High Accuracy Eddy Current Type Displacement Sensor

GP-A SERIES

Resolution 0.04 % F.S., Linearity ±0.5 % F.S., IP67g environment resistance

Accurate measurement of minute displacements
Minute displacement of metallic objects can be accurately measured with a resolution of 0.04 % F.S.

GP-A5S (For 1 mm 0.039 in sensing type)
Resolution: 0.4 µm 0.016 mil

Linearity ±0.5 % F.S.
Displacement is accurately output since it incorporates a high accuracy linearity correction circuit.

ENVIRONMENTAL RESISTANCE
The sensor head protected as per IP67g (JEM)
With IP67g environment resistance, various measurements are possible under many different conditions.

FUNCTIONS
Equipped with a zero-adjustment function
By pressing the zero-adjustment button, you can reset the output voltage to 0 V with one touch. (Resets the current output to 4 mA)
This function comes in handy when performing tolerance diagnosis of a masterwork to be used as the standard. Easy adjustment for product changes.
Remote operation is also possible by way of an external input.

OPERABILITY
Fine adjustment of output
Fine adjustment according to the sensing conditions is possible with shift and span functions.

MOUNTING
Sensor heads can be mounted in narrow spaces
If mounting standard types and different frequency types parallel to each other, they use up one-third the space needed for mounting compared to the same models. In addition, the GP-A14F type can be mounted close together and the sensor heads can be set in a narrow range for distortion and other difficult measurements.

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With IP67g environment resistance, various measurements are possible under many different conditions.

FUNCTIONS
Equipped with a zero-adjustment function
By pressing the zero-adjustment button, you can reset the output voltage to 0 V with one touch. (Resets the current output to 4 mA)
This function comes in handy when performing tolerance diagnosis of a masterwork to be used as the standard. Easy adjustment for product changes.
Remote operation is also possible by way of an external input.

OPERABILITY
Fine adjustment of output
Fine adjustment according to the sensing conditions is possible with shift and span functions.

MOUNTING
Sensor heads can be mounted in narrow spaces
If mounting standard types and different frequency types parallel to each other, they use up one-third the space needed for mounting compared to the same models. In addition, the GP-A14F type can be mounted close together and the sensor heads can be set in a narrow range for distortion and other difficult measurements.
### APPLICATIONS

**Measuring gap between rollers**  
Fine gap measurement is possible to control the gap between rollers.

**Measuring parallelism of chassis**  
Even a slight tilt can be reliably detected.

### ORDER GUIDE

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance (mm in)</th>
<th>Sensing range</th>
<th>Set model No.</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor heads</td>
<td>Amplifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For 1 mm 0.039 in sensing</strong></td>
<td></td>
<td>0 to 1 mm 0 to 0.039 in</td>
<td>GP-A5S</td>
<td>Analog voltage: Output voltage: 0 to 5 V</td>
</tr>
<tr>
<td>Non-threaded type sensor head</td>
<td>ø0.213</td>
<td>0.669</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different frequency</td>
<td>GP-A5SI</td>
<td></td>
<td>Analog current: Output current: 4 to 20 mA</td>
<td></td>
</tr>
<tr>
<td><strong>For 2 mm 0.079 in sensing</strong></td>
<td></td>
<td>0 to 2 mm 0 to 0.079 in</td>
<td>GP-A8S</td>
<td>Analog voltage: Output voltage: 0 to 5 V</td>
</tr>
<tr>
<td>Non-threaded type sensor head</td>
<td>ø0.315</td>
<td>0.669</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different frequency</td>
<td>GP-A8SI</td>
<td></td>
<td>Analog current: Output current: 4 to 20 mA</td>
<td></td>
</tr>
<tr>
<td><strong>For 5 mm 0.197 in sensing</strong></td>
<td></td>
<td>0 to 5 mm 0 to 0.197 in</td>
<td>GP-A10M</td>
<td>Analog voltage: Output voltage: 0 to 5 V</td>
</tr>
<tr>
<td>Threaded type sensor head</td>
<td>M12 21</td>
<td>0.827</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different frequency</td>
<td>GP-A10MI</td>
<td></td>
<td>Analog current: Output current: 4 to 20 mA</td>
<td></td>
</tr>
<tr>
<td><strong>For 3 mm 0.118 in sensing</strong></td>
<td></td>
<td>0 to 3 mm 0 to 0.118 in</td>
<td>GP-A14F</td>
<td></td>
</tr>
<tr>
<td>Front sensing type sensor head</td>
<td>ø0.213</td>
<td>0.591</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.4 3.391</td>
<td>1.339</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Please ensure to order the sensor head and the amplifier as a set. The set is calibrated and delivered.

### OPTIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor head mounting bracket</td>
<td>MS-SS5</td>
<td>Mounting bracket for GP-A5S</td>
</tr>
<tr>
<td></td>
<td>MS-SS8</td>
<td>Mounting bracket for GP-A8S</td>
</tr>
</tbody>
</table>

**Sensor head mounting bracket**  
- MS-SS5  
- MS-SS8

It enables easy fixing of the sensor head.
## SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>For 1 mm 0.039 in sensing</td>
<td>For 2 mm 0.079 in sensing</td>
<td>For 5 mm 0.197 in sensing</td>
<td>For 3 mm 0.118 in sensing</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sensing range</td>
<td>0 to 1 mm</td>
<td>0 to 2 mm</td>
<td>0 to 5 mm</td>
<td>0 to 3 mm</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Standard sensing object</td>
<td>Iron sheet 8 × 8 × 1 mm</td>
<td>Iron sheet 12 × 12 × 1 mm</td>
<td>Iron sheet 30 × 30 × 1 mm</td>
<td>Iron sheet 15 × 15 × 1 mm</td>
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</tr>
<tr>
<td>Supply voltage</td>
<td>24 V DC ±10 % Ripple P-P 10 % or less</td>
<td></td>
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<td></td>
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<tr>
<td>Current consumption</td>
<td>150 mA or less</td>
<td></td>
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<tr>
<td>Analog output</td>
<td>Analog voltage: 0 to 5 V</td>
<td>Analog current: 4 to 20 mA</td>
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<tr>
<td>Response frequency</td>
<td>1.6 kHz (–3 dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Resolution</td>
<td>0.04 % F.S.</td>
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</tr>
<tr>
<td>Linearity</td>
<td>Within ±0.5 % F.S.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Alarm output</td>
<td>NPN open-collector transistor</td>
<td></td>
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</tr>
<tr>
<td>External zero-adjustment input</td>
<td>Non-voltage contact or NPN open-collector transistor input</td>
<td></td>
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<tr>
<td>Power indicator</td>
<td>Green LED (lights up when the power is ON)</td>
<td></td>
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<tr>
<td>Over indicator</td>
<td>Orange LED (lights up when sensing range is exceeded)</td>
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<tr>
<td>Alarm indicator</td>
<td>Yellow LED (lights up when the alarm output is ON)</td>
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</tr>
<tr>
<td>Adjustments</td>
<td>Shift adjustment (by push-buttons), Span adjustment (by 14-turn adjuster)</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Temperature characteristics (Note 2)</td>
<td>Sensor head</td>
<td>0.5 μm°C</td>
<td>0.020 mil°C</td>
<td>0.6 μm°C</td>
<td>0.024 mil°C</td>
<td>1 μm°C</td>
<td>0.059 mil°C</td>
<td>0.6 μm°C</td>
<td>0.024 mil°C</td>
<td>1 μm°C</td>
<td>0.059 mil°C</td>
</tr>
<tr>
<td>Amplifier</td>
<td>0.4 μm°C</td>
<td>0.016 mil°C</td>
<td>0.8 μm°C</td>
<td>0.031 mil°C</td>
<td>2.0 μm°C</td>
<td>0.079 mil°C</td>
<td>1.2 μm°C</td>
<td>0.047 mil°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Sensor head</td>
<td>–10 to +55 °C</td>
<td>0 to +50 °C</td>
<td>–20 to +70 °C</td>
<td>0 to +50 °C</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Insulation resistance</td>
<td>Sensor head</td>
<td>20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure</td>
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<tr>
<td>Vibration resistance</td>
<td>Sensor head</td>
<td>10 to 55 Hz frequency, 1.5 mm 0.059 in amplitude in X, Y, and Z directions for two hours each</td>
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<tr>
<td>Shock resistance</td>
<td>Sensor head</td>
<td>500 m/s² acceleration (50 G approx.) in X, Y, and Z directions for five times each</td>
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</tr>
<tr>
<td>Material</td>
<td>Sensor head</td>
<td>Enclosure: Stainless steel</td>
<td>No cutout</td>
<td>Sensing part: Polyamide</td>
<td>Enclosure: Stainless steel</td>
<td>No cutout</td>
<td>Sensing part: ABS</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cable</td>
<td>Sensor head</td>
<td>Connector attached high frequency coaxial cable, 3 m 9.843 ft long</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Net Weight</td>
<td>Sensor head</td>
<td>40 g approx.</td>
<td>50 g approx. (Note 4)</td>
<td>45 g approx. (Note 4)</td>
<td></td>
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</tr>
<tr>
<td>Accessories</td>
<td>Adjusting screwdriver: 1 pc.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Notes:**
1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C ±6 °C.
2) These values are for a range which is 20 to 60 % of the maximum sensing distance.
3) Take care that the output voltage is reduced due to the resistance of the wiring cable.
4) The given weight of the threaded type sensor head is the value including the weight of the nuts and the toothed lock washer.

