



MARVELOC-CURTAIN-CS

3 types of sensors for complete quality control of battery film

- ✓ Basis-weight measurement
- ✓ Thickness measurement
- ✓ Edge measurement of the coating



Basis-weight measurement



U-Ray Technology

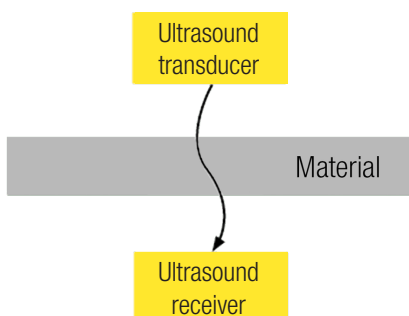
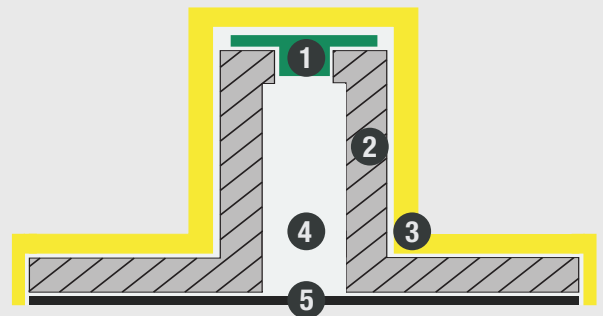
U-Ray is an ultrasonic technology for basis-weight measurement, optimized for materials where electromagnetic methods, such as C-Rays (our capacitive technology) and M-Rays (our millimeter wave technology), are ineffective. It's ideal for quality control of thin materials, such as battery films on metal substrates.

The system consists of a transmitter above and a receiver below, with the material passing through the gap. Non-ionizing and cost-effective, U-Ray can effortlessly measure through metal and semiconductive materials.

U-Ray head

The transducer ① is housed in a foam-lined waveguide ② which is a rectangular or circular tube ③ with foam on the inside and an air-filled center. ④ The foam acts as an anti-reflective layer, reducing the reflection of ultrasound waves.

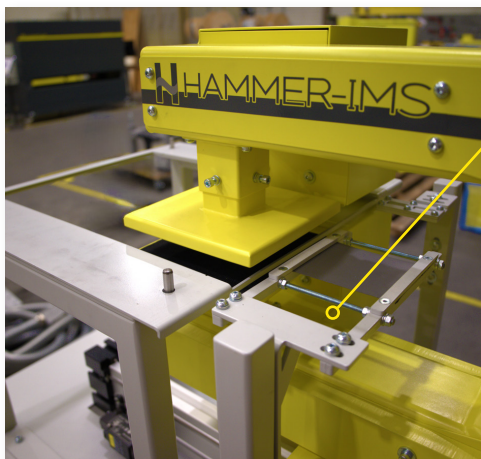
To regulate the air within the gap and maintain consistent measurements, the transducer is enclosed in this tube. This design minimizes variations in the air gap, leading to more precise measurements. It prevents movements or disturbances from affecting the receiver. Additionally, a thin, nonwoven protective layer is included to prevent dust infiltration. ⑤



Stand-off

The transducer is positioned at a specific distance from the material, known as the stand-off. This stand-off ensures the ultrasound waves to travel before reaching the material and receiver below. By the time the waves are detected, the transmitter has already stopped transmitting. Reducing the chances of interference by the direct coupling of the transmitted signal into the receiver.

Basis-weight measurement



Calibration

To maintain accuracy, the system periodically calibrates itself to account for any variations caused by environmental conditions. Calibration is typically performed either in air or using a reference material, with the reference material being preferred. This process, also called “zeroing,” helps keep the system’s measurements reliable.

