Optical fibers and optical fiber cables

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

Continuous control of production data helps to avoid wall thickness oversizes and leads to a more efficient material usage. The cable manufacturer consumes fewer resources and achieves a more efficient material usage. Every micrometer of material that can be saved by the use of measuring and control technology makes production more economical and saves increasingly scarce resources.

SIKORA is headquartered in Bremen, Germany. Since 1973, the high-quality devices have been developed and manufactured at this site. When it comes to service and sales, SIKORA is globally active with offices in Brazil, China, France, India, Italy, Japan, Korea, Malaysia, Mexico, Russia, Turkey, Ukraine, the United Arab Emirates and the USA. In cooperation with more than 30 local representatives worldwide, SIKORA serves all customer demands with regard to quality, productivity and cost saving. In addition, international service locations assure fast and reliable customer support on site, any time.

Since 1993, SIKORA has been certified according to DIN EN ISO 9001. The certification confirms SIKORA’s focus on continuous improvement. Customer satisfaction is SIKORA’s primary objective.

Innovation, technological know-how, quality and service are the four pillars of SIKORA’s company philosophy. A strong research and development team continuously works on the development of new technologies, enabling manufacturers of optical fibers and optical fiber cables, wires, cables, hoses, tubes as well as raw materials to increase the process reliability, efficiency and ecological balance of their production lines.

Measuring technology for the production of optical fibers and optical fiber cables

All over the world, large amounts of electronic data are transferred every day – faster and over longer distances. Data transfer is mainly via optical fibers. In order to transmit data without loss, optical fibers have to meet the highest quality requirements. SIKORA offers a complete series of measuring and control devices that are used in the drawing tower during the production of optical fibers. The FIBER Series 6000 monitors and controls the entire drawing process and optimizes productivity. SIKORA is known worldwide for its measuring devices for optical cables.

Highlights FIBER Series 6000

- Measurement of the diameter, position, vibration frequency, tension and spinning
- Control of the fiber draw process
- Detection of airlines and temperature measurement at the bare fiber
- Coating concentricity evaluation
- Reliable lump detection with double sensor technology and 3-axis or 6-axis measurement
- No moving parts, no calibration
1 Measuring technology for the production of optical fibers

1.1 FIBER LASER 6003 – After the furnace, before and after the coating

The FIBER LASER 6003 is an innovative device for diameter measurement of optical fibers, directly in the drawing tower. The unique measuring principle assures an accuracy of 0.05 μm at a repeatability of 0.02 μm. 2,500 measurements per second with high single value precision and a short exposure time of 1.0 μs always guarantee the highest accuracy.

The measuring principle is based on diffraction analysis. Using this method, SIKORA has become the worldwide technology leader. The principle allows a non-contact, optical measurement of diameters without moving parts and no need for calibration.

Typically, the first gauge head is installed after the furnace to measure the diameter and position of the bare fiber and to control the process. Based on the vibration of the fiber, this gauge head calculates the tension at the bare fiber by means of a Fast Fourier Transformation (FFT). The single values of the fiber position are graphically visualized via the processor system FIBER ECOCONTROL, in the form of a scatter plot and are available via Ethernet.

A second gauge head, before the coating, measures the cold diameter of the fiber and provides spinning information via FFT of the ovality. The control is carried out either by the hot or cold measuring gauge head. Both devices can be optionally equipped with a protection plate to avoid cooling and condensed water falling into the measuring head.

Additional FIBER LASER 6003 devices measure the diameter after the primary and secondary coating. Optionally, these gauge heads also provide information on the concentricity of the coating.
1.2 FIBER LASER 6003 AIRLINE
– Diameter measurement with airline detection

Alternatively to the FIBER LASER 6003, installed before the coating, SIKORA offers the FIBER LASER 6003 AIRLINE, a device which detects the smallest airlines from 0.5 μm diameter. Both gauge heads can also be installed after the preform before the cooling process.

