

GA-311 GH SERIES

Related Information

- General terms and conditions..... F-7
- Sensor selection guide P.803~
- Glossary of terms..... P.1482~
- General precautions P.1485~



panasonic.net/id/pidsx/global



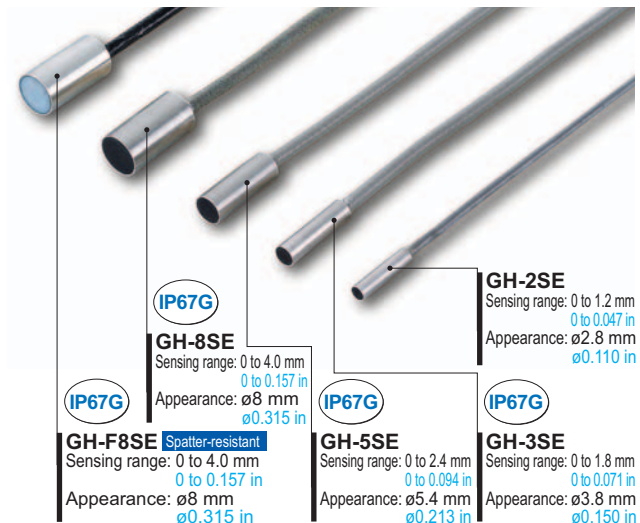
High-speed response and excellent workability

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.



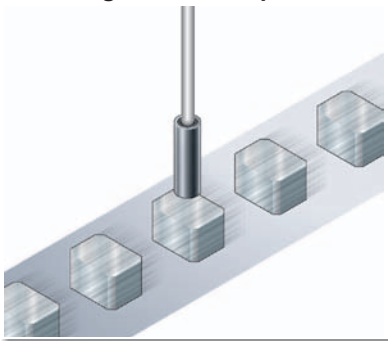
- Selection Guide
- Amplifier Built-in
- Amplifier-separated

GA-311/GH

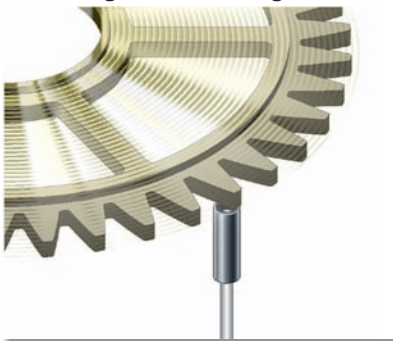
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- LASER SENSORS
- PHOTOELECTRIC SENSORS
- MICRO PHOTOELECTRIC SENSORS
- AREA SENSORS
- LIGHT CURTAINS / SAFETY COMPONENTS
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- STATIC ELECTRICITY PREVENTION DEVICES
- LASER MARKERS
- PLC
- HUMAN MACHINE INTERFACES
- ENERGY CONSUMPTION VISUALIZATION COMPONENTS
- FA COMPONENTS
- MACHINE VISION SYSTEMS
- UV CURING SYSTEMS

