

**GA-311 GH SERIES**

## Related Information

■ General terms and conditions..... F-3    ■ Selection guide ..... P.781~

■ Glossary of terms..... P.1576~    ■ General precautions ..... P.1579~



[panasonic.net/id/pidsx/global](http://panasonic.net/id/pidsx/global)



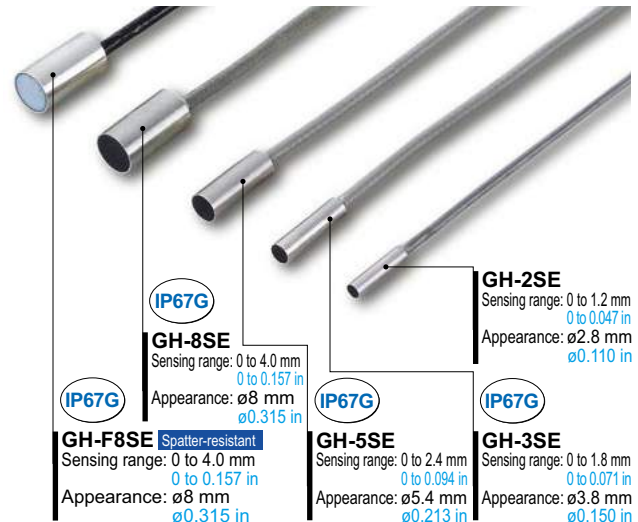
## High-speed response and excellent workability

### Suitable for high-speed applications

It has a high performance of 3.3 kHz response frequency. These sensors are ideal for sensing objects moving at high speeds.

### IP67G sensor head variations

The lineup includes 5 different models, from an ultra-compact 2.8 mm  $0.110$  in diameter type to a spatter-resistant type. Furthermore, all except for the **GH-2SE** are IP67G oil-resistant models so that they can be used with confidence even in adverse environments.



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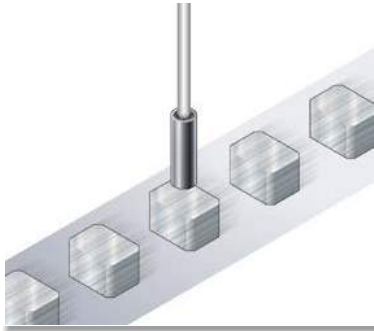
Selection Guide

