# Digital Laser Sensor Amplifier-separated
# LS-500 SERIES

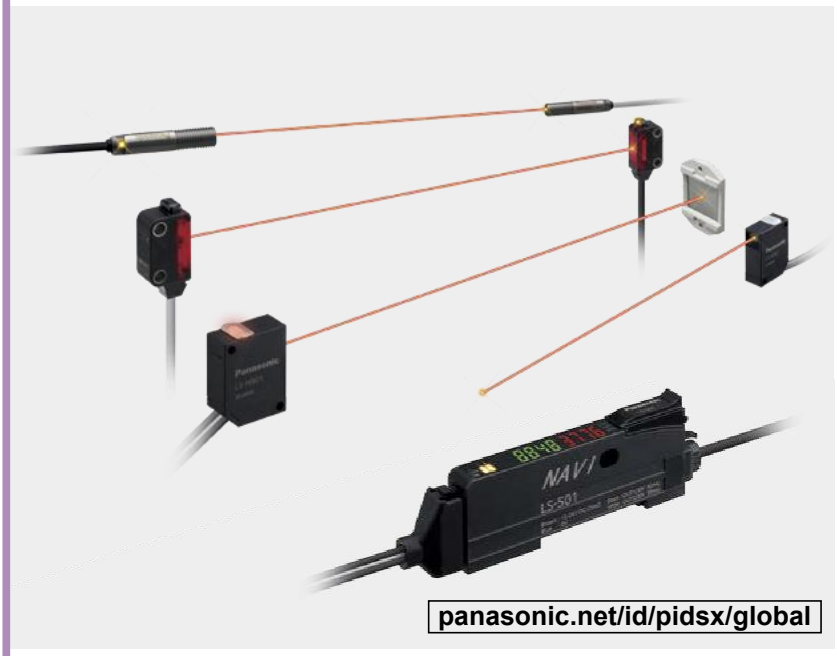

FIBER SENSORS
LASER SENSORS
PHOTOELECTRIC SENSORS
MICRO PHOTOELECTRIC SENSORS
AREA SENSORS
SAFETY LIGHT CURTAINS / SAFETY COMPONENTS
PRESSURE / FLOW SENSORS
INDUCTIVE PROXIMITY SENSORS
PARTICULAR USE SENSORS
SENSOR OPTIONS
SIMPLE WIRE-SAVING UNITS
WIRE-SAVING SYSTEMS
MEASUREMENT SENSORS
STATIC CONTROL DEVICES
LASER MARKERS
PLC
HUMAN MACHINE INTERFACES
ENERGY MANAGEMENT SOLUTIONS
FA COMPONENTS
MACHINE VISION SYSTEMS
UV CURING SYSTEMS

Selection Guide
Amplifier Built-in
Amplifier-separated

LS-500
LS-400



Related Information
■ General terms and conditions..... F-3
■ SC-GU3 ..... P.971~
■ About laser beam..... P.1593~
■ Selection guide..... P.169~
■ Glossary of terms / General precautions.....P.1549~ / P.1552~


panasonic.net/id/pidsx/global

CE

FDA Conforming to FDA regulations

This product is classified as a Class 1 Laser Product in IEC / JIS standards and in FDA* regulations. Do not look at the laser beam through optical system such as a lens.

*This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration).

Self-diagnosis | Test input | PNP output type available | Timer

Light intensity monitor | Interference prevention sensitivity setting | Automatic setting

## Industry's smallest*

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

## Industry's smallest* + Stainless steel (SUS) enclosure

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

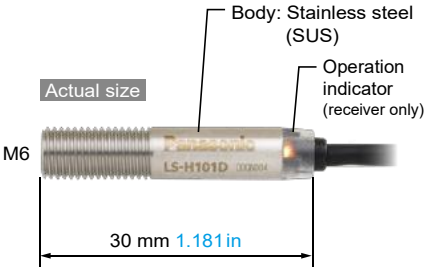
**LS-H101**

### Stainless steel (SUS) body

Featuring stainless steel (SUS) enclosure that won't break when bumped during installation or maintenance.

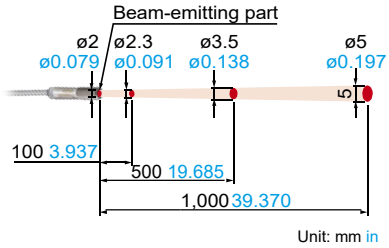
### One-point M6 installation

The **LS-H101** features an easy-to-install design.




### 1 m 3.281 ft sensing range

(In STD amplifier response time mode)




Unit: mm in

## Industry's smallest* + IP67

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

**LS-H102**

### Waterproof IP67

Featuring waterproof IP67 to allow use in the presence of large amounts of water or dust.

### Simple positioning

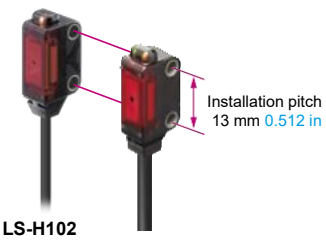
Check the optimal receiving location at a glance while watching the red spot on the beam axis adjustment screen.

### 1 m 3.281 ft sensing range (In STD amplifier response time mode)

The **LS-H102** delivers sufficient sensing range for use with 450 mm 17.717 in wafers.

### Two-point installation

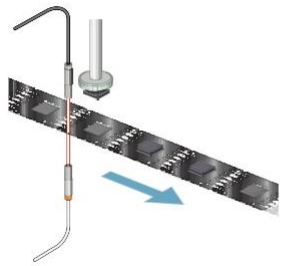
The thru-beam type **LS-H102** features the same form as the **EX-L200** amplifier built-in ultra-compact laser sensor. And it can be used as an **EX-L200** with a digital indicator.



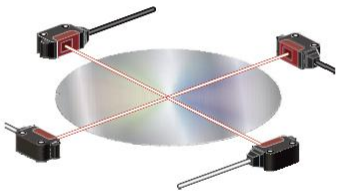

**EX-L211 / EX-L212**
Same installation pitch as the **EX-L200** series

## APPLICATIONS

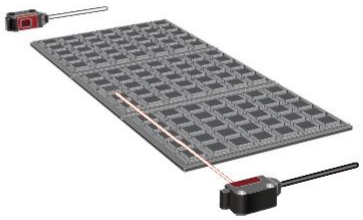
### Lead frame position detection



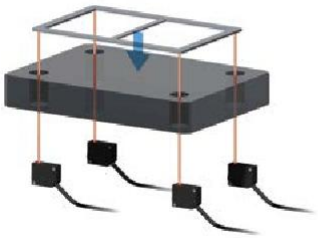
### Wafer inclination detection



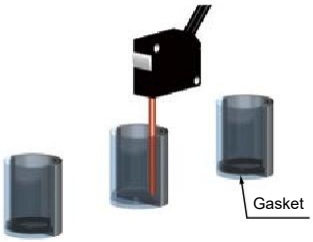
### IC float detection



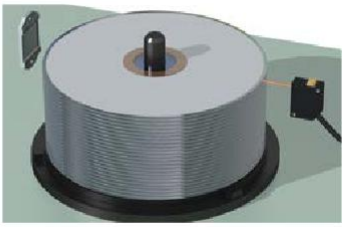
### Detection of workpieces through a workbench



### Detection of gaskets in caps




### Detection of the top of DVDs, substrate, etc.



## Industry's smallest* + Thinnest profile

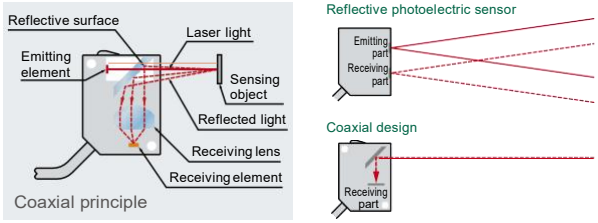
*Amplifier-separated type laser sensor head as of September 2014, in-company survey **LS-H201**

### Featuring a 60% smaller design (by volume) than previous coaxial reflective models

Our smallest unit is smaller in every dimension at just W8 × H23 × D18 mm W0.315 × H0.906 × D0.709 in (excluding indicators).

