Cylindrical Compact Inductive Proximity Sensor Amplifier Built-in

GX SERIES

Related Information
■ General terms and conditions..... F-3
■ Selection guide ..... P.781~
■ Glossary of terms..... P.1576~
■ General precautions ..... P.1579~

Recognition (Excluding **GX-4S□** and 5 m cable length type)

Bending-resistant cable type available

Metal embedding possible

Robust enclosure and bending-resistant cable types are also available

VARIETIES

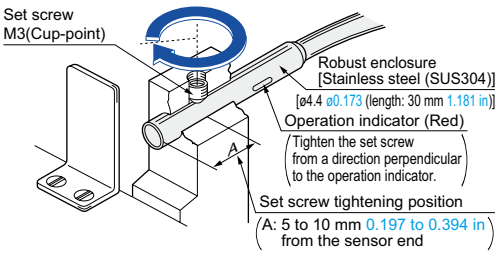
Miniature GX-3S□

GX-3S□ is an amplifier built-in inductive proximity sensor having a diameter of just ø3.8 mm ø0.150 in.

Robust housing GX-4S□

The **GX-4S□** uses a robust stainless steel enclosure. The tightening torque can be 0.58 N·m or less. (2 times compared with conventional models)

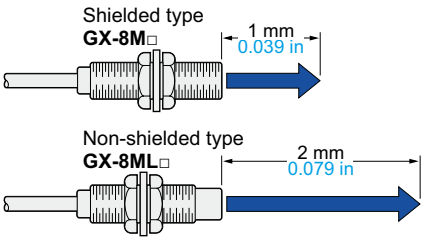
Tightening torque: **0.58 N·m or less**



BASIC PERFORMANCE

Long sensing range GX-8ML□

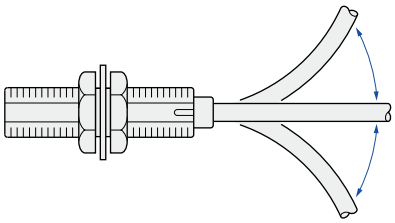
The non-shielded type (**GX-8ML□**) has twice the sensing range of the shielded type (**GX-8M□**), although having the same size. Hence, it allows margin against sensing distance variations.



ENVIRONMENTAL RESISTANCE

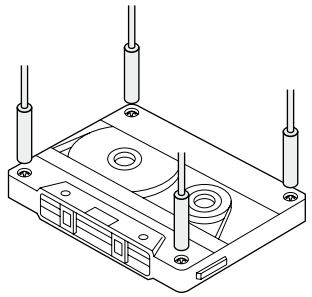
Ten times greater bending durability (Compared with conventional models) GX-□-R

The bending durability of the cable to repeated bending has been increased tenfold by using special alloy cores for the cable.

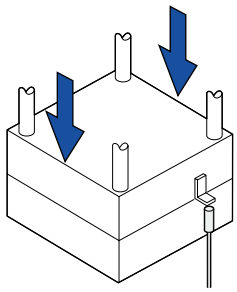


APPLICATIONS

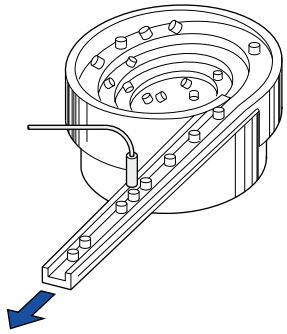
Sensing screws on cassette



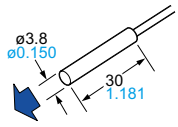
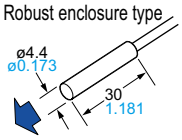
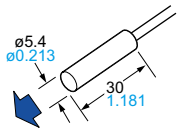
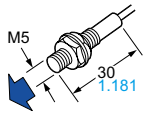
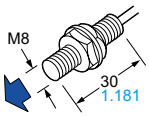
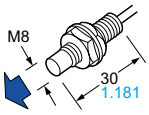
Sensing the punch of a die



