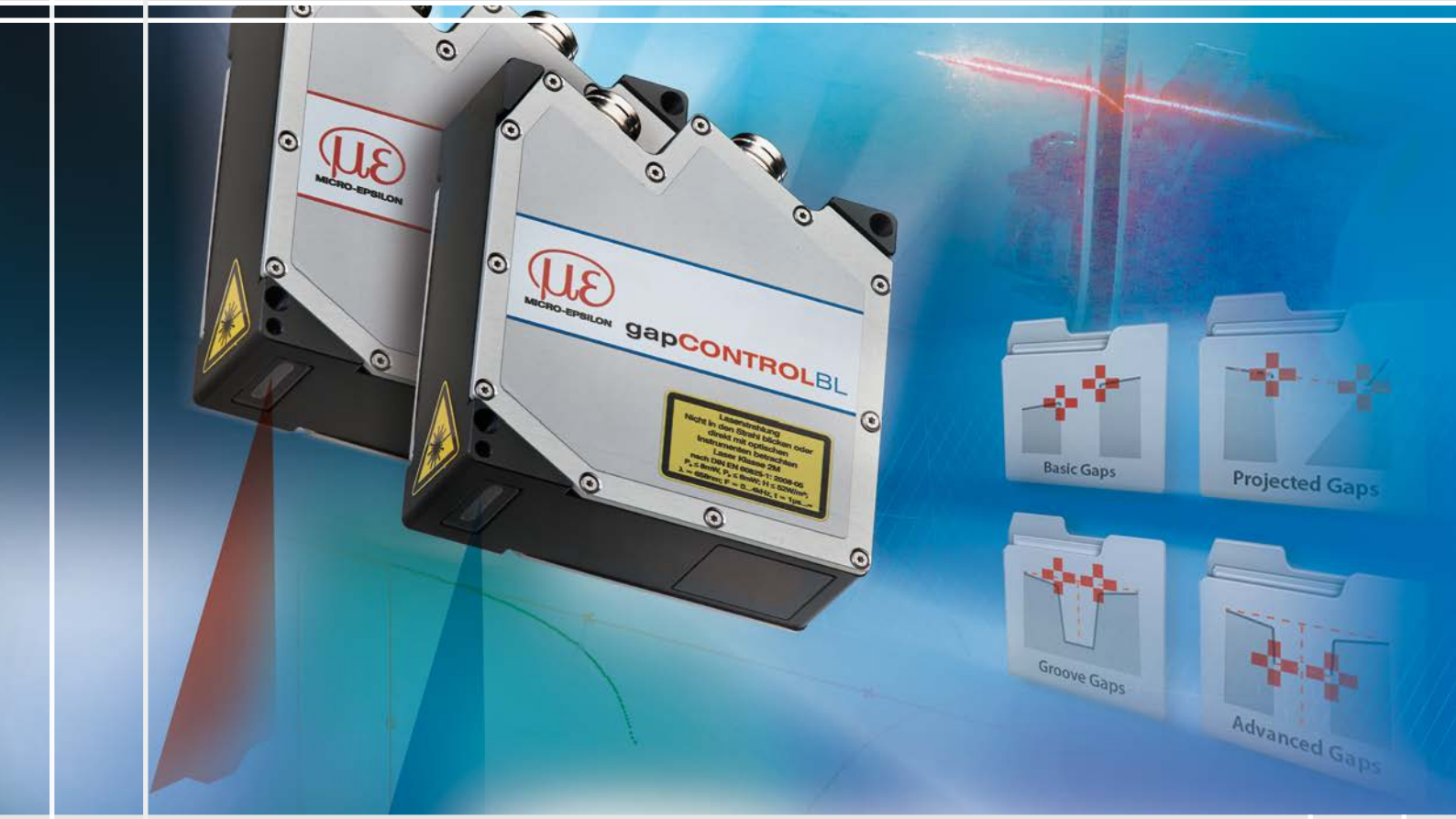
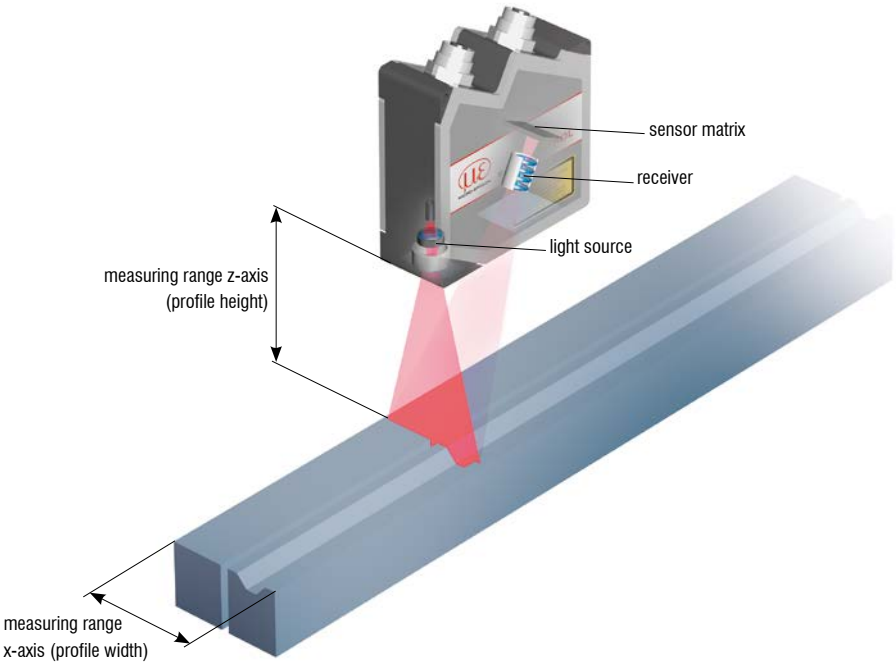
MICRO-EPSILON

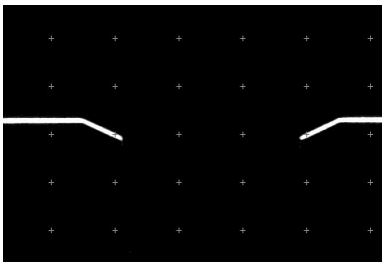
More Precision

gapCONTROL // Non-contact gap measurement

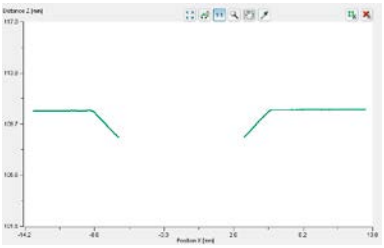




❶ **Laser line**
Projecting a laser line onto the target surfcae



❷ **Sensor matrix (pixels)**
The diffusely reflected light of the laser line is displayed on the high-value sensormatrix



❸ **Calibrated x / z - measuring points**
Calculation of the distance coordinate z and the actual position x along the laser line for each measuring point

What is gapCONTROL?

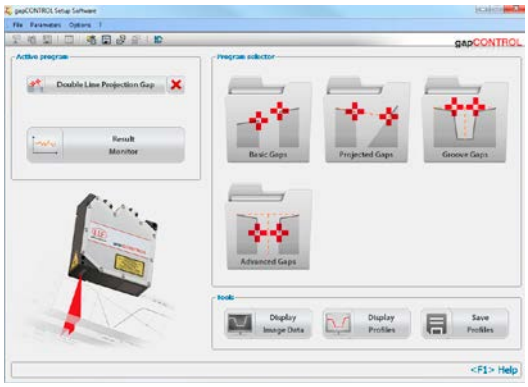
The laser scanners of the gapCONTROL series record, measure and evaluate gaps on very different target surfaces. With gapCONTROL, Micro-Epsilon offers a measurement system specially matched to the demands of gap measurement.

