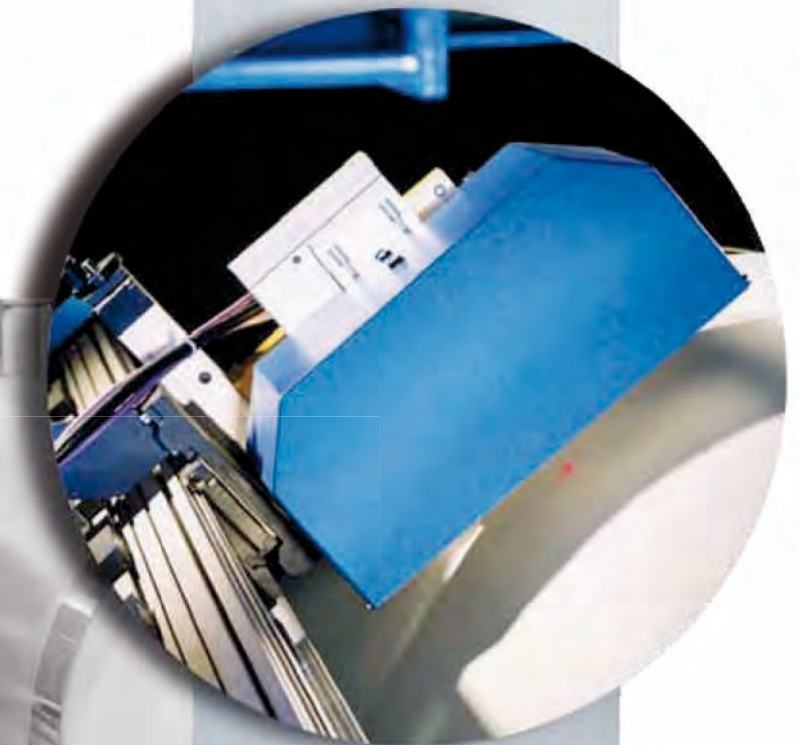
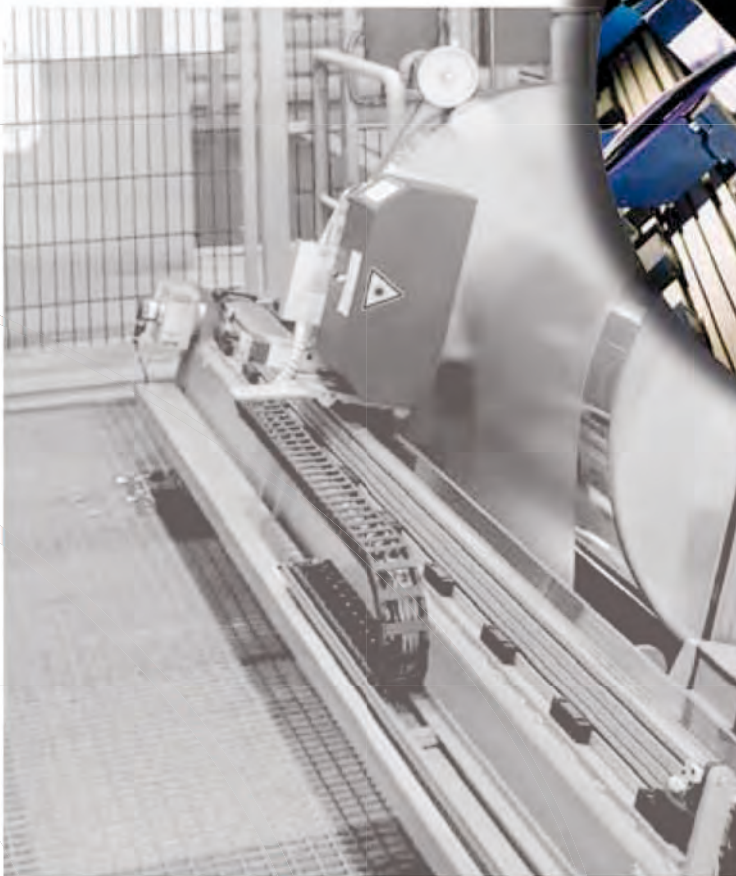