The FIBER LASER 6003 and FIBER LASER 6003 AIRLINE are factory calibrated and keep their absolute accuracy for the entire life-cycle. These gauge heads can be connected via numerous interfaces to the SIKORA processor system FIBER ECOCONTROL as well as to a line computer.

Coloring lines
The diameter gauges of the FIBER Series 6003 are also the optimal equipment for quality control in coloring lines.

1.3 FIBER LASER 6003 CCE – Evaluation of coating concentricity

In order to evaluate the concentricity of the coating, the FIBER LASER 6003 can be equipped with an additional function. This FIBER LASER 6003 CCE (Coating Concentricity Evaluation) is installed after the coating and provides information on the coating concentricity in addition to the diameter values.

As the FIBER LASER 6003 CCE replaces the FIBER LASER 6003 within the drawing tower, an additional diameter gauge head is not required at this position.
1.4 FIBER TEMP 6003 – Measurement of the fiber temperature

The FIBER TEMP 6003 is a standalone gauge for the measurement of the fiber temperature during the drawing process. The gauge head can be either installed at the cold (measuring range +40°C to 120°C) or at the hot end (measuring range +500°C to +1,500°C) of the fiber line. With the precise information on the optical fiber temperature, the melt temperature can be controlled or the forced helium cooling can be reduced to a minimum, resulting in reduced costs.

The integration of two FIBER TEMP 6003 devices at the hot respectively cold position guarantees the compliance of the optimal temperatures for the highest stability of the process.

Technical Data FIBER TEMP 6003

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Cold: +40°C to +120°C</th>
<th>Hot: +500°C to +1,500°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Diameter</td>
<td>100 - 500 μm</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 1 °C, for the cold end</td>
<td></td>
</tr>
<tr>
<td>Measuring Rate</td>
<td>100/sec</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Interfaces</td>
<td>RS485, RS232, LAN; Optional: Wi-Fi, analog output, industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinet-DP, CANopen, DeviceNet)</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>170 x 65 x 265 mm (width x height x depth)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>ca. 4 kg</td>
<td></td>
</tr>
</tbody>
</table>

In combination with the FIBER ECOCONTROL, the temperature is displayed in real time or visualized in the trend diagram. Besides, the FIBER TEMP 6003 can be connected with the plant computer via one of the numerous interfaces.
1.5 FIBER LUMP 6003/FIBER LUMP 6003 MICRO
  – Lump detection on the surface

In addition to diameter measurement, lump detectors are essential for continuous quality control in drawing towers. The 3-axis FIBER LUMP 6003 reliably detects the smallest lumps and neckdowns with a minimum length as small as 500 μm.

For even higher quality requirements, SIKORA offers the FIBER LUMP 6003 MICRO. This device detects non-conformities on the optical fiber surface from a length of 50 μm to 100 %. The performance is achieved by the integrating six measuring axes. Both gauge heads detect faults as small as of 5 μm.

With the SIKORA double sensor technology, punctual non-conformities are detected. The faults are analyzed regarding height, length, number and position. The lump detectors are available for product diameters from 100 to 500 μm and can be easily integrated into a new or already existing drawing tower. The lump detectors can be connected to the SIKORA processor system FIBER ECOCONTROL or to a line computer.

Coloring lines
The described lump detectors FIBER LUMP 6003 and FIBER LUMP 6003 MICRO are equally applicable in coloring lines.

