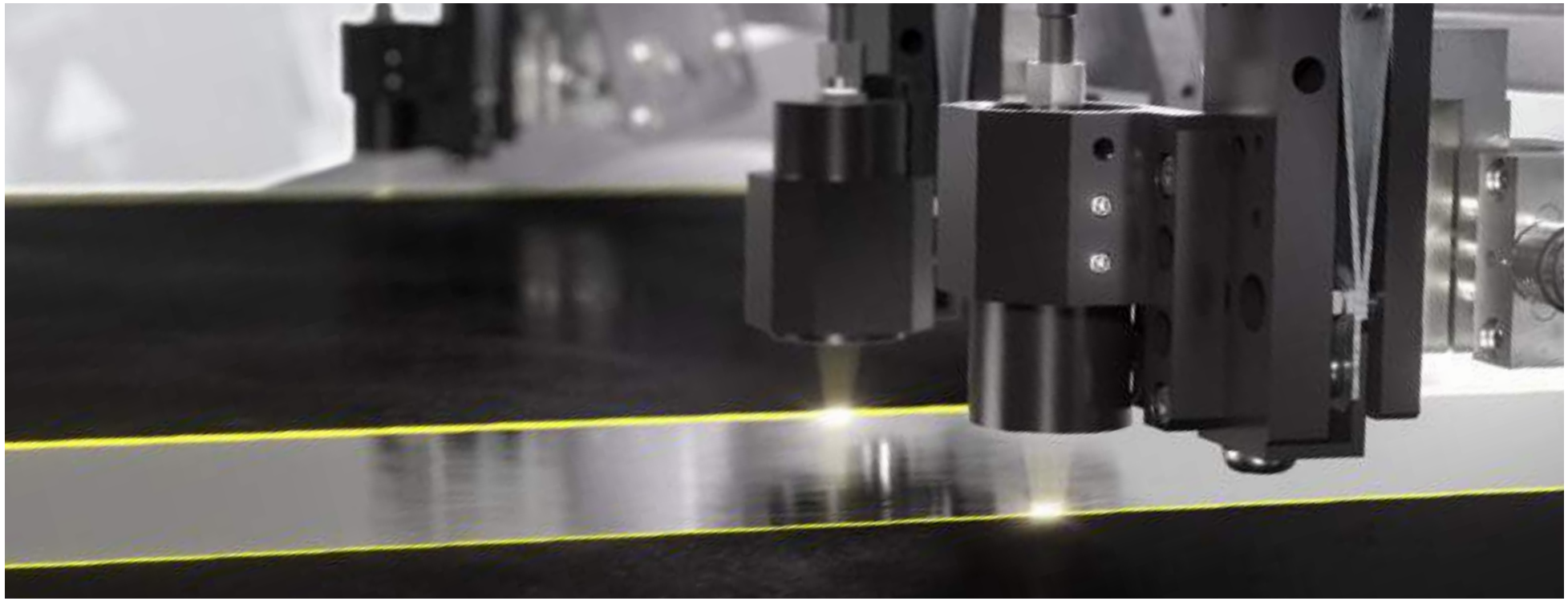
TCM measuring systems

Inspection of insulation layers and thin layers in Lithium battery production

NXT
Measuring Technology

Click at your desired area.



Lithium batteries - precisely controlled layer by layer

The spectrometric measurement of thin layers - especially the thickness of insulation layers - is an excellent method for quality control in the production process.

