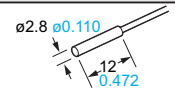
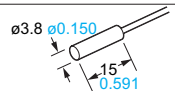
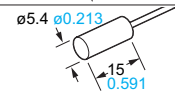
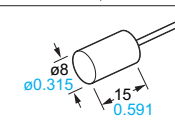


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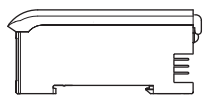
## ORDER GUIDE

### 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>	
Spatter-resistant type		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.

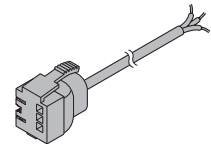
Type	Appearance	Model No.	Output
Connector type		<b>GA-311</b>	NPN open-collector transistor

**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 0.15 mm <sup>2</sup> 3-core cabtyre cable, with connector on one end Cable outer diameter: 3.0 mm 0.118 in
	<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 0.15 mm <sup>2</sup> 1-core cabtyre cable, with connector on one end Cable outer diameter: 3.0 mm 0.118 in
	<b>CN-71-C2</b>	Length: 2 m 6.562 ft
	<b>CN-71-C5</b>	Length: 5 m 16.404 ft

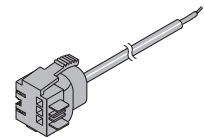
**Main cable**

- CN-73-C□

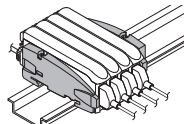


**Sub cable**

- CN-71-C□

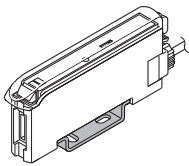


**End plates** End plates are not supplied with the amplifier. Please order them separately when the amplifiers are mounted in cascade.

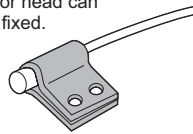
Appearance	Model No.	Description
	<b>MS-DIN-E</b>	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. 2 pcs. per set

**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**

Item	Type Model No.	Cylindrical type				Spatter-resistant type
		<b>GH-2SE</b>	<b>GH-3SE</b>	<b>GH-5SE</b>	<b>GH-8SE</b>	<b>GH-F8SE</b>
Applicable amplifier		<b>GA-311</b>				
Stable sensing range (Note 2)		0 to 0.6 mm <b>0 to 0.024 in</b>	0 to 0.8 mm <b>0 to 0.031 in</b>	0 to 1.0 mm <b>0 to 0.039 in</b>	0 to 2.0 mm <b>0 to 0.079 in</b>	
Max. operation distance (Note 2)		1.2 mm <b>0.047 in</b>	1.8 mm <b>0.071 in</b>	2.4 mm <b>0.094 in</b>	4.0 mm <b>0.157 in</b>	
Standard sensing object		Iron sheet 5 × 5 × t 1 mm <b>0.197 × 0.197 × t 0.039 in</b>			Iron sheet 10 × 10 × t 1 mm <b>0.394 × 0.394 × t 0.039 in</b>	
Hysteresis (Note 3)		0.07 mm <b>0.003 in</b> or less	0.05 mm <b>0.002 in</b> or less		0.04 mm <b>0.002 in</b> or less	
Repeatability (Note 3)		Along sensing axis, perpendicular to sensing axis: 1 μm <b>0.039 mil</b> or less				
Environmental resistance	Protection	IP50 (IEC)	IP67 (IEC), IP67g (JEM)			
	Ambient temperature	−10 to +60 °C <b>14 to +140 °F</b> , Storage: −20 to +70 °C <b>−4 to +158 °F</b>				
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH				
	Vibration resistance	10 to 55 Hz frequency, 1.5 mm <b>0.059 in</b> 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 for five times each				
Temperature characteristics (Note 4)		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 5)		Oil-resistant [Spatter-resistant type: Spatter-resistant cable (Sheath: Fluorine resin)] high-frequency coaxial cable, 3 m <b>9.843 ft</b> 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) 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.)

