

# $\mu$ SPEED - Product Overview

Non-Contact Length & Speed Measurement  
Laser-Encoder  $\mu$ SPEED

Product Overview  
Q1/2019 - Version 1.0

## Product Information

μSPEED gauges are capable of measuring speed and length without contact to the moving material surface. The μSPEED Laser-Encoder systems replace tactile measurement solutions as e.g. contact wheels, which tend to measurement errors caused by slippage, chatter, dirt build-up and day to day wear problems. The maintenance free and long term calibrated μSPEED gauges measure nearly all surfaces without parameter setting.

Most important system features:

- material independent
- long term calibrated
- 0 m/s up to 100 m/s
- bidirectional measurement
- typ. accuracy better  $\pm 0,5$  m at 1 km
- accredited calibratable acc. MID 2014/32/EU

## Benefits

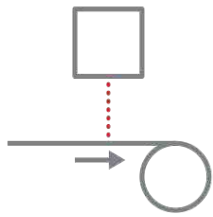
### compared to tactile measurement systems :

- self-monitoring
- non-contact, no slippage
- maintenance free and permanently calibrated
- measurement independent from material, surface structur, thickness, elasticity
- can not damage material surface
- high accuracy, high repeatability

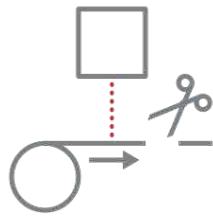
### compared to other non-contact devices:

- the most compact gauge in class
- the most easy to handle gauge (plug & play)
- non-contact direction detection
- non-contact zero speed measurement
- no parameter setting necessary
- permanently calibrated
- long laser lifetime
- optimum price performance ratio
- accredited calibratable acc. MID 2014/32/EU
- Made in Germany

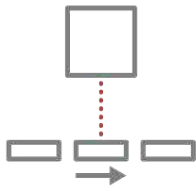




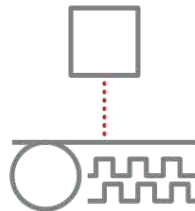
Roll / Spool Length



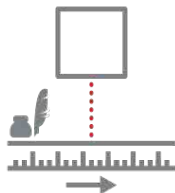
Cut-to-length Control



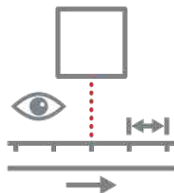
Discrete Part Length



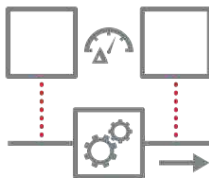
Counter Calibration



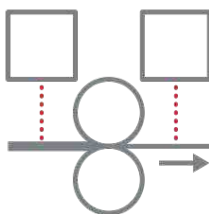
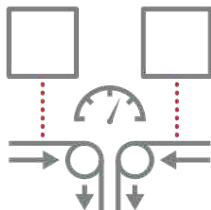
Print Mark Control



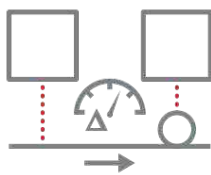
Pattern Repeat Length



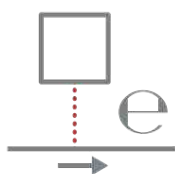
Difference Measurement Speed Balancing



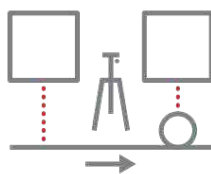
Elongation Ratio



Slippage Detection



Calibrated Length



Portable Measurement

## Application Overview

There are many different applications for the use of non-contact laser encoders:

### Roll / Spool Length / Cut-to-Length Control:

- Web, rolled and spooled materials, coils
- Textile, fabrics, carpet, nonwoven, felt
- Foil, film, tape, membranes, artificial leather, Roof foil, bitumen web, geo textile
- Printed and coated material
- Paper, corrugated paper, abrasive paper, packaging material
- Rubber, laminate, extrusion material
- Tube, hose, profile, bar
- Wire, cable, rope

