KEYENCE

KEYENCE EX-V01

12.345

HIGH — TIM
GO
LOW

ZERO

CALL

SET ▶ ▲ ↵

FUNC UTILITY MODE CALIB

POWER

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

High Accuracy Inductive Gauging Technology

CE

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-centre 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.
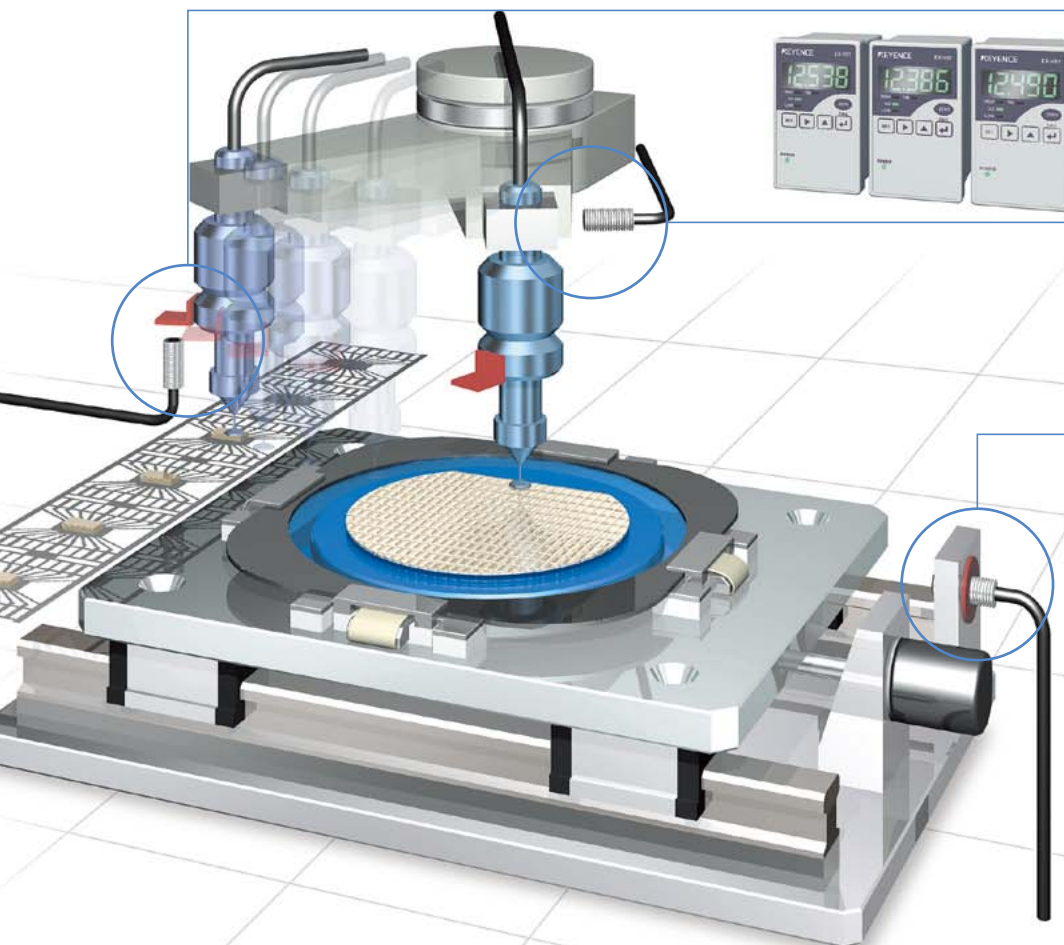
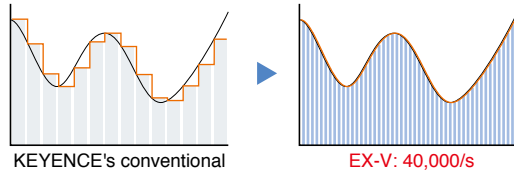### High-speed, High-Accuracy Digital Displacement Sensor

EX-V Series

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

KEYENCE's conventional model: 2000/s

EX-V: 40,000/s

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

KEYENCE's conventional model
Ideal line

Resolution: 0.04% of F.S.
Linearity: ±1% of F.S.

EX-V
Ideal line

Resolution: 0.02% of F.S.
Linearity: ±0.3% of F.S.