Counting parts



ORDER GUIDE

Type		Appearance (mm in)	Sensing range (Note)	Model No.	Supply voltage	Output	Output operation
Shielded type	Non-threaded type		Maximum operation distance 0.8 mm 0.031 in (0 to 0.6 mm 0 to 0.024 in) Stable sensing range	GX-3S	12 to 24 V DC ±10 %	NPN open-collector transistor	Normally open
				GX-3SB			Normally closed
		Robust enclosure type 	0.8 mm 0.031 in (0 to 0.6 mm 0 to 0.024 in)	GX-4S			Normally open
				GX-4SB			Normally closed
			1 mm 0.039 in (0 to 0.8 mm 0 to 0.031 in)	GX-5S	10 to 30 V DC		Normally open
				GX-5SB			Normally closed
	Threaded type		0.8 mm 0.031 in (0 to 0.6 mm 0 to 0.024 in)	GX-5M	12 to 24 V DC ±10 %		Normally open
				GX-5MB			Normally closed
			1 mm 0.039 in (0 to 0.8 mm 0 to 0.031 in)	GX-8M	10 to 30 V DC		Normally open
				GX-8MB			Normally closed
Non-shielded type			2 mm 0.079 in (0 to 1.6 mm 0 to 0.063 in)	GX-8ML			Normally open
				GX-8MLB			Normally closed

Note: The maximum operation distance stands for the maximum distance for which the sensor can detect the standard sensing object.
The stable sensing range stands for the sensing range for which the sensor can stably detect the standard sensing object even if there is an ambient temperature drift and/or supply voltage fluctuation.

ORDER GUIDE

Bending-resistant cable type

Bending-resistant cable type is also available for shielded type.
When ordering this type, suffix "**-R**" to the model No.
(e.g.) Bending-resistant cable type of **GX-3S** is "**GX-3S-R**".

5 m 16.404 ft cable length type

5 m 16.404 ft cable length type (standard: 3 m 9.843 ft) is also available. (excluding **GX-4SB**)
When ordering this type, suffix "**-C5**" to the model No.
(e.g.) 5 m 16.404 ft cable length type of **GX-3S** is "**GX-3S-C5**".

Refer to table below for 5 m 16.404 ft cable length type of bending-resistant cable type sensor.

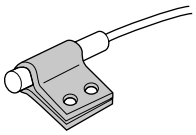
• **Table of model Nos.**

Type		Standard	Bending-resistant cable of 5 m 16.404 ft cable length type
Shielded type	Non-threaded type	**GX-3S**	**GX-3S-R-C5**
		GX-3SB	**GX-3SB-R-C5**
		GX-4S	**GX-4S-R-C5**
		GX-4SB	———
		GX-5S	**GX-5S-R-C5**
		GX-5SB	———
	Threaded type	**GX-5M**	**GX-5M-R-C5**
		GX-5MB	———
		GX-8M	**GX-8M-R-C5**
		GX-8MB	**GX-8MB-R-C5**

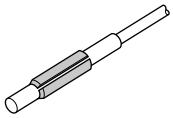
Accessories

• **MS-SS3** (Sensor mounting bracket for **GX-3S** type)
• **MS-SS3-2** (C bracket for **GX-3S** type)
• **MS-SS5** (Sensor mounting bracket for **GX-5S** type)

• **MS-SS3**
• **MS-SS5**



• **MS-SS3-2**



By using the C bracket, the applicable tightening force can be doubled.

