MICRO-EPSILON

LASER OPTICAL PRINCIPLE

NEW

scanCONTROL 2800

Very high-speed
profile measurement for
industrial in line applications.

**High accuracy and
very high frame frequency**
thanks to
- **innovative
  CMOS-technology**
- **high-performance
  signal processing unit**
- **flexible field of view**

2D/3D profile sensor
scanCONTROL 2800

Measuring principle

The laser-line profile sensor scanCONTROL 2800 makes use of the triangulation principle for two-dimensional acquisition of profiles on the most varied target surfaces.
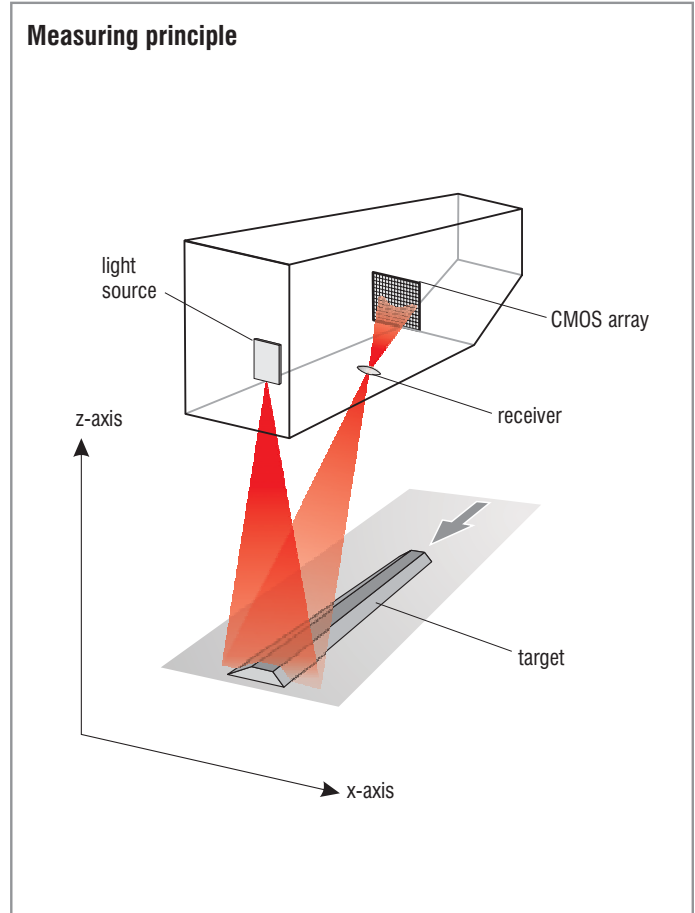
In contrast to familiar point laser sensors, a line optical system projects a laser line onto the surface of the object to be measured. The back scattered light from the laser line is registered on a CMOS array by a high quality optical system.

Along with distance information (z-axis), the controller also computes the true position along the laser line (x-axis) from the camera image and outputs both values in the sensor two-dimensional coordinate system.

A moving object or a scanning sensor will genera-te three-dimensional representation of the object.

System configuration

scanCONTROL consists of a compact sensor and an intelligent controller connected together via cable of variable length. The controller outputs measurement raw data computed from both axes (standard) as well as related values of geometrical features (optional).

Thanks to its exceptional speed of measuring and real time data output synchronisation scanCONTROL is not limited in its applications and is ideally suited for industrial in line inspection. The integrated FireWire interface enables scanCONTROL to be fully controlled from a PC, while insuring high data output rates and simultaneously preserving the bandwidth. Integrated via a PCI card in the bus system, FireWire also facilitates control of several scanCONTROL systems from one PC.

Three ways of creating the application:

- PC solutions with the customer's own software (C++ library included in supplied items).
- PC solutions with the ICONNECT modular software with ready-made standard modules for control and evaluation.
- Integrated software packages (optional) in the digital signal processor (DSP) of the controller.

