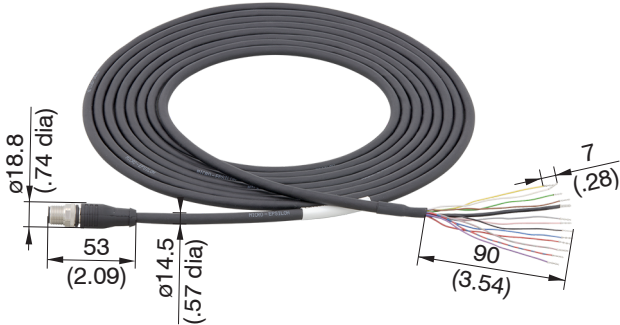

Appendix

A 1      Accessories

A 1.1    Recommended Accessories

PS2020		Power supply for DIN rail mounting, input 230 VAC, output 24 VDC/2.5 A for maximum 2 sensors scanCONTROL 25xx at the same time.
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A 1.2      Optional Accessories

PCR3000-x		Multifunction cable, suitable for use with drag chains and robots  length x = 2, 5, 10, 15, 20, 25, 35 m  cable 6x2x0.14 shielded, with integrally cast 12-pole M12x1 screw con- nector and free cable ends
SCR3000A-x		Ethernet connection cable, suitable for use with drag chains and robots  length x = 0.5, 2, 5, 10, 15, 20, 25, 28, 35 m  cable 4x2x0.14; shielded, with integrally cast 8-pole M12x1 screw connector and 8-pole Ethernet cable connector RJ45.



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