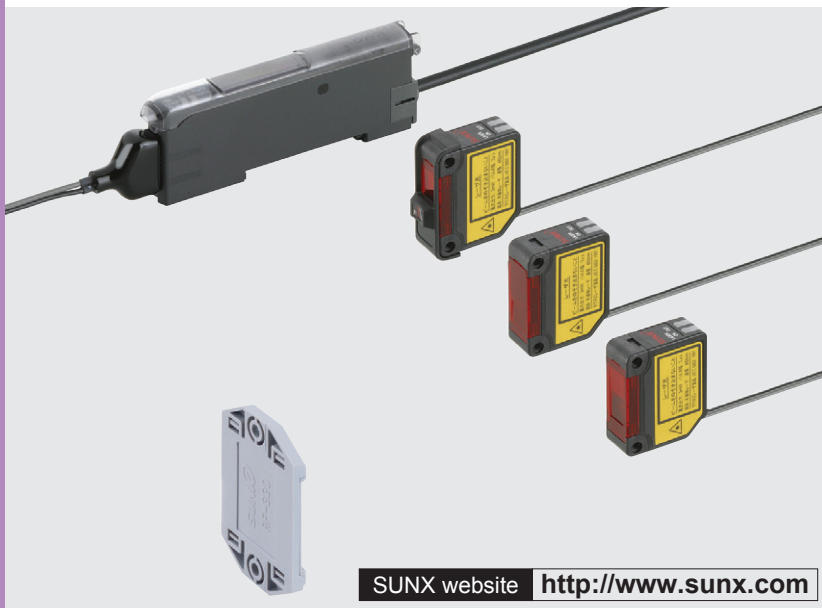


# LS SERIES

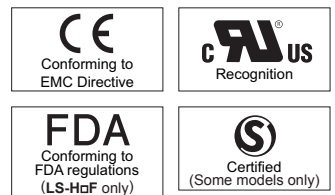
- General terms and conditions..... P.1
- Sensor selection guide ..... P.11~ / P.21~
- Glossary of terms / General precautions... P.983~ / P.986~
- About laser beam..... P.1025~
- Korea's S-mark..... P.1034~

Related Information

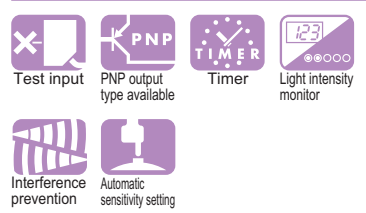
- FIBER SENSORS
- LASER SENSORS
- PHOTOELECTRIC SENSORS
- MICRO PHOTOELECTRIC SENSORS
- AREA SENSORS
- SAFETY COMPONENTS
- PRESSURE SENSORS
- INDUCTIVE PROXIMITY SENSORS
- PARTICULAR USE SENSORS
- SENSOR OPTIONS
- WIRE-SAVING SYSTEMS
- MEASUREMENT SENSORS
- STATIC CONTROL DEVICES
- LASER MARKERS



SUNX website <http://www.sunx.com>

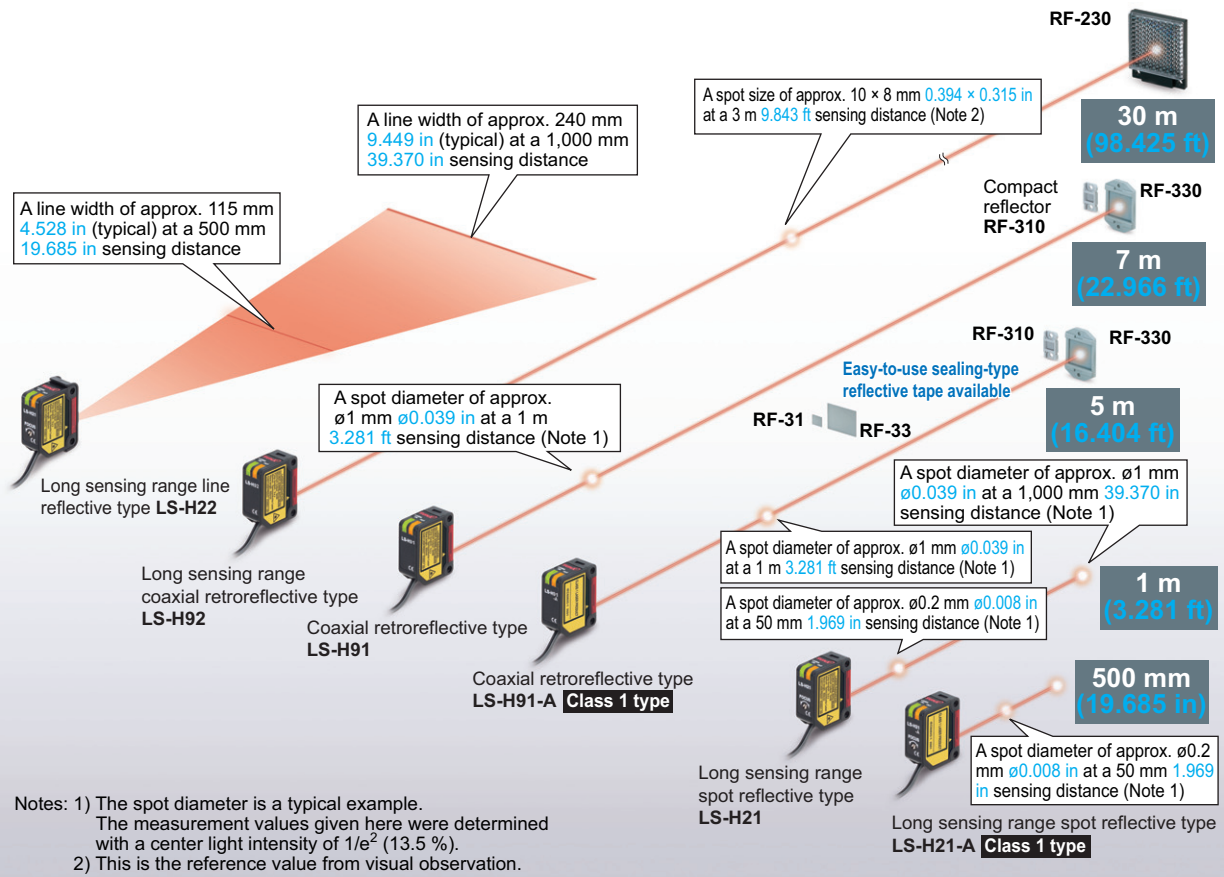


These products are class 2 (LS-H□-A: Class 1) laser in compliance with IEC / JIS / GB standards and FDA regulations 21 CFR 1040.10. Do not look at the laser beam directly or through optical system such as a lens.



## User-friendly, high precision laser sensing!

### We offer 6 types of laser sensor heads for various applications

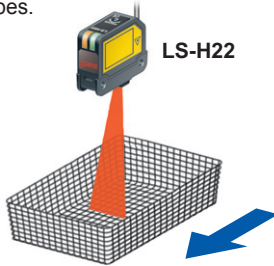


Notes: 1) The spot diameter is a typical example. The measurement values given here were determined with a center light intensity of  $1/e^2$  (13.5 %).  
 2) This is the reference value from visual observation.

**APPLICATIONS**

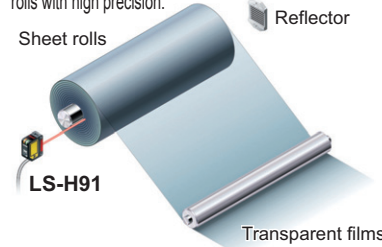
**Detecting objects with a complex shape**

Its linear sensing area enables more stable detection of objects with complex shapes.



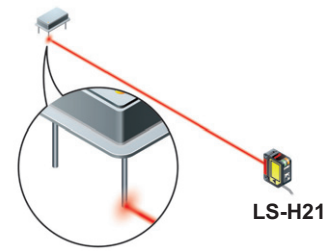
**Detecting the remaining amount of sheet rolls**

This is a coaxial retroreflective sensor with a spot diameter of approx.  $\phi 1 \text{ mm } \phi 0.039 \text{ in}$  (at a 1 m 3.281 ft sensing distance), so it can measure amounts remaining on sheet rolls with high precision.



**Detecting electronic component pins**

Because its spot shape can be adjusted in accordance with the object, it can be easily set to detect even the minutest object from a remote location.



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Selection Guide

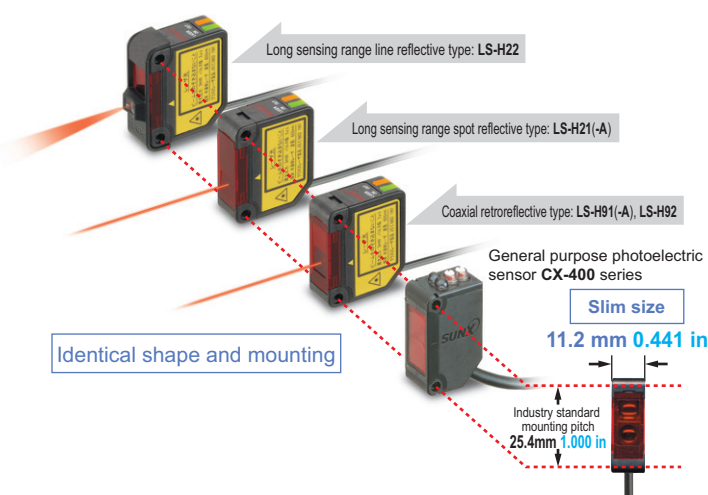
Amplifier-separated

LS

NOTE: The applications given in this catalog are examples for reference only. Stable sensing may not be possible under certain setup conditions and environmental conditions, so be sure to check the actual sensor before use.