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

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LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS

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ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Amplifier Built-in

Amplifier-separated

**GA-311/ GH**

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FA COMPONENTS  
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## SPECIFICATIONS

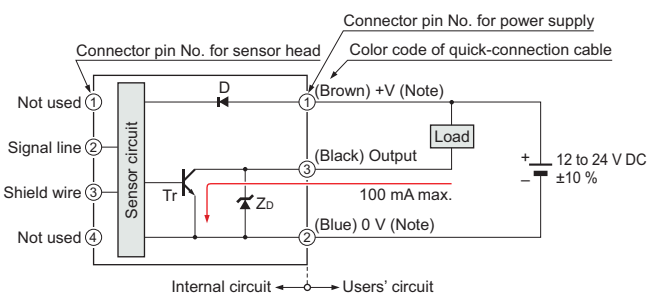
### Amplifier

Item	Model No.	GA-311
Applicable sensor head		<b>GH-□SE</b>
Supply voltage		12 to 24 V DC ±10 % Ripple P-P 10 % or less
Current consumption		25 mA or less
Output		NPN open-collector transistor • 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 <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 MΩ, 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> 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 for three times each
Temperature characteristics (Note 2)		Within ±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

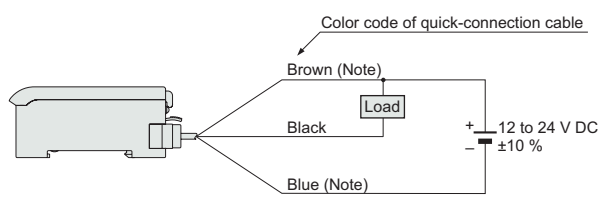
### I/O circuit diagram



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

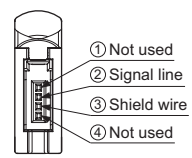
### Wiring diagram



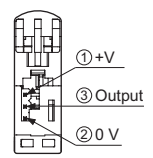
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

### Connector pin position

#### Connector for sensor head



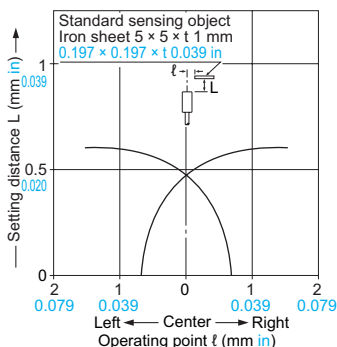
#### Connector for power supply



**SENSING CHARACTERISTICS (TYPICAL)**

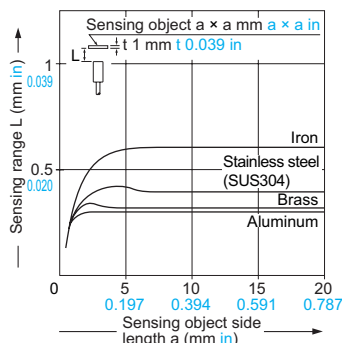
**GH-2SE**

**Sensing field**



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

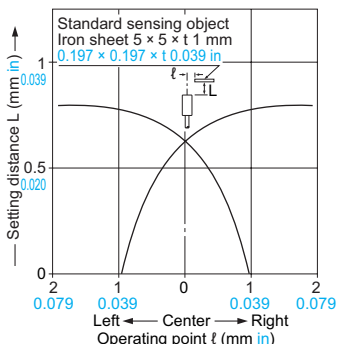


As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t 1$  mm  $0.197 \times 0.197 \times t 0.039$  in), the sensing range shortens as shown in the left figure.

(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.)

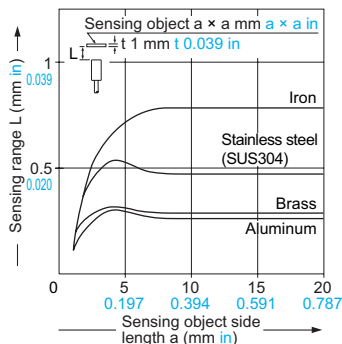
**GH-3SE**

**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**

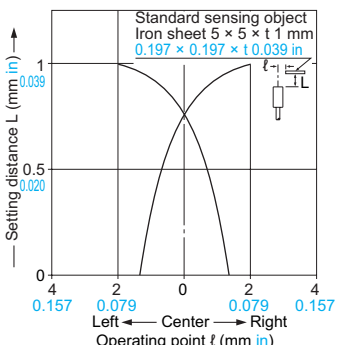


As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t 1$  mm  $0.197 \times 0.197 \times t 0.039$  in), the sensing range shortens as shown in the left figure.

(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.)

