

# SUNX

## NEW & KEY PRODUCTS 2009-2010



Laser Sensor .....	p. 1
Fiber Sensors .....	p. 2~
Optical Fiber Heads .....	p. 7
Sensors for Semiconductor / FPD Industry	
Glass Substrate / Wafer Detection .....	p. 8
Liquid Leak / Liquid Level Detection .....	p. 8~
Mark Sensor .....	p.10
Photoelectric Sensors .....	p.11~
Micro Photoelectric Sensors .....	p.16
Light Curtains .....	p.17~
Safety Sensors .....	p.20
Optical Touch Switch .....	p.21
Wire-saving System .....	p.21
Pressure / Flow Sensors .....	p.22~
Inductive Proximity Sensors .....	p.24
Measurement Sensors	
Light / Reflective Type .....	p.25~
Light / Thru-beam Type .....	p.27
Static Removers .....	p.28~
Industrial Use Video Endoscope .....	p.31

# Laser Sensor Photoelectric Sensor

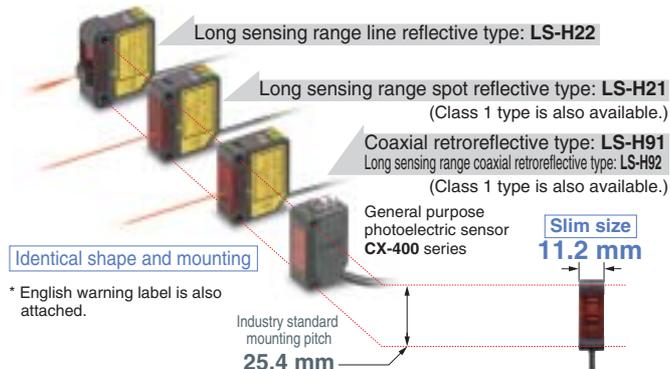
Digital Laser Sensor

LS SERIES

## User-friendly, high precision laser sensing!

### 4 types of identically sized sensor heads available

We designed 4 types of sensor heads. They are approximately the same size as general purpose photoelectric sensors and the mounting method is identical.



## New coaxial reflective type with a long sensing range of 30 m LS-H92

The introduction of the **LS-H92** long sensing range coaxial reflective type sensor means that even longer sensing ranges are now possible.

- Sensing of projections from conveyor belts
- Sensing items inside large stockers



## Spot size adjustment LS-H21, LS-H22

The long sensing range spot reflective type and long sensing range line reflective type have a built-in spot-size adjuster that enables spot size adjustment according to the object for optimal setting.



## Accurately detect 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 for the optimal setting. In addition, changing the receiving sensitivity will not affect the response time.

### Sensor heads

Type	Coaxial retroreflective		Diffuse reflective	
	Long sensing range type	Long sensing range spot reflective	Long sensing range line reflective	Long sensing range line reflective
Model No. (Note 1)	<b>LS-H91(F)-(A)</b> (Note 2)	<b>LS-H92(F)</b>	<b>LS-H21(F)-(A)</b> (Note 2)	<b>LS-H22(F)</b> (Note 3)
Sensing range	0.1 to 7 m (U-LG) 0.1 to 5 m (STD) 0.1 to 3 m (FAST / H-SP) (Note 4)	0.2 to 30 m (U-LG) 0.2 to 20 m (STD) 0.2 to 10 m (FAST / H-SP)	30 to 1,000 mm (U-LG) 30 to 500 mm (STD) 30 to 300 mm (FAST / H-SP) (Note 4)	30 to 1,000 mm (U-LG) 30 to 500 mm (STD) 30 to 300 mm (FAST / H-SP)
Ambient temperature	- 10 to + 55 °C			
Emitting element	Red semiconductor laser, Class 2 (LS-H□: IEC / JIS / GB, LS-H□F: FDA / IEC / JIS) [LS-H91(F)-A, LS-H21(F)-A: Class 1][Max. output: 3 mW or less [LS-H91(F)-A, LS-H21(F)-A: 1 mW or less], Peak emission wavelength: 655 nm]			
Dimensions	W11.2 × H31 × D25 mm			

- Notes: 1) LS-H□ conforms IEC / JIS / GB standards.  
LS-H□F conforms FDA / IEC / JIS standards.  
2) LS-H91(F)-A, LS-H21(F)-A: Class 1 type  
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. LS-H21(F) appears on the sensor itself.  
4) Sensing range: LS-H91(F)-A 0.1 to 5 m (U-LG), 0.1 to 3 m (STD), 0.1 to 1 m (FAST / H-SP)  
LS-H21(F)-A 30 to 500 mm (U-LG), 30 to 250 mm (STD), 30 to 150 mm (FAST / H-SP)



