High-speed, High-Accuracy Digital Displacement Inductive Sensor EX-V Series

High-speed Sub-micron Displacement Sensor with 40,000 Samples/sec.

High Accuracy Inductive Gauging Technology
High-performance & Simple Setup

High-speed, high-accuracy detection allows for 24-hour monitoring of facilities and products, preventing defective products from being produced.

The high-speed, 40,000 samples/second sampling, does not overlook any instantaneous changes. Even high-speed production lines or moving objects can be measured accurately and efficiently.

The EX-V Series significantly improves the reliability of facility monitoring system by adding more accurate measurement to the rugged design, which is virtually unaffected by harsh environments.

- **Bottom-dead-center measurement**
  - High-accuracy and high-speed sampling enables the detection of minute changes in end of stroke.

- **Vibration measurement**
  - The high-speed sampling of 40,000 times/second allows for reliable detection of abnormal vibrations in facilities.

- **Gap measurement**
  - The rugged, compact sensor head allows for accurate measurement of the position or gap between devices.
Best-in-its class accuracy and high-speed sampling

The EX-V Series combines high-speed sampling with a newly developed linearity correction circuit which results in dramatic performance improvement over conventional eddy current systems.

High-speed sampling: 40,000 samples/second

Instantaneous changes can be detected reliably.

The high-speed digital processing circuit allows for accurate detection of real peak (bottom) values that cannot be detected at conventional sampling speeds.

High resolution: 0.02% of F.S.; Linearity: ±0.3% of F.S.

FLL circuit for high accuracy

The FLL (Flat Level Linearize) circuit applies the optimal linearization correction for each individual sensor head. You can achieve the measurement with best-in-its class accuracy with simple setting.

Significant reductions in cost/labor-hours at the touch of a button

The optimal program for the application is automatically set by just selecting the measurement mode. There is no need for complicated settings of a trigger input, timer setting or arithmetic operation using external devices.

Small and highly resistant sensor head

Considering the use in factories, the sensor head is designed to be resistant against harsh environments, to save space and to allow for easy maintenance.

Resistant against harsh environments: IP67 rated

All models are rated as IP67, offering resistance against both water and oil. They offer reliable operation even in harsh environments.

Space saving: Compact or low-profile type available

You can select the optimal sensor head according to the application and available mounting space.

Easy maintenance

Compatible sensor head

The FLL circuit allows for compatibility among sensor heads of the same model.

Alarm output

The alarm output indicates accidental breakage or disconnection of the sensor head.

Easy maintenance and useful functions ensure reliable operation in factories.
Just select the optimal setting for your application.

### Basic modes for quick operation
Optimal settings for common applications are preprogrammed. Simply selecting the appropriate mode completes the setting. There is no need for time-consuming initial setting or adjustment.

#### Select the mode

- **Bottom-dead-center mode**
- **Eccentricity/vibration mode**
- **Thickness/gap mode**

#### For automatic setting

- **Bottom-dead-center hold**
- **Automatic trigger**
- **Previous value comparison**

### Bottom-dead-center mode

**Automatically detects the bottom dead center of stroke.**

- **Detecting bottom dead center of an ultrasonic welder**
  The EX-V Series measures the bottom dead center of the horn of the ultrasonic welder to detect defective welding.

### Eccentricity/vibration mode

**Accurately measures amplitude without being affected by changes over time.**

- **Measuring the eccentricity of a shaft**
  The eccentricity of a rapidly turning shaft is measured for abnormality detection.

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### Measuring the eccentricity of a shaft

The eccentricity of a rapidly turning shaft is measured for abnormality detection.
**Thickness/gap mode**

Measures the average thickness of the desired section with a simple setting.

**Average measurement**

Just selecting the “Average” measurement type automatically activates trigger inputs to measure the average value within the specified section.

**Select the program best suited for your application.**

**Various measurement modes**

You can select the measurement mode best suited for your application, such as the limited bottom-dead-center mode or difference between peaks (bottoms) mode.

**Limited bottom-dead-center mode**

Detecting swarf generation in a press

The swarf may not be detected at the bottom dead center of the die because it is crushed there. Detecting the bottom dead center of the stripper allows for stable detection.

**Automatic trigger**

When a target approaches the sensor, a trigger signal is automatically turned ON to start measurement. There is no need for an external trigger input or timer setting.