Measuring principle

Measuring principle

light source
CMOS array
receiver
z-axis
target
x-axis

Sensor LLT 2800

Controller LLT 2800

Special performance features

scanCONTROL has been developed for industrial applications. In this respect, innovative technologies are employed through which the functionality of the system and adaptability to different applications are substantially increased.

Synchronous measurement through synchronous illumination

scanCONTROL uses an innovative CMOS array with a global, electronic shutter (high speed shutter) instead of a "rolling shutter" used in conventional scanners.
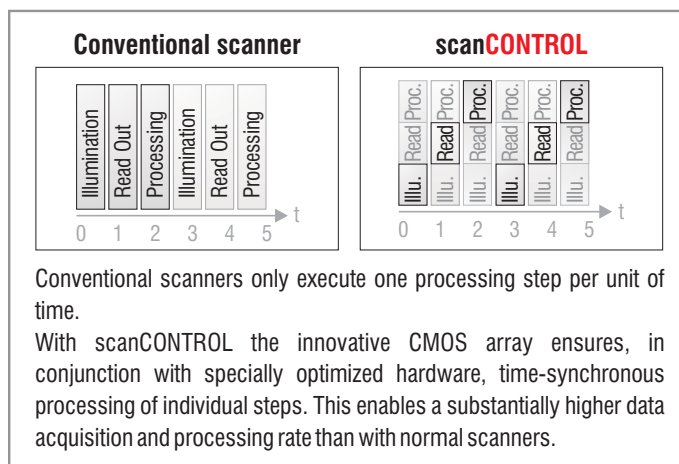
Measurement therefore occurs synchronously along the laser line, thus eliminating any distortion of the measurement image due to scanning.

The shutter can in addition be controlled in real time via an external trigger input (on the controller). The additional trigger input eases synchronizing several scanCONTROL systems together.

The real time shutter renders the measurement system nearly independent of scanning or object displacement speed and acceleration. This is an important advantage in achieving short throughput times, particularly in automation where varying acceleration levels often occur in processes.

Innovative high performance CMOS array

A specially developed high performance CMOS array supports the illumination of the next image while the current image is still being read out. This means that for the same laser class higher measuring frequencies are achieved even with shiny or strongly absorbing surfaces.

Conventional scanners only execute one processing step per unit of time.

With scanCONTROL the innovative CMOS array ensures, in conjunction with specially optimized hardware, time-synchronous processing of individual steps. This enables a substantially higher data acquisition and processing rate than with normal scanners.
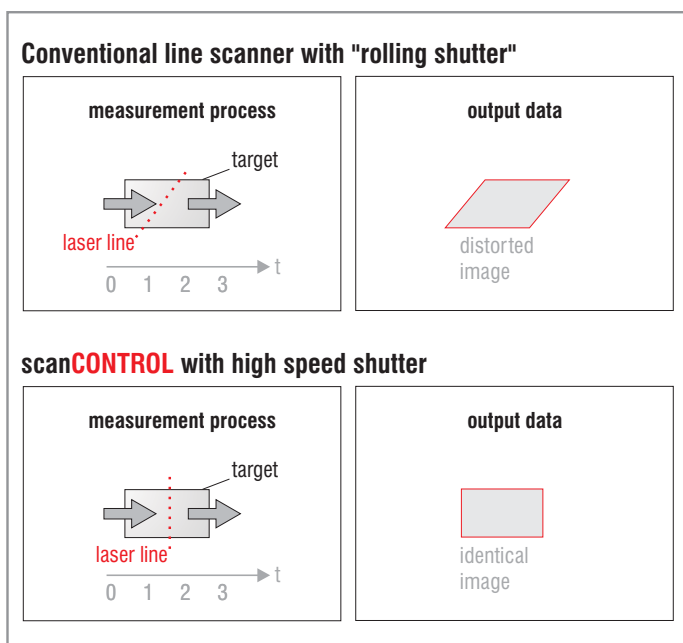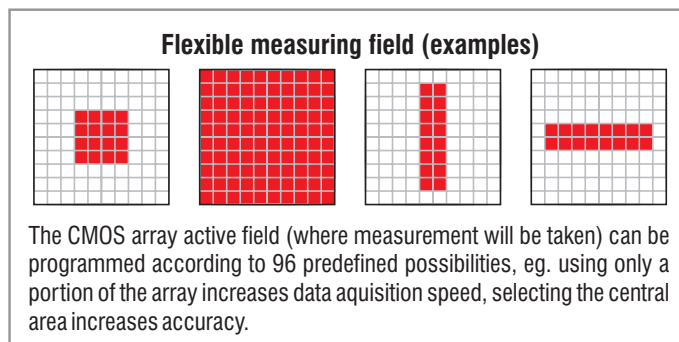
Flexible measuring field