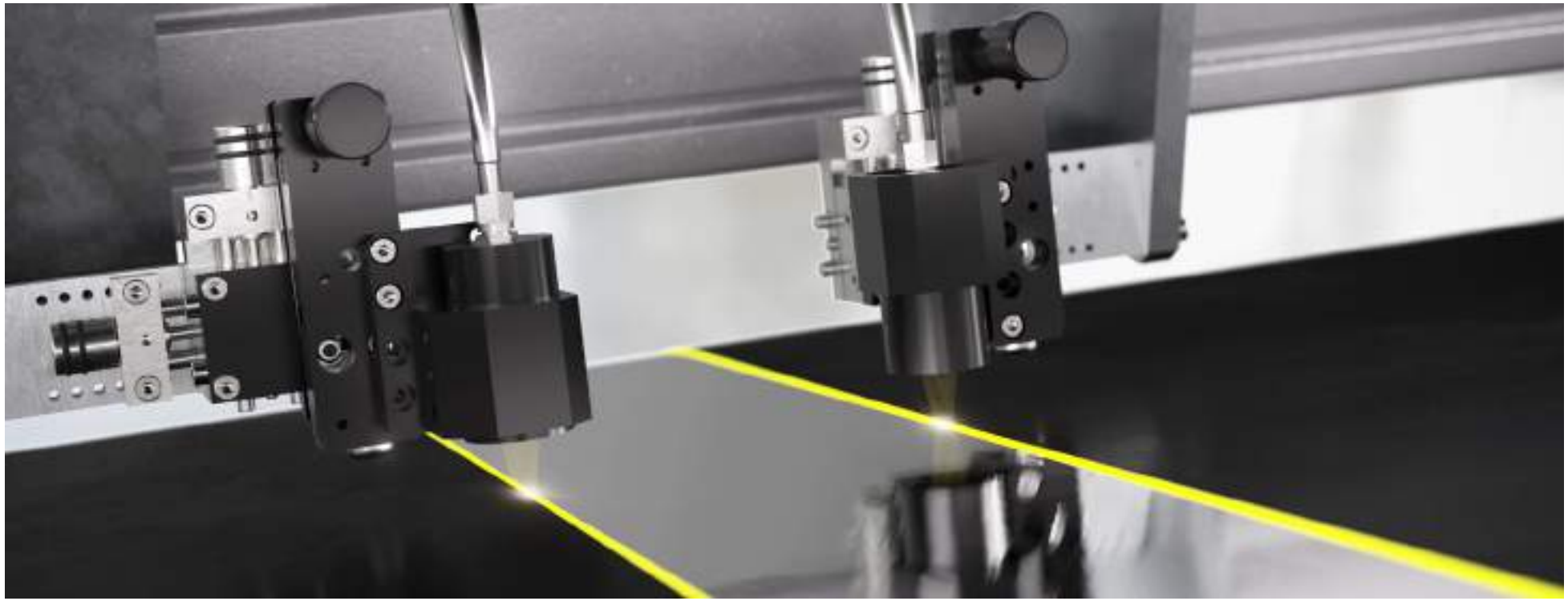
Using wet coating, narrow strips of insulation layers are usually applied directly next to the black slurry on the aluminum cathode.

They serve an important safety function by preventing short circuits and ensuring a long lifespan for lithium batteries.

Inline measurement of this layer thickness is therefore of crucial importance. Any deviations and their causes are detected early in the process, thus optimizing production costs and quality.

Our modular and software-controlled TCM measuring systems can be customized to your process and measuring tasks and easily integrated into your production line.

Experience it for yourself.



Measuring with TCM - clear advantages for your process

- Non-contact and non-destructive measurement
- Measurement insensitive to:
  - Distance variations
  - Tilt/Inclination
  - Waviness of the film
- Adjustable with fine adjuster:
  - Working distance
  - left-right position
  - Inclination
- Fast measurement: 2 ms
- Repetition rate: 30 measurements/s

Optional

- Profile measurement of the insulation layer:
  - Measuring head motorized left-right scanning
  - Measuring spot 0.5 mm
  - 2 adjacent insulation layers can be measured with one measuring head

Suitable for

- Insulation layers wet film
- Insulation layers dry film
- Thin, transparent layers

Measured values for

- Thickness of thin layers and layer stacks
- Spectral reflectance

User friendly thanks to

- Easy operation
- User-definable quality limits
- Good/bad indication

One principle, numerous possibilities.

Our INLINE and OFFLINE systems always use the same measuring optics and electronics and follow a constant measuring principle:

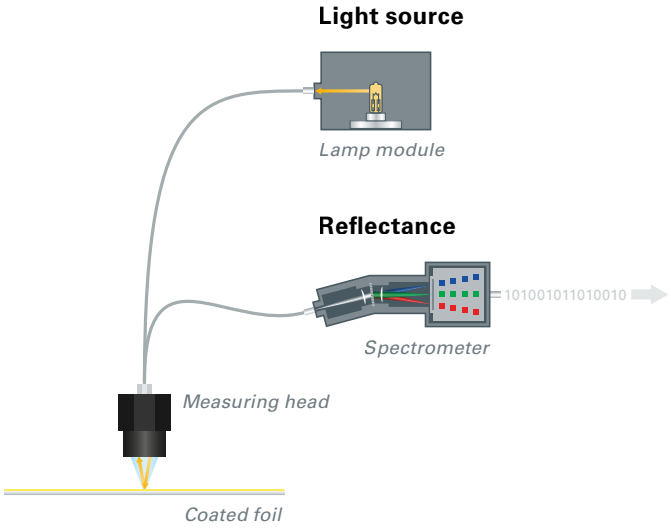
1. Acquire measurement data
TCM INLINE systems consist of one or more spectrometers and light sources that are connected to several measuring heads via optical fibers.
Motorized linear stages enable fast, software-controlled scanning. The optical signals are converted into data signals, the so-called raw spectra.

