Incredible stability with any type of target

Integration of digital technology and ultrasonic waves has produced super multi-reflective type sensors.
All-purpose digital sensor

Introducing the FW Series, a tough, super multi-reflective sensor unaffected by a target’s material, color, or luster.

**Reasons for its strength**

1. **Can be used for all types of targets**

   The FW Series easily detects metal, glass, liquid level or other targets that have been difficult to detect with reflective-type photoelectric sensors. Also, the detections are not influenced by the color, pattern, or luster of the target surface.

2. **High stability and reliability**

   A new algorithm A.W.S. (Active Wave Stabilizer)* stabilizes detection while avoiding the influence of target vibration or external disturbances.

* The A.W.S. (Active Wave Stabilizer) function executes optimal processing according to the detecting condition and cancels fluctuations even when the receiving condition of the ultrasonic wave changes due to target vibration.
The long-range model features a maximum detecting distance of 39.37" (1,000 mm)!

FW-H10R: 39.37" (1,000 mm)
FW-H07: 27.56" (700 mm)
FW-H02: 7.87" (200 mm)

First in its class
Digital amplifier
FW-V20

Smallest in its class
Metal body
M18

Resistant to mist and dirt
The intense ultrasonic wave penetrates dust and dirt and detects the target. Also, the sensor body is IP67 rated and has excellent environmental resistance.

The easily detachable connector is also IP67 rated.

Unaffected by the background
The N.O.D. (Nearest Object Detection) function, which detects only the target located nearest to the sensor, eliminates the need to consider the background luster or shape. Reliable detection is ensured without taking measures such as tilting the sensor or changing the color of the background.
**Versatile performance with user-friendly operation**

**Dual Digital Display**
The digital indicator displays the distance in an easy-to-understand numerical display.

**Easy set up with one-button operation**
The settings can be configured by simply pressing the [SET] button with or without the target in place.

**Target Height Display**  
*First in the industry*

This function is convenient for differentiating target heights or for detecting liquid levels. The height of the target or liquid level can be displayed numerically to allow the user to determine the preset value, which makes for an easy-to-understand sensor for any user. The FW Series is the clear choice over conventional reflective sensors which feature unitless numerical displays, or LED bar indicators.

**Convenient sensitivity adjustment method**

**1-point zone tuning**  
*First in its class*

This function is useful for detection with a background. Pressing the [SET] button once will enable detection of only a target with a certain height without detecting the background.

**Conveyor tuning**  
*First in its class*

A preset value is tuned automatically to a level unaffected by background vibrations (conveyor, etc.).

**Chatter prevention function and display averaging mode**

**F-1**  **F-2**  **A-1**  **A-2**  **A-3**

The chatter prevention function prevents the outputs from chattering. This is possible by delaying the response time when the liquid surface ripples in liquid level detections. In addition, selecting the display averaging mode will reduce fluctuations of the display.

**External shift function**  
*A-1*  *First in its class*

This function is effective for severe environments with slight sensitivity differences. When the displayed values fluctuate due to variations in temperature or background position, the displayed value can be compensated by an external shift input immediately before detection.

**Bank switching function**  
*F-1*  *F-2*  *A-3*

Detection of up to four types of targets is enabled by entering a bank-switching input externally.

**Power-saving function**

**F-1**  **F-2**  **A-1**  **A-2**  **A-3**

With this function, the display can be simplified when the sensor is not being operated. Power consumption can be reduced by approximately 20% ¹.

**Analog monitor output**  
*F-1*  *F-2*  *A-3*

The FW Series features an analog output (4 to 20 mA).

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¹ When using the FW-H02/H07  
² Only one function can be used at one time.
Choose from 5 different detection modes for your application

**F-1 mode (General purpose)**
Various sensitivity adjustments are available. For example, “two-point tuning” can be performed by pressing the [SET] button with or without the target in place, and “full-automatic tuning” can be performed automatically while the operator moves the target.

**F-2 mode (Detecting a target with a background)**
This mode is useful when detecting a target with a background. The target height is displayed with the background as the reference. “One-point zone tuning” is available, which detects only targets at a certain height without detecting the background.

**A-1 mode (Detecting a target on a conveyer)**
This mode is optimal for detecting the presence and absence of targets traveling on a conveyer. The target height is displayed with the conveyer as the reference. “Conveyer tuning” is available, which detects only the targets without detecting the vibrations of the conveyer. Output 2 serves as the alarm signal that detects unloading of the conveyer and other abnormalities.