According to application, user may parameter the sensor privileging either data acquisition speed or width and/or depth of measuring field. The sole limit is acquisition of a max. of 256,000 points/sec eg.: user can elect to measure

256 points/profile: at profile frequency of **1000 profiles/sec**
512 points/profile: at profile frequency of **500 profiles/sec**
**1024 points/profile:** at profile frequency of **250 profiles/sec**

On top of speed and number of points selection, user can also decide width of profile line and depth of measuring field eg.: 512 points over a narrow profile thus increasing lateral resolution (for edge detection) or 256 points over a large profile to increase digitising speed (typical for large surface inspection) or any other combination among 96 possible.


Conventional line scanner with "rolling shutter"

scanCONTROL with high speed shutter

Flexible measuring field (examples)

The CMOS array active field (where measurement will be taken) can be programmed according to 96 predefined possibilities, eg. using only a portion of the array increases data aquisition speed, selecting the central area increases accuracy.
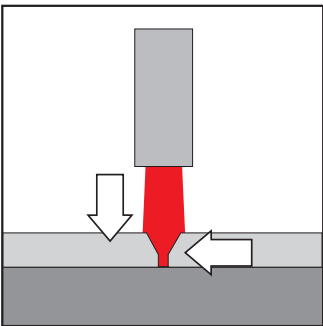
Applications

scanCONTROL 2800 is designed for applications in industrial environments. High measuring rate and accuracy make the system ideally suited for applications requiring highest precision with short cycle times.
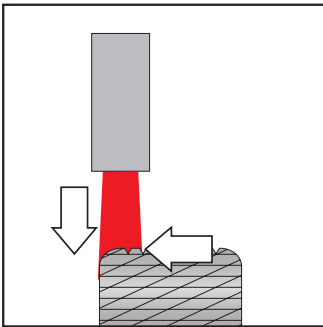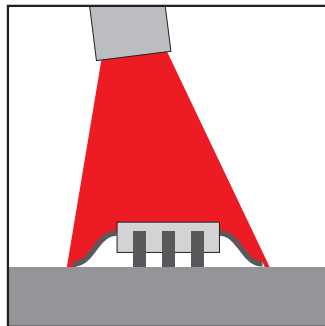

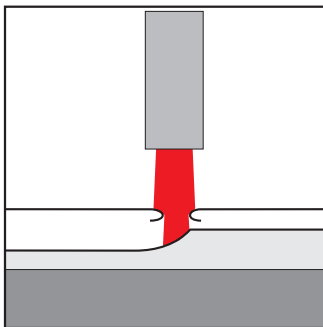Tire profile
Tire roundness
Tire deformation
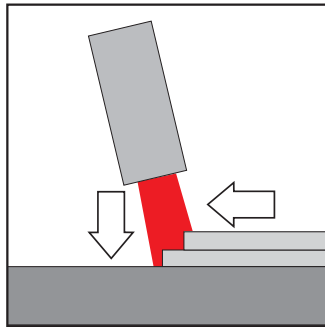
Edge detection
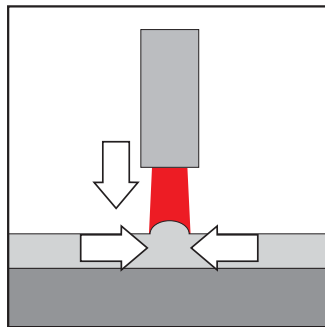Positioning
Height profile

