Overview

Measurement sensors

Laser displacement sensors
Contact type displacement sensors
Eddy current type displacement sensors
Panasonic Industrial Devices SUNX
Over 40 years of invention

Since Panasonic Industrial Devices SUNX had released the world's first reflective type photoelectric sensor using LEDs, we have contributed to total FA solution systems with sensing and control technology over 40 years.
Measurement sensors

Index

Measure sensor products .......................................................... 4
Specification .............................................................................. 5
Product positioning .................................................................... 6
Principles .................................................................................... 7
Choosing the right measurement sensor ................................ 8
HL-C2 .................................................................................. 10
HL-G1 .............................................................................. 15
HG-C ................................................................................ 19
HL-D3 ............................................................................... 22
HL-T1 ............................................................................... 26
HG-S ................................................................................ 28
HG-S communication unit ....................................................... 32
GP-X ................................................................................ 34
Programable logic controller ................................................. 36
Human machine interface ....................................................... 39
Global network ......................................................................... 41
Measure sensor products

HL-C2
Ultra High-speed / High-precision Laser Displacement Sensor

HL-G1
Compact Laser Displacement Sensor

HG-C
Micro Laser Distance Sensor

HL-D3
High Speed, Multi-Point Laser Displacement Sensor

HL-T1
Ultra-compact Laser Collimated Beam Sensor

HG-S
Contact-Type Digital Displacement Sensor

GP-X
High Speed / High Accuracy Eddy Current Type Digital Displacement Sensor
# Specification

<table>
<thead>
<tr>
<th>Series</th>
<th>Spot size</th>
<th>Resolution</th>
<th>Measurement range</th>
<th>Sampling rate</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL-C2</td>
<td>Small 20 to 400μm (Line spot type) 700 to 6,500μm</td>
<td>0.01 to 0.2μm</td>
<td>7.2 to 550mm</td>
<td>minimum 10μs</td>
<td>Ultra High-speed • High-precision Laser Displacement Sensor</td>
</tr>
<tr>
<td>HL-G1</td>
<td>Small 100 to 3,500μm</td>
<td>0.5 to 20μm</td>
<td>24.3 to 400mm</td>
<td>minimum 200μs</td>
<td>Compact Laser Displacement Sensor</td>
</tr>
<tr>
<td>HG-C</td>
<td>Small 50 to 500μm</td>
<td>Repeatability 10 to 800μm</td>
<td>25 to 600mm</td>
<td>fixed value 500μs</td>
<td>CMOS type Micro Laser Distance Sensor</td>
</tr>
<tr>
<td>HL-D3</td>
<td>50μm × 15mm</td>
<td>1μm</td>
<td>40 to 60mm</td>
<td>minimum 80μs</td>
<td>High Speed, Multi-Point Laser Displacement Sensor</td>
</tr>
<tr>
<td>HL-T1</td>
<td>-</td>
<td>Repeatability 4μm</td>
<td>-</td>
<td>-</td>
<td>Ultra-compact sensor head A high-functionality intelligent controller</td>
</tr>
<tr>
<td>HG-S</td>
<td>Large</td>
<td>0.1 to 0.5μm</td>
<td>10mm</td>
<td>-</td>
<td>Slim &amp; Robust Sensor Unit Introducing Contact-Type Digital Displacement Sensor Featuring optical absolute method in the slim and strong unit body</td>
</tr>
<tr>
<td>GP-X</td>
<td>Large</td>
<td>0.32 to 20μm</td>
<td>0 to 10 mm</td>
<td>fixed value 25μs</td>
<td>High Speed High Accuracy Eddy Current Type Digital Displacement Sensor</td>
</tr>
</tbody>
</table>

The resolution changes depend on setting of the sampling cycle and the response frequency. And the accuracy also related to the ambient temperature and lineality. Please consult with our sales when selecting the measurement sensor products.
Product positioning

System price

Resolution

HL-D3
HL-C2
HL-T1
HL-G1
GP-X
HG-S
HG-C

6
**Principles**

**Laser displacement sensors**

Measures the distance to the object, by using the triangulation principle. (Measures displacement or thickness)

- Long sensing distance
- Measurement by small beam spot
- High speed measurement
- Multi-point type allow the profile measurement
- Measurement will be influenced by the environment

**Contact-Type displacement sensors**

Measures the distance by contacting the sensor. As the sensor pushed in, the glass scale inside moves and displacement can be read distance from the glass slit.

- High resolution
- Not affected by the surface condition
- No influence from the environmental condition
- The risk of causing damage by the contacting
- Longer tact time

**Eddy current type displacement sensors**

Measures the distance by using impedance change from electromagnetic induction.