The measuring principle

Laser scanners - often referred to as profile sensors - use the laser triangulation principle for two-dimensional profile detection on different target surfaces.
Using special lenses, a laser beam is enlarged to form a static laser line and projected onto the target surface. A high-quality optical system projects the diffusely reflected light of this laser line onto a highly sensitive CMOS matrix. In addition to the distance information (z-axis), the controller also uses this camera image to calculate the position along the laser line (x-axis). These measured values are then designated as a profile in a two-dimensional coordinate system that is fixed in respect to the sensor. The gapCONTROL sensor evaluates this profile according to specified criteria and outputs the result (e.g. gap width) as a measured value via the interfaces.

gapCONTROL Setup Software

Not all gaps are alike. There are different definitions of how the optical gap is defined for different industries and measuring targets. The gapCONTROL Setup Software enables quick and easy configuration of gapCONTROL sensors. Both components together represent a complete solution for automated gap measurement.
After parameterisation, the sensor operates in standalone mode. However, the software can be used for the visualisation of the measured values.



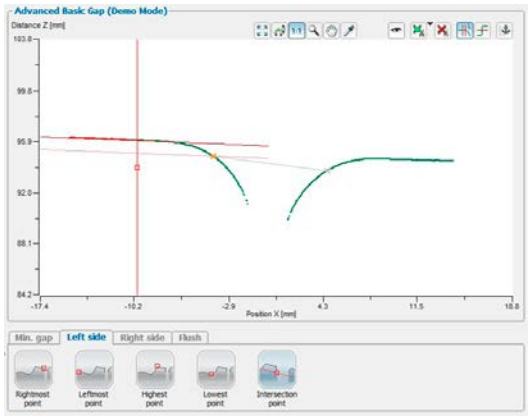
❹ Selection of the gap type and measuring program

gapCONTROL gap modes

The user-friendly, intuitive software guides the user through the program. In the first step, a gap mode is chosen from a wide selection of conventional gap types. This pre-selection specifies a start configuration for the chosen gap type. With simple types of gap, e.g. “Edge Points Gap”, no additional configuration is needed. Other gap types offer application-specific configuration options.

Parameterisation of the gap measurements

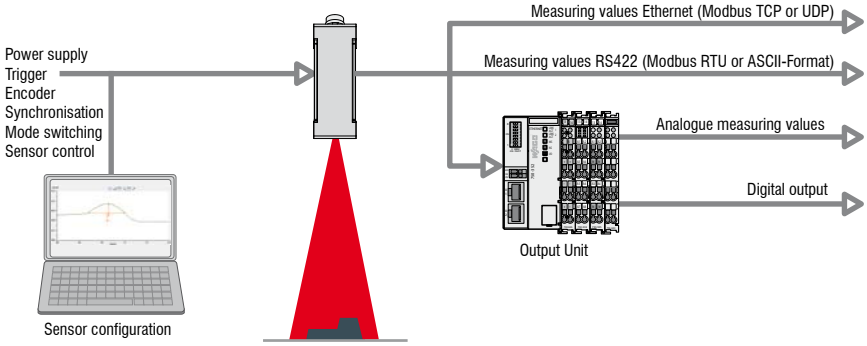
After selecting the gap mode, the search algorithms for the right and left-hand gap edges as well as for the gap offset are specified with the gapCONTROL Software.
For dynamic processes, gapCONTROL also offers tracking functionality, e.g. following the center position.

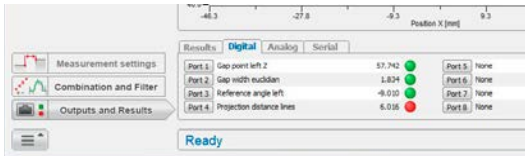


❺ Parameterising the gap on the left and right-hand edge

Measurement output: Plug&Play solution in the integrated controller

For output of measured values, these can be configured with freely assigned values. The configuration of gapCONTROL can be saved in the memory of the sensor. Consequently, the sensor is ready for running in its standalone mode without an external PC. Besides measurement value output via Ethernet (Modbus TCP protocol, UDP protocol) and RS422 (Modbus RTU protocol or ASCII format), additional digital switch signals and analog measuring values can also be output.





❻ Measurement value output

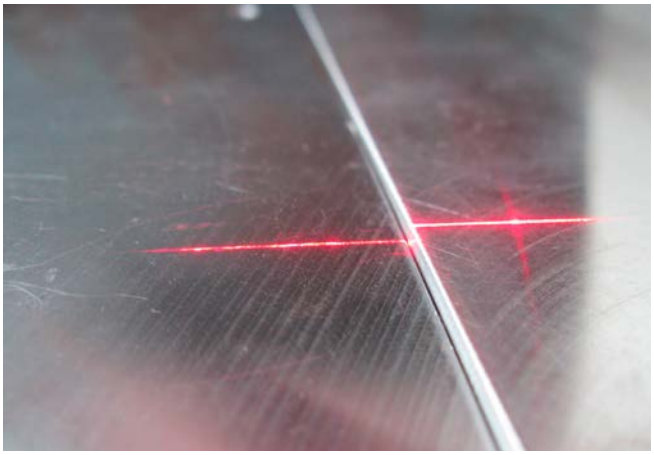
Measurement and evaluation of the measurement value sequence

Using the „Result Monitor“ analysis program, selected measurement value sequences of recorded profiles and live profiles can be displayed and analysed, enabling the evaluation of measurements. Additionally, an integrated cgm analysis (capability gauge measurement), and further statistical parameters (e.g. limit value exceeded, average values) are available. The software allows these values to be exported for archive purposes or for further analysis in calculation tables.

❼ Measured value sequence (optional)

Load and save

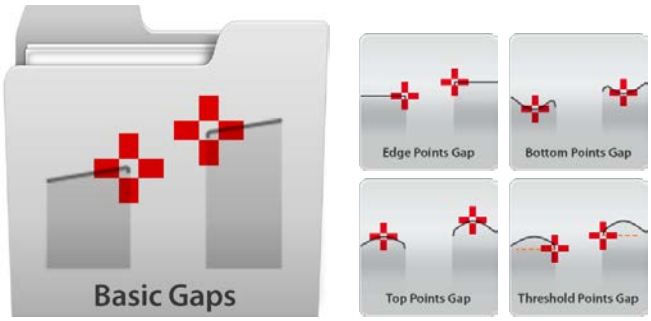
The gapCONTROL Setup Software allows both profiles and measuring results (e.g. gap width) to be saved. Stored profiles, even without a gapCONTROL sensor connected, can be re-loaded, and all parameters of the evaluation can be tested on these offline data. Several example profiles are already included with the standard installation of the gapCONTROL Setup Software, and they can largely be used to test the functioning of the software.
Download at: **http://www.micro-epsilon.com/gapcontrol-setup-software**

