

OpreX Battery Web Gauge ES-5 with X-ray Sensor for Battery Electrode Sheets



QC2FB1 box type frame

As the adoption of electric vehicles (EVs) and energy storage systems (ESSs) advances in order to realize a sustainable society, the production volume of secondary batteries, including lithium-ion batteries, is expanding.

Meanwhile, the following issues have been identified as challenges in the secondary battery market:

- Reduction of CO₂ emissions in the supply chain
- Monitoring and improving of manufacturing quality to prevent and mitigate fire accidents
- Enhancement of production efficiency

Yokogawa Electric Corporation has integrated knowledge of battery manufacturing processes accumulated since the WEBFREX II era with its strengths in measurement, control, and information technologies to develop the OpreX Quality Control System Battery Web Gauge ES-5. Following the launch of the ES-5 with β -ray Sensor in September 2024, the ES-5 with X-ray Sensor was launched in August 2025.

MAIN FEATURES

The sensitivity of the X-ray sensor varies depending on the atomic weight of the measured material. It is particularly sensitive to metallic elements, so it is well suited for thickness measurement of coated sheets such as battery electrode cathode sheets and multilayer ceramic capacitors (MLCCs).

The ES-5 with X-ray Sensor provides additional value in the following ways.

■ High-Definition, High-Resolution Profiles Enabled by Fast Response

The ES-5 with X-ray Sensor uses a silicon detector, which has a faster response time compared with β -ray sensors. In addition, it is free from signal noise caused by statistical fluctuations originating from the random decay of radioactive isotopes. As a result, stable output is obtained, enabling high-speed signal filtering at the detector. Furthermore, the irradiation collimator diameter (X-ray spot diameter) is set to $\phi 3$ mm, providing high positional resolution in the sheet width direction.

These features make the ES-5 with X-ray Sensor ideal for applications such as monitoring the shape of coated edges, where high-definition, high-resolution quality monitoring is required.

■ More Compact and Lightweight Than Conventional Models

By achieving significant reductions in size and weight to less than half those of conventional X-ray sensors, the ES-5 with X-ray Sensor can be installed in the new space-saving ES-5 QC2FB1 frame.

The QC2FB1 box-type frame equipped with the ES-5 with X-ray Sensor features a compact design with a machine-direction length of 260 mm (excluding protrusions, with the control box installed separately). This contributes to a

more compact battery electrode sheet coating process. In addition, its weight of approximately 85 kg (for the 800 mm measurement width specification) facilitates easy installation.

■ Easier Handling Than β -ray Sensors

X-ray sensors are easier to handle than β -ray sensors that use radioactive sources because X-ray irradiation can be stopped simply by turning off the power. In addition, radiation leakage to the surrounding area is negligible, allowing the space required for protective barriers and other equipment to be reduced.

X-ray sensors also offer advantages in terms of administrative procedures and regulatory requirements. In Japan, the following are not required for X-ray sensors.

- Appointment of a Radiation Protection Supervisor
- Establishment of a controlled area
- Special training and medical examinations under the Regulation on Prevention of Ionizing Radiation Hazards

Therefore, barriers to installation and operation are low, helping to reduce the associated costs.

MAIN SPECIFICATIONS

■ Frame

Overall frame length: 1,654 mm (short frame) or 2,454 mm (long frame)

Maximum measurement width: 800 mm (short frame) or 1,600 mm (long frame)

Maximum number of measurement points: 1,600

Measurement pitch: Select from 0.5 (short frame only), 1.0, 2.0, 2.5, 4.0, 5.0, and 10.0 mm

Mountable sensor type: β -ray sensor (radiation source: ⁸⁵Kr 15.54 GBq, 37 GBq), X-ray sensor (mid-range measurement)

Number of sensors mountable: 1

Sensor head speed during scanning: 3 to 36 m/min

Permissible frame tilt angle: $\pm 10^\circ$

■ X-ray Sensor

Measurement method: Transmission

Measurement range: 0 to 600 g/m²

X-ray source: Reflective X-ray tube

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