Amplifier Built-in

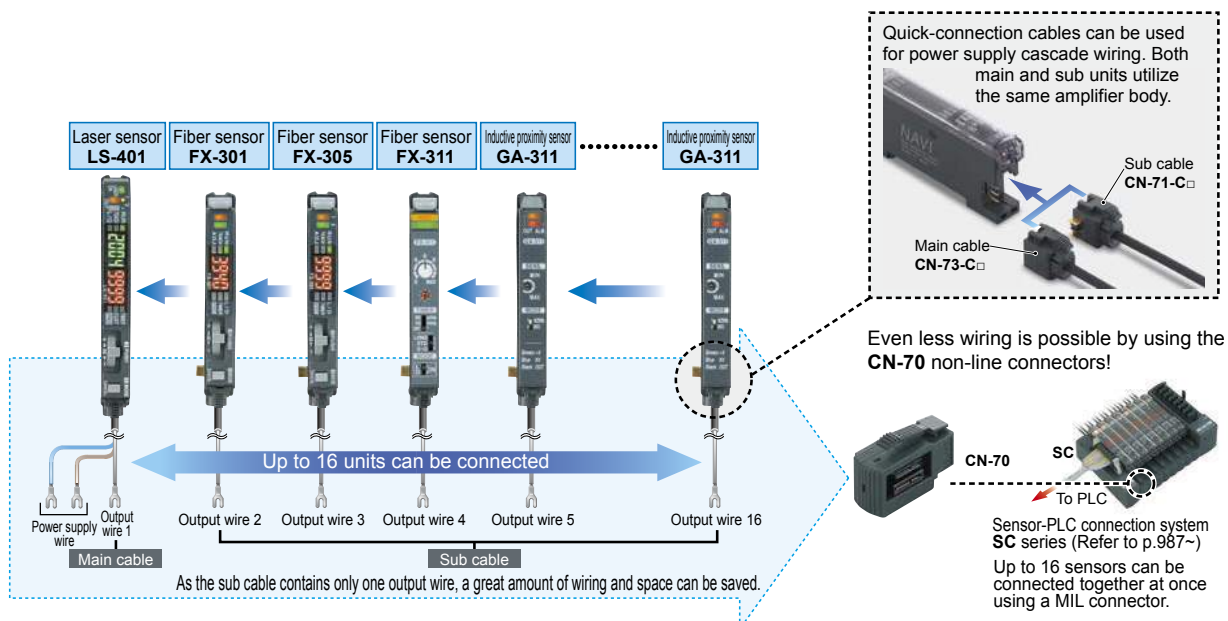
Amplifier-separated

Other Products

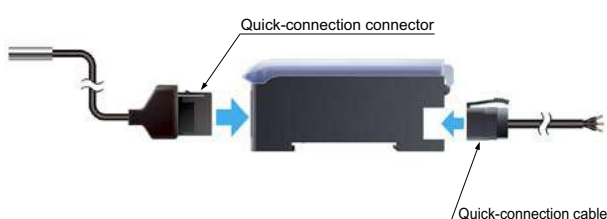
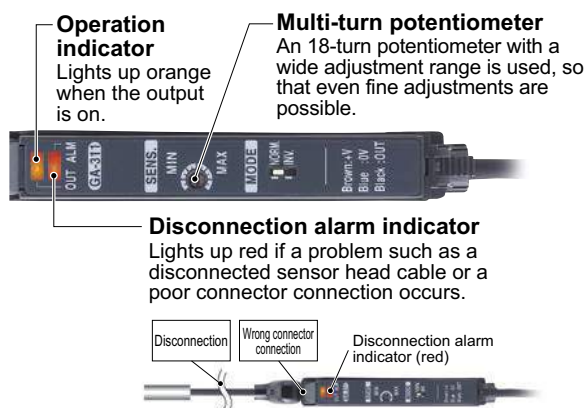
GA-311/GH

**APPLICATIONS****Detecting small metal parts****Detecting rotation of a gear****MOUNTING / MAINTENANCE****Excellent workability and ease of maintenance**

They all have the same form as the **FX-300** series of fiber sensors. The quick-connection cables are also of the same shape, so that fiber sensors and laser sensors can all be used together and less power supply wiring is required.

**Labor-saving by one-touch connections**

The connection between the sensor head and the amplifier is made using a quick-connection connector. Past troublesome wiring connections using a screwdriver are no longer necessary.

**FUNCTIONS****Disconnection alarm indicator and operation indicator have been incorporated**

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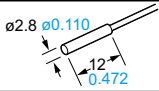
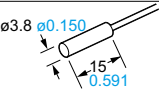
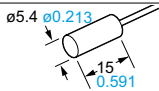
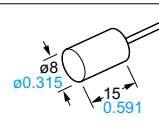
Amplifier Built-in

Amplifier-separated

Other Products

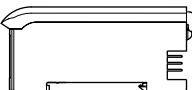
**GA-311/GH**

**ORDER GUIDE****Sensor heads**

Type	Appearance (mm in)	Sensing range (Note)	Model No.	Hysteresis
Cylindrical type		1.2 mm 0.047 in (0 to 0.6 mm 0 to 0.024 in) Maximum operation distance Stable sensing range	<b>GH-2SE</b>	0.07 mm 0.0028 in or less
		1.8 mm 0.071 in (0 to 0.8 mm 0 to 0.031 in)	<b>GH-3SE</b>	0.05 mm 0.0020 in or less
		2.4 mm 0.094 in (0 to 1.0 mm 0 to 0.039 in)	<b>GH-5SE</b>	
		4.0 mm 0.157 in (0 to 2.0 mm 0 to 0.079 in)	<b>GH-8SE</b> <b>GH-F8SE</b>	0.04 mm 0.0016 in or less

Note: The stable sensing range represents the sensing range for which the sensor can satisfy all the given specifications with the standard sensing object.  
The maximum operation distance represents the maximum distance for which the sensor can detect the standard sensing object at +20 °C +68 °F constant ambient temperature.  
Usage within the stable sensing range is recommended for accurate sensing applications.

