Optical fibers and optical fiber cables

Measuring and control technology for the production of

SIKORA
Technology To Perfection
Content

Introduction ........................................................................ 2

1 Measuring technology for the production of optical fibers ........ 3

1.1 FIBER LASER 6003 .................................................. 3
   for the diameter measurement after the furnace, before and after the coating

1.2 FIBER LASER 6003 AIRLINE ..................................... 4
   for diameter measurement with airline detection

1.3 FIBER LASER 6003 CCE .......................................... 5
   for the evaluation of coating concentricity

1.4 FIBER TEMP 6003 ................................................... 5
   for the measurement of the optical fiber temperature

1.5 FIBER LUMP 6003/FIBER LUMP 6003 MICRO .......... 6
   for lump detection on the surface

1.6 FIBER ECOCONTROL ............................................. 7
   premium processor system for visualization and control of production data

2 Measuring technology for the production of optical cables in loose tubing, tight buffering and sheathing lines ............... 9

2.1 LASER Series 2000/6000 ....................................... 9
   for 2- and 3-axis diameter measurement

2.2 X-RAY 6000/6000 PRO ........................................... 10
   intelligent partner for eccentricity measurement

2.3 LUMP Series 2000 ................................................ 11
   for 2- and 3-axis lump detection

2.4 ECOCONTROL 600/1000/6000 ........................... 12
   processor systems for visualization and control of production data at the production of optical fiber cables
SIKORA AG is a leading manufacturer and supplier of innovative online measuring, control, inspection and sorting technology for the wire and cable, hose and tube as well as optical fiber and plastics industries. Worldwide, users of these measuring devices benefit from an increasing manufacturing quality, profitability and efficiency. Modern Laser and X-ray technologies measure precisely and reliably, product parameters such as the diameter, ovality, wall thickness and eccentricity.

A continuous control of production data helps to avoid wall thickness over sizes and leads to a more efficient material usage. Every micrometer of insulation material that can be saved by the use of measuring and control technology makes the production more economic and saves at the same time, increasingly the scarce resources.

SIKORA has its headquarters in Bremen, Germany. Since 1973 the high-quality devices have been developed and manufactured at this site. Regarding service and sales SIKORA is globally active with offices in Brazil, China, France, India, Italy, Japan, Korea, Russia, Turkey, the Ukraine, USA and the United Arab Emirates. In cooperation with more than 30 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.

Since 1993 SIKORA has been certificed 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 team in research and development is working continuously on the development of new technologies which help manufacturers of wires, cables, hoses, tubes, raw materials, optical fibers and optical fiber cables to run their production lines more efficiently and economically.

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

All over the world huge 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 the productivity of the production. Moreover, SIKORA is worldwide well-known for its measuring devices for optical cables. Please refer to this catalog for further information.

**Highlights FIBER Series 6000**
- Measurement of the diameter, position, vibration frequency, tension and spinning
- Control of the fiber draw process
- Detection of Airlines
- Temperature measurement
- Coating concentricity evaluation
- Reliable lump detection with double sensor technology and 3- oder 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 1.2 μs always guarantees the highest accuracy.

The measuring principle is based on diffraction analysis. With the measurement according to that method SIKORA became the worldwide technology leader. It allows a non-contact, optical measurement of diameters without moving parts and no need for calibration.

Typically, a 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 also calculates the tension by means of a Fast Fourier Transformation (FFT). The single values of the fiber position and the vibration frequency are graphically visualized by 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 the 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. With corresponding adjustments, these gauge heads also provide information on the concentricity of the coating.
1.2 FIBER LASER 6003 AIRLINE for diameter measurement with airline detection

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

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 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.

Technical data FIBER LASER 6003/
FIBER LASER 6003 AIRLINE/
FIBER LASER 6003 CCE

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product diameter</td>
<td>0.05 - 0.5 mm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 0.05 μm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.02 μm</td>
</tr>
<tr>
<td>Smallest detectable airline</td>
<td>0.5 μm (diameter)</td>
</tr>
<tr>
<td>Exposure time</td>
<td>1.2 μs</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>2,500/sec</td>
</tr>
<tr>
<td>Power supply</td>
<td>100 ... 240 V AC ± 10%, 50/60 Hz</td>
</tr>
</tbody>
</table>

Interfaces
Serial interface RS485, Setup and diagnosis interface RS232, LAN (EtherNet), 4 analog outputs (uni/bipolar) or optional Profibus-DP, alternatively industrial field busses such as CANopen, EtherNet/IP, DeviceNet, ProfiNet IO

Highlights
FIBER LASER 6003 AIRLINE/FIBER LASER 6003/
FIBER LASER 6003 CCE
- Highest accuracy for an optimum quality control during optical fiber production
- Diameter, position, tension, vibration frequency and spinning measurement directly in the gauge head
- Airline detection (FIBER LASER 6003 AIRLINE)
- Coating concentricity evaluation (FIBER LASER 6003 CCE)
- No moving parts
- No calibration
- Availability 99.8%
1.3 FIBER LASER 6003 CCE for the evaluation of coating concentricity

In order to precisely evaluate the concentricity of the coating, the FIBER LASER 6003 can optionally 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 as well as 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 for the 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 installed at the cold (measuring range 30° to 270°C) or at the hot end (measuring range 500° to 1,500°C) of the fiber line. With the precise information on the fiber temperature, the melt temperature can be controlled or the forced helium cooling can be reduced to a minimum, resulting in reduced costs.