### Discrete Part Length Measurement:

- Plate, panel, tube, bar, profile, rail
- Gypsum board, chip board, MDF panel
- Insulating panel, insulating board
- Wooden beam, panel, KVH structural timber
- Metal- and plastic tube
- Metal sheet and metal panel, slab

### Counter / Encoder Calibration:

- Calibration of machine counters
- Calibration of tachometers
- Portable calibration of several production lines

### Print Control:

- Printing of length scales
- Printing proportional to length

### Pattern Repeat Mark Measurement:

- Packaging film, wall paper, carpet
- Measurement of print pattern distances
- Setting of printing machines

### Difference Length / Speed Measurement:

- Speed balancing e.g. for lamination or coating
- Elongation speed ratio measurement
- Slippage detection (Cause study for surface errors, material and web breaks, detection of errors caused by wear and tear)

## Application Examples

μSPEED gauges are designed for all kinds of conveying processes, for frequent material starts and stops as well as for changes of material feeding direction.

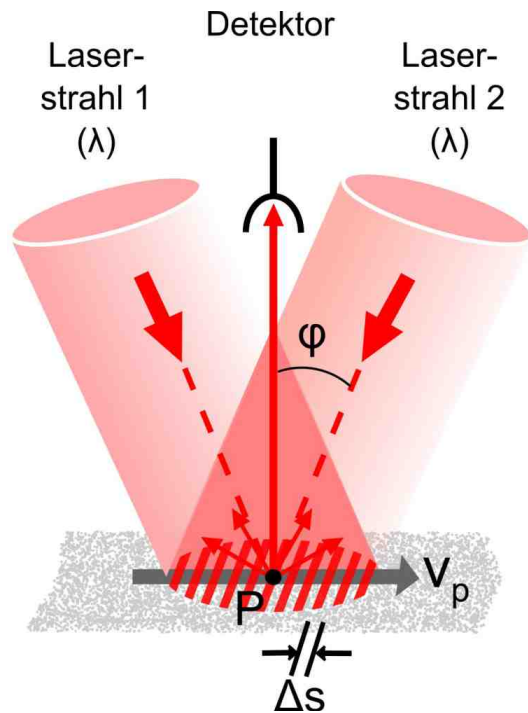
### μSPEED gauges

- work on almost any moving objects, such as  
Web and coiled material, tube, pipe, rod, sheet,  
plate, cylinder, roller, profile, wire, cable,  
yarn, rope
- are suitable for a wide range of applications e.g.  
Continuous length measurement,  
Cut-to-length control, Portable tachometer  
Calibration and differential speed  
measurement, Discrete part length  
measurement, Control of scale print marks
- can be found in various industrial sectors:  
Textile: fabrics, non-woven, felt and leather  
Plastics: film, foil and self adhesive tape,  
rubber, profile  
Metal: sheet, web, foil, profile, tube  
Reel goods: wire, cable, rope, fibre, yarn  
Paper: print and packaging paper, corrugated  
products and cardboard  
Hygiene and food as well as wood, glass and  
Ceramics and construction industry  
Machine building: converting industry





**Fig.:**  
Laser-Encoder - Measurement Principle



## Measurement Principle

μSPEED gauges operate according to the differential doppler method. Therefore two laser beams intersect at an angle φ to the optical axis on the surface of the measurement object. For a point P which moves with the velocity v through the point of intersection of the two laser beams, the frequencies of the two laser beams are doppler shifted.

The two laser beams are superimposed in the measurement volume, producing an interference pattern of light and dark stripes. The stripe spacing Δs is a constant which depends on the laser wavelength λ and the angle between the measurement beams 2φ:

$$\Delta s = \lambda / (2 \sin \varphi)$$

If a particle moves through the stripe pattern, the back-scattered light from the particle is modulated in its intensity. A photodetector in the sensor produces a signal whose frequency fD is directly proportional to the speed component of the surface in the measuring direction v<sub>p</sub> and:

$$fD = v_p / \Delta s = (2v / \lambda) \sin \varphi$$

fD = Doppler frequency

v<sub>p</sub> = Velocity vector in measuring direction

Δs = Stripe spacing in the measurement volume

The value of λ/sinφ is the measuring scale for speed and length measurement.