## A new CC-Link compatible type LS-403 that makes maintenance and preventive maintenance easy

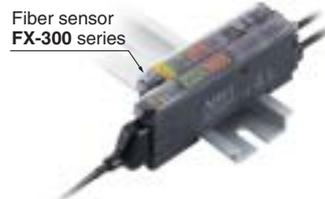
CC-Link communication is possible through the connection to **SC-GU2-C**. By having the configurations saved as "Configuration file" before equipment shipment, later on when it comes to exchanging the sensors, the configurations can be simply written in through CC-Link. When connecting with digital fiber sensors **FX-301/305** or digital pressure sensors **DPS-401/402**, batch data communication can be carried out.



Refer to p.21 for details.

## Wiring and space saving

The quick-connection cable enables reduction in wiring (connector type). The connection and man-hours for the intermediate terminal block setup can be reduced and valuable space is saved. Also, LS series amplifiers can be connected side-by-side with the **FX-300** series fiber sensors.



Up to 16 units can be connected side by side in series

### Amplifiers

Type	Connector type (Note)		
	With communication function	LS-401	LS-403
Model No.	NPN output PNP output	<b>LS-401</b> <b>LS-401P</b>	<b>LS-401-C2</b> <b>LS-401P-C2</b>
Supply voltage	12 to 24 V DC ± 10 %		
Output (Output 1, Output 2)	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor		
Output operation	Selectable either Light-ON or Dark-ON, with jog switch		
Response time	80 μs or less (H-SP), 150 μs or less (FAST), 500 μs or less (STD), 4 ms or less (U-LG), selectable with jog switch		
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: LS-401□: 5-level settings, LS-403: 8-level settings		
Digital display	4 digit (green) + 4 digit (red) LED display		
Automatic interference prevention function	Incorporated [Up to four sets of sensor heads can be mounted close together (However, LS-401□: disabled when in H-SP mode, LS-403: up to two sets sensor heads when in H-SP mode)]		
Ambient temperature	- 10 to + 55 °C (If 4 to 7 units are mounted close together: - 10 to + 50 °C, if 8 to 16 units are mounted close together: - 10 to + 45 °C)		
Dimensions	W10 × H30 × D75 mm		

- Note: The cable for amplifier connection is not supplied as an accessory with the connector type amplifier. Make sure to use the optional quick-connection cable given below.  
Main cable (4-core): **CN-74-C1** (cable length 1 m), **CN-74-C2** (cable length 2 m)  
**CN-74-C5** (cable length 5 m)  
Sub cable (2-core): **CN-72-C1** (cable length 1 m), **CN-72-C2** (cable length 2 m)  
**CN-72-C5** (cable length 5 m)

# Fiber Sensors Photoelectric Sensor

## Dual Digital Display Fiber Sensor FX-100 SERIES

Taking digital fiber sensors to the next level

### Space-saving 9 mm in width

The unit is a slim 9 mm in width, even with the digital dual screen display. It both saves space and is easy to handle.



Threshold value Incident light intensity

9 mm

DIN rail installation also possible

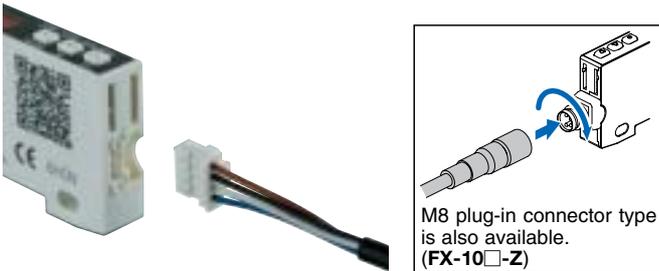
φ 3.2 mounting hole  
Direct installation possible without bracket

Uses a four-chemical emitting element

Changes in the properties of the light emitting element over years of use is kept to an absolute minimum so that stable sensing performance can be obtained for a long time.

