

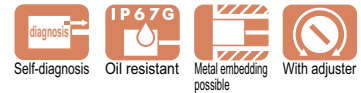
Amplifier-separated

Compact Inductive Proximity Sensor

GA-311 GH SERIES



GA-311 GH SERIES



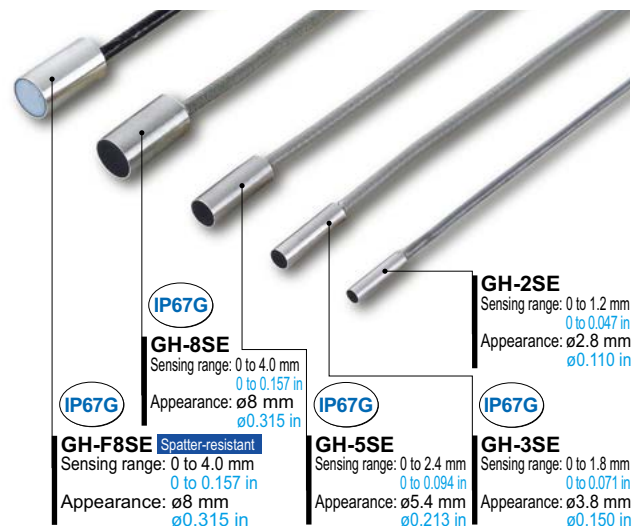
High-speed response and excellent workability

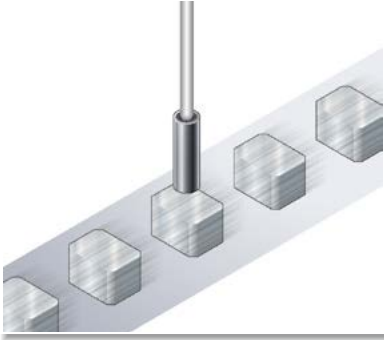
Suitable for high-speed applications

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

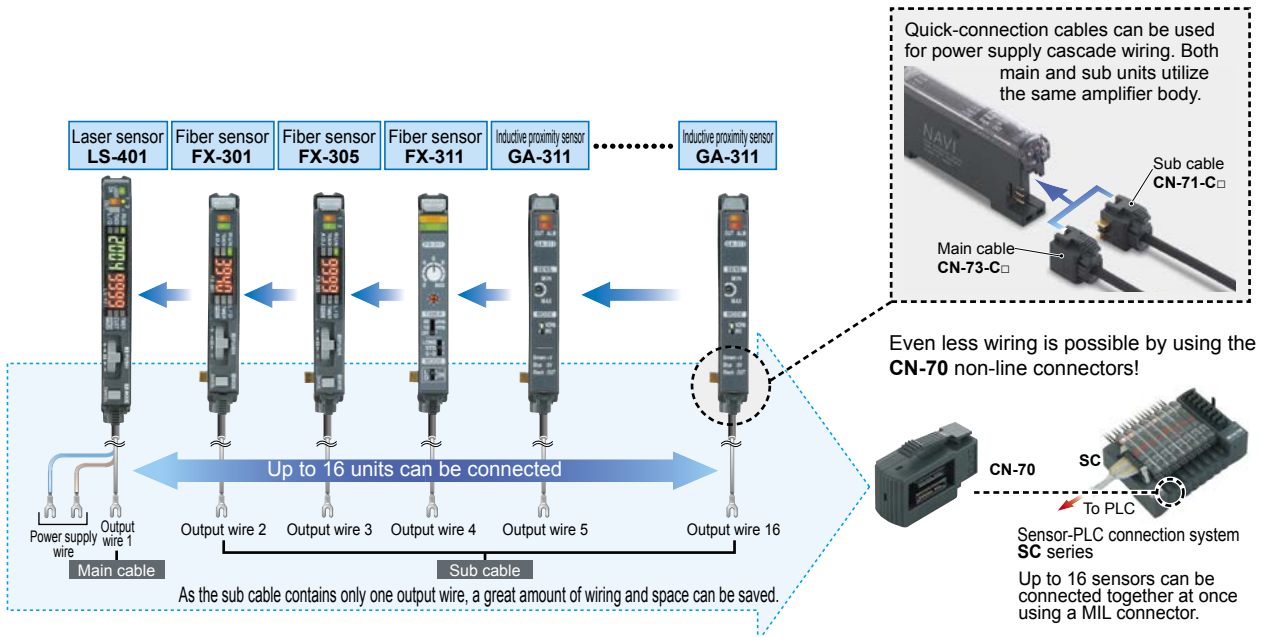
IP67G sensor head variations

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.