To ensure the right temperature at both positions, two FIBER TEMP 6003 devices should be installed, for highest stability of the process.

Technical data FIBER TEMP 6003

<table>
<thead>
<tr>
<th>Product diameter</th>
<th>100 to 500 μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>1° for the cold end</td>
</tr>
<tr>
<td>Measuring rate</td>
<td>100/s</td>
</tr>
<tr>
<td>Power supply</td>
<td>100 – 240 V AC ± 10%, 50/60 Hz</td>
</tr>
<tr>
<td>Interfaces</td>
<td>LAN (EtherNet) interface</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>Cold: 40° to 200°C (measuring range 30° to 270°C)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>150 x 30 x 225 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>ca. 1 kg</td>
</tr>
</tbody>
</table>

In combination with the FIBER ECOCONTROL, the temperature is indicated and also visualized in the trend diagram.

Display of the temperature and other measuring values on the FIBER ECOCONTROL
1.5 FIBER LUMP 6003/FIBER LUMP 6003 MICRO
for 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 length of 500 μm.

For even higher quality requirements, SIKORA offers the FIBER LUMP 6003 MICRO. The device detects non-conformities on the optical fiber surface from a length of 100 μm, to 100%. This performance is achieved by the integration of 6 measuring axes. Both gauge heads detect faults from a height of 5 μm.

In combination 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>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product diameter</td>
<td>100 to 500 μm</td>
</tr>
<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: 100 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, Proﬁbus-DP, alternatively fault contact or analog input, lump/neckdown tolerance, industrial ﬁeld busses such as CANopen, EtherNet/IP, DeviceNet, Proﬁnet IO</td>
</tr>
</tbody>
</table>
1.6 FIBER ECOCONTROL – premium processor system for visualization and control of production data

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. Moreover, 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 value, standard deviation, Cp and Cpk values. The operation is intuitive, 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 end measuring gauge head.

Technical data FIBER ECOCONTROL

Display
15” TFT touch monitor

Display of production and product parameters
- Diameter
- Concentricity
- Diameter Tolerance
- Temperature
- Temperature Tolerance
- Optical fiber position with scatter plot presentation
- Trend and Statistics
- Vibration frequency
- Number of lumps/neckdowns

In- and Outputs
1 LAN interface for the connection of the gauges FIBER LASER 6003, FIBER LASER 6003 CCE
8 serial interfaces RS485 for the connection of the gauges FIBER LUMP 6003, FIBER LASER 6003 AIRLINE, FIBER TEMP 6003
4 analog outputs 16 Bit, unipolar 0 to 10 V or bipolar -10 to +10 V (option)
Up to 8 contact outputs for tolerances or status messages (max. 30 V, max. 0.5 A)
1 serial interface RS232 for communication with an external computer (option)
1 speed input analog 0-10V or 1 electrically isolated inputs for rotary pulse generators (0/15 V)
1 USB customer interface as well as USB interface for a printer (option)
1 LAN interface (OPC (option))
Additional in- and outputs, e.g. Profinet IO, EtherNet/IP, or control modules are available as options

Data storage
HDD, USB memory stick or network

Power supply
100 to 240 V (+/- 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 for 2- and 3-axis diameter measurement

SIKORA’s product range also includes measuring and control technologies at 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 a classic 2- or 3-axis diameter gauge head from the LASER Series 2000, or a high-end 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 on smartphones. The operator can easily log in via the Wi-Fi interface and receives 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 at the ECOCONTROL. 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- or 3-axis diameter measurement
- No moving parts, no calibration

Typical features LASER Series 6000
- High measuring rate of up to 5,000 measurements/s
- Detection of lumps and neckdowns
- Integrated LCD display to visualize the diameter value
- Wi-Fi
- 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>
<tr>
<td>LASER Series 2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LASER Series 6000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measuring Rate
- 500/s (higher measuring rates on demand) up to 5,000/s

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

Interfaces
- Serial interface RS485, Setup and diagnosis interface RS232, optional 2 analog interfaces, Profibus-DP or alternatively industrial field busses such as CANopen, EtherNet/IP, DeviceNet, Profinet IO
- Serial interface RS485, Setup and diagnosis interface RS232, LAN (EtherNet), optional 2 analog interfaces, Profibus-DP, Wi-Fi or alternatively industrial field busses such as CANopen, EtherNet/IP, DeviceNet, Profinet IO
2.2 X-RAY 6000/6000 PRO - intelligent partner for eccentricity measurement

Sheathing lines
The quality of optical cables requires the latest measuring technology already during manufacture. 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 directly during the extrusion process and ensure a reduction of the material usage and an optimal line productivity by means of the automatic control of 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 measuring 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 an impressive accuracy.