### Wiring can be carried out using commercially-available connectors

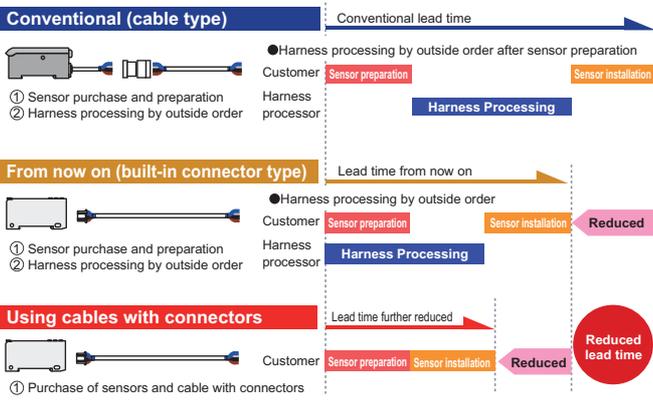
The DP-100 series of digital pressure sensors and the PM-64 series of micro photoelectric sensors can be wired using the same commercially-available connectors.



M8 plug-in connector type is also available. (FX-10□-Z)

### Lead time and spare part numbers can both be reduced

The connectors used are commercially-available connectors, so that processing costs and lead time required for carrying out processing after purchase of the sensors can be greatly reduced. The same connection parts as the DP-100 series of digital pressure sensors and the PM-64 series of micro photoelectric sensors can be used.



CE  
Conforming to  
EMC Directive

### A 3-level navigation structure provides easy access to the sensor's functions, from basic to advanced

Setting details are divided into three levels for simple operation, so that settings for normal operation are made in 'RUN mode', basic settings are made in 'SET mode', and advanced functions are set in 'PRO mode'. This makes configuration much easier to understand and carry out.

#### RUN mode

Functions used during normal operation

[ Function table ]

- Changing threshold values
- Key lock
- Quick settings
- Code settings

#### SET mode

Functions used when initializing the sensor and carrying out maintenance

[ Function table ]

- Teaching
- L-ON / D-ON setting
- Timer setting
- Light-emitting amount selection
- Emission frequency setting function

#### PRO mode

Equipped with a full complement of digital fiber sensor functions

[ Function table ]

- Shift
- External input
- Reset
- GETA
- ECO
- Display reversing
- Surplus value display
- Copy
- Threshold value seeking cycle setting

### A copy unit which lets you copy setting details at a single touch is available

The sensor's copy function can be run by pressing a single button. Setting details of master sensor can be copied to slave sensors. When setting multiple sensors at the same time, this greatly reduces lead time and prevents setting errors by operators.



Copy unit  
SC-SU1

Type	Standard type		Long sensing range type		
	Cable set		Cable set		
Model No. (Note 1)	NPN output	FX-101-CC2	FX-101(-Z)	FX-102-CC2	FX-102(-Z)
	PNP output	FX-101P-CC2	FX-101P(-Z)	FX-102P-CC2	FX-102P(-Z)
Supply voltage	12 to 24 V DC ± 10 %				
Output	NPN open-collector transistor or PNP open-collector transistor				
Output operation	Selectable either Light-ON or Dark-ON, at SET mode				
Response time	Emission frequency 0: 250 μs or less		Emission frequency 1: 2.5 ms or less		
	Emission frequency 1: 450 μs or less		Emission frequency 2: 2.8 ms or less		
	Emission frequency 2: 500 μs or less		Emission frequency 3: 3.2 ms or less		
	Emission frequency 3: 600 μs or less		Emission frequency 4: 5.0 ms or less		
Sensitivity setting	2-level teaching / Limit teaching / Full-auto teaching				
Digital display	4 digits (green) + 4 digits (red) LCD display				
Timer function	ON-delay / OFF-delay timer, switchable either effective or ineffective. [Timer period: 1 ms, 5 ms, 10 ms, 20 ms, 40 ms, 50 ms, 100 ms, 500 ms, 1,000 ms]				
Interference prevention function	Incorporated		Incorporated		
	Emission frequency selection method (Note 2) (Functions at emission frequency 1, 2 or 3)		Emission frequency selection method (Note 2) (Functions at emission frequency 1, 2, 3 or 4)		
Ambient temperature	- 10 to + 55 °C (Note 3)				
Emitting element (modulated)	Red LED (Peak emission wavelength : 632 nm)				
Dimensions	W9×H30×D64.5 mm				

