X-RAY 6000/6000 PRO

Diameter/wall thickness/eccentricity/ovality measuring system
for hose and tube extrusion lines
Measurement of the wall thickness, eccentricity, diameter and ovality of single and multi-layer products
For quality control at the extrusion of hoses and tubes, the X-RAY 6000 continuously provides data for inner and outer diameter, wall thickness, ovality and eccentricity to ensure that the required product specifications are met. Therefore, the system provides the basis for optimization and repeatability of processes.

X-ray measuring technology for single and multi-layer products
The XRAY 6000 series is an innovative, powerful measuring system for the use in extrusion lines. X-RAY 6000 PRO is perfection in its most impressive form, for the measurement of hoses and tubes with up to three layers, the X-RAY 6000 for single layer products and total wall thickness measurement of multi-layer products.

X-RAY 6000 PRO for multi-layer products
The X-RAY 6000 PRO measures wall thickness, eccentricity, inner and outer diameter and ovality of up to three different material layers. As standard, the system includes the processor-based display and control device ECOCONTROL 6000 with a vertically arranged 22” TFT monitor.

The ECOCONTROL 6000 is conveniently and intuitively operated via touch screen. All relevant measuring values are numerically as well as graphically and as trend and statistical data shown at a glance. A line presentation with pictograms of the connected devices provides a clear overview. The PROfessional devices are most efficiently used with the automatic control of the line speed or extruder rpm under consideration of the minimum values. Comprehensive information is provided by the ECOCONTROL 6000, with reel and length related data storage, included as standard.

Specific applications for the X-RAY 6000 PRO
Single layer or multi-layer tubes, aluminium composite tubes, pressure hoses with textile reinforcement, small or large diameter hoses made of PE, HDPE, PVC as well as foamed products and hoses made of EPDM, nylon, rubber or silicone are reliably measured by the X-RAY 6000 PRO. Moreover, the special version X-RAY 6020 PRO offers quality control of medical and cosmetic tubes.
X-RAY 6000 for single layer products
The X-RAY 6000 is most effective in production lines, for single layer products and measures the wall thickness, eccentricity, inner and outer diameter as well as the total wall thickness of multi-layer products. The production data is clearly visualized at an intuitive 7” touch screen monitor, however in combination with the processor system ECOCONTROL 6000, 1000 or 600, an automatic control of the line assures highest perfection. By controlling line speed or extruder rpm, the product parameters are controlled to the nominal value, which is an essential step for cost saving.

The X-RAY 6000 is focused on single layer products as well as total wall thickness measurement of multi-layer products and is an economic and powerful alternative to the X-RAY 6000 PRO. It provides the relevant data that is the crucial factor for quality control.

X-RAY 6020 PRO for ultra small diameters
The X-RAY 6020 PRO is suitable for product diameters from 0.65 to 15 mm and for ultra-thin wall thicknesses down to 100 μm. The device is designed for the area of medical tubes where quality is a vital requirement.

X-RAY 6000 i
An overall measurement, covering each point of the product’s circumference is enabled by the innovative X-RAY 6000 i. The applied rotating X-ray technology provides perfection in the segment of 100 % control of the total tube and is particularly suitable for the measurement of foamed tubes with a diameter of 100 mm.

CENTERWAVE 6000
In the rotating version, the innovative CENTERWAVE 6000 also provides a total recording of wall thickness, diameter and ovality over 360 degrees of the circumference. Its integrated groundbreaking millimeter waves technology is used for the measurement of big pipes.

Positioning
The X-RAY 6000/6000 PRO can be installed in different production zones:
1. Between extruder and vacuum tank/cooling section
   Hot measurement
2. Between two vacuum tanks/cooling sections
   Pre-cooled measurement
3. After the vacuum tank/cooling section for final inspection
   Cold measurement
Display of measuring data and operation
Optimum information on the ongoing production process is provided by the 22" TFT color monitor of the ECOCONTROL 6000, all measuring data is displayed graphically and numerically, including inner and outer diameter, wall thickness, eccentricity and ovality. The operation is menu-driven via touch screen. An eccentricity of the wall thickness is displayed as an eccentric ring, whereby the point of the thinnest wall thickness is colorfully highlighted. Optimum information on the ongoing production process is provided by a length related trend diagram with zoom function for all values as well as a graph of the distribution of the single values and statistics with the minimum/maximum/mean value, standard deviation, Cp and CpK values.