- No influence from the environmental condition
- Suitable for the high-speed moving application
- High resolution
- Contactless and no damage
- Short measurement distance
Choosing the right measurement sensor

For choosing your right measurement sensor, you need to consider several conditions.

- **Measurement object**: Choose the type of measurement according to material, size or surface state.
- **Ambient environment**: Choose the sensor considering the surrounding oil mist or temperature.
- **Precision**: Choose the sensor by the required accuracy.
- **Cycle time**: Choose the sensor by required tact time.
- **Range**: Narrow sensor candidates by considering the distance from the object or required measurement range.
<table>
<thead>
<tr>
<th>Series</th>
<th>Method</th>
<th>Metal (Mirror surface)</th>
<th>Metal (Hairline finished)</th>
<th>Plastics (Transparent)</th>
<th>Plastics (Half transparent)</th>
<th>Opaque plastics</th>
<th>Glass (Transparent)</th>
<th>Glass (Half transparent)</th>
<th>Black rubber</th>
<th>Soft body objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL-C2</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Specular reflective</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Thickness (2 heads)</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Diffuse reflective</td>
<td>2</td>
</tr>
<tr>
<td>HL-G1</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Specular reflective</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Thickness (2 heads)</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Diffuse reflective</td>
<td>2</td>
</tr>
<tr>
<td>HG-C</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Thickness (2 heads)</td>
<td>1</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>0</td>
</tr>
<tr>
<td>HL-D3</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>2</td>
<td>Specular reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thickness (1 head)</td>
<td>2</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>1</td>
</tr>
<tr>
<td>HL-T1</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thickness (1 head)</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>1</td>
<td>Specular reflective</td>
<td>3</td>
</tr>
<tr>
<td>HG-S</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Specular reflective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thickness (2 heads)</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>2</td>
<td>Specular reflective</td>
<td>3</td>
</tr>
<tr>
<td>GP-X</td>
<td>Distance (1 head)</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>Specular reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>0</td>
<td>Specular reflective</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Thickness (2 heads)</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Diffuse reflective</td>
<td>3</td>
<td>Specular reflective</td>
<td>0</td>
<td>Specular reflective</td>
<td>0</td>
</tr>
</tbody>
</table>

Possible: Possible
Impossible: Impossible
*A: For the glossy surface, measurable with Specular reflective

Distance (1 head): Distance (1 head)
Thickness (2 heads): Thickness (2 heads)
HL-C2
Ultra High-speed / High-precision Laser Displacement Sensor

Micro Spot Gaussian Beam
Exclusive optical equipment and diaphragm structure sustain laser beam of high quality at a radiant density that is close to ideal in the Gaussian distribution.

High-resolution lens
The light-receiving part can create images at a minimum point from light received from a variety of different angles to produce images with even greater precision.

HDLC-CMOS sensors
High density light-receiving cells and a processing speed which is close to maximum limits result in high resolutions and high speeds which exceed all expectations for laser displacement sensors.

Ultra high-speed calculation processor
All signals are digitalized by a high speed processor while achieving high precision and high speed with its exclusive algorithm.

Sampling rate 100 kHz
Linearity ±0.02%
Resolution 0.01 μm
### Head lineup

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurement center distance</th>
<th>Measuring range</th>
<th>Resolution</th>
<th>Beam size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL-C201F(-MK)</td>
<td>10 mm</td>
<td>±1 mm</td>
<td>0.01 μm</td>
<td>20 μm</td>
</tr>
<tr>
<td>HL-C201A-SP2(M)</td>
<td>8 mm</td>
<td>±0.8 mm</td>
<td>0.01 μm</td>
<td>20 μm</td>
</tr>
<tr>
<td>HL-C201A-SP3(M)</td>
<td>15 mm</td>
<td>±1 mm</td>
<td>0.01 μm</td>
<td>30 μm</td>
</tr>
<tr>
<td>HL-C203F(-MK)</td>
<td>30 mm</td>
<td>±5 mm</td>
<td>0.025 μm</td>
<td>30 μm</td>
</tr>
<tr>
<td>HL-C205B(-MK)</td>
<td>50 mm</td>
<td>±5 mm</td>
<td>0.05 μm</td>
<td>70 μm</td>
</tr>
<tr>
<td>HL-C205C(-MK)</td>
<td>85 mm</td>
<td>±20 mm</td>
<td>0.15 μm</td>
<td>100 μm</td>
</tr>
<tr>
<td>HL-C208B(-MK)</td>
<td>110 mm</td>
<td>±15 mm</td>
<td>0.1 μm</td>
<td>80 μm</td>
</tr>
<tr>
<td>HL-C208C(-MK)</td>
<td>350 mm</td>
<td>±50 mm</td>
<td>0.5 μm</td>
<td>250 μm</td>
</tr>
<tr>
<td>HL-C211F(-MK)</td>
<td>350 mm</td>
<td>±200 mm</td>
<td>0.5 μm</td>
<td>400 μm</td>
</tr>
<tr>
<td>HL-C235BE(-MK)</td>
<td>350 mm</td>
<td>±200 mm</td>
<td>0.5 μm</td>
<td></td>
</tr>
<tr>
<td>HL-C235CE-W(-MK)</td>
<td>85 mm</td>
<td>±200 mm</td>
<td>0.5 μm</td>
<td></td>
</tr>
</tbody>
</table>