APPLICATIONS

Detecting small metal parts



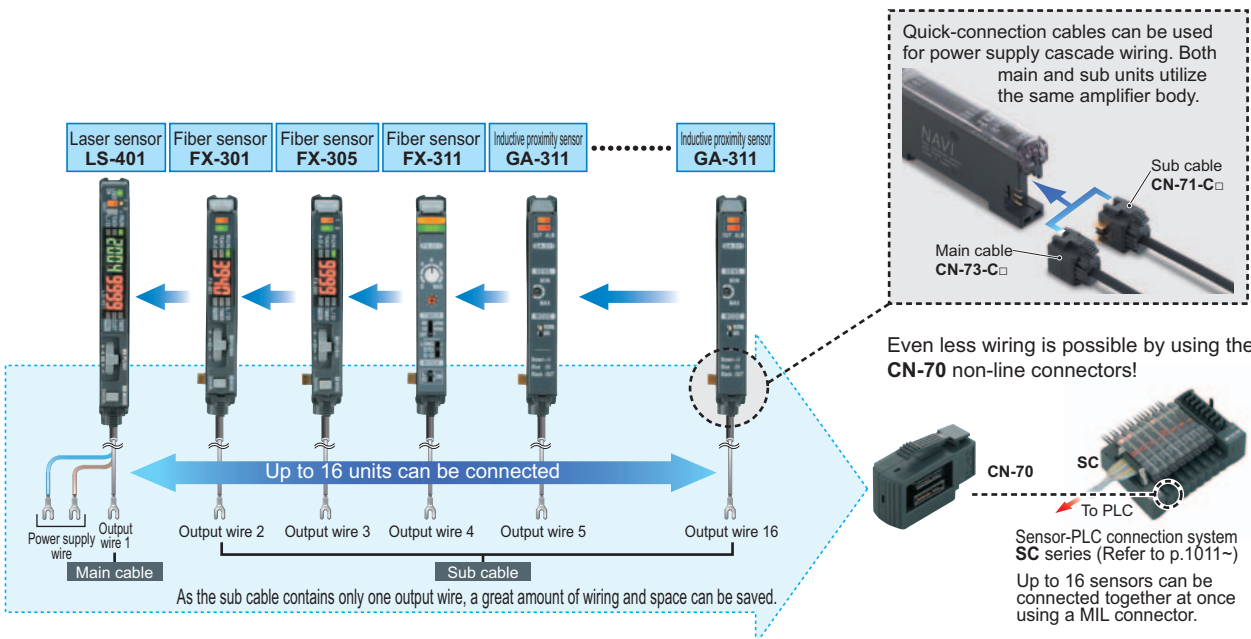
Detecting rotation of a gear



MOUNTING / MAINTENANCE

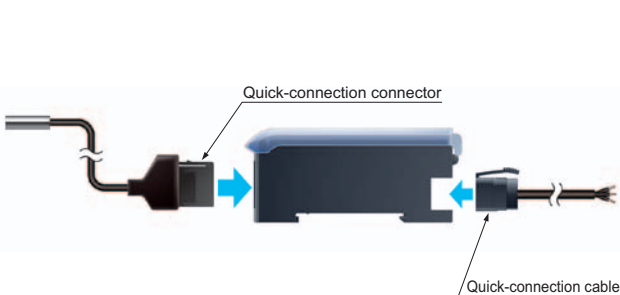
Excellent workability and ease of maintenance

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.



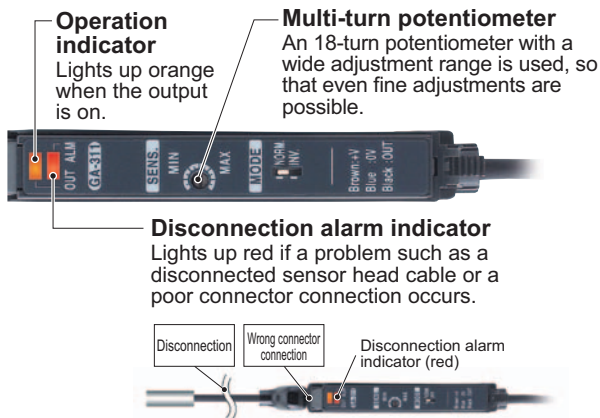
Labor-saving by one-touch connections

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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FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

Selection Guide

Amplifier Built-in

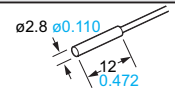
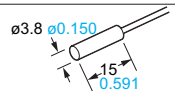
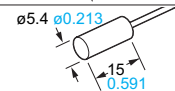
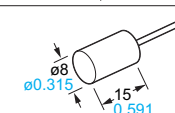
Amplifier-separated

GA-311/GH

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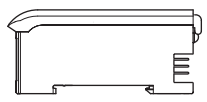
ORDER GUIDE

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) | 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) | | |
| |  | 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.

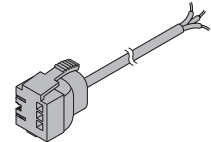
| Type | Appearance | Model No. | Output |
|----------------|---|---------------|-------------------------------|
| Connector type |  | GA-311 | NPN open-collector transistor |

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 |

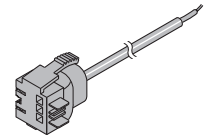
Main cable

- CN-73-C□

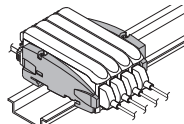


Sub cable

- CN-71-C□



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

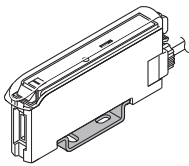
| Appearance | Model No. | Description |
|---|-----------------|--|
|  | MS-DIN-E | When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple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

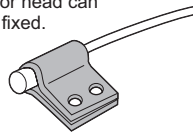
• MS-DIN-2



Sensor head mounting bracket

• MS-SS□

The sensor head can be easily fixed.