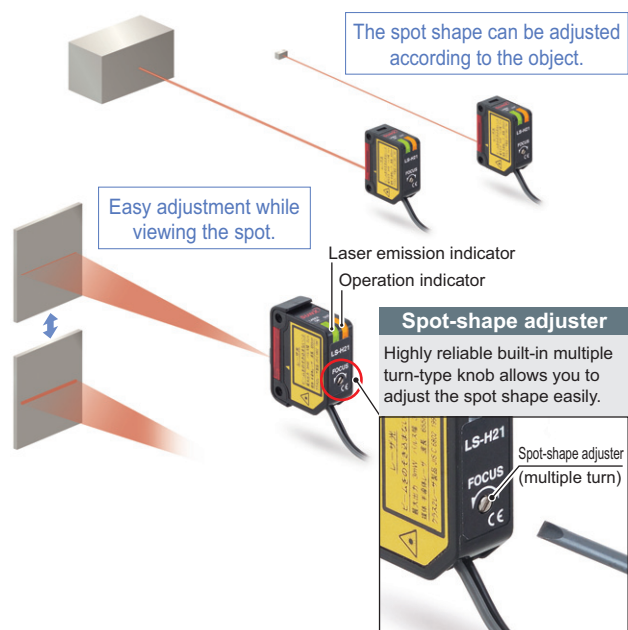
**Industry standard mounting pitch**

The mounting pitch for sensor heads is 25.4 mm 1.000 in, the same industry standard as the CX-400 series general purpose photoelectric sensors. Hence, existing mounting brackets can be used even when replacing general purpose sensors with laser sensors.



**Easy and accurate adjustments**    Long sensing range spot reflective type    Long sensing range line reflective type

A spot-size adjuster is built into the back of the sensor head allowing the user to adjust the sensor easily while viewing the spot. The adjuster is adjustable with a screwdriver to avoid accidents during maintenance or any other time the sensors are handled.

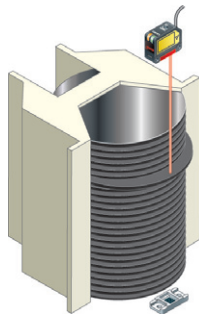


- FIBER SENSORS
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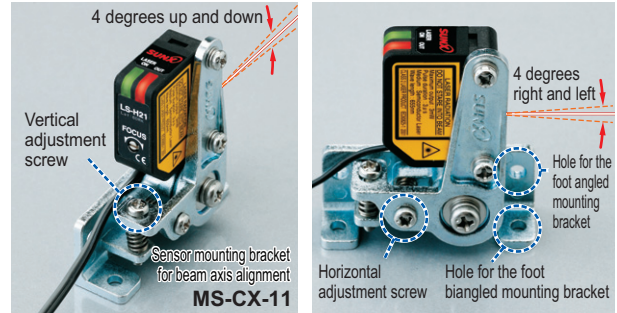
**Line-up of FDA / IEC / JIS Class 1 type** **LS-H91(F)-A, LS-H21(F)-A**

Visible light spot using the Class 1 type. This makes beam axis alignment much easier.



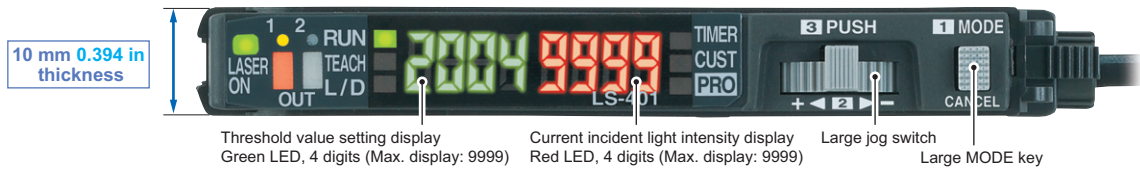
**Sensor mounting bracket for beam axis alignment is available** **MS-CX-11**

It is possible to make a minor adjustment for the bracket by 4 degrees up, down, right or left, even after setting up the sensor. The bracket can be mounted in both longitudinal and lateral directions.



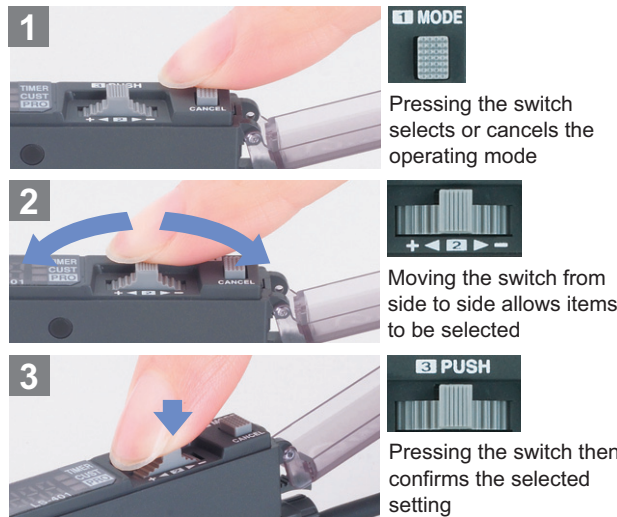
**Easy setting, dual display**

Equipped with 2 large 4-digit digital displays. While checking the current incident light intensity (red display), the optimal threshold value (green display) can be set easily.



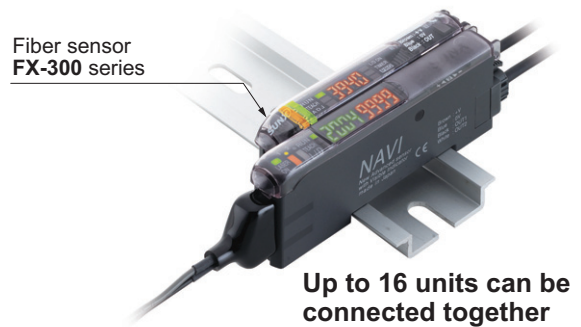
**2 switches enable simple operation**

Only two switches, the large MODE key and the large jog switch, are required for operation.



**Wiring and space savings**

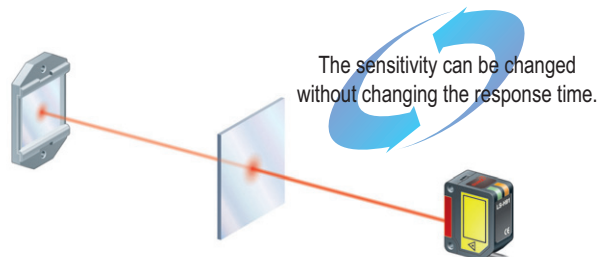
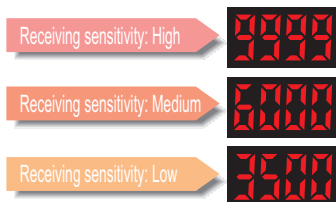
The quick-connection cables enable reductions in wiring (connector type). The connections and man-hours for the relay terminal setup can be reduced and valuable space saved. Also, LS series sensors can be connected side-by-side with FX-300 series fiber sensors.



Note: Because the transmission method varies depending on the amplifiers, check the instruction manual for the amplifiers when connecting them.

**Accurately sense the minutest variations (M.G.S. function)**

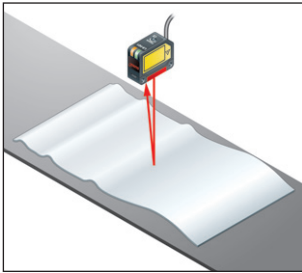
When sensing at close range or when the target objects are transparent or minute, adjust the sensor receiving sensitivity to one of 3 levels (U-LG mode: 4 levels) for the optimal setting. In addition, changing the receiving sensitivity will not effect the response time.





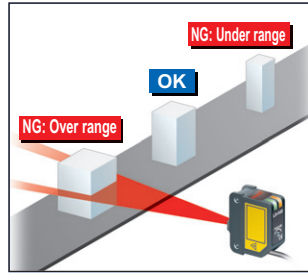
### 4 new modes enabling wide array of sensing

#### Hysteresis mode



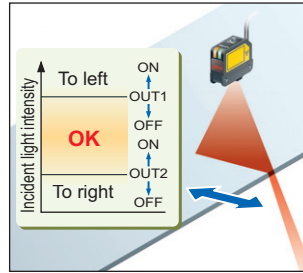
By adjusting the hysteresis, convexo-concave parts of uneven objects can be cancelled enabling more stable sensing.

#### Window comparator mode



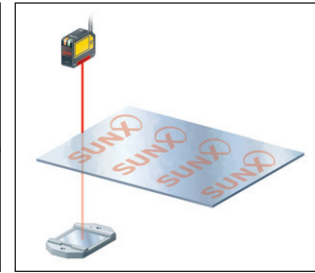
The sensor judges any object outside the range of incident light intensity established by two set threshold values.

#### 2 independent output modes



By combining two outputs, wide array of control is possible, allowing you to detect meandering objects, for example.

