SIKORA
Technology To Perfection

X-RAY 6000/6000 PRO

Diameter/wall thickness/concentricity measuring system
for insulating and sheathing lines

www.sikora.net

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Measurement of the wall thickness, concentricity, diameter and ovality of single and multi-layer products

For quality control of cables in insulating and sheathing lines, the X-RAY 6000/6000 PRO continuously provides data for diameter, wall thickness and concentricity to ensure that the required cable 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 X-RAY 6000 series is an innovative, powerful measuring system for the use in cable production lines. X-RAY 6000 PRO is perfection in its most impressive form, for the measurement of cables 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, concentricity, diameter and ovality of up to three different cable layers. Typically it is used at tandem extrusion lines. As standard, the system includes the display and control device ECOCONTROL 6000 with a vertically arranged 22" TFT monitor. You can decide whether it is mounted directly at the X-RAY gauge head, on a separate stand, or remotely integrated in the control cabinet of the line control.

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 – measurement of foamed products

The X-RAY 6000 PRO is also used for the measurement of foam insulated high frequency cables, where the degree of foaming and radial distribution of the foaming are displayed in addition to eccentricity.

Which X-RAY 6000 fits your production line?

For quality control at tandem extrusion lines, in which cables get a filler and an outer jacket, the X-RAY 6000 PRO is the best choice. Cables with a single insulation or sheathing layer can be measured by the X-RAY 6000.

ECOCONTROL 6000: The production data of the X-RAY 6000 PRO is clearly visualized at the vertical 22" TFT monitor

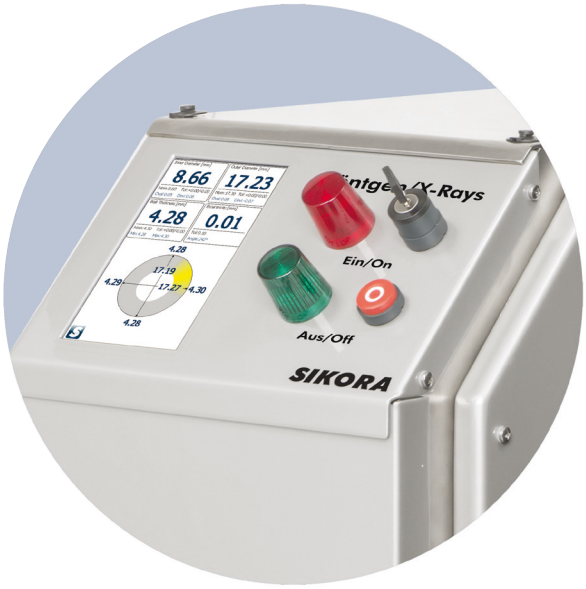
X-RAY 6120 PRO with 22" TFT monitor

X-RAY 6000 for single layer products

The X-RAY 6000 is most effective in cable production lines for single layer products and measures the wall thickness, concentricity, and the outer diameter as well as the total wall thickness of multi-layer products. The production data is clearly displayed on an intuitive 7" touch screen monitor, which is integrated directly into the measuring system. In combination with the optional processor system ECOCONTROL 6000, 1000 or 600, an automatic control of the line is assured. By controlling line speed or extruder rpm, the cable parameters are controlled to the nominal value which is an essential step for cost saving.

In sheathing lines the X-RAY 6000 is typically integrated between two cooling trough sections. In this position the device measures the outer jacket of the cable. An additional diameter gauge head at the end of the production line, combined with Hot/Cold-Control, considers the shrinkage of the diameter.

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.