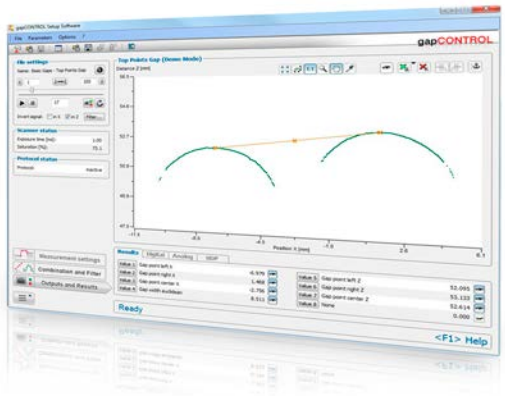


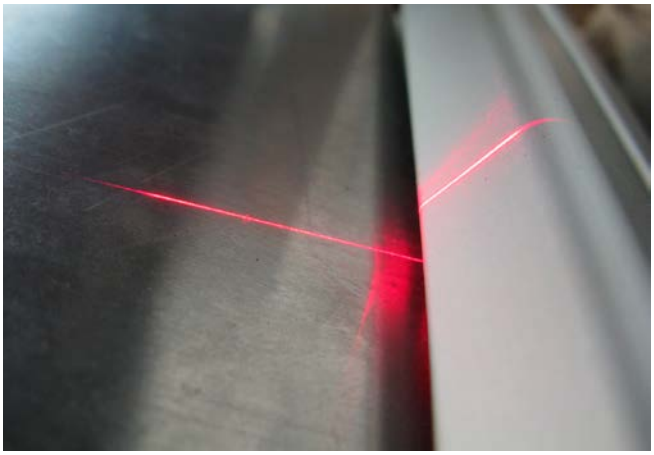
Edgeless gap
The edgeless gaps are the so-called „Basic Gaps“ and are characterised by clearly defined reference points for gap measurement. These could be, for example, the end points or the lowest points of each side. Furthermore, the offset of both sides is easily measurable.
This gap type allows for an easy entry and the desired measurement result is output by modifying just a few settings.

„Basic Gaps“ programs:
- Edge Points Gap
- Top Points Gap
- Bottom Points Gap
- Threshold Points Gap

Typical values measured:
- Gap width
- Height differences
- Center position



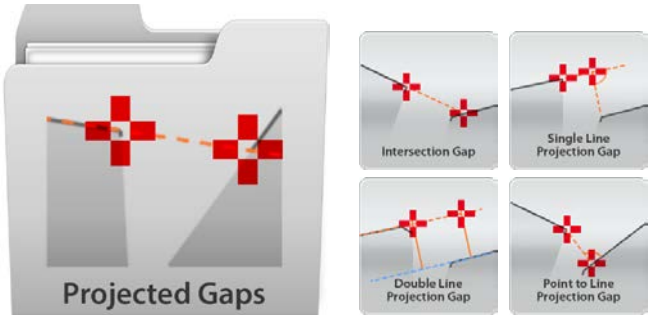


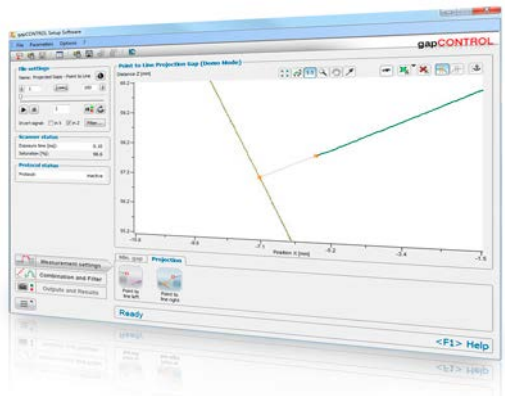


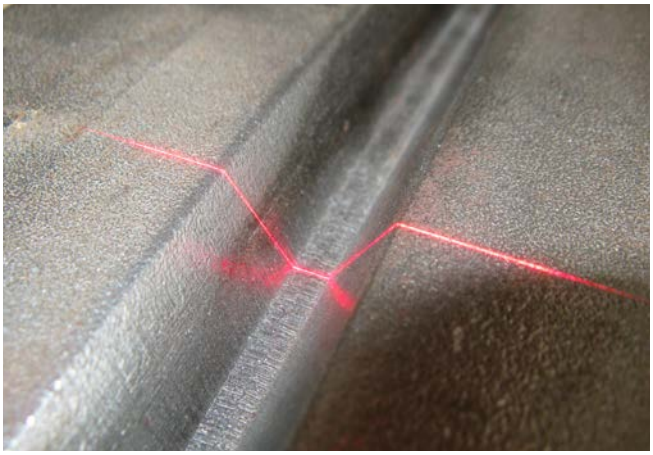
Projected Gap
With these types of gaps, the end points of both sides are projected. There are different ways of projection, for example, the projection onto a common parallel or the projection of an end point onto the opposite side.
The distance between the projected points is described as gap width.
The pre-defined gap variants allow for easy and fast setting.

„Projected Gaps“ programs:
- Intersection Gap
- Single Line Projection Gap
- Double Line Projection Gap
- Point to Line Projection Gap

Typical values measured:
- Gap width
- Minimum distance
- Angle







Gaps with floor

If there is a visible floor in the gap, further inspections can be carried out in order to e.g. measure the gap depth. The evaluations also apply for grooves and other cavities.

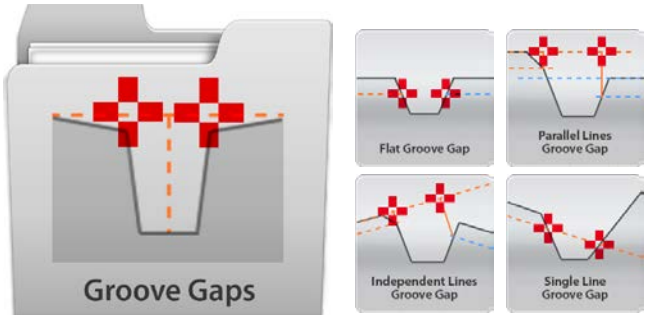
With soldering applications e.g. the so-called V-gap of pipelines, special algorithms of the „Advanced Groove Gap“ output the oscillation width depending on the current soldering depth.

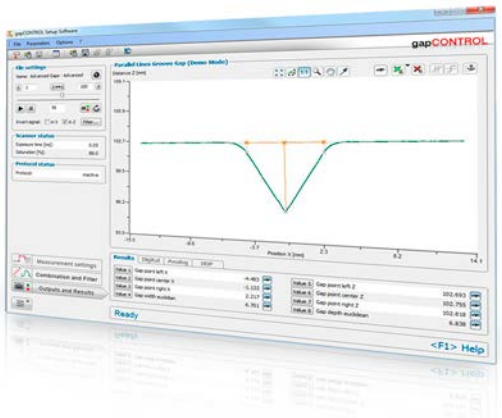
Programs:

- Flat Groove Gap
- Parallel Lines Groove Gap
- Independent Lines Groove Gap
- Single Line Groove Gap

Typical values measured:

- Gap width
- Gap depth
- Angle



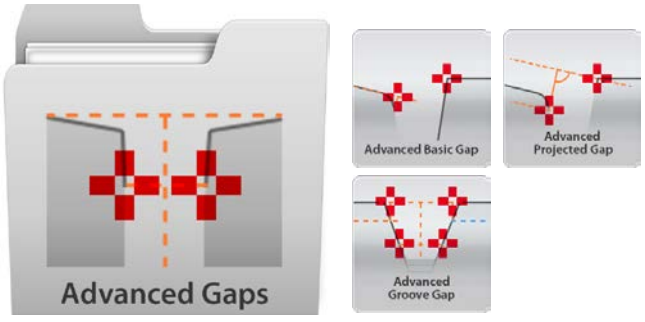


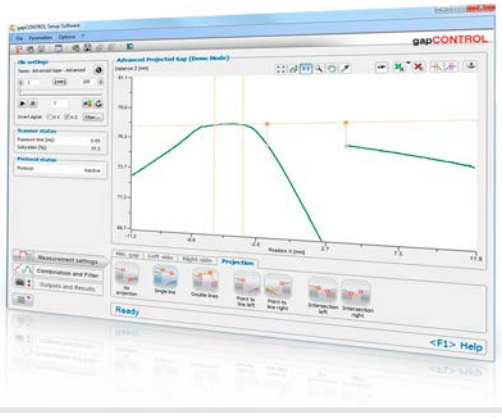
Advanced Gaps:

These types offer the user advanced settings. The algorithms for flushness measurement or projection can be adapted independently of each other as well as the search criteria for the respective gap points. Furthermore, these gap types provide numerous additional measured values such as angle or unevenness of the edges.