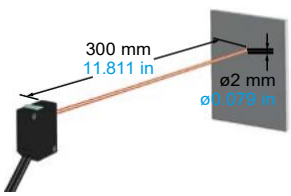

### Coaxial design

By using a laser with high linearity in a coaxial design, the **LS-H201** is able to deliver stable sensing in confined spaces as well as simple installation.




### Small, long-range spot

The **LS-H201** produces a spot with a diameter of 2 mm 0.079 in at a sensing range of up to 300 mm 11.811 in (in STD amplifier response time mode).




### Easy-to-see operation indicator

The **LS-H201**'s operation indicator is visible from all directions.

## Industry's smallest* + Horizontal symmetry

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

LS-H901

### Horizontal symmetry

Featuring a simple system design process thanks to a light source that is placed in the center of the sensor head and a coaxial design.

### Industry's smallest* and thinnest design

The **LS-H901** is even thinner than previous models, measuring just W8 × H23 (excluding indicators) × D18 mm W0.315 × H0.906 × D0.709 in.

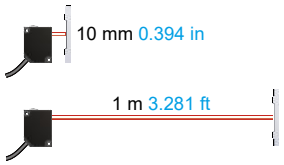

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

### Sensing range of 10 mm to 1 m

0.394 in to 3.281 ft

(In STD amplifier response time mode)

The **LS-H901** supports close-range sensing



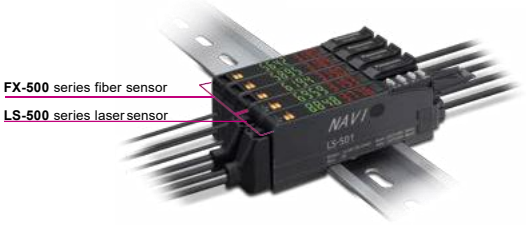

## Among industry's fastest response times* 60 µs

*Amplifier-separated type laser sensor head as of September 2014, in-company survey

LS-501□

### Maximum compatibility with fiber sensors

The **LS-500** series features the same operation, menu displays, and form factor as the **FX-500** series for increased compatibility with fiber sensors.




### Detection of beam axis misalignment
### Dual outputs (self-diagnosis output)

The **LS-500** series can detect any reduction in incident light intensity, for example due to the accumulation of dirt such as dust, and issue an alarm. Sensing output 2 can be set as self-diagnosis output. When you teach the threshold for sensing output 1, sensing output 2 is set accordingly, allowing you to shift the threshold by a previously set margin.

### Stable sensing over the long term

The **LS-500**'s threshold-tracking function helps maintain stable sensing over the long term and reduce maintenance man-hours. The incident light intensity can be checked and the threshold automatically reset at a user-selected interval to track changes in light intensity due to environmental changes (such as dust, etc.) over extended periods of time.

### Logic operations

The **LS-500**'s ability to perform three logic operations (AND, OR, and XOR) on a standalone basis eliminates the need for a dedicated controller, cuts down on wiring, and lowers costs. This functionality can also be combined with the **FX-500** series.

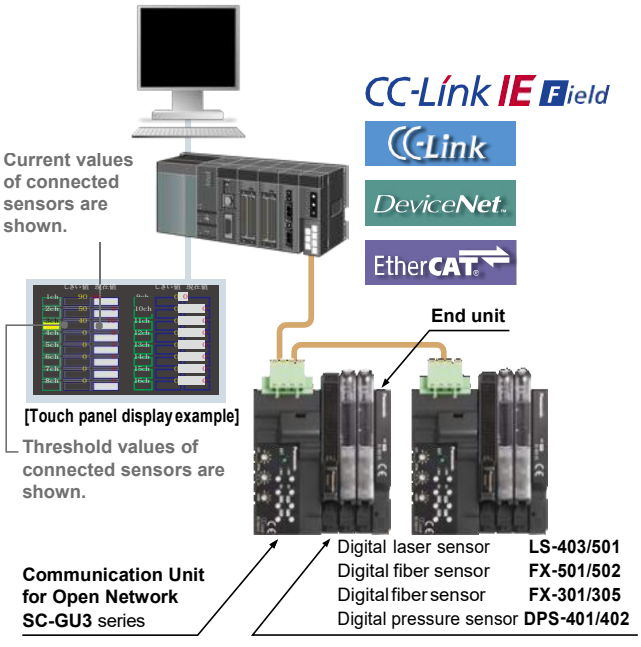
### Data bank

Eight sets of amplifier settings can be stored in the unit's built-in memory. The ability to save and load settings reduces workload when changing the setup in a multi-model production environment.

## Network communication possible

LS-501

Can connect to Open Network CC-Link IE Field / CC-Link / DeviceNet / EtherCAT via Communication Unit for Open Network **SC-GU3** series. Monitoring and various settings can be done from PLC, PC, etc.

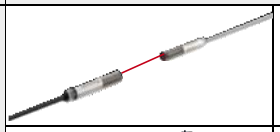
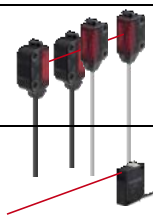
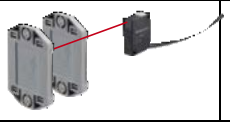



*CC-Link and CC-Link IE Field are a registered trademark of Mitsubishi Electric Corporation.
DeviceNet is a registered trademark of ODVA (Open DeviceNet Vender Association, Inc.).
EtherCAT is a registered trademark of Beckhoff Automation GmbH.

*Refer to p.971~ for details of **SC-GU3** series.

# ORDER GUIDE

## Sensor heads

| Type | Appearance | Model No. | Sensing range<br>○: HYPR ○: U-LG ○: LONG ○: STD ○: FAST ○: H-SP |
|---|---|---|---|
| Thru-beam type Cylindrical |  | **LS-H101** | 1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft |
| Thru-beam type Square |  | **LS-H102** | 1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft<br>1 m 3.281 ft |
| Coaxial reflective type |  | **LS-H201** | 750 mm 29.528 in<br>600 mm 23.622 in<br>450 mm 17.717 in<br>300 mm 11.811 in<br>200 mm 7.874 in<br>150 mm 5.906 in |
| Coaxial retroreflective type |  | **LS-H901** | 0.01 to 2.5 m 0.033 to 8.202 ft<br>0.01 to 2 m 0.033 to 6.562 ft<br>0.01 to 1.5m 0.033 to 4.921 ft<br>0.01 to 1m 0.033 to 3.281 ft<br>0.01 to 1m 0.033 to 3.281 ft<br>0.01 to 1m 0.033 to 3.281 ft |

### 5 m 16.404 ft cable length type

5 m 16.404 ft cable length types (Standard: 2 m 6.562 ft) are available. When ordering this type, suffix "**-C5**" to the model No.

**LS-H101-C5** **LS-H102-C5** **LS-H201-C5** **LS-H901-C5**

### Package without reflector

The **LS-H901** is also available without a reflector (**RF-330**).
When ordering this type, suffix "**-Y**" to the model No.