The integrated 7" TFT touch screen of the X-RAY 6000

X-RAY 6070 PRO integrated in a production line

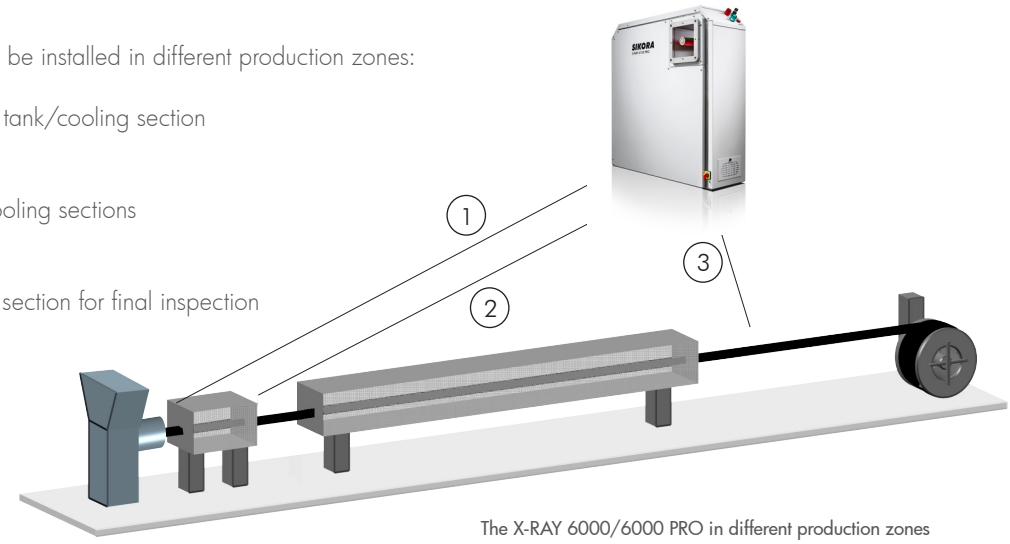
Positioning

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



The X-RAY 6000/6000 PRO in different production zones

Display of measuring data and operation

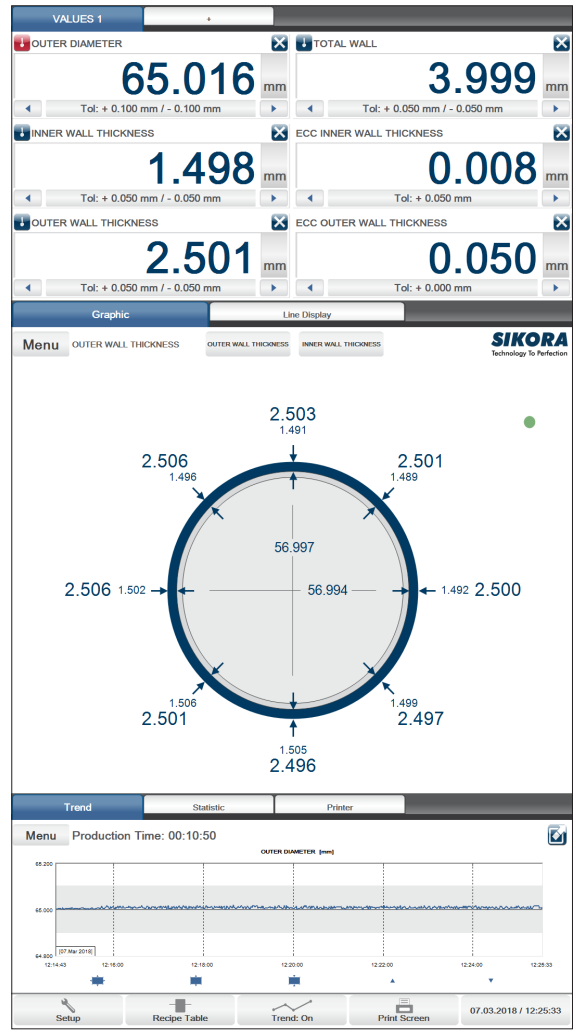
At the clearly arranged 22" TFT color monitor of the ECOCONTROL 6000, all measuring data is displayed graphically and numerically, including diameter, wall thickness, concentricity and ovality. The operation is menu-driven via touch screen. In case of eccentricity, the wall thickness is displayed as an eccentric ring. The position of the thinnest wall thickness is highlighted in color. The extensive system contains a length or time-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.

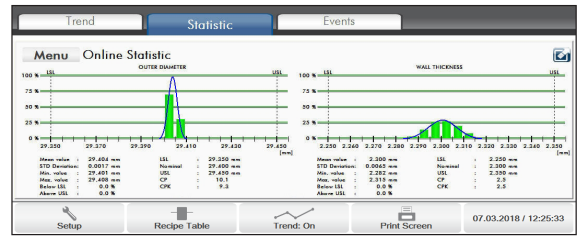
Virtual Gauge Technology

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.