Easy start

In most cases, it makes sense to start with the „Basic Gaps“ or „Projected Gaps“ measurement programs. If required, the user can easily switch to the advanced settings via the navigation menus. The software enables the user to keep all previous settings.

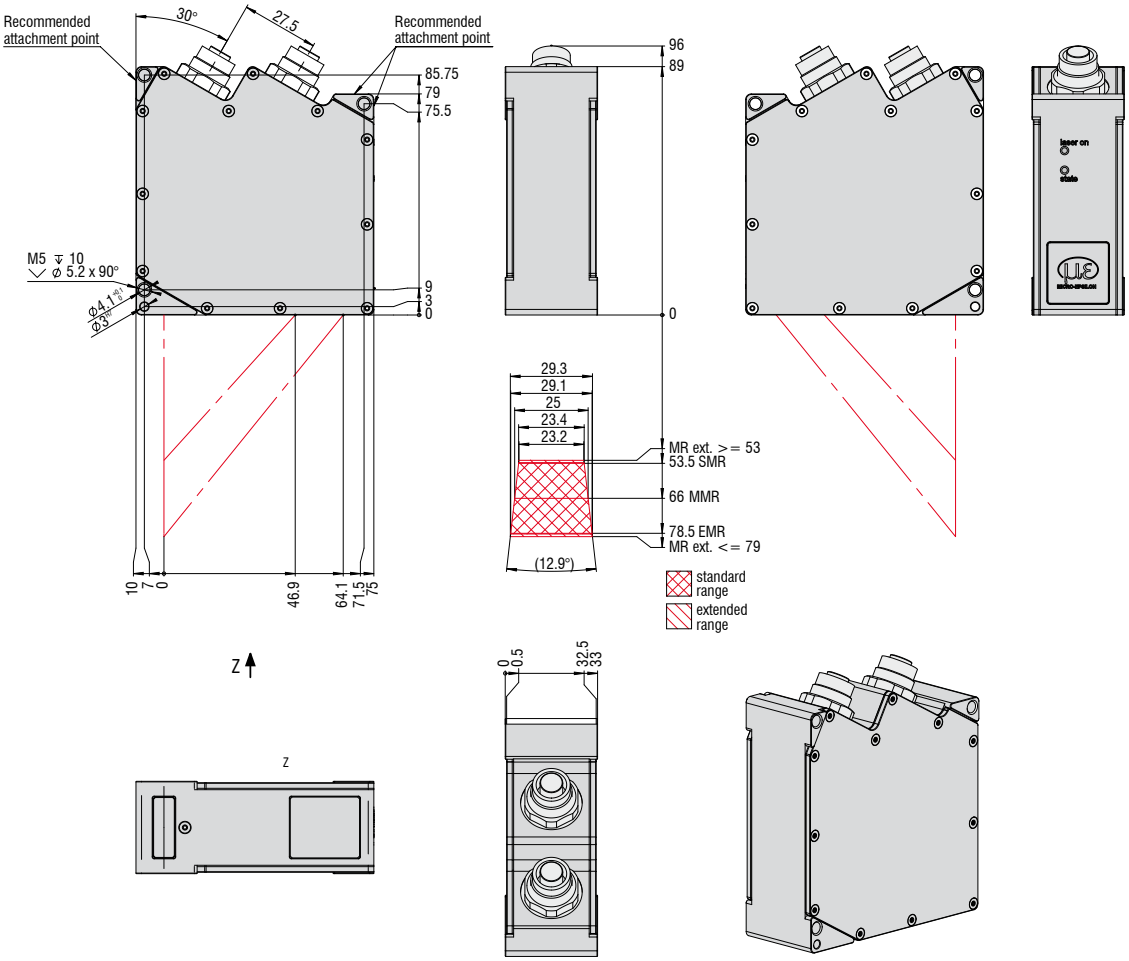




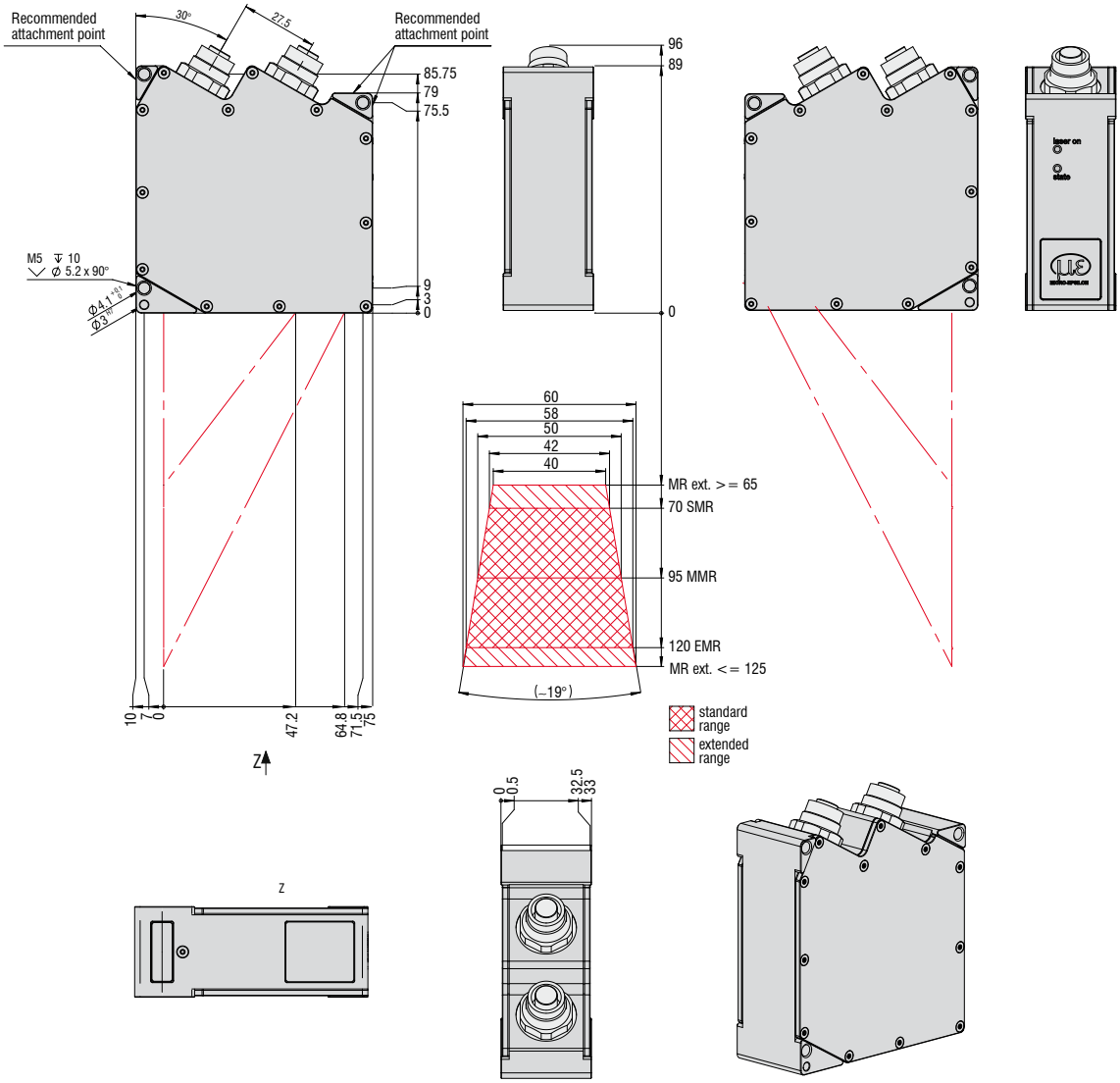
	Model	gapCONTROL	2611/2911-25	2611/2911-50	2611/2911-100
z-axis (height)	Standard measuring range	Start of measuring range	53.5mm	70mm	190mm
		Midrange	66mm	95mm	240mm
		End of measuring range	78.5mm	120mm	290mm
	Extended measuring range	Start of measuring range	53mm	65mm	125mm
		End of measuring range	79mm	125mm	390mm
	Linearity [1]	(3sigma)	±0.16% FSO	±0.16% FSO	2611: ±0.20% FSO 2911: ±0.16% FSO
		(2sigma)	±0,10 % FSO	±0,10 % FSO	2611: ±0,13 % FSO 2911: ±0,10 % FSO
	Reference resolution [2] [3]		2µm	4µm	12µm
x-axis (width)	Standard measuring range	Start of measuring range	23.4mm	42mm	83.1mm
		Midrange	25mm	50mm	100mm
		End of measuring range	29.1mm	58mm	120.8mm
	Extended measuring range	Start of measuring range	23.2mm	40mm	58.5mm
		End of measuring range	29.3mm	60mm	143.5mm
	Resolution x-axis		2611: 640 points/profile 2911: 1.280 points/profile		
	Profile frequency		up to 300Hz		
	Interfaces	Ethernet GigE-Vision	Output of measurement values Sensor control Profile data transmission		