Technical Data FIBER LUMP 6003/
FIBER LUMP 6003 MICRO

<table>
<thead>
<tr>
<th>Product Diameter</th>
<th>100 - 500 μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Detectable Fault Height</td>
<td>5 μm</td>
</tr>
<tr>
<td>Min. Fault Length</td>
<td>FIBER LUMP 6003: 500 μm</td>
</tr>
<tr>
<td></td>
<td>FIBER LUMP 6003 MICRO: 50 μm</td>
</tr>
<tr>
<td>Speed</td>
<td>1 to 3,000 m/min</td>
</tr>
<tr>
<td>Power Supply</td>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Serial interface RS485, setup and diagnosis interface RS232, fault contact; Optional: analog input, lump/neckdown tolerance or alternatively industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinet-DP, CANopen, DeviceNet)</td>
</tr>
</tbody>
</table>

Typical features FIBER LUMP 6003/
FIBER LUMP 6003 MICRO
- Highest reliability with double sensor technology
- Detection of the smallest lumps from up to 5 μm height
- Reliable fault analysis regarding height, length, number and position
The FIBER ECOCONTROL is an extremely powerful display and control processor system, which clearly visualizes the measuring values of the connected measuring devices and lump detectors of the FIBER Series 6000.

The measuring values are displayed numerically and graphically on a 15" TFT monitor. In addition, it includes a time-related trend diagram of all values and a display of the distribution of single values (statistical distribution curve) and comprehensive statistics with the minimum, maximum and mean values, standard deviation, Cp and Cpk values. The operation is intuitive and menu-driven via touch screen. Data storage is available.

### Automatic diameter control
A special feature of the FIBER ECOCONTROL is the control module SET POINT. It ensures a continuous control of the diameter by automatically controlling the line speed or tension. The control is done either by the hot or cold measuring gauge.

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#### Technical Data FIBER ECOCONTROL

**Display**
- 15" TFT touch monitor

**Display of Production and Product Parameters**
- Diameter
- Concentricity
- Ovality
- Temperature
- Tension
- Airlines
- Spinning
- Vibration frequency
- Optical fiber position with scatter plot presentation
- Trend and statistics
- Number of lumps/neckdowns

**Inputs and Outputs**
- 1 LAN interface for the connection of the gauges FIBER LASER 6003, FIBER LASER 6003 CCE
- 4 serial interfaces RS485 for the connection of the gauges FIBER LUMP 6003, FIBER LASER 6003 AIRLINE, FIBER TEMP 6003 (optional 8 outputs available)
- 4 analog outputs 16 Bit, unipolar 0 to 10 V or bipolar -10 to +10 V (optional)
- 4 contact outputs for tolerance or status messages (max. 30 V, max. 0.5 A; optional 8 outputs available)
- 1 communication interface via RS232 or LAN (optional)
- 1 speed input analog 0 to 10 V or 1 electrically isolated input for rotary pulse generators (0/15 V)
- 1 USB customer interface as well as USB interface for a printer (optional)
- 1 LAN interface (selectable OPC DA/UA/SuiteLink - optional)
- Additional inputs and outputs, e.g. Profinet IO, EtherNet/IP, or control modules are optionally available

**Data Storage**
- HDD, USB memory stick or network

**Power Supply**
- 100 - 240 V AC ± 10 %, 50/60 Hz, 24 V on request
2 Measuring technology for the production of optical fiber cables in loose tubing, tight buffering and sheathing lines

2.1 LASER Series 2000/6000 – 2-axis and 3-axis diameter measurement

SIKORA's product range also includes measuring and control technologies for the coloring of optical fibers, the loose tubing or tight buffering respectively, extrusion of the outer sheath of optical cables.

Loose tubing lines/Tight buffering lines
For quality control during the production of loose tubes and tight buffered cables, SIKORA recommends the use of an efficient 2-axis or 3-axis diameter gauge head from the LASER Series 2000 or a superior measuring head from the LASER Series 6000 for diameter measurement with integrated lump detection.

For the LASER Series 6000, SIKORA offers an app displaying measuring values, trends, statistics or video signals at smartphones. The operator can easily log in via the optional Wi-Fi interface and receives immediate production data of the particular gauge head on the smartphone. In combination with the processor system ECOCONTROL 600 the measured values, trend and statistic data are directly visualized. With the efficient control module SET POINT, the connected ECOCONTROL controls the production process via line speed or extruder rpm.