U-Ray specifications

Feature	Value
General device info	
Generic name	MARVELOC-U-RAY-SENSOR
Featured technology	Hammer-IM’s genuine U-Ray technology Dual-head with one of the following operating modes time-of-flight or power detection
Measurement specs	
Battery film	
Intrinsic precision in scanning mode (std. dev., in Marveloc-CURTAIN over 12 scans) ¹	1 gsm
Maximum measurable weight	400 gsm
Typical scanning period (in Marveloc-CURTAIN)	~10 seconds
Sensor head update rate	142 Hz, averaged over 5 bursts: 28 Hz
Burst duration	275 µs
Applied frequency	40 kHz
Maximum material width	350 mm
Dimensions and geometry	
Head area	150x150 mm ²
Typical head-to-head distance (2·stand-off)	35 mm
Head-to-material surface angle	90 degrees (perpendicular)
Measurement spot (diameter)	20 mm
Connectivity	
Bus	RS-485
Electrical specs	
Power inlet	230 VAC / 50 Hz
Motor drive power	< 500 mW
Emergency stop present	yes

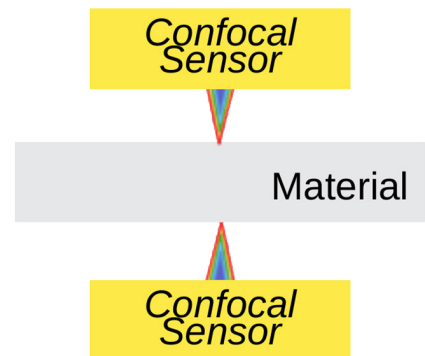
¹verified on a 200 gsm coat-weight battery film.

Thickness measurement



Confocal Sensor Technology

The CURTAIN-CS system is equipped with the Keyence CL-P030* confocal optical sensor, designed for high-precision, non-contact thickness measurement. This setup includes two sensor heads that measure the distance to the material, allowing the system to accurately determine the material's thickness. Just like the U-ray head, the confocal laser sensors also require periodic calibration to ensure precise measurements.



Calibration



Calibration is crucial, particularly when working with reflective surfaces, to account for environmental factors that might impact sensor accuracy. To calibrate the Keyence sensor, we utilize Mitutoyo gauge blocks, which are in accordance with the ISO standard EN ISO 3650. These gauge blocks ensure that the system is calibrated with utmost precision, maintaining measurement accuracy over time. The use of such highly accurate calibration tools is essential for achieving reliable and consistent results.

**Other confocal sensors are available upon request; however, our preference is the Keyence CL-P030.*

Thickness measurement



Our frame

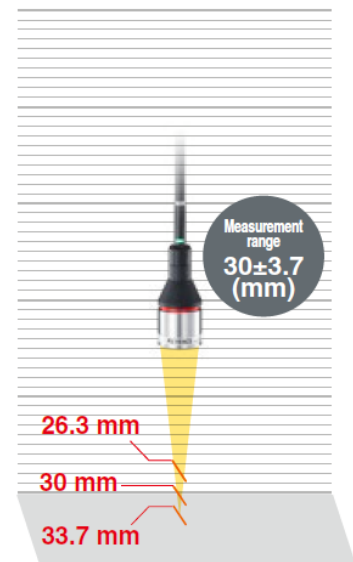
A rigid frame is essential for this differential measurement method, as the confocal sensors require stability to maintain accuracy. Confocal sensors are particularly well-suited for measuring the thickness of shiny materials, as they do not rely on triangulation, which needs the presence of optical surface scattering. This is typically not the case for reflective surfaces, such that a confocal sensor is the only valuable approach. This makes confocal technology the ideal choice for contactless thickness measurement in battery film production, where high reflectivity is often a challenge.