Groove width and depth
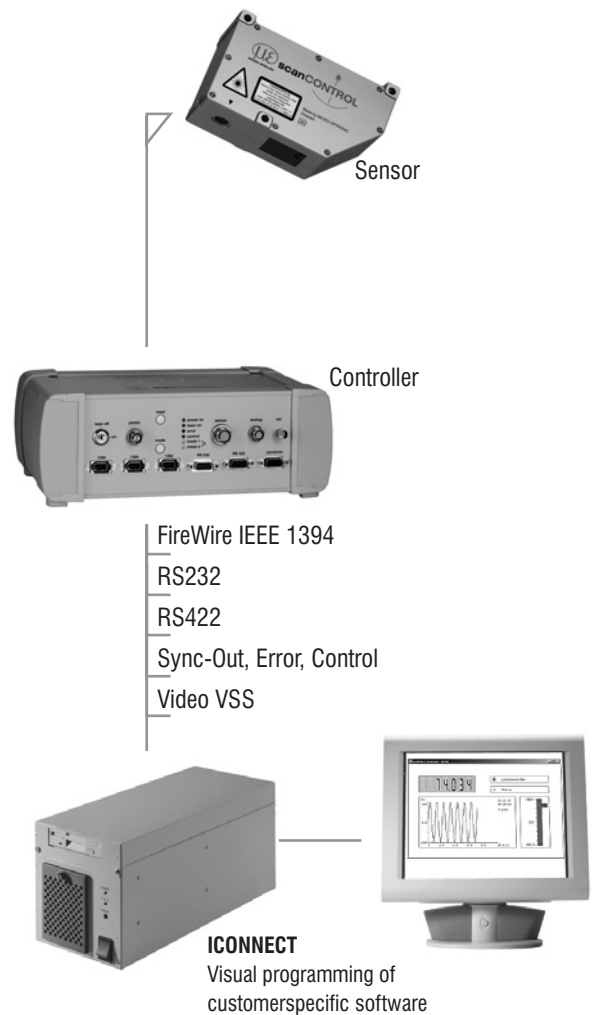Robot guidance

Coplanarity
Deformation
Lead position

Gap and flush
Door edges

Welding seam inspection
Glue bead inspection
Profile monitoring

scanCONTROL and ICONNECT

The link between the FireWire high speed interface and the MICRO-EPSILON real-time software ICONNECT opens up an unlimited number of possible applications for scanCONTROL. Using the graphic user interface in ICONNECT, it is very easy for user to generate applications of their own. The modular programming principle allows complex links to be produced with just a mouse click. The real-time capability and high data throughput of ICONNECT supplement and support the high processing speed of scanCONTROL. Data are recorded, processed and visually displayed in real time, even at the highest scanning rate. ICONNECT can also be used as the real time control software and then acts as a line PLC.