Typical features LASER Series 2000
- Reliable and precise 2-axis or 3-axis diameter measurement
- No moving parts, no calibration

Typical features LASER Series 6000
- Innovative CCD line sensor technology with high pixel resolution combined with pulse controlled laser diodes
- Measuring rate of up to 5,000 measurements/sec/axis
- Detection of lumps and neckdowns
- Integrated LCD display to visualize the diameter value
- Wi-Fi interface and SIKORA App
- No moving parts, no calibration

Technical Data LASER Series 2000/LASER Series 6000

<table>
<thead>
<tr>
<th>Gauge Head</th>
<th>Product Diameter</th>
<th>Accuracy</th>
<th>Repeatability</th>
<th>Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>LASER 2005 XY</td>
<td>0.05 - 5 mm</td>
<td>± 0.25 µm</td>
<td>± 0.1 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 2010 XY/T</td>
<td>0.2 - 10 mm</td>
<td>± 0.5 µm</td>
<td>± 0.1 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 2025 T</td>
<td>0.2 - 25 mm</td>
<td>± 1.0 µm</td>
<td>± 0.2 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 2030 XY</td>
<td>0.2 - 25 mm</td>
<td>± 1.0 µm</td>
<td>± 0.2 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 2050 XY/T</td>
<td>0.5 - 50 mm</td>
<td>± 2.5 µm</td>
<td>± 0.5 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 6020 XY</td>
<td>0.2 - 18 mm</td>
<td>± 0.2 µm</td>
<td>± 0.1 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 6040 XY</td>
<td>0.5 - 38 mm</td>
<td>± 0.5 µm</td>
<td>± 0.2 µm</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>LASER 6080 XY</td>
<td>1.0 - 78 mm</td>
<td>± 1.0 µm</td>
<td>± 0.5 µm</td>
<td>0.2 µs</td>
</tr>
</tbody>
</table>

LASER Series 2000
- Measuring Rate: 500/sec/axis (higher measuring rates on demand)
- Power Supply: 100 - 240 V AC ± 10 %, 50/60 Hz
- Interfaces: Serial interface RS485, setup and diagnosis interface RS232
- Optional: 2 analog outputs or alternatively industrial fieldbus
  (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet, OPC UA)

LASER Series 6000
- Measuring Rate: up to 5,000/sec/axis (LASER 6020 XY)
- Power Supply: 100 - 240 V AC ± 10 %, 50/60 Hz
- Interfaces: Serial interface RS485, setup and diagnosis interface RS232, LAN
- Optional: Wi-Fi, 2 analog outputs or alternatively industrial fieldbus
  (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet, OPC UA)
2.2 X-RAY 6000/6000 PRO

– Intelligent partner for eccentricity measurement

Sheathing lines
The quality of optical cables requires the latest measuring technology during the manufacturing process. The technology used in the X-RAY 6000/X-RAY 6000 PRO is by far the most interesting option in this application field.

The devices measure the diameter, wall thickness and eccentricity during the extrusion process and ensure a reduction of material usage and an optimal line productivity by automatically controlling the wall thickness.

The X-RAY 6000 is specifically designed for single layer products and equipped with an integrated 7” monitor for the graphical and numerical display of the measured values. This operation is intuitively carried out via a touch screen. The high-performance model X-RAY 6000 PRO measures up to three material layers and provides impressive accuracy.

Included within the delivery of the X-RAY 6000 PRO is the processor system ECOCONTROL 6000 (optionally available for X-RAY 6000) for an automatic control of the line speed or extruder rpm. Brilliantly, the ECOCONTROL 6000 visualizes the measuring values graphically and numerically. It provides trend, statistical data and data storage of all measuring values.