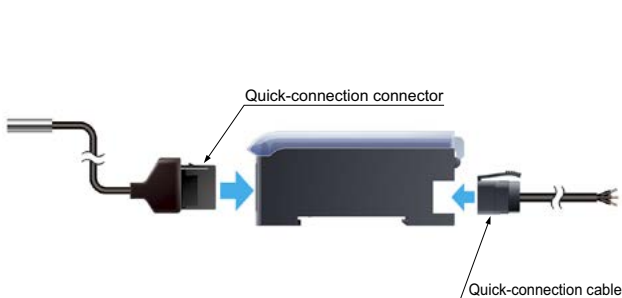
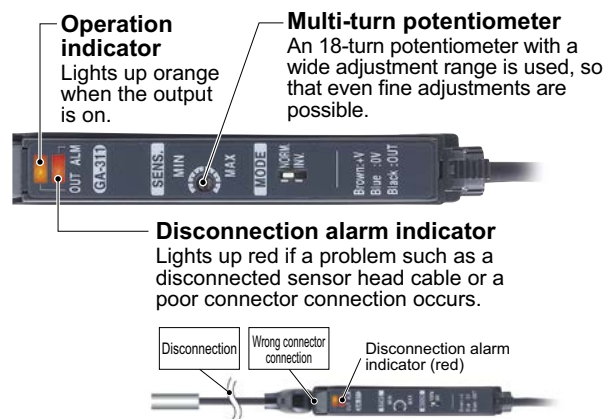


APPLICATIONS**Detecting small metal parts****Detecting rotation of a gear****MOUNTING / MAINTENANCE****Excellent workability and ease of maintenance**

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.

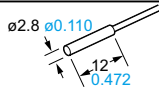
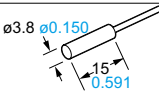
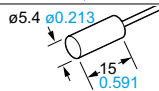
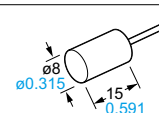
**Labor-saving by one-touch connections**

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**

ORDER GUIDE

Sensor heads

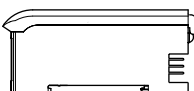
Type	Appearance (mm in)	Sensing range (Note)	Model No.	Hysteresis
Cylindrical type		1.2 mm 0.047 in Maximum operation distance (0 to 0.6 mm 0 to 0.024 in) Stable sensing range	GH-2SE	0.07 mm 0.0028 in or less
		1.8 mm 0.071 in (0 to 0.8 mm 0 to 0.031 in)	GH-3SE	0.05 mm 0.0020 in or less
		2.4 mm 0.094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

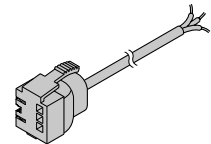
Type	Appearance	Model No.	Output
Connector type		GA-311	NPN open-collector transistor

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

Type	Model No.	Description
Main cable (3-core)	CN-73-C1	Length: 1 m 3.281 ft 0.2 mm ² 3-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 in
	CN-73-C2	Length: 2 m 6.562 ft
	CN-73-C5	Length: 5 m 16.404 ft
Sub cable (1-core)	CN-71-C1	Length: 1 m 3.281 ft 0.2 mm ² 1-core cabtyre cable, with connector on one end Cable outer diameter: ø3.3 mm ø0.130 in
	CN-71-C2	Length: 2 m 6.562 ft
	CN-71-C5	Length: 5 m 16.404 ft

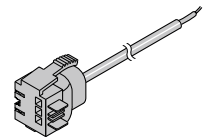
Main cable

- CN-73-C□

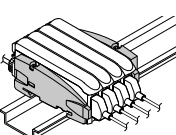


Sub cable

- CN-71-C□



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

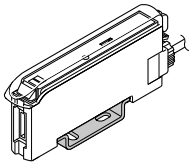
Appearance	Model No.	Description
	MS-DIN-E	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. 2 pcs. per set

OPTIONS

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

Amplifier mounting bracket

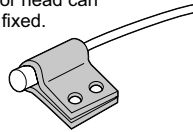
• MS-DIN-2



Sensor head mounting bracket

• MS-SS□

The sensor head can be easily fixed.



SPECIFICATIONS

Sensor heads

Item	Type	Cylindrical type				Spatter-resistant type
	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 ² 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.

