Helios-rc

Control texturing and etching processes of solar wafers

Securing Good Results

Click at your desired area.

Precise process control for your solar wafers

Whether PERC, TopCON, HJT, n-type or p-type: The secret to success of highly efficient crystalline solar cells always has two sides: A textured front side and an etched rear side.

Etching, for example, has a strong influence on the passivation of the ultra-thin silicon wafers, which minimizes electrical losses.

The chemical treatment of both surfaces requires precise Process control. For this challenge, you can always trust the Helios-rc systems.

They are your reliable instruments that allow you to completely measure, analyze and optimize surface treatment.

This means that you not only hold control over the entire manufacturing process, but also you ensure the seamless high quality of your modules.

Experience it firsthand!

One principle, numerous possibilities.

Our INLINE and OFFLINE systems always use the same measurement optics and electronics, and constantly follow one measurement principle:

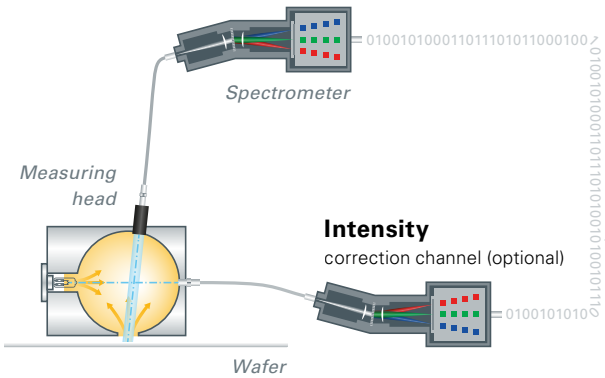
1. Acquire measurement data
Your wafer is captured by a reflection measuring head with an integrated light source in the integrating sphere. Subsequently, a reflection spectrometer converts the optical signals into data signals, the so-called raw spectra.

2. Evaluating measurement data
Using the ETA-TCM software, we process the raw spectra into measurement spectra and determine the reflectance of the wafer. Filters, averaging, factors and offsets can be optionally set.
When processing the measurement spectra in the evaluation modules, you also define the relevant parameters for reflectance, color and layer thickness.

3. Measurement result
Your measured values are displayed in tabular and graphical format. Optionally, you can display statistics. By setting limits you can generate good/bad signals for your wafers. All results are stored and can be directly communicated to your systems via various interfaces, such as Digital IO, TCP/IP, Profibus.

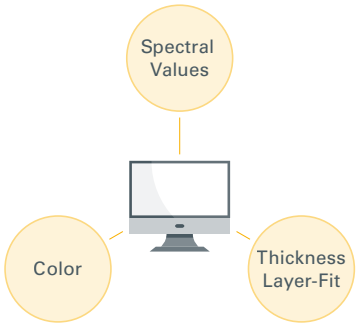
Acquire measurement data | **Evaluate measurement data** | **Measurement result**

Reflectance



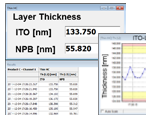
Measurement data
Preparation of measurement data to spectra

Evaluation modules



Results
- Statistics
- Output of the results to the PLC of the production line
- Data logging

Visualization
Individual results,



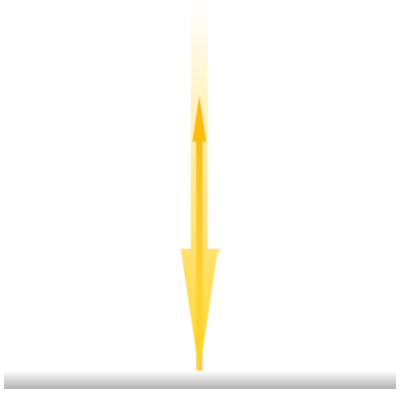
Trend displays,

and many other display types.