SPECIFICATIONS

Non-threaded type

Item / Type	Shielded type											
			Bending-resistant cable				Bending-resistant cable				Bending-resistant cable	
Model No.	GX-3S	GX-3SB	GX-3S-R	GX-3SB-R	GX-4S	GX-4SB	GX-4S-R	GX-4SB-R	GX-5S	GX-5SB	GX-5S-R	GX-5SB-R
CE marking directive compliance	EMC Directive, RoHS Directive											
Max. operation distance (Note 2)	0.8 mm 0.031 in ±15 %								1 mm 0.039 in ±15 %			
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			
Standard sensing object	Iron sheet 5 × 5 × t 1 mm 0.197 × 0.197 × t 0.039 in								Iron sheet 6 × 6 × t 1 mm 0.236 × 0.236 × t 0.039 in			
Hysteresis	15 % or less of operation distance (with standard sensing object)											
Repeatability	20 µm 0.787 mil or less								8 µm 0.315 mil or less			
Supply voltage	12 to 24 V DC ±10 % Ripple P-P 10 % or less								10 to 30 V DC Ripple P-P 10 % or less			
Current consumption	15 mA or less											
Output	NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 0.4 V or less (at 50 mA sink current)								NPN open-collector transistor • Maximum sink current: 200 mA (Note 3) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 200 mA sink current) 0.4 V or less (at 50 mA sink current)			
Output – Utilization category	DC-12 or DC-13											
Output – Output operation	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed
Output – Short-circuit protection	———								Incorporated			
Max. response frequency	1 kHz								1.5 kHz			
Operation indicator	Red LED (lights up when the output is ON)											
Environmental resistance – Pollution degree	3 (Industrial environment)											
Environmental resistance – Protection	IP67 (IEC)											
Environmental resistance – Ambient temperature	–25 to +70 °C –13 to +158 °F, Storage: –25 to +80 °C –13 to +176 °F											
Environmental resistance – Ambient humidity	35 to 95 % RH, Storage: 35 to 95 % RH								35 to 85 % RH, Storage: 35 to 95 % RH			
Environmental resistance – Voltage withstandability	500 V AC for one min. between all supply terminals connected together and enclosure											
Environmental resistance – Insulation resistance	5 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure								50 MΩ, or more, with 500 V DC megger between all supply terminals connected together and enclosure			
Environmental resistance – 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											
Environmental resistance – Shock resistance	200 m/s² acceleration (20 G approx.) in X, Y and Z directions ten times each								300 m/s² acceleration (30 G approx.) in X, Y and Z directions ten times each			
Sensing range variation – Temperature characteristics	Over ambient temperature range –25 to +70 °C –13 to +158 °F: Within ±20 % of sensing range at +20 °C +68 °F								Over ambient temperature range –25 to +70 °C –13 to +158 °F: Within ±15 % of sensing range at +20 °C +68 °F			
Sensing range variation – Voltage characteristics	Within ±2 % for ±10 % fluctuation of the supply voltage								Within ±2.5 % for ±15 % fluctuation of the supply voltage			
Material	Enclosure: Stainless steel (SUS304), Resin part: TPX								Enclosure: Brass (Nickel plated) Resin part: ABS			
Cable	0.08 mm² 3-core oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long		0.1 mm² 3-core bending, oil and heat resistant cabtyre cable, 3 m 9.843 ft long		0.08 mm² 3-core oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long		0.1 mm² 3-core bending, oil and heat resistant cabtyre cable, 3 m 9.843 ft long		0.14 mm² 3-core oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long		0.15 mm² 3-core bending, oil and heat resistant cabtyre cable, 3 m 9.843 ft long	
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable.											
Weight	Net weight: 30 g approx.								Net weight: 55 g approx.			
Accessories	**MS-SS3** (Sensor mounting bracket): 1 pc. **MS-SS3-2** (C bracket): 1 pc.				———				**MS-SS5** (Sensor mounting bracket): 1 pc.			

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 maximum operation distance stands for the maximum distance for which the sensor can detect the standard sensing object.
The stable sensing range stands for the sensing range for which the sensor can stably detect the standard sensing object even if there is an ambient temperature drift and/or supply voltage fluctuation.
3) The maximum sink current varies depending on the ambient temperature. Refer to "**I/O CIRCUIT AND WIRING DIAGRAMS** (p.846)" for details.

