Inline quality control in the metal industries

Innovative measuring and control technology for
INLINE QUALITY CONTROL OF METAL TUBES, PIPES, STRIPS AND PLATES

Innovative measuring and control technology

SIKORA – your partner in quality

SIKORA is a manufacturer and global supplier of innovative measuring, control, inspection, analysis and sorting technologies. The systems are used in the area of wire, cable, hose, metal and plastic pipes, sheets as well as optical fiber and plastics industry.

For more than ten years, SIKORA has been successfully active in the plastic tube and pipe market. The applied technologies for quality control measure and control inline product parameters such as diameter, ovality, wall thickness as well as eccentricity for the highest quality of the end product and optimal process efficiency during the production.

SIKORA is now transferring the operator’s advantages, that result from using SIKORA measuring systems, with proven technologies to the metal industries.
“Many measuring technologies are good. Ours will inspire you...”

Use of radar technology in the automotive sector
For years, the automotive industry has been focusing on radar technology that generates reliable measuring values under all environmental conditions, and thus, guarantees the highest safety. The future-oriented technology can be transferred to the dimension measurement of strips, plates as well as tubes and pipes made of steel or other metals.

Benefits of radar technology for the metal markets
Radar technology, based on millimeter waves (Frequency Modulated Continuous Waves, in short FMCW), convinces with the measurement of the diameter of tubes and pipes as well as the thickness of strips and plates. In tube and pipe applications, the measurement is done simultaneously via transceivers* from different directions over 360 degrees of the circumference. The thickness of strips and plates is also measured by this technology.

The advantages of radar technology, compared to optical measurement methods, are that the measurement is carried out from a protected position and that it is resistant to heat, steam and dust. Furthermore, radar technology is independent of alloys or surfaces.

* A transceiver sends and receives radar signals, from which the run time and subsequently the distance are determined.

Benefits of radar technology (millimeter wave technology) at a glance:
- Precise diameter and thickness measurement independent of the quality of the product surface
- Insensitive to dust, steam, heat
- Flexible applications by measuring blank, rough, cold and hot surfaces
- Complete recording of the measuring values over 360° of the circumference of the tube/pipe
- Narrow gauge head with large clear span
- No time-consuming maintenance

The RADAR SCAN 6000, based on radar technology, leads to precise measuring results and is insensitive to dust, steam and heat.

Inspection, sorting, analysis technologies (X-ray, optical, infrared technologies)
- 2009/10: Entering the fiber optic (cable) market
- 2013: Entering the plastics market
- 2016: Market launch of systems on the basis of millimeter wave technology for the measurement of pipes and sheets
- 2018: Entering the metal industries

45th anniversary of SIKORA
SIKORA’s RADAR SCAN 6000 is based on progressive, high resolution radar technology and represents an innovative alternative to the optical triangulation technology. The RADAR SCAN 6000 measures inline and contactless, simultaneously from several directions, the diameter and ovality of metal pipes. It completely records to micron accuracy measuring values over 360° of the circumference of the pipe. In addition, rotating metal pipes can be precisely measured. The radar measuring system requires no time-consuming calibration, is insensitive to dust, heat and steam and continuously delivers precise measuring values. Due to the narrow design, the RADAR SCAN 6000 can easily be integrated into the production process. The technology is suitable for blank or rough as well as cold or hot surfaces.

**Technical Data**

**RADAR SCAN 6000**

<table>
<thead>
<tr>
<th>Measuring Principle</th>
<th>Non-contact on the basis of radar technology (FMCW(^*) millimeter wave technology)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application and Material</strong></td>
<td>Diameter and ovality measurement of metal pipes (hot and cold measurement), complete recording of the measuring values over 360° of the circumference of the pipe</td>
</tr>
<tr>
<td><strong>Measuring Range</strong></td>
<td>150 to 2,500 mm (other measuring ranges on request)</td>
</tr>
<tr>
<td><strong>Measuring Frequency</strong></td>
<td>Measuring Rate</td>
</tr>
<tr>
<td>80 to 300 GHz</td>
<td>370 Hz to 2 kHz</td>
</tr>
<tr>
<td><strong>Interfaces</strong></td>
<td>USB</td>
</tr>
<tr>
<td>Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinbus-DP, CANopen, DeviceNet), LAN, OPC DA/UA</td>
<td></td>
</tr>
<tr>
<td><strong>Power Supply</strong></td>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
</tr>
</tbody>
</table>