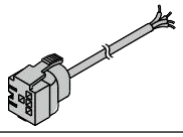
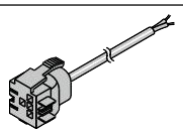
**LS-H901-Y**

## Amplifiers

| Type | Appearance | Model No. | Output | Connection method |
|---|---|---|---|---|
| Connector type |  | **LS-501** | NPN open-collector transistor two outputs | Use quick-connection cable (optional) |
| | | **LS-501P** | PNP open-collector transistor two outputs | |
| Cable type (With external input) |  | **LS-501-C2** | NPN open-collector transistor two outputs | 2 m 6.562 ft cabtyre cable (6-core) included<br>Cable outer diameter: ø4 mm ø0.157 in |
| | | **LS-501P-C2** | PNP open-collector transistor two outputs | |

## Quick-connection cables

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

| Type | Appearance | Model No. | Description | |
|---|---|---|---|---|
| Main cable (4-core) |  | **CN-74-C1** | Length: 1 m 3.281 ft | 0.2 mm² 4-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.3 mm ø0.130 in |
| | | **CN-74-C2** | Length: 2 m 6.562 ft | |
| | | **CN-74-C5** | Length: 5 m 16.404 ft | |
| Sub cable (2-core) |  | **CN-72-C1** | Length: 1 m 3.281 ft | 0.2 mm² 2-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.3 mm ø0.130 in<br>Connectable to a main cable up to 15 cables |
| | | **CN-72-C2** | Length: 2 m 6.562 ft | |
| | | **CN-72-C5** | Length: 5 m 16.404 ft | |

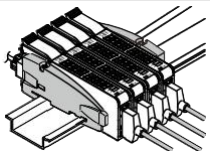
## Connector

| Type | Appearance | Model No. | Description |
|---|---|---|---|
| Connector for amplifier |  | **CN-EP4** | Connector included with sensor head<br>Use for maintenance, for example when another connector is damaged.<br>Five pcs. per set |

# ORDER GUIDE

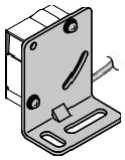
## End plates

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

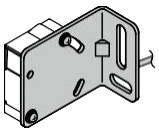
| Appearance | Model No. | Description |
|---|---|---|
|  | **MS-DIN-E** | When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers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

## Accessories

**MS-LS-1** (Sensor head mounting bracket)
For **LS-H201**□ / **LS-H901**□



Foot angled mounting

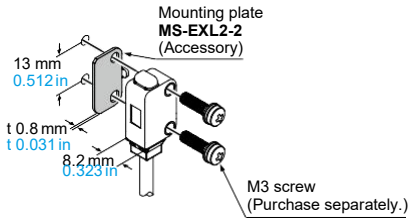


Back angled mounting

Material: Stainless steel (SUS304)
Two M2 (length 12 mm 0.472 in) screws with washers [stainless steel (SUS)] are attached.

**RF-330** (Reflector)

**MS-EXL2-2** (Mounting plate for thru-beam type)



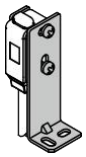

Material: Stainless steel (SUS304)

# OPTIONS

| Designation | Model No. | Description | |
|---|---|---|---|
| Sensor head mounting bracket | **MS-EXL2-1** | For **LS-H102**□ (square side sensing type)<br>Foot angled mounting bracket | |
| | **MS-EXL2-4** | For **LS-H102**□ (square side sensing type)<br>Universal sensor mounting bracket | |
| | **MS-EXL2-5** | For **LS-H102**□ (square side sensing type)<br>Back angled mounting bracket | |
| Amplifier mounting bracket | **MS-DIN-2** | Mounting bracket for amplifier | |
| Amplifier protective seal | **FX-MB1** | 10 sets of 2 communication window seals and 1 connector seal<br>Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier.<br>Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable. | |
| Reflector | **RF-310** | For coaxial retroreflective type<br>Compact reflector | Sensing range:<br>0.01 to 1 m 0.033 to 3.281 ft |
| Reflective tape | **RF-31** | For coaxial retroreflective type<br>Size: 9.2 × 9.2 × t 0.4 mm 0.362 × 0.362 × t 0.016 in | |
| | **RF-33** | For coaxial retroreflective type<br>Size: 25.2 × 27.8 × t 0.4 mm 0.992 × 1.094 × t 0.016 in | Sensing range:<br>Same as the **RF-330**. |

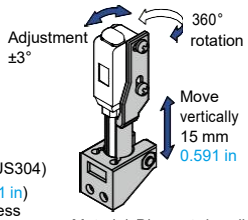
## Sensor head mounting bracket

• **MS-EXL2-1**



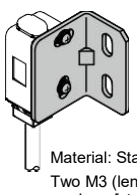
Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)] are attached.

• **MS-EXL2-4**




Material: Die-cast zinc alloy
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)], one M3 (length 10 mm 0.394 in) hexagon-socket-head bolt [stainless steel (SUS)], and one M3 hexagon nut [stainless steel (SUS)] are attached.

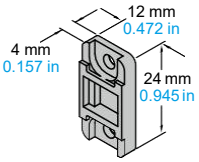
• **MS-EXL2-5**



Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)] are attached.