ETA-TCM software
- Hardware control (shutters, lamps, references)
- Data management (settings, parameters, user data etc.)
- IO interface to the PLC of the production line

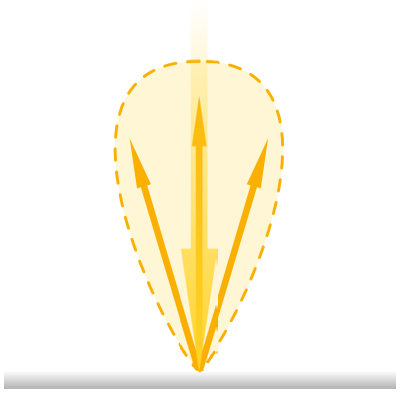
Measurement optics and electronics | **ETA-TCM software (Windows PC)**

Reflection properties of different surfaces



Polished wafer, specular

Wafer front side, diffuse

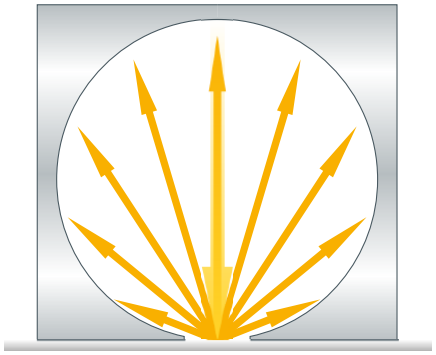


Wafer rear side, glossy

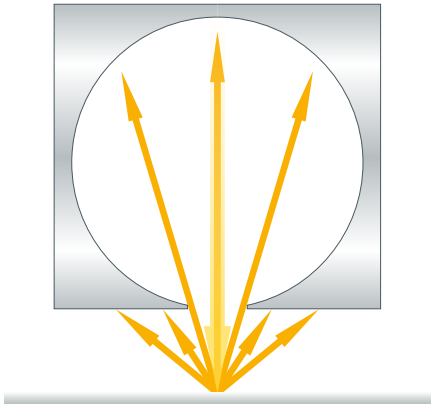
Front side texturing
changes the overall reflectance.

Rear side etching,
on the other hand, changes the angular distribution of reflected light.

Measurement geometry for front and rear side



Total reflectance
measurement of the front side of the wafer



Spatial angle reflectance
measurement of the rear side of the wafer

Total reflectance
At very short working distance,
all light reflected from the wafer is captured by the integrating sphere.

Spatial angle reflectance
At an increased working distance,
only a part of the light reflected from the wafer is captured by the integrating sphere.
This sensitivity changes with the surface etching of the wafer.

All wafers, all processes. INLINE and OFFLINE measurement.

- Identical measurement hardware for accurate comparison.
- Non-contact and non-destructive measurement
- With integrated reference standard
- With adjustable working distance
- Very quick measurement (≤ 100 ms)

Suitable for
- PERC, TopCON, HJT
- n-type, p-type
- All types of front side textures
- All kinds of rear side etchings
- Coated wafers (SiNx, AlOx, SiOx, Poly-Si)

Measurement values for
- Integral spectral reflectance:
  - Total reflectance (small working distance ≈ 1 mm)
  - Spatial angle reflectance (Typical working distance ≈ 6 – 8 mm)
- Color of coated wafer
- Coating thickness

User-friendly through
- Easy operation
- User-definable quality limits
- Good/Bad indication

Helios LAB-rc | Manually operated tabletop device

- Adjustable measuring distance
- Integrated reference samples in the measurement table
- For uncoated and coated wafers
- External power unit provides voltage supply (12 VDC)

Wafer sizes
For mounting in moving sample frame
Minimum: 20 x 20 mm
Maximum: 245 x 245 mm

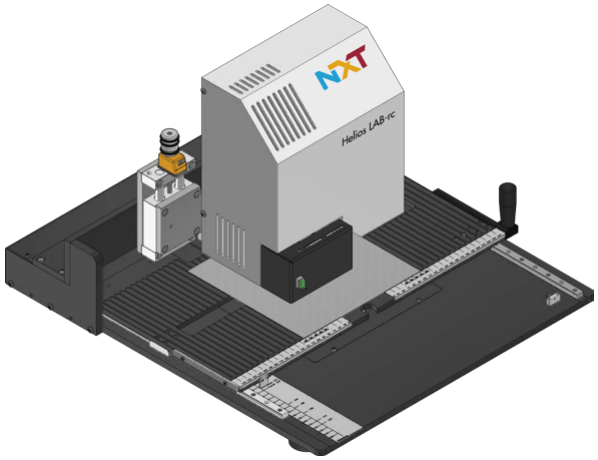
Measurement table
- Y-axis manually traversable
- Traversing range 300 mm
- Rulers on X- and Y-axis
- High-quality surface for placing the wafers