Sensor

Controller

FireWire IEEE 1394

RS232

RS422

Sync-Out, Error, Control

Video VSS

ICONNECT
Visual programming of
customerspecific software

| Model	LLT2800-25		LLT2800-100	
Standard ranges, extended range in brackets (±5%)				
Measuring range z-axis	25 (55) mm	0.98" (2.17")	100 (245) mm	3.94" (9.65")
Start of measuring range (SMR)	62.5 (50) mm	2.46" (1.96")	145 (115) mm	5.71" (4.53")
Reference distance, midrange (MMR)	75 (82.5) mm	2.95" (3.25")	195 (235) mm	7.68" (9.25")
End of measuring range (EMR)	87.5 (105) mm	3.44" (4.13")	245 (360) mm	9.65" (14.17")
Resolution z-axis *	0.04%			
	10 μm		40 μm	
Linearity z-axis, ±3σ♂	±0.2 %			
	±50 μm		±200 μm	
Measuring range x-axis — SMR	13 (23) mm	0.51" (0.91")	30 (50) mm	1.18" (1.97")
Measuring range x-axis — EMR	18 (41) mm	0.70" (1.61")	50 (140) mm	1.97" (5.51")
Laser aperture angle	30 °			
Resolution x-axis	**256 / 512 points/profile (1024 points/profile)******			
Linearity x-axis, ±3σ♂	±0.4 %			
	SMR 60 μm / EMR 80 μm		SMR 120 μm / EMR 200 μm	
Profile frequency	**to 1000 profiles/s**			
Measuring rate	**256,000 points/s**			
Light source	laser diode 655 nm, 15 mW			
Laser class	class 2M			
Laser off	remote - input and key switch			
Permissible ambient light (fluorescent light)	10,000 lx			
Protection class — sensor	IP 64			
Protection class — controller	IP 40			
Operating temperature	0...50 °C / 32...122 °F			
Storage temperature	-20...70 °C / -4...158 °F			
Weight — sensor	350 g		400 g	
Weight — controller	3.5 kg			
Sensor cable standard length	2 m			
Output analog				
preprogrammed x- and z-axis, alternative profile parameter **	±10 V (16 bit, up to 150 kHz)			
Output/Input digital				
Interface (measurement data and control commands)	3x IEEE 1394 („FireWire"), 400 MBit/s (similar DCAM 1.30)			
	1x RS232 (115200 Baud)			
	1x RS422 (115200 Baud)			
Synchron-connector, input ***	sync-in, remote laser ON/OFF, mode			
Synchron-connector, output ***	sync-out, error, user mode (2x)			
Video signal (test and set up mode)	1 V_{SS} (BAS-signal, 8-bit-grey)			
Supply	24 VDC (±15 %) / 0.5 A			

ll specifications apply for a diffusely reflecting matt white ceramic target - marginal position tolerance of the measuring-field is possible (sensor depending)   SMR = Start Measuring Range EMR = End of Measuring Range

 * for standard measuring ranges (512 points/profile preprogrammed)

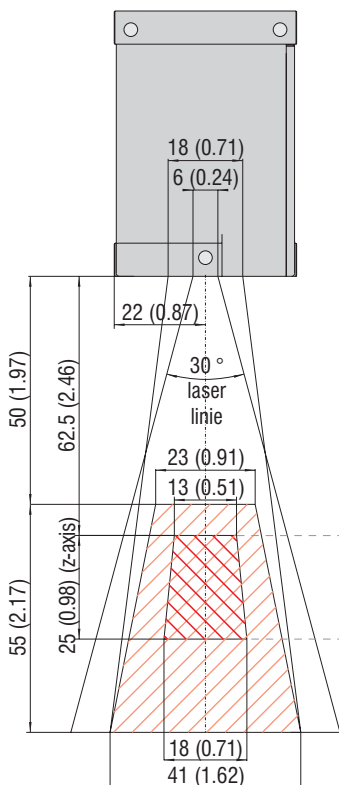** only for preprogrammed data, e.g. gap edge position, gap width, step heigth, angle
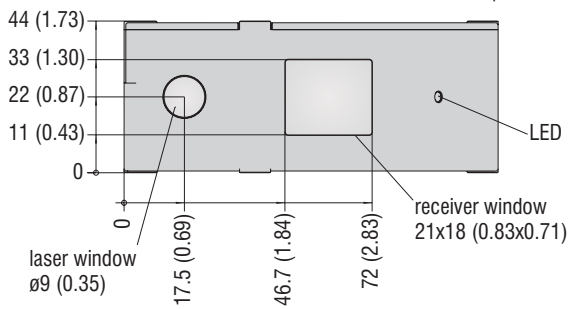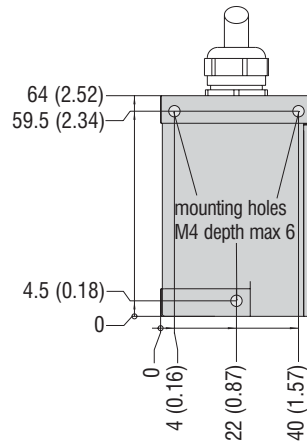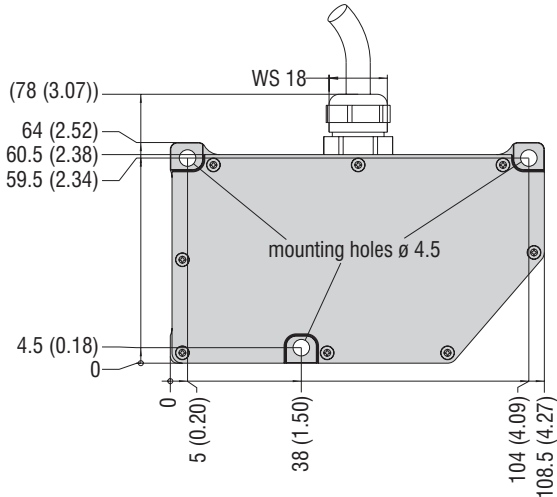
*** preprogrammed, other function possible

