

Laser scanner

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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:



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



Indicates a situation which, if not avoided, may lead to property damage.



Indicates a user action.



Indicates a user tip.

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.

- > Damage to or destruction of the sensor
- > Failure of the measuring device

Do not touch the protective windows of the optics with the fingers. Wipe off any fingerprints immediately.

- > Inaccurate, erroneous measurements.

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 gapCONTROL 2711 measuring system:

- EU directive 2004/108/EC
- EU directive 2011/65/EC, "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

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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
 - Gap 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 for connected sensor cable)
- Operating temperature: 0 to +50 °C (+32 to +122 °F)
- Humidity: 5 - 95 % (non-condensing)
- Ambient pressure: atmospheric pressure

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 gapCONTROL 2711 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 gapCONTROL 2711 sensors, the relevant regulations according to EN 60825-1 (IEC 60825, Part 1 of 11/2001) and the applicable accident prevention regulations must be followed.

The housing of the gapCONTROL 2711 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

gapCONTROL 2711 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.

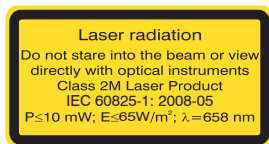
Laser equipment of the Class 2M can be employed without further protective measures, when deliberate viewing into the laser beam or into a beam reflected by mirrors is not longer than 0.25 s.

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):



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



IEC label



THIS PRODUCT COMPLIES
WITH FDA REGULATIONS
21CFR 1040.10 AND 1040.11

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.

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.



Fig. 1 True reproduction of the sensor with its actual location of the warning label

⚠ 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.

gapCONTROL 2711

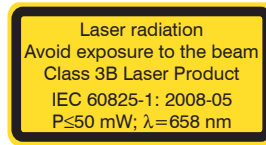
2.2 Laser Class 3B

gapCONTROL 2711 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. 5.2.5. 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 equipments 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):



IEC label

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.



Beam attenuator

Fig. 2 gapCONTROL beam attenuator masks aperture

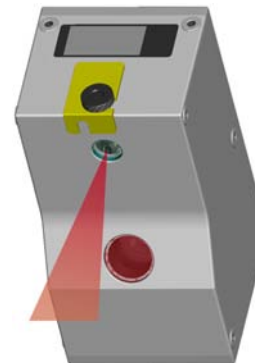


Fig. 3 gapCONTROL beam attenuator in measuring position

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:

- ➡ Unscrew the knurled screw,
- ➡ Change the attenuator position and tighten the knurled screw.

The laser aperture must be open during measurement.



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. [5.2.5](#).

3. Functional Principle, Technical Data

3.1 Short Description

3.1.1 Measurement Principle

The gapCONTROL 2711 sensor operates according to the principle of optical triangulation (light intersection method):

- A laser line is projected onto the gap 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 gapCONTROL 2711 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

- gapCONTROL 2711 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).
- gapCONTROL 2711 works even without a PC in conjunction with saved configurations. The sensor runs the gap measurement internally and calculates default measured values such as gap width or gap concision.

Besides measurement value output via Ethernet (Modbus TCP protocol) and RS422 (Modbus RTU protocol or ASCII format), additional digital switch signals and analog measuring values can also be output. This is done by an Output Unit which transforms the measurement signals into switch and analog signals. Furthermore, a determination of internal limit value with subsequent output of the evaluation results (good / bad) is possible via the switching outputs.

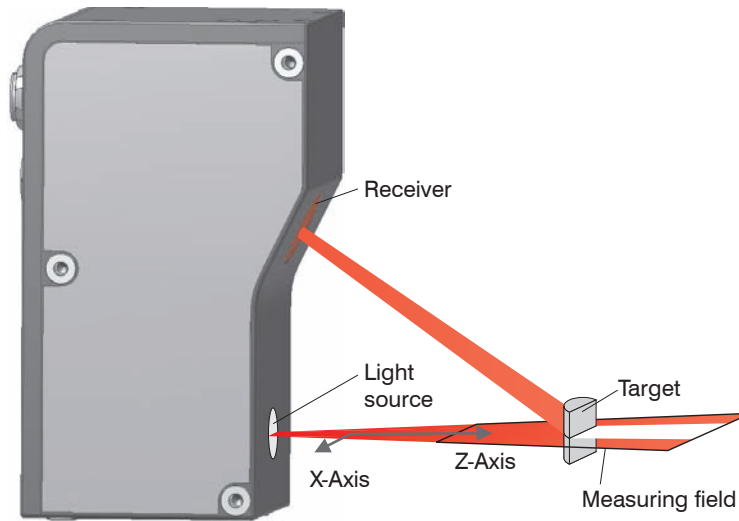


Fig. 5 Basic design

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.
- Selectable Firewire (IEEE1394a) or Ethernet 100/1000 Mbit as fast standard connection to the PC.