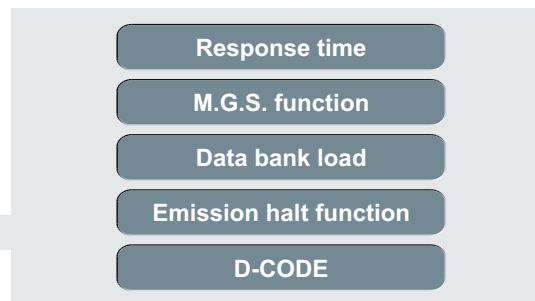
#### Differential sensing mode



Only rapid changes in light received are detected, which enable the edge of glass, etc. to be detected accurately. Optimal for positioning.

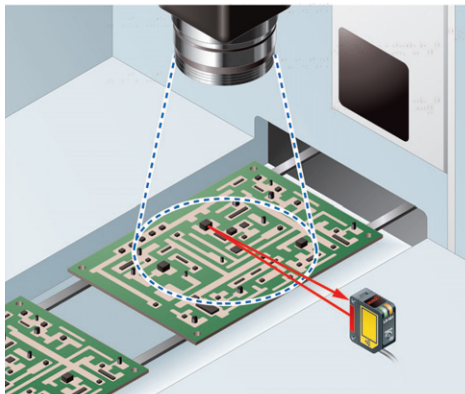
### MODE NAVI customized function

Because one of frequently used functions (response time, M.G.S. function, data bank load, emission halt function and D-CODE values) can be stored in CUSTOM mode, the settings are changed easily.



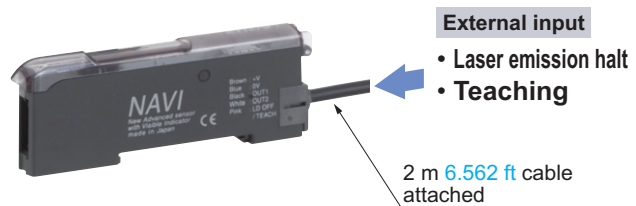
### Emission halt function

Using the emission halt function, the laser beam can be stopped via external input, e.g. when a spot appears within the visual range of an image processor.



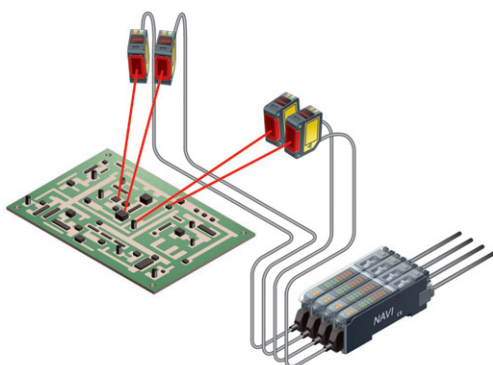
### Cable type allows external input

The **LS-401-C2** cable-type amplifier is equipped with external input wires (5-core). It is ideal for using the laser sensors in places when external teaching or laser light emission halting is to be carried out, or when using separately.



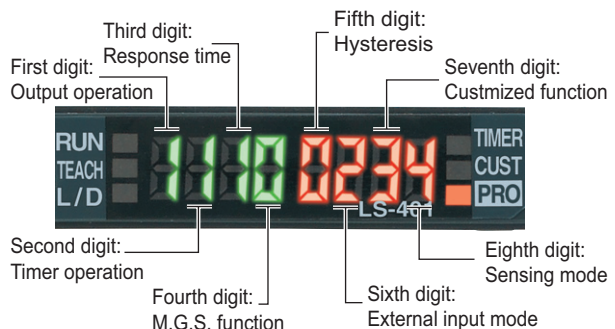
### Interference prevention function

The automatic interference prevention function protects against interference among up to 4 sensors.



### Setting conditions viewed at a glance (D-CODE)

The amplifier setting is shown as an 8-digit code. Handy for remote indications and follow-ups.



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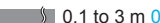
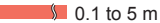


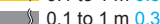

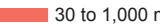


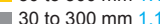


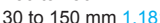
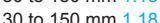



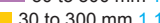
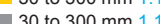
LASER MARKERS

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LS

**ORDER GUIDE****Sensor heads**

Type	Appearance	Model No.	Conforming standards	Sensing range
Coaxial retroreflective		<b>LS-H92</b>	IEC / JIS / GB	 0.2 to 30 m <b>0.656 to 98.425 ft</b> (Note 2)  0.2 to 20 m <b>0.656 to 65.617 ft</b> (Note 2)  0.2 to 10 m <b>0.656 to 32.808 ft</b> (Note 2)  0.2 to 10 m <b>0.656 to 32.808 ft</b> (Note 2)
		<b>LS-H92F</b> (Note 1)	FDA / IEC / JIS	
		<b>LS-H91</b>	IEC / JIS / GB	 0.1 to 7 m <b>0.328 to 22.966 ft</b> (Note 2)  0.1 to 5 m <b>0.328 to 16.404 ft</b> (Note 2)  0.1 to 3 m <b>0.328 to 9.843 ft</b> (Note 2)  0.1 to 3 m <b>0.328 to 9.843 ft</b> (Note 2)
		<b>LS-H91F</b> (Note 1)	FDA / IEC / JIS	
		<b>LS-H91-A</b>	IEC / JIS / GB	 0.1 to 5 m <b>0.328 to 16.404 ft</b> (Note 2)  0.1 to 3 m <b>0.328 to 9.843 ft</b> (Note 2)  0.1 to 1 m <b>0.328 to 3.281 ft</b> (Note 2)  0.1 to 1 m <b>0.328 to 3.281 ft</b> (Note 2)
		<b>LS-H91F-A</b> (Note 1)	FDA / IEC / JIS	
Diffuse reflective		<b>LS-H21</b>	IEC / JIS / GB	 30 to 1,000 mm <b>1.181 to 39.370 in</b>  30 to 500 mm <b>1.181 to 19.685 in</b>  30 to 300 mm <b>1.181 to 11.811 in</b>  30 to 300 mm <b>1.181 to 11.811 in</b>
		<b>LS-H21F</b> (Note 1)	FDA / IEC / JIS	
		<b>LS-H21-A</b>	IEC / JIS / GB	 30 to 500 mm <b>1.181 to 19.685 in</b>  30 to 250 mm <b>1.181 to 9.843 in</b>  30 to 150 mm <b>1.181 to 5.906 in</b>  30 to 150 mm <b>1.181 to 5.906 in</b>
		<b>LS-H21F-A</b> (Note 1)	FDA / IEC / JIS	
Long sensing range line reflective		<b>LS-H22</b> (Note 3)	IEC / JIS / GB	 30 to 1,000 mm <b>1.181 to 39.370 in</b>  30 to 500 mm <b>1.181 to 19.685 in</b>  30 to 300 mm <b>1.181 to 11.811 in</b>  30 to 300 mm <b>1.181 to 11.811 in</b>
		<b>LS-H22F</b> (Note 1, 3)	FDA / IEC / JIS	

**NOTE:** Mounting bracket is not supplied with the sensor head. Please select from the range of optional sensor head mounting brackets.

Notes: 1) This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated July 26, 2001, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration). For details, refer to the Laser Notice No. 50.

2) The sensing range is the value for the **RF-330** [**RF-230** for the **LS-H92(F)**] reflector. In addition, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1 m **0.328 ft** [**LS-H92(F)**: 0.2 m **0.656 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 M.G.S. function of the amplifier unit to change the response time or incident light sensitivity.

3) **LS-H22(F)** is the model No. for **LS-H21(F)** long sensing range spot reflective type sensor head combined with the **LS-MR1** lens attachment for line reflective type sensor head, hence **LS-H21(F)** appears on the sensor head itself.

**5 m 16.404 ft cable length type**

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

- **LS-H91-C5**
- **LS-H91-A-C5**
- **LS-H21-C5**
- **LS-H22-C5**



**Package without reflector**

The **LS-H91(F)**, **LS-H91(F)-A** and **LS-H92(F)** are also available without the reflector (**RF-330** or **RF-230**).  
When ordering this type, suffix "-Y" to the model No.

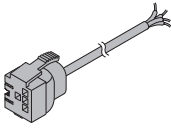
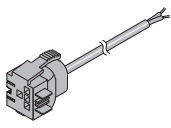
- **LS-H92-Y**
- **LS-H92F-Y**
- **LS-H91-Y**
- **LS-H91F-Y**
- **LS-H91-A-Y**
- **LS-H91F-A-Y**

## ORDER GUIDE

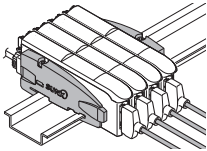
### Amplifiers

Type	Appearance	Model No.	Output	Connection method
Connector type		<b>LS-401</b>	NPN open-collector transistor two outputs	Use quick-connection cable (4-core) (optional)
		<b>LS-401P</b>	PNP open-collector transistor two outputs	
Cable type (With external input)		<b>LS-401-C2</b>	NPN open-collector transistor two outputs	2 m <b>6.562 ft</b> cabtyre cable (5-core) included Cable outer diameter: $\varnothing 3.7$ mm $\varnothing 0.146$ in
		<b>LS-401P-C2</b>	PNP open-collector transistor two outputs	

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

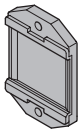
Type	Appearance	Model No.	Description
Main cable (4-core)		<b>CN-74-C1</b>	Length: 1 m <b>3.281 ft</b>
		<b>CN-74-C2</b>	Length: 2 m <b>6.562 ft</b>
		<b>CN-74-C5</b>	Length: 5 m <b>16.404 ft</b>
Sub cable (2-core)		<b>CN-72-C1</b>	Length: 1 m <b>3.281 ft</b>
		<b>CN-72-C2</b>	Length: 2 m <b>6.562 ft</b>
		<b>CN-72-C5</b>	Length: 5 m <b>16.404 ft</b>

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

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

### Accessories

- **RF-330** (Reflector)



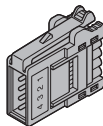
- **RF-230** (Reflector)



Note: **LS-H92(F)** only

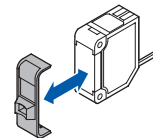
- **CN-EP1** (Connector for amplifier)

**5 pcs. per set** (Note)



Note: One is attached to each sensor head according to standard.