2. Evaluating measurement data
We use the ETA-TCM software to process the raw spectra into measurement spectra.
The layer thickness is determined by frequency analysis (FFT) and shown as a peak in the power spectrum.

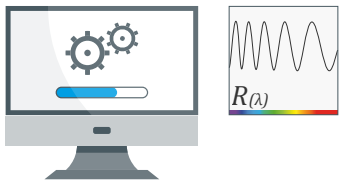
Filters, averaging, factors and offsets can be optionally set. You also define the relevant parameters when processing the measurement spectra in the evaluation modules: coating thickness or spectral reflectance.

3. Measurement result
Your measured values are displayed as statistics, in tabular and graphical form. Set limits and display the respective deviations.
All results are stored and can be directly communicated to your systems via 24VDC digital IO, TCP/IP and other interfaces.

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



Measurement data
Preparation of measurement data to spectra

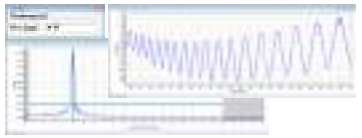


ETA-TCM software
- Hardware control (shutters, lamps, references)
- Data management (settings, parameters, user data etc.)
- IO interface to the PLC of the production line

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

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

TCM INLINE R-NIR-HR1 **2ch-s** | Static mounted measuring heads

- Measurement of the thickness of insulation layers
- Measurement of wet and dry film
- Measurement without referencing
- Individually integrable measuring heads

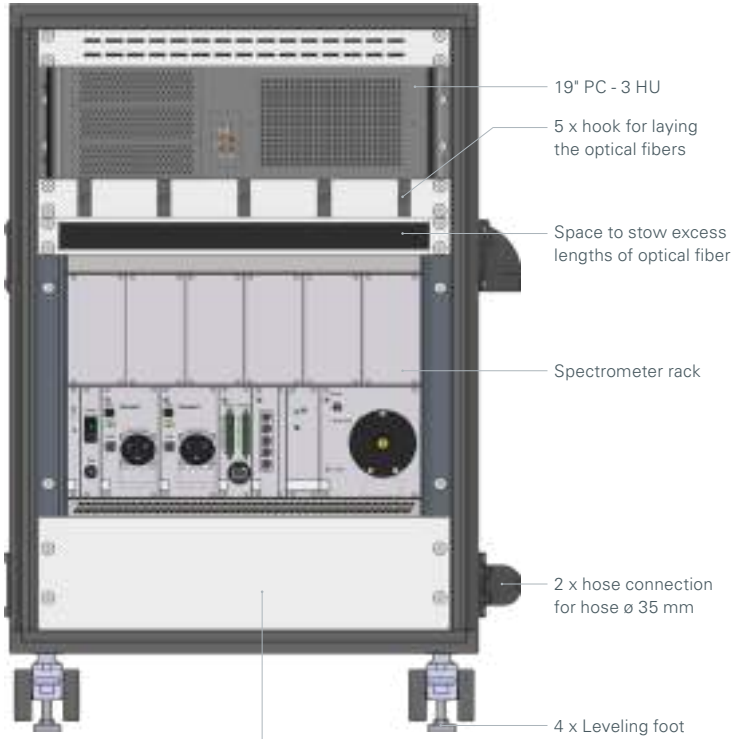
2 measuring heads
Measuring heads can be integrated on 2 adjacent tracks using left and right mounting kits.
Manual fine adjustment with adjusters for:
- X-axis - fine adjustment for small changes in the coating position
- Z-axis - fine adjustment of working distance
- Tilt fine adjustment relative to the Y-axis

Weight / measuring head
≤ 1 kg

Spectrometer cabinet
- Dimensions [mm]:
  H = 830, W = 606, D = 625
- Weight: 40 kg
- Electrical data:
  – Voltage: 100 - 240 VAC
  – Frequency: 50 - 60 Hz
  – Max. power consumption: 200 VA

