Tire Surface Inspection
Extruder Line Profilometer
Innerline Thickness Measurement
Extruder Line Profilometer

The Micro-Epsilon extruder line profilometer provides on-line precision measurements of the overall dimensions of rubber profiles. Using laser scanning technology, the extruder line profilometer is able to perform measurements continuously, contactless and independently of conveyor speed. On-line measurement system allows automated collection of product data, as well as providing the feedback necessary to process control. All these factors give you ability to improve consistency and stability of the profile extrusion process.

The sheet of light sensor equipment scans projected laser line across a product at high frequency. Profile dimensions are detected as a difference of the top and the bottom product distance measurement. Sensing equipment is attached to a robust steel frame, which ensures long-term mechanical stability of system, crucial for measurement accuracy. Data obtained from sensors are processed in industrial PC and integrated with other line control systems. The system has a built-in automatic calibration tool.

Features
- Continuous non-contact measurement (sheet-of-light laser)
- Automated data collection and powerful visualization
- Robust construction
- Extended connectivity
- Long term stability and accuracy
- Simple calibration
- Offline processing tools (trends visualization, correlation evaluation, …)
Software features

Trend chart
Allow operator to follow product dimensions graphically.
The user may customize the trend charts to show desired data
versus different process quantities

Recipes
Database of model profiles used for quality check

Network and integration
Flexible communication, fieldbus interface protocol support, TCP/IP
networking

Printed reports
Single/batch measurement reports are generated, event is triggered
manually by the operator or automatically on regular basis

Data logging
Profile data logging for off-line analysis and archives

Subprofile analysis
Allows check multiple tread profiles per each tread batch cut.

Technical specifications

Profile thickness 50mm max
Profile width 400, 500, 600mm (standard)
Thickness accuracy * 0.03mm
Width accuracy * 0.3mm
Measurement rate 40/s max
Tread length 1m min.
Conveyor speed 2m/s max
Connectivity TCP/IP, ADS, RS-232, A/D I/O, fieldbus interface

* related to measurement rate 40/s, conveyor speed 1m/s, tread length 1m
Innerliners in the tire are responsible for keeping the air in the tire. As the innermost layer of the tire, the thickness is an important criterion for continuous safety. A measurement is already made during the production for checking that the required thickness has been complied with. The thickness is measured without contact using a dual sensor technique. As an experienced player, Micro-Epsilon has profound knowledge, mainly in one-sided thickness measurement.

**Features**

- High product quality due to in-line thickness measurement
- Dynamic measurement with high precision
- Continuous non-contact measurement (Combination of thrubeam and eddy current sensors)
- Emission-free and material independent measuring technology
- Long term stability and accuracy
- Automatic calibration
- Online processing tools (trend visualization, correlation evaluation, …)
Special features of the inner liner measuring system

The inner liner measuring system continuously measures the thickness profile on rubber webs. The system is designed to be flexible and can process different material thicknesses and widths without complex retooling. The hot rubber web is measured without contact immediately after the calender roller. A measuring head traverses above the rubber web. Thereby, the system is integrated in the heating circuit of the calender roller. The heating circuit water passes through the rotating roller and ensures a constant target temperature. The special measurement roller is used as reference object and as guidance for the target. An eddy current sensor on the measurement roller measures through the rubber web on top of the roller. The top edge of the material is measured using an optical micrometer. Both signals are calculated together for the material thickness.

A one-sided thickness measurement technique which has been developed by Micro-Epsilon is used for the measurement. The thickness profile is measured without contact to the rubber web using a traversing measuring arm and evaluated using the integrated processor unit. The relevant measured data are output to the production environment via customised interfaces and used for controlling the rubber extrusion and calendering.

Dual sensor with eddy current and laser ThruBeam:
The eddy current sensor supplies a reference signal with respect to the roller which goes into the calculation of the actual thickness signal from the laser micrometer.

Technical specifications

- Thickness max.: 20mm
- Width max.: 3000mm
- Gap max.: 25mm
- Measurement rate max.: 4kHz
- Traversing speed max.: 10m/min
- Connectivity: TCP/IP or fieldbus interface

Trend Chart
Allow operator to follow product dimensions graphically. The user may customize the trend charts to show desired data versus different process quantities.

Network and integration
Flexible communication: fieldbus interface protocol support, TCP/IP networking

Printed reports
Single/batch measurement reports are generated, event is triggered manually by the operator or automatically on regular basis

Recipes
Database of model profiles used for quality check

Data logging
Profile data logging for off-line analysis and archives
Tire surface inspection system

For tire surface inspection, three laser profile sensors are used to detect bulges and depressions as well as radial and lateral runout in tire production. They are mounted on a solid and accurate transport system. Laser sensors provide single/multi track measurement, in case of spot laser sensor or whole sidewall is scanned by sheet-of-light laser providing tire profile in every sample instance. The Tire Surface Inspection monitors the signals from sensors, eliminates lettering, performs filtering and detects bulges and depressions, calculates radial and lateral runout, checks tire dimensions, performs harmonic analysis, defect quality classification, according to the customer specification.

Features
- Non-contact measurement (laser-line triangulation)
- True 3D defect elimination
- Precise lettering elimination
- Complete tire scan
- Automatic inspection range selection
- Extended connectivity
- Powerful visualization tools
- Standalone application
- Adaptation to different TU machines
4 Axis positioning system
- Robust transport mechanism
- Soft Servo Drive from Festo for precise positioning (16 bit resolution)
- 3 x profile sensors (2 x 2D + 1 x P)
- PC compatible realtime control system-connectivity via TCP/IP, ADS, profibus, analog, digital I/O

Technical data
- Tire width min: 100mm
- Tire width max: 460mm
- Resolution max: 640 dots/profile
- Measurement time: 1 sec. (60rpm)
- Calculating time: ~2 sec.
- Repetitability: <0.04 mm (3-Sigma)

Subject to measurement
- Bulge and depression detection
  - Amplitudes and angles
  - Top and bottom side
- Radial and lateral runout
  - Average, peak-to-peak values
  - Harmonics
- Tire dimensions
  - Tire radius (mean, min., max., angle)
  - Tire width
- Defect classification (feedback)
- Tread monitoring

Bulge on top passenger car tire side
Bulge - depression combination

Subject to measurement
- Bulge and depression detection
  - Amplitudes and angles
  - Top and bottom side
- Radial and lateral runout
  - Average, peak-to-peak values
  - Harmonics
- Tire dimensions
  - Tire radius (mean, min., max., angle)
  - Tire width
- Defect classification (feedback)
- Tread monitoring

Bulge on top passenger car tire side
Bulge - depression combination
Data preprocessing
Dropout filtering
Profile compensation
Revolution identification

Bulge and depression detection

Lettering elimination:
The unique software allows to differentiate between real defects and bumps caused by letters.

MICRO-EPSILON
Koenigbacher Strasse 15
94496 Ortenburg / Germany
Phone +49/8542/168-0
Fax +49/8542/168 90
info@micro-epsilon.com
www.micro-epsilon.com
certified DIN EN ISO 9001 : 2000
modifications reserved / Y9761259-A020029JKR