SPECIFICATIONS

Sensor heads

| Item | Type Model No. | Cylindrical type | | | | Spatter-resistant type |
|--------------------------------------|----------------------|--|--|--|---|---|
| | | 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 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 for 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

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SPECIFICATIONS

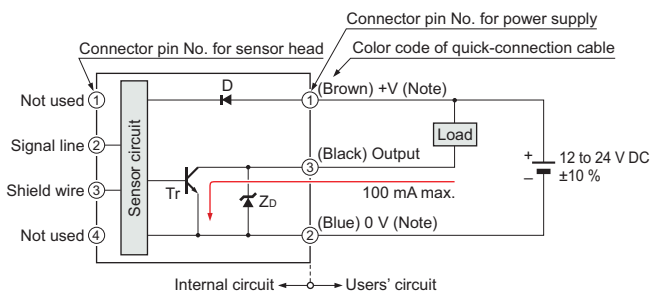
Amplifier

| Model No. | | GA-311 |
|--------------------------------------|--------------------------|---|
| Item | | |
| Applicable sensor head | | GH-□SE |
| 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 +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 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 0.030 in 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 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 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

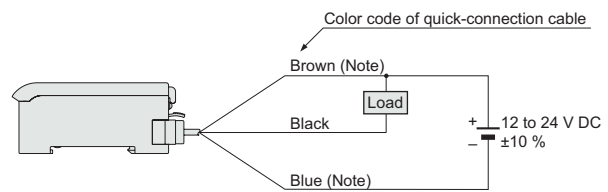
I/O circuit diagram



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

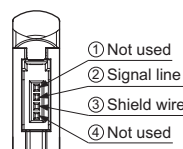
Wiring diagram



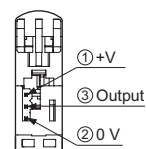
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Connector pin position

Connector for sensor head



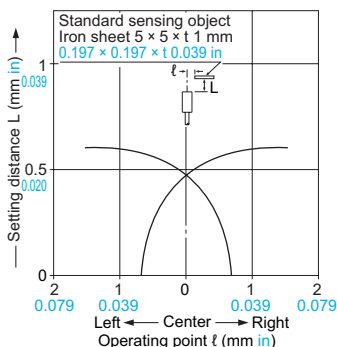
Connector for power supply



SENSING CHARACTERISTICS (TYPICAL)

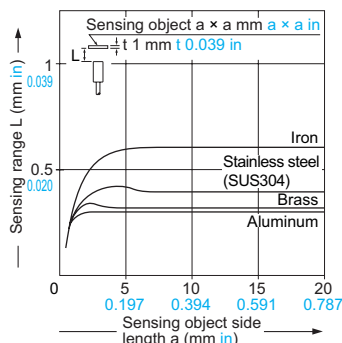
GH-2SE

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

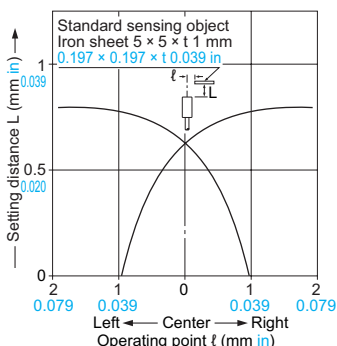


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t$ 1 mm $0.197 \times 0.197 \times t$ 0.039 in), the sensing range shortens as shown in the left figure.

(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.)

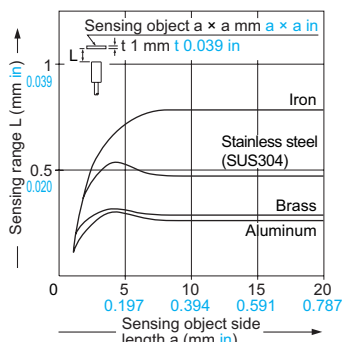
GH-3SE

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

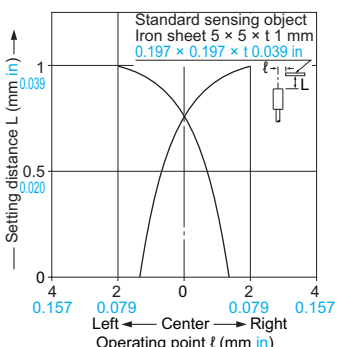


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t$ 1 mm $0.197 \times 0.197 \times t$ 0.039 in), the sensing range shortens as shown in the left figure.