### High Accuracy Eddy Current Type Displacement Sensor GP-A SERIES
I/O CIRCUIT AND WIRING DIAGRAMS

I/O circuit diagram

- Terminal No.: Amplifier
- GP-A series is made for all types of standard iron sensing objects. The graph below describes the output discrepancies that occur when detecting different types of metals.

<table>
<thead>
<tr>
<th>GP-A5S(1)</th>
<th>GP-A8S(1)</th>
<th>GP-A10M(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless steel (SUS304)</td>
<td>Stainless steel (SUS304)</td>
<td>Stainless steel (SUS304)</td>
</tr>
<tr>
<td>Stainless steel (SUS410)</td>
<td>Stainless steel (SUS410)</td>
<td>Stainless steel (SUS410)</td>
</tr>
</tbody>
</table>

Wiring diagram

- Supply voltage: 24 V DC ±10%
- Output voltage (0 to 5 V) (Note 1)
- Analog output current (4 to 20 mA)
- Analog voltage output (5 to 30 V, or open): External zero-adjustment ineffective
- Low (0 to 1 V) (duration 30 ms or more): External zero-adjustment setting
- High (5 to 30 V, or open): External zero-adjustment ineffective

SENSING CHARACTERISTICS (TYPICAL)

Correlation between material and output voltage / current

The GP-A series is made for all types of standard iron sensing objects. The graph below describes the output discrepancies that occur when detecting different types of metals.

GP-A5S(1)

- Aluminum: 0.028, 0.016, 0.024
- Brass: 0.031, 0.039

GP-A8S(1) GP-A10M(1)

- Aluminum: 0.020, 0.039
- Brass: 0.118, 0.117

GP-A12ML(1)

- Stainless steel (SUS304): 0.039
- Stainless steel (SUS410): 0.079, 0.118

GP-A14F(1)

- Stainless steel (SUS304): 0.039
- Stainless steel (SUS410): 0.079, 0.118

Symbols:
- D1: Input protection diode
- D2: Reverse supply polarity protection diode
- ZD: Surge absorption zener diode
- Tr: NPN output transistor

Notes:
1) In case of using the analog voltage output, connect a device having a high input impedance. Also, take care that the output voltage is reduced due to the resistance of the wiring cable.
2) The alarm output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.
PRECAUTIONS FOR PROPER USE

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

- Make sure to use in combination the sensor head and amplifier which have the same production serial number (5 digits). Since adjustment is done before shipment, if items with different production serial numbers are combined, the sensing characteristics will deteriorate even if they have the same model number.
- The length of the sensor head cable cannot be changed.

Linearity in case of disc-shaped or cylindrical objects
- In case the sensing object is disc-shaped or cylindrical, the linearity of the analog output varies with the sensing object size. In such a case, conduct zero adjustment when close mounting and, by adjusting to the maximum sensing distance and to 5 V as the voltage output (current output 20 mA), linearity (±0.5 % F.S.) can be attained on a full-scale if the sensing object’s size is larger than those described in the table below.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Iron disc diameter ø (mm in)</th>
<th>Iron cylinder diameter ø (mm in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-ASS(I)</td>
<td>12 0.472</td>
<td>10 0.394</td>
</tr>
<tr>
<td>GP-ASS(I)</td>
<td>12 0.472</td>
<td>10 0.394</td>
</tr>
<tr>
<td>GP-A10M(I)</td>
<td>12 0.472</td>
<td>10 0.394</td>
</tr>
<tr>
<td>GP-A12ML(I)</td>
<td>30 1.118</td>
<td>50 1.969</td>
</tr>
<tr>
<td>GP-A14F(I)</td>
<td>12 0.472</td>
<td>10 0.394</td>
</tr>
</tbody>
</table>

<In case of disc><In case of cylinder>

Mounting sensor head

Mounting with set screw
- The tightening torque should be under the value given below.
- Make sure to use an M3 or smaller set screw having a cup-point.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>A (mm in)</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-55(I)</td>
<td>5 0.197</td>
<td>0.44 N·m</td>
</tr>
<tr>
<td>GP-85(I)</td>
<td>10 0.394</td>
<td>0.58 N·m</td>
</tr>
</tbody>
</table>

Note: Do not apply excess torque.