\(^*\) Frequency Modulated Continuous Waves

**Evaluation and display**

Diameter and ovality are shown in real time. A processor system offers a numerical visualization of the measuring values and their graphical visualization as well as extensive trend and statistical functions. The display of measuring values of the RADAR SCAN 6000 at the ECOCONTROL 6000 is clear and comprehensive.
PLANOWAVE 6000 M

Radar technology measures the thickness of metal strips and plates

PLANOWAVE 6000 M is a measuring system that is used for non-contact thickness measurement of strips and plates. The system is based on millimeter waves based radar technology. It offers a precise thickness measurement independent of material, temperature and surface of the product. A calibration on the material is not needed.

The PLANOWAVE 6000 M is either integrated directly into the production line or used for final inspection. The measurement of the product is accomplished by using millimeter waves, according to the FMCW* runtime method. An optionally traversing set of transceivers above and below the strip or plate continuously sends and receives frequency modulated millimeter waves. From the runtime difference, the thickness of the product is precisely determined.

The measured values are processed and visualized in real time. The processor system ECOCONTROL 6000 offers a numerical display of the measuring values at any number of measuring points over the width of the product with a graphical visualization as well as extensive trend and statistical data.

Technical Data

PLANOWAVE 6000 M

<table>
<thead>
<tr>
<th>Measuring Principle</th>
<th>Non-contact on the basis of radar technology (FMCW* millimeter wave technology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application and Material</td>
<td>Thickness measurement of metal strips and plates</td>
</tr>
<tr>
<td>Measuring Range</td>
<td>0.5 to 500 mm</td>
</tr>
<tr>
<td>Material Width</td>
<td>up to 2,500 mm (larger sheet widths on request)</td>
</tr>
<tr>
<td>Measuring Frequency</td>
<td>80 to 300 GHz</td>
</tr>
<tr>
<td>Measuring Rate</td>
<td>370 Hz to 2 kHz</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet), LAN, OPC DA/UA</td>
</tr>
<tr>
<td>Power Supply</td>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
</tr>
</tbody>
</table>

* Frequency Modulated Continuous Waves
SIKORA measuring systems are worldwide known for their unique non-contact and non-destructive measuring principles. The gauge heads of the LASER Series 2000 reliably and precisely measure the diameter and ovality of metal tubes, wire rods and bars during production.

The measuring method is based on the usage of CCD sensors and laser light sources in combination with powerful signal processors. The outer diameter of the metal tube, wire rod or bar is calculated by means of an intelligent diffraction analysis. Extremely short exposure times guarantee a high accuracy of the single value at all line speeds.

The gauge heads are free of wearing parts, keep their precision during the entire operating time and no calibration or maintenance work is necessary.

The innovative LASER Series 6000 opens up a new era of precision diameter measurement. The LASER Series 6000 devices expand SIKORA’s current range of intelligent diameter gauges with three high-end models.

Up to 5,000 measurements per second and axis, all with extremely high single value precision, enable an optimum line control and provide reliable statistical data. The SIKORA gauge heads measure the diameter of tubes, wire rods and bars with impressive precision and repeatability. Three gauge head models cover product diameters from 0.2 to 78 mm.

The devices include an integrated LCD display that provides the operator with diameter values at one glance, directly at the measuring device.

**Technical Data**

**LASER Series 2000/6000**

- **Measuring Principle**
  Non-contact and non-destructive on the basis of CCD line sensors and laser light sources in combination with powerful signal processors

- **Application and Material**
  2-axis or 3-axis diameter and ovality measurement of tubes, wire rods and bars made of metal, aluminum, copper etc.