Automatic mode and Hot/Cold Control
With the control module SET POINT, all conditions are met for fast and precise control of the wall thickness or the diameter through the line speed or extruder rpm. Other signal outputs allow the automatic centering of the crosshead. To ensure the best possible quality with simultaneous minimization of material over-consumption, SIKORA recommends the Hot/Cold Control module HC 2000, combined with the X-RAY 6000/6000 PRO* and a diameter gauge head of the LASER Series 2000 or LASER Series 6000 for measuring the cold diameter. With the Hot/Cold Control module HC 2000 the material shrinkage is continuously calculated and automatically taken into consideration at the control of the diameter and/or the wall thickness.

Automatic crosshead centering
Especially for the manufacture of rubber hoses at the extrusion process, the X-RAY 6000/6000 PRO provides measuring values for automatic wall thickness centering. By using this technique, a manual centering during production is not necessary. In addition, the online concept continuously ensures an optimum hose centering, and thus, a uniform wall thickness distribution over the entire hose circumference.

Virtual gauge technology
The virtual gauge technology VIRTUAL 2000 is suitable for all applications for which a fast wall thickness control is required, but due to line configuration or product structure, a diameter or wall thickness measurement directly after the extruder is not possible.

* X-RAY 6000: Automatic control and the Hot/Cold Control with automatic shrinkage compensation requires an ECOCONTROL 6000, ECOCONTROL 1000 or ECOCONTROL 600 (control only) processor system.
Quality assurance and significant cost savings

From the first day of operating, the X-RAY 6000/6000 PRO assures a continuous online quality control at the hose and tube extrusion. A time consuming offline quality control is no longer necessary.

At the same time, the X-RAY 6000/6000 PRO works to reduce the wall thickness to the minimum value. Both quality assurance and the reduction of material lead to a significant increase of productivity.

An example:
The capital expenditure for a measuring system may be 75,000 €. The material cost may be 5.4 million €/year (600 kg/h extruder output, 6,000 working hours/year, material costs 1.5 €/kg).

With the X-RAY 6000, material savings of at least 5 % can be achieved, resulting in savings of 45 €/h (270,000 €/year). In consideration of costs for maintenance and service in the amount of 0.5 €/h and a depreciation of 1.46 €/h (depreciation, i.e. the reduction in the value of an asset, over eight years, 6,000 h/year) the profit of the company improves from the first day of initial operation by 43.04 €/h. If this is multiplied with the assumed 6,000 h/year, the impressive profit for a business year would be 258,240 €. This results in a Return on Investment (ROI) of 3.5 months (75,000 €/258,240 € = 0.29 years).

Check your specific material savings associated with the purchase of an X-RAY 6000/6000 PRO using our online ROI calculator at: www.sikora.net/roi.

X-RAY 6000/6000 PRO – outstanding measuring systems

The XRAY 6000/6000 PRO provides reliable measurement and control in hose and tube extrusion lines at all line speeds. The system is as simple to use as a diameter gauge, but including the eccentricity measurement and the possibility to measure the minimum wall thickness, it offers the highest potential for savings in respect to material over-consumption and start-up scrap and assures, in addition, reliable and controlled processes.