# Superfast Optical Roughness Measurement



- ▶ online
- ▶ contactless
- ▶ laser-optical

# SORM 3plus

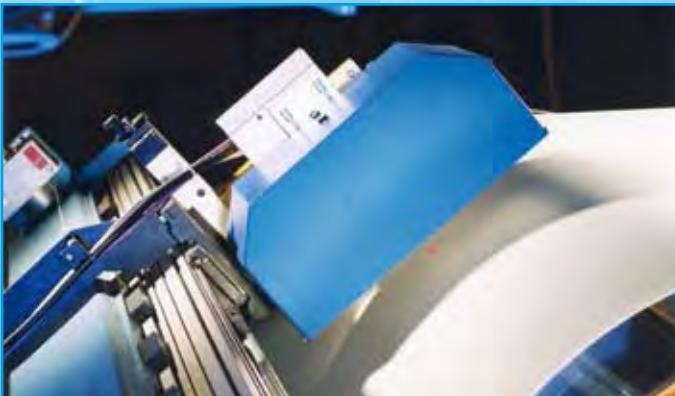
## Superfast Optical Roughness

### Operating principle

SORM 3plus (SORM = Superfast Optical Roughness Measurement) is a system enabling online measurement of roughness parameters during continuous strip processing. Increased requirements for new materials and more complex components call for ever increasing process safety. The roughness parameters are important quality feature of uncoated and surface refined strips. The traditional method of measurement involves using a mechanical stylus based instrument. For this purpose the operator must stop the production line or samples are taken from the end of the coil and measurements are made offline in the lab.

SORM 3plus, however, is a non-contact, online surface roughness measurement system that can be used for metallic and many non-metallic surfaces at strip speeds of up to 2400 m/min.

The surface roughness data are stored in the system computer, displayed to the operator and if needed are fed into a higher-level network. The operator is alerted, if the limited values preset by him are exceeded or if any changes within the line will jeopardize the production process. SORM 3plus calculates the roughness parameters as defined in the standards, such as the arithmetic average roughness (Ra) and the peak count (RPC).