- **Measuring Range**
  LASER Series 2000: 0.05 to 500 mm
  LASER Series 6000: 0.2 to 78 mm

- **Measuring Rate**
  LASER Series 2000: 500 measurements/sec/axis
  LASER Series 6000: 2,500 measurements/sec/axis
  (5,000 measurements/sec/axis optionally available for LASER 6020 XY)

- **Exposure Time**
  0.2 µs

- **Interfaces**
  RS485, RS232
  Optional: analog output or alternatively industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinus-SP, CANopen, DeviceNet, OPC UA), Wi-Fi (only at LASER Series 6000)

- **Power Supply**
  100 - 240 V AC ± 10 %, 50/60 Hz
X-RAY 6000 PRO

X-ray technology measures the wall thickness of light alloy tubes and the wall thickness of the plastic coating on metal tubes and pipes

The X-RAY 6000 PRO is used for the wall thickness measurement of light alloy tubes. It measures with extremely high accuracy in two axes the wall thickness, diameter and ovality. The X-RAY 6000 PRO is independent of the product material to be measured as well as the temperature; no coupling media or calibration is required. Precise measuring values are immediately retrievable with the inline measurement. The data is visualized at the monitor of the processor system ECOCONTROL 6000 and enables the user to intervene into the process if needed. Hence, the SIKORA measuring system is an essential component for the assurance of the highest quality and an efficient process during production of plastic coated metal tubes and pipes.

A plastic coating is among others applied at freely installed, underground and under water laid metal tubes and pipes for corrosion protection. The plastic coating has to meet certain specifications. Thus, in order to measure the wall thickness of the plastic coating, SIKORA’s X-ray-based X-RAY 6000 PRO is used for tubes and pipes with a diameter of up to 270 mm.

Technical Data

X-RAY 6000 PRO

<table>
<thead>
<tr>
<th>Measuring Principle</th>
<th>Non-contact with latest X-ray technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application and Material</td>
<td>Wall thickness measurement of light alloy tubes (cold measurement), coating thickness measurement of the plastic coating on metal tubes/pipes</td>
</tr>
<tr>
<td>Measuring Range</td>
<td>0.65 to 270 mm diameter</td>
</tr>
<tr>
<td>Safety (X-ray Radiation)</td>
<td>Radiation measurements by independent experts have revealed that the radiation of the X-RAY 6000 PRO is far below limiting values of all international regulations</td>
</tr>
<tr>
<td>Measuring Frequency</td>
<td>1 to 3 Hz (optional 10/25 Hz)</td>
</tr>
<tr>
<td>Interfaces</td>
<td>RS232, USB</td>
</tr>
<tr>
<td></td>
<td>Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Proibus-DP, CANopen, DeviceNet), LAN, OPC DA/UA</td>
</tr>
<tr>
<td>Power Supply</td>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
</tr>
</tbody>
</table>

The measuring values of the X-RAY 6000 PRO are visualized on the ECOCONTROL 6000.
Company profile SIKORA AG

SIKORA is a leading manufacturer and supplier of innovative measuring, control, inspection, analysis and sorting technology for the hose & tube, sheets, metals, wire & cable as well as optical fiber and plastics industries. Worldwide, users of these measuring devices benefit from increasing quality, profitability and efficiency of the manufacturing process. Modern laser, X-ray and millimeter wave technologies measure precisely and reliably product parameters such as diameter, ovality, wall thickness and eccentricity.

SIKORA is headquartered in Bremen, Germany. Since 1973, the high-quality devices have been developed and manufactured at this site. With about 300 employees worldwide, 14 international offices and various regional representatives, the medium-sized company provides customers with innovative product solutions and individual service.

The certification according to DIN EN ISO 9001 confirms SIKORA’s focus on continuous improvement of process and product quality. Innovation, product quality and customer satisfaction have been defining the daily activities at SIKORA for more than 45 years.