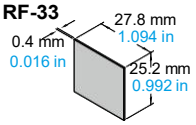
## Reflector

• **RF-310**

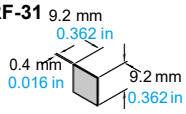



## Reflective tape

• **RF-33**

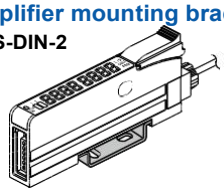



• **RF-31**



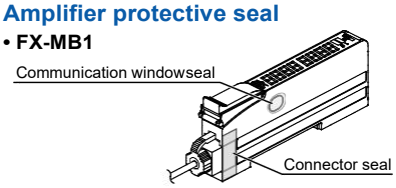

## Amplifier mounting bracket

• **MS-DIN-2**



## Amplifier protective seal

• **FX-MB1**



# SPECIFICATIONS

## Sensor heads

| Item \ Type | | Thru-beam type | | Coaxial reflective type | Coaxial retroreflective type |
|---|---|---|---|---|---|
| | | Cylindrical | Square | | |
| Model No. | | **LS-H101** | **LS-H102** | **LS-H201** | **LS-H901** |
| CE marking directive compliance | | EMC Directive, RoHS Directive | | | |
| Applicable amplifiers | | **LS-501(P)**, **LS-501(P)-C2** (Note 2) | | | |
| Sensing range (Note 3,4) | H-SP | 1 m 3.281 ft | 1 m 3.281 ft | 150 mm 5.906 in | 0.01 to 1 m 0.033 to 3.281 ft |
| | FAST | 1 m 3.281 ft | 1 m 3.281 ft | 200 mm 7.874 in | 0.01 to 1 m 0.033 to 3.281 ft |
| | STD | 1 m 3.281 ft | 1 m 3.281 ft | 300 mm 11.811 in | 0.01 to 1 m 0.033 to 3.281 ft |
| | LONG | 1 m 3.281 ft | 1 m 3.281 ft | 450 mm 17.717 in | 0.01 to 1.5 m 0.033 to 4.921 ft |
| | U-LG | 1 m 3.281 ft | 1 m 3.281 ft | 600 mm 23.622 in | 0.01 to 2 m 0.033 to 6.562 ft |
| | HYPR | 1 m 3.281 ft | 1 m 3.281 ft | 750 mm 29.528 in | 0.01 to 2.5 m 0.033 to 8.202 ft |
| Spot size | | ø5 mm ø0.197 in approx. or less (at a distance from the emitter of 1 m 3.281 ft) | ø5 mm ø0.197 in approx. or less (at a distance from the emitter of 1 m 3.281 ft) | ø2 mm ø0.079 in approx. or less (at a distance from the sensor head of 300 mm 11.811 in) | ø6 mm ø0.236 in approx. or less (at a distance from the sensor head of 1 m 3.281 ft) |
| Sensing object | | Opaque, translucent, or transparent object (Note 5) | | | |
| Operation indicator | | Orange LED (lights up when the amplifier output is ON) | | | |
| Environmental resistance | Protection | IP40 (IEC) | IP67 (IEC) | IP40 (IEC) | IP40 (IEC) |
| | Ambient temperature | –10 to +55 °C +14 to +131 °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 | | | |
| | Ambient illuminance | Incandescent light: 3,000 ℓx or less at the light-receiving face | | | |
| | 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 500 Hz frequency, 1.5 mm 0.059 in double amplitude in X, Y and Z directions for two hours each | | | |
| | Shock resistance | 100 m/s² acceleration (10 G approx.) in X, Y and Z directions three times each | | | |
| Emitting element | Type | Red semiconductor laser diode | | | |
| | Peak emission wavelength | 660 nm 0.026 mil | | | |
| | Laser class | Class 1 [IEC / JIS / FDA (Note 6)] | | | |
| | Max. output | 2 mW | 2 mW | 2 mW | 1 mW |
| Material | | Enclosure: Stainless steel (SUS303)<br>Cover: Polycarbonate | Enclosure: PBT<br>Cover: Acrylic | Enclosure: PBT, Indicator cover: Polycarbonate<br>Beam-emitting/receiving surfaces: Glass | |
| Cable | | 0.09 mm² 2-core shielded cable, 2 m 6.562 ft long (Note 7) | | 0.15 mm², 2-core two parallel shielded cables, 2 m 6.562 ft long (Note 7) | |
| Weight | | Net weight: 50 g approx.<br>Gross weight: 75 g approx. | Net weight: 50 g approx.<br>Gross weight: 70 g approx. | Net weight: 50 g approx.<br>Gross weight: 80 g approx. | Net weight: 50 g approx.<br>Gross weight: 85 g approx. |
| Accessories | | M6 screw: 4 pcs.<br>Toothed lock washer: 2 pcs. | **MS-EXL2-2**<br>(Mounting plate): 2 pcs. | **MS-LS-1**<br>(Mounting bracket): 1pc. | **MS-LS-1** (Mounting bracket): 1pc.<br>**RF-330** (Refrector): 1pc. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) When using the thru-beam type **LS-H101**□ or **LS-H102**□, do not set the receiving light sensitivity (gctL) of the applicable **LS-500** series amplifier to level 2 or less. This is because there is a possibility of sensing becoming unstable.
3) The sensing range of the coaxial reflective type sensor is specified for white non-glossy paper (100 × 100 mm 3.937 × 3.937 in) as the object.
4) The sensing ranges for coaxial retroreflective type sensors are values for the **RF-330** reflector. In addition, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.01 m 0.033 ft away. Note that if there are white papers or specular objects near the sensor head, reflected light from these objects may be received. In such cases, use the amplifier unit's receiving sensitivity function to lower the sensitivity, change the response time, or move the sensor head away from the target object. The incident light intensity may vary with the condition of the reflector surface. When using one of the applicable **LS-500** series amplifiers, leave an adequate safety margin when setting the threshold.
5) Make sure to confirm detection with an actual sensor before use.
6) This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration).
7) Cable cannot be extended.

# SPECIFICATIONS

## Amplifiers

| Item | | Type / Model No. | Connector type | Cable type |
|---|---|---|---|---|
| | | NPN output | **LS-501** | **LS-501-C2** |
| | | PNP output | **LS-501P** | **LS-501P-C2** |
| CE marking directive compliance | | | EMC Directive, RoHS Directive | |
| Supply voltage | | | 12 to 24 V DC $^{+10}_{-15}$ % Ripple P-P 10 % or less | |
| Power consumption | | | Normal operation: 1,200 mW or less (Current consumption 50 mA or less at 24 V supply voltage, Cable type: excluding monitor current output)<br>ECO mode: 980 mW or less (Current consumption 40 mA or less at 24 V supply voltage, Cable type: excluding monitor current output) | |
| Sensing outputs (Sensing output 1, 2) (Note 4) | | | <NPN output type><br>NPN open-collector transistor<br>• Maximum sink current: 50 mA (Note 2)<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 2 V or less (at max. sink current) | <PNP output type><br>PNP open-collector transistor<br>• Maximum source current: 50 mA (Note 2)<br>• Applied voltage: 30 V DC or less (between output and +V)<br>• Residual voltage: 2 V or less (at max. source current) |
| | Output operation | | Selectable either Light-ON or Dark-ON | |
| | Short-circuit protection | | Incorporated | |
| Sensing output setting | Sensing output 1 | | Normal mode, differential mode, hysteresis mode, window comparator mode, selectable | |
| | Sensing output 2 (Note 4) | | Normal mode, differential mode, hysteresis mode, self-diagnosis output mode, selectable | Normal mode, differential mode, hysteresis mode, self-diagnosis output mode, answer-back output mode, selectable |
| Response time | | | H-SP: 60 µs or less, FAST: 150 µs or less, STD: 250 µs or less, LONG: 500 µs or less, U-LG: 5 ms or less, HYPR: 24 ms or less , selectable | |
| Monitor current output | | | — | Output current: Approx. 4 to 20 mA (H-SP, FAST, STD: at 0 to 4,000 indication)<br>Response time: 2 ms or less<br>Zero point: 4 mA ± 1 % F.S.<br>Span: 16 mA ± 5 % F.S.<br>Linearity: ± 3 % F.S.<br>Load resistance: 0 to 250 Ω |
| External input (Note 4) | | | <NPN output type><br>NPN non-contact input<br>• Signal condition High: +8 V to +V DC or open,<br>Low: 0 to +2 V DC (source current 0.5 mA or less)<br>• Input impedance: 10 kΩ approx. | <PNP output type><br>PNP non-contact input<br>• Signal condition High: +4 V to +V DC (sink current 3.0 mA or less),<br>Low: 0 to +0.6 V DC or open<br>• Input impedance: 10 kΩ approx. |
| External input function | | | Laser emission halt / teaching (full-auto teaching, limit teaching, 2 point teaching) / logic operation setting / copy lock / display adjustment / data bank load / data bank save, selectable | |
| Sensing output operation indicator | | | Orange LED (lights up when sensing output 1 or sensing output 2 is ON) | |
| Laser emission indicator | | | Green LED (lights up during laser emission) | |
| Output select indicator | | | Yellow LED (lights up when output is selected) | |
| Digital display | | | 8-digit 7-segment digital display (4-digit green LED + 4-digit red LED), MODE indicator (Yellow LED): L/D, CUST, PRO | |
| Incident light indication range | | | H-SP / FAST / STD: 0 to 4,000, LONG / U-LG / HYPR: 0 to 9,999 | |
| Sensitivity setting | | | 2-level teaching / limit teaching / full auto teaching / manual adjustment | |
| Logical operation | | | Between sensing output 1 and calculation target: Disabled / AND / OR / XOR, selectable<br>Calculation target: Sensing output 2 / adjacent upstream amplifier (sensing output 1) / external input, selectable | |
| Timer functions | | | <Sensing output 1><br>OFF-delay timer, ON-delay timer, One-shot timer, ON/OFF-delay timer, ON-delay / One-shot timer, switchable either effective or ineffective, with variable timer period | |
| | | | <Sensing output 2><br>OFF-delay timer, ON-delay timer, One-shot timer, switchable either effective or ineffective, with variable timer period | |
| | Timer period | | Timer range “ms”: 0.5 ms approx., 1 to 9,999 ms approx., in approx. 1 ms intervals<br>Timer range “sec”: 0.5 sec. approx., 1 to 32 sec. approx., in approx. 1 sec. intervals<br>Timer range “1/10 ms”: 0.05 ms approx., 0.1 to 999.9 ms approx., in approx. 0.1 ms intervals, Set separately for each output. | |
| Interference prevention function | | | Incorporated (Note 3) | |
| Environmental resistance | Protection | | IP40 (IEC) | |
| | Ambient temperature | | −10 to +55 °C +14 to +131 °F (If 4 to 7 units are mounted close together, −10 to +50 °C +14 to +122 °F; if 8 to 16 units (cable type: 8 to 12 units) are mounted close together, −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 (max. 10 G) double amplitude in X, Y and Z directions for two hours each | |
| | Shock resistance | | 98 m/s² acceleration (10 G approx.) in X, Y and Z directions five times each | |
| Material | | | Enclosure: Polycarbonate, Cover: Polycarbonate, Switch: Polyacetal | |
| Cable | | | — | 0.2 mm² 6-core cabtyre cable, 2 m 6.562 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: 15 g approx., Gross weight: 55 g approx. | Net weight: 75 g approx., Gross weight: 110 g approx. |
| Accessory | | | **FX-MB1** (Amplifier protective seal): 1 set | |