- Notes: 1) Model Nos. having the suffix '-Z' are M8 plug-in connector type.  
 2) When using the interference prevention function, set the emission frequencies for the amplifiers to be covered by the interference prevention function to different frequency value. However, the interference prevention function does not operate at emission frequency 0 (factory default setting) for the FX-101(P)(-Z) / FX-101(P)-CC2.  
 3) If 4 to 7 units are mounted close together: - 10 to + 50 °C, if 8 to 16 units are mounted close together: - 10 to + 45 °C

## Digital Fiber Sensor FX-301 SERIES

**Enhanced functions and performance yet still easy to use**

### FX-301(P) (red LED type) version upgrade

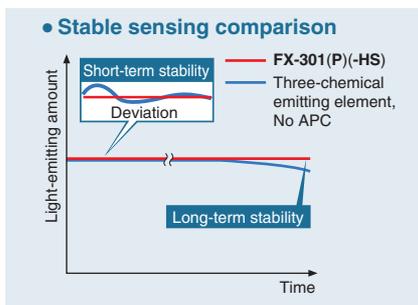
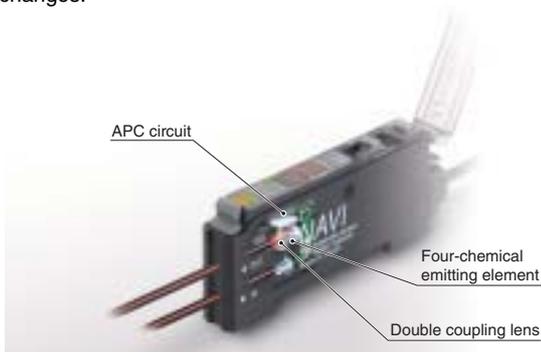
We improved the standard model by enhancing its sensing stability and equipping it with handy functions such as light-emitting amount selection function. This makes the fiber sensor easier to use than ever while conserving the superior operability of the conventional model.

### Super high speed response of 35 $\mu\text{s}$ FX-301(P)-HS

The new **FX-301(P)-HS** model is a digital type fiber sensor with a super high speed response of 35  $\mu\text{s}$  that is capable of sensing minute objects moving at high speeds. At 65  $\mu\text{s}$ , the standard **FX-301(P)** model (H-SP mode) has twice the speed of the conventional model.

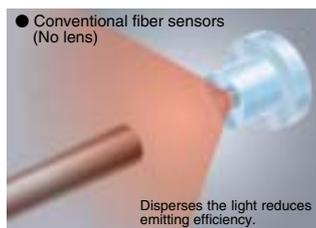
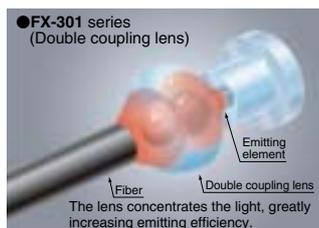
### Stable sensing over long and short periods FX-301(P)(-HS)

In addition to a **"four-chemical emitting element"** which suppresses changes in the light-emitting element over time so that a stable level of light emission can be maintained over long periods, a new **"APC (Auto Power Control) circuit"** has also been adopted. Because fluctuations over short periods of time have also been suppressed, stable sensing is possible soon after the power is turned back on after setup changes.



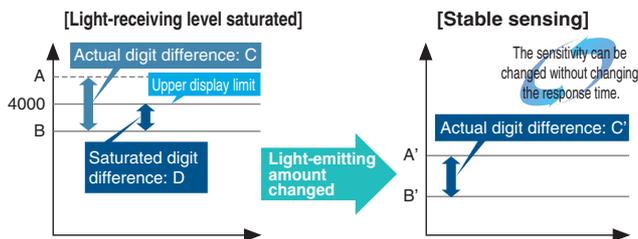
### Sensing range has been greatly increased All models

All models use a **"double coupling lens"** that enables a much wider sensing range and maximization in the light emission efficiency. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular due to the miniaturization of chip components, have been increased by 50 % over previous values achieved with other amplifiers.



### Light-emitting amount selection function FX-301(P)(-HS)

If the light-receiving level becomes saturated during close-range sensing or when sensing transparent or ultra-small objects, you can adjust the light-emitting amount of the sensor to stabilize sensing without needing to change the response time. Sensing which previously required the response time or fibers to be changed can now be set much more easily using this function.