Separate type

Realize the stable measurement by coaxially align the drop from nozzle and measurement point.

Linear beam spot type (-MK)

Even the object which looks flat has some roughness at the surface. This roughness cause the variation with the measurement result. By using line-spot type, averaging the influence and allow the stable measurement even on the rough surface.
2 heads with 1 controller

Calculation function is implemented to the controller. This function allows output of the calculation result from the thickness measurement and 2-point gap measurement directly.

(Typical examples of the calculation)
A+B
-(A+B)
A-B
B-A
**Setting software**

**HL-C2AiM**

Easy waveform monitoring and function setting by PC. The software is available on the website.

**Programmable Display**

**GT12**

GT12 can be used as the console, by downloading screen data from website. (Waveform display, setting, etc)

---

**Easy operation**

Combining a software tool (Intelligent Monitor HL-C2AiM or Collecting data HL-C2AiG) or Programmable Display GT12, it shows not only measurement results but also received light waveform.

**Adjusting the setting, varieties of objects can be measured.**

- **Diffuse reflective setting**
  - Penetration
  - Metal 1
  - Metal 2
  - Glass
  - Pattern glass
  - Any objects other than mirror-surface or transparent objects
  - Metal, resin, ceramic, etc.
  - Hard hairline finished metal
  - Materials with tiny scratch, cutting mark, grinding mark
  - Clearance of glass, thickness

- **Specular reflective setting**
  - Reflective object
  - Transparent object
  - Surface of glass

**Various filter functions**

- Moving average
- High-pass filter
- Low-pass filter
- Median filter

By using suitable filters, customer can realize the high precision measurement.
Applications

- Measurement of the heights of chip parts
- Measurement of HDD surface variations
- Detection of deformed narrow pitch connector leg pins
- Controlling the camera focus
- Measurement of disk brake thickness
- Measurement of the thickness of copper clad laminate
- Gap measurement between glass and bottom layer
- Controlling the nozzle height of a dispenser
HL-G1
Compact Laser Displacement Sensor

High resolution and Fast response

Resolution  Sampling rate
0.5\(\mu m\)  200\(\mu s\)

Timing input and multi input
In addition to timing input select the desired input according to your application.
- Zero set on/off
- Teaching
- Laser control
- Memory switching
- Reset
- Saving
- Alarm output
- Analog output: current and voltage modes

Compact size with the built-in controller and digital output
As a self contained sensor, the HL-G1 series offers a space saving configuration by removing the need for an external controller.

IP67 dust- and water-proof protective enclosure
Exclusive optical equipment and diaphragm structure sustain laser beam of high quality at a radiant density that is close to ideal in the Gaussian distribution.
High functionality type

Connect to upper devices of RS-422/485.
The HL-G1 can be connected to upper devices of RS-422/485.
When upper device sends the request command, the HL-G1 series send the response command.

Software tool for sensor configuration and evaluation

In addition to configuring up to 16 sensors at once, this free tool makes it easy to gather data needed for analysis, including received light waveform monitoring and data buffering. The interface language can be selected at the time of installation.