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.
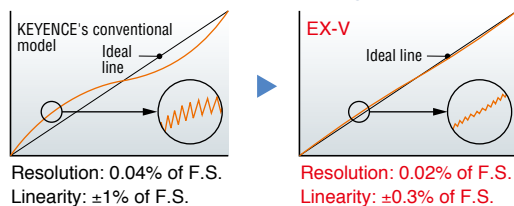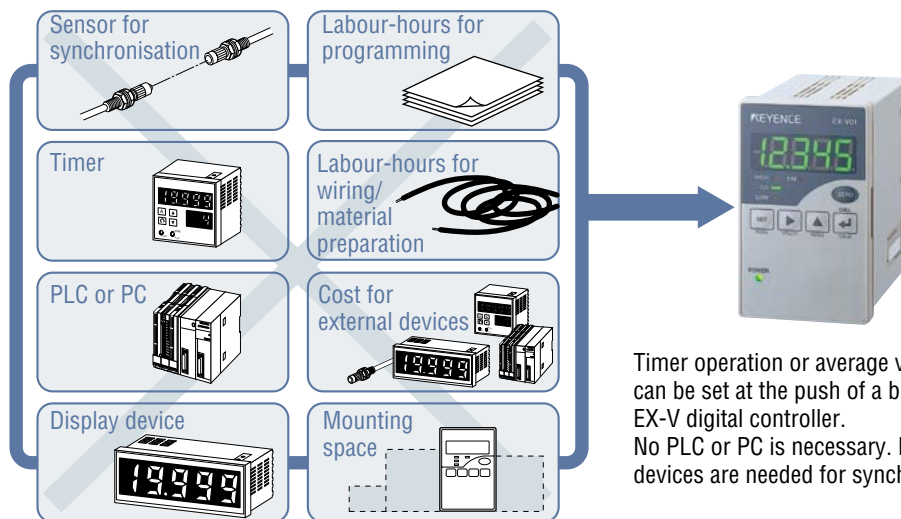
FLL circuit for high accuracy

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

Significant reductions in cost/labour-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.

Sensor for synchronisation

Labour-hours for programming

Timer

Labour-hours for wiring/material preparation

PLC or PC

Cost for external devices

Display device

Mounting space

Timer operation or average value calculation can be set at the push of a button on the EX-V digital controller.
No PLC or PC is necessary. No external devices are needed for synchronisation.

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

18 mm

ø5,4 mm

t=4,8 mm
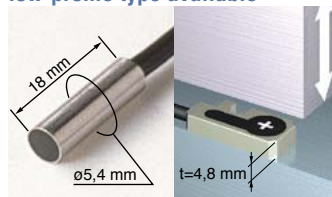
You can select the optimal sensor head according to the application and available mounting space.

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

For automatic setting

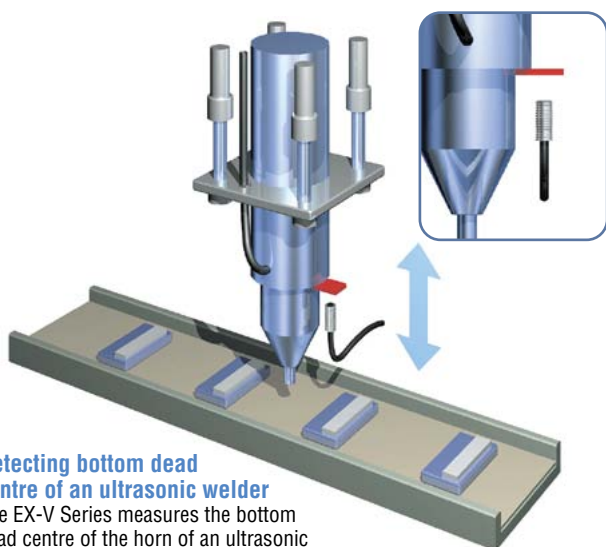- Bottom-dead-centre mode
- Eccentricity/vibration mode
- Thickness/gap mode

Bottom-dead-centre mode
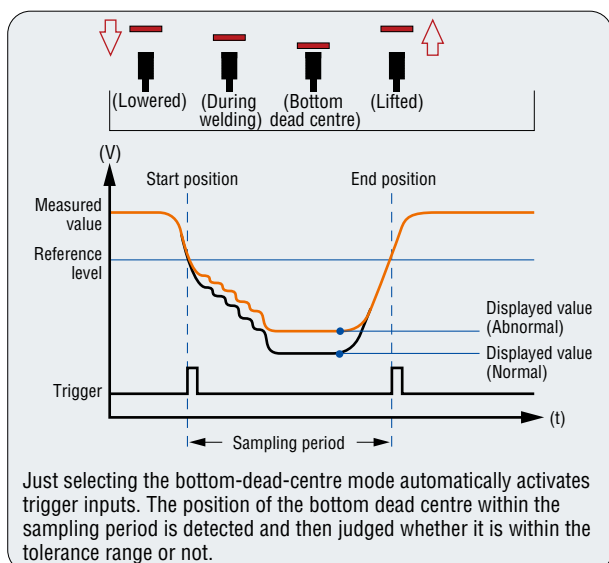
| Bottom-dead-centre hold | Automatic trigger | Previous value comparison |

Automatically detects the bottom dead centre of stroke.