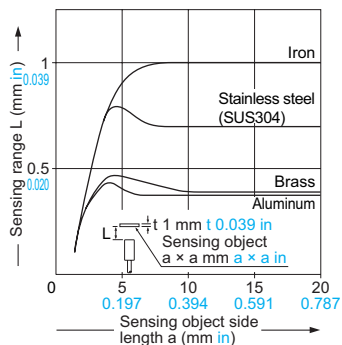
**GH-5SE**

**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**

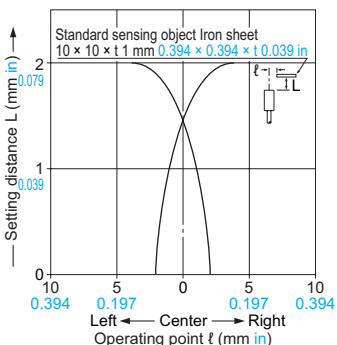


As the sensing object size becomes smaller than the standard size (iron sheet  $5 \times 5 \times t 1$  mm  $0.197 \times 0.197 \times t 0.039$  in), the sensing range shortens as shown in the left figure.

(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.)

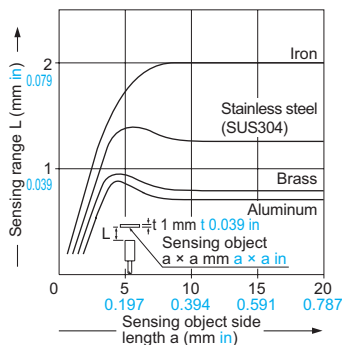
**GH-8SE GH-F8SE**

**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.)

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- Amplifier-separated

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UV CURING SYSTEMS

## PRECAUTIONS FOR PROPER USE

Refer to General precautions.



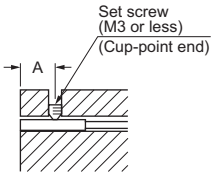
- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

- 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.

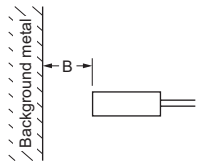


Model No.	Tightening torque	A (mm in)
<b>GH-2SE</b>	0.17N·m	3 <b>0.118</b> or more
<b>GH-3SE</b>	0.17N·m	4 <b>0.157</b> or more
<b>GH-5SE</b>	0.78N·m	5 <b>0.197</b> or more
<b>GH-8SE</b> <b>GH-F8SE</b>	0.59N·m	5 <b>0.197</b> or more

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.

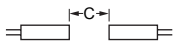


Model No.	B (mm in)
<b>GH-2SE</b>	3 <b>0.118</b>
<b>GH-3SE</b>	4 <b>0.157</b>
<b>GH-5SE</b>	5 <b>0.197</b>
<b>GH-8SE</b> <b>GH-F8SE</b>	9 <b>0.354</b>

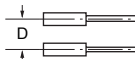
#### Mutual interference

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

<Face to face mounting>



<Parallel mounting>



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.

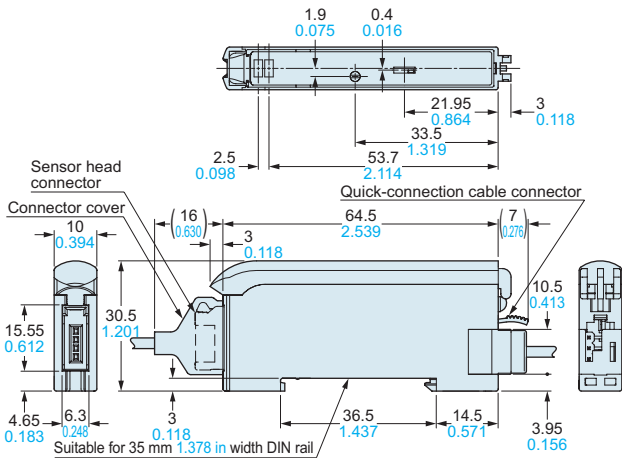
#### Others

- 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.

**DIMENSIONS (Unit: mm in)**

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

**GA-311 Amplifier**

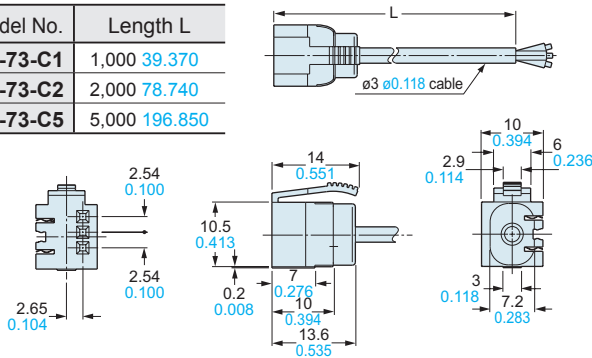


Note: The front view shows the sensor head connector and quick-connection cable connector attached.  
The top view is without the sensor head connector, quick-connection cable and the cover.