SPECIFICATIONS

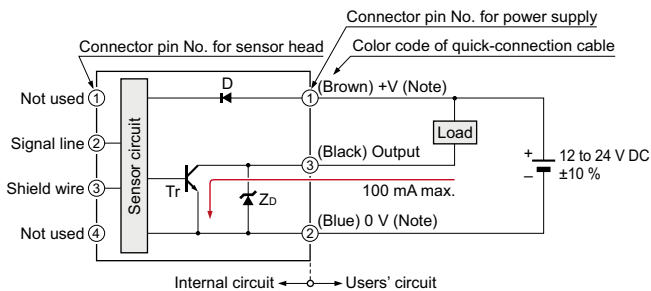
Amplifier

Model No.		GA-311
Item		GH-□SE
Applicable sensor head		GH-□SE
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"> • Maximum sink current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between sensing output and 0 V) • Residual voltage: 1 V or less [at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.]
	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 +14 to +140 °F (If 4 to 7 units are connected in cascade: -10 to +50 °C +14 to +122 °F , if 8 to 16 units are connected in cascade: -10 to +45 °C +14 to +113 °F) (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F
	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 Ω , 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 0.030 in double amplitude in X, Y and Z directions for two hours each
	Shock resistance	100 m/s ² 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 328.084 ft (if 5 to 8 units are connected in cascade: 50 m 164.042 ft , if 9 to 16 units are connected in cascade: 20 m 65.617 ft) is possible with 0.3 mm ² , 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

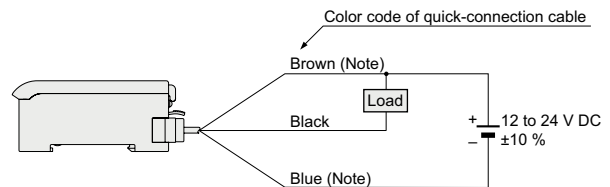
I/O circuit diagram



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

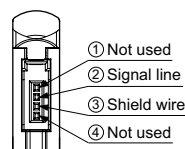
Wiring diagram



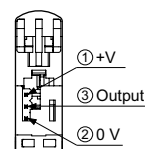
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Connector pin position

Connector for sensor head



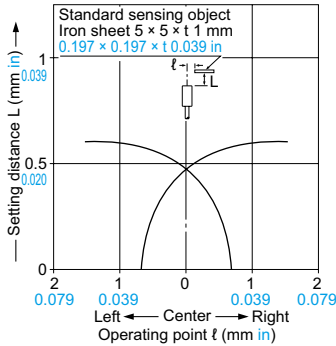
Connector for power supply



SENSING CHARACTERISTICS (TYPICAL)

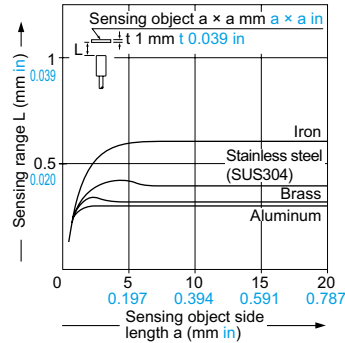
GH-2SE

Sensing field



The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ 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

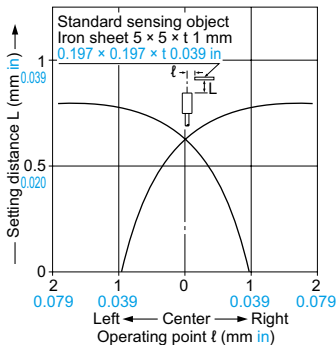


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in iron sheet placed at a distance of 0.6 mm 0.024 in.)

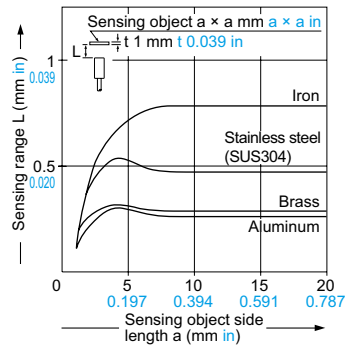
GH-3SE

Sensing field



The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ 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

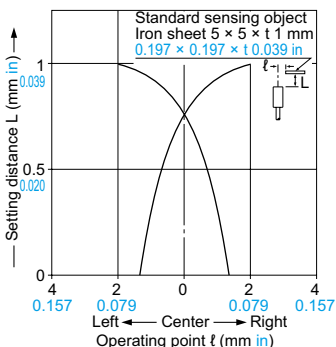


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in iron sheet placed at a distance of 0.8 mm 0.031 in.)