**Amplifier** Quick-connection cable is not supplied with the amplifier. Please order it separately.

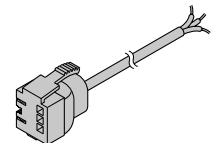
Type	Appearance	Model No.	Output
Connector type		<b>GA-311</b>	NPN open-collector transistor

**Quick-connection cable** Quick-connection cable is not supplied with the amplifier. Please order it separately.

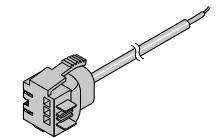
Type	Model No.	Description
Main cable (3-core)	<b>CN-73-C1</b>	Length: 1 m 3.281 ft
	<b>CN-73-C2</b>	Length: 2 m 6.562 ft
	<b>CN-73-C5</b>	Length: 5 m 16.404 ft
Sub cable (1-core)	<b>CN-71-C1</b>	Length: 1 m 3.281 ft
	<b>CN-71-C2</b>	Length: 2 m 6.562 ft
	<b>CN-71-C5</b>	Length: 5 m 16.404 ft

**Main cable**

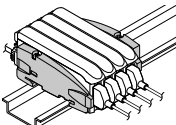
• CN-73-C□

**Sub cable**

• CN-71-C□

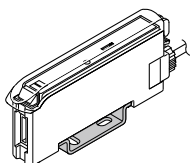


**End plates** End plates are not supplied with the amplifier. Please order them separately when the amplifiers are mounted in cascade.

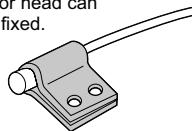
Appearance	Model No.	Description
	<b>MS-DIN-E</b>	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. 2 pcs. per set

**OPTIONS**

Designation	Model No.	Description
Amplifier mounting bracket	<b>MS-DIN-2</b>	Mounting bracket for amplifier
Sensor head mounting bracket	<b>MS-SS3</b>	Mounting bracket for <b>GH-3SE</b>
	<b>MS-SS5</b>	Mounting bracket for <b>GH-5SE</b>
	<b>MS-SS8</b>	Mounting bracket for <b>GH-8SE</b>

**Amplifier mounting bracket**• **MS-DIN-2****Sensor head mounting bracket**• **MS-SS□**

The sensor head can be easily fixed.

**SPECIFICATIONS****Sensor heads**

Type		Cylindrical type				Spatter-resistant type
Item	Model No.	GH-2SE	GH-3SE	GH-5SE	GH-8SE	GH-F8SE
Applicable amplifier		GA-311				
Stable sensing range (Note 2)		0 to 0.6 mm 0 to 0.024 in	0 to 0.8 mm 0 to 0.031 in	0 to 1.0 mm 0 to 0.039 in	0 to 2.0 mm 0 to 0.079 in	
Max. operation distance (Note 2)		1.2 mm 0.047 in	1.8 mm 0.071 in	2.4 mm 0.094 in	4.0 mm 0.157 in	
Standard sensing object		Iron sheet 5 × 5 × t 1 mm 0.197 × 0.197 × t 0.039 in			Iron sheet 10 × 10 × t 1 mm 0.394 × 0.394 × t 0.039 in	
Hysteresis (Note 3)		0.07 mm 0.003 in or less	0.05 mm 0.002 in or less		0.04 mm 0.002 in or less	
Repeatability (Note 3)		Along sensing axis, perpendicular to sensing axis: 1 μm 0.039 mil or less				
Environmental resistance	Protection	IP50 (IEC)	IP67 (IEC), IP67G (Note 4)			
	Ambient temperature	−10 to +60 °C 14 to +140 °F, Storage: −20 to +70 °C −4 to +158 °F				
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH				
	Vibration resistance	10 to 55 Hz frequency, 1.5 mm 0.059 in double amplitude in X, Y and Z directions for two hours each				
	Shock resistance	500 m/s <sup>2</sup> acceleration (50 G approx.) in X, Y and Z directions five times each				
Temperature characteristics (Note 5)		Within ±7 %	Within ±5 %	Within ±4 %		
Material		Enclosure: Stainless steel (SUS303) Sensing part: PVC	Enclosure: Stainless steel (SUS303) Sensing part: ABS	Enclosure: Stainless steel (SUS303) Sensing part: PAR	Enclosure: Stainless steel (SUS303) Sensing part: ABS	Enclosure: Stainless steel (SUS303) Sensing part: Fluorine resin
Cable (Note 6)		Oil-resistant [Spatter-resistant type: Spatter-resistant cable (Sheath: Fluorine resin)] high-frequency coaxial cable, 3 m 9.843 ft long, with a connector at the end				
Weight		Net weight: 15 g approx. Gross weight: 30 g approx.	Net weight: 35 g approx. Gross weight: 45 g approx.		Net weight: 40 g approx. Gross weight: 55 g approx.	Net weight: 55 g approx. Gross weight: 70 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.