3.2 Technical Data

	Model	gapCONTROL		2711-25	2711-50	2711-100
z-axis (height)	Standard measuring range	Start of measuring range	mm (inches)	90 (3.54)	175 (6.89)	350 (13.78)
		Midrange	mm (inches)	102.5 (4.04)	200 (7.87)	400 (15.75)
		End of measuring range	mm (inches)	115 (4.53)	225 (8.86)	450 (17.72)
	Extended measuring range	Start of measuring range	mm (inches)	85 (3.35)	160 (6.30)	300 (11.81)
		End of measuring range	mm (inches)	125 (4.92)	260 (10.24)	600 (23.62)
	Linearity ¹⁾	±0.2 % FSO (3 sigma)		±50 µm	±100 µm	±200 µm
	Resolution	0.04 % FSO		10 µm	20 µm	40 µm
Reference resolution ^{2) 3)}			4 µm	10 µm	15 µm	
x-axis (width)	Standard measuring range	Start of measuring range	mm (inches)	23 (0.91)	44 (1.73)	88 (3.46)
		Midrange	mm (inches)	25 (0.98)	50 (1.97)	100 (3.94)
		End of measuring range	mm (inches)	27 (1.06)	56 (2.20)	112 (4.41)
	Extended measuring range	Start of measuring range	mm (inches)	22 (0.87)	41 (0.16)	76 (2.99)
		End of measuring range	mm (inches)	29 (1.14)	64 (2.52)	148 (5.83)
	Point distance	Midrange	µm	40	80	160
	Resolution x-axis			640 points/profile		
Measurement rate			100 Hz			
Sensor configuration and profile data transmission	Ethernet		■	■	■	
	RS422 ⁴⁾		■	■	■	
Sensor control	Trigger ⁴⁾		■	■	■	
	Synchronization ⁴⁾		■	■	■	
Measurement value output	Ethernet (Modbus TCP)		■	■	■	
	RS422 (ASCII / Modbus RTU)		■	■	■	
	Analog ⁵⁾		■	■	■	
	Switching signal ⁵⁾		■	■	■	

Model	gapCONTROL	2711-25	2711-50	2711-100
Display (LED)		1x Laser, 1x power/error/status		
Protection class		IP 64		
Operating temperature		0 °C up to 50 °C (+32 ° up to +122 °F)		
Storage temperature		-20 °C up to 70 °C (-4 up to +158 °F)		
Cable length	Ethernet with switch	Up to 20 m		
		Up to 50 m		
Weight		approx. 700 g	approx. 800 g	approx. 850 g
Galvanic isolation		Only at RS422, no isolation of 24 V supply, internal circuit. If isolation necessary, external 24 VDC-DC converter required		
Supply		8 - 30 VDC, 500 mA		
Light source		Semiconductor laser 658 nm		
Aperture angle laser line		20 °		
Laser power	standard	10 mW (Laser class 2M)		
	optional	20 mW (Laser class 3B)		
Laser off		via software / via external contact (optional)		
Permissible ambient light (fluorescent light) ²⁾		10.000 lx		

1) Standard measuring range

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 can be programmed as serial interface or as input for trigger / synchronization

5) Only with Output Unit

FSO = Full scale output

➡ Check for completeness and transport damage immediately after unpacking.

Contact the supplier immediately in the case of damage or incompleteness.

4.2 Accessories

4.2.1 Recommended Accessories

- Power supply PS2010, power supply for DIN rail mounting, input 230 VAC, output 24 VDC/2.5 A

4.2.2 Optional Accessories

- Interface cable RS422, 4.5 m (SC2700-4.5 RS422), with mounted ODU round connector and 9-pin D-SUB cable socket, fits converter from RS422 to USB from MICRO-EPSILON.
- FireWire connection cable X m (SC2700-X FireWire), optional lengths: X = 1.8 m, 4.5 m, 10 m, 15 m, 20 m. With mounted ODU round connector and 6-pin FireWire cable connector type A. Version compatible for cable carriers and industrial robots also available.
- Ethernet connection cable X m (SC2700-X Ethernet)
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.

4.3 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 tightening torque must not be selected too high.

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

i Attach the sensor only to the existing mounting holes / threaded holes on a flat surface. Clamps of any kind are not permitted.

NOTICE