SPECIFICATIONS

Threaded type

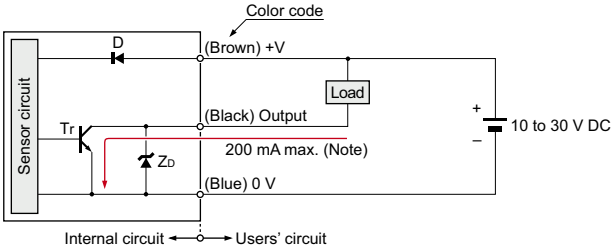
Item \ Type	Shielded type								Non-shielded type	
			Bending-resistant cable				Bending-resistant cable			
Model No.	GX-5M	GX-5MB	GX-5M-R	GX-5MB-R	GX-8M	GX-8MB	GX-8M-R	GX-8MB-R	GX-8ML	GX-8MLB
CE marking directive compliance	EMC Directive, RoHS Directive									
Max. operation distance (Note 2)	0.8 mm 0.031 in ±15 %				1 mm 0.039 in ±15 %				2 mm 0.079 in ±15 %	
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 1.6 mm 0 to 0.063 in	
Standard sensing object	Iron sheet 5 × 5 × t 1 mm 0.197 × 0.197 × t 0.039 in				Iron sheet 8 × 8 × t 1 mm 0.315 × 0.315 × t 0.039 in				Iron sheet 12 × 12 × t 1 mm 0.472 × 0.472 × t 0.039 in	
Hysteresis	15 % or less of operation distance (with standard sensing object)				10 % or less of operation distance (with standard sensing object)					
Repeatability	20 µm 0.787 mil or less				8 µm 0.315 mil or less				40 µm 1.575 mil or less	
Supply voltage	12 to 24 V DC ±10 % Ripple P-P 10 % or less				10 to 30 V DC Ripple P-P 10 % or less					
Current consumption	15 mA or less									
Output	NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0V) • Residual voltage: 0.4 V or less (at 50 mA sink current)				NPN open-collector transistor • Maximum sink current: 200 mA (Note 3) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 200 mA sink current) 0.4 V or less (at 50 mA sink current)					
Output – Utilization category	DC-12 or DC-13									
Output – Output operation	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed	Normally open	Normally closed
Output – Short-circuit protection	———				Incorporated					
Max. response frequency	1 kHz								500 Hz	
Operation indicator	Red LED (lights up when the output is ON)									
Environmental resistance – Pollution degree	3 (Industrial environment)									
Environmental resistance – Protection	IP67 (IEC)									
Environmental resistance – Ambient temperature	– 25 to +70 °C –13 to +158 °F, Storage: – 25 to +80 °C – 13 to +176 °F									
Environmental resistance – Ambient humidity	35 to 95 % RH, Storage: 35 to 95 % RH				35 to 85 % RH, Storage: 35 to 95 % RH					
Environmental resistance – Voltage withstandability	500 V AC for one min. between all supply terminals connected together and enclosure									
Environmental resistance – Insulation resistance	5 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure				50 MΩ, or more, with 500 V DC megger between all supply terminals connected together and enclosure					
Environmental resistance – 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									
Environmental resistance – Shock resistance	200 m/s² acceleration (20 G approx.) in X, Y and Z directions ten times each				300 m/s² acceleration (30 G approx.) in X, Y and Z directions ten times each				300 m/s² acceleration (30 G approx.) in X, Y and Z directions three times each	
Sensing range variation – Temperature characteristics	Over ambient temperature range – 25 to +70 °C –13 to +158 °F: Within ±20 % of sensing range at +20 °C +68 °F				Over ambient temperature range –25 to +70 °C –13 to +158 °F: Within $^{+15}_{-10}$ % of sensing range at +20 °C +68 °F					
Sensing range variation – Voltage characteristics	Within ±2 % for ±10 % fluctuation of the supply voltage				Within ±2.5 % for ±15 % fluctuation of the supply voltage					
Material	Enclosure: Brass (Nickel plated) Resin part: TPX				Enclosure: Brass (Nickel plated) Resin part: ABS					
Cable	0.08 mm² 3-core oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long		0.1 mm² 3-core bending, oil and heat resistant cabtyre cable, 3 m 9.843 ft long		0.14 mm² 3-core oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long		0.15 mm² 3-core bending, oil and heat resistant cabtyre cable, 3 m 9.843 ft long		0.14 mm² 3-core, oil, heat and cold resistant cabtyre cable, 3 m 9.843 ft long	
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable.								Extension up to total 100 m 328.084 ft is possible with 0.14 mm², or more, cable.	
Weight (Note 4)	Net weight: 30 g approx.				Net weight: 60 g approx.					
Accessories	Nut: 2 pcs. Toothed lock washer: 1 pc.		Nut: 2 pcs. Toothed lock washer: 2 pcs.		Nut: 2 pcs. Toothed lock washer: 1 pc.		Nut: 2 pcs. Toothed lock washer: 2 pcs.		Nut: 2 pcs. Toothed lock washer: 1 pc.	

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 maximum operation distance stands for the maximum distance for which the sensor can detect the standard sensing object.
The stable sensing range stands for the sensing range for which the sensor can stably detect the standard sensing object even if there is an ambient temperature drift and/or supply voltage fluctuation.
3) The maximum sink current varies depending on the ambient temperature. Refer to "**I/O CIRCUIT AND WIRING DIAGRAMS** (p.846)" for details.
4) The given weight of the threaded type includes the weight of nuts and toothed lock washers.