- **LS-MR1** (Lens attachment for line reflective type)



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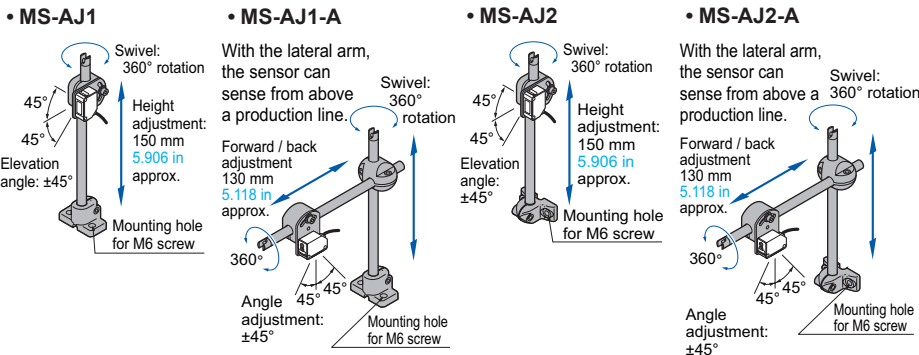
**LS**

**OPTIONS**

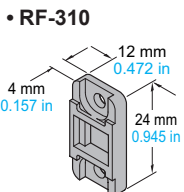
Designation	Model No.	Description	
Sensor head mounting bracket	<b>MS-CX-1</b>	Foot angled mounting bracket	
	<b>MS-CX-2</b>	Foot biangled mounting bracket Flat mounting possible to avoid obstructions caused by the height of the sensor.	
	<b>MS-CX-3</b>	Back angled mounting bracket	
	<b>MS-CX-4</b>	Protective mounting bracket Protects sensors preventing beam axis displacement due to shocks.	
Sensor mounting bracket for beam axis alignment	<b>MS-CX-11</b>	Mounting bracket that makes fine beam axis alignment possible after setting the sensor head. Adjustment angle: up and down, right and left: 4 degrees Mounting directions: two directions, vertical and horizontal	
Universal sensor mounting stand (Note 1)	<b>MS-AJ1</b>	Horizontal mounting type	Basic assembly
	<b>MS-AJ2</b>	Vertical mounting type	
	<b>MS-AJ1-A</b>	Horizontal mounting type	Lateral arm assembly
	<b>MS-AJ2-A</b>	Vertical mounting type	
Amplifier mounting bracket	<b>MS-DIN-2</b>	Mounting bracket for amplifier	
Reflector mounting bracket	<b>MS-RF23</b>	Mounting bracket for <b>RF-230</b>	
Amplifier protection seal	<b>FX-MB1</b>	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.	
Reflector	<b>RF-310</b>	For coaxial retroreflective type Compact reflector	Sensing range (U-LG mode) • <b>LS-H91(F)</b> : 0.1 to 7 m 0.328 to 22.966 ft • <b>LS-H91(F)-A</b> : 0.1 to 5 m 0.328 to 16.404 ft
Reflective tape	<b>RF-33</b>	For coaxial retroreflective type Size: 25.2 × 27.8 × t 0.4 mm 0.992 × 1.094 × t 0.016 in	
	<b>RF-31</b>	For coaxial retroreflective type Size: 9.2 × 9.2 × t 0.4 mm 0.362 × 0.362 × t 0.016 in	
Bank selection unit	<b>FX-CH</b>	NPN input type	Setting for up to 16 laser sensors can be changed at once by means of external signals.
	<b>FX-CH-P</b>	PNP input type	

Notes: 1) Refer to p.799 for details of the universal sensor mounting stand.  
2) Refer to p.207~ for details of the bank selection unit.

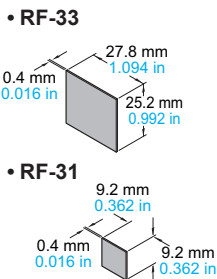
**Universal sensor mounting stand**



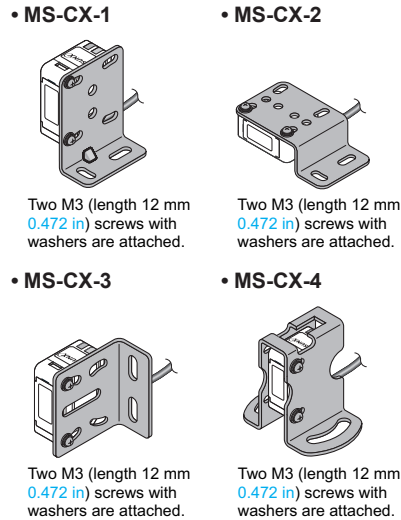
**Reflector**



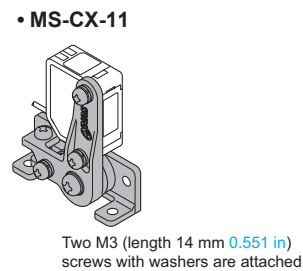
**Reflective tape**



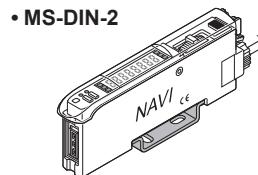
**Sensor head mounting bracket**



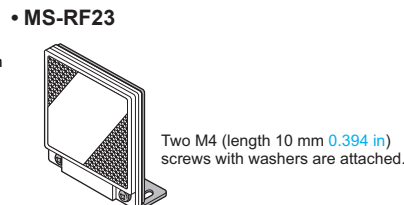
**Sensor mounting bracket for beam axis alignment**



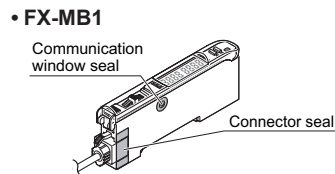
**Amplifier mounting bracket**



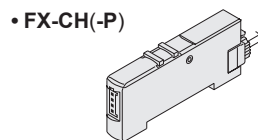
**Reflector mounting bracket**



**Amplifier protection seal**



**Bank selection unit**





## SPECIFICATIONS

### Sensor heads

Item	Type		Coaxial retroreflective			Diffuse reflective		
			Class 2		Class 1	Long sensing range spot reflective		Long sensing range line reflective
			LS-H92	LS-H91	LS-H91-A	Class 2	Class 1	
Model No.	IEC / JIS / GB standards conforming type	LS-H92F	LS-H91F	LS-H91F-A	LS-H21	LS-H21-A	LS-H22(Note 3)	
		FDA / IEC / JIS standards conforming type (Note 2)					LS-H22F(Note 3)	
Applicable amplifiers			LS-401(P), LS-401(P)-C2					
Sensing range	U-LG mode	0.2 to 30 m 0.656 to 98.425 ft (Note 4)	0.1 to 7 m 0.328 to 22.966 ft (Note 4)	0.1 to 5 m 0.328 to 16.404 ft (Note 4)	30 to 1,000 mm 1.181 to 39.370 in	30 to 500 mm 1.181 to 19.685 in	30 to 1,000 mm 1.181 to 39.370 in	
	STD mode	0.2 to 20 m 0.656 to 65.617 ft (Note 4)	0.1 to 5 m 0.328 to 16.404 ft (Note 4)	0.1 to 3 m 0.328 to 9.843 ft (Note 4)	30 to 500 mm 1.181 to 19.685 in	30 to 250 mm 1.181 to 9.843 in	30 to 500 mm 1.181 to 19.685 in	
	FAST mode	0.2 to 10 m 0.656 to 32.808 ft (Note 4)	0.1 to 3 m 0.328 to 9.843 ft (Note 4)	0.1 to 1 m 0.328 to 3.281 ft (Note 4)	30 to 300 mm 1.181 to 11.811 in	30 to 150 mm 1.181 to 5.906 in	30 to 300 mm 1.181 to 11.811 in	
	H-SP mode							
Operation indicator			Orange LED (lights up when the amplifier output is ON)					
Laser emission indicator			Green LED (lights up during laser emission)					
Spot-shape adjuster			—		Multi-turn adjuster			
Environmental resistance	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 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 (10 G max.) amplitude in X, Y and Z directions for two hours each						
	Shock resistance	100 m/s <sup>2</sup> acceleration (10 G approx.) in X, Y and Z directions for three times each						
Emitting element	IEC / JIS / GB standards conforming type	Red semiconductor laser, Class 2 (IEC / JIS / GB) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 1 (IEC / JIS / GB) (Max. output: 1 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 2 (IEC / JIS / GB) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 1 (IEC / JIS / GB) (Max. output: 1 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 2 (IEC / JIS / GB) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)		
	FDA / IEC / JIS standards conforming type (Note 2)	Red semiconductor laser, Class 2 (FDA / IEC / JIS) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 1 (FDA / IEC / JIS) (Max. output: 1 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 2 (FDA / IEC / JIS) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 1 (FDA / IEC / JIS) (Max. output: 1 mW Peak emission wavelength: 655 nm 0.026 mil)	Red semiconductor laser, Class 2 (FDA / IEC / JIS) (Max. output: 3 mW Peak emission wavelength: 655 nm 0.026 mil)		
Material			Enclosure: PBT (Mounting part: PEI), Lens cover: Acrylic					
Cable			0.1 mm <sup>2</sup> , single core two parallel shielded cables, 2 m 6.562 ft long (Connector for amplifier attached) (Note 5)					
Weight			Net weight: 30 g approx. Gross weight: 40 g approx.	Net weight: 30 g approx. Gross weight: 45 g approx.	Net weight: 30 g approx. Gross weight: 40 g approx.	Net weight: 35 g approx. Gross weight: 45 g approx.		
Accessories			RF-230(Reflector): 1 pc. Warning label: 1 set (Labels are written in Japanese, English and Chinese for compliance with various standards.)	RF-330(Reflector): 1 pc. Warning label: 1 set (Labels are written in Japanese, English and Chinese for compliance with various standards.)	RF-330(Reflector): 1 pc. Explanation label: 1 set (Labels are written in Japanese and Chinese for compliance with various standards.)	Warning label: 1 set (Labels are written in Japanese, English and Chinese for compliance with various standards.)	Explanation label: 1 set (Labels are written in Japanese and Chinese for compliance with various standards.)	
			LS-MR1 (Lens attachment for line reflective): 1 pc. Warning label: 1 set (Labels are written in Japanese, English and Chinese for compliance with various standards.)					

- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.  
2) This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated July 26, 2001, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration). For details, refer to the Laser Notice No. 50.  
3) LS-H22(F) is the set model No. for LS-H21(F) long sensing range spot reflective type sensor head combined with the LS-MR1 lens attachment for line reflective type, hence LS-H21(F) appears on the sensor head itself.  
4) The sensing range is the value for the RF-330 [RF-230 for the LS-H92(F)] reflector. In addition, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1 m 0.328 ft [LS-H92(F): 0.2 m 0.656 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 M.G.S. function of the amplifier unit to change the response time or incident light sensitivity.  
5) Cable cannot be extended.

FIBER

SENSORS

LASER

SENSORS

PHOTO-

ELECTRIC

SENSORS

MICRO

PHOTO-

ELECTRIC

SENSORS

AREA

SENSORS

SAFETY

COMPONENTS

PRESSURE

SENSORS

INDUCTIVE

PROXIMITY

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LS



## SPECIFICATIONS

### Amplifiers

Item	Model No.	Type	Connector type	Cable type
		NPN output	<b>LS-401</b>	<b>LS-401-C2</b>
		PNP output	<b>LS-401P</b>	<b>LS-401P-C2</b>
Supply voltage		12 to 24 V DC $\pm$ 10 % Ripple P-P 10 % or less		
Power consumption		Normal operation: 950 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 780 mW or less (Current consumption 33 mA or less at 24 V supply voltage)		
Outputs (Output 1, Output 2)		<NPN output type> NPN open-collector transistor <ul style="list-style-type: none"> <li>• Maximum sink current: 100 mA (Note 2)</li> <li>• Applied voltage: 30 V DC or less (between output and 0 V)</li> <li>• Residual voltage: 1.5 V or less [at 100 mA (Note 2) sink current]</li> </ul>	<PNP output type> PNP open-collector transistor <ul style="list-style-type: none"> <li>• Maximum source current: 100 mA (Note 2)</li> <li>• Applied voltage: 30 V DC or less (between output and +V)</li> <li>• Residual voltage: 1.5 V or less [at 100 mA (Note 2) source current]</li> </ul>	
Output operation		Selectable either Light-ON or Dark-ON, with jog switch		
Short-circuit protection		Incorporated		
Response time		80 $\mu$ s or less (H-SP), 150 $\mu$ s or less (FAST), 500 $\mu$ s or less (STD), 4 ms or less (U-LG) selectable with jog switch		
External input (Laser emission halt / Full-auto teaching / Limit teaching)		—	<NPN output type> NPN non-contact input <ul style="list-style-type: none"> <li>• Signal condition High: +5 V to +V DC or open, Low: 0 to +2 V DC (source current 0.5 mA or less)</li> <li>• Input impedance: 10 k<math>\Omega</math> approx.</li> </ul>	<PNP output type> PNP non-contact input <ul style="list-style-type: none"> <li>• Signal condition High: +4 V to +V DC (sink current 3 mA or less) Low: 0 to +0.6 V DC or open</li> <li>• Input impedance: 10 k<math>\Omega</math> approx.</li> </ul>
Operation indicator		Orange LED (lights up when output 1 and output 2 are ON)		
Laser emission indicator		Green LED (lights up during laser emission)		
Select indicator		Yellow LED (lights up when either output 1 or output 2 is selected)		
MODE indicator		RUN: Green LED, TEACH • L/D • TIMER • CUST • PRO: Yellow LED		
Digital display		4 digit (green) + 4 digit (red) LED display		
Sensitivity setting		Normal mode: 2-level teaching / Limit teaching / Full-auto teaching / Manual adjustment Window comparator mode: Teaching (1-level, 2-level, 3-level) / Manual adjustment Hysteresis mode: Teaching (1-level, 2-level, 3-level) / Manual adjustment Differential mode: 5-level settings		
Fine sensitivity adjustment function		Incorporated		
Timer function		Incorporated with variable ON-delay / OFF-delay / ONE SHOT timer, switchable either effective or ineffective. (Timer period: 1 to 9,999 ms approx.)		
Automatic interference prevention function		Incorporated [Up to four sets of sensor heads can be mounted close together. (However, disabled when in H-SP mode)]		
Environmental resistance	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 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 M $\Omega$ , 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	98 m/s <sup>2</sup> acceleration (10 G approx.) in X, Y and Z directions for five times each		
Material		Enclosure: Heat-resistant ABS, Transparent cover: Polycarbonate, Push button switch: Acrylic, Jog switch: ABS		
Cable		— (Note 3)	0.15 mm <sup>2</sup> 5-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 mm <sup>2</sup> , or more, cable.		
Weight		Net weight: 15 g approx., Gross weight: 20 g approx.	Net weight: 65 g approx., Gross weight: 75 g approx.	

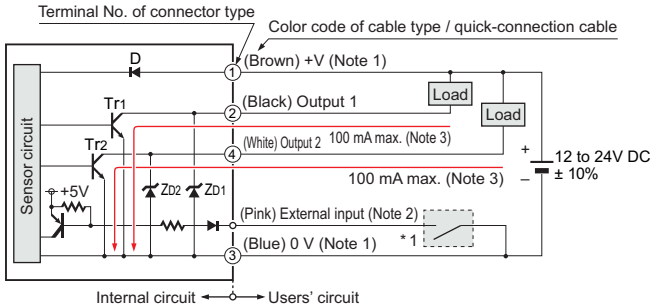
- Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.  
 2) 50 mA if 5 to 8 connector type amplifiers are connected in cascade, and 25 mA if 9 to 16 connector type amplifiers are connected in cascade.  
 3) The cable is not supplied as an accessory for connector type **LS-401(P)**. Be sure to use the optional quick-connection cables given below.  
 Main cable (4-core): **CN-74-C1** (cable length 1 m 3.281 ft), **CN-74-C2** (cable length 2 m 6.562 ft), **CN-74-C5** (cable length 5 m 16.404 ft)  
 Sub cable (2-core): **CN-72-C1** (cable length 1 m 3.281 ft), **CN-72-C2** (cable length 2 m 6.562 ft), **CN-72-C5** (cable length 5 m 16.404 ft)

## I/O CIRCUIT AND WIRING DIAGRAMS

### LS-401(-C2)

NPN output type

#### I/O circuit diagram



- 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) Connector type **LS-401(P)** does not incorporate the external input.
- 3) 50 mA max. if 5 to 8 connector type amplifiers are connected in cascade, and 25 mA max. if 9 to 16 connector type amplifiers are connected in cascade.

\* 1

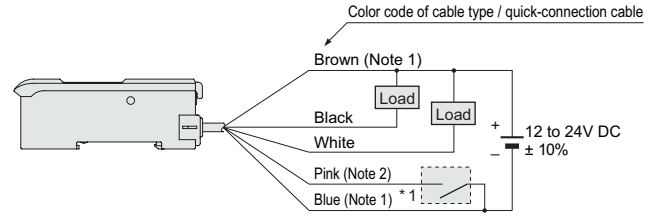
Non-voltage contact or NPN open-collector transistor

• External input  
High: +5 V to +V, or open  
Low: 0 to +2 V (source current: 0.5 mA or less)

• Beam emission halts and teaching occurs when at Low.

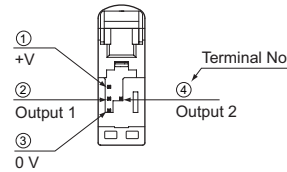
Symbols ... D: Reverse supply polarity protection diode  
ZD1, ZD2: Surge absorption zener diode  
Tr1, Tr2: NPN output transistor

#### Wiring diagram

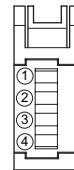


- Notes: 1) The quick-connection sub cable does not have brown lead wire and blue lead wire.  
The power is supplied from the connector of the main cable.
- 2) The quick-connection cable does not have a pink lead wire.

