



# X-RAY 8000

X-ray measuring systems for MV, HV and EHV cables  
in CCV, VCV and MDCV lines



# X-RAY 8000 ADVANCED/NXT

Two perfect possibilities to control the quality of cables in CV lines

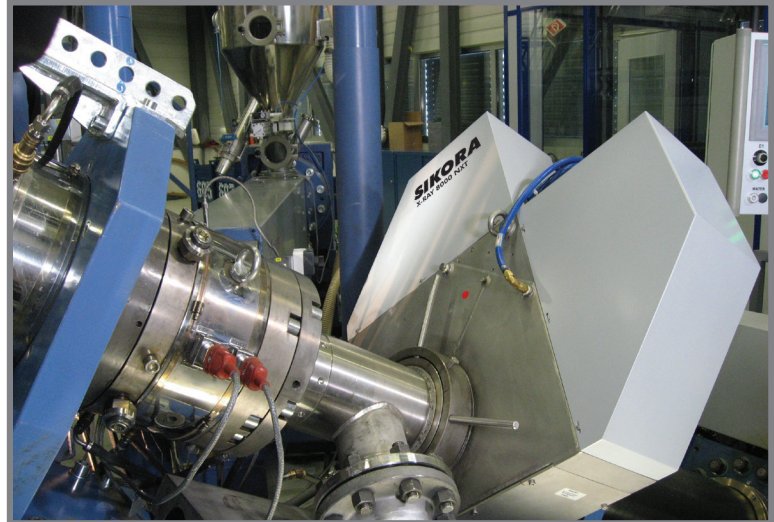
## X-RAY 8000 NXT – An invention of SIKORA that decisively shapes the high voltage cable production

The X-RAY 8000 NXT is a proven tool that became globally an industrial standard for quality control at the production of medium, high and extra-high voltage cables in CCV, VCV and MDCV lines\*. It convinces by precise and reliable measurements of concentricity, wall thickness, diameter and ovality as well as by controlling cables with up to three layers. Today there are more than 1,500 X-RAY 8000 systems at customer locations worldwide assuring online quality control.

### X-RAY 8000 NXT with Multi-Sensor-Technology (MST)

The SIKORA Multi-Sensor-Technology (MST) guarantees, in combination with two high-speed-scanners, accurate and reliable measurements of medium, high voltage and extra-high voltage cables, even when the cable is vibrating. Furthermore, due to the MST, every scan of the two scanners provides four measuring values, ensuring an extremely high accuracy.

\* CCV (Catenary Continuous Vulcanization), VCV (Vertical Continuous Vulcanization), MDCV (Mitsubishi Dainichi Continuous Vulcanization)



X-RAY 8000 NXT in CV line

## X-RAY 8000 ADVANCED — while others still measure, we already control

With the X-RAY 8000 ADVANCED, SIKORA offers a system with state-of-the-art High-Speed-Technology (HST) that is tailored to the requirements of Industry 4.0. It represents an advanced alternative to the successful and established X-RAY 8000 NXT. The system – equipped with 16 measuring sensors – measures the diameter, wall thickness and eccentricity by a factor of up to 10 faster than the X-RAY 8000 NXT, and thus, is predestined for an efficient control.

Excellent are the advantages resulting from the centering as each change of the centering screws is immediately registered and visualized. The four times greater number of measuring points, compared to the NXT system, simultaneously leads to a measurement almost without delay and an immediate control. Both factors optimize the process and ensure the highest quality of the cables, at maximum material and cost savings.

### X-RAY 8000 ADVANCED with High-Speed-Technology (HST)

The High-Speed-Technology (HST) is the latest innovation from SIKORA. The focus is on efficiency enhancement due to a fast centering and an automatic control of the product parameters. The basis for this are quick and reliable measuring values with the HST. For a fast update of the scan data, the system optimizes the scanning time by automatically adapting the scan path to the cable diameter.

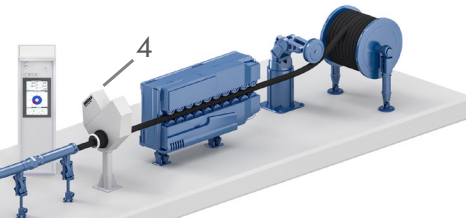
1. PURITY SCANNER ADVANCED
2. ULTRATEMP 6000
3. X-RAY 8000 ADVANCED/NXT
4. X-RAY 8700 NXT



CVC line with SIKORA devices



VCV line with SIKORA devices



### Design

SIKORA's X-RAY 8000 devices consist of two components: the scanner unit and the control cabinet. Typically, the scanner unit is installed in the moving part of the telescopic tube, directly after the crosshead. Measuring values for centering and control are therefore, immediately available.