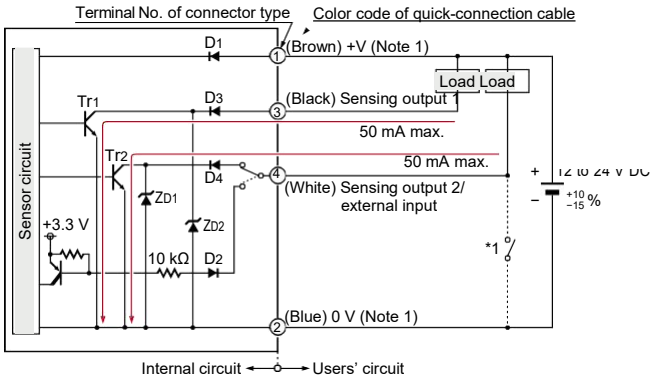
Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) 25 mA if 5 or more amplifier are connected in cascade (excluding cable extension).
3) Number of units that can be mounted close together: 0 for H-SP; 2 for FAST; 4 for STD, LONG, U-LG, or HYPR
4) Select either sensing output 2 or external input as the connector type.

# I/O CIRCUIT AND WIRING DIAGRAMS

## I/O circuit diagrams

### NPN output type

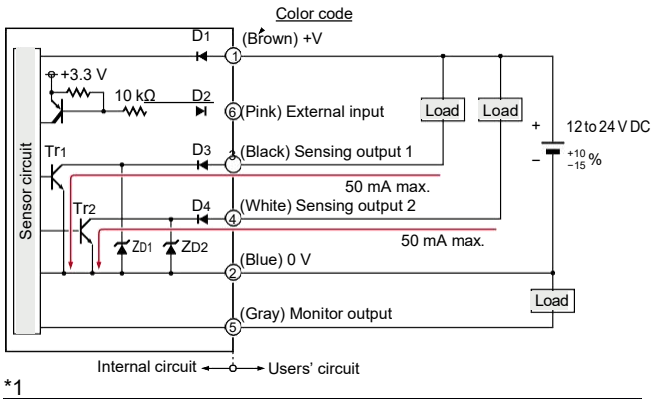
#### Connector type




Notes: 1) 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.
2) Wiring when sensing output 2 is selected is shown with solid lines. Wiring when external input is selected is shown with broken lines.

Symbols ... $D_1$, $D_2$, $D_3$, $D_4$: Reverse supply polarity protection diode
$Z_{D1}$, $Z_{D2}$: Surge absorption zener diode
$Tr_1$, $Tr_2$: NPN output transistor

#### Cable type




*1

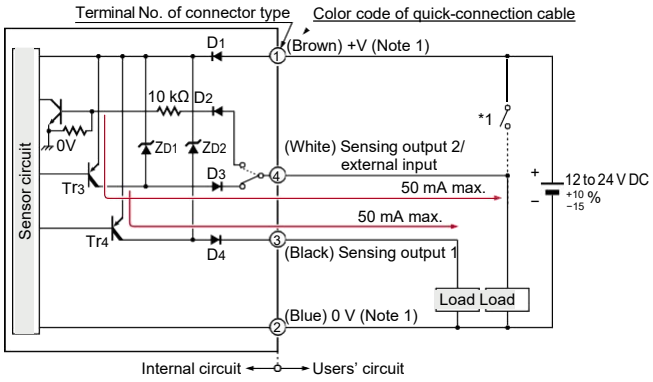
Non-voltage contact or NPN open-collector transistor

or

- External input
  High: +8 V to +V, or open
  Low: 0 to +2 V (source current: 0.5 mA or less)
- Light emission halts and teaching occurs when at Low.

### PNP output type

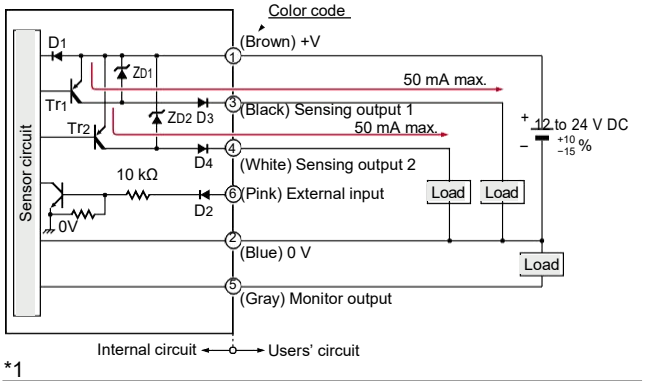
#### Connector type




Notes: 1) 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.
2) Wiring when sensing output 2 is selected is shown with solid lines. Wiring when external input is selected is shown with broken lines.

Symbols ... $D_1$, $D_2$, $D_3$, $D_4$: Reverse supply polarity protection diode
$Z_{D1}$, $Z_{D2}$: Surge absorption zener diode
$Tr_1$, $Tr_2$: PNP output transistor

#### Cable type




*1

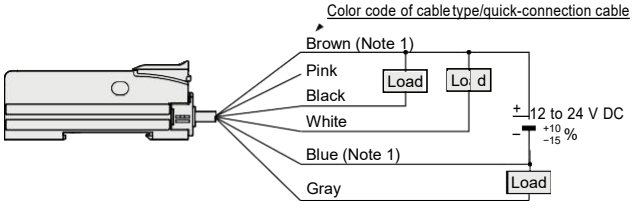
Non-voltage contact or PNP open-collector transistor

or

- External input
  High: +4 V to +V (sink current: 3 mA or less)
  Low : 0 to +0.6 V, or open
- Light emission halts and teaching occurs when at High.

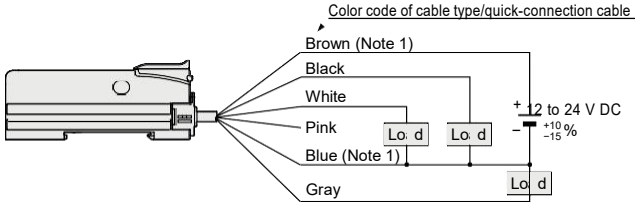
## Wiring diagrams

### NPN output type



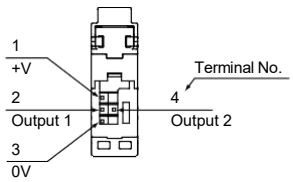

Notes: 1) The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.
2) The quick-connection cable does not have gray or pink lead wires.

### PNP output type

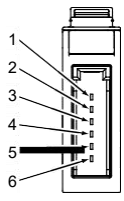



Notes: 1) The quick-connection sub cable does not have brown lead wire and blue lead wire. The power is supplied from the connector of the main cable.
2) The quick-connection cable does not have gray or pink lead wires.

## Terminal layout of connector type




## * Connector for amplifier (CN-EP4) pin position




| Terminal No. | Connection cable |
|---|---|
| ① | Purple |
| ② | White |
| ③ | Shield |
| ④ | Shield |
| ⑤ | Black |
| ⑥ | Pink |

# PRECAUTIONS FOR PROPER USE

Refer to p.1552~ for general precautions and p.1593~ for information about laser beam.