		multi-function: digital inputs	Mode switching Encoder Trigger		
		multi-function: RS422 (half duplex)	Output of measurement values Sensor control Trigger Synchronisation		
	Measurement value output		Ethernet (UDP / Modbus TCP) RS422 (ASCII / Modbus RTU) [4] Analog [5] Switching signal [5]		
	Display (LED)		1x laser ON/OFF, 1x power/error/status		
	Light source	standard	Semiconductor laser 658nm (red)		
		optional (only 29xx)	Semiconductor laser 405nm (blue)		
	Aperture angle laser line		20°	25°	25°
	Laser power	standard	8mW (class 2M)		
		optional	20mw (class 3B)		
	Laser off	optional	via external contact		
	Permissible ambient light (fluorescent light) [2]		10.000lx		
	Protection class (sensor)		IP 65		
	EMC		acc. EN 61326-1: 2006-10 DIN EN 55011: 2007-11 (group 1, class B) EN 61000-6-2: 2006-03		
	Vibration		2g / 20 ... 500Hz		
	Shock		15g / 6ms		
	Operating temperature		0°C to 45°C		
	Storage temperature		-20°C to 70°C		
	Dimensions		96 x 85 x 33mm		
	Weight		380g		
	Supply		11-30VDC, 24V, 500mA, IEEE 802.3af class 2, Power over Ethernet		

[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 / Synchronisation
[5] Only with Output Unit
FSO = Full scale output

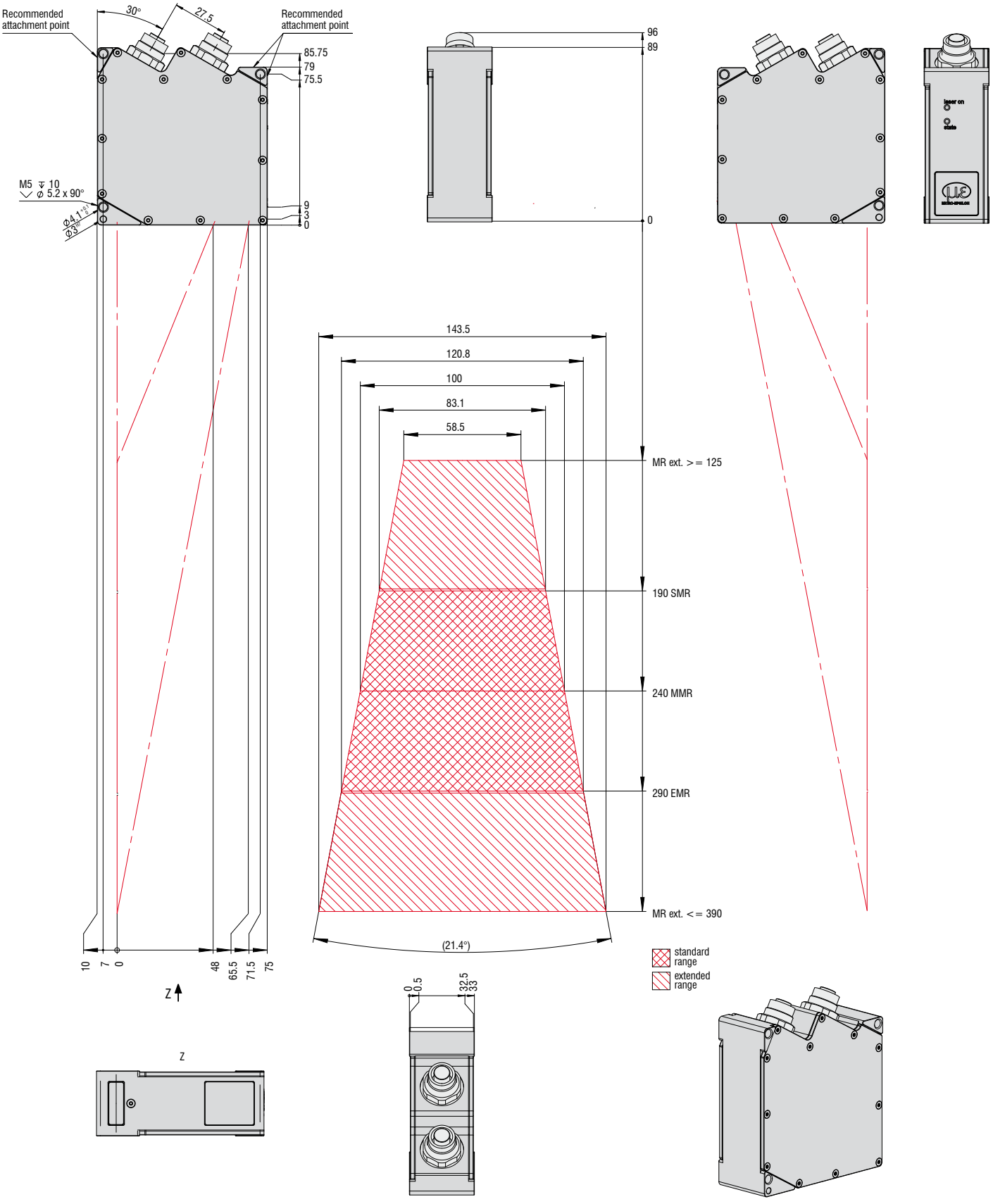
gapCONTROL 2611/2911-25



gapCONTROL 2611/2911-50



gapCONTROL 2611/2911-100



Options*:

