WEBFREX NV has been developed based on the concept of our vision “VigilantPlant”: SEE (accurately measuring sheet quality in producing films and sheets), KNOW (exactly delivering and understanding information), and ACT (supporting optimum control and quick decisions).

Yokogawa supports your production sites with our various product lineups, extensive experiences, and solutions based on our proven records.

### Accurate Quality Measurement
**Measures Quickly, Closely, and Accurately**
Accurate measured values play a basic and most important role in thickness gauge systems. WEBFREX NV offers measurement systems appropriate for your needs with a wide variety of sensors, measurement frames with high speed and high accuracy, and application know-how based on our numerous experiences and achievements of more than 2,500 system implementations.

### Quality Visualization
**Supports Right Judgment with Straightforward Information**
The role of human interface devices is to notify busy on-site operators of process information to help the operator’s right judgment and prompt actions without stressing them out. Ideas for catching significant changes are designed into the simple and easy to use operator screens.

### Quality Optimization
**Keeps Stable Quality with Optimum Control for Processes**
Control algorithms suitable for the characteristics of processes are essential to unleash the productivity of high-performance facilities. WEBFREX NV includes control methods suitable for film making machines and materials. The control methods largely contribute to improving productivity.

### From Quality Optimization to Production Optimization
**Balancing Quality Improvement with Productivity Enhancement**
“Highly Accurate and Reliable Measurement,” “Optimum Control,” and “Package for Quality and Production Management” contribute to enhancing quality of films and sheets, improving yields, and saving materials and energy.

### Optimum Solution for Diversified Needs
A wide range of applications are carefully supported leveraging Yokogawa’s abundant experiences proven by the track records of over 2,500 system implementations and our leading-edge, advanced technologies.

### SEE CLEARLY
### KNOW IN ADVANCE
### ACT WITH AGILITY

**High Reliability**
Yokogawa ensures in-house development and in-house production, and offers high reliability based on complete quality control. Yokogawa also supports you through an entire system life cycle, such as compatibility with our conventional models, maintenance check, and preventive maintenance services.
Application

Available for All Applications
WEBFREX NV is available for a great variety of applications, such as single-layer films, multi-layered films, coated sheets, battery electrodes, separator sheets, and ceramic capacitors. In addition, the optical multi thickness sensor can measure up to five layers’ thicknesses of multi-layered films.

PA, PC, PE, PI, PO, PP, PS, PET, PVC, EVA, PTFE, PMMA, OP, EP, MLCC, multi-layered films, magnetic tapes, non-woven fabrics, printed circuit boards, ceramics, engineering plastics, batteries, papers, tires, adhesive tapes, carbon sheets, sandpapers, cell phones, coated papers, photoresists, glasses, glass cloths, photo films, ink ribbons, wall papers, etc.

Flexible Scalability
WEBFREX NV provides a flexible system suitable for customer needs; a small-scale system with one frame and sensor, a high-performance system that uses several frames and sensors, and a production management system that combines user systems. WEBFREX NV can also flexibly adapt to the upgrade of production line facilities. A system can be constructed with minimum necessary equipment for the initial system implementation to be expanded at a later time in accordance with enhancement of the facility.

Excellent Open Network
WEBFREX NV networks every type of systems, including measurement, control, quality/production control, and management information systems. This networking supports quick and appropriate decision-making, by providing information suitable for production sites, quality control, and top management.

Collective Management of Several Lines
WEBFREX NV can collectively manage system data of up to four lines with one server. Collectively managing multiple lines improves production efficiency.

Quality Management Function
A quality management package is available for WEBFREX NV. It stores and analyzes measured profiles for a long term. This package also allows the examination of quality data of shipped products, helping the quality assurance process considerably.

System Configuration
WEBFREX NV includes sensors, frames, operator stations, and control units that perform MD and CD controls.

Battery Applications (WEBFREX3ES)
WEBFREX3ES is a dedicated system that meets the needs of intermittent coat weight and high-speed measurements for battery electrode sheets. A combined use of WEBFREX3ES and EdgeEye, a measurement system using cameras, allows quality management of the coating width.

Simultaneous Multi Thickness Measurement
There is rising importance in quality control of thin films and multi-layered films, such as optical films (used for LCD, PDP, and displays of mobile devices) and food films.

The optical multi thickness sensor, which is superior at this application, can simultaneously measure several layers’ thicknesses of films and sheets. This sensor also excels the beta-ray and X-ray sensors in thin film thickness measurement.
Frames and Sensors Providing High Accuracy Measurement and Having Highly Reliable Design

- **Frame**
  The performance of the sensors, scanning speed of the sensor head, and read cycle of measured data are the key performance of the online thickness gauge, which moves the sensor head on films and sheets to measure them. To unleash the performance of the sensors, Yokogawa has mounted the latest intelligence in the popular and highly stiff frames. The intelligence achieves high-speed and high accuracy measurement.