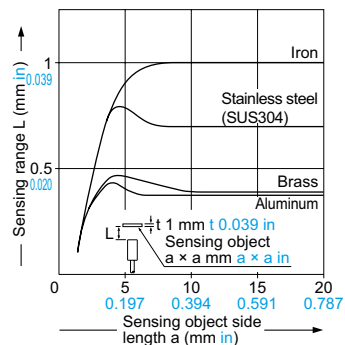
GH-5SE

Sensing field



The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ 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

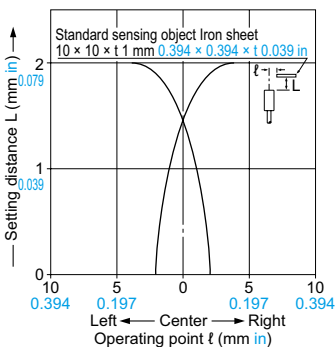


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in), the sensing range shortens as shown in the left figure.

(The graph on the left is plotted with the sensitivity adjusted so as to just detect a $5 \times 5 \times t 1$ mm $0.197 \times 0.197 \times t 0.039$ in iron sheet placed at a distance of 1.0 mm 0.039 in.)

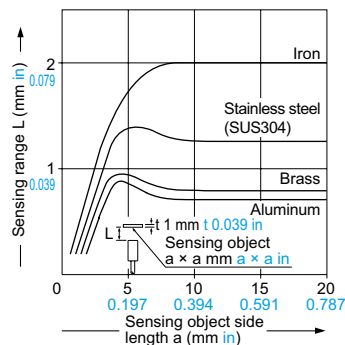
GH-8SE GH-F8SE

Sensing field



The graph on the left is plotted with the sensitivity adjusted so as to just detect a $10 \times 10 \times t 1$ 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 $10 \times 10 \times t 1$ 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 $10 \times 10 \times t 1$ 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



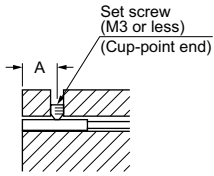
- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

- 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.

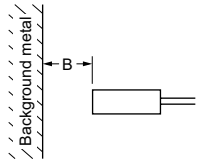


Model No.	Tightening torque	A (mm in)
GH-2SE	0.17N·m	3 0.118 or more
GH-3SE	0.17N·m	4 0.157 or more
GH-5SE	0.78N·m	5 0.197 or more
GH-8SE GH-F8SE	0.59N·m	5 0.197 or more

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.

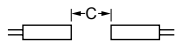


Model No.	B (mm in)
GH-2SE	3 0.118
GH-3SE	4 0.157
GH-5SE	5 0.197
GH-8SE GH-F8SE	9 0.354

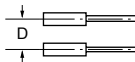
Mutual interference

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

<Face to face mounting>



<Parallel mounting>



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

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.

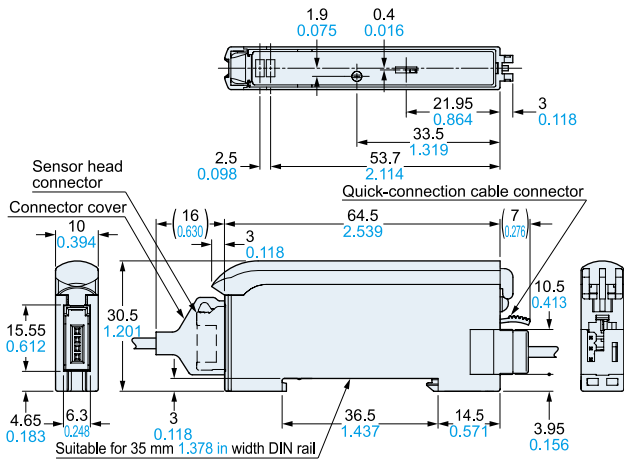
Others

- 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.

DIMENSIONS (Unit: mm in)

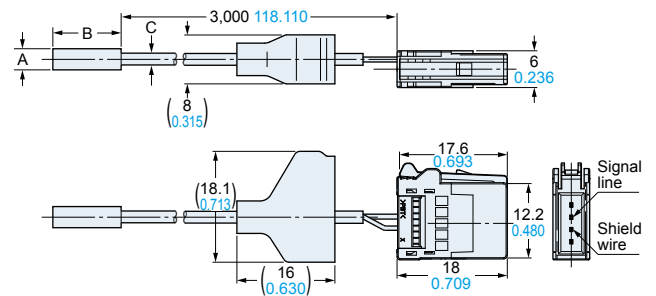
The CAD data can be downloaded from our website.