- This catalog is a guide to select a suitable product. Be sure to read the instruction manual attached to the product prior to its 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 regulations and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

## Cautions for laser beams

- These products are Class 1 laser in compliance with IEC, JIS standards and FDA* regulations. To reduce the risk of danger, do not look directly at the laser beam or view it through an optical system.
- A label with instructions as found at the below is affixed to the product. Handle this sensor as per the instruction on the labels.


*This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration).

## Safety standards for laser beam products

- A laser beam can harm human being's eyes, skin, etc., because of its high energy density. IEC has classified laser products according to the degree of hazard and the stipulated safety requirements. **LS-H□** is classified as Class 1 laser.

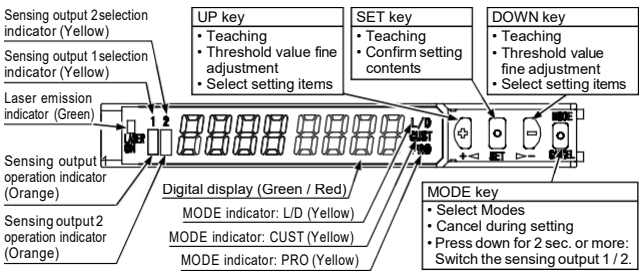
### Classification by IEC 60825-1

| Classification | Description |
|---|---|
| Class 1 | Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. |

## Safe use of laser products

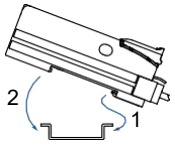
- For the purpose of preventing users from suffering injuries by laser products, IEC 60825-1 (Safety of laser products). Please check the standards before use. (Refer to p.1593~ for information about laser beam.)

## Part description (Amplifier)




## Mounting

### Amplifier

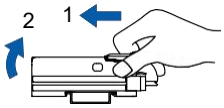



**<How to mount the amplifier>**

(1) Fit the rear part of the mounting section of the amplifier on a 35 mm 1.378 in width DIN rail.

(2) Press down the rear part of the mounting section of the unit on the 35 mm 1.378 in width DIN rail and fit the front part of the mounting section to the DIN rail.

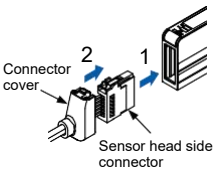
**<How to remove the amplifier>**




(1) Push the amplifier forward.
(2) Lift up the front part of the amplifier to remove it.

Note: Be careful. If the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

**<How to mount the sensor head>**

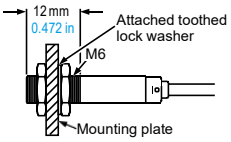



(1) Insert the sensor head connector into the inlet until it clicks.
(2) Fit the cover to the connector.

### Sensor head

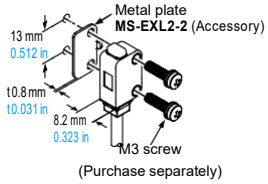
#### LS-H101□

- The tightening torque should be 0.98 N·m or less.



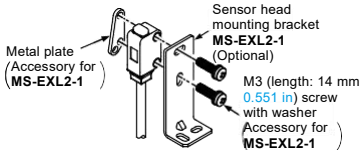

#### LS-H102□

- In case mounting this product, use a metal plate **MS-EXL2-2** (accessory).
- The tightening torque should be 0.5 N·m or less with M3 screws.

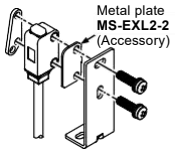



- In case using the dedicated sensor head mounting bracket **MS-EXL2-1** (optional) when mounting this product, the metal plate **MS-EXL2-2** (accessory) is required depending on the mounting direction. Mount as the diagram below indicates.

**<Not requiring the metal plate>**

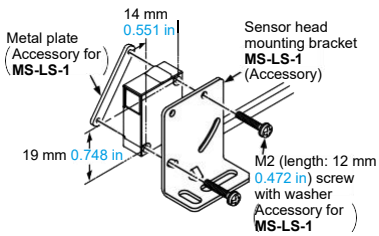



**<Requiring the metal plate>**




#### LS-H201□, LS-H901□

- The tightening torque should be 0.5 N·m or less.
- When placing the sensor head horizontally or vertically, the reflector must also be positioned horizontally or vertically as shown in Fig. 1 below. If the sensor head is placed horizontally or vertically but the reflector is tilted as shown in Fig. 2 below, the reflection amount will decrease, which may cause unstable detection.



## PRECAUTIONS FOR PROPER USE

Refer to p.1552~ for general precautions and p.1593~ for information about laser beam.

**Fig. 1 Proper positioning**

When placing the sensor head horizontally or vertically, the reflector shall also be positioned horizontally or vertically.

**<Correct>**

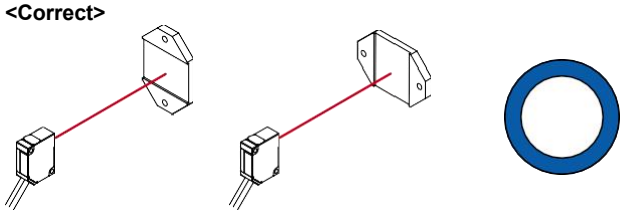
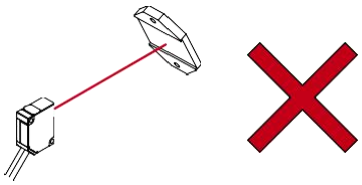


**Fig. 2 Improper positioning**

When placing the reflector tilted even when the sensor head is positioned horizontally or vertically.

**<Incorrect>**



### Wiring

- Make sure that the power supply is off while wiring.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- Make sure to use the optional quick-connection cable for the connection of the amplifier [connector type **LS-501(P)**]. Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible. Set the supply voltage after considering the voltage drop caused by the cable's resistance.
  When adding units, wiring length must not exceed 50 m 164.042 ft (for 5 to 8 amplifiers) or 20 m 65.617 ft (for 9 to 16 amplifiers).

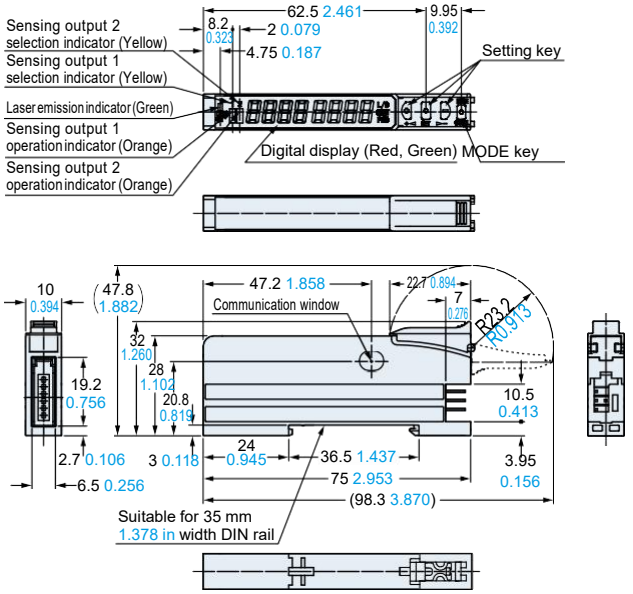
### Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Because the sensitivity is higher in U-LG and HYPER modes than in other modes, it can be more easily affected by extraneous noise. Check the operating environment before use.