Keyence CL-P030 specifications

Property	Value
General device info	
Spot diameter	$\varnothing 38 \mu\text{m}$
Reference distance	30 mm
Measurement range	$\pm 3.7 \text{ mm}$
Linearity	$\pm 0.94 \mu\text{m}$ ($\pm 0.81 \mu\text{m}$)
Linearity thickness	$\pm 1.88 \mu\text{m}$
Measurement range (high-precision)	$\pm 1.0 \text{ mm}$
Linearity (high-precision)	$\pm 0.72 \mu\text{m}$ ($\pm 0.59 \mu\text{m}$)
Linearity thickness (high-precision)	$\pm 1.44 \mu\text{m}$
Resolution (thickness + distance)	$0.25 \mu\text{m}$ ($0.015 \mu\text{m}$)
Update rate	$\sim 10 \text{ ms}$ (Hammer-IMS integration number)

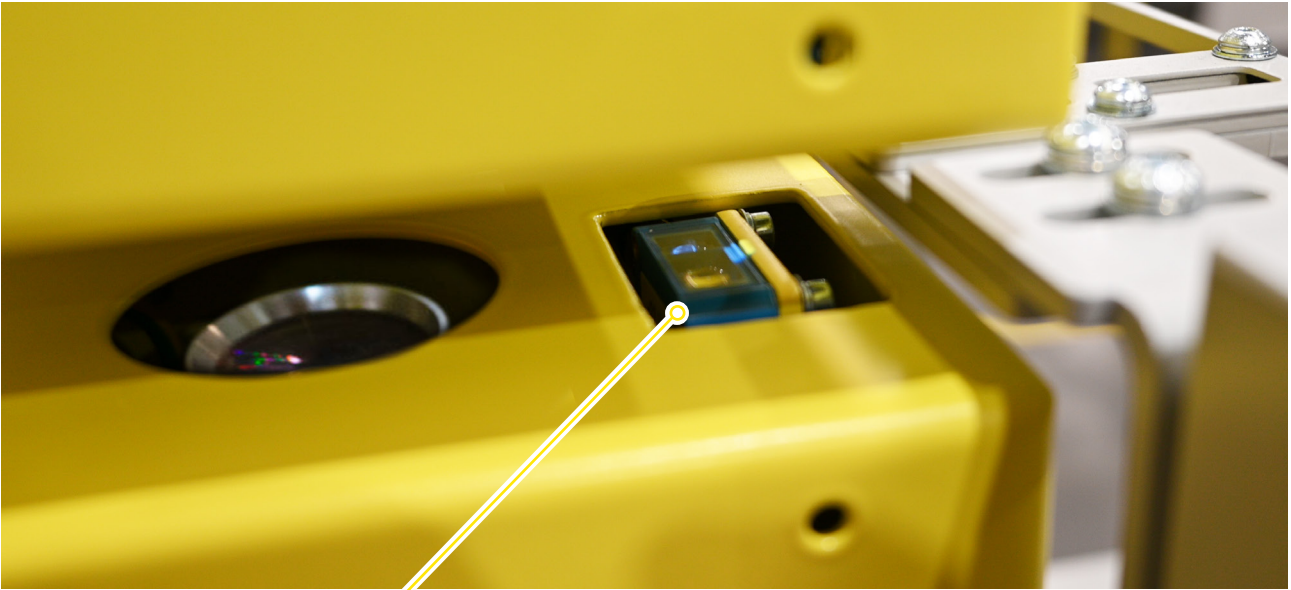
High-Accuracy Model

CL-P030



For further details on this confocal sensor, please refer to the Keyence brochure. This image is also sourced from the Keyence brochure.

Edge detection



Contrast sensor

The KTM-MB8A191P contrast sensor from SICK is perfect for edge detection in battery film production. Its high grayscale resolution and quick response time ensure reliable detection, even on reflective materials like aluminum or copper foil. To achieve optimal accuracy, two sensors are installed—one on the top and one on the bottom of the film—detecting edges on both sides. This setup precisely measures the edge between the coating and the foil, ensuring accurate alignment of the coating.



Laser sensor



Material

Laser sensor

Edge detection

The system utilizes a sensor both above and below the material. These sensors move along with the frame, allowing precise localization of the edge. The edge position is detected by a sudden change in the signal; where the signal value shifts significantly, the edge of the material is identified.