Sheathing lines, for which only a limited budget is available, are controlled conventionally without taking into account the eccentricity. For this, a diameter gauge head is installed before and after the crosshead and the average wall thickness is determined by calculating the difference of the diameter measuring values. Similar to the X-RAY 6000 systems, the control is carried out via one of the processor systems ECOCONTROL 6000/1000/600. Depending on the requirements, diameter measuring gauge heads of the LASER Series 2000 or LASER Series 6000 may be used.

An additional diameter gauge head after the cooling section combined with a Hot/Cold Control compensates for the diameter shrinkage.

Production data is clearly displayed at the vertical 22” wide-screen monitor of the X-RAY 6000 PRO

Typical features X-RAY 6000/X-RAY 6000 PRO
- Measurement of the diameter, the eccentricity and the wall thickness
- Automatic control of the line speed and extruder rpm under consideration of the minimum values (in combination with the processor systems ECOCONTROL 6000/1000/600)
- Selectable measuring rate from 1 to 3 Hz (optional 10/25 Hz)
- Intuitive touch screen operation
- No calibration
2.3 LUMP 2000
– 2-axis and 3-axis lump detection

Loose tubing/Tight buffering lines
For reliable lump detection in loose tubing or tight buffering lines, 2-axis lump detectors from the LUMP 2000 XY series are available as well as 3-axis lump detectors from the LUMP 2000 T series. The 3-axis measuring principle is focused on the detection of punctual faults with a constantly high detection probability. The 2-axis lump detectors are perfect for the detection of larger faults and bamboo rings.

Sheathing lines
In sheathing lines, lump detectors of the LUMP 2000 series are equally important, reliably detecting faults on the sheathing surface during production.

Technical Data LUMP 2000

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Product Diameter</th>
<th>Min. Detectable Lumps/Neckdowns</th>
<th>Min. Fault Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUMP 2010 XY</td>
<td>0.5 - 10 mm</td>
<td>0.01 mm</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>LUMP 2025 XY</td>
<td>0.5 - 25 mm</td>
<td>0.01 mm</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>LUMP 2010 T</td>
<td>0.25 - 10 mm</td>
<td>0.02 mm</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>LUMP 2035 T</td>
<td>0.5 - 35 mm</td>
<td>0.02 mm</td>
<td>0.5 mm</td>
</tr>
</tbody>
</table>

Line Speed
up to 3,000 m/min

Power Supply
100 - 240 V AC ± 10 %, 50/60 Hz

Interfaces
Serial interface RS485, setup and diagnosis interface RS232, fault contact
Optional: analog input for lump/neckdown tolerance alternatively industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profinbus-DP, CANopen, DeviceNet)

* “Ghost faults” are caused by light fluctuations from the outside, and thus, are no real faults.
Three ECOCONTROL processor systems form the SIKORA premium segment of display and control devices. Intelligent software technology, clear arrangements, intuitive structure and usability are their convincing characteristics.

Choose the extremely innovative and powerful ECOCONTROL 6000, the unique ECOCONTROL 1000 or the smart ECOCONTROL 600. Each of these display and control systems exceeds all expectations in their class.

The innovative display of the line including pictograms of the connected devices provides a unique overview, while the numeric and graphic display of the measuring values, trend diagrams and statistics fulfill every wish regarding process visualization.

The 22", 15" and 8.4" TFT monitors and the intuitive touch screen control of the ECOCONTROL 6000, 1000 and 600 processor systems represent an intelligent and cutting edge technology.

Advanced software (optional)

**Automatic diameter/wall thickness control**

In combination with the control module SET POINT, the ECOCONTROL systems deliver quality assurance and cost reduction. They ensure a continuous, automatic control of the diameter or wall thickness to the nominal value by controlling either the line speed or the extruder rpm.

**Hot/Cold Module HC 2000 (ECOCONTROL 6000/1000)**

With the Hot/Cold Module HC 2000, the material shrinkage is continuously calculated and considered automatically for the control of the diameter and/or wall thickness.