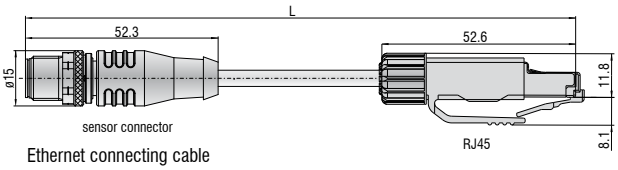
/SI	Integrated sensor switch-off	/PT	Pigtail cable
 Hardware switch-off of the laser line		 0.25m long cable directly out of the sensor	
/3B	**Class 3B**	**/BL**	**Blue laser line**
 Improved laser power (20mW) for e.g. dark surfaces		 Blue laser line (405nm) for (semi-) transparent, red-hot glowing and organic materials	

*Options can be combined

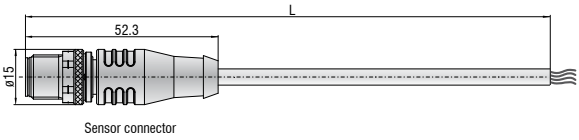
Ethernet connecting cable, qualified for drag chain use*

Part. No.	Model	Description
2901856	SC2600/2900-0.5	Ethernet interface cable, 0.5m
2901857	SC2600/2900-2	Ethernet Interface cable, 2m
2901858	SC2600/2900-5	Ethernet Interface cable, 5m
2901769	SC2600/2900-10	Ethernet Interface cable, 10m
2901859	SC2600/2900-15	Ethernet Interface cable, 15m
2901783	SC2600/2900-20	Ethernet Interface cable, 20m
2901860	SC2600/2900-35	Ethernet Interface cable, 35m

*Version suitable for use with robots is available



Ethernet connecting cable



Multi-function cable

Multi-function cable, qualified for drag chain use*

Part. No.	Model	Description
2901988	PC2600/2900-2	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 2m
2901868	PC2600/2900-5	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 5m
2901767	PC2600/2900-10	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex),10m
2901989	PC2600/2900-15	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 15m
2901869	PC2600/2900-20	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 20m
2901966	PC2600/2900-25	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 25m
2901990	PC2600/2900-35	multi-function cable, power supply, digital inputs (TTL or HTL), RS422 (half-duplex), 35m

*Version suitable for use with robots is available

Accessories

Part. No.	Model	Description
0323478	Connector/12-pol/LLT2600-2900/PS/RS422/DigIN	Connector multifunction port for series scanCONTROL 2600/2900
0323479	Connector/8-pol/LLT2600-2900/Ethernet	Connector for Ethernet port for series scanCONTROL 2600/2900
2420067	PS2600/2900	Wall power supply for scanCONTROL 2600/2900
0254058	Suitcase scanCONTROL	Transport suitcase for scanCONTROL sensors, incl. measuring stand

Output Unit

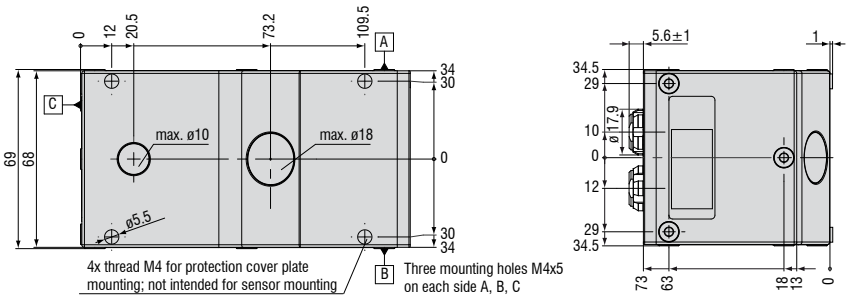
6414073	Output Unit Basic/ET	Fieldbus coupler with filter module and bus end terminal
0325131	OU-DigitalOut/8-channel/DC24V/0.5A/negative	8-channel digital output terminal; DC 24V; 0.5A; negative switching;
0325115	OU-DigitalOut/8-channel/DC24V/0.5A/positive	8-channel digital output terminal; DC 24V; 0.5A; positive switching
0325116	OU-AnalogOut/4-channel/±10V	4-channel analog output terminal; ±10V
0325135	OU-AnalogOut/4-channel/0-10V	4-channel analog output terminal; 0-10V
0325132	OU-AnalogOut/4-channel/0-20mA	4-channel analog output terminal; 0-20mA
0325133	OU-AnalogOut/4-channel/4-20mA	4-channel analog output terminal; 4-20mA

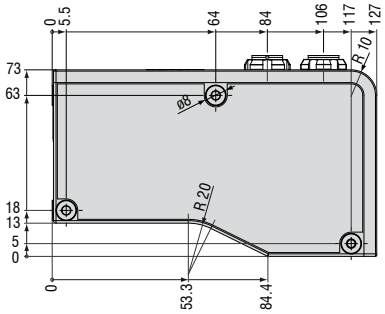
Further terminals are available on request.

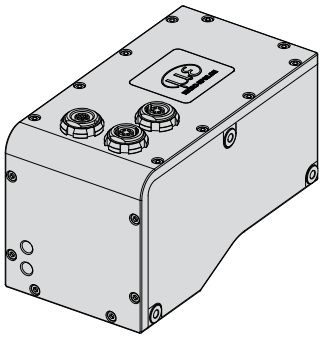
	Model	gapCONTROL	2711-25	2711-50	2711-100
z-axis (height)	Standard measuring range	Start of measuring range	90mm	175mm	350mm
		Midrange	102.5mm	200mm	400mm
		End of measuring range	115mm	225mm	450mm
	Extended measuring range	Start of measuring range	85mm	160mm	300mm
		End of measuring range	125mm	260mm	600mm
	Linearity [1]	(3sigma)	±0.2% FSO		
		(2sigma)	±0,13% FSO		
	Reference resolution [2] [3]		4µm	10µm	15µm
x-axis (width)	Standard measuring range	Start of measuring range	23mm	44mm	88mm
		Midrange	25mm	50mm	100mm
		End of measuring range	27mm	56mm	112mm
	Extended measuring range	Start of measuring range	22mm	41mm	76mm
		End of measuring range	29mm	64mm	148mm
	Resolution x-axis		640 points/profile		
	Profile frequency		up to 100Hz		
	Interfaces	Ethernet GigE-Vision [6]	Output of measurement values Sensor control Profile data transmission		
		RS422	Output of measurement values Sensor control Trigger Encoder Synchronisation		
	Measurement value output		Ethernet (UDP / Modbus TCP) RS422 (ASCII / Modbus RTU) [4] Analog [5] Switching signal [5]		
	Display (LED)		1x laser ON/OFF, 1x power/error/status		
	Light source	standard	Semiconductor laser 658nm (red)		
		optional	-	-	Semiconductor laser 405nm (blue)
	Aperture angle laser line		20°		
	Laser power	standard	10 mW (class 2M)		
		optional	20 mW (class 3B)		
	Laser off	optional	via external contact		
	Permissible ambient light (fluorescent light) [2]		10.000lx		
	Protection class		IP 64		
	EMC		acc. EN 61326-1: 2006-10 DIN EN 55011: 2007-11 (group 1, class B) EN 61000-6-2: 2006-03		
	Vibration		2g / 20 ... 500Hz		
	Shock		15g / 6ms		
	Operating temperature		0°C to 50°C		
	Storage temperature		-20°C to 70°C		
	Dimensions		127 x 69 x 73mm	142 x 69 x 73mm	170 x 69 x 73mm
	Weight		~700g	~800g	~850g
	Supply		8-30 VDC, 500mA		