**** optional 1024 points/profile only in extended range

LASER RADIATION
CLASS II LASER
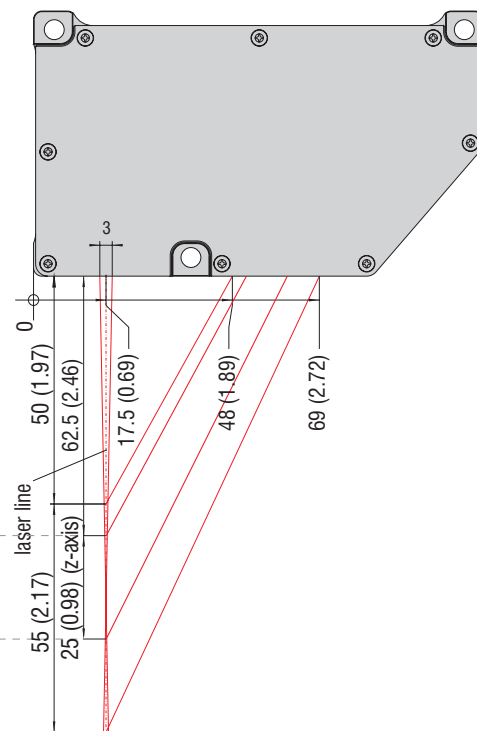P≤15 mW; E≤70 W/m²; λ=655 nm
DO NOT STARE INTO BEAM
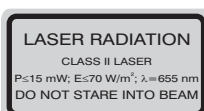
The laser unit of scanCONTROL 2800 uses a semiconductor laser with a wavelengh of 655 nm (visible/red) and 15 mW optical output (class 2M). The sensor is classified as laser class 2M. A warning sign is attached to the sensor housing.