2) The stable sensing range represents the sensing range for which the sensor can satisfy all the given specifications with the standard sensing object. The maximum operation distance represents the maximum distance for which the sensor can detect the standard sensing object at +20 °C **+68 °F** constant ambient temperature.

Usage within the stable sensing range is recommended for accurate sensing applications.

3) The hysteresis and the repeatability are specified for the standard sensing object within the stable sensing range.

4) If using the sensor in an environment where cutting oil droplets splatter, the sensor may be deteriorated due to added substances in the oil.

Please check the resistivity of the sensor against the cutting oil you are using beforehand.

5) The value represents the variation in the operation distance, that has been set within the stable sensing range at +20 °C **+68 °F**, for an ambient temperature drift from 0 to +55 °C **+32 to +131 °F**. (Values are for sensor head only.)

6) The length of the sensor head cable cannot be changed.

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**GA-311/ GH**

## SPECIFICATIONS

### Amplifier

Model No.		GA-311
Item		
Applicable sensor head		GH-nSE
Supply voltage		12 to 24 V DC $\pm 10\%$ Ripple P-P 10 % or less
Current consumption		25 mA or less
Output		NPN open-collector transistor <ul style="list-style-type: none"> <li>Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.)</li> <li>Applied voltage: 30 V DC or less (between sensing output and 0 V)</li> <li>Residual voltage: 1 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.]</li> </ul>
Output operation		Switchable either Normally open or Normally closed
Short-circuit protection		Incorporated
Max. response frequency		3.3 kHz
Operation indicator		Orange LED (lights up when the output is ON)
Disconnection alarm indicator		Red LED (lights up when the sensor head cable is disconnected or misconnected)
Sensitivity adjuster		18-turn potentiometer
Environmental resistance	Ambient temperature	-10 to +60 °C <b>+14 to +140 °F</b> (If 4 to 7 units are connected in cascade: -10 to +50 °C <b>+14 to +122 °F</b> , if 8 to 16 units are connected in cascade: -10 to +45 °C <b>+14 to +113 °F</b> ) (No dew condensation or icing allowed), Storage: -20 to +70 °C <b>-4 to +158 °F</b>
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure
	Insulation resistance	20 M $\Omega$ , or more, with 250 V DC megger between all supply terminals connected together and enclosure
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm <b>0.030 in</b> double amplitude in X, Y and Z directions for two hours each
	Shock resistance	100 m/s <sup>2</sup> acceleration (10 G approx.) in X, Y and Z directions three times each
Temperature characteristics (Note 2)		Within $\pm 5\%$
Material		Enclosure: PBT, Cover: Polycarbonate
Connecting method		Connector (Note 3)
Cable length		Total length up to 100 m <b>328.084 ft</b> (if 5 to 8 units are connected in cascade: 50 m <b>164.042 ft</b> , if 9 to 16 units are connected in cascade: 20 m <b>65.617 ft</b> ) is possible with 0.3 mm <sup>2</sup> , or more, cable.
Weight		Net weight: 15 g approx., Gross weight: 40 g approx.

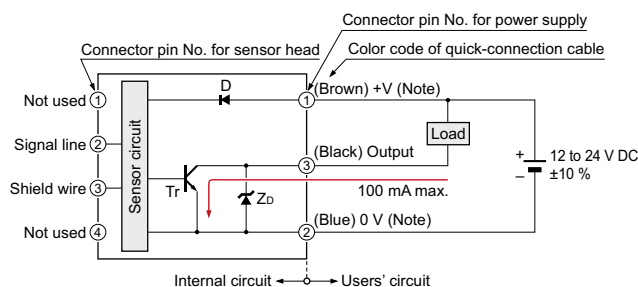
Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.

2) The value of the temperature characteristics gives the variation in the operation distance, that has been set within the stable sensing range at +20 °C **+68 °F**, for an ambient temperature drift from 0 to +55 °C **+32 to +131 °F**. (Value is for amplifier only.)

3) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.  
 Main cable (3-core): **CN-73-C1** (cable length 1 m **3.281 ft**), **CN-73-C2** (cable length 2 m **6.562 ft**), **CN-73-C5** (cable length 5 m **16.404 ft**)  
 Sub cable (1-core): **CN-71-C1** (cable length 1 m **3.281 ft**), **CN-71-C2** (cable length 2 m **6.562 ft**), **CN-71-C5** (cable length 5 m **16.404 ft**)

## I/O CIRCUIT AND WIRING DIAGRAMS

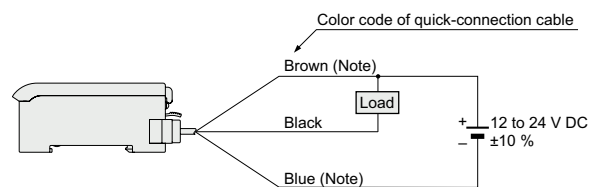
### I/O circuit diagram



Note: The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.

Symbols ... D : Reverse supply polarity protection diode  
 ZD: Surge absorption zener diode  
 Tr: NPN output transistor

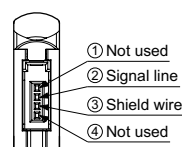
### Wiring diagram



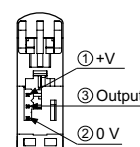
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

### Connector pin position

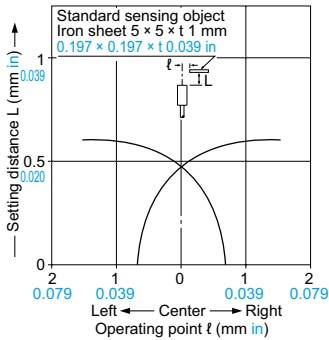
#### Connector for sensor head



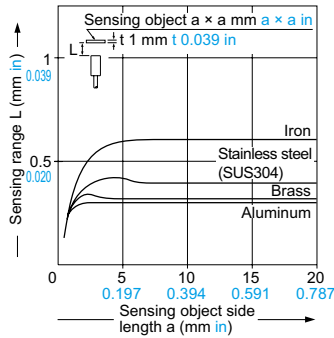
#### Connector for power supply





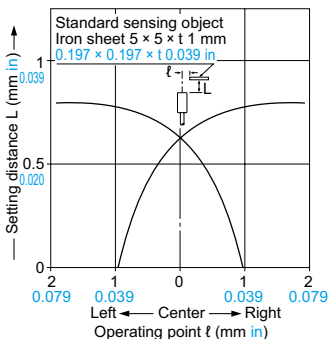
**SENSING CHARACTERISTICS (TYPICAL)****GH-2SE****Sensing field**

The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 0.6 mm 0.024 in.

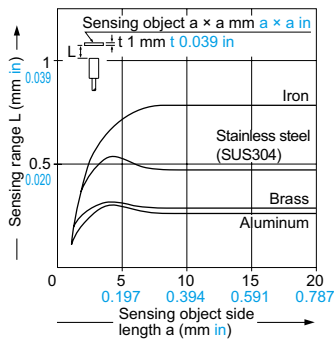
**Correlation between sensing object size and sensing range**

As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 0.6 mm 0.024 in.)

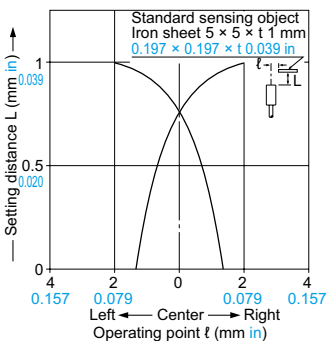
**GH-3SE****Sensing field**

The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 0.8 mm 0.031 in.

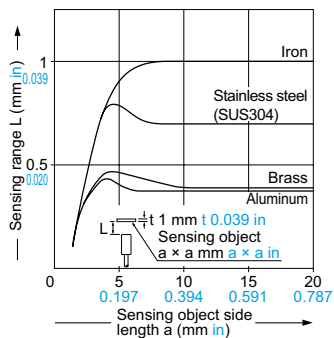
**Correlation between sensing object size and sensing range**

As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 0.8 mm 0.031 in.)

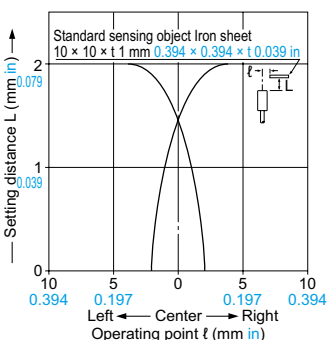
**GH-5SE****Sensing field**

The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 1.0 mm 0.039 in.