**Timer function**

The flicker function using the internal timer allows for measurement of the average value or vibration within a specified period. Moreover, the timer enables adjustment of the start or end point of measurement from the instant the automatic trigger is turned ON.

**Previous value comparison**

The latest measured value can be compared with the average value of the previous measurements. This allows for the detection of only abrupt changes without being affected by changes over time.
Various Functions for Every Need

Measurement period output
The measurement period for bottom-dead-center or eccentricity detection can be specified by strobe outputs. By connecting the EX-V Series to an oscilloscope or other device, you can adjust the device while monitoring a waveform.

Comparator output disable input
The comparator output can be stopped with external signals. While continuing comparator operation, you can stop the output until the device operation stabilizes.

Tolerance limit memory function
Up to four upper/lower tolerance limit settings can be stored in memory. You can switch these settings also by external signals. This makes changeover quick and easy.

Applications by Facility/Product

<table>
<thead>
<tr>
<th>Electric machinery/electronics</th>
<th>Metal/automobile</th>
<th>Plastic/paper</th>
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</thead>
<tbody>
<tr>
<td><strong>Facility</strong></td>
<td><strong>Product</strong></td>
<td></td>
</tr>
<tr>
<td>Detecting improper crimping</td>
<td>Measuring the surface runout of a disk</td>
<td>Measuring the distortion of a die for an injection molding machine</td>
</tr>
<tr>
<td>Improper crimping can be detected by checking the bottom dead center of the machine.</td>
<td>The eccentricity mode detects the surface runout of a disk.</td>
<td>The amount of distortion can be measured by comparing the measured values before and after the load is applied.</td>
</tr>
<tr>
<td>Checking the origin of the X-Y stage</td>
<td>Measuring the elongation of a tie bar</td>
<td>Detecting the surface runout of a slitter blade</td>
</tr>
<tr>
<td>The resolution of 0.4 µm enables accurate measurement of the position of the origin.</td>
<td>The elongation of the tie bar of a die-cast machine can be measured by using a magnet jig.</td>
<td>The eccentricity mode automatically detects the surface runout exceeding the reference value.</td>
</tr>
</tbody>
</table>

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<tr>
<th>Facility</th>
<th>Product</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detecting the eccentricity of ATC tools</td>
<td>Measuring the elongation of a tie bar</td>
<td>Measuring the gap between rollers</td>
</tr>
<tr>
<td>Eccentricity due to trapped swarf can be detected.</td>
<td>The elongation of the tie bar of a die-cast machine can be measured by using a magnet jig.</td>
<td>The gap between the molding rollers can be accurately measured</td>
</tr>
<tr>
<td>Differentiation of the outer diameter of a bearing</td>
<td>Detecting the eccentricity of a gear</td>
<td>Detecting double-fed paper bags</td>
</tr>
<tr>
<td>The bottom-dead-center mode detects the point where the bearing comes the closest to the sensor head to differentiate the outer diameter.</td>
<td>Setting the eccentricity mode to the difference between peaks measurement type detects the eccentricity in gear teeth tops.</td>
<td>Detecting the movement of a jig allows for differentiation between one and two paper bags.</td>
</tr>
<tr>
<td>Measuring subtle vibration of a precision motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detecting abnormal vibration prevents defective products from being sent to the next process.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Selection Chart

## Specifications

<table>
<thead>
<tr>
<th>Controller</th>
<th>Sensor head</th>
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</thead>
<tbody>
<tr>
<td>EX-V Series</td>
<td>![Image of EX-V Series controller and sensor head]</td>
</tr>
</tbody>
</table>

## Controller Specifications
- Measuring range
- Display range
- Linearity
- Resolution
- Sampling rate
- Display rate
- Display character
- Range-over alarm

## Sensor head Specifications
- Timing input
- Reset input
- Auto-zero input
- Comparator output
- Disable input
- Synchronous input
- External setting input

### Measuring range and Resolution
- Model: EX-305V
  - ø5.4 x 18 mm ø0.21" x 0.71"
  - Resolution: 0.4 µm 0.016 Mil
  - Measuring range: 0 to 1 mm 0.04"

- Model: EX-110V
  - M10 x 18 mm 0.71"
  - Resolution: 0.4 µm 0.016 Mil
  - Measuring range: 0 to 2 mm 0.08"