- Data buffering
- Received light waveform display
- Measured value display

HMI screen for the HL-G1 series

The GT02 / GT12 HMI operator panel can be used in combination with the HL-G1 to allow easy confirmation of sensor status and configuration of sensor settings from a remote location. Japanese, English, Chinese, and Korean are supported.
<table>
<thead>
<tr>
<th>Model</th>
<th>Diffuse</th>
<th>Specular</th>
<th>Diffuse</th>
<th>Specular</th>
<th>Diffuse</th>
<th>Specular</th>
<th>Diffuse</th>
<th>Specular</th>
<th>Diffuse</th>
<th>Specular</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL-G103</td>
<td>30 mm</td>
<td>26.3 mm</td>
<td>50 mm</td>
<td>47.3 mm</td>
<td>85 mm</td>
<td>82.9 mm</td>
<td>120 mm</td>
<td>250 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL-G103A</td>
<td>±4 mm</td>
<td>±2 mm</td>
<td>±10 mm</td>
<td>±5 mm</td>
<td>±20 mm</td>
<td>±10 mm</td>
<td>±60 mm</td>
<td>±150 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL-G105</td>
<td>0.5 μm</td>
<td>0.5 μm</td>
<td>1.5 μm</td>
<td>1.5 μm</td>
<td>2.5 μm</td>
<td>2.5 μm</td>
<td>8 μm</td>
<td>20 μm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL-G105A</td>
<td>φ0.1 mm</td>
<td>φ0.1 mm</td>
<td>φ0.5 mm</td>
<td>φ0.1 mm</td>
<td>φ0.75 mm</td>
<td>φ0.2 mm</td>
<td>1.0 mm</td>
<td>1.75 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL-G108</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85 mm</td>
<td></td>
</tr>
<tr>
<td>HL-G108A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>±20 mm</td>
<td></td>
</tr>
<tr>
<td>HL-G112</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>±8 mm</td>
<td></td>
</tr>
<tr>
<td>HL-G125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>±20 mm</td>
<td></td>
</tr>
</tbody>
</table>

- Diffuse reflective model
- Specular reflective model
Applications

- Control of hollow pipe positioning
- Detecting rotating direction of fan
- Positioning of wafer
- Controlling the height of a dispenser nozzle
- Inspecting processed food quantities
- Detection of aluminum wheel grooves
- Testing sheet slack
- Measuring the thickness of a steel plate
A new optical system with a built-in mirror

The HG-C series sensors incorporating a new optical system with a built-in mirror provides smaller sensor depth as well as higher measurement accuracy equivalent to displacement sensors.

Standard equipped analog output

Analog output is provided in addition to control output. It can be used as a simple measurement sensor.

Analog voltage output range : 0 to 5 V
Analog current output range : 4 to 20mA
**Zero set function**

The zero point can be set at a desired value. It is useful when measuring steps or tolerance with reference to the height of a sensing object.

**External input setting function**

One of four functions, “zero setting function,” “teaching function,” “emission stopping function” and “trigger function” can be assigned to an external input line.

---

**Measuring range**

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurement center distance</th>
<th>Measuring range</th>
<th>Repeatability</th>
<th>Beam diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG-C1030</td>
<td>30 mm</td>
<td>±5 mm</td>
<td>10 μm</td>
<td>φ 50 μm</td>
</tr>
<tr>
<td>HG-C1050</td>
<td>50 mm</td>
<td>±15 mm</td>
<td>30 μm</td>
<td>φ 70 μm</td>
</tr>
<tr>
<td>HG-C1100</td>
<td>100 mm</td>
<td>±35 mm</td>
<td>70 μm</td>
<td>φ 120 μm</td>
</tr>
<tr>
<td>HG-C1200</td>
<td>200 mm</td>
<td>±80 mm</td>
<td>200 μm</td>
<td>φ 300 μm</td>
</tr>
<tr>
<td>HG-C1400</td>
<td>400 mm</td>
<td>±200 mm</td>
<td>300 μm</td>
<td>φ 500 μm</td>
</tr>
</tbody>
</table>

---

**Control output**

- An analog output of 0 to +5V or 4 to 20 mA can be selectable.
Applications

Controlling the mounter head height

Detecting on-vehicle seats

Detecting warpage of a circuit board

Measuring the distance of 3D printer injector and part

Checking of correct pins alignment of connector

Measurement of a remaining functional sheet

Judging front or back of cover of electric parts

Detecting a seam (overlap) of functional sheet
High Speed, Multi-Point Laser Displacement Sensor

**HL-D3**

**High Speed Multi-point Sensing**

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Sampling rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z axis</td>
<td>80 µs</td>
</tr>
<tr>
<td>1 µm</td>
<td></td>
</tr>
</tbody>
</table>

**Measurement range of width (X axis)**

12.5 mm

*measurement center

**Parallel beam**

HL-D3 adopts parallel beam made possible by the latest optical system. The reduced area of shadow that appears when light is emitted on the target object made it possible to accurately sense the shape of the object.

**Wide-cell function**

When the surface condition is rough, such as with cut metal, sensing of a single point will result in errors due to the uneven surface.

The wide-cell function expands the sensing points for the light receiving side and obtains the mean value (or maximum or minimum value, depending on the setting) to improve the stability of the measurements.
Multiple Shape Calculation Functions

The HL-D3 series calculates the shapes, including the height difference, width, and cross-sectional area, from the shape waveform based on the received light. At the same time, the displacement sensor uses these calculation results to instantaneously make Hi / Go / Lo judgments based on the present upper and lower limits. Thanks to the two sets of output, different shape calculations can be performed for each output or two sensor heads can be connected and used to output each judgment results.