**A-2 mode (Detecting the liquid level)**
This mode is suitable for detecting the liquid level. The height of the liquid level is displayed with the bottom of the tank as the reference. Two preset values (upper and lower limits) and two additional preset values for predicting the upper and lower values can be set up to enable monitoring the following four statuses: normal, near the upper limit, near the lower limit, and abnormality of upper and lower limits.

**A-3 mode (Zone control)**
This mode is suitable for controlling the pump by detecting the liquid level in a tank, or for controlling the tension of sheet material. The height of the liquid level or the sheet can be displayed by setting the reference level as desired. Two preset values (upper and lower limits) can be set up to control the device: When the upper limit is exceeded, the output is turned off to stop the device, and when the lower limit is exceeded, the output is turned on to activate the device.
Wide range of applications

Automotive Industry

Detecting springs during the assembly process
Due to an unstable profile, detection of springs has been unreliable with conventional reflective photoelectric sensors. The FW Series ensures reliable detection without being influenced by background luster.

Detecting mesh trays used for quenching the targets
The FW Series ensures reliable detection of targets with metallic luster and small holes. In addition, detection is unaffected by workpieces located on the opposite side of the holes.

Detecting automotive plate glass
Reliable detection of transparent targets has been difficult with conventional reflective photoelectric sensors. The FW Series ensures reliable detection of transparent targets without being affected by the glass colors.

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Reliable detection of transparent targets has been difficult with conventional reflective photoelectric sensors. The FW Series ensures reliable detection of transparent targets without being affected by the glass colors.

Detecting the presence/absence of bolts
The FW Series is used to detect metal targets on metal boards. Detecting only the presence of bolts is possible without being affected by the luster of the metal.

Checking target removal from a die-cast machine
The FW Series ensures reliable detection of multi-colored targets without being affected by the colors. In addition, detection is unaffected by mold release agents in the environment.

Detecting black-colored cushioning material on black resin
Detection of black-colored targets has been difficult with conventional reflective photoelectric sensors. The FW Series ensures reliable height differentiation without being affected by color.

Detecting con-rods
Due to the coolant on the target surface, reliable detection of an atomized area has been difficult with conventional reflective photoelectric sensors. The FW Series ensures reliable detection unaffected by the coolant on the target surface.

Detecting the liquid level of hydraulic fluid for a press
Dirty oil has been difficult to detect with conventional contact liquid level sensors. The FW Series enables non-contact detection reducing the need for costly maintenance services.
Detection of adhesive with high viscosity has been difficult with conventional contact liquid level sensors. The FW Series enables non-contact detection. In addition, outputs of upper and lower limits can be performed separately.

Detecting the fluid level of adhesive on a roll coater
Detection of adhesive with high viscosity has been difficult with conventional contact liquid level sensors. The FW Series enables non-contact detection. In addition, outputs of upper and lower limits can be performed separately.

Detecting remaining pellet quantity in a hopper
Due to shape and color variations of pellets, detection has been unstable with conventional reflective photoelectric sensors. The FW Series ensures reliable detection regardless of pellet color or shape.

Detecting transparent bottles in the cleaning process
The FW Series ensures reliable detection of transparent targets with a rounded shape. In addition, detection is unaffected by an environment where water splashes on the target surface.

Detecting decorative bottles in the cleaning process
The FW Series ensures reliable detection of transparent targets with a rounded shape. In addition, detection is unaffected by an environment where water splashes on the target surface.

Detecting confectionery packaging on a conveyer
Depending on the condition of the contents, stable detection of transparent confectionery packaging has been difficult with conventional photoelectric sensors. The FW Series reliably detects only the outside transparent package without being affected by the contents.

Detecting confectionery packaging on a conveyer
Depending on the condition of the contents, stable detection of transparent confectionery packaging has been difficult with conventional photoelectric sensors. The FW Series reliably detects only the outside transparent package without being affected by the contents.

Detecting transparent lids of containers
The FW Series ensures reliable detection even if the target surface is rippled. In addition, detection is not affected by the inner contents when covered with a transparent lid.

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The FW Series ensures reliable detection even if the target surface is rippled. In addition, detection is not affected by the inner contents when covered with a transparent lid.

Differentiating the presence / absence of product packaging and product varieties
The FW Series is capable of differentiating only the height without being affected by the color or pattern of the targets. In addition, it is capable of differentiating product variety by using two outputs.

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The FW Series is capable of differentiating only the height without being affected by the color or pattern of the targets. In addition, it is capable of differentiating product variety by using two outputs.

Detecting the presence / absence of contents in containers
Pasta or targets with an uneven surface profile can be detected reliably. In addition, detection is not affected by steam from fresh-cooked targets.