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

(Lowered) (During welding) (Bottom dead centre) (Lifted)

(V)

Start position End position

Measured value
Reference level
Displayed value (Abnormal)
Displayed value (Normal)

Trigger

Sampling period

(t)

Just selecting the bottom-dead-centre mode automatically activates trigger inputs. The position of the bottom dead centre within the sampling period is detected and then judged whether it is within the tolerance range or not.

Eccentricity/vibration mode

| Amplitude hold | Automatic trigger | Cyclical difference measurement |

Accurately measures amplitude without being affected by changes over time.
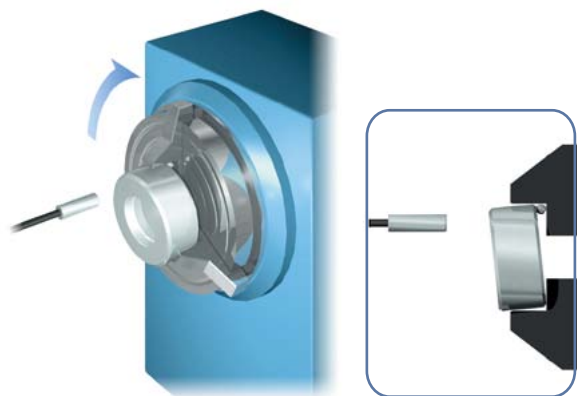
Detection of runout due to chucking failure
When a workpiece is chucked, particles are sometimes trapped between the workpiece and chuck, resulting in improper chucking.
The sensor-to-workpiece distance is detected while the workpiece is being rotated.
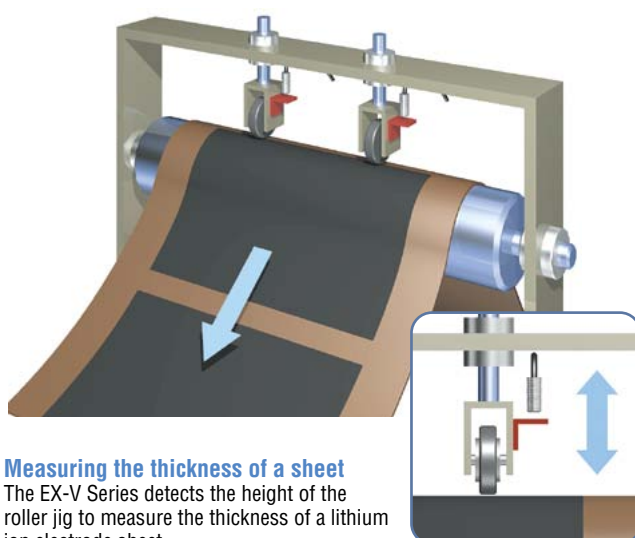
The amplitude in one cycle is measured and displayed.

(V)

Start position

Displayed value (Abnormal)

Measured value

Trigger

Sampling period

(t)

Measurement automatically starts when the amplitude exceeds the specified value. If the amplitude exceeds the tolerance range, an output is produced to indicate abnormal vibration.
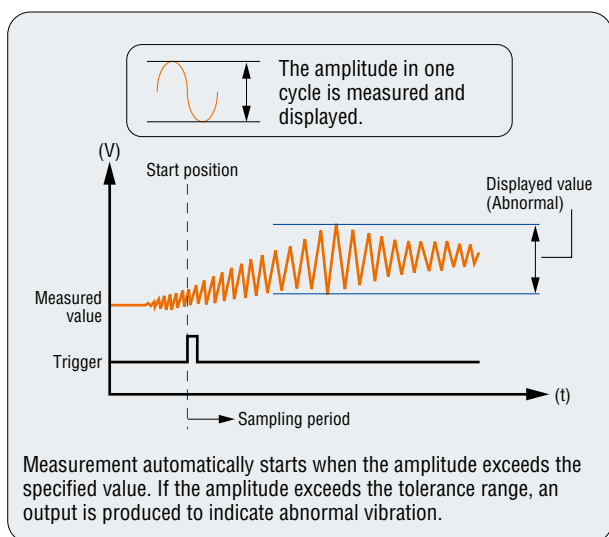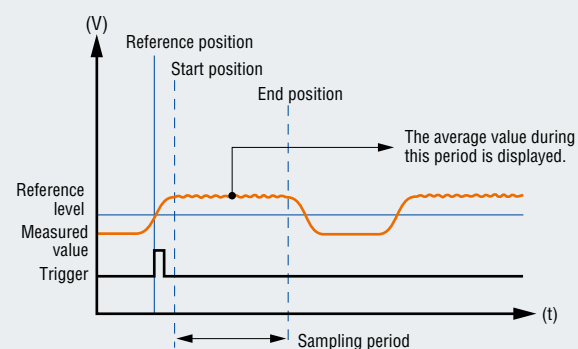
Thickness/gap mode