- **Height calculation**
  The height difference between the reference value and measured value is calculated.

- **Step calculation**
  The height difference is calculated from 2 measured values.

- **Width calculation**
  The width is calculated from 2 measured values.

- **Cross-sectional area calculation**
  HL-D3 calculates the cross-sectional area defined by the reference value.
Settings & Monitoring Software
HL-D3SMI

Conditions and the monitoring of measurements and judgment results can easily be set up by connecting to the HL-D3C controller and a PC pre-installed with HL-D3SMI using USB cables. The shape waveform based on the saved data can be reproduced on screen, which allows for it to be used as an analytical tool.

- Store displacement shape waveform data, calculated measured values, and judgment results on the memory built into the controller during continuous sensing.
- Provides a stereoscopic representation of the shape by a 3D display of stored data.
- Replay the stored data on the buffering screen at a later time, provided that the stored data is saved in the dedicated file format.
- Allow waveform display and analysis by means of spreadsheet software based on the data saved in CSV file format.
System configuration

Controller

Monitoring software HL-D3SMi

HL-D301□

PC

USB cable (2 m 6.562 ft)

Extension cable for sensor head
(2 m 6.562 ft, 5 m 16.404 ft, 10 m 32.808 ft, 20 m 65.617 ft)

Sensor head B

Sensor head A

HL-D3CCJ □

Applications

Detecting misaligned pins on surface mounted components

Sensing Objects with Sloped Prof

Sensing objects using both gold plates and black resin

Checking for loose screws

Line-up

HL-D301B

HL-D301C

Laser class

Class 2

Class 3R

Measurement center distance

50 mm

±10 mm

Width (X axis)

12.5 mm

Resolution (Z axis)

1 μm
**Ultra-compact Laser Collimated Beam Sensor**

Ultra-compact sensor head
A high-functionality intelligent controller

- **Resolution**
  - 4 μm
  - 8 μm

- **Minimum sensing object**
  - 8 μm

- **Sampling rate**
  - 150 μs

**Small sensor head**
The most compact size (HL-T1001A/T1005A) and yet the highest level of performance in their class. These sensors require less space for installation and contribute to overall space savings.

**Computations for 2 sensors**
The computation unit (option) just needs to be connected between the two controllers to enable computations (addition and subtraction) to be carried out for two sensors. No digital panel controller is needed either.
### Sensor head

**Type**
- \( \phi 1 \text{mm type} \) HL-T1001A
- \( 5 \text{mm type} \) HL-T1005A
- \( 10 \text{mm type} \) HL-T1010A

**Sensing range**
- \( 0 \text{ to } 500 \text{mm} \)
- \( 500 \text{ to } 2,000 \text{mm} \)
- \( 0 \text{ to } 500 \text{mm} \)
- \( 0 \text{ to } 500 \text{mm} \)

**Sensing width**
- \( \phi 1 \text{mm} \)
- \( \phi 2.5 \text{mm} \)
- \( 5 \text{mm} \)
- \( 10 \text{mm} \)

**Minimum sensing object**
- \( \phi 8 \mu \text{m} \)
- \( \phi 50 \mu \text{m} \)
- \( \phi 0.05 \mu \text{m} \)
- \( \phi 0.1 \mu \text{m} \)

**Repeatability**
- \( 4 \mu \text{m} \)

### Controller

**Applications**

1. Sensing wafer position in wafer cassette
2. Checking the positioning of chip components
3. Detecting defective lead frame seating
4. Distinguishing opacity of glass

**Type**
- NPN output type HL-AC1
- PNN output type HL-AC1P

**Supply voltage**
- \( 12 \text{ to } 24 \text{V DC } \pm 10\% \)

**Measurement rate**
- \( 150 \mu \text{s} \)

**Linear output**
- Current output: 4 to 20mA/F.S.
- Voltage output: ±4V/F.S.
HG-S

Contact-Type Digital Displacement Sensor

Slim and Robust sensor

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Indication accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 μm</td>
<td>1.0 μm or less</td>
</tr>
</tbody>
</table>

*10mm type sensor head

Measurement range

10 mm • 32 mm

Sensor head

Slim body

The slim unit body contains plain bearings with 2-point support structure disperses load and achieves superb durability. The sensor head offers long life and reduces maintenance costs dramatically.

2-point support structure

Ball-less bearings are installed at the upper and lower sections of the unit. This ensures excellent strength against lateral loads.

No "value skipping" or "unset zero point"

Displacement is measured by reading a glass scale with a different slit pattern at each reading position using a high-resolution sensor. This eliminates "value skipping" even when measuring at high speed, and there is no concern of "unset zero point".