*Installation in a continuous strip galvanising line*



*SORM application at a hot-dip galvanising line*

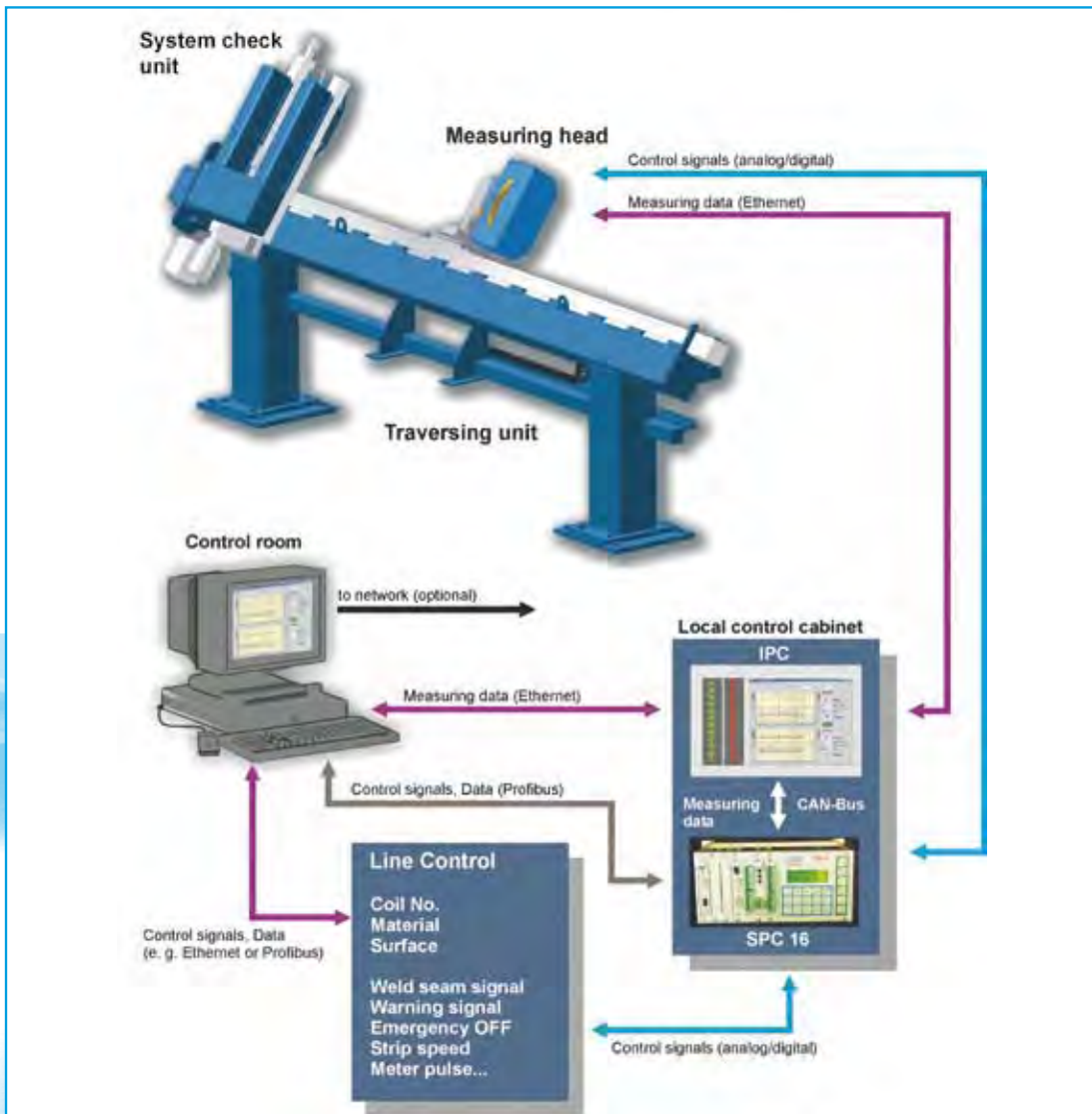
EMG Automation GmbH specialises in the automation of continuous production processes in the metal, paper and plastics industries as well as in the foil and tyre industries. The company, which was established in 1946, is a leading provider of electro hydraulic control systems. Furthermore, they provide quality assurance systems for the manufacturing industry.

Based on the combination of more than 60 years of experience, the quality of our products and complete solutions as well as our advisory skills, our customer, by his trust, makes us the market leader. In close co-operation with our customers, research facilities and universities we are permanently searching for innovative solutions to promote our new and further developments and therefore to design and form the market as innovation leader actively.



*SORM 3plus measuring head*

## System configuration:



## Customer benefit:

- ▶ Improvement of product quality
- ▶ Control and optimisation of skin-pass or rolling process
- ▶ Cost reduction by optimising the skin-pass roll lifetime
- ▶ Reduction of complaints based on an early detection of deviations from the requested roughness range
- ▶ Reduction of rejects during a subsequent control at the recoiling line
- ▶ Stable forming operation (pressing, deep-drawing) by constant roughness parameters
- ▶ Excellent coating results due to a homogeneous surface roughness
- ▶ Cost savings over the manual stylus based measurement

## Performance features:

- ▶ Contactless and online measurement of roughness parameters ( $R_a$ ,  $R_{pC}$ , ...) across strip width and strip length
- ▶ Online visualisation of roughness parameters via the process control system
- ▶ Set-up of measuring system from the control room (graphical user interface)
- ▶ Long-term storage of roughness parameters of each coil processed
- ▶ Teleservice or remote parameter assignment via Ethernet