I/O CIRCUIT AND WIRING DIAGRAMS

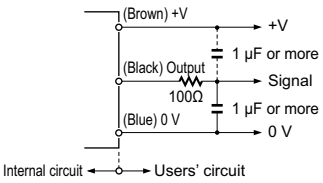
GX-5S□ GX-8M□ GX-8ML□

I/O circuit diagram



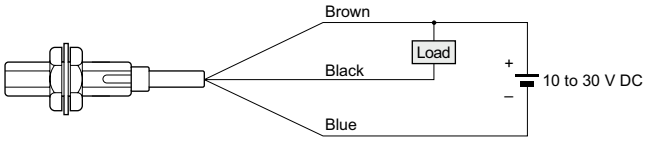
Symbols … D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

- If a capacitor of 1 μF or more is connected between 0 V and output or between +V and output, connect a 100 Ω resistor in series as shown below.

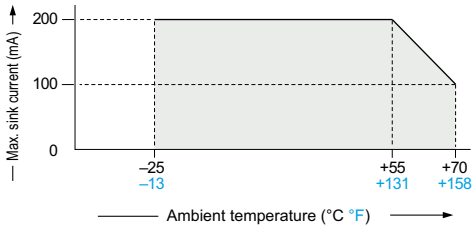


Without the resistor, the short-circuit protection is activated by the charge or discharge current of the capacitor, so that it results in delaying the response whenever the sensor switches. The connected resistor solves this problem.

Wiring diagram

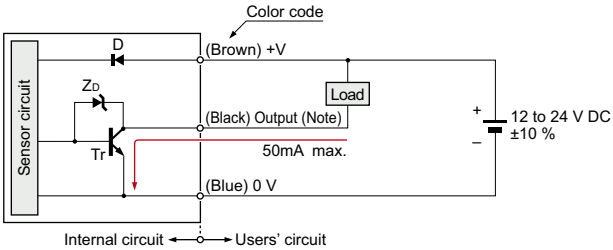


Note: The maximum sink current varies depending on the ambient temperature.



GX-3S□ GX-4S□ GX-5M□

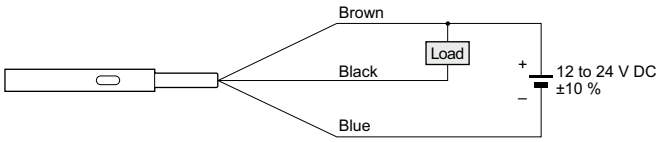
I/O circuit diagram



Note: **GX-3S□**, **GX-4S□** and **GX-5M□** do not incorporate a short-circuit protection circuit at the output. Do not connect them directly to a power supply or a capacitive load.

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

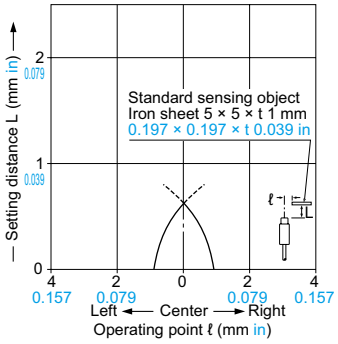
Wiring diagram



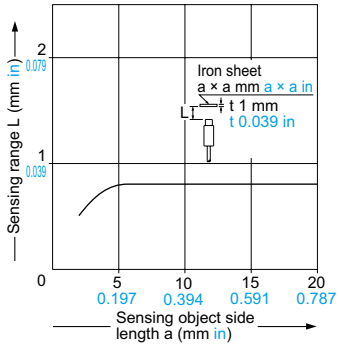
SENSING CHARACTERISTICS (TYPICAL)

GX-3S□ GX-4S□ GX-5M□

Sensing field



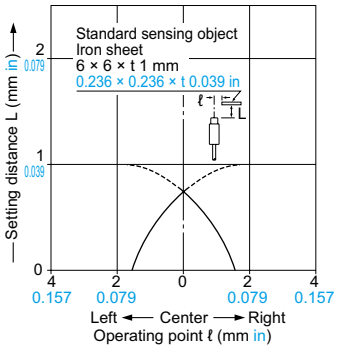
Correlation between sensing object size and sensing range



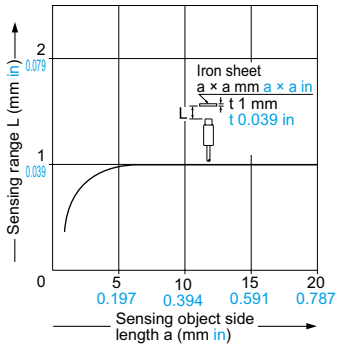
As the sensing object size becomes smaller than the standard size (iron sheet 5 × 5 × t 1 mm 0.197 × 0.197 × t 0.039 in), the sensing range shortens as shown in the left figure.