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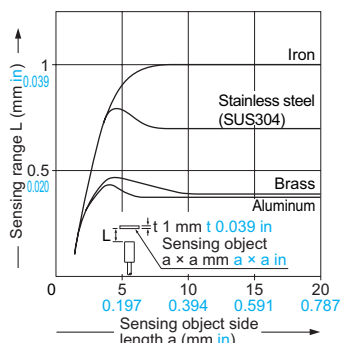
GH-5SE

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

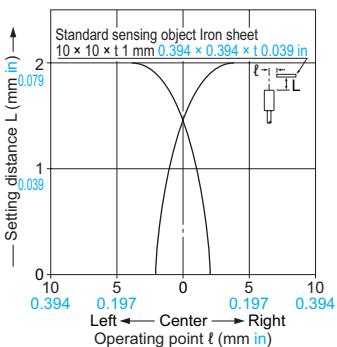


As the sensing object size becomes smaller than the standard size (iron sheet $5 \times 5 \times t$ 1 mm $0.197 \times 0.197 \times t$ 0.039 in), the sensing range shortens as shown in the left figure.

(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.)

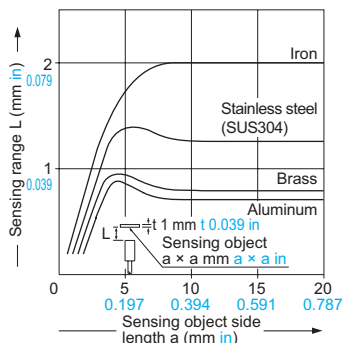
GH-8SE GH-F8SE

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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PLC
HUMAN MACHINE INTERFACES
ENERGY CONSUMPTION VISUALIZATION COMPONENTS
FA COMPONENTS
MACHINE VISION SYSTEMS
UV CURRING SYSTEMS

PRECAUTIONS FOR PROPER USE

Refer to p.1485~ for general precautions.



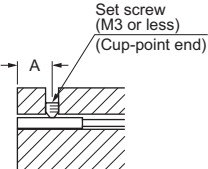
- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

- 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.

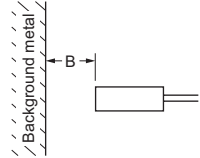


| Model No. | Tightening torque | A (mm in) |
|---------------------------------|-------------------|------------------------|
| GH-2SE | 0.17N·m | 3 0.118 or more |
| GH-3SE | 0.17N·m | 4 0.157 or more |
| GH-5SE | 0.78N·m | 5 0.197 or more |
| GH-8SE GH-F8SE | 0.59N·m | 5 0.197 or more |

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.

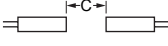


| Model No. | B (mm in) |
|---------------------------------|----------------|
| GH-2SE | 3 0.118 |
| GH-3SE | 4 0.157 |
| GH-5SE | 5 0.197 |
| GH-8SE GH-F8SE | 9 0.354 |


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. |

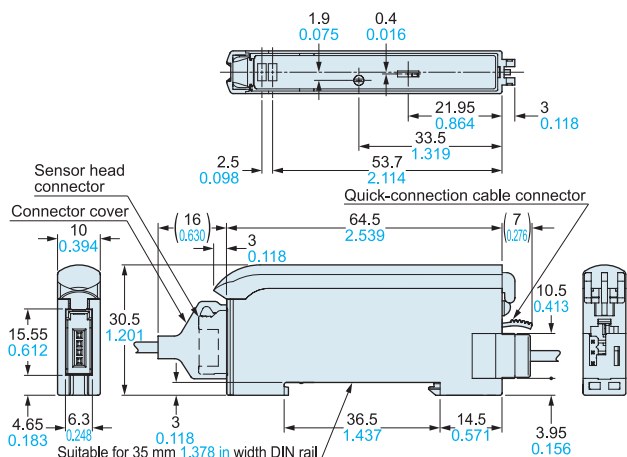
Others

- 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.