- **contactless**

**Technical description:**

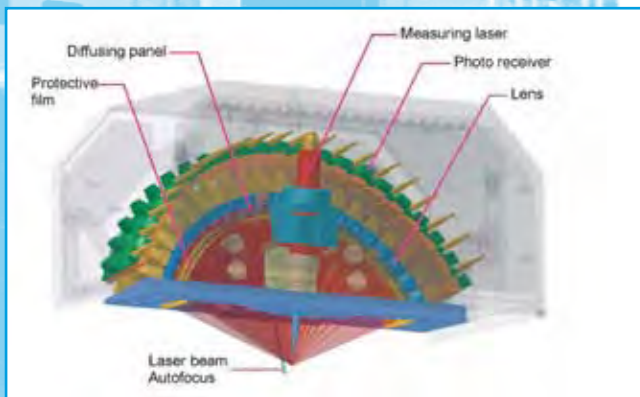
SORM 3plus detects the surface roughness of a moving strip within the limits of the processing line. SORM 3plus uses a laser-optical scanning method to measure the microprofile of a surface. This surface profile can be compared to the profile which is detected by a stylus instrument. Then the measured profile is taken as basis to calculate the roughness parameters (Ra, RPc) according to the applicable standards (DIN/ISO/SEP). Together with a traversing unit SORM 3plus will establish the roughness profile across strip width and strip length. This ensures the online availability of the roughness parameters of the entire strip for the line operator. The use of SORM 3plus makes it possible to detect roughness defects at an early stage and to correct them during manufacturing (e. g. wear of rolls inside skin-pass mill).

- **laser-optical**

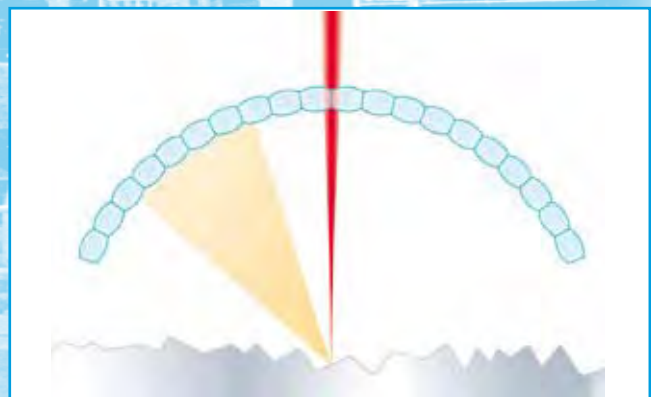
**Measuring principle:**

The principle of SORM 3plus is an angular measurement of the reflected beam of diffused light. A laser beam is directed onto the material surface and the angle of the reflected diffused light is detected by an angle-sensitive sensor.

The measurement of the angle is repeated every 5 µm up to a maximum length of 300 mm. After that the surface profile is calculated. The roughness parameters (Ra, RPc) are determined from the profile according to the standard (DIN EN ISO 4287/4288).



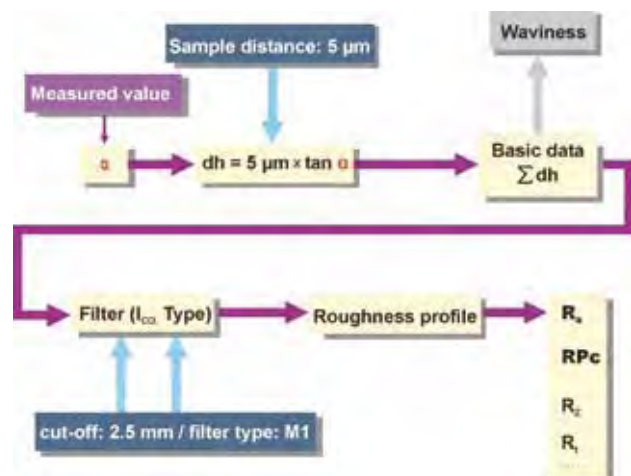
Sensor array with laser device



Measuring principle

**Function principle:**

- ▶ Measurement of angle of diffusion (scattered light) of the material surface
- ▶ Calculation of surface profile (basic data)
- ▶ High-pass filtering of profile measured acc. to standard specification
- ▶ Determination of roughness parameters acc. to DIN EN ISO 4287/4288