GX-5S□

Sensing field



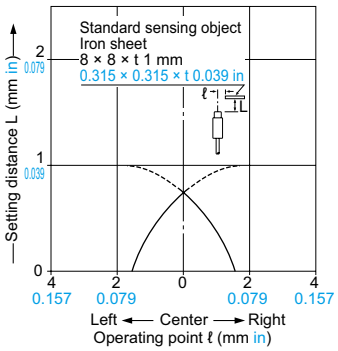
Correlation between sensing object size and sensing range



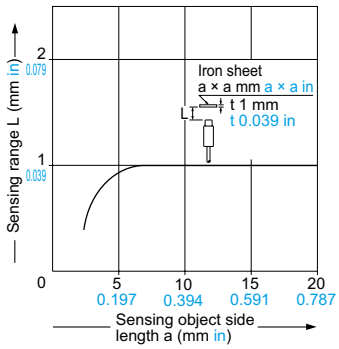
As the sensing object size becomes smaller than the standard size (iron sheet 6 × 6 × t 1 mm 0.236 × 0.236 × t 0.039 in), the sensing range shortens as shown in the left figure.

GX-8M□

Sensing field



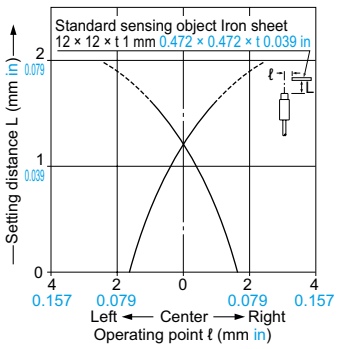
Correlation between sensing object size and sensing range



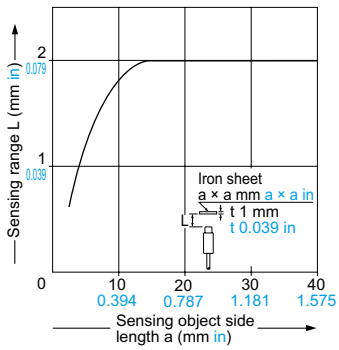
As the sensing object size becomes smaller than the standard size (iron sheet 8 × 8 × t 1 mm 0.315 × 0.315 × t 0.039 in), the sensing range shortens as shown in the left figure.

GX-8ML□

Sensing field



Correlation between sensing object size and sensing range



As the sensing object size becomes smaller than the standard size (iron sheet 12 × 12 × t 1 mm 0.472 × 0.472 × t 0.039 in), the sensing range shortens as shown in the left figure.

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.

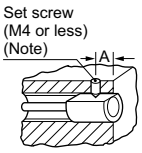
Mounting

- The tightening torque should be as given below.

Mounting with set screw

<Shielded of threaded type>

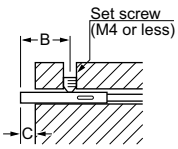
- Tighten the set screw on the flat surface of the sensor without applying excessive force. Make sure to use a set screw with a cup-point end.



Note: To fasten **GX-5M□**, use a M3 or less set screw.

Model No.	Set screw tightening position A (mm in)	Tightening torque
GX-5M□	5 to 10 0.197 to 0.394	0.29 N·m
GX-8M□	8 to 22 0.315 to 0.866	0.29 N·m

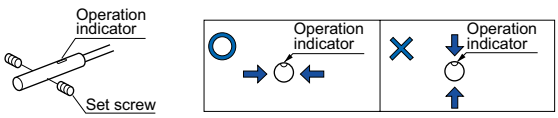
<Non-threaded type and non-shielded of threaded type>



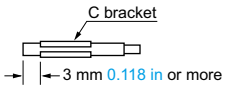
Model No.	B (mm in)	C (mm in)	Tightening torque
GX-3S□	5 to 10 0.197 to 0.394	3 0.118	0.29 N·m
When using the C bracket			0.58 N·m
GX-4S□	5 to 10 0.197 to 0.394	3 0.118	0.58 N·m
GX-5S□	8 to 20 0.315 to 0.787	5 0.197	0.29 N·m
GX-8ML□	13 to 22 0.517 to 0.866	10 0.394	0.29 N·m

Note: The protrusion should be kept C (mm in) or more to avoid reduction of sensing range.