Mounting with nut
- The tightening torque should be under the value given below.

<Threaded type Sensor head>

<table>
<thead>
<tr>
<th>Model No.</th>
<th>B (mm in)</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-A10M(I)</td>
<td>7 0.276</td>
<td>9.8 N·m</td>
</tr>
<tr>
<td>GP-A12ML(I)</td>
<td>14 0.551</td>
<td>20 N·m</td>
</tr>
</tbody>
</table>

Note: Install in such a way so that the nut does not protrude from the screw.

Mounting GP-A14(I)

Distance from surrounding metal
- As metal around the sensor may affect the sensing performance, pay attention to the following points.

<Embedding of the sensor in metal>
- Since the analog output may change if the sensor is completely embedded in metal, keep the minimum separation distance specified in the table below.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>C (mm in)</th>
<th>D (mm in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-ASS(I)</td>
<td>ø15</td>
<td>4 0.157</td>
</tr>
<tr>
<td>GP-ASS(I)</td>
<td>ø0.709</td>
<td>7 0.276</td>
</tr>
<tr>
<td>GP-A10M(I)</td>
<td>ø50 ø1.969</td>
<td>14 0.551</td>
</tr>
<tr>
<td>GP-A12ML(I)</td>
<td>6 0.236</td>
<td>36 1.417</td>
</tr>
<tr>
<td>GP-A14F(I)</td>
<td>19 0.748</td>
<td>38 1.496</td>
</tr>
</tbody>
</table>

<Front sensing type sensor head>

Mutual interference
- When two or more sensor heads are installed in parallel or face to face, since the specifications may not be met, keep the minimum separation distance specified in the table below.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>E (mm in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-55(I)</td>
<td>11 0.433</td>
</tr>
<tr>
<td>GP-ASS(I)</td>
<td>11 0.433</td>
</tr>
<tr>
<td>GP-A10M(I)</td>
<td>14 0.551</td>
</tr>
<tr>
<td>GP-A12ML(I)</td>
<td>0 0</td>
</tr>
<tr>
<td>GP-A14F(I)</td>
<td>0 0</td>
</tr>
</tbody>
</table>

Notes: 1) ‘T’ type is different frequency type.
2) If the required resolution is lower than the specification (0.04 % F.S.), it is possible to bring the sensor heads nearer than the separation distances given in the table above. For further details, please contact our office.

Dimensions of suitable crimp terminals

<table>
<thead>
<tr>
<th>Y type</th>
<th>Round type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 0.126 or more</td>
<td>10 0.394 or less</td>
</tr>
<tr>
<td>0.236 or less</td>
<td>6 0.236 or more</td>
</tr>
<tr>
<td>19 0.748 or less</td>
<td>19 0.748 or less</td>
</tr>
</tbody>
</table>

Note: Please use crimp terminals which have insulation sleeves.
Recommended crimp terminal: Type 1.25 – 3.0

Others
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Do not use the sensor at places having intense vibrations, as this can cause malfunction.

Refer to General precautions.
### DIMENSIONS (Unit: mm in)

#### Sensor head

**GP-A5S(I)**

- ø5.4 ø0.213
- ø2.5 ø0.098 high frequency coaxial cable, 3 m 9.843 ft long

**GP-A8S(I)**

- ø8 ø0.315
- ø2.5 ø0.098 high frequency coaxial cable, 3 m 9.843 ft long

**GP-A10M(I)**

- M10 × 1 0.039
- ø2.5 ø0.098 high frequency coaxial cable, 3 m 9.843 ft long

**GP-A12ML(I)**

- ø12 ø0.472
- ø2.5 ø0.098 high frequency coaxial cable, 3 m 9.843 ft long

**GP-A14F(I)**

- ø14 ø0.551
- ø2.5 ø0.098 high frequency coaxial cable, 3 m 9.843 ft long

#### Amplifier

**All models**

- Connector for sensor head connection
- Suitable for 35 mm 1.378 in width DIN rail

#### Cover removed condition

- Power indicator (Green)
- Over indicator (Orange)
- Alarm indicator (Yellow)
- Shift-down button
- Shift-up button
- Zero-adjustment button
- Button operation effective / ineffective selection switch

#### Mounting bracket for GP-A5S(I) (Optional), mounting bracket for GP-A8S(I) (Optional)

**MS-SS5**

- A 18 0.709
- B 10 0.394
- C 8.3 0.327
- D 6.1 0.240

**MS-SS8**

- A 20 0.787
- B 11 0.433
- C 10.3 0.406
- D 6.5 0.256

*Material: Nylon 66*