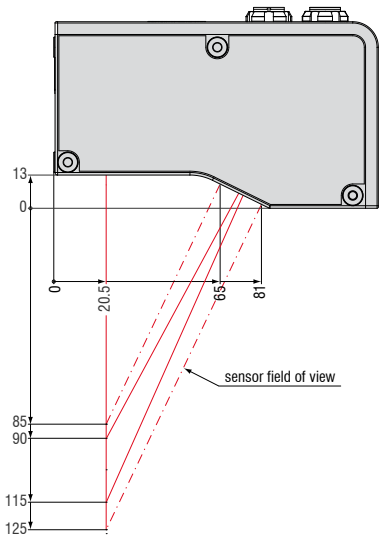
[1] Standard measuring range
[2] Measuring object: Micro-Epsilon standard object (metallic, diffusely reflecting material)
[3] According to a one-time averaging across the measuring field (640 points)
[4] RS422 interface can be programmed as serial interface or as input for trigger / Synchronisation
[5] Only with Output Unit
[6] Optionally available as FireWire interface
FSO = Full scale output

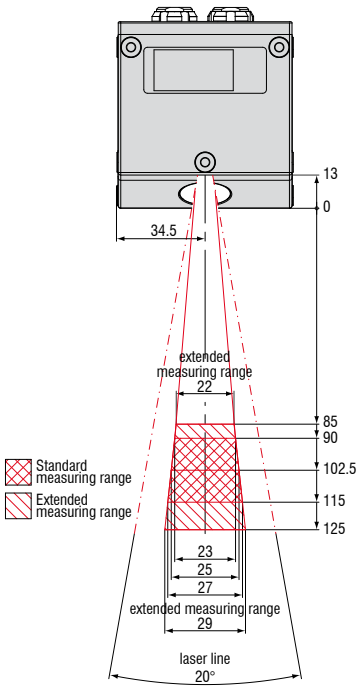
gapCONTROL 2711-25



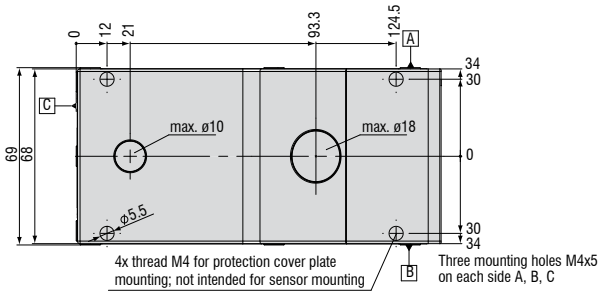


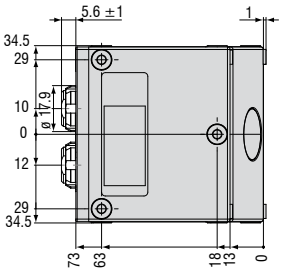


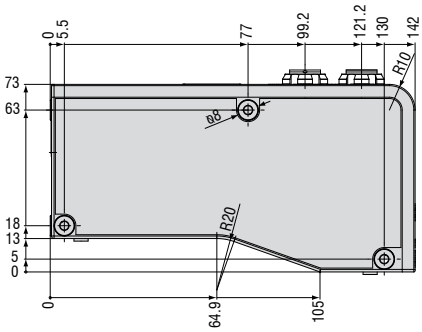


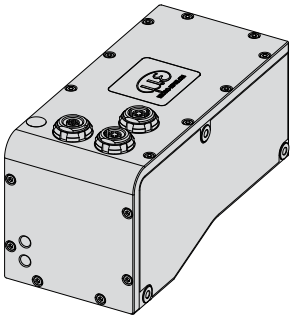


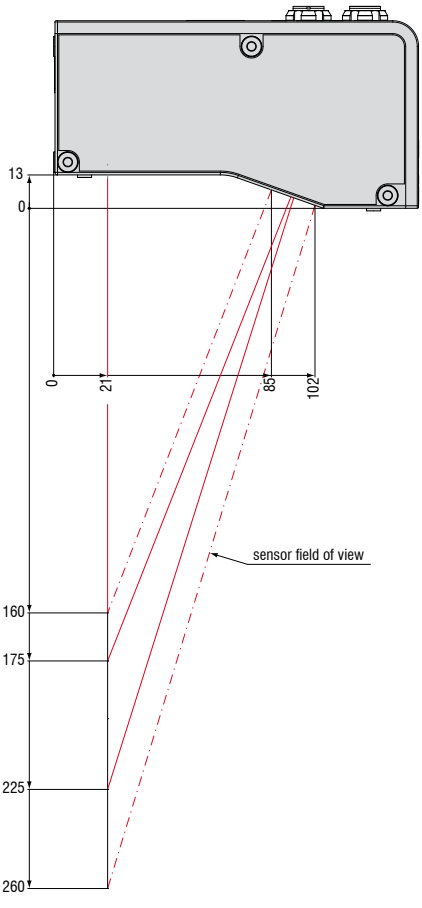
gapCONTROL 2711-50

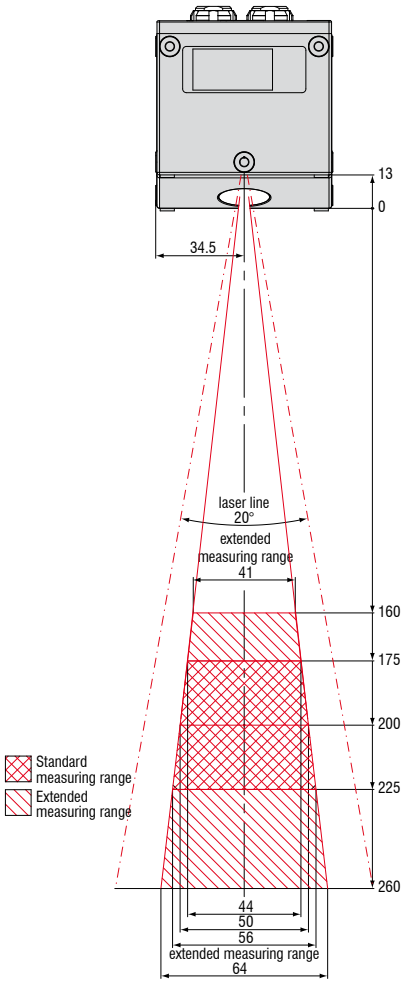




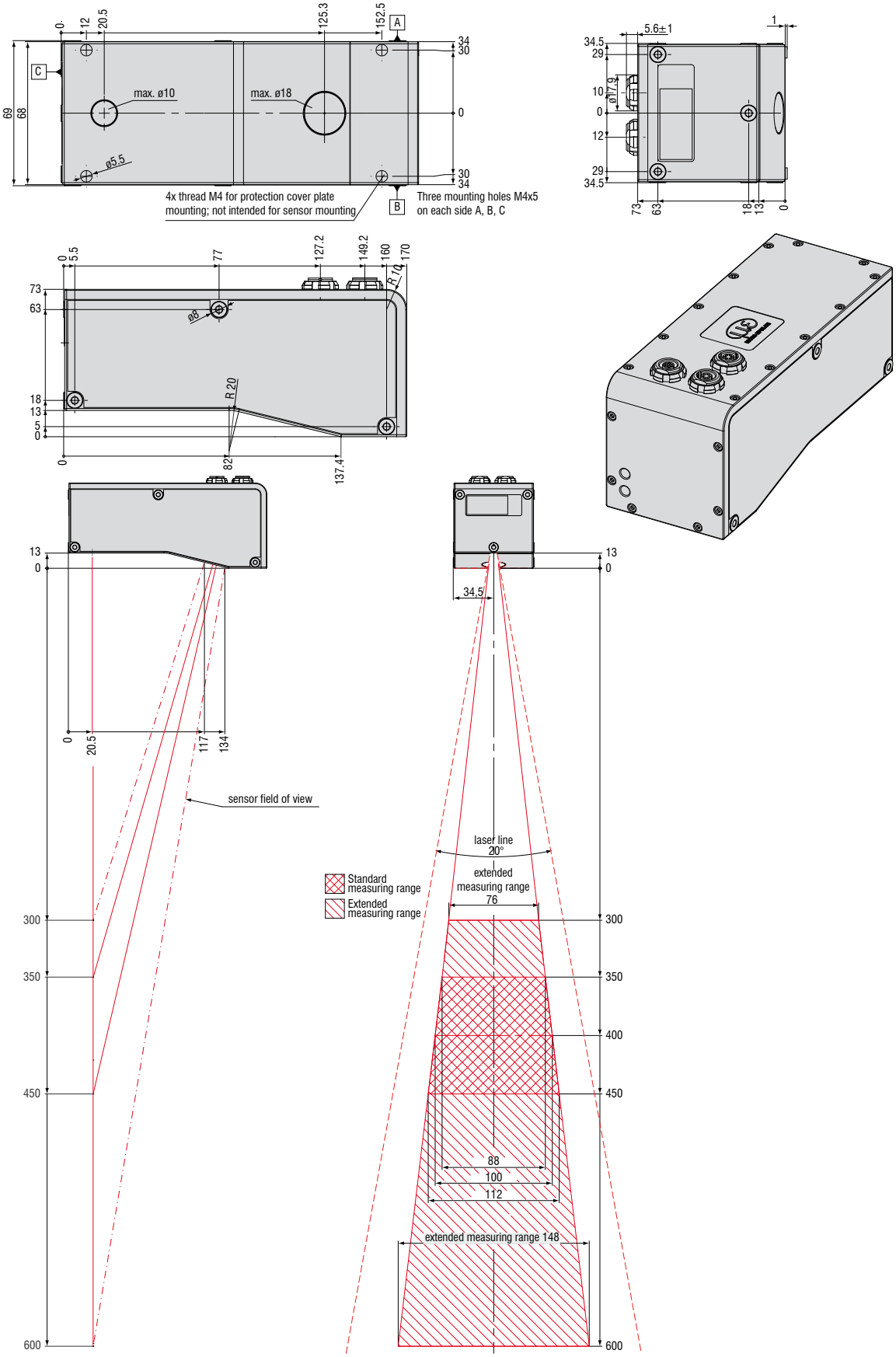








gapCONTROL 2711-100



Connecting cables for power supply and interfaces

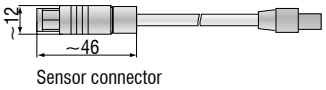
Ethernet connecting cables, qualified for drag chain use

Part. No.	Model	Description
2901512	SC2700-2/ET	Ethernet connecting cable 2m
2901513	SC2700-5/ET	Ethernet connecting cable 5m
2901514	SC2700-10/ET	Ethernet connecting cable 10m
2901515	SC2700-15/ET	Ethernet connecting cable 15m
2901516	SC2700-20/ET	Ethernet connecting cable 20m
2901640	SC2700-35/ET	Ethernet connecting cable 35m

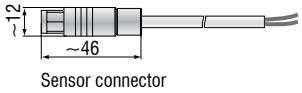
Ethernet connecting cables, qualified for robotic use

Part. No.	Model	Description
2901542	SCR2700-2/ET	Ethernet connecting cable 2m
2901543	SCR2700-5/ET	Ethernet connecting cable 5m
2901544	SCR2700-10/ET	Ethernet connecting cable 10m
2901545	SCR2700-15/ET	Ethernet connecting cable 15m
2901546	SCR2700-20/ET	Ethernet connecting cable 20m
2901702	SCR2700-35/ET	Ethernet connecting cable 35m

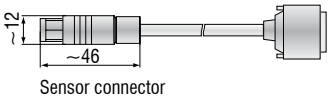
Ethernet connecting cable RJ45



External power supply cable



RS422 interface cable



Other cables

Part. No.	Model	Description
2901407	PC2700-4,5	Power supply cable, 4.5m
2901406	SC2700-4,5/RS422	RS422 interface cable, 4.5m
2901581	SC2700-0,5/SYNC	Synchronisation cable for two scanCONTROL 2700 sensors