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

Measuring the thickness of a sheet
The EX-V Series detects the height of the roller jig to measure the thickness of a lithium ion electrode sheet.

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-centre mode or difference between peaks (bottoms) mode.

Limited bottom-dead-centre mode
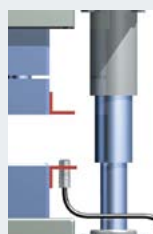
Detecting swarf generation in a press
The swarf may not be detected at the bottom dead centre of the die because it is crushed there. Detecting the bottom dead centre of the stripper allows for stable detection.

(Lowered) (Bottom dead centre of stripper) (Bottom dead centre of die) (Lifted)
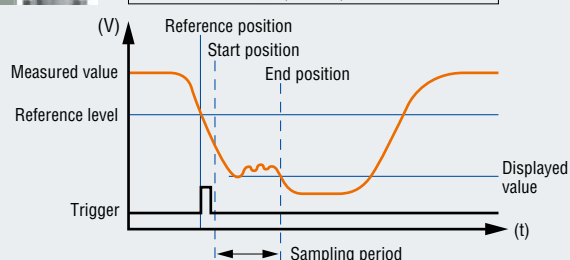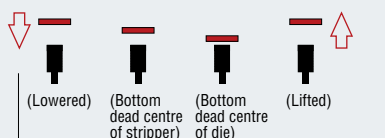
Automatic trigger
When a target approaches the sensor, a trigger signal is automatically turned ON to start measurement. There is no need for an external trigger input or timer setting.

When a target approaches:

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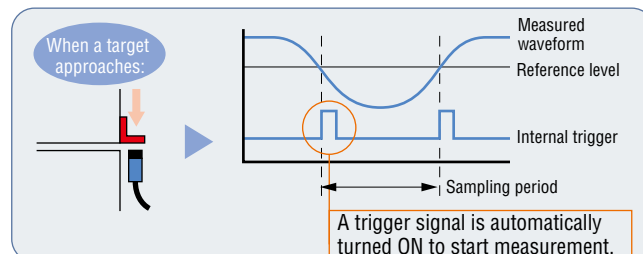
Timer function
The flicker function using the internal timer allows for measurement of the average value or vibration within a specified period. Moreover, the timer enables adjustment of the start or end point of measurement from the instant the automatic trigger is turned ON.

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-centre 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.
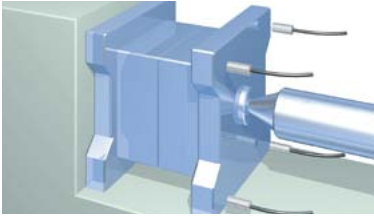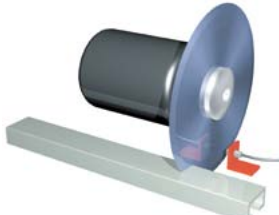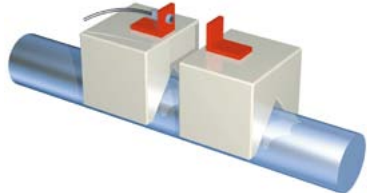
Tolerance limit memory function