Weight
20 kg

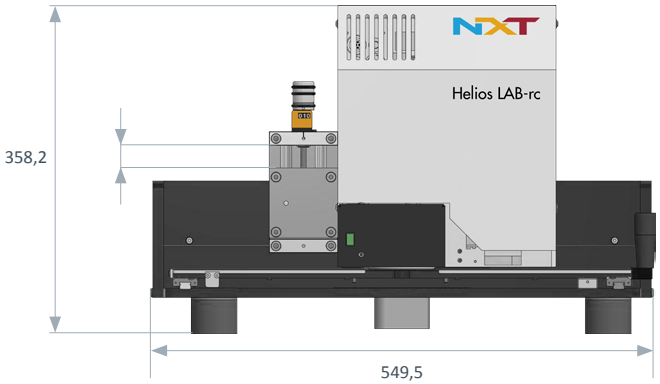
Power consumption
Maximum: 150 VA
Average: 100 VA

Customizations
Other measurement table sizes or special sample frames are available upon request.

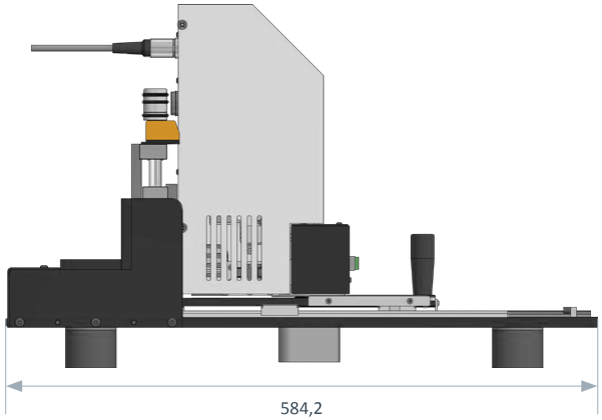
Power unit
Dimensions [mm]: H = 139, B = 165, T = 316
Weight: 3.5 kg
Electrical data
Input voltage: 100 – 240 VAC / 50 – 60 Hz
Output voltage: 12 VDC



Helios LAB-rc from top



from front



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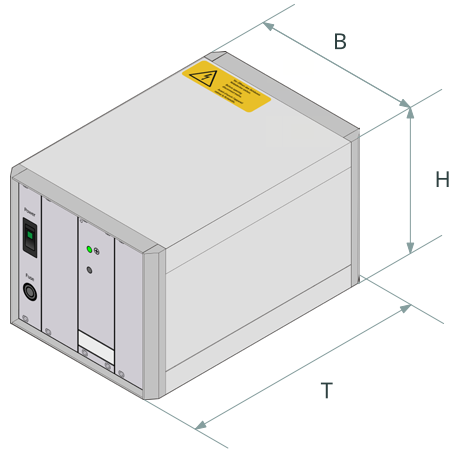


External power unit

Helios SCAN-rc | Motorized scanning tabletop device

- Integrated PC (also available without PC)
- Adjustable measuring distance
- Reference samples integrated in the measurement table
- For uncoated and coated wafers

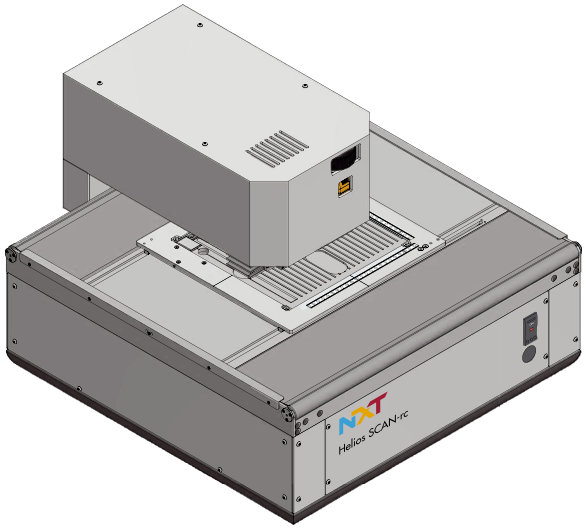
Wafer sizes
For mounting in moving sample frame
Minimum: 20 x 20 mm
Maximum: 245 x 245 mm