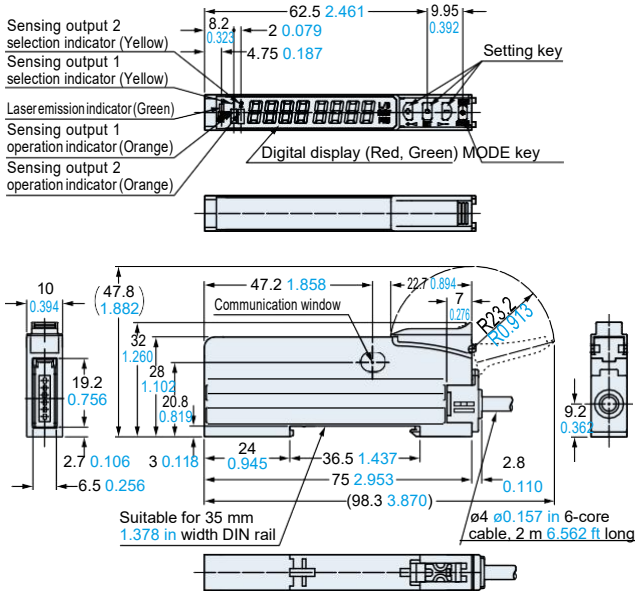
## DIMENSIONS (Unit mm in)

The CAD data can be downloaded from our website.

### LS-501 LS-501P — Amplifier



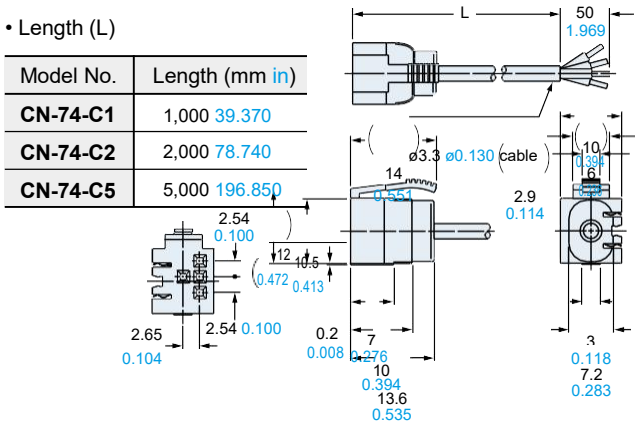

### LS-501-C2 LS-501P-C2 — Amplifier




### CN-74-C1 CN-74-C2 CN-74-C5 — Main cable (Optional)

- Length (L)

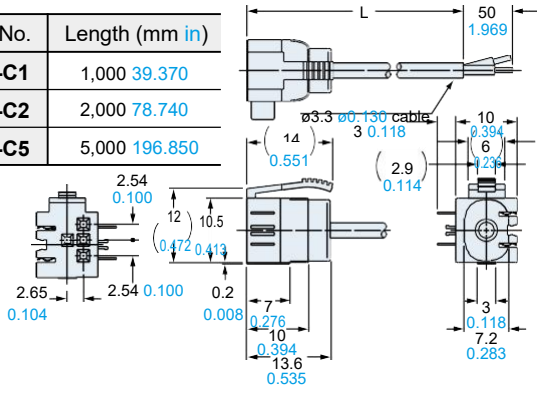
| Model No. | Length (mm in) |
|---|---|
| CN-74-C1 | 1,000 39.370 |
| CN-74-C2 | 2,000 78.740 |
| CN-74-C5 | 5,000 196.850 |




### CN-72-C1 CN-72-C2 CN-72-C5 — Sub cable (Optional)

- Length (L)

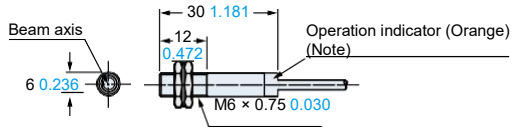
| Model No. | Length (mm in) |
|---|---|
| CN-72-C1 | 1,000 39.370 |
| CN-72-C2 | 2,000 78.740 |
| CN-72-C5 | 5,000 196.850 |



# DIMENSIONS (Unit mm in)

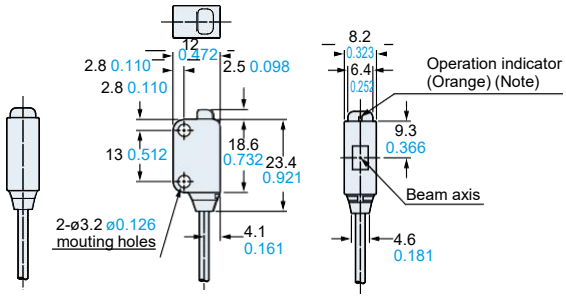
The CAD data can be downloaded from our website.

## LS-H101□ Sensor head



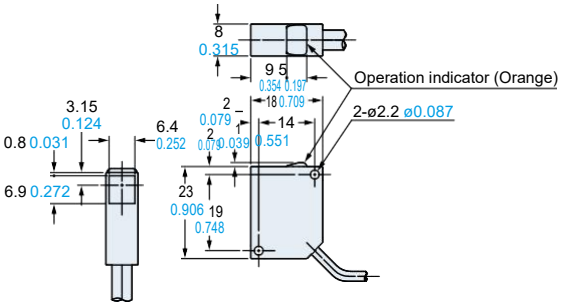

Note: Not incorporated on the emitter.

## LS-H102□ Sensor head

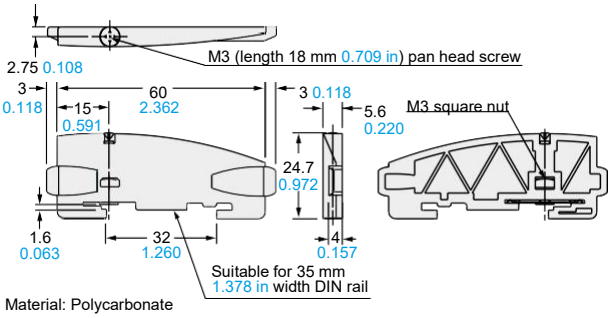



Note: Not incorporated on the emitter.

## LS-H201□ LS-H901□ Sensor head

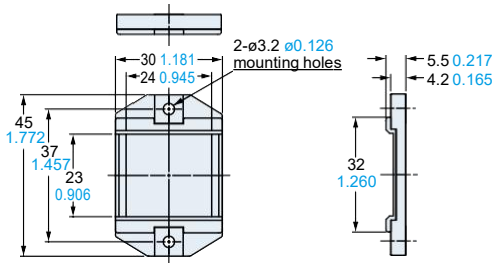



## MS-DIN-E End plate (Optional)



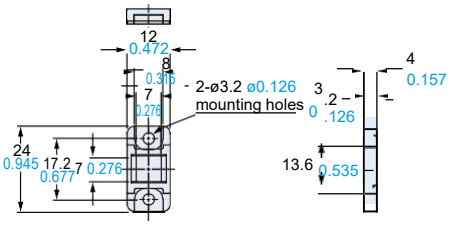

Material: Polycarbonate

## RF-330 Reflector (Accessory for LS-H901□)



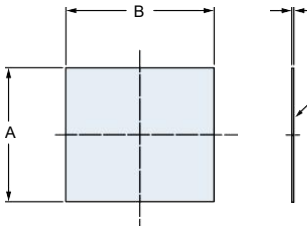

Material: Acrylic (Reflector)
ABS (Base)

## RF-310 Reflector (Optional)



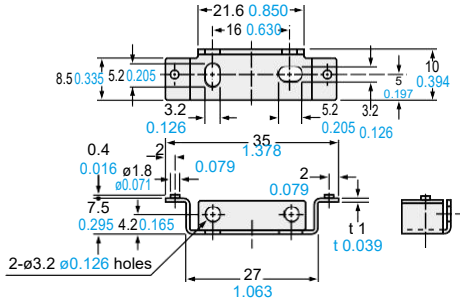

Material: Acrylic (Reflector)
ABS (Base)