Integrated into the scanner unit are two high-speed scanners, which provide an X-ray picture of the cable from perpendicular directions.

The control cabinet includes an industrial PC for the analysis of the scan picture. The control of the scanner motors and the high voltage supply are safely located in the control cabinet. In this position, these components are not exposed to the high temperatures.

### Analysis

All measuring values are calculated directly from the X-ray picture by regression analysis. This concept provides measuring values of the highest accuracy and repeatability, requires no calibration, no fine tuning, no warm-up period and no pre-setting for the absorption parameter of the different insulating materials.

### Innovative ceramic and NTX windows

The measurement is done through ceramic windows and NTX windows (Non Toxic X-ray windows), which separate the scanners from the pressure of the CV line. With these windows, SIKORA presents another masterpiece of engineering. The surface of the windows does not react with any by-products resulting from the cross linking. Thus, the windows remain clean due to the "Lotus Effect", even without any rinsing or any mechanical protection.

### XLL (eXtra Long Life) X-ray tubes

The X-RAY 8000 ADVANCED/NXT is equipped with high-quality XLL (eXtra Long Life) gate-controlled X-ray tubes. These ensure long operation time combined with highest accuracy and reliability.

### 8-point display of the wall thickness and eccentricity

The wall thickness, eccentricity, diameter and ovality are clearly visualized on a TFT monitor. An 8-point display of the wall thickness and a color highlighting of the eccentricity, together with numerical information on its angle and size, guarantee optimum process stability.

Information is displayed both numerically and graphically. The display includes a length related trend display of all values together with a graphic for the distribution curves on the single values and a comprehensive statistic with min/max value as well as average and standard deviation.

### Automatic Control and Hot/Cold Control

The use of the control module SET POINT is the precondition for the control of the wall thickness or diameter in automatic mode. Additional signal outputs allow an automatic centering of the crosshead when the extruder is prepared for this step.

For optimum product quality, and simultaneously, the lowest possible compound consumption, SIKORA offers the Hot/Cold Control Module HC 2000. The HC 2000 includes the continuous control with an online shrinkage calculation. For this application, the X-RAY 8000 ADVANCED/NXT is combined with the X-RAY 8700 NXT or a diameter gauge head of the LASER Series 2000/6000 for the measurement of the cold diameter.

#### Typical features X-RAY 8000 NXT:

- More than 1,500 X-RAY 8000 systems sold worldwide
- 8-point display of wall thickness and concentricity for three insulation layers
- XLL (eXtra Long Life) gate controlled X-ray tubes for highest reliability and long life
- Ceramic windows at the bottom, for a reliable long-term operation without cleaning, combined with NTX (NonToxic X-ray) windows (none Beryllium) at the top
- Unique Multi-SensorTechnology
- Fast centering of the crosshead and optimum quality and process control
- No calibration, no warm-up

#### Additional features X-RAY 8000 ADVANCED

- Faster recording of measuring data by a factor of up to 10 directly after starting up the line enables an immediate control
- Optimization of the start-up process
- Ensurance of the highest cable quality at maximum material and cost savings



X-RAY 8000 ADVANCED monitor image

## Further systems for individual applications

### X-RAY 8700 NXT at the end of the production line

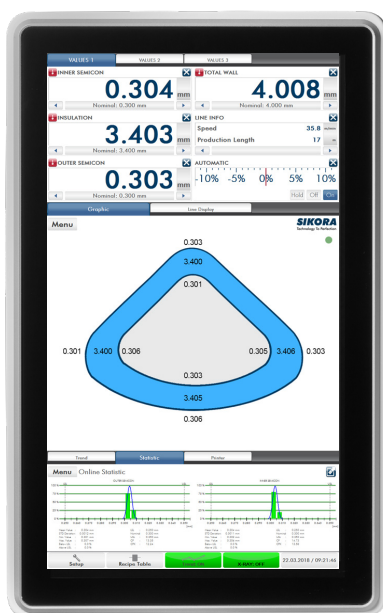
While the X-RAY 8000 ADVANCED/NXT provides information for a fast centering of the crosshead and an automatic control, the X-RAY 8700 NXT measures the final product dimensions (diameter, wall thickness, eccentricity) at the end of the production line. It is applicable for cables with solid and stranded as well as milliken conductors with single, double or triple layer insulation. The X-RAY 8700 NXT is also suitable for the reliable quality control of insulation material based on polypropylene (High Performance Thermoplastic Elastomer – HPTE). The cable is thereby produced in an on-line production process. The combination of the X-RAY 8000 ADVANCED/NXT at the beginning with the X-RAY 8700 NXT at the end of the line offers a precise determination of the shrinkage values for all three insulation layers. This assures an optimum in process control.