### Figures on page 4:

Example applications of non-contact length and speed measurement: Foil, timber, textile, cable, wire, steel rope, artificial leather, measurement of cylinder speeds

## Product Overview

### μSPEED-SMART

- High accuracy smartsensor (typ. better  $\pm 0,05$  %)
- Mid price category
- For standard rolling/ cutting processes
- Easy electrical and mechanical integration
- Calibratable length gauge acc. MID 2014/32/EU

### μSPEED-ECO

Identical to μSPEED-SMART(see above) apart from:

- Mid accuracy (better  $\pm 0,3$  %)
- Low price category

### μSPEED-PRO

Identical to μSPEED-SMART (see above) apart from:

- Non-contact bi-directional measurement
- Zero speed measurement
- For each kind of process including stop and go and direction changes
- Calibratable length gauge acc. MID 2014/32/EU

### MID-COUNTER & CONTROLLER

- Display and operator unit and controller
- Control functions for cut-to-length; good/waste length counting; internal memory; direct print-out control; measurement data logging
- For fix integration into machine or portable use
- For each kind of process including stop and go and direction changes
- MID-COUNTER for calibrated length measurement acc. to MID/2014/32/EU

### Accessories

- Equipment for portable use: tripod, fast installation devices, case
- PC software for configuration and monitoring
- Eifferential speed measurement software
- Display-units, counters and operator interfaces
- Accessories for accredited version acc. MID 2014/32/EU e.g. printer
- Protective housings, air and water conditioning