- **Highly Stiff and Durable Design**
  The frames use highly stiff I-steel or monocoque structure. This material and structure achieve high stiffness and durability and allows mounted sensors to measure films and sheets with their maximum performance even under harsh installation environments.

- **Frames Installable in Any Installation Spaces**
  Various shapes of frames are available so that you can select the best one according to measured objects and installation spaces. Yokogawa can provide consultation on other shapes of frames suited to customer’s different installation spaces.

- **Sensor**
  Sensors using beta-ray, X-ray, infrared radiation, or visible light can be selected according to measured objects. Sensor specifications can also be selected depending on measurement ranges and use environments. Choose the best sensor appropriate for your needs.

  - **Beta-ray Sensor**
    Irradiates measured objects with radiation, which is emitted from the radiation source, to determine the object’s thickness (basis weight) from radiation attenuation in transmitting through the object.
    Being less sensitive to materials, the beta-ray sensor can check any measured objects if their thickness is within a measurement range of this sensor.
    The intelligence achieves high-speed and high accuracy measurement.

  - **X-ray Sensor**
    Irradiates measured objects with X-rays, which are emitted from the X-ray tube, to determine the object’s thickness (basis weight) from X-ray attenuation in transmitting through the object. The X-ray sensor sensitivity differs according to atomic weights of measured objects. Being particularly sensitive to metallic elements, this sensor is suitable for measurement of coated sheets, such as battery electrodes and ceramic capacitors (MLCC).
    **Our Unique X-ray Tube Achieving Stability and Higher Output**
    The X-ray tube uses a thickness gauge, dedicated reflective trode, improving stability and measurement accuracy of the X-ray sensor.
    **High Accuracy Measurement**
    In principle, the X-ray sensor simultaneously measures objects and weight of air between the radiation source and detector (sensor gap). Although weight of air varies depending on air pressure and temperature, an air purge mechanism contained in this sensor always maintains a certain air density of the sensor gap. In addition, the sensor automatically compensates for the decay of radiation sources and performs computation to reduce the effect of air purge.
    These compensation and computation provide highly accurate and stable measurement.

- **Infrared Sensor**
  Irradiates measured objects with infrared radiation to determine the object’s thickness (basis weight) from infrared attenuation in transmitting through the object. The infrared sensor is sensitive to CH group and suitable for many kinds of films and sheets.
  **Light Source Requires No Replacement**
  The light source uses a dedicated heating wire, which has a semi-permanent life. Filters most sensitive to the thickness of measured objects can be selected.
  **High Accuracy Measurement**
  Using several kinds of wavelength filters as well as the filters sensitive to the thickness of measured objects minimizes the changes in ambient temperature, haze, and color and provides stable and highly accurate measurement.

- **Optical Multi Layered & Coated Film Thickness Sensor**
  The optical multi thickness sensor simultaneously measures up to five layers’ thicknesses of measured objects by dispensing reflected light from each interface of the objects to obtain the reflectance spectrum.
  The sensor can measure each layer’s thickness of optical films that transmit visible light.
  **Excellent Thin Film Thickness Measurement**
  This sensor excels the other transmission sensors in thin film thickness measurement and can measure not only multi-layered films but thin and single-layer films.
  **Unaffected by Pass Line Position Variation**
  Quantity of light reflected from films fluctuates when films flutter; however, this sensor measures thickness by converting interference fringes in the reflected light to a frequency, being unaffected by pass line position variation.

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![Diagram](image1.png)

![Diagram](image2.png)

![Diagram](image3.png)

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YOKOGAWA
**Measurement Operator Station**
A Windows-based and specifically designed PC offers high usability. It can be easily connected to printers and other peripherals.

**Sub Measurement Operator Station**
Installing the sub measurement operator station allows remote operation and monitoring of production lines. This operator station is also available for backup to prepare for possible failures.

**3D Profile View and Analysis Package** - Detecting and Predicting Changes -
This package illustrates the roll thickness distribution in three dimensions on a real-time basis. The different colors used for each standard value allow you to intuitively capture the roll quality. The package visually shows profile variations from the past to the present which facilitates understanding of the profile periodicity and correlation, empowering you to predict what happens next to the profile, and to take counteractions before the change happens.

**Other Features**
- 3D profiles are displayed on measurement operator station screens.
- The display angle and size of the profile can be freely changed.
- Profiles and trends at any position can be displayed.

**Profile Stack Server**
- Profile data of several lines can be stored on a roll-by-roll basis.
- Long-period profile data can be saved.
- Allows you to refer to data from your systems.
- Data can be output in CSV format. This allows you to freely use the data on your PC.
Optimum Control Suitable for Machines

Cross-machine Direction (CD) Control

- Wealth of Control Method Appropriate for Processes

CD control adjusts the lip opening at the T-die to obtain uniform thickness of products. The characteristics of film making machines include a long distance from a location where the frame is installed to actuators (such as the T-die) and a large variation of processes (like stretching). To bring out the performance of film making machines and obtain the best controllability, a control system considering these features is required.