Detecting the presence / absence of contents in containers
Pasta or targets with an uneven surface profile can be detected reliably. In addition, detection is not affected by steam from fresh-cooked targets.
Detecting slack in films
Reliable detection is ensured regardless of surface color, pattern, and luster. In addition, upper and lower limits can be output separately.

Detecting the level of chocolate
Since the targets are food products, contact liquid level sensors cannot be used. In addition, detection with photoelectric sensors is adversely affected by the target color and luster. The FW Series ensures reliable detection regardless of target color and luster.

Detecting wafers in the cleansing process
Reliable detection of sweating wafers is ensured even in a vaporous atmosphere immediately after the slicing process.

Detecting slit substrates in the transfer process
Due to the colors and slits of the substrate, instability and chattering of outputs have been inevitable with conventional photoelectric sensors. The FW Series ensures reliable detection unaffected by colors and small slits.

Controlling web tension
Due to transparency and surface irregularities, detection with photoelectric sensors has been difficult. The FW Series ensures reliable detection unaffected by projections and depressions. In addition, the two outputs can be used for making outputs of upper and lower limits separately.

Detecting wafers from an angle
Detection has been difficult because of the minute height difference between the thin wafer and background. The FW Series ensures reliable detection by applying ultrasonic waves from an angle to cause slight reflections from the edge.

Detecting wafers in a magazine rack
The FW Series is used to detect the remaining wafers. Detection with reflective-type sensors has been difficult because the light was absorbed by the surface film of the wafers. The FW Series is not affected by surface films or glossy backgrounds.

Controlling the fluid level of a cleaning solution
The FW Series is used for controlling the liquid level. The two outputs can be used for making outputs of upper and lower limits separately. In addition, the special liquid level detection mode enables various controls with simple setup.
Analog output circuit
Analog output (4 to 20 mA)
0V

Main circuit
Pink
Blue

External shift input/
Bank switching input circuit
Pink
White
Black

Analog output/
External shift input/
Bank switching input-selectable
Pink
White
Blue
Pink

Input/Output circuit
FW-V20/FW-V25
NPN

Input/Output circuit
FW-V20P/FW-V25P
PNP

Applications
Detecting baskets
Cage-type targets with an open structure can be detected reliably with the FW Series with a wide detection range.

Detecting the passage of plate glass
Detection is ensured unaffected by the curvature, color, and luster of the surface.

Specifications
Sensor head

<table>
<thead>
<tr>
<th>Model</th>
<th>Detecting range (inch mm)</th>
<th>Size (inch mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FW-H02</td>
<td>1.97&quot; to 7.87&quot; 50 to 200 mm</td>
<td>M18 x P1 P0.04&quot;, Length = 2.5&quot; 63.5</td>
</tr>
<tr>
<td>FW-H07</td>
<td>5.91&quot; to 27.56&quot; 150 to 700 mm</td>
<td></td>
</tr>
<tr>
<td>FW-H10R</td>
<td>5.91&quot; to 39.37&quot; 150 to 1000 mm</td>
<td>M18 x P1 P0.04&quot;, Length = 4.1&quot; 104</td>
</tr>
</tbody>
</table>

1. Dead zones of approx. 2% of F.S. exist at both ends of the detecting range.
2. The errors for the indicated value at 25°C (77°F).
3. The variation of sonic velocity in air generates errors in the negative direction at 25°C (77°F) and above, or in the positive direction at 25°C (77°F) and below.
【Digital amplifier】

<table>
<thead>
<tr>
<th>Model</th>
<th>NPN</th>
<th>PNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>FW-V20</td>
<td>1680 mW (97 mA) max.</td>
<td>2600 mW (110 mA) max.</td>
</tr>
<tr>
<td>FW-V20P/FW-V25P</td>
<td>1370 mW (57 mA) max.</td>
<td>2330 mW (97 mA) max.</td>
</tr>
</tbody>
</table>

- **Power-supply voltage**: 24 VDC, Ripple (P-P): 10% max.
- **Current consumption**:
  - Normal mode: When connected to the FW-H02/H07
  - ECO mode: When connected to the FW-H10R
- **Maximum load resistance**: 40 V max. for PNP

#### Display format (inch/mm selectable)
- 2-row display with signed 3-digit, 7-segment LED
- Character height: Upper row: 0.50" 8 mm, Red; Lower row: 0.25" 5.7 mm, Green
- Refresh rate: 10 times/sec. (5 times/sec. when using the display averaging function)

#### Operation indicator lamp
- LED x 2 (corresponding to Control output 1 and Control output 2)
- Green LED x 2 (Display CH indicator)