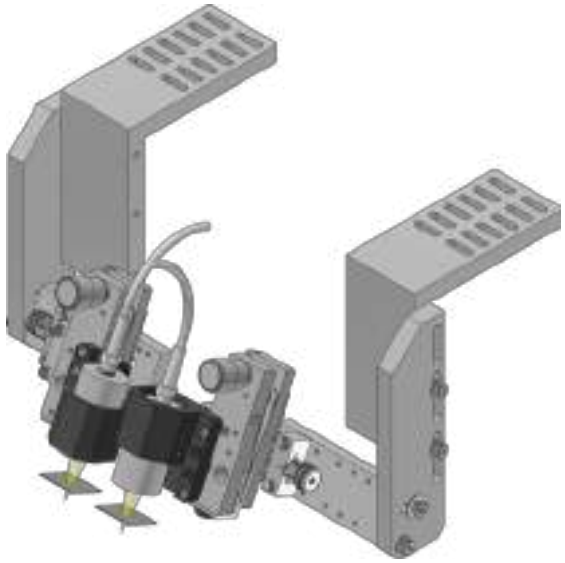
Certification
Measuring system complies with the safety requirements of the Low Voltage Directive 2014/35/EU.

A UL certification is also available.
If needed, please contact us.



Glass door is not shown

Spectrometer cabinet front side



Measuring heads with adjusters

TCM INLINE R-NIR-HR1 **4ch-s** | Static mounted measuring heads

- Measurement of the thickness of insulation layers
- Measurement of wet and dry film
- Measurement without referencing
- Individually integrable measuring heads

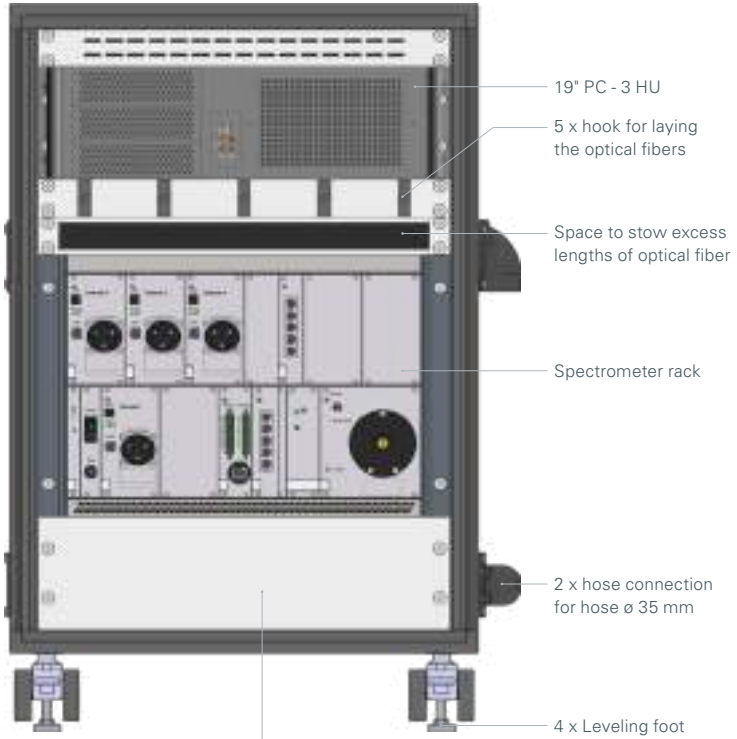
4 measuring heads
Measuring heads can be integrated on 2 adjacent tracks using left and right mounting kits.
Manual fine adjustment with adjusters for:
- X-axis - fine adjustment for small changes in the coating position
- Z-axis - fine adjustment of working distance
- Tilt fine adjustment relative to the Y-axis

Weight / measuring head
≤ 1 kg

Spectrometer cabinet
- Dimensions [mm]:
  H = 830, W = 606, D = 625
- Weight: 45 kg
- Electrical data:
  – Voltage: 100 - 240 VAC
  – Frequency: 50 - 60 Hz
  – Max. power consumption: 300 VA

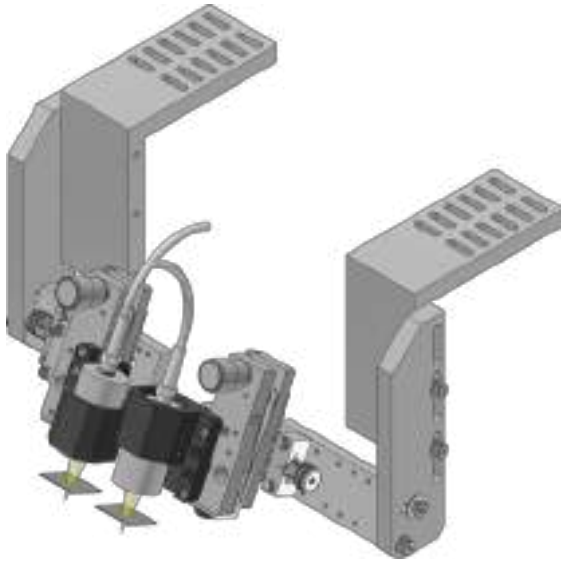
Certification
Measuring system complies with the safety requirements of the Low Voltage Directive 2014/35/EU.