Measurement table
- Drive with stepper motors
- Traversing range of 240 x 240 mm
- Positioning accuracy ≤ 0,1 mm
- Typical measuring speed ≤ 0,1 s/measuring point

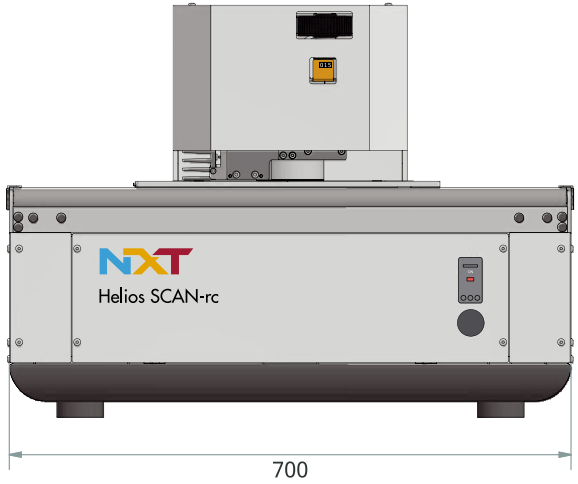
Weight
45 kg

Power consumption
Maximum: 400 VA
Average: 250 VA

Customizations
Other table sizes or special sample frames are available upon request.



Helios SCAN-rc from top



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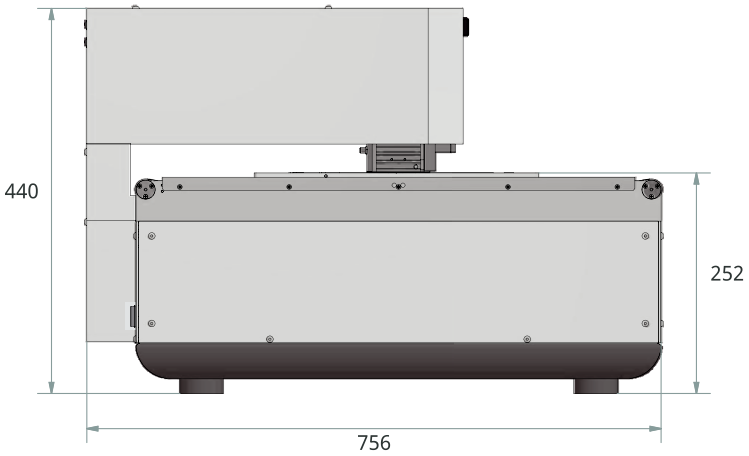

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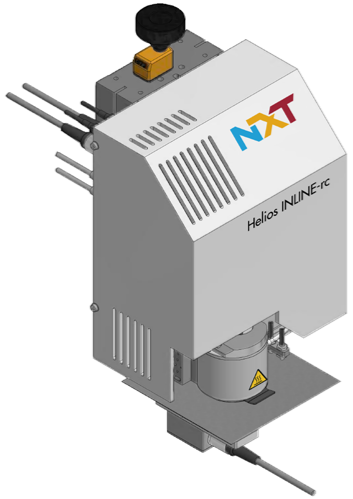
Helios INLINE-rc | Compact unit for your production line

- On-the-fly measurement
- Integrated trigger sensors (measurement start/stop)
- Adjustable working distance
- Compact external reference unit -
  motorized reference sample and dark trap
  (in the production facility)
- For uncoated and coated wafers
- External power unit
  (outside the production line)
  – generates the power supply (12 VDC)
  – Integrated digital I/O module

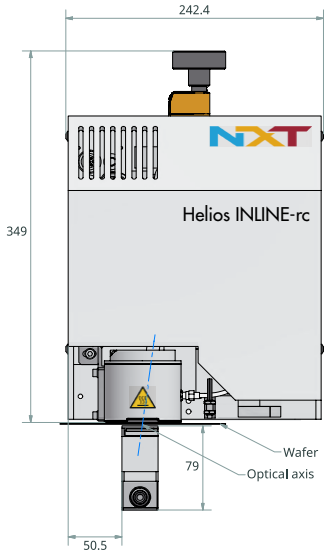
Weight
Measurement unit: 8 kg
Reference unit: 0,35 kg