Fig. 1: μSPEED-SMART/-ECO/-PRO



Fig. 2: MID-COUNTER & μSPEED-CONTROLLER

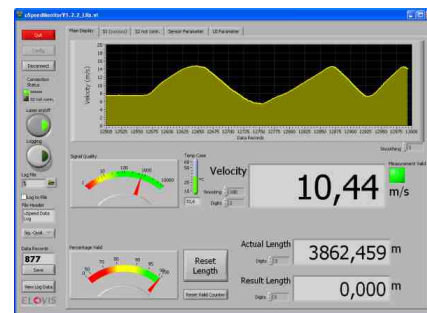


Fig. 3: PC-Software



Fig. 4: Big Display



Fig. 5: Tripod, Transportation Case

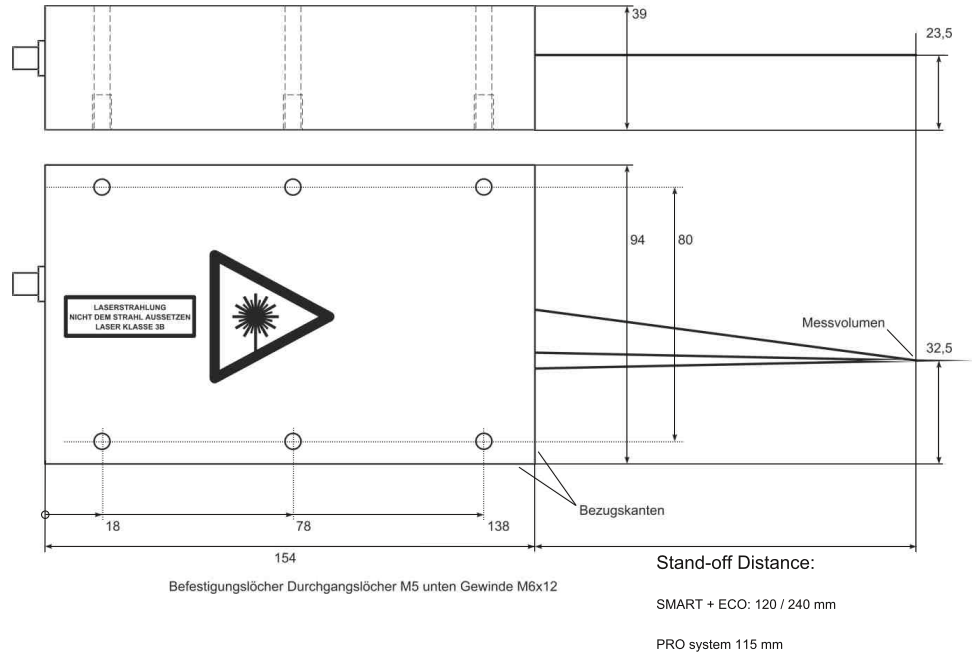
## Specifications

		μSPEED-PRO	μSPEED-SMART & SMART-ECO	μSPEED-CONTROLLER & MID-COUNTER
<b>Parameter</b>	<b>Unit</b>			
<b>Direction Detection</b>		YES non-contact	via external direction signal	acc. to type of gauge
<b>Zero Speed Measurement</b>		YES non-contact	NO	acc. to type of gauge
<b>Material Presence</b>		YES non-contact	optional non-contact	acc. to type of gauge
<b>Accuracy (typical) (2σ;L&gt;10m/3σ;L&gt;20m)</b>	%	± 0,05	SMART ± 0,05 SMART-ECO ± 0,3	acc. to type of gauge
<b>Repeatability</b>	%	± 0,02 (except SMART-ECO)		
<b>Gauge / Device Type</b>		Smart Sensor	Smart Sensor	Controller + Display
<b>Speed-Range</b>	m/min	0 to ± 1.200	1 to ± 6.000	acc. to type of gauge
	m/s	0-20	0,02-100	
<b>Stand-off Distances (Tolerances)</b>	mm	115±5 (±20)	120±5 (±20) 240±10 (±40)	
<b>Interfaces</b>		1 x RS-485 or RS-232 alternativ to I/Os: RS-422, RS-485		RS-232 Sensor, USB Ethernet, ...
<b>I/Os</b>	pls/m	Quadrature Output 1 to 100.000 (depending on max. speed) Input: Start, Gate, Direction, Laser Interlock Output: Status		Quadr.Out/Imp.Out RS-485 / RS-232 L-Reset, Direction, Gate Status
<b>I/O Type</b>		RS-422 level Laser Interlock (single, 24V)		4 x digital high speed I/O 5V or 24V level
<b>Data available</b>		Speed, Length, Signal Quality, Status, Laser Interlock, Valid, Measurements, Material Presence		
<b>Fieldbus</b>		Profibus, Ethernet-IP, Profinet (fieldbus optional)		MID-CNT: Available Protocols: SOAP, XML, JSON, UPD
<b>IP Code</b>		Sensor head: IP67		CONTR. & MID-CNT.: Front: IP51; Back: IP20
<b>Dimensions (LxWxH)</b>	mm	Sensor head: 154x94x39		CONTR.:236x166x126 mm MID-CNT: 96x96x160 mm
<b>Voltage</b>		24VDC (18 V to 30 V)		CONTR: 110-230VAC MID-CNT: 24VDC
<b>Weight</b>	kg	Sensor head: 1 kg		Controller: 2,5 kg MID-CNT: 1 kg
<b>Laser Data</b>		25mW, 780 nm (Laser class 3B)		
<b>Ambient temperature</b>		5 bis 55°C (41 to 131 °F) non condensing		
<b>Humidity</b>		Cooling/heating required outside this range		

Specifications are subject to change without notice.

## Dimensions

**Fig.:**  
**Sensor head**  
 identical measured  
 for all types of  
 sensors\_  
 (μSPEED-SMART,  
 -ECO, -PRO)







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Technical Data are subject to change without notice.