- Model: EX-416V
  - ø14.5 x 20 mm ø0.57" x 0.79"
  - Resolution: 1 µm 0.039 Mil
  - Measuring range: 0 to 5 mm 0.20"

- Model: EX-422V
  - ø22 x 35 mm ø0.87" x 1.38"
  - Resolution: 2 µm 0.078 Mil
  - Measuring range: 0 to 10 mm 0.39"

- Model: EX-614V
  - 14 x 30 x 4.8 mm 0.55" x 1.18" x 0.19"
  - Resolution: 4 µm 0.16"
  - Measuring range: 0 to 4 mm 0.16"

## Control input
- Timing input
- Reset input
- Auto-zero input
- Comparator output
- Disable input
- Synchronous input
- External setting input

## Control output
- Tolerance setting
  - Upper/lower 2-level setting x 4 sets (selectable)
- Signal
  - NPN open-collector (HIGH, GO and LOW): 100 mA max. (40 V max.)
  - PNP open-collector (HIGH, GO and LOW): 100 mA max. (30 V max.)
- Response time
  - 0.075 ms (at maximum speed)
- Off-delay time
  - 60 ms

## Strobe output
- NPN open-collector: 100 mA max. (40 V max.) (N.O.)
- PNP open-collector: 100 mA max. (30 V max.) (N.O.)

## Alarm output
- NPN open-collector: 100 mA max. (40 V max.) (N.C.)
- PNP open-collector: 100 mA max. (30 V max.) (N.C.)

## Analog voltage output
- Output voltage
  - ±5 V
- Impedance
  - 100Ω
- Response time
  - 0.075 ms (at maximum speed)

## Temperature fluctuation
- ±0.07% of F.S./°C

## Power supply
- 24 VDC ±10%, Ripple (P-P): 10% max.

## Current consumption
- 240 mA max.

## Ambient temperature
- Sensor head: -10 to +60°C (14 to 140 ºF), No freezing
- Controller: 0 to +50°C (32 to 122 ºF), No freezing

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

## Vibration
- 10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y and Z directions, 2 hours respectively

## Weight
- Controller
  - Approx. 45 g
  - Approx. 55 g
  - Approx. 75 g
  - Approx. 200 g
  - Approx. 60 g
- Major functions
  - Auto-zero function, Offset function, Measurement modes (15 types), Tolerance limit value memory function (4 patterns)

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The above data was obtained using an iron target (S45C, SS400, t = 1 mm 0.04”). When measuring aluminum, copper, or stainless steel targets, refer to the linear characteristics for these materials.

1. When the digital filter function is used, the sampling rate is 20000 samples/sec.
2. When the distance between the sensor head and the target is within 50% of the measuring range.
### Dimensions

<table>
<thead>
<tr>
<th>Controller</th>
<th>EX-V01(P)/EX-V02(P)/EX-V05(P)/EX-V10(P)/EX-V64(P)</th>
<th>Panel cutout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel thickness:</td>
<td>0.5 to 6.0</td>
<td>5.0 to 6.0</td>
</tr>
<tr>
<td>75 min.</td>
<td>100 min.</td>
<td>100 min.</td>
</tr>
</tbody>
</table>

#### Sensor head

**EX-305V**
- Sensor head: EX-V01(P)/EX-V02(P)/EX-V05(P)/EX-V10(P)/EX-V64(P)
- Mounting stand: OP-35407
- The stand has two 0.63" (16-mm) diameter mounting holes for attaching a push-button switch for reset input or comparator output disable input.

*The switch is not included. Contact KEYENCE for details.*

**EX-614V**
- Coaxial cable: ø0.13" (3.2 mm)

**EX-110V**
- Across flats: 14, t=3
- Across flats: 19, t=3.5

**EX-416V**
- Across flats: 21, t=4
- Across flats: 21, t=4.0 (ø3.2 mm coaxial cable)

**EX-422V**
- Detecting surface: ø2.0 (ø14.5 mm)
- Coaxial cable: ø0.13" (3.2 mm)

### Options

**OP-35407 Mounting stand**
- The stand has two 0.63" (16-mm) diameter mounting holes for attaching a push-button switch for reset input or comparator output disable input.

*The switch is not included. Contact KEYENCE for details.*

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**Specifications are subject to change without notice.**