A UL certification is also available.
If needed, please contact us.



Glass door is not shown

Spectrometer cabinet front side



Measuring heads with adjusters

TCM INLINE R-NIR-HR1 **8ch-s** | Static mounted measuring heads

- Measurement of the thickness of insulation layers
- Measurement of wet and dry film
- Measurement without referencing
- Individually integrable measuring heads

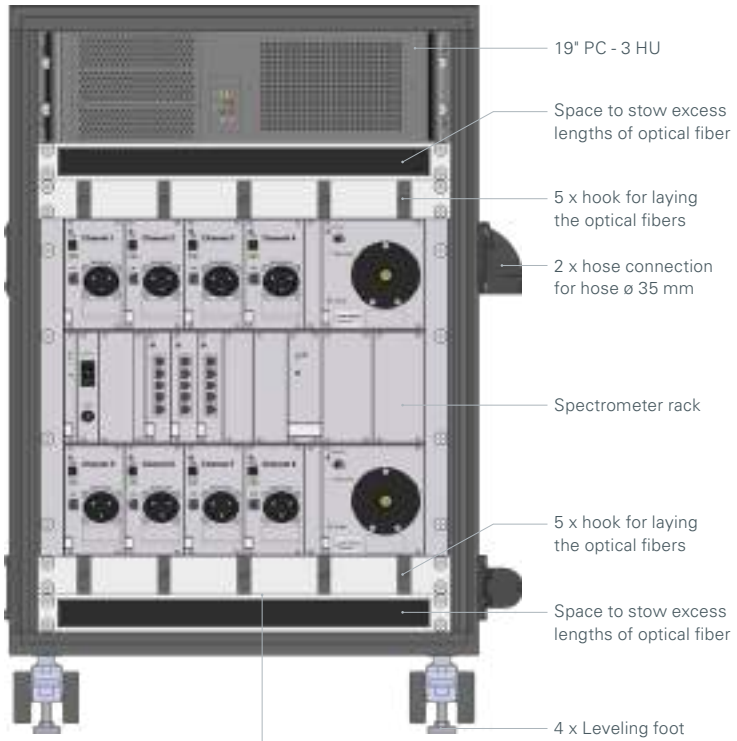
8 measuring heads
Measuring heads can be integrated on 2 adjacent tracks using left and right mounting kits.
Manual fine adjustment with adjusters for:
- X-axis - fine adjustment for small changes in the coating position
- Z-axis - fine adjustment of working distance
- Tilt fine adjustment relative to the Y-axis

Weight / measuring head
≤ 1 kg

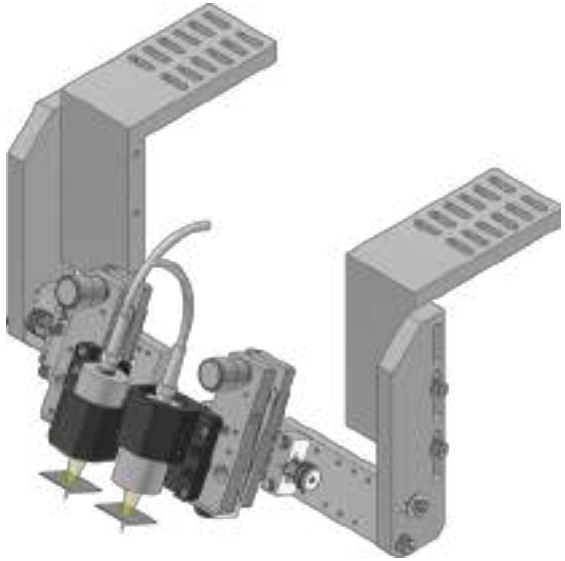
Spectrometer cabinet
- Dimensions [mm]:
  H = 830, W = 606, D = 625
- Weight: 50 kg
- Electrical data:
  – Voltage: 100 - 240 VAC
  – Frequency: 50 - 60 Hz
  – Max. power consumption: 400 VA

Certification
Measuring system complies with the safety requirements of the Low Voltage Directive 2014/35/EU.

A UL certification is also available.
If needed, please contact us.