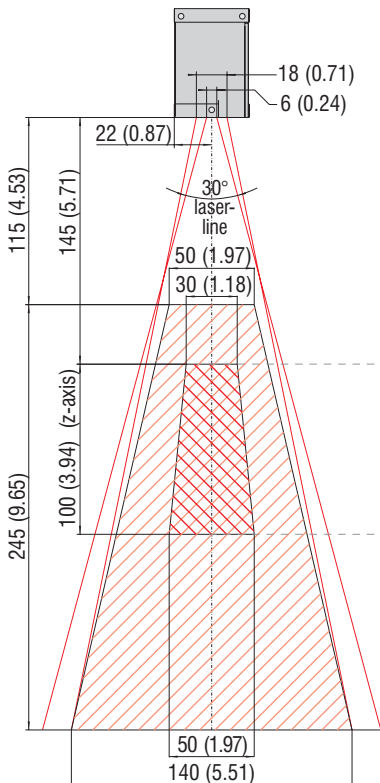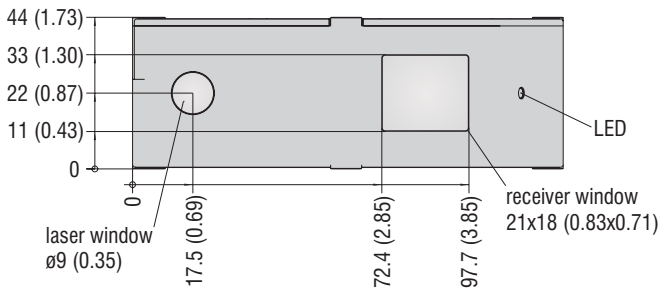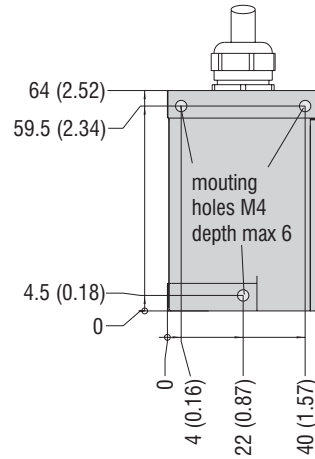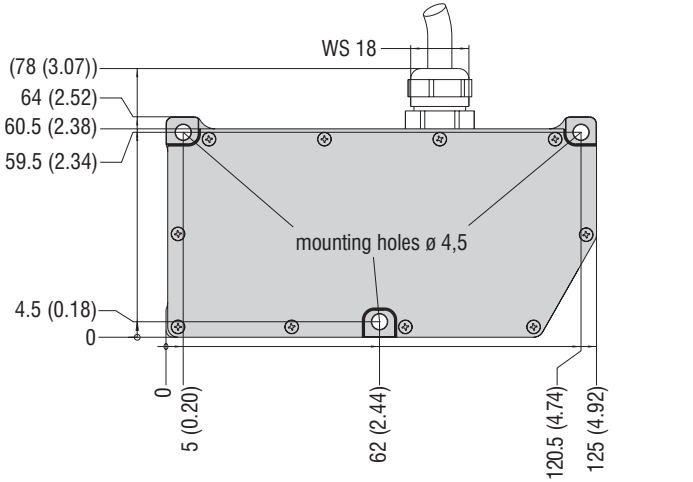# scanCONTROL 2800-25 Dimensions in mm (inch), not to scale

WS 18

(78 (3.07))
64 (2.52)
60.5 (2.38)
59.5 (2.34)

mounting holes ø 4.5

4.5 (0.18)
0

0
5 (0.20)
38 (1.50)
104 (4.09)
108.5 (4.27)

64 (2.52)
59.5 (2.34)

mounting holes
M4 depth max 6

4.5 (0.18)
0

0
4 (0.16)
22 (0.87)
40 (1.57)

44 (1.73)
33 (1.30)
22 (0.87)
11 (0.43)
0

LED

0
17.5 (0.69)
46.7 (1.84)
72 (2.83)

laser window
ø9 (0.35)

receiver window
21x18 (0.83x0.71)

18 (0.71)
6 (0.24)

22 (0.87)

30 °
laser
linie

23 (0.91)
13 (0.51)

50 (1.97)
62.5 (2.46)
25 (0.98) (z-axis)
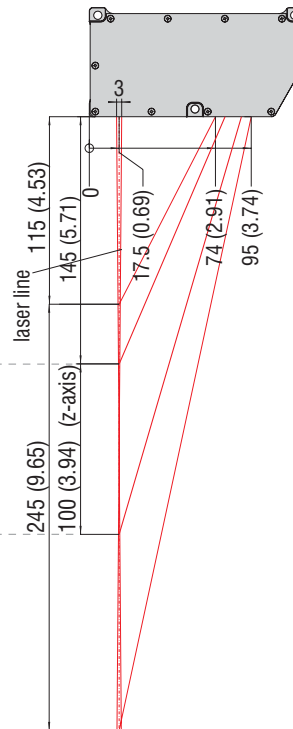55 (2.17)

18 (0.71)
41 (1.62)

standard measuring range

extended measuring range

3

0

50 (1.97)
62.5 (2.46)
17.5 (0.69)
48 (1.89)
69 (2.72)

laser line

55 (2.17)
25 (0.98) (z-axis)