GA-311 Amplifier



Note: The front view shows the sensor head connector and quick-connection cable connector attached.
The top view is without the sensor head connector, quick-connection cable and the cover.

GH-2SE GH-3SE GH-5SE GH-8SE GH-F8SE Sensor head

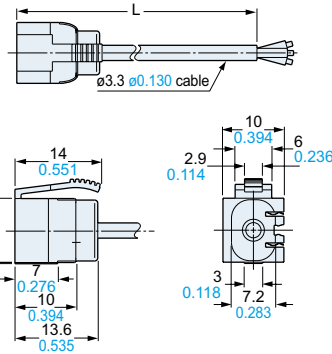


Model No.	A	B	C
GH-2SE	ø2.8 ø0.110	12 0.472	ø1.6 ø0.063
GH-3SE	ø3.8 ø0.150	15 0.591	ø2.5 ø0.098
GH-5SE	ø5.4 ø0.213	15 0.591	ø2.5 ø0.098
GH-8SE	ø8.0 ø0.315	15 0.591	ø2.5 ø0.098
GH-F8SE	ø8.0 ø0.315	15 0.591	ø2.65 ø0.104

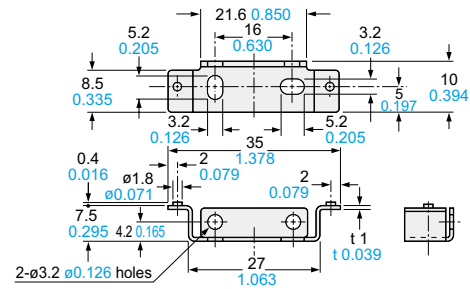
CN-73-C1 CN-73-C2 CN-73-C5 Main cable (Optional)

• Length L

Model No.	Length L
CN-73-C1	1,000 39.370
CN-73-C2	2,000 78.740
CN-73-C5	5,000 196.850



MS-DIN-2 Amplifier mounting bracket (Optional)

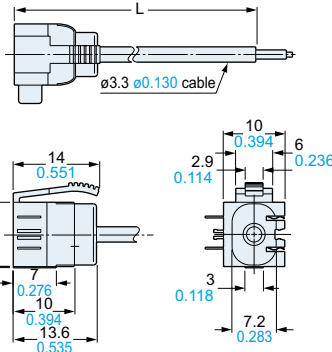


Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

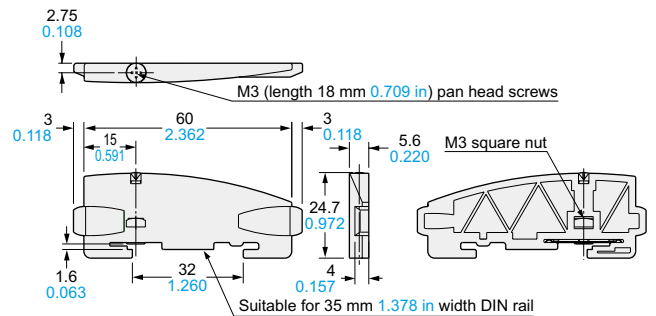
CN-71-C1 CN-71-C2 CN-71-C5 Sub cable (Optional)

• Length L

Model No.	Length L
CN-71-C1	1,000 39.370
CN-71-C2	2,000 78.740
CN-71-C5	5,000 196.850

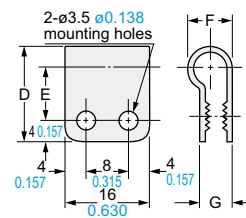


MS-DIN-E End plate (Optional)



Material: Polycarbonate

MS-SS3 MS-SS5 MS-SS8 Sensor head mounting bracket (Optional)



Material: Nylon 66

Model No.	MS-SS3	MS-SS5	MS-SS8
Symbol	MS-SS3	MS-SS5	MS-SS8
D	16 0.630	18 0.709	20 0.787
E	9 0.354	10 0.394	11 0.433
F	6.3 0.248	8.3 0.327	10.3 0.406
G	4.9 0.193	6.1 0.240	6.5 0.256
Applicable sensor head model No.	GH-3SE	GH-5SE	GH-8SE

Disclaimer

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