High Accuracy Eddy Current Type Displacement Sensor

GP-A SERIES

Related Information
- General terms and conditions ............... F-17
- Sensor selection guide ...................... P.967–
- Glossary of terms .......................... P.1397
- General precautions ....................... P.1405

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

**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.

**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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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>For 1 mm sensing</td>
<td></td>
<td>0 to 1 mm</td>
<td>GP-A5S</td>
<td>Analog voltage</td>
</tr>
<tr>
<td>Non-threaded type</td>
<td></td>
<td>0 to 0.039 in</td>
<td>GP-A5SI</td>
<td>• Output voltage: 0 to 5 V</td>
</tr>
<tr>
<td>M5</td>
<td>ø5.4</td>
<td>0.213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td>0.669</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For 2 mm sensing</td>
<td></td>
<td>0 to 2 mm</td>
<td>GP-A8S</td>
<td>Analog current</td>
</tr>
<tr>
<td>Non-threaded type</td>
<td></td>
<td>0 to 0.079 in</td>
<td>GP-A8SI</td>
<td>• Output current: 4 to 20 mA</td>
</tr>
<tr>
<td>M10</td>
<td>ø8</td>
<td>0.315</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>0.669</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For 5 mm sensing</td>
<td></td>
<td>0 to 5 mm</td>
<td>GP-A10M</td>
<td></td>
</tr>
<tr>
<td>Threaded type</td>
<td></td>
<td>0 to 0.197 in</td>
<td>GP-A10MI</td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>67</td>
<td>2.638</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>3.543</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For 3 mm sensing</td>
<td></td>
<td>0 to 3 mm</td>
<td>GP-A12ML</td>
<td></td>
</tr>
<tr>
<td>Front sensing type</td>
<td></td>
<td>0 to 0.118 in</td>
<td>GP-A12MLI</td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td>ø5.4</td>
<td>0.213</td>
<td></td>
<td></td>
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<td>M5</td>
<td>0.669</td>
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</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</td>
<td>MS-SS5</td>
<td>Mounting bracket for GP-A5S(d)</td>
</tr>
<tr>
<td>Sensor head</td>
<td>MS-SS8</td>
<td>Mounting bracket for GP-A8S(d)</td>
</tr>
</tbody>
</table>

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

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

#### Item

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>For 1 mm 0.039 in sensing</th>
<th>For 2 mm 0.079 in sensing</th>
<th>For 5 mm 0.197 in sensing</th>
<th>For 3 mm 0.118 in sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non-threaded type sensor head</td>
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<td>Threaded type sensor head</td>
<td>Threaded type sensor head</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Different frequency</td>
<td>Different frequency</td>
<td>Different frequency</td>
<td>Different frequency</td>
</tr>
</tbody>
</table>

#### Sensing range

- 0 to 1 mm 0 to 0.039 in
- 0 to 2 mm 0 to 0.079 in
- 0 to 5 mm 0 to 0.197 in
- 0 to 3 mm 0 to 0.118 in

#### Standard sensing object

- Iron sheet 8 × 8 × t 1 mm 0.315 × 0.315 × 0.039 in
- Iron sheet 12 × 12 × t 1 mm 0.472 × 0.472 × 0.039 in
- Iron sheet 30 × 30 × t 1 mm 1.151 × 1.151 × 0.039 in
- Iron sheet 15 × 15 × t 1 mm 0.591 × 0.591 × 0.039 in

#### Supply voltage

- 24 V DC ±10 % Ripple P-P 10 % or less

#### Current consumption

- 150 mA or less

#### Analog output

- Analog voltage
  - Output voltage: 0 to 5 V
  - Output impedance: 100 Ω approx.
- Analog current
  - Output current: 4 to 20 mA
  - Load resistance: 0 to 350 Ω

#### Response frequency

- 1.6 kHz (~3 dB)

#### Resolution

- 0.04 % F.S.

#### Linearity

- Within ±0.5 % F.S.

#### Alarm operation

- Turns ON when the sensor head connection is improper or the sensor head cable is disconnected

#### External zero-adjustment input

- Input condition: Non-voltage contact or NPN open-collector transistor input
  - Low ... 0 to 1 V (duration 30 ms or more)
  - High ... 5 to 30 V, or open
- Operation: Low ... External zero-adjustment setting
  - High ... External zero-adjustment ineffective
- Push button setting / External input setting
- Green LED (lights up when the power is ON)
- Orange LED (lights up when sensing range is exceeded)
- Yellow LED (lights up when the alarm output is ON)

#### Adjustments

- (Shift adjustment (by push-buttons), (Span adjustment (by 14-turn adjuster)