- To fasten **GX-3S□** and **GX-4S□**, use a M3 or less set screw and tighten it from a direction perpendicular to the operation indicator.



- When using the C bracket, place it on the sensor at a distance of 3 mm 0.118 in or more from the sensor end.

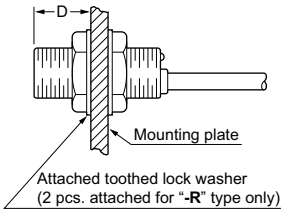


- To fasten the non-shielded threaded type, tighten the set screw on the flat surface of the sensor.

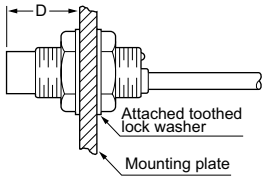
Mounting with nut

- Note that the maximum tightening torque differs according to the location of the nuts.

<Shielded of threaded type>



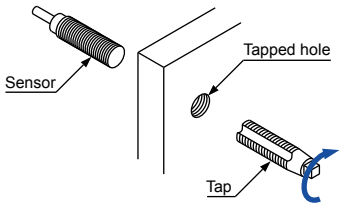
<Non-shielded of threaded type>



Model No.	D (mm in)	Tightening torque
GX-5M□	2 to 3 0.079 to 0.118	0.49 N·m
	3 0.118 or more	1.47 N·m
GX-8M□	3 to 11 0.118 to 0.433	1.47 N·m
	11 0.433 or more	3.43 N·m
GX-8ML□	9 to 11 0.345 to 0.433	0.98 N·m
	11 0.433 or more	3.43 N·m

Note: Mount such that the nuts do not protrude from the threaded portion.

- The root truncation of the threads with **GX-8M□** and **GX-8ML□** is shallow owing to strengthening of the sensors against tightening.
  When tapped hole on equipment to fix the sensors, the prepared hole must be ø7.2 mm ø0.283 in or more.



PRECAUTIONS FOR PROPER USE

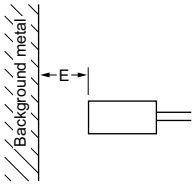
Refer to p.1579~ for general precautions.

Distance from surrounding metal

- As metal around the sensor may affect the sensing performance, pay attention to the following points.

Influence of surrounding metal

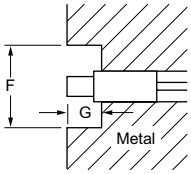
- The surrounding metal will affect the sensing performance. Keep the minimum distance specified in the table below.



Model No.	E (mm in)
GX-3S□	3 0.118
GX-4S□	3 0.118
GX-5S□	4 0.157
GX-5M□	3 0.118
GX-8M□	4 0.157
GX-8ML□	8 0.315

Embedding of the sensor in metal

- Sensing range may decrease if the sensor is completely embedded in metal. Especially for the non-threaded type and the non-shielded type, keep the minimum distance specified in the table below.

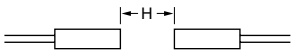


Model No.	F (mm in)	G (mm in)
GX-3S□	ø12 ø0.472	3 0.118
GX-4S□	ø12 ø0.472	3 0.118
GX-5S□	ø15.4 ø0.606	5 0.197
GX-8ML□	ø30 ø1.181	10 0.394

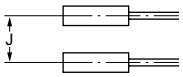
Mutual interference

- 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.	H (mm in)	J (mm in)
GX-3S□	16 0.630	16 0.630
GX-4S□	16 0.630	16 0.630
GX-5S□	20 0.787	15 0.591
GX-5M□	10 0.394	10 0.394
GX-8M□	20 0.787	15 0.591
GX-8ML□	50 1.969	30 1.181

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	GX-3S□ GX-4S□	GX-5M□	GX-5S□ GX-8M□ GX-8ML□
Iron	1	1	1
Stainless steel (SUS304)	0.65 approx.	0.83 approx.	0.7 approx.
Brass	0.36 approx.	0.61 approx.	0.4 approx.
Aluminum	0.30 approx.	0.58 approx.	0.35 approx.