Included with 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, 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 system ECOCONTROL 600/1000/6000. Depending on the requirements, diameter measuring gauge heads of the LASER Series 2000 or LASER Series 6000 are used.

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

At the vertical 22" wide-screen monitor of the X-RAY 6000 PRO, production data are clearly displayed.

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 600/1000/6000)
- Selectable measuring rate from 1 to 3 Hz (optional 10 Hz)
- Intuitive touch-screen operation
- No calibration
2.3 LUMP Series 2000 for 2- 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 Series 2000 XY are available, as well as 3-axis lump detectors from the LUMP Series 2000 T. 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 surface imperfections and bamboo rings.

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

Technical data LUMP Series 2000

<table>
<thead>
<tr>
<th>Gauge head</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
90 to 264 V AC, 50/60 Hz

Interfaces
Serial interface RS485, Setup and diagnosis interface RS232, Profinet-DP, alternatively fault contact or analog input, lump/neckdown tolerance;
Universal interface module for EtherNet/IP, DeviceNet, ProfiNet IO, CANopen, Profinet-DP
2.4 ECOCONTROL 600/1000/6000 – processor systems for visualization and control of production data at the production of optical cables

Three ECOCONTROL processor systems form the SIKORA premium segment of display and control devices. Intelligent software technology, clear arrangements and easy usability are their convincing characteristics.

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

The innovative display of the line with pictograms of the connected devices provides an unique overview, while the numeric and graphic display of the measuring values, trend diagrams and statistics fulfill every wish regarding the 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 future-oriented technology.

Advanced Software (option)

Automatic diameter/wall thickness control
In combination with the control module SET POINT, the ECOCONTROL systems stand for quality assurance and cost reduction. It ensures 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 1000/6000)
With the HC 200, the material shrinkage is continuously calculated and considered automatically for the control of the diameter and/or wall thickness.

FFT-Analysis
Optionally, the ECCONTROL 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 of the industry and detects weak points of the production in time.

Data storage
The data storage on a high-performance hard disk is a standard for the ECOCONTROL 6000. For the ECOCONTROL 1000 and 600 this feature is optionally available.

Recording
Time, length or reel related production reports are available for each of the three ECOCONTROL Series devices.
**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; (alternatively 15&quot;, horizontal)</td>
</tr>
<tr>
<td><strong>In-/outputs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial interface RS485</td>
<td>4 (8 option)</td>
<td>2 (4 option*)</td>
<td>1</td>
</tr>
<tr>
<td>Electrically isolated digital inputs for the connection to testing devices</td>
<td>4 (8 option)</td>
<td>4 (option)</td>
<td>4 (option)</td>
</tr>
<tr>
<td>Analog outputs 16 Bit: 0 ...10 V or +/-10 V (unipolar/bipolar)</td>
<td>4 (option)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Contact outputs for tolerance and status messages (max. 30 V, max. 0.5 A)</td>
<td>4 (8 option)</td>
<td>4 (option)</td>
<td>4 (option)</td>
</tr>
<tr>
<td>Serial interface RS232 for communication with an external computer</td>
<td>1 (option)</td>
<td>1 (option)</td>
<td>1 (option)</td>
</tr>
<tr>
<td>USB interface for a printer</td>
<td>1 (option)</td>
<td>1 (option)</td>
<td>1 (option)</td>
</tr>
<tr>
<td>Electrically isolated input for rotary pulse generators (0/15 V)</td>
<td>1 (option)</td>
<td>1 (option)</td>
<td>1 (option)</td>
</tr>
<tr>
<td>Electrically isolated interface module for control of the diameter (HC 2000)</td>
<td>1 (option)</td>
<td>1 (option)</td>
<td>-</td>
</tr>
<tr>
<td>USB customer interface</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Profinet as well as alternative field busses</td>
<td>Yes (option)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>EtherNet interface (selectable OPC/Suitelink)</td>
<td>1 (option)</td>
<td>1 (option)</td>
<td>1 (option)</td>
</tr>
<tr>
<td>WiFi (WLAN)</td>
<td>1 (option)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard disk</td>
<td>Hard disk</td>
<td>USB drive (option)</td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 … 240 V (+/-10%)</td>
<td>50 / 60 Hz</td>
<td>100 … 240 V (+/-10%)</td>
<td>50 / 60 Hz</td>
</tr>
</tbody>
</table>

* 2 for event devices only, e.g. lump detectors

**VIRTUAL 2000 - Intelligent software concept (optional)**
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.
We are here for you!

SIKORA AG (Headquarters)
Bruchweide 2
28307 Bremen
Germany

Ph.: +49 421 48900 0
email: 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

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

ISO 9001
QUALITY
SIKORA

Certified according to
DIN EN ISO 9001

Technical data is subject to change

www.sikora.net