Power consumption
Maximum: 150 VA
Average: 100 VA

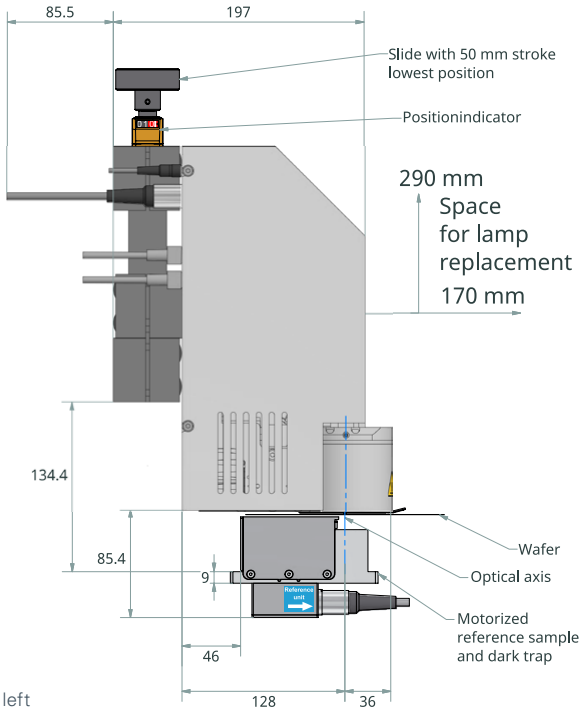
Power unit
Dimensions [mm]: H = 139, B = 165, T = 316
Weight: 3.5 kg
Electrical data
Input voltage: 100 – 240 VAC / 50 – 60 Hz
Output voltage: 12 VDC
8 digital inputs and outputs



Helios INLINE-rc from top



from front



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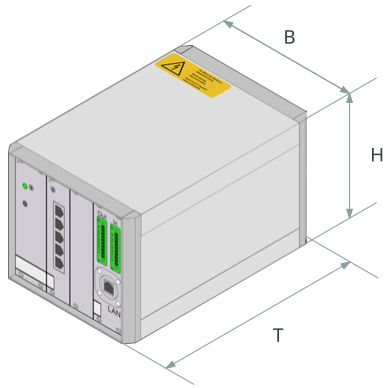


External power unit

Measurement	
Measured values	Spectral reflectance (depending on working distance) – Total – in spatial angle
	Spectral values (integral, averaged)
	Color measurement
	Layer thickness fit
Measurement speed (Spectral acquisition)	≤ 100 ms / measuring point

Color measurement	
Color spaces	Lab / Luv / LCH / xyY / XYZ / Yab
Standard illuminants	A / B / C / D50 / D55 / D65 / D70
Other illuminants	S1 / 100% / Xe / P2300K – P3600K (in 50K steps) / P3700K – P6500K (100K steps)
Standard observer	2° / 10°
Color value accuracy (xyY)	x, y 3σ ≤ 0,002 Y 3σ ≤ 0,2
Repeatability* of color values (xyY)	x, y 3σ ≤ 0,001 Y 3σ ≤ 0,05

Layer thickness fit				
Wafer type		**Textured**	**Shiny etched**	**Polished**
Range per layer material	SiNx	25 – 200 nm	15 – 200 nm	5 – 200 nm
	AlOx	30 – 200 nm	20 – 200 nm	7 – 200 nm
	SiOx	35 – 200 nm	25 – 200 nm	10 – 200 nm
Accuracy		± 1 nm		
Repeatability*		± 0.2 nm		

* 100 consecutive measurements at a single static position

Spectral reflectance / Spectral values		
Wavelength range λ-range	VIS	380 – 1050 nm
	VIS_ext	360 – 1050 nm (optional)
Accuracy for ranges of reflectance	**Accuracy**	**Range**
	0,1 %	0 – 5 %
	0,2 %	5 – 40 %
	0,4 %	40 – 100 %