ECOCONTROL 6000: Main screen with figures, diagram and statistics on a 22" TFT monitor with touch operation

* 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



Statistics

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 cable production. 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:

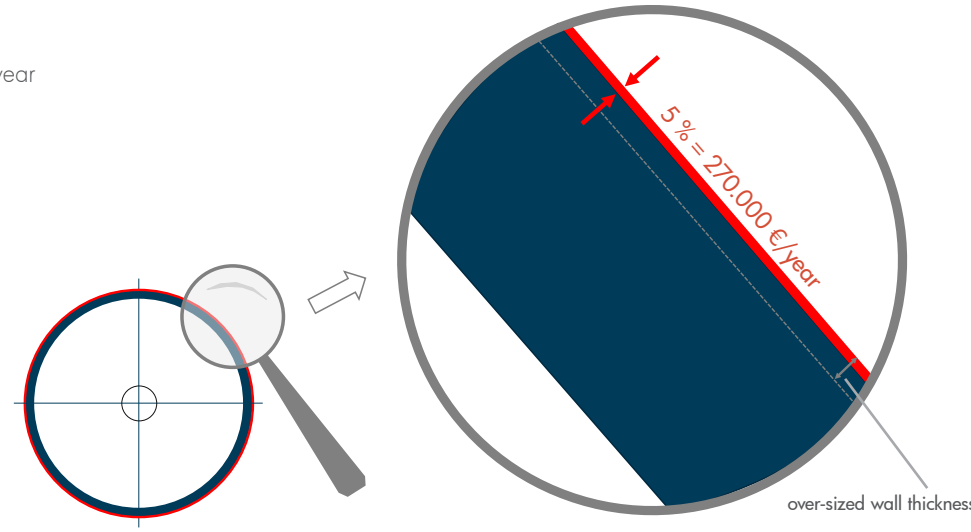
The capital expenditure for a measuring system may be 75,000 €. The material cost may be 5.4 million €/year (600 kg/h extruder output, 6,000 working hours/year, material costs 1.5 €/kg).

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.

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 – outstanding measuring systems

The X-RAY 6000/6000 PRO provides reliable measurement and control in sheathing and insulating lines at all line speeds. The system is as simple to use as a diameter gauge but, including the concentricity 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. Furthermore, precise control can be realized using the SET POINT, HC 2000 or VIRTUAL 2000 modules.

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.

Typical features X-RAY 6000 PRO

- Measurement of wall thickness, concentricity, core 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 wall thickness, concentricity, core 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

X-RAY 6000/6000 PRO*

Diameter/wall thickness/concentricity measuring system for insulating and sheathing lines

Certified according to DIN EN ISO 9001

Technical Data X-RAY 6000/6000 PRO

Measuring Principle
Non-contact with state-of-the-art X-ray technology

Application*
Insulation and sheathing lines, coax and RF cables

Material
PE, PVC, HDPE, foamed plastic, EPDM, nylon, rubber, silicone and many others

Wall Thickness
≥ 0.3 - 30 mm for PE, HDPE,
≥ 0.3 - 2 mm for PVC and EPR[1)]
≥ 3.5 - 30 mm for foamed PE[2)]
(min. outer diameter 8 mm)

1) Products with PVC/ERP 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

Permissable Temperature
+ 5 to + 45 °C

Interfaces
X-RAY 6000 PRO:

RS232, USB
Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet), LAN, OPC DA/UA

X-RAY 6000:

RS485, RS232
Optional: industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet), LAN

	X-RAY 6020	X-RAY 6035	X-RAY 6070	X-RAY 6120	X-RAY 6200	X-RAY 6300
Diameter	0.65 - 15 mm min. wall: 0.1 mm	5 - 30 mm	6 - 65 mm	10 - 100 mm**	20 - 180 mm	30 - 270 mm
Accuracy X-RAY 6000 PRO X-RAY 6000	 5 µm -	 5 µm 50 µm	 10 µm 60 µm	 10 µm 60 µm	 20 µm -	 30 µm -
Sight field	20 mm	35 mm	70 mm	120 mm	200 mm	300 mm
Opening	25 mm	100 mm	100 mm	180 mm	350 mm	400 mm

* X-RAY 6000 PRO for multi-layer products/X-RAY 6000 for single layer products and total wall thickness measurement of multi-layer products

** Expanded measuring range up to 110 mm on request

Technical data is subject to change

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