Selection Guide
Amplifier Built-in
Amplifier-separated
GA-311/ GH

DIMENSIONS (Unit: mm in)

GA-311 Amplifier

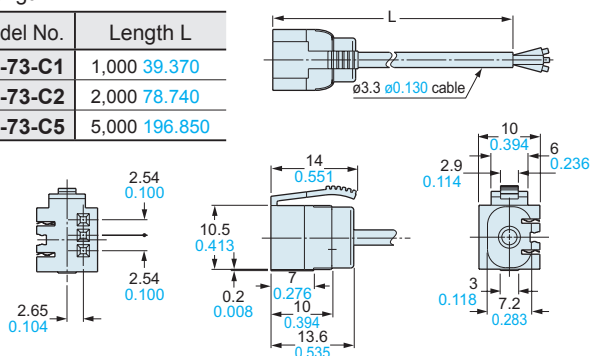


Note: The front view shows the sensor head connector and quick-connection cable connector attached.
The top view is without the sensor head connector, quick-connection cable and the cover.

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

• Length L

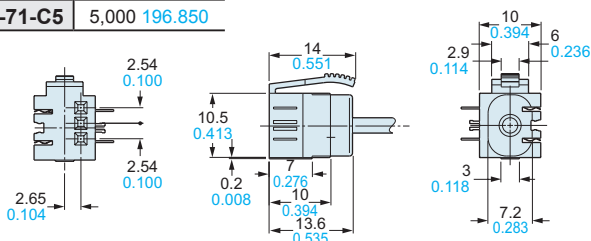
| Model No. | Length L |
|-----------------|----------------------|
| CN-73-C1 | 1,000 39.370 |
| CN-73-C2 | 2,000 78.740 |
| CN-73-C5 | 5,000 196.850 |



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

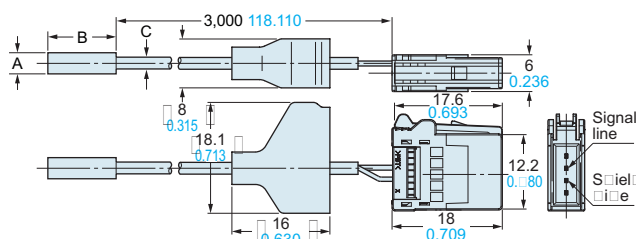
• Length L

| 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 |



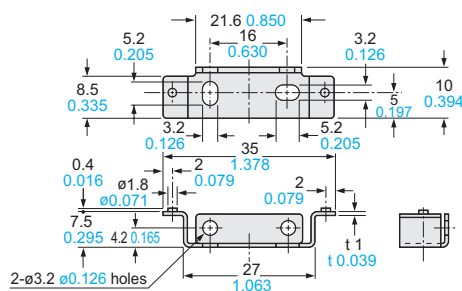
The CAD data in the dimensions can be downloaded from our website.

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



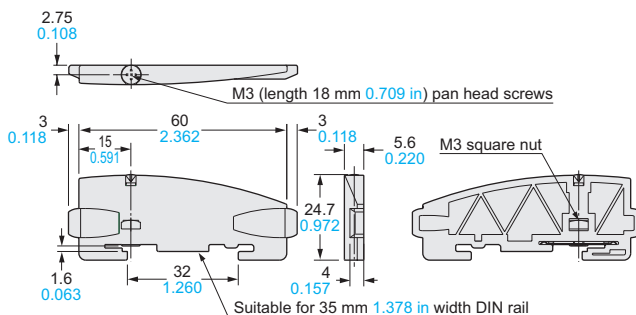
| Model No. | A | B | C |
|----------------|--------------------|-----------------|---------------------|
| GH-2SE | ø2.8 ø0.110 | 12 0.472 | ø1.6 ø0.063 |
| GH-3SE | ø3.8 ø0.150 | 15 0.591 | ø2.5 ø0.098 |
| GH-5SE | ø5.4 ø0.213 | 15 0.591 | ø2.5 ø0.098 |
| GH-8SE | ø8.0 ø0.315 | 15 0.591 | ø2.5 ø0.098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

MS-DIN-2 Amplifier mounting bracket (Optional)



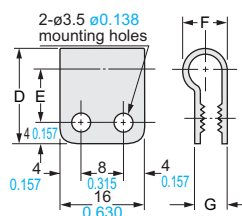
Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)

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 |
|----------------------------------|------------------|------------------|-------------------|
| Symbol | | | |
| 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 |

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SMILE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASUREMENT SENSORS

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