Accessories

Part. No.	Model	Description
0323399	Plug/8-pol/LLT2700/Ethernet	Connector for Ethernet port for series scanCONTROL 27xx
0323320	Connector/6-pin/LLT2700/power supply	Connector for power port for series scanCONTROL 27xx
0323351	Connector/6-pin/LLT2700/RS422	Connector for RS422 port for series scanCONTROL 27xx
2420059	PS2700	Power supply für suitcase scanCONTROL 2700
0254058	Suitcase scanCONTROL	Transport suitcase for scanCONTROL sensors, incl. measuring stand

Output Unit

6414073	Output Unit Basic/ET	Fieldbus coupler with filter module and bus end terminal
0325131	OU-DigitalOut/8-channel/DC24V/0.5A/neg.	8-channel digital output terminal; DC 24V; 0.5A; negative switching;
0325115	OU-DigitalOut/8-channel/DC24V/0.5A/pos.	8-channel digital output terminal; DC 24V; 0.5A; positive switching
0325116	OU-AnalogOut/4-channel/±10V	4-channel analog output terminal; ±10V
0325135	OU-AnalogOut/4-channel/0-10V	4-channel analog output terminal; 0-10V
0325132	OU-AnalogOut/4-channel/0-20mA	4-channel analog output terminal; 0-20mA
0325133	OU-AnalogOut/4-channel/4-20mA	4-channel analog output terminal; 4-20mA

Further terminals are available on request.

Protective shield, fixed on the sensor (with or without air supply)

Part. No.	Model	Description
2105029	PS-LLT2700-25	protective shield, mounted
2105028	PS-LLT2700-25/AIR	protective shield with air supply, mounted
2105027	PS-LLT2700-50	protective shield, mounted
2105026	PS-LLT2700-50/AIR	protective shield with air supply, mounted
2105025	PS-LLT2700-100	protective shield, mounted
2105024	PS-LLT2700-100/AIR	protective shield with air supply, mounted

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Sensors and measurement devices for non-contact temperature measurement

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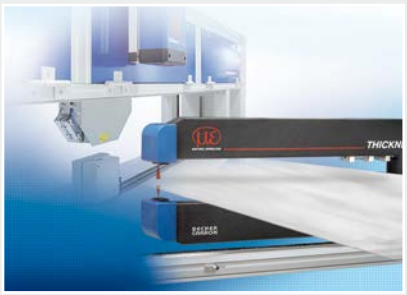
Optical micrometers, fibre optic sensors and fibre optics

Colour recognition sensors, LED analyzers and colour online spectrometer



Measurement and inspection systems

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