- Virtual Zone Control
  - Even Controls between Bolts

Virtual zone profile control generates profiles at the midpoint between real bolts as well as on these bolts to perform control calculation so that the profile could be flat. This prevents occurrence of profile peaks and troughs between the bolts, which often become a problem in conventional profile controls only intended for such functions (applied to sampled data PI control and expert fuzzy control).

- Sampled Data PI Control
  - Most Suitable for Cast Machines

Yokogawa’s sampled data PI control algorithm, whose usefulness has been proven in many processes, is now extended to CD control. Tuning this PI control is easy because its tuning parameters are the same as those of the typical PI control algorithm. Output distribution calculation compensates for mutual interference between adjacent bolts to correctly cope with process variations.

- Expert Fuzzy Control
  - Most Suitable for Biaxially Oriented Machines

Expert fuzzy control theorizes manual operation of bolts performed by experienced operators who are familiar with machine features by using fuzzy theory. This control is effective for machines (mainly for biaxially oriented machines) with low repeatability of profile response to bolt manipulations and achieves higher stable control than conventional controls.

- Finite Setting Model Predictive Control
  - Most Suitable for Machines with Long Lag Time

Finite setting model predictive control applies a finite time settling response method to the profile control. This predictive control contributes to machines with a long lag time. This control produces a large amount of outputs; this allows even machines with a long lag time to settle down to target values within the shortest possible time.

CD Adaptive Control (Automatic Mapping Control)

- Keeps Optimum Control on a 24 Hour Basis

Mapping (*) is the most important parameter of CD control; however, it varies depending on operational conditions, such as stretch ratio and machine speed. For this reason, setting parameters for each grade and re-tuning has been required to keep optimum control. CD adaptive control always monitors process status and maintains mappings at an optimum state without stopping control by our unique algorithm that combines steepest descent method with neural network.

- CD Control Window
  - Simple, User-friendly, and Intuitive Usability

- Roll Shape Control
  - Prevents Quality Deterioration after Winding

Roll shape control improves roll shape by eliminating peaks of profiles. This control reduces local stresses due to “bumps” on rolls, avoiding roll degradation occurred until the roll is delivered.

- Machine Direction (MD) Control
  - Machine Direction (MD) Control

MD control controls machine direction thickness of films and sheets. Either control method of “sampled data PI control” or “finite time settling response control” can be selected.

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* (*) Positional correspondence between actuators (such as heat bolts) and measurement points on profiles.
### Performance Specifications

Sensors that measure any materials accurately

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Measurement Range</th>
<th>Source Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission sensor</td>
<td><strong>Beta-ray</strong></td>
<td><strong>Source:</strong> 147Pm, 85Kr, or 90Sr (depending on measurement ranges)</td>
</tr>
<tr>
<td></td>
<td><strong>X-ray</strong></td>
<td><strong>Source:</strong> Tungsten target or titanium target (depending on measurement ranges)</td>
</tr>
<tr>
<td>Infrared</td>
<td><strong>Measurement range:</strong> 0 to 2,000 μm (*1)</td>
<td></td>
</tr>
<tr>
<td>Reflective sensor</td>
<td><strong>Optical Multi Layered &amp; Coated Film Thickness Sensor</strong></td>
<td><strong>Measurement range:</strong> 0.5 to 200 μm (*1)</td>
</tr>
</tbody>
</table>

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*1: Measurement range is different depending on materials to be measured. For details, consult your local sales representative.

Frames installable in any spaces

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Sheet Width</th>
<th>Num. of Sensors to be Mounted</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-frame Standard type</td>
<td>6 m or less</td>
<td>One sensor, or any one of the transmission sensors and Optical Multi Layered &amp; Coated Film Thickness Sensor</td>
<td></td>
</tr>
<tr>
<td>High-performance type</td>
<td>6 m or less</td>
<td>Two sensors (transmission sensors only)</td>
<td></td>
</tr>
<tr>
<td>Long type</td>
<td>10 m or less (*2)</td>
<td>Two sensors (transmission sensors only)</td>
<td></td>
</tr>
<tr>
<td>C-frame Standard type</td>
<td>1.2 m or less</td>
<td>One sensor</td>
<td></td>
</tr>
</tbody>
</table>

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*2: Contact us when a sheet width is more than 10 m.

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VigilantPlant is Yokogawa’s automation concept for safe, reliable, and profitable plan operations. VigilantPlant aims to enable an ongoing state of Operational Excellence where plant personnel are watchful and attentive, well-informed, and ready to take actions that optimize plant and business performance.

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**Represented by:**

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