Typical features X-RAY 6000 PRO
- Measurement of the wall thickness, eccentricity, the inner and outer diameter and ovality of up to three different material layers
- Automatic control of the line speed and extruder rpm under consideration of the minimum values
- Selectable measuring rate from 1 to 3 Hz (optional 10/25 Hz)
- 22” TFT monitor, or 15” wide-screen monitor
- No calibration

Typical features X-RAY 6000
- Measurement of the wall thickness, eccentricity, the inner and outer diameter and ovality of single layer products as well as total wall thickness measurement of multi-layer products
- Automatic control of the line speed and extruder rpm under consideration of the minimum values (optional)
- Selectable measuring rate from 1 to 3 Hz
- Integrated 7” monitor for measuring value display
- No calibration

Safety
Concerns on the safety of X-ray devices are arbitrary, as the radiation is, because of the low energy, of no relevance. In fact, a human is exposed to a much higher radiation on a flight from New York to Frankfurt.

Note:
Extruder output: 600 kg/h
Operating time: 6,000 h/year
Material costs: 1.50 €/kg
5 % savings = 270,000 €
**X-RAY 6000/6000 PRO**

Diameter/wall thickness/eccentricity/ovality measuring system for hose and tube extrusion lines

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**Technical Data X-RAY 6000/6000 PRO**

<table>
<thead>
<tr>
<th>Measuring Principle</th>
<th>Non-contact with state-of-the-art X-ray technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application*</td>
<td>Programmable, factory setting 1/sec</td>
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<tr>
<td>Material</td>
<td>PE, PVC, HDPE, foamed plastic, EPDM, nylon, rubber, silicone and many others</td>
</tr>
</tbody>
</table>
| Wall Thickness      | ≥ 0.3 - 30 mm for PE, HDPE  
≥ 0.3 - 2 mm for PVC and EPR  
≥ 3.5 - 30 mm for foamed PE (min. outer diameter 8 mm) |
|                     | 1) Products with PVC/EPR wall thickness ≥ 2 mm and a diameter > 50 mm require a higher X-ray power  
2) Foamed PE requires lower X-ray power and a higher measuring rate |
| Calibration         | The X-RAY 6000/6000 PRO requires no calibration |
| Safety (Radiation)  | Radiation measurements by independent experts have revealed that the radiation of the X-RAY 6000/6000 PRO is far below limiting values of all international regulations |

**Measuring Rate**

| X-RAY 6000 PRO: 1 to 3 Hz (optional 10/25** Hz)  
X-RAY 6000: 1 to 3 Hz |

**Power Supply**

| 100 - 240 V AC ± 10 %, 50/60 Hz, 1,200 VA |

**Permissible Temperature**

| +5 to +45°C |

**Interfaces**

| X-RAY 6000 PRO:  
RS232, USB  
Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinus-DP, CANopen, DeviceNet), LAN, OPC DA/UA |
| X-RAY 6000:  
RS485, RS232  
Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinus-DP, CANopen, DeviceNet), LAN |

* X-RAY 6000 PRO for multi-layer products/X-RAY 6000 for single layer products and total wall thickness measurement of multi-layer products  
** 25 Hz are optionally available at X-RAY 6035 PRO and X-RAY 6070 PRO

<table>
<thead>
<tr>
<th>X-RAY 6020</th>
<th>X-RAY 6035</th>
<th>X-RAY 6070</th>
<th>X-RAY 6120</th>
<th>X-RAY 6200</th>
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<tr>
<td>Diameter</td>
<td></td>
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</tr>
<tr>
<td>min. wall</td>
<td>0.65 - 15 mm</td>
<td>5 - 30 mm</td>
<td>6 - 65 mm</td>
<td>10 - 100 mm***</td>
<td>20 - 180 mm</td>
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<td>Accuracy</td>
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<td>X-RAY 6000 PRO</td>
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<td>10 μm</td>
<td>20 μm</td>
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<tr>
<td>X-RAY 6000</td>
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<td>50 μm</td>
<td>60 μm</td>
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<td>Sight Field</td>
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<td>35 mm</td>
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<td>Opening</td>
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<td>25 mm</td>
<td>100 mm</td>
<td>100 mm</td>
<td>180 mm</td>
<td>350 mm</td>
<td>400 mm</td>
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</table>

*** Expanded measuring range up to 110 mm on request  
Technical data is subject to change

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