#### Terminal layout of connector type



#### \* Connector for amplifier (CN-EP1) pin position

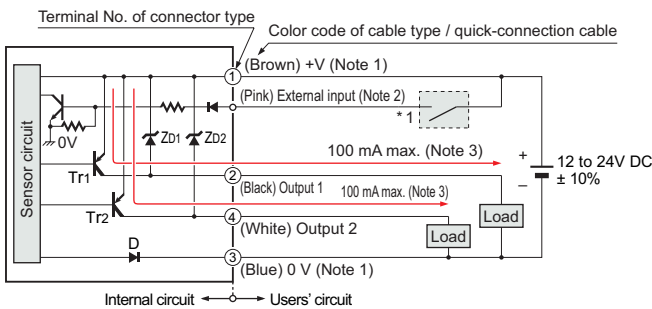


Terminal No.	Connection cable	
1	Conductor core wire: Brown	Cable color: Gray
2	Shield wire	
3	Conductor core wire: Yellow	Cable color: Black
4	Shield wire	

### LS-401P(-C2)

PNP output type

#### I/O circuit diagram



- 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) Connector type **LS-401(P)** does not incorporate the external input.
- 3) 50 mA max. if 5 to 8 connector type amplifiers are connected in cascade, and 25 mA max. if 9 to 16 connector type amplifiers are connected in cascade.

\* 1

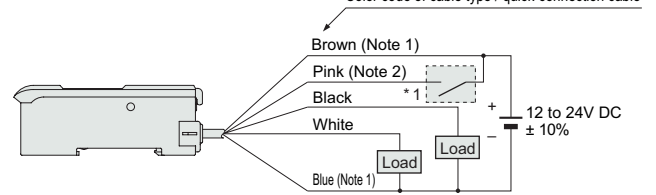
Non-voltage contact or PNP open-collector transistor

• External input  
High: +4 V to +V (sink current: 3 mA or less)  
Low: 0 to +0.6 V, or open

• Beam emission halts and teaching occurs when at Low.

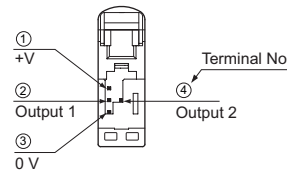
Symbols ... D: Reverse supply polarity protection diode  
ZD1, ZD2: Surge absorption zener diode  
Tr1, Tr2: PNP output transistor

#### Wiring diagram

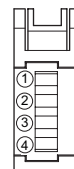


- Notes: 1) The quick-connection sub cable does not have brown lead wire and blue lead wire.  
The power is supplied from the connector of the main cable.
- 2) The quick-connection cable does not have a pink lead wire.

#### Terminal layout of connector type



#### \* Connector for amplifier (CN-EP1) pin position



Terminal No.	Connection cable	
1	Conductor core wire: Brown	Cable color: Gray
2	Shield wire	
3	Conductor core wire: Yellow	Cable color: Black
4	Shield wire	

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

SAFETY COMPONENTS

PRESSURE SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

WIRE- SAVING SYSTEMS

MEASURE- MENT SENSORS

STATIC CONTROL DEVICES

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LS

**PRECAUTIONS FOR PROPER USE**

Refer to p. 986~ for general precautions and p.1025~ for laser beam. Refer to the "PRO mode operation guide" which can be downloaded from our website at <http://www.sunx.com> for the amplifier operation procedures.

- 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 laws 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 2 (**LS-H□-A**: Class 1) laser in compliance with IEC / JIS / GB standards and FDA regulations 21 CFR 1040.10. Do not look at the laser beam directly or through optical system such as a lens.
- The following label is attached to the product. Handle the product according to the instruction given on the warning label.

IEC / JIS / GB Class 2 type



(This product has warning labels attached and included in the packaging that are written in Japanese, English and Chinese for compliance with various standards.)

FDA Class 1 type



(This product has explanation labels attached and included in the packaging that are written in Japanese, English and Chinese for compliance with various standards.)

**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□(F)** is classified as Class 2 laser. **LS-H□(F)-A** is classified as Class 1 laser. (Refer to p.1025~ for laser beam.)

**Safe use of laser products**

- For the purpose of preventing users from suffering injuries by laser products, IEC 60825-1: 2001 (Safety of laser products). Kindly check the standards before use.

**Spot-shape adjuster (Only for LS-H21□, LS-H22□)**

- The diffuse reflective type **LS-H21□** and **LS-H22□** incorporate the spot-shape adjuster to adjust the shape of spots.

Spot-shape adjuster	Description
	Turn the spot-shape adjuster clockwise or counter-clockwise to adjust the spot shape at your desired detecting distance. However, if the adjuster is turned too far, it may be damaged.

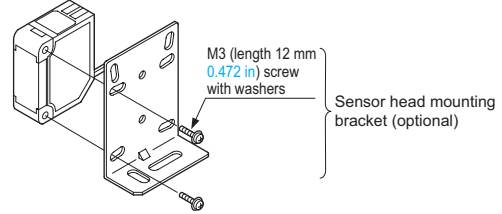
**Others**

- 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 mode than in other modes, it can be more easily affected by extraneous noise. Check the operating environment before use.

**Mounting**

**Sensor head**

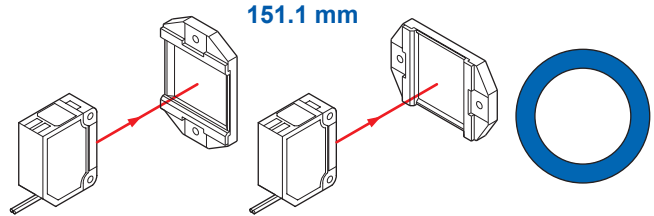
- The tightening torque should be 0.5 N·m or less.



- 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 leaned as shown in Fig. 2 below, the reflection amount will decrease, which may cause unstable detection.

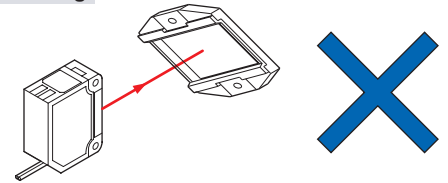
**Fig. 1 Proper positioning**

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



**Fig. 2 Improper positioning**

When placing the sensor head horizontally or vertically, but the reflector is leaned.



**Lens attachment for line reflective type (LS-MR1)**

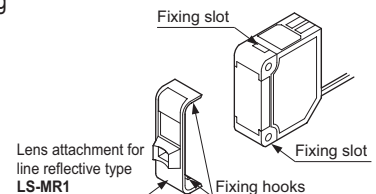
- The lens attachment for line reflective type **LS-MR1** mounted in the long sensing range line reflective type **LS-H22□** is removable. When **LS-H22□** is used without **LS-MR1**, it will provide the equivalent performance to the long sensing range spot reflective type **LS-H21□**. In addition, the optional **LS-MR1** can be attached to **LS-H21□** to obtain the performance equivalent to **LS-H22□**.
- Keep the lens clean of dust, dirt, water, oil, grease, etc.
- Do not apply any excessive force to **LS-MR1**. Such force may cause damage.

**Removing method**

- ① Insert a screwdriver into the fixing slot located at the top of sensor head.
- ② Tilt the screwdriver inserted in Step ① to remove **LS-MR1**.

**Mounting method**

- ① The size of upper fixing hook of **LS-MR1** is not same as the lower fixing hook. After identifying the upper and lower fixing hooks, insert **LS-MR1** upper fixing hook into the fixing slot at the top of sensor head and then insert **LS-MR1** lower fixing hook into the fixing slot at the bottom of sensor head.

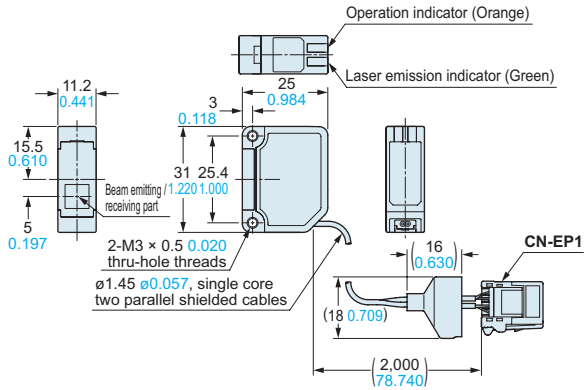


- ② After mounting, check that **LS-MR1** is properly fixed to the sensor head.