Type	Standard type (Note 2)		High speed type
Model No.	NPN output	FX-301□	FX-301-HS
	PNP output	FX-301□P	FX-301P-HS
Sensing range (Red LED type)		Thru-beam type (FT-B8): 1,100 mm (LONG), 530 mm (STD), 400 mm (FAST), 200 mm (H-SP), 180 mm (S-D) Reflective type (FD-B8): 480 mm (LONG), 220 mm (STD), 160 mm (FAST), 85 mm (H-SP), 75 mm (S-D)	Thru-beam type (FT-B8): 1,100 mm (LONG), 530 mm (STD), 400 mm (FAST), 160 mm (H-SP), 180 mm (S-D) Reflective type (FD-B8): 480 mm (LONG), 220 mm (STD), 160 mm (FAST), 60 mm (H-SP), 75 mm (S-D)
Supply voltage	12 to 24 V DC $\pm$ 10 %		
Output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor		
Output operation	Selectable either Light-ON or Dark-ON, with jog switch		
Response time	65 $\mu\text{s}$ or less [H-SP (Red LED type only)], 150 $\mu\text{s}$ or less (FAST), 250 $\mu\text{s}$ or less (STD / S-D (Red LED type only)), 2 ms or less (LONG) selectable with jog switch		35 $\mu\text{s}$ or less (H-SP), 150 $\mu\text{s}$ or less (FAST), 250 $\mu\text{s}$ or less (STD / S-D), 2 ms or less (LONG) selectable with jog switch
Sensitivity setting	2-level teaching / Limit teaching / Manual adjustment / Full-auto teaching / Max. sensitivity teaching		
Digital display	4-digit red LED display		
Automatic interference prevention function	Incorporated [(Up to 4 sets of fiber heads can be mounted close together.) (However, H-SP mode is 2 sets.)]		— (Not equipped with communication function)
Ambient temperature	- 10 to + 55 °C (If 4 to 7 units are connected in cascade: - 10 to + 50 °C, if 8 to 16 units are connected in cascade: - 10 to + 45 °C)		
Emitting element (modulated)	FX-301(P): Red LED, FX-301B(P): Blue LED, FX-301G(P): Green LED, FX-301H(P): Infrared LED		Red LED
Dimensions	W10 $\times$ H30.5 $\times$ D64.5 mm		

Notes: 1) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.  
Main cable (3-core): **CN-73-C1** (cable length 1 m), **CN-73-C2** (cable length 2 m), **CN-73-C5** (cable length 5 m)  
Sub cable (1-core): **CN-71-C1** (cable length 1 m), **CN-71-C2** (cable length 2 m), **CN-71-C5** (cable length 5 m)  
2) Red LED type **FX-301(P)** is the upgraded version.

## Easy operation with MODE NAVI All models

MODE NAVI uses six indicators to display the amplifier's basic operations. The current operating mode can be confirmed at a glance, so even a first time user can easily operate the amplifier without becoming confused.

RUN

TEACH

ADJ

**RUN→**  
This is the sensing mode. Light-receiving amount is displayed in the digital display.

L/D

TIMER

PRO

**L/D→**  
This mode allows the selection of output operation as either Light-ON or Dark-ON.

RUN

TEACH

ADJ

**TEACH→**  
This mode is for setting the threshold value.



L/D

TIMER

PRO

**TIMER→**  
This mode allows timer selection and permits the choice of using or not using the timer.

RUN

TEACH

ADJ

**ADJ→**  
In this mode, the threshold value, once set, may be fine-tuned.

L/D

TIMER

PRO

**PRO→**  
This mode allows the selection of further advanced functions, such as the copying of individual settings and the memory functions.

## The use of only two switches makes for very simple operations All models

Only two switches, the large jog switch and the large MODE key, are required for operation. Pressing the large MODE key sets the 'mode selection' and 'mode cancel' functions. The large jog switch is used to select the detailed functions available within each mode, as well as to change numerical values after the mode has been chosen.

**Large MODE key**

1

2

3

Pressing the switch selects or cancels the operating mode

Moving the switch from side to side allows items to be selected

Pressing the switch then confirms the selected setting

**Large jog switch**

1

2

3

Pressing the switch selects or cancels the operating mode

Moving the switch from side to side allows items to be selected

Pressing the switch then confirms the selected setting

## Easy threshold value verification FX-301(P)(-HS)

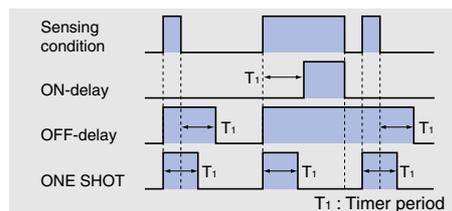
The threshold value can be confirmed by turning the jog switch even during RUN mode.