Hot-swappable

The sensor head can be changed safely without turning off the controller. This reduces the man-hours required for the change of line setup for processing of different workpieces, thus achieving a significant reduction of setup change time.
Controller

Dual display
The 2-line digital display simultaneously shows head measurement (measured value) and judgment value (calculated value).

Intuitive circle meter
Values between allowable maximum and minimum values are indicated in green. Values outside of the allowable range are indicated in orange. This provides at-a-glance understanding of the margin to the tolerance limits.

Connection of up to 15 slaves units
One master unit can be connected with up to 15 slave units in any order. This allows easy multi-point calculations.

Example: Connection of 15 slave units

Master unit
High performance type
(analog current + input / output)
HG-SC101

Slave unit
High performance type
(analog current + input / output)
HG-SC111

Slave unit
Standard type
(input / output)
HG-SC112

Slave unit
Wire-saving type
HG-SC113

End plates
MS-DIN-E

*End plates (optional) must be mounted on both sides of the controller after the connection of slave units.
Sensor head

<table>
<thead>
<tr>
<th>Type</th>
<th>Measuring range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG-S1010</td>
<td>10 mm</td>
<td>0.5 μm</td>
</tr>
<tr>
<td>HG-S1010R</td>
<td>10 mm</td>
<td>0.5 μm</td>
</tr>
<tr>
<td>HG-S1110</td>
<td>10 mm</td>
<td>0.1 μm</td>
</tr>
<tr>
<td>HG-S1110R</td>
<td>10 mm</td>
<td>0.1 μm</td>
</tr>
<tr>
<td>HG-S1032</td>
<td>32 mm</td>
<td>0.5 μm</td>
</tr>
</tbody>
</table>

Controller

<table>
<thead>
<tr>
<th>Type</th>
<th>Master unit</th>
<th>Slave unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG-SC101</td>
<td>High performance</td>
<td>Standard</td>
</tr>
<tr>
<td>HG-SC101-P</td>
<td>Analog current output</td>
<td>Wire-saving</td>
</tr>
<tr>
<td>HG-SC111</td>
<td>Standard</td>
<td>Wire-saving</td>
</tr>
<tr>
<td>HG-SC111-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HG-SC112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HG-SC112-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HG-SC113</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Applications

- Screw head height measurement
- Transmission parts height measurement
- Motor shaft eccentricity measurement
- Automotive parts dimension measurement
- X-Y stage position measurement
- Tablet surface flatness measurement
- Resin roller eccentricity measurement
- Coupling assembly inspection
SC-HG1-C / SC-HG1-CEF

CC-Link / CC-Link IE Field Communication Unit
for Digital Displacement Sensors

Direct connect to CC-Link master
Program-less transmission of high-precision data
Batch change of internal settings via CC-Link

Contact-Type Digital Displacement Sensor
HG-S SERIES

CC-Link Master
CC-Link Communication Unit for Digital Displacement Sensors
SC-HG1-C

Connection of 1 master unit and up to 14 slave units
SC-HG1-485
RS-485 Communication Unit
for Digital Displacement Sensors

Direct transfer of high-precision measurement values
Batch change of internal settings via RS-485

Contact-Type Digital Displacement Sensor
HG-S SERIES

Connection of 1 master unit and up to 14 slave units

PLC
RS-485 Communication

RS-485 Communication Unit
for Digital Displacement Sensors
SC-HG1-485
GP-X
High Speed / High Accuracy Eddy Current Type Digital Displacement Sensor

Optimal correction of the output characteristics
Because they perform with a 0.3 % F.S. linearity, they can be used for sensing stainless steel and iron enabling precise measurements not affected by the work’s material. Specifications corresponding to each material (stainless steel, iron, aluminum) has already been inputted in the controller enabling the easy selection of the setting that is most suitable for the particular material used.

Sampling rate: 25μs
Linearity: ±0.3% F.S.
Resolution: 0.32μm

0.02 % F.S. resolution for highly accurate measurement
With high resolution, 0.02 % F.S. (Note), they can perform high accuracy measurements of micro-displacements. (Average number of samples: 64)
Note: GP-XC3SE and GP-XC5SE Resolution: 0.04 %F.S.
Applications

Stroke end sensing
GP-XC22KL(-P)
Type: GP-XC22KL(-P)
Measuring range: 10mm
Appearance: φ22mm

Gap sensing
GP-XC12ML(-P)
Type: GP-XC12ML(-P)
Measuring range: 5mm
Appearance: M12

Eccentricity sensing
GP-XC10M(-P)
Type: GP-XC10M(-P)
Measuring range: 2mm
Appearance: M10

Gap sensing
GP-XC8S(-P)
Type: GP-XC8S(-P)
Measuring range: 2mm
Appearance: φ8mm

Gap sensing
GP-XC5SE(-P)
Type: GP-XC5SE(-P)
Measuring range: 1mm
Appearance: φ5.4mm

Gap sensing
GP-XC3SE(-P)
Type: GP-XC3SE(-P)
Measuring range: 0.8mm
Appearance: φ3.8mm

Applications:
- Stroke end sensing
- Gap sensing
- Eccentricity sensing
- Measuring the eccentricity of tools
Programmable logic controller
FP7

FP7 allows building traceability system by the remote monitoring and data logging functions, addition to the equipment control.