#### Temperature characteristics

- Non-threaded type sensor head
  - 0.5 μm/℃ 0.020 mil/℃
  - 0.6 μm/℃ 0.024 mil/℃
  - 1 μm/℃ 0.059 mil/℃
  - 0.6 μm/℃ 0.024 mil/℃
  - 1 μm/℃ 0.059 mil/℃
  - 1.5 μm/℃ 0.059 mil/℃
  - 2.5 μm/℃ 0.059 mil/℃
  - 0.9 μm/℃ 0.059 mil/℃
  - 1.5 μm/℃ 0.059 mil/℃
  - Amplifier
  - 0.4 μm/℃ 0.016 mil/℃
  - 0.8 μm/℃ 0.031 mil/℃
  - 2.0 μm/℃ 0.079 mil/℃
  - 1.2 μm/℃ 0.047 mil/℃

#### Protection

- Sensor head
  - IP67 (IEC), IP67g (JEM)
- Amplifier

#### Ambient temperature

- Sensor head
  - -10 to +55 °C +14 to +131 °F. Storage: -20 to +70 °C +4 to +168 °F
  - Amplifier
  - 0 to +50 °C +32 to +122 °F (No dew condensation), Storage: 0 to +50 °C +32 to +122 °F
- Ambient humidity
  - 35 to 85 % RH, Storage: 35 to 85 % RH

#### Insulation resistance

- Sensor head
  - 20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure
- Amplifier

#### Vibration resistance

- Sensor head
  - 10 to 55 Hz frequency, 1.5 mm 0.059 in amplitude in X, Y and Z directions for two hours each
  - Amplifier
  - 10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each

#### Shock resistance

- Sensor head
  - 500 m/s² acceleration (50 G approx.) in X, Y and Z directions for five times each
  - Amplifier
  - 1000 m/s² acceleration (10 G approx.) in X, Y and Z directions for five times each

#### Material

- Sensor head
  - Enclosure: Stainless steel (SUS303) Sensing part: Polyimide
  - Enclosure: Stainless steel (SUS303) Sensing part: ABS
  - Enclosure: Brass (Nickel plated) Sensing part: Nylon
  - Enclosure: Stainless steel (SUS303) Sensing part: ABS
- Amplifier
  - Enclosure: ABS

#### Cable

- Sensor head
  - Connector attached high frequency coaxial cable, 3 m 9.843 ft long
- Cable length (Note 3)
  - Total length up to 100 m 328.084 ft is possible with 0.3mm², or more, cable.

#### Net Weight

- Sensor head
  - 40 g approx.
  - 50 g approx. (Note 4)
  - 45 g approx. (Note 4)
  - 50 g approx.
- Amplifier
  - 170 g approx.

#### Accessories

- Adjusting screwdriver: 1 pc.
  - Nut: 2 pcs., Toothed lock washer: 1 pc.
  - Adjusting screwdriver: 1 pc.

#### Notes

1. Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.
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.
I/O CIRCUIT AND WIRING DIAGRAMS

I/O circuit diagram

![I/O Circuit Diagram]

Wiring diagram

![Wiring Diagram]

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 voltage is reduced due to the resistance of the wiring cable.

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(I)

<table>
<thead>
<tr>
<th>Material</th>
<th>Output Voltage (V)</th>
<th>Output Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>0.005</td>
<td>2</td>
</tr>
<tr>
<td>Stainless steel (SUS304)</td>
<td>0.015</td>
<td>20</td>
</tr>
<tr>
<td>Stainless steel (SUS410)</td>
<td>0.020</td>
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GP-A8S(I) GP-A10M(I)

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<th>Output Voltage (V)</th>
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<tbody>
<tr>
<td>Aluminum</td>
<td>0.012</td>
<td>2</td>
</tr>
<tr>
<td>Stainless steel (SUS304)</td>
<td>0.015</td>
<td>6</td>
</tr>
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GP-A12ML(I)

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GP-A14F(I)

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</table>
**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.

**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's size. Since 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.

**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.

**Mounting with nut**

- The tightening torque should be under the value given below.
- Make sure to install in such a way so that the nut does not protrude from the screw.

**Distance from surrounding metal**

- As metal around the sensor may affect the sensing performance, pay attention to the following points.
- Since the analog output may change if the sensor is completely embedded in metal, keep the minimum separation distance specified in the table below.

**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.

**Dimensions of suitable crimp terminals**

- 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.
DIMENSIONS (Unit: mm in)

Sensor head

GP-A5S(I)

GP-A8S(I)

GP-A10M(I)

GP-A12ML(I)

GP-A14F(I)

MS-SS5 MS-SS8

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

Amplifier

All models

The CAD data in the dimensions can be downloaded from our website.