Connectivity 3.0

The user-friendly, straightforward, and logically designed Connectivity 3.0 Interface serves as a unified platform for real-time monitoring and data processing across all sensors and automated surface inspection functions. With a single HMI, it enables simultaneous operations and comprehensive data processing/storage, streamlining the entire process for enhanced efficiency and convenience.

The Connectivity 3.0 software can be tailored to accommodate customized algorithms and calculations. This adaptability and flexibility in software design allow customers to create specific solutions that overcome their individual challenges and meet their needs and requirements. Customized algorithms and calculations can be implemented to address a wide range of tasks, from data analysis and optimization to specialized simulations and predictions. The recipe selection tool with customizable settings allows manufacturers to manage and customize production processes effectively.



Industrial HMI units

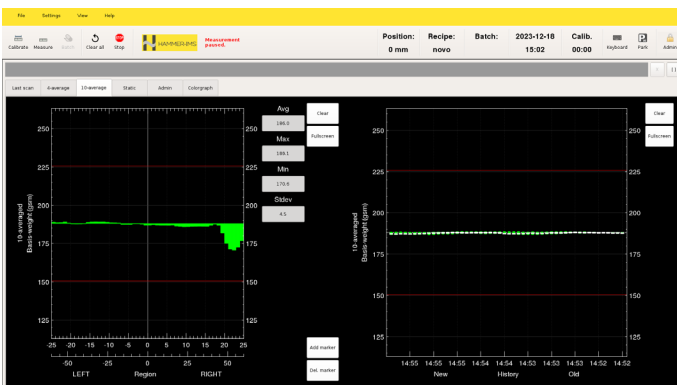
Data management and Interfaces

Data management in battery production is a crucial aspect of modern manufacturing processes ensuring top-quality control, process optimization, and traceability for product reliability, safety, and compliance.

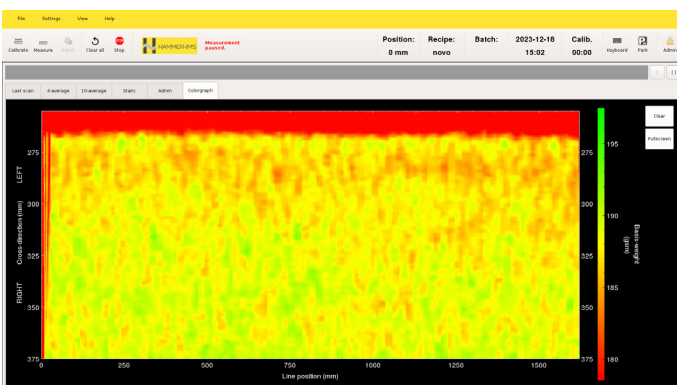
We offer and implement a wide range of data interfaces:

- PC UA integration for standardized data exchange.
- Powerful SQL database (Microsoft SQL) for data logging and analysis.
- Effortless FTP/SFTP file transfer for data sharing.

The BUS-INTERFACE-HUB brings the capability to establish connections with other industrial bus networks, enabling seamless data sharing in various formats. This enhancement makes the system highly compatible to integrate into any process and workflow.



Profile and Trend view of thickness measurement



Enhanced 100% heat map (scanner movement in white) and trend of thickness measurement

Why choose Hammer-IMS?



Non-nuclear
measurement solutions



High accuracy and
reliability



Custom-made solutions
for your needs

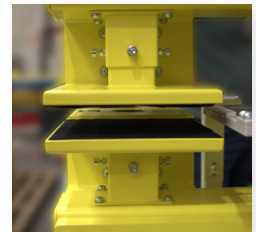
Confocal laser

Thickness measurement



U-Ray sensor

Basis-weight measurement



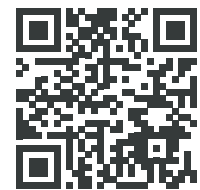
Contrast sensor

Edge detection



Discover more

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