Program capacity

196k steps

Ultra high speed processing

11 ns/step

I/O points

Max. 4096 Points

Add-on cassettes
Analog input unit
AFP7FCAD2

Programmable controller
FP7

AFP7FCAD2
2-channel analog input 0–10V/0–5V/0–20mA, resolution 12 bit, conversion speed 1ms/channel (non-insulated)

FP7 allows data logging of analog output from the digital measurement sensor. Logged data can be monitored by the browser of PC or smart phone.

Digital displacement sensor

Analog output

FP7 Web server function

Wi-Fi rooter
Programmable logic controller
FP7

CPU units
- Standard model
  - AFP7CPS41E
  - AFP7CPS31E
  - AFP7CPS31
  - AFP7CPS21

Analog input and output units
- Analog input unit
  - High-speed and high-accuracy type
  - 4 points, voltage and current
    - AFP7AD4H
- Analog input unit
  - High-speed and multi-channel type
  - 8 points, voltage and current
    - AFP7AD8

Add-on cassettes
- Function cassettes
  - AFP7FCAD2
  - AFP7FCA21

Motor control
Encoder trigger
Ethernet
SD memory card logging
PC + Spreadsheet software, etc.
Programmable logic controller

New standard for compact PLCs  
**FP0R**

- Program capacity: 32k steps
- Ultra high speed processing: 80 ns/step
- I/O points: Max. 128 Points

Powerful compact PLC  
**FPΣ**

- Program capacity: 32k steps
- High speed processing: 320 ns/step
- I/O points: Max. 384 Points

Analog I/O Unit
- **AFP0RAD4**: Input: 4 channels
- **AFP0RAD8**: Input: 8 channels

Analog I/O Unit
- **AFP0RA21**: Input: 2 channels / Output: 1 channel
- **AFP0RA42**: Input: 4 channels / Output: 2 channels

Analog Input Unit
- **AFP0RAD4**: Input: 4 channels
- **AFP0RAD8**: Input: 8 channels
Consoles for measurement sensors

GT12 Selection 4 models
(RS232C, No SD card slot)

GT02 Selection 4 models
(24V, RS485, No SD card slot)

GT12 Selection 8 models
(RS485, With/without SD card slot)

*Not using SD card for console purpose

Ultra High-speed / High-precision Laser Displacement Sensor
HL-C2

Compact Laser displacement Sensor
HL-G1

GT12 Selection 4 models
(RS232C, No SD card slot)

GT02 Selection 4 models
(24V, RS485, No SD card slot)

GT12 Selection 8 models
(RS485, With/without SD card slot)

*Not using SD card for console purpose

Programmable Display

GT02

Hairline silver

Programmable Display

GT12

Pure black

Hairline silver

GT02 / GT12 Bright three-color LED background

M type

White

Pink

Red

G type

Green

Orange

Red

74mm

112mm

74mm

146mm
Human Machine Interface
GT series

Touch screen operator panel suitable for being used in applications with harsh environmental conditions:
ideal for outdoor applications with high brightness and sunlight, humidity and water
Global Network

Please Contact our Global Sales Companies in:

**Europe**

<table>
<thead>
<tr>
<th>Country</th>
<th>Company Name</th>
<th>Address</th>
<th>Phone Numbers</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headquarters</td>
<td>Panasonic Electric Works Europe AG</td>
<td>Robert-Koch-Straße 100, 85521 Ottobrunn, Tel. +49 89 45354-1000, Fax +49 89 45354-2111, <a href="http://www.panasonic-electric-works.com">www.panasonic-electric-works.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>Panasonic Electric Works Austria GmbH</td>
<td>Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43 (0) 2236-26846, Fax +43 (0) 2236-46133, <a href="http://www.panasonic-electric-works.at">www.panasonic-electric-works.at</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panasonic Industrial Devices Materials Europe GmbH</td>
<td>Ennshafenstraße 30, 4470 Erns, Tel. +43 (0) 7223 883, Fax +43 (0) 7223 88333, <a href="http://www.panasonic-electronic-materials.com">www.panasonic-electronic-materials.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benelux</td>
<td>Panasonic Electric Works Sales Western Europe B.V.</td>
<td>De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31 (0) 499 372727, Fax +31 (0) 499 372185, <a href="http://www.panasonic-electric-works.nl">www.panasonic-electric-works.nl</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Panasonic Electric Works Europe AG, organizacni slozka</td>
<td>Administrative centre PLATINIUM, Veverí 3163/111, 616 00 Brno, Tel. +420 541 217 001, Fax +420 541 217 101, <a href="http://www.panasonic-electric-works.cz">www.panasonic-electric-works.cz</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Panasonic Electric Works Sales Western Europe B.V.</td>
<td>Succursale française, 10, rue des petits ruisseaux, 91370 Vernières Le Buisson, Tél. +33 (0) 1 6013 5757, Fax +33 (0) 1 6013 5758, <a href="http://www.panasonic-electric-works.fr">www.panasonic-electric-works.fr</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>Panasonic Electric Works Europe AG</td>
<td>Robert-Koch-Straße 100, 85521 Ottobrunn, Tel. +49 (0) Tel. +49 (0) 45354-1000, Fax +49 (0) 45354-2111, <a href="http://www.panasonic-electric-works.de">www.panasonic-electric-works.de</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>Panasonic Electric Works Europe AG</td>
<td>Magyarországi Közvetlen Kereskedelmi Képviselő, 1117 Budapest, Neumann János u. 1., Tel. +36 20 264 9896, Mobile: +36 20 264 9896, Fax +36 22 233 46133, <a href="http://www.panasonic-electric-works.hu">www.panasonic-electric-works.hu</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>Panasonic Electric Works UK Ltd.</td>
<td>Irish Branch Offi ce, Dublin, Tel. +353 (0) 14600969, Fax +353 (0) 14601131, <a href="http://www.panasonic-electric-works.co.uk">www.panasonic-electric-works.co.uk</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Panasonic Electric Works Italia srl</td>
<td>Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +39 0456752711, Fax +39 0456700444, <a href="http://www.panasonic-electric-works.it">www.panasonic-electric-works.it</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nordic Countries</td>
<td>Panasonic Electric Works Europe AG</td>
<td>Filial Nordic, Knarramäsgatan 15, 164 40 Kista, Sweden, Tel. +46 859476680, Fax +46 859476690, <a href="http://www.panasonic-electric-works.se">www.panasonic-electric-works.se</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panasonic Eco Solutions Nordic AB</td>
<td>Jungmanskatan 12, 21119 Malmö, Tel. +46 40 697 7000, Fax +46 40 697 7099, <a href="http://www.panasonic-fi">www.panasonic-fi</a> re-security.com</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>Panasonic Electric Works Polska sp. z o.o</td>
<td>ul. Wołoska 9A, 02-583 Warszawa, Tel. +48 22 338-11-33, Fax +48 22 338-12-00, <a href="http://www.panasonic-electric-works.pl">www.panasonic-electric-works.pl</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Panasonic Electric Works España S.A.</td>
<td>Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 913293875, Fax +34 913292976, <a href="http://www.panasonic-electric-works.es">www.panasonic-electric-works.es</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Panasonic Electric Works Schweiz AG</td>
<td>Grundstrasse 8, 6343 Rotkreuz, Tel. +41 (0) 41 7997050, Fax +41 (0) 41 7997055, <a href="http://www.panasonic-electric-works.ch">www.panasonic-electric-works.ch</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Panasonic Electric Works UK Ltd.</td>
<td>Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6 LF, Tel. +44 (0) 1908 231555, Fax +44 (0) 1908 231599, <a href="http://www.panasonic-electric-works.co.uk">www.panasonic-electric-works.co.uk</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**North & South America**

<table>
<thead>
<tr>
<th>Country</th>
<th>Company Name</th>
<th>Address</th>
<th>Phone Numbers</th>
<th>Website</th>
</tr>
</thead>
</table>

**Asia Pacific / China / Japan**

<table>
<thead>
<tr>
<th>Country</th>
<th>Company Name</th>
<th>Address</th>
<th>Phone Numbers</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>Panasonic Industrial Devices Automation Controls Sales (Hong Kong) Co., Ltd.</td>
<td>RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. +852-2956-3118, Fax +852-2956-0396</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>Panasonic Industrial Devices Automation Controls Sales Asia Pacific c</td>
<td>300 Beach Road, #16-01 The Concourse, Singapore 199555, Tel. +65-6390-3811, Fax +65-6390-3810</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>Panasonic Corporation</td>
<td>1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. +81-6-6908-1050, Fax +81-6-6908-5781, <a href="http://www.panasonic.net">www.panasonic.net</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>