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.
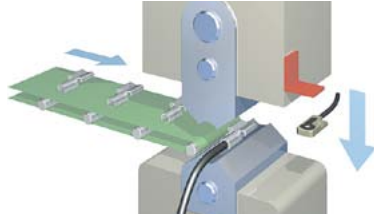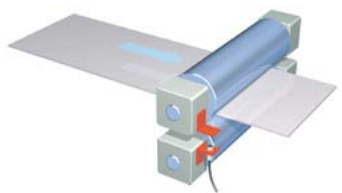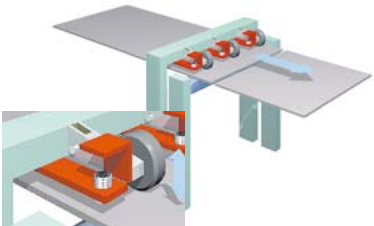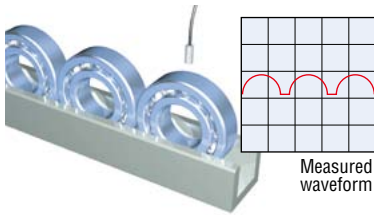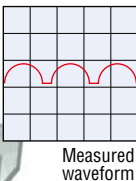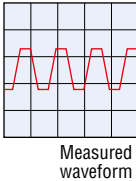
Comparator output disable input

The comparator output can be stopped with external signals. While continuing comparator operation, you can stop the output until the device operation stabilises.

Applications by Facility/Product

Plastic/paper

Facility

Measuring the distortion of a die for an injection molding machine
The amount of distortion can be measured by comparing the measured values before and after the load is applied.

Detecting the surface runout of a slitter blade
The eccentricity mode automatically detects the surface runout exceeding the reference value.

Metal/automobile

Measuring the eccentricity of ATC tools
Eccentricity due to trapped swarf can be detected.

Measuring the elongation of a tie bar
The elongation of the tie bar of a die-cast machine can be measured by using a magnet jig.

Electric machinery/electronics

Detecting improper crimping
Improper crimping can be detected by checking the bottom dead centre of the machine.

Checking the origin of the X-Y stage
The resolution of 0.4 µm enables accurate measurement of the position of the origin.

Product

Measuring the gap between rollers
The gap between the molding rollers can be accurately measured

Detecting double-fed paper bags
Detecting the movement of a jig allows for differentiation between one and two paper bags.

Measured waveform

Differentiation of the outer diameter of a bearing
The bottom-dead-centre mode detects the point where the bearing comes the closest to the sensor head to differentiate the outer diameter.

Measured waveform

Detecting the eccentricity of a gear
Setting the eccentricity mode to the difference between peaks measurement type detects the eccentricity in gear teeth tops.

Measuring the surface runout of a disk
The eccentricity mode detects the surface runout of a disk.

Measuring subtle vibration of a precision motor
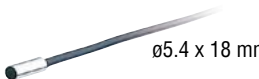Detecting abnormal vibration prevents defective products from being sent to the next process.
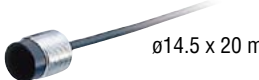
■ Selection Chart

Controller

EX-V Series

Sensor head

Shape		Measuring range	Resolution	Model
	ø5.4 x 18 mm	1 mm	0.4 µm	**EX-305V**
	M10 x 18 mm	2 mm	0.4 µm	**EX-110V**
	ø14.5 x 20 mm	5 mm	1 µm	**EX-416V**
	ø22 x 35 mm	10 mm	2 µm	**EX-422V**
	14 x 30 x 4.8 mm	4 mm	1 µm	**EX-614V**

■ Specifications

Shape			Cylindrical ø5.4 x 18 mm	Threaded M10 x 18 mm	Cylindrical + threaded ø14.5 x 20 mm	ø22 x 35 mm	Thin profile 14 x 30 x 4.8 mm
Model	Sensor head		EX-305V	EX-110V	EX-416V	EX-422V	EX-614V
	Controller	NPN	EX-V01	EX-V02	EX-V05	EX-V10	EX-V64
		PNP	EX-V01P	EX-V02P	EX-V05P	EX-V10P	EX-V64P
Measuring range			0 to 1 mm	0 to 2 mm	0 to 5 mm	0 to 10 mm	0 to 4 mm
Display range			-19999 to +19999				
Linearity			±0.3% of F.S.				
Resolution			0.4 µm	0.4 µm	1 µm	2 µm	1 µm
Sampling rate			40000 samples max./sec.[1]				
Display rate			20/sec.				
Display character			7-segment 2-colour LED				
Range-over alarm			±FFFF is displayed.				
Control input	Timing input		NPN: Open-collector or non-voltage contact PNP: Applied voltage; 10 to 30 V				
	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.)				
Analogue voltage output	Output voltage		±5 V				
	Impedance		100 Ω				
	Response time		0.075 ms (at maximum speed)				
Temperature fluctuation			0.07% of F.S./ºC [2]				
Power supply			24 VDC±10%, Ripple (P-P): 10% max.				
Current consumption			240 mA max.				
Ambient temperature	Sensor head		-10 to +60ºC, No condensation				
	Controller		0 to +50ºC, No condensation				
Relative humidity			35 to 85%, No condensation				
Vibration			10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, 2 hours respectively				
Weight	Sensor head (including 3-m cable)		Approx. 45 g	Approx. 55 g	Approx. 75 g	Approx. 200 g	Approx. 60 g
	Controller		Approx. 235 g				
Major functions			Auto-zero function, Offset function, Measurement modes (15 types), Tolerance limit value memory function (4 patterns)				