Spectrometer cabinet front side



Measuring heads with adjusters

TCM INLINE R-NIR-HR1 **5ch-m** | Motorized with swiveling measuring heads

- Measurement of the thickness of insulation layers
- Measurement of wet and dry film
- Measurement without referencing
- Individually integrable measuring heads
- Profile scan of the layer (X-axis) with motorized moving measuring head
- Measurement of 2 adjacent tracks

5 measuring heads motorized movable

- Swivel range X-axis: 25 mm
- Manual fine adjustment with adjusters for:
  - Z-axis - fine adjustment of working distance
  - Tilt fine adjustment relative to the Y-axis

Weight/measuring head

≤ 1 kg

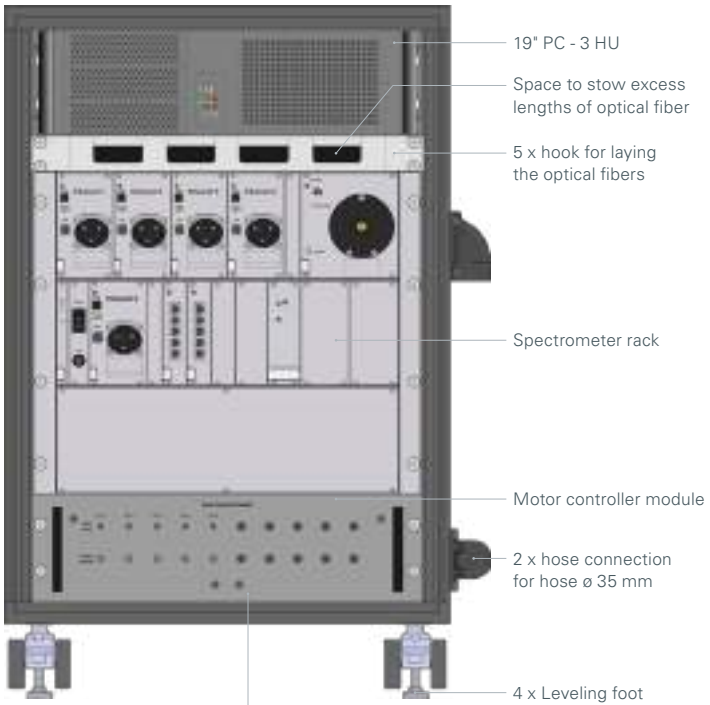
Spectrometer cabinet

- Dimensions [mm]:
  H = 830, W = 606, D = 625
- Weight: 52 kg
- Electrical data:
  - Voltage: 100 - 240 VAC
  - Frequency: 50 - 60 Hz
  - Max. power consumption: 300 VA

Certification

Measuring system complies with the safety requirements of the Machinery Directive 2006/42/EC.

A UL certification is also available.
If needed, please contact us.



Spectrometer cabinet front side

Measuring SwingHead with adjusters

TCM INLINE R-NIR-HR1 **9ch-m** | Motorized with swiveling measuring heads

- Measurement of the thickness of insulation layers
- Measurement of wet and dry film
- Measurement without referencing
- Individually integrable measuring heads
- Profile scan of the layer (X-axis) with motorized moving measuring head
- Measurement of 2 adjacent tracks

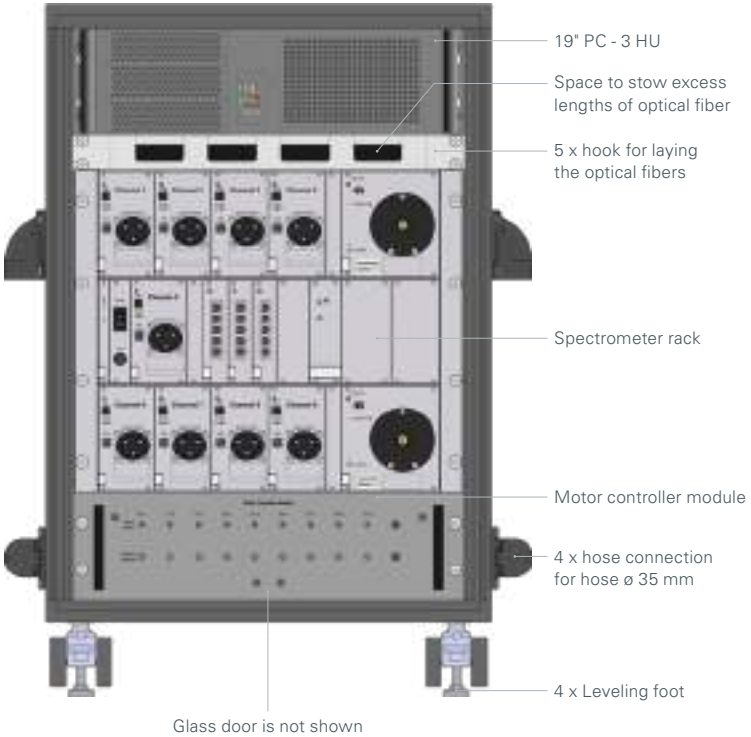
9 measuring heads motorized movable
- Swivel range X-axis: 25 mm
- Manual fine adjustment with adjusters for:
  – Z-axis - fine adjustment of working distance
  – Tilt fine adjustment relative to the Y-axis