Spectral reflectance (depending on working distance)		
Measured value	**Working distance**	**Angular range**
Total reflectance	1 mm	± 84°
Spatial angle reflectance	2 mm	± 78°
	3 mm	± 72°
	4 mm	± 66°
	5 mm	± 61°
	6 mm	± 57°
	7 mm	± 52°
	8 mm	± 49°
	9 mm	± 45°
	10 mm	± 42°

- 1 mm working distance is typical for measuring the wafer front side.
- 6 – 8 mm working distance is typical for measuring the wafer rear side.
- At 10 mm working distance, the integrating sphere captures half the angular range compared to 1 mm working distance.

General	
Measurement geometry	integrating sphere
Working distance (adjustable with linear adjuster)	1 – 10 mm
Size of measuring spot	≈ 4 mm

Light source		
Halogen lamp	Power consumption	20 W
	Service life	≥ 2000 hrs.
	Color temperature	3000 K
UV-enhanced with LEDs	385 nm and 405 nm	
Option: UV-extended (VIS_ext) with LEDs	365 nm and 395 nm	

Spectrometer (VIS)	
Holographic transmission grating	
Spectral range	380 – 1070 nm
Silicon diode array detector	512 pixels
Digitization	16 Bit
Interface	LAN

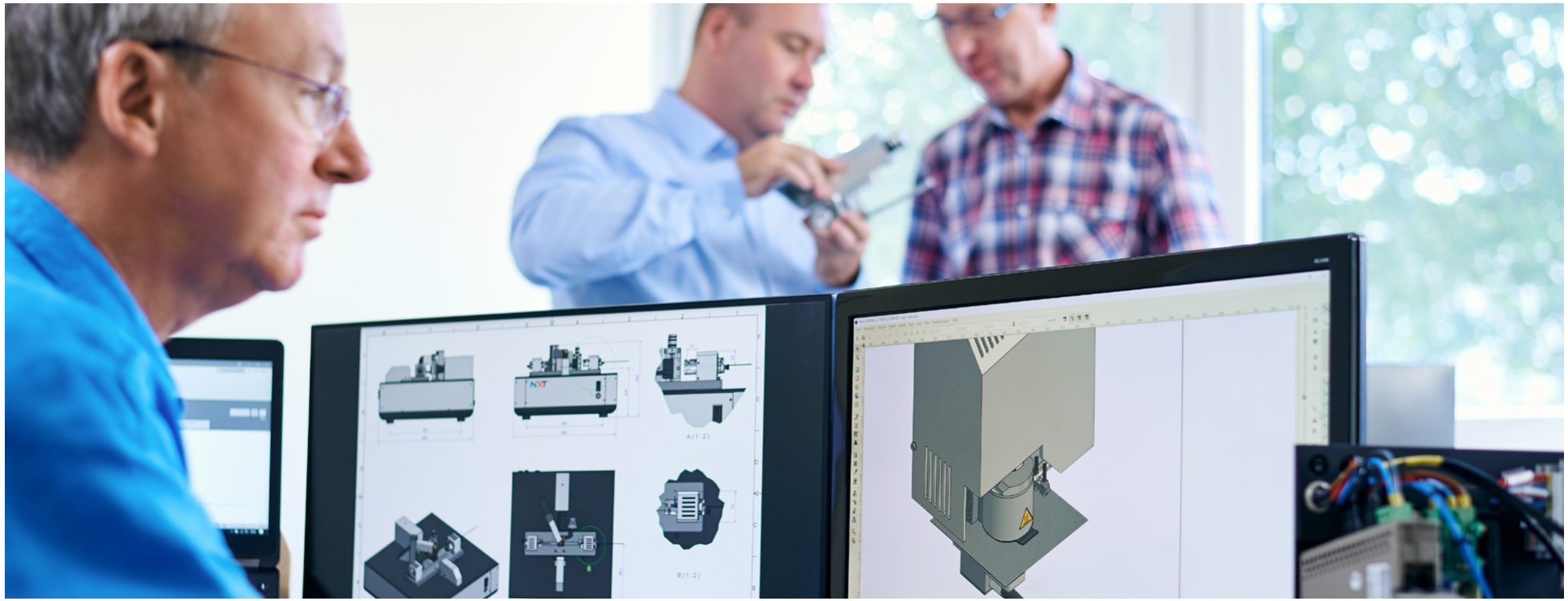
Option: Spectrometer (VIS_ext)	
Holographic transmission grating	
Spectral range	360 – 1050 nm
Silicon diode array detector	512 pixels
Digitization	16 Bit
Interface	LAN