## RF-33 RF-31 Reflective tape (Optional)




| Model No. | A | B |
|---|---|---|
| RF-33 | 25.2 0.992 | 27.8 1.094 |
| RF-31 | 9.2 0.362 | 9.2 0.362 |

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

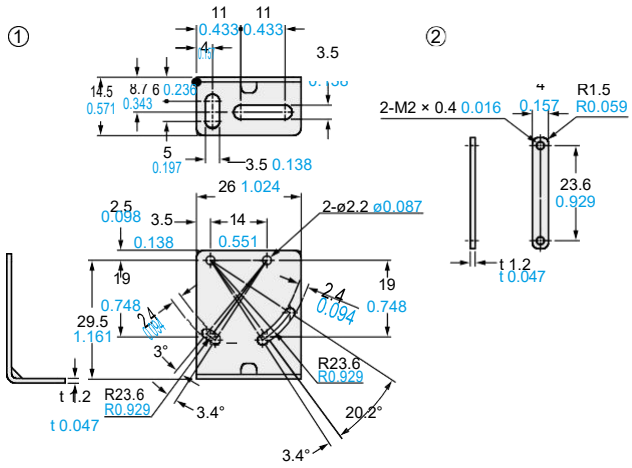



Material: Cold rolled carbon steel (SPCC)
(Uni-chrome plated)

# DIMENSIONS (Unit mm in)

The CAD data can be downloaded from our website.

## MS-LS-1 Sensor head mounting bracket (Accessory for LS-H201□, LS-H901□)




Material: Stainless steel (SUS304)

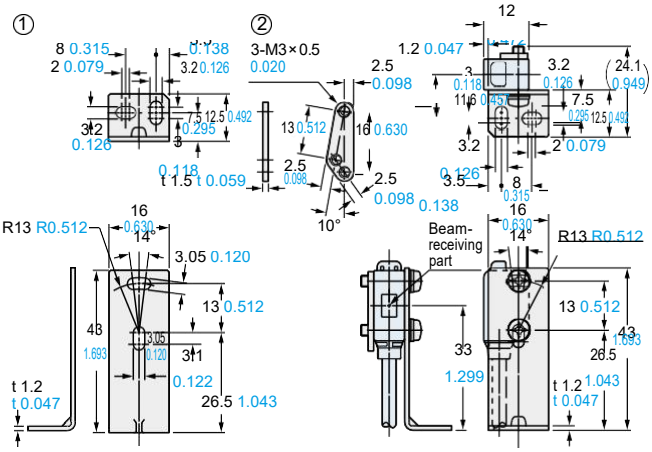
Two M2 (length 12 mm 0.472 in) screws with washers [stainless steel (SUS)] are attached.

## MS-EXL2-1 Sensor head mounting bracket for LS-H102□ (Optional)

Foot angled mounting bracket

### Assembly dimensions

Mounting drawing with the receiver of **LS-H102**□



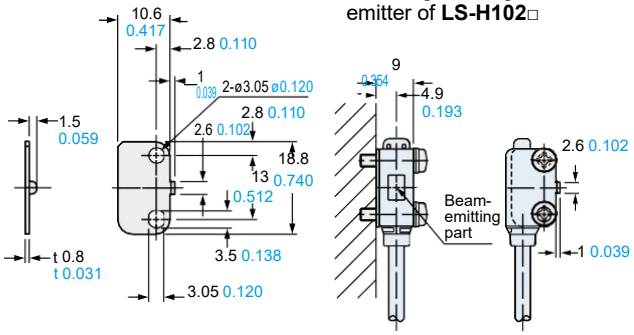

Material: Stainless steel (SUS304)

Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)] are attached.

## MS-EXL2-2 Mounting plate (Accessory for LS-H102□)

### Assembly dimensions

Mounting drawing with the emitter of **LS-H102**□



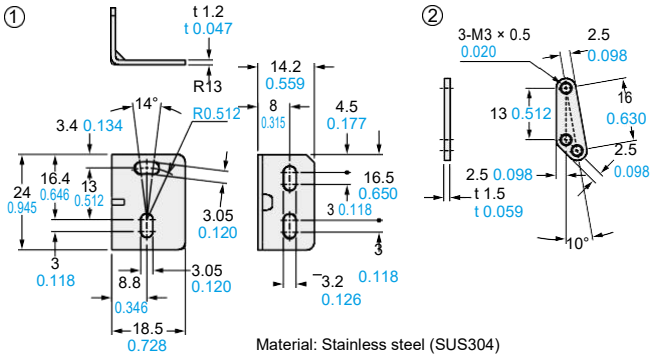

Material: Stainless steel (SUS304)

Note: Screws are not attached. Purchase separately.

Note: Without using the mounting plate, beam misalignment may occur.

## MS-EXL2-5 Sensor head mounting bracket for LS-H102□ (Optional)

Back angled mounting bracket




Material: Stainless steel (SUS304)

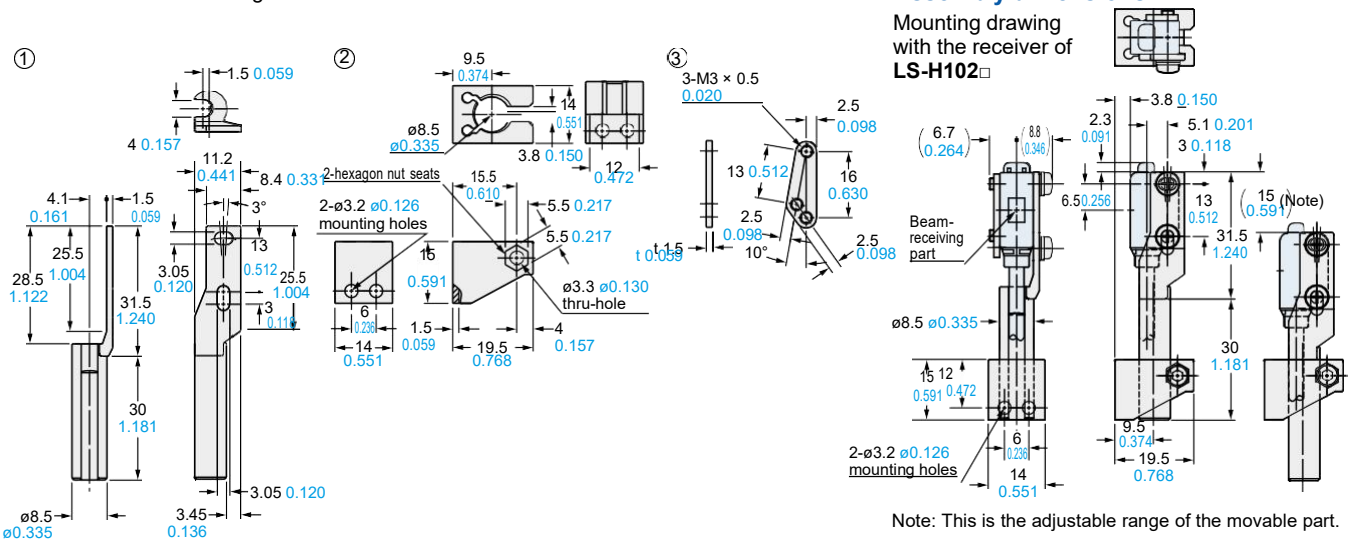
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)] are attached.

## MS-EXL2-4 Sensor head mounting bracket for LS-H102□ (Optional)

Universal sensor mounting bracket

### Assembly dimensions

Mounting drawing with the receiver of **LS-H102**□




Material: Die-cast zinc alloy

Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS)], one M3 (length 10 mm 0.394 in) hexagon socket-head bolt [stainless steel (SUS)], and one M3 hexagon nut [stainless steel (SUS)] are attached.

Note: This is the adjustable range of the movable part.