Weight / measuring head
≤ 1 kg

Spectrometer cabinet
- Dimensions [mm]:
  H = 830, W = 660, D = 625
- Weight: 58 kg
- Electrical data:
  – Voltage: 100 - 240 VAC
  – Frequency: 50 - 60 Hz
  – Max. power consumption: 400 VA

Certification
Measuring system complies with the safety requirements of the Machinery Directive 2006/42/EC.

A UL certification is also available.
If needed, please contact us.



Spectrometer cabinet front side

Measuring SwingHead with adjusters

TCM LITE R-NIR | Compact, manually operated tabletop device

- Measurement of dry film
- Integrated PC (also available without PC)

Measuring sample sizes

For use in moving sample frame:

- Minimum: 20 x 20 mm
- Maximum (with sample frame): 245 x 245 mm
- Maximum (without sample frame): 600 x 600 mm

Measurement table

- Dimensions: 600 x 600 mm
- Sample frame: 245 x 245 mm

General data

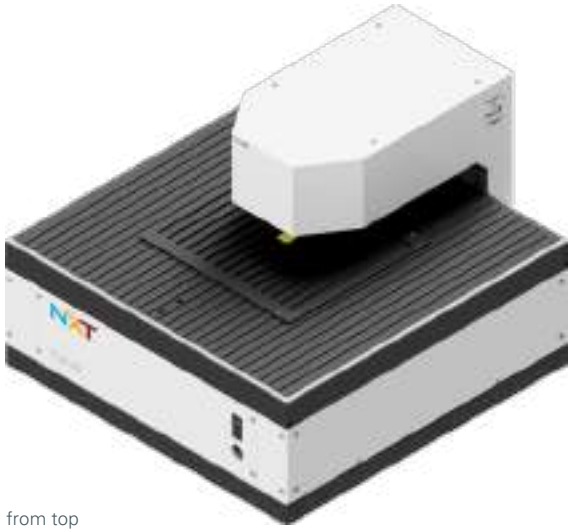
- Dimensions [mm]:
  H = 442, B = 604, T = 660
- Weight: 45 kg
- Electrical data:
  – Voltage: 100 - 240 VAC
  – Frequency: 50 - 60 Hz
  – Max. power consumption: 460 VA

Certification

Measuring system complies with the safety requirements of the Low Voltage Directive 2014/35/EU.

A UL certification is also available.
If needed, please contact us.

TCM LITE R-NIR from front



from top

Precise measurements, tailored to your layers

Measurement	
Measured values	Layer thickness - FFT
	Spectral values (integral, averaged)
Measuring speed / measuring point[1]	≤ 2 ms

[1] The Spectral acquisition runs in parallel with the evaluation, which is processed in a queue.

Layer thickness - FFT				
Layer type		**Thickness range**	**Wavelength range (λ-range)**	
Range per layer type	Dry film	1 - 25 µm	NIR	850 - 1700 nm
	Wet film	7 - 200 µm	NIR_HR1	1340 - 1660 nm
Film thickness accuracy		± 0.1 µm		
Film thickness repeatability*		3σ ≤ 0.005 µm		

* 100 consecutive measurements at a single static position

Spectral reflectance / Spectral values		
Wavelength range λ-range	NIR	850 - 1700 nm
	NIR_HR1	1340 - 1660 nm

General		
Send and receive geometry	0° / 0° axial	
Size of the measuring spot (round)	Dry film	≈ 1 mm
	Static wet film	≈ 1 mm
	Scanning wet film	≈ 0.5 mm
Working distance	Dry film	32 mm
	Static wet film	14 mm
	Scanning wet film	21 mm
Distance tolerance	± 1 mm	
Tilt tolerance	± 1°	