**FFT analysis**

Optionally, the ECOCONTROL 6000 visualizes periodical variations of the product parameter from an FFT analysis of the measuring values. This software package was developed with the support of competent partners within the industry and detects weak points of the production in time.
### Technical Data ECOCONTROL

<table>
<thead>
<tr>
<th></th>
<th>6000</th>
<th>1000</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFT color monitor</td>
<td>22&quot; (vertical)</td>
<td>15&quot;</td>
<td>8.4&quot;</td>
</tr>
<tr>
<td>(alternatively 15&quot;, horizontal)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inputs/Outputs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial interface RS485 for the connection to measuring devices</td>
<td>8*</td>
<td>4*</td>
<td>1</td>
</tr>
<tr>
<td>Electrically isolated digital inputs for the connection to testing devices</td>
<td>8*</td>
<td>4*</td>
<td>4*</td>
</tr>
<tr>
<td>Analog inputs 16 Bit, ± 10 V (bipolar)</td>
<td>8*</td>
<td>4*</td>
<td>-</td>
</tr>
<tr>
<td>Analog outputs 16 Bit, ± 10 V (bipolar)</td>
<td>8*</td>
<td>4*</td>
<td>-</td>
</tr>
<tr>
<td>Contact outputs for tolerance and status messages (max. 30 V, max. 0.5 A)</td>
<td>8*</td>
<td>4*</td>
<td>4*</td>
</tr>
<tr>
<td>Communication interface via RS232 or LAN</td>
<td>1*</td>
<td>1*</td>
<td>1*</td>
</tr>
<tr>
<td>Interface for printer</td>
<td>1*</td>
<td>1*</td>
<td>1*</td>
</tr>
<tr>
<td>Electrically isolated input for rotary pulse generators (0/15 V)</td>
<td>1*</td>
<td>1*</td>
<td>1*</td>
</tr>
<tr>
<td>Electrically isolated interface module for control of the diameter (HC 2000)</td>
<td>1*</td>
<td>1*</td>
<td>-</td>
</tr>
<tr>
<td>USB customer interface</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Industrial fieldbus (e.g. Profinet IO, EtherNet/IP, Profibus-DP, CANopen, DeviceNet)</td>
<td>Yes*</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>LAN interface (selectable OPC DA/UA/SuiteLink)</td>
<td>1*</td>
<td>1*</td>
<td>1*</td>
</tr>
<tr>
<td>(only OPC DA/SuiteLink)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>1*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard disk (optional)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External media (optional)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power Supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 - 240 V AC ± 10 %, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Depending on the equipment

### Data storage
The data storage on a hard disk is a standard for the ECOCONTROL 6000. For the ECOCONTROL 1000, this feature is optionally available. For the ECOCONTROL 600, an external storage (USB, LAN) is available upon request.

### Reporting
Time, length or reel related production reports are available for each of the three ECOCONTROL devices (6000, 1000, and 600).

### VIRTUAL 2000 – Intelligent software concept
The virtual gauge technology is suitable for all applications, which require a fast wall thickness control, but due to line configuration or the product structure, a diameter or wall thickness measurement directly after the extruder is not possible.
SIKORA AG (Headquarters)
Bruchweide 2
28307 Bremen
Germany

Ph.: +49 421 48900 0
e-mail: sales@sikora.net

Brazil
sales@sikora-brazil.com

China
sales@sikora-china.com

France
sales@sikora-france.com

India
sales@sikora-india.com

Italy
sales@sikora-italia.com

Japan
sales@sikora-japan.com

Korea
sales@sikora-korea.com

Malaysia
sales@sikora-sea.com

Mexico
sales@sikora-mexico.com

Russia
sales@sikora-russia.com

Turkey
sales@sikora-turkey.com

Ukraine
sales@sikora-ukraine.com

United Arab Emirates
sales@sikora-uae.com

USA
sales@sikora-usa.com

Certified according to
DIN EN ISO 9001

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