#### Light source
- Blue LED (wave length: 470 nm)
- Red LED x 2 (corresponding to Control output 1 and Control output 2)

#### Power-supply voltage
- 6 VDC (button battery LR43 x 4)

#### Ambient temperature
- -25 to +70°C (-13 to 158°F), No condensation

#### Relative humidity
- 35 to 85%, No condensation

#### Resistance to vibrations
- 10 to 55 Hz, Horizontal amplitude: 1.5 mm, 2 hours each in the X, Y, and Z axis

#### Housing material
- Main unit and cover: Polycarbonate, Keycaps: elastomer
- approx. 70 g

#### Weight (including a 6.6’ 2-m power cable)
- approx. 85 g

#### Accessories
- FW-V20 (P): Mounting bracket, power cable, and instruction manual
- FW-V25(P): Panel mounting bracket, front protective cover, power cable, and instruction manual
- *It is recommended that the product be used with a maximum detecting distance of 19.69’ 500 mm due to the visibility and consistency of the spot and the detecting distance.

### Specifications of options

#### Side-view attachment FW-SV01

<table>
<thead>
<tr>
<th>Sensor head model combination</th>
<th>FW-H02</th>
<th>FW-H07</th>
<th>FW-H10R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detecting range 1</td>
<td>2.2’ to 7.1’</td>
<td>5.9’ to 24.4’</td>
<td>5.9’ to 35.4’</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>25 to +70°C</td>
<td>11 to 131°F</td>
<td>No condensation</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>35 to 85%, No condensation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to vibrations</td>
<td>10 to 55 Hz, Horizontal amplitude: 1.5 mm, 2 hours each in the X, Y, and Z axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 15 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>PPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>M16 nut: 1, Wave washer: 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Light guide attachment FW-LG01

<table>
<thead>
<tr>
<th>Model</th>
<th>FW-LG01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power-supply voltage</td>
<td>6 VDC (button battery LR43 x 4)</td>
</tr>
<tr>
<td>Light source</td>
<td>Blue LED (wave length: 470 mm)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to 45°C (32 to 113°F), No condensation</td>
</tr>
<tr>
<td>Resistance to vibrations</td>
<td>10 to 55 Hz, Horizontal amplitude: 1.5 mm, 2 hours each in the X, Y, and Z axis</td>
</tr>
<tr>
<td>Housing material</td>
<td>Main unit: ABS, Keycaps: Silicone rubber</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 21 g (including batteries)</td>
</tr>
<tr>
<td>Accessories</td>
<td>Test button batteries (LR44): 4, instruction manual</td>
</tr>
</tbody>
</table>

* Batteries are loaded to the casing.

#### L-shaped relay connector OP-S1691

<table>
<thead>
<tr>
<th>Model</th>
<th>OP-S1691</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-25 to +70°C (-13 to 158°F), No condensation</td>
</tr>
<tr>
<td>Resistance to vibrations</td>
<td>0.05’ 1.5 mm, 2 hours each in the X, Y, and Z axis</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 70 g</td>
</tr>
</tbody>
</table>

### Dimensions

#### Sensor head FW-H02/FW-H07

- Cable length: 6.6’ 2 m
- ø0.14” 3.4
- ø0.08” 0.20 mm

#### Sensor head FW-H10R

- Cable length: 6.6’ 2 m
- ø0.15” 3.6
- ø0.09” 0.20 mm

#### Digital amplifier FW-V20/V20P

- When mounted to a DIN rail

#### When attaching a bracket (standard)

#### Digital amplifier FW-V25/V25P

- Mounting bracket: TYPE304 stainless steel

### Notes

- 1. Indicates the distance from the detecting reference (zero point).
- Refer to the dimensions below for the detecting reference.
Digital Laser Optic Sensors  LV Series

High-Power Digital Laser Optic Sensor
Laser technology achieves new sensing standards that are impossible with conventional sensors.

<table>
<thead>
<tr>
<th>Dual digital display</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 µs high-speed mode</td>
</tr>
<tr>
<td>16-bit high-precision, high-power</td>
</tr>
<tr>
<td>Two independent outputs</td>
</tr>
</tbody>
</table>

RGB Digital Fiberoptic Sensors  CZ-V Series

The Smartest RGB Sensor in the Industry

| World’s first |
| Hybrid SUPER RGB sensor |
| First-in-its-class |
| Triple 16-bit calculation for accurate recognition |
| World’s First |
| Automatic selection from 7 different light combinations |
| Four independent outputs |

Specifications are subject to change without notice.