Light source		
Halogen lamp	Power consumption	50 W
	Service life	≥ 2000 hrs.
	Color temperature	3000 K

Spectrometer (NIR) for dry film	
Holographic transmission grating	
Number of spectrometers OFFLINE	1
Number of spectrometers INLINE	2, 4, 8 or more
Spectral range	850 - 1700 nm
InGaAs line detector	256 pixels
Digitization	16 Bit
Interface	LAN

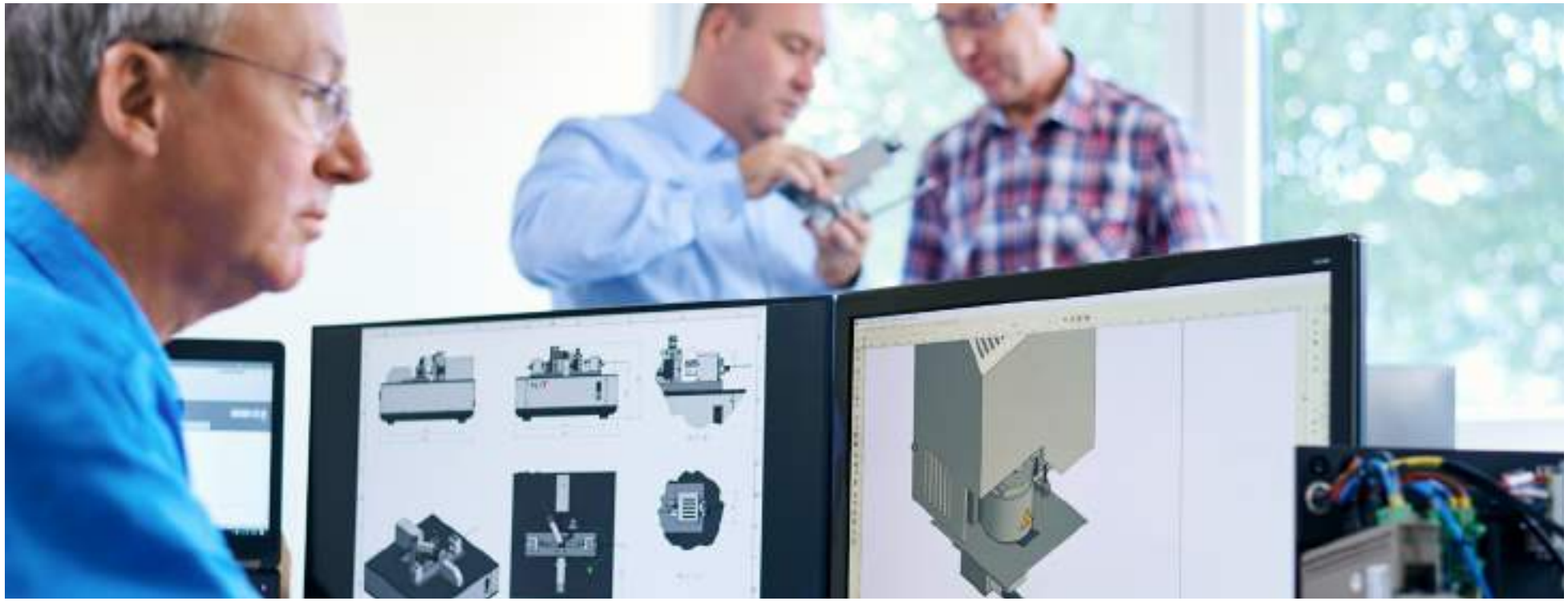
Spectrometer (NIR) for wet film - INLINE only	
Holographic transmission grating	
Number of spectrometers	2, 4, 8 or more
Spectral range	1340 - 1660 nm
InGaAs line detector	256 pixels
Digitization	16 Bit
Interface	LAN

Option: PC	
Operating system	Windows® 10 / 11
Processor type	Intel i7
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 TCM measuring system.



Customizable to your preferences

To integrate the TCM 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 glad to demonstrate our TCM measuring system at your location, 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 TCM 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 Measuring Technology

Recognize deviations where they occur.

Your processes in focus.

We develop and produce spectrometric measuring systems for non-contact process and quality control in numerous high-tech industries.

Our INLINE and OFFLINE systems follow a constant measuring principle, have a modular design and can be individually configured.

With accompanying training and technical support, we have been helping manufacturers of high-tech products worldwide with their quality assurance for over 30 years.

Our headquarters are located in Heinsberg, Germany, with subsidiaries in China, Taiwan, Korea and international representatives for service and support.

NXT Measuring Technology

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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