### X-RAY 8000 ADVANCED/NXT for steam lines

Mining and ship cables are typically rubber insulated and vulcanized in steam CCV lines at temperatures of 225 °C and a pressure of 25 bars. A special version of the X-RAY 8000 ADVANCED/NXT is also available for this application and provides a permanent quality monitoring and control.

### X-RAY 8000 ADVANCED/NXT for sector cables in CCV lines

Optionally, the X-RAY 8000 ADVANCED/NXT is also available as special edition for the measurement of straight sector cables.



X-RAY 8000 ADVANCED monitor  
image of a sector cable in CCV lines

### X-RAY 6000 PRO for jacketing lines

The X-RAY 6000 PRO is another X-ray based measuring system providing monitoring and control of the wall thickness in consideration of the eccentricity. In combination with the ECOCONTROL 6000, all measuring data are clearly displayed on a 22" widescreen TFT monitor.



X-RAY 6000 PRO monitor image at the  
ECOCONTROL 6000

## TECHNICAL DATA

### X-RAY 8000 ADVANCED/NXT

<b>Field of Application</b>	
CCV, VCV line operating with nitrogen and/or steam	
<b>Field of Use</b>	
Medium, high and extra-high voltage cables with XLPE, EPR*, EPDM, HYPALON insulation etc.	
<b>Product Name</b>	<b>Product Diameter</b>
X-RAY 8000 ADVANCED/NXT	10 to 92, 130, 168 mm for CCV lines
X-RAY 8000 ADVANCED/NXT	10 to 140, 205 mm for VCV lines
X-RAY 8700 NXT	10 to 94, 145, 180 mm at the end of CCV, VCV, MDCV lines
<b>Measuring Accuracy</b>	
Wall thickness $\pm 15 \mu\text{m}$ , $\pm 0.02 \%$ Diameter $\pm 5 \mu\text{m}$ , $\pm 0.02 \%$	
<b>Scan Speed</b>	
Up to 60 mm/s	
<b>Radiation</b>	
A dual safety system guarantees that the X-ray device can only be switched on when the safety of the operator is assured. Radiation measurements in direct proximity of the scanner box are below limiting values of all international regulations. As the windows for the measurement through the CV tube are made of ceramic, perfect safety is assured at that position as well.	
<b>Permissible Temperature</b>	
+ 5 to + 50 °C	
<b>Cooling Water, Consumption</b>	
Approx. 70-150 l/h at max. 30 °C	
<b>Dimensions (Scanner Box)</b>	
Approx. 950 x 900 x 270 mm	

\* 70 kV scanners for EPR cables with big diameters > 45 mm  
Technical data is subject to change

### PROCESSOR/MONITOR SYSTEM

<b>Display</b>
22" TFT color monitor with touch screen operation
<b>Display of Measured Values</b>
<ul style="list-style-type: none"> <li>Diameter, ovality, wall thickness, eccentricity</li> <li>Graphical trend display of measured values on a time or length related diagram</li> <li>Statistical distribution</li> <li>SPC data, mean/max/min value, standard deviation, cp, cpk</li> </ul>
<b>Control Modes (Optional)</b>
<ul style="list-style-type: none"> <li>Wall thickness of the insulation</li> <li>Wall thickness of the outer semiconductor</li> <li>Wall thickness of the inner semiconductor</li> <li>Outer diameter</li> <li>Hot/Cold Control HC 2000</li> </ul>
<b>Control Interface</b>
Isolated, max. $\pm 12 \text{ V}$ , max. $\pm 5 \text{ mA}$
<b>Interfaces (Optional)</b>
RS485, USB, OPC DA/UA, Profinet IO, EtherNet/IP, Profibus-DP, analog outputs, LAN, digital inputs and outputs
<b>Data Recording</b>
Measuring values are stored in a time or length related interval in .xls format. Optionally, a recording in .pdf format is available. The data recording is made selectively as length related production report or as time-oriented trend.
<b>Power Supply</b>
230 V AC $\pm 10 \%$ , 50 Hz/60 Hz, 900 VA
<b>Permissible Temperature</b>
+ 5 to + 45 °C
<b>Dimensions (Cabinet)</b>
19" cabinet, 600 x 610 x 2,150 mm

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