Marginal position tolerance of the
measuring-field is possible (sensor depending)

scanCONTROL 2800-100 Dimensions in mm (inch), not to scale

WS 18

(78 (3.07))
64 (2.52)
60.5 (2.38)
59.5 (2.34)

mounting holes ø 4,5

4.5 (0.18)
0

0
5 (0.20)
62 (2.44)
120.5 (4.74)
125 (4.92)

64 (2.52)
59.5 (2.34)

mouting
holes M4
depth max 6

4.5 (0.18)
0

0
4 (0.16)
22 (0.87)
40 (1.57)

44 (1.73)
33 (1.30)
22 (0.87)
11 (0.43)
0

LED

0
17.5 (0.69)
72.4 (2.85)
97.7 (3.85)

laser window
ø9 (0.35)

receiver window
21x18 (0.83x0.71)

18 (0.71)
6 (0.24)
22 (0.87)

3

30°
laser-
line

50 (1.97)
30 (1.18)

115 (4.53)
145 (5.71)
245 (9.65)
100 (3.94) (z-axis)

50 (1.97)
140 (5.51)

laser line
115 (4.53)
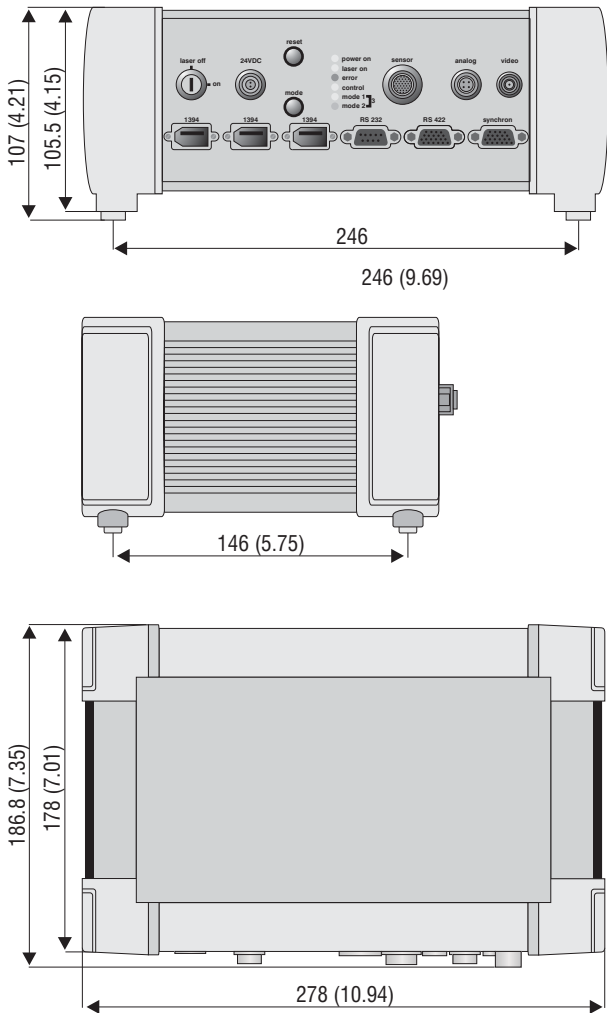145 (5.71)
245 (9.65)
100 (3.94) (z-axis)

0
17.5 (0.69)
74 (2.91)
95 (3.74)

standard measuring range

extended measuring range

Marginal position tolerance of the
measuring-field is possible (sensor depending)

Typical system includes (standard)

- ICONNECT-demonstration software (FireWire interface)
- Stand alone demo-software (standard FireWire or
  serial interface RS232)
- C++ library for customer-specific application
- IEEE 1394 cable
- Calibration certificate

Accessories (optional)

- Sensor extension cable 3 m or 8 m
- Cable analog output
- Interface card IEEE 1394
- ICONNECT modular software

MICRO-EPSILON