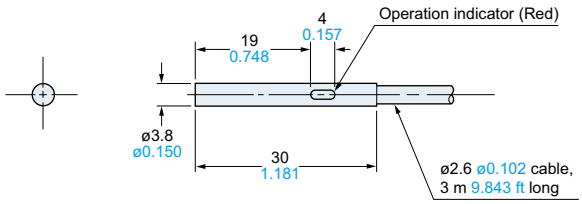
Others

- Do not use during the initial transient time (10 ms) after the power supply is switched on.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
- **GX-3S□**, **GX-4S□** and **GX-5M□** do not incorporate a short-circuit protection circuit at the output. Do not connect them directly to a power supply or a capacitive load.

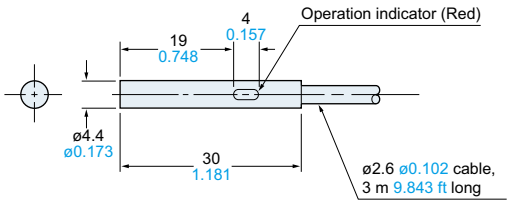
DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

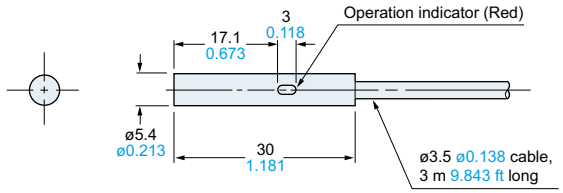
GX-3S□ Sensor



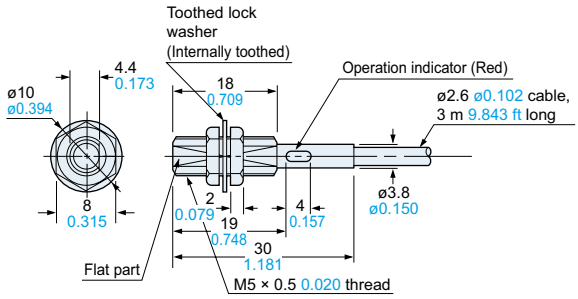
GX-4S□ Sensor



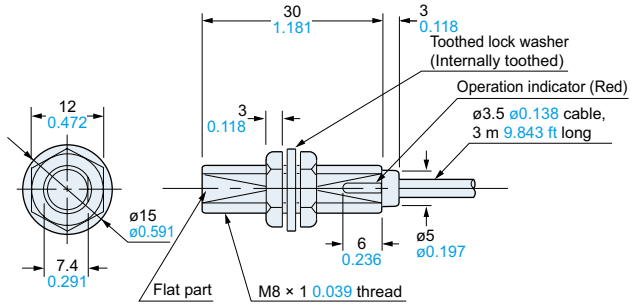
GX-5S□ Sensor



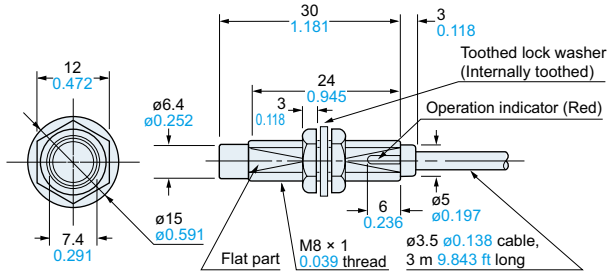
GX-5M□ Sensor



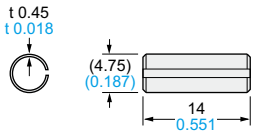
GX-8M□ Sensor



GX-8ML□ Sensor



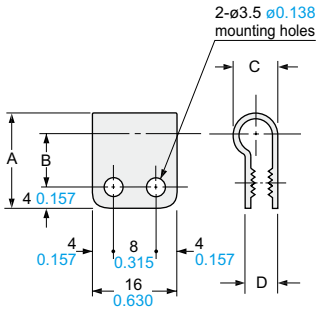
MS-SS3-2 C bracket for GX-3S□ (Accessory for GX-3S□)



Note: By using the C bracket, the applicable tightening force can be doubled.

MS-SS3 / MS-SS5

Sensor mounting bracket for GX-3S□ (Accessory for GX-3S□)
Sensor mounting bracket for GX-5S□ (Accessory for GX-5S□)



Symbols \ Model No.	MS-SS3	MS-SS5
A	16 0.630	18 0.709
B	9 0.354	10 0.394
C	6.3 0.248	8.3 0.327
D	4.9 0.193	6.1 0.240
Applicable model No.	GX-3S□	GX-5S□

Material: Nylon 66