Option: PC	
Operating system	Windows® 10 / 11
Processor type	Intel i7
Working memory (RAM)	≥ 8 GB
Hard disk drive (HDD)	≥ 500 GB

Environmental conditions	
Temperature	5 – 45 °C (50 – 90 °F)
Maximum humidity (non-condensing at 20 °C)	90 %

Electrical data	
Input voltage	100 – 240 VAC (± 10 %)
Frequency	50 – 60 Hz

Other specifications, such as the size and type of measurement table (offline) or type and length of linear axis (inline), motorization, dimensions and weight etc. depend on the model of Helios measuring system.



Configurable according to your preferences

To integrate the Helios-rc measuring system into your production line, we support a wide range of communication interfaces. Thanks to the modular design of our hardware and ETA-TCM software, our measuring systems can be configured specifically to your requirements.

As a process owner, you define the relevant process windows in the software based on adjustable limits. The compliance with these threshold values is verified and displayed.

This allows for the sorting of defective products and also the detection and prevention of process drift.

We would be pleased to demonstrate our Helios-rc measuring system at your premises, our headquarters or at a branch office located near you.

The measurement capability can be verified by using the provided reference samples, and the results can be documented through a measurement report.

Easy to learn and operate

The configurable ETA-TCM software is the central User Interface of the Helios-rc measuring system.

As a process owner, you will receive guidance and training from us, enabling you to independently set process limits to optimize the balance between Scrap and Throughput.

Depending on the complexity of the system, you usually need only half a day to three days of training to be able to confidently and safely operate the system.

In addition, details on operation and maintenance are described in the operation manual, ensuring not only ease of use but also basic maintenance.
For example, you can replace the lamp yourself.

Reliable and stable in the long term

Due to the modular design of our measuring systems, identical and proven hardware is used. The susceptibility to faults is very low.

With our 30 years of experience, we have established standardized commissioning and quality assurance processes to ensure consistent quality of our systems.

Long-term stability in the production process is ensured by automatic referencing and regular verification of the measuring equipment capability using reference samples.

Our measuring systems have been in operation for over 30 years, even in harsh industrial environments. They are still periodically maintained and supplied with spare parts by us.

Technical support

The replacement of wear parts can be found in the maintenance schedule in the operation manual.
The required time may vary depending on the model, but it is generally minimal.
In case of difficulties, a quick analysis can be performed based on a service report that can be exported from your ETA-TCM software and sent to us.
Your request will be handled by one of our technicians who will promptly contact you for further assistance.

More extensive maintenance to ensure the correct functioning of the entire measuring system is also carried out by one of our technicians. In this case, a downtime of half a day to a full day can usually be expected. Alternatively, you can simply send us your measuring system, and the maintenance will be completed within one week at our facility.

Our service is available beyond the specified lifespan of your system. We will inform you in a timely manner if maintenance becomes unfeasible, for example, due to discontinued components, or if a paid inventory stocking is required.

NXT
Securing Good Results

Your processes in focus

NXT GmbH is a global leader in providing comprehensive quality assurance solutions for specialized industries.

Our modular measuring systems with high-precision measuring optics and an excellent evaluation software (ETA-TCM), are fully developed and manufactured in-house with a high degree of manufacturing depth.

Whether offline or inline - all systems are based on the same measuring technology and can be configured and customized according to your specific needs.

In addition to high-precision measuring systems, we provide active customer support and training worldwide.

Our headquarters are located in Heinsberg, Germany, with branch offices in China, Taiwan, and Korea, as well as a network of representatives for service and support worldwide.

Securing Good Results

Let's talk about your new possibilities.

Are you looking for consultation regarding your specific application, do you have questions about our measuring systems, or would you like a non-binding offer?

We look forward to hearing from you.

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