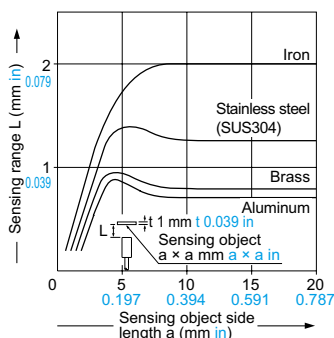
**Correlation between sensing object size and sensing range**

As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $5 \times 5 \times t$  mm  $0.197 \times 0.197 \times t$  0.039 in iron sheet placed at a distance of 1.0 mm 0.039 in.)

**GH-8SE GH-F8SE****Sensing field**

The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $10 \times 10 \times t$  mm  $0.394 \times 0.394 \times t$  0.039 in iron sheet placed at a distance of 2.0 mm 0.079 in.

**Correlation between sensing object size and sensing range**

As the sensing object size becomes smaller than the standard size (iron sheet  $10 \times 10 \times t$  mm  $0.394 \times 0.394 \times t$  0.039 in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a  $10 \times 10 \times t$  mm  $0.394 \times 0.394 \times t$  0.039 in iron sheet placed at a distance of 2.0 mm 0.079 in.)

**PRECAUTIONS FOR PROPER USE**

Refer to p.1579~ for general precautions.

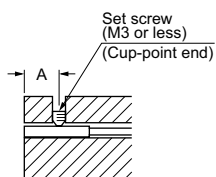


- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

- Always be sure to use sensor heads and amplifiers from the same set.
- Do not shorten or lengthen the sensor head cable.

**Mounting of the sensor head****How to mount the sensor head**

- The tightening torque should be as given below.  
Make sure to use a set screw with a cup-point end.

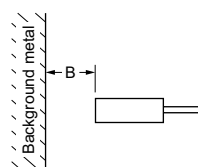


Model No.	Tightening torque	A (mm in)
<b>GH-2SE</b>	0.17N·m	3 <b>0.118</b> or more
<b>GH-3SE</b>	0.17N·m	4 <b>0.157</b> or more
<b>GH-5SE</b>	0.78N·m	5 <b>0.197</b> or more
<b>GH-8SE</b> <b>GH-F8SE</b>	0.59N·m	5 <b>0.197</b> or more

Note: Do not tighten excessively.

**Distance from surrounding metal**

- If there is a metal near the sensor head, it may affect the sensing performance.  
Keep the minimum distance specified in the table below.

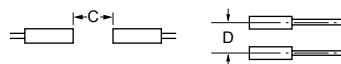


Model No.	B (mm in)
<b>GH-2SE</b>	3 <b>0.118</b>
<b>GH-3SE</b>	4 <b>0.157</b>
<b>GH-5SE</b>	5 <b>0.197</b>
<b>GH-8SE</b> <b>GH-F8SE</b>	9 <b>0.354</b>

**Mutual interference**

- When two or more sensors are installed in parallel or face to face, keep the minimum separation distance specified below to avoid mutual interference.

&lt;Face to face mounting&gt; &lt;Parallel mounting&gt;



Model No.	C (mm in)	D (mm in)
<b>GH-2SE</b>	15 <b>0.591</b>	10 <b>0.394</b>
<b>GH-3SE</b>	20 <b>0.787</b>	15 <b>0.591</b>
<b>GH-5SE</b>	25 <b>0.984</b>	20 <b>0.787</b>
<b>GH-8SE</b> <b>GH-F8SE</b>	40 <b>1.575</b>	26 <b>1.024</b>

**Sensing range**

- The sensing range is specified for the standard sensing object. With a non-ferrous metal, the sensing range is obtained by multiplying with the correction coefficient specified below. Further, the sensing range also changes if the sensing object is smaller than the standard sensing object or if the sensing object is plated.

**Correction coefficient**

Model No. Metal	GH-2SE	GH-3SE	GH-5SE	GH-8SE GH-F8SE
Iron	1	1	1	1
Stainless steel (SUS304)	0.68 approx.	0.55 approx.	0.69 approx.	0.64 approx.
Brass	0.53 approx.	0.35 approx.	0.41 approx.	0.37 approx.
Aluminum	0.51 approx.	0.33 approx.	0.39 approx.	0.32 approx.

**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.
- Make sure that stress by forcible bend or pulling is not applied directly to the cable joint of the sensor head.