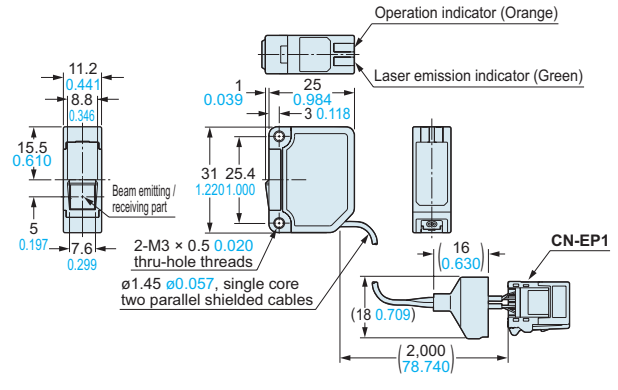
- FIBER SENSORS
- LASER SENSORS
- PHOTO-ELECTRIC SENSORS
- MICRO PHOTO-ELECTRIC SENSORS
- AREA SENSORS
- SAFETY COMPONENTS
- PRESSURE SENSORS
- INDUCTIVE PROXIMITY SENSORS
- PARTICULAR USE SENSORS
- SENSOR OPTIONS
- WIRE-SAVING SYSTEMS
- MEASUREMENT SENSORS
- STATIC CONTROL DEVICES
- LASER MARKERS
- Selection Guide
- Amplifier-separated
- LS

**DIMENSIONS (Unit: mm in)** The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.com>

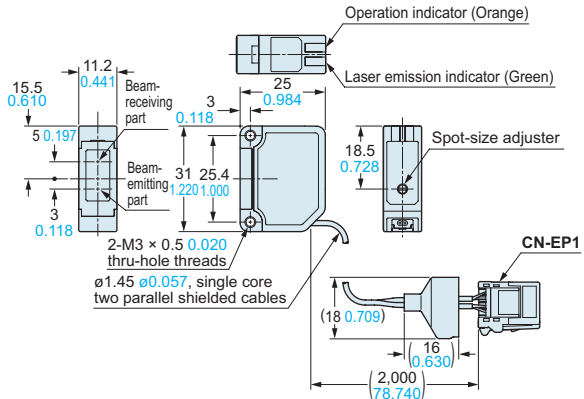
**LS-H91(-A) LS-H91F(-A)** Sensor head



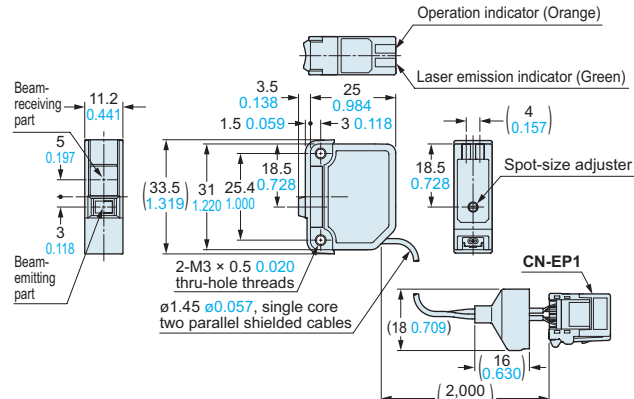
**LS-H92 LS-H92F** Sensor head



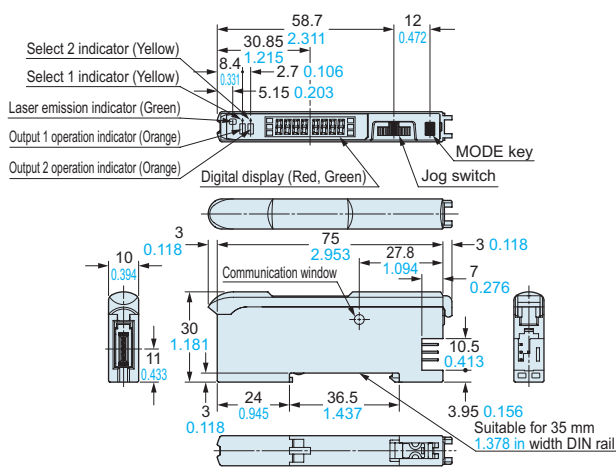
**LS-H21(-A) LS-H21F(-A)** Sensor head



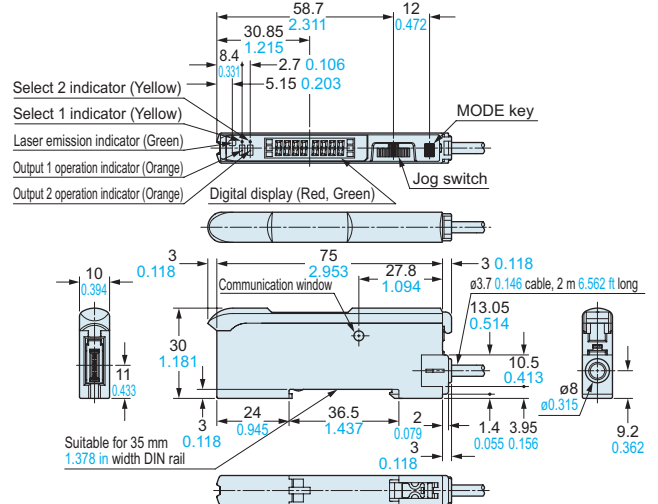
**LS-H22 LS-H22F** Sensor head



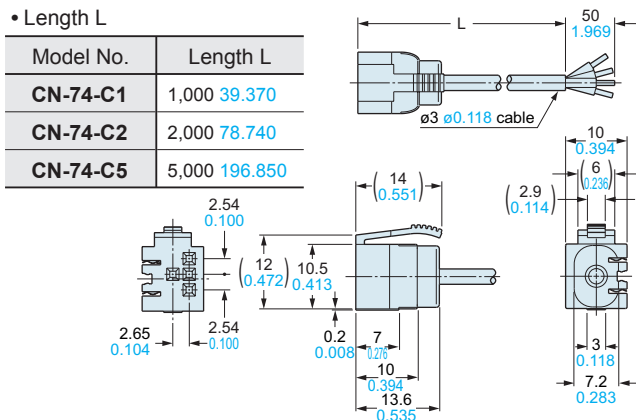
**LS-401 LS-401P** Amplifier



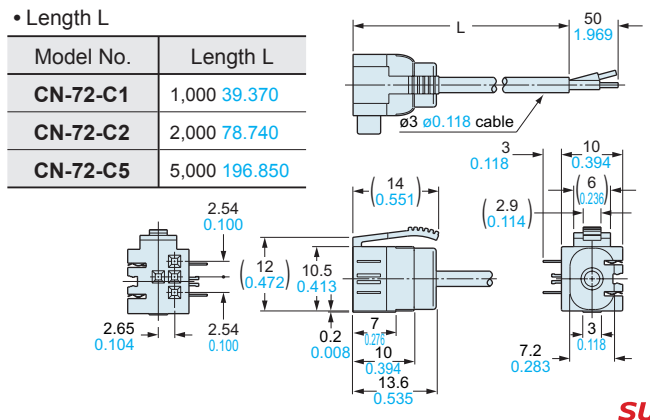
**LS-401-C2 LS-401P-C2** Amplifier



**CN-74-C1 CN-74-C2 CN-74-C5** Main cable (Optional)



**CN-72-C1 CN-72-C2 CN-72-C5** Sub cable (Optional)



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- MICRO PHOTO-ELECTRIC SENSORS
- AREA SENSORS
- SAFETY COMPONENTS
- PRESSURE SENSORS
- INDUCTIVE PROXIMITY SENSORS
- PARTICULAR USE SENSORS
- SENSOR OPTIONS
- WIRE-SAVING SYSTEMS
- MEASUREMENT SENSORS
- STATIC CONTROL DEVICES
- LASER MARKERS

Selection Guide  
Amplifier-separated  
**LS**



**DIMENSIONS (Unit: mm in)**

The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.com>

FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

SAFETY COMPONENTS

PRESSURE SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

WIRE-SAVING SYSTEMS

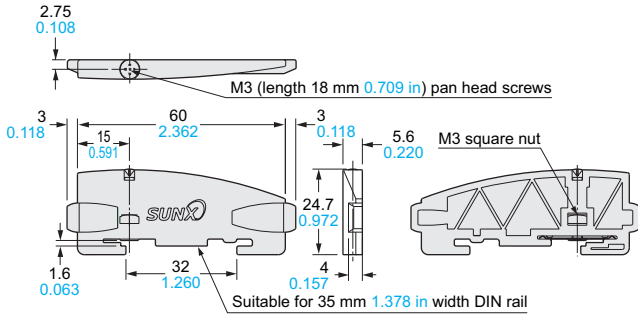
MEASUREMENT SENSORS

STATIC CONTROL DEVICES

LASER MARKERS

**MS-DIN-E**

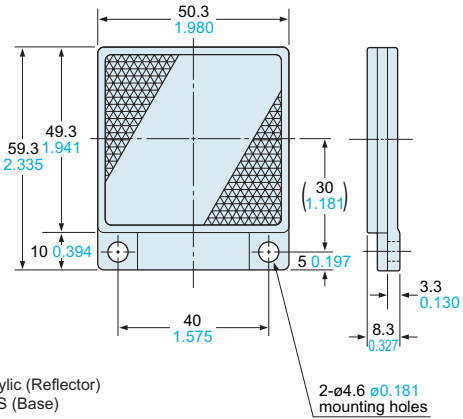
End plate (Optional)



Material: Polycarbonate

**RF-230**

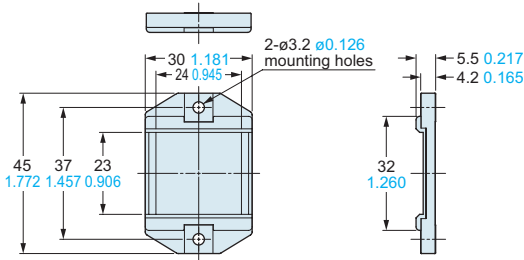
Reflector [Accessory for LS-H92(F)]



Material: Acrylic (Reflector)  
ABS (Base)

**RF-330**

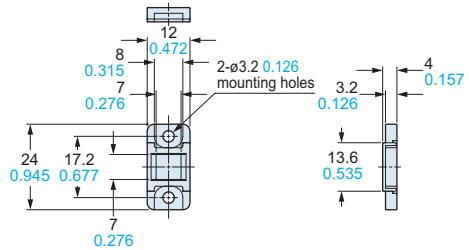
Reflector (Accessory for LS-H91□)



Material: Acrylic (Reflector)  
ABS (Base)