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

• Length L

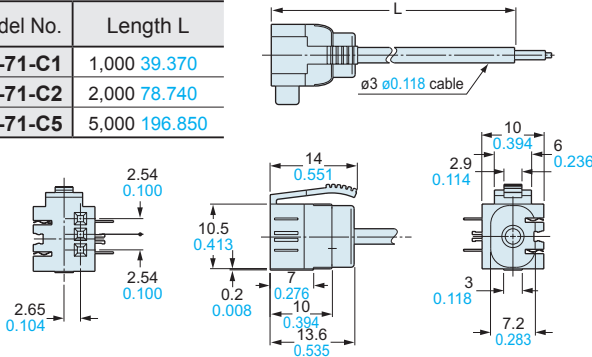
Model No.	Length L
<b>CN-73-C1</b>	1,000 <b>39.370</b>
<b>CN-73-C2</b>	2,000 <b>78.740</b>
<b>CN-73-C5</b>	5,000 <b>196.850</b>



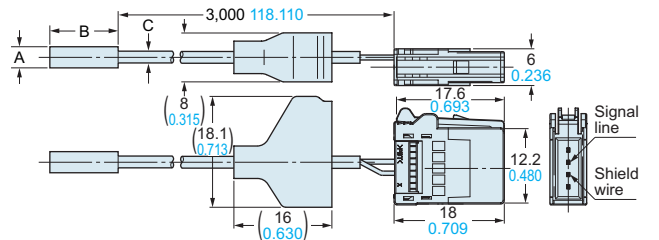
**CN-71-C1 CN-71-C2 CN-71-C5 Sub cable (Optional)**

• Length L

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

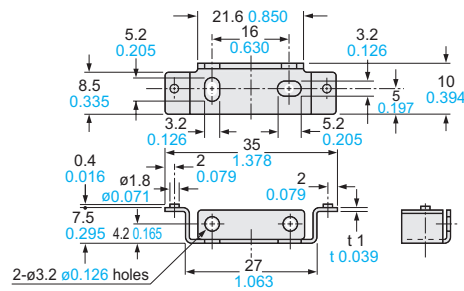


**GH-2SE GH-3SE GH-5SE GH-8SE GH-F8SE Sensor head**



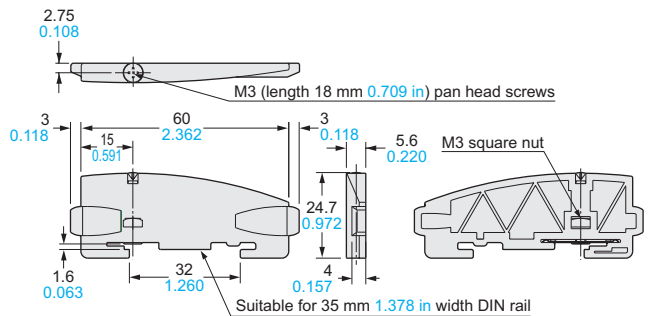
Model No.	A	B	C
<b>GH-2SE</b>	ø2.8 <b>ø0.110</b>	12 <b>0.472</b>	ø1.6 <b>ø0.063</b>
<b>GH-3SE</b>	ø3.8 <b>ø0.150</b>	15 <b>0.591</b>	ø2.5 <b>ø0.098</b>
<b>GH-5SE</b>	ø5.4 <b>ø0.213</b>	15 <b>0.591</b>	ø2.5 <b>ø0.098</b>
<b>GH-8SE</b>	ø8.0 <b>ø0.315</b>	15 <b>0.591</b>	ø2.5 <b>ø0.098</b>
<b>GH-F8SE</b>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

**MS-DIN-2 Amplifier mounting bracket (Optional)**



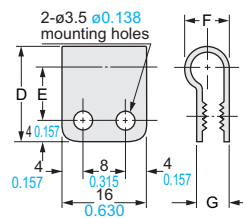
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

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

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

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PLC / TERMINALS

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ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Amplifier Built-in

Amplifier-separated

GA-311/GH