The above data was obtained using an iron target (S45C, SS400, t = 1 mm). When measuring aluminium, copper, or stainless steel targets, refer to the linear characteristics for these materials.
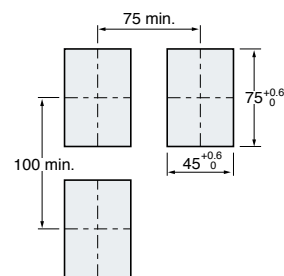1. When the digital filter function is used, the sampling rate is 20000 sampling/sec.
2. When the distance between the sensor head and the target is within 50% of the measuring range.

∎ Dimensions

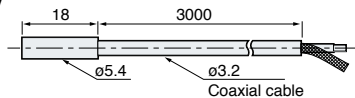**Controller**   Unit: mm

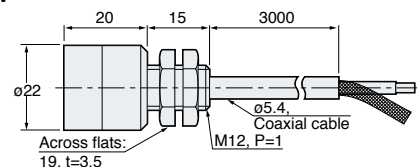### EX-V01(P)/EX-V02(P)/EX-V05(P)/EX-V10(P)/EX-V64(P)

Panel thickness: 0.5 to 6.0

46 / 78 / 91 / 48 / 13 / 74 / 8 / 80

Panel cutout

75 min.
100 min.
$75^{+0.6}_{0}$
$45^{+0.6}_{0}$

Sensor head

EX-305V

18 / 3000
ø5.4 / ø3.2
Coaxial cable

EX-110V

18 / 3000
M10, P=1
Across flats: 14, t=3
ø3.2 Coaxial cable

EX-416V

6 / 14 / 3000
ø14.5
M16, P=1
Across flats: 21, t=4
ø3.2 Coaxial cable

EX-614V

3000
14 / 4 / 3
7 / 10 / 10
30
ø3.2 Coaxial cable
2 x ø3.3 (mounting hole)
Detecting surface
6 / 6
4.8 / 1.6

EX-422V

20 / 15 / 3000
ø22
Across flats: 19, t=3.5
M12, P=1
ø5.4, Coaxial cable
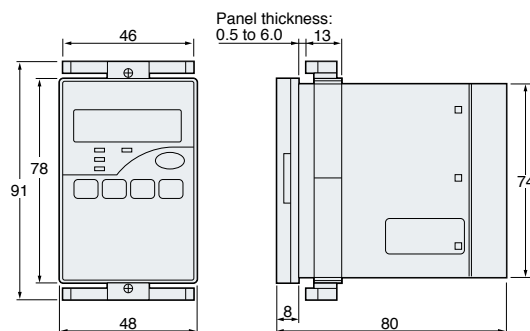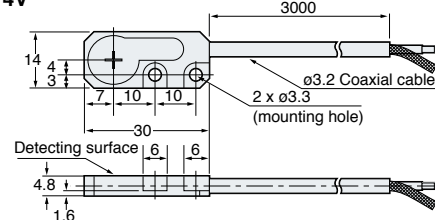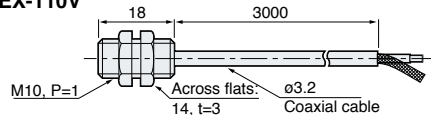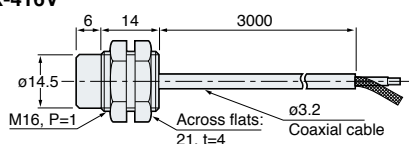
∎ Options

OP-35407
Mounting stand

The stand has two 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.

15 / 59 / 15
20 / 7
5541
75 / 7
ø4 x 4.5 x 7, slot
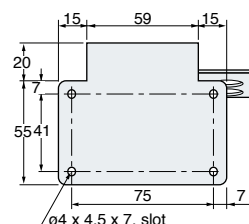
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Please visit: www.keyence.com