## Technical data

### SORM 3plus Measuring system

Application:	<ul style="list-style-type: none"> <li>metallic and non-metallic surfaces             <ul style="list-style-type: none"> <li>requirements:                 <ul style="list-style-type: none"> <li>low gloss grade (fully reflecting materials cannot be measured)</li> <li>dry and clean material surface</li> </ul> </li> </ul> </li> <li>surface in applications using cold rolled steel strip:             <ul style="list-style-type: none"> <li>untreated</li> <li>skin-pass rolled</li> <li>surface finish (galvanised, galvanized, colour coated, ...)</li> </ul> </li> </ul>
Variables:	<ul style="list-style-type: none"> <li>Ra average arithmetic roughness value</li> <li>RPc peak value             <ul style="list-style-type: none"> <li>calibration according to DIN EN 10049 (SEP1940)                 <ul style="list-style-type: none"> <li>cut-off frequency freely adjustable</li> <li>threshold for RPc freely adjustable (standard +/- 0.5 µm)</li> <li>other roughness parameters on request</li> </ul> </li> </ul> </li> </ul>
Measuring range:	<ul style="list-style-type: none"> <li>Ra = 0.1 - 3.0 µm</li> <li>RPc: up to 120 peaks/cm</li> </ul>
Measuring accuracy:	<ul style="list-style-type: none"> <li>Ra: +/- 1 σ = +/- 10 % from measuring value (acc. to gaussian distribution)</li> <li>RPc: +/- 20 % from measuring value (absolut)</li> <li>Marginal conditions:             <ul style="list-style-type: none"> <li>the average of 5 stylus instrument measurements using a calibrated tracer (diameter tip 5 µm) on a specimen of 200 x 300 mm serves as a reference</li> <li>the measurements are carried out on a clean and dry sample with undamaged surface</li> <li>the measuring accuracy is achieved in at least 95 % of all reference measurements</li> </ul> </li> </ul>
Measuring length:	<ul style="list-style-type: none"> <li>variably adjustable, max. 300 mm per measurement</li> </ul>
Distance between measuring points:	<ul style="list-style-type: none"> <li>standard: 5 µm (adjustable)</li> </ul>
Strip speed:	<ul style="list-style-type: none"> <li>max. 2400 m/min</li> </ul>
Working distance to strip:	<ul style="list-style-type: none"> <li>50 mm</li> </ul>
Autofocussing range:	<ul style="list-style-type: none"> <li>+/- 10 mm</li> </ul>
Measuring cycle:	<ul style="list-style-type: none"> <li>&lt; 6 sec. as a function of the measuring length</li> </ul>
Maintenance:	<ul style="list-style-type: none"> <li>changing of the protective film (macroolon) on the lens approx. once a month</li> </ul>

### SORM 3plus Measuring head

Dimensions:	<ul style="list-style-type: none"> <li>L x H x W: - 450 x 310 x 230 mm (incl. traversing unit and adapter plate)</li> </ul>
Weight:	<ul style="list-style-type: none"> <li>approx. 17 kg</li> </ul>
Measuring laser:	<ul style="list-style-type: none"> <li>type: diode laser</li> <li>wavelength: λ = 660 nm</li> <li>laser spot dia. max. 6 µm FWHM (Full Width Half Modulation)</li> <li>laser capacity: P<sub>nom</sub> = 22 mW</li> <li>type of protection 3b</li> </ul>
Autofocussing unit:	<ul style="list-style-type: none"> <li>laser-triangulation-distance sensor</li> <li>type of protection 2</li> </ul>

### Mechanics

Traversing unit:	<ul style="list-style-type: none"> <li>travel: depending on the application (typically 3000 mm)</li> <li>traversing speed:             <ul style="list-style-type: none"> <li>0 - 600 mm/sec (at 50 Hz) adjustable by means of frequency converter</li> </ul> </li> </ul>
System check unit:	<ul style="list-style-type: none"> <li>size of sample: 200 x 300 x (0.7 - 2) mm (L x W x H)</li> <li>in the parking position the sample is protected in a housing</li> <li>traversing speed:             <ul style="list-style-type: none"> <li>0 - 115 mm/sec (at 50 Hz) adjustable by means of frequency converter</li> </ul> </li> </ul>

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