**RF-310**

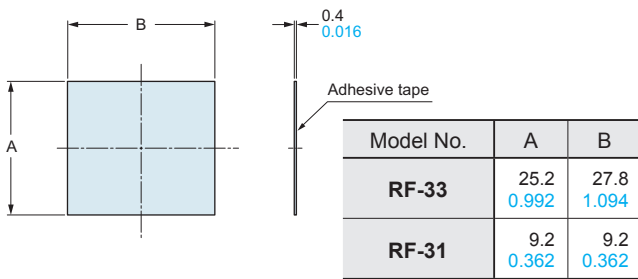
Reflector (Optional)



Material: Acrylic (Reflector)  
ABS (Base)

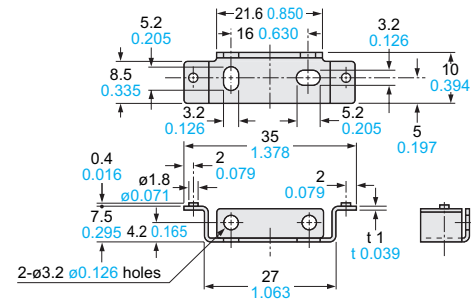
**RF-33 RF-31**

Reflective tape (Optional)



**MS-DIN-2**

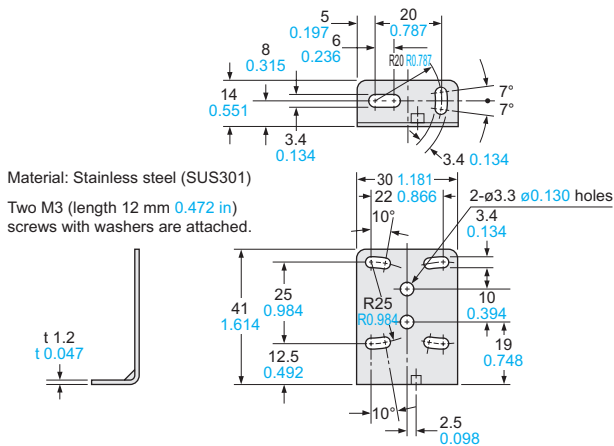
Amplifier mounting bracket (Optional)



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

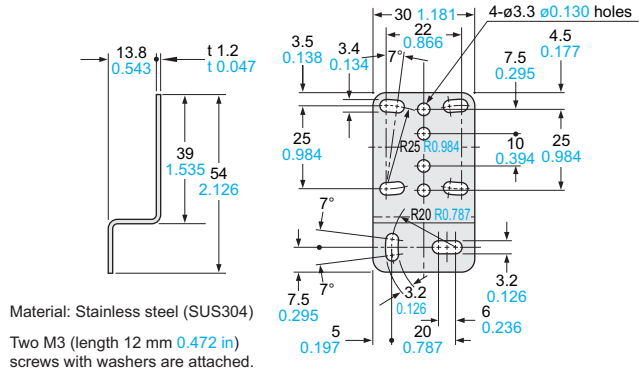
**MS-CX-1**

Sensor head mounting bracket (Optional)



**MS-CX-2**

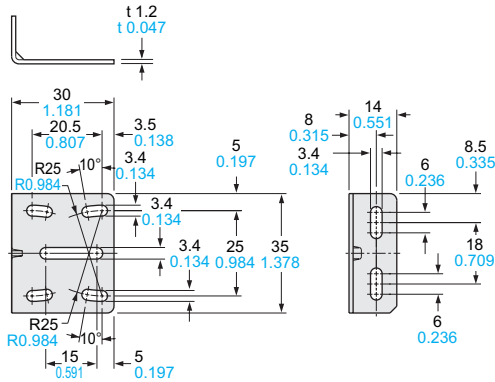
Sensor head mounting bracket (Optional)



**DIMENSIONS (Unit: mm in)**

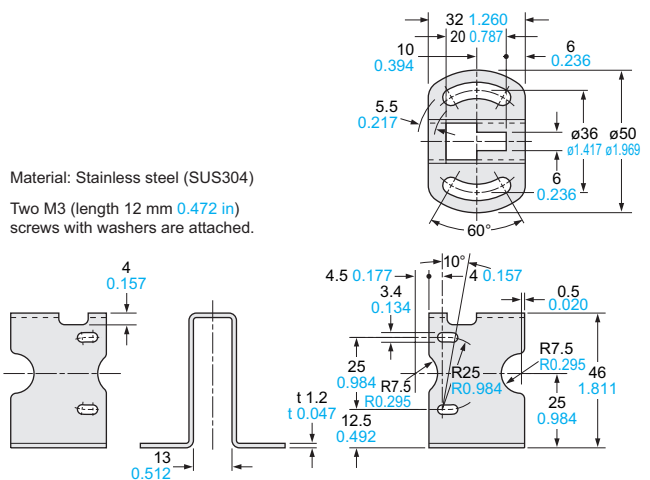
The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.com>

**MS-CX-3** Sensor head mounting bracket (Optional)



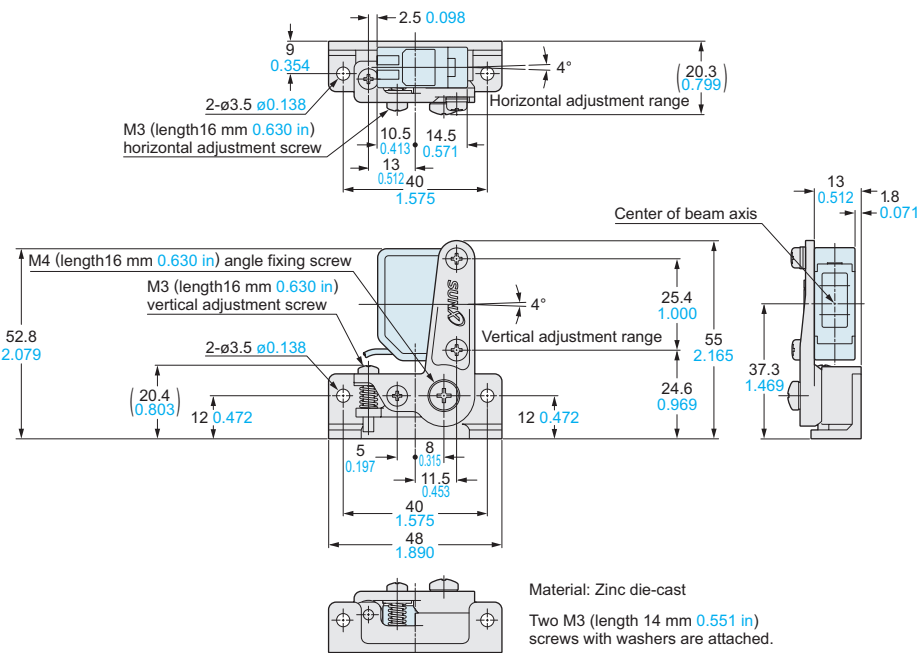
Material: Stainless steel (SUS304)  
Two M3 (length 12 mm 0.472 in) screws with washers are attached.

**MS-CX-4** Sensor head mounting bracket (Optional)



Material: Stainless steel (SUS304)  
Two M3 (length 12 mm 0.472 in) screws with washers are attached.

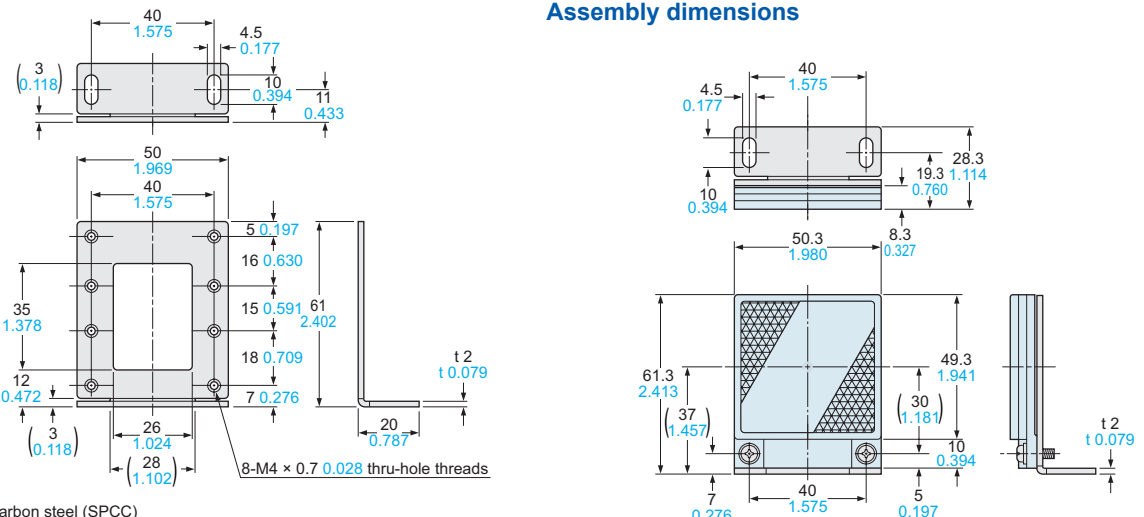
**MS-CX-11** Sensor mounting bracket for beam axis alignment (Optional)



Material: Zinc die-cast  
Two M3 (length 14 mm 0.551 in) screws with washers are attached.

**MS-RF23** Reflector mounting bracket for RF-230 (Optional)

**Assembly dimensions**



Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated)  
Two M4 (length 10 mm 0.394 in) screws with washers are attached.

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