## Equipped with 3 types of timers All models

These sensors are equipped with 3 types of timers, ON-delay, OFF-delay, and ONE SHOT, for compatibility to variegated environments.

## Key lock function prevents accidental setting changes All models

Equipped with a key lock function that disables the jog switch and MODE key to prevent accidental setting changes by the operator.



## Optical communication function allows multiple sensors to be adjusted at once FX-301□(P)

The optical communication function allows the data that is currently set to be copied and saved all at once for all amplifiers connected together from the right side. This greatly reduces troublesome setup tasks and makes setup much smoother.

## Wiring- and labor-saving design allows side-by-side configuration for up to sixteen units All models

## Easy maintenance, as main and sub units are identical All models

\* Use the optical communication function for only the same types of sensors. Furthermore, the **FX-301-HS** is not equipped with optical communication function capability.

## A lineup of four light source type sensors gives a greater range of applications

In addition to our red LED (four-chemical emitting element) type, the blue, green, and infrared LED types are also available to correspond to your specific application.

### Red LED type FX-301(P)(-HS)

This standard type of **FX-301(P)(-HS)** using red light has a four-chemical emitting element for stable sensing over long periods.

### Blue LED type FX-301B(P)

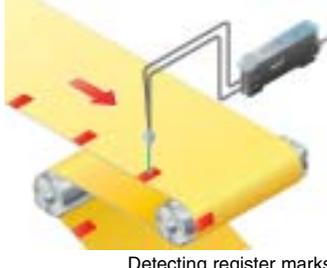
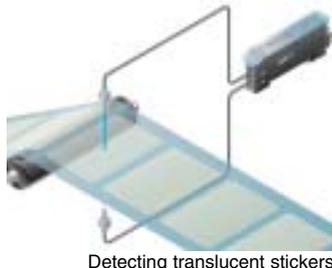
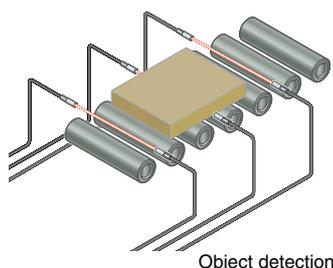
The blue LED type greatly reduces the dampening rate, making it ideal for delicate detection.

### Green LED type FX-301G(P)

The green LED type can accurately discriminate between red and yellow, which cannot be easily detected using red LED type.

### Infrared LED type FX-301H(P)

Infrared LED type is ideal for sensing environments with light restrictions, such as places where light-sensitive film is being handled. (The emission peak wavelength: 940 nm.) It includes full-auto teaching function which allows sensitivity to be set without stopping the target object line.



# Fiber Sensors Photoelectric Sensor

## Dual Digital Display Fiber Sensor FX-410 SERIES

Just "Look" and "Turn", simple, easy-to-use fiber sensor

**Incident light intensity and threshold value are displayed simultaneously**

The incident light intensity and threshold value can be checked at the same time with no operations needed. In addition, no complex mode settings are needed when the values are adjusted.



### Large endless adjuster New concept

Standard screwdrivers can be used to turn the adjuster as well as precision screwdrivers. In addition, an 'endless' mechanism is used which eliminates the possibility of any damage being caused by turning the adjuster too far.

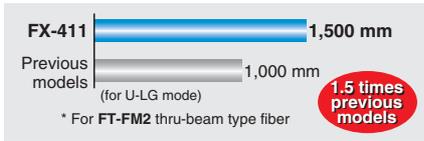
### Immediate setting possible using the R.S.S. adjuster

The sensitivity amount changes depending on the rotation speed of the adjuster, so that adjustment can be carried out speedily.



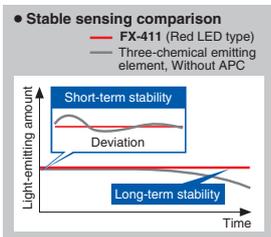
### Beam power greatly increased to give strong performance under adverse environments Red LED type

The beam power has been greatly increased. This means a longer sensing distance and less trouble from problems such as dust accumulation. These sensors have outstanding performance for your workplace needs.



### Improved stability over both long and short terms Red LED type

The red LED type sensors have a "four-chemical emitting element" which maintains stability of light emissions for long-term operation. Furthermore, all models have an "APC (Auto Power Control) circuit" which improves stability at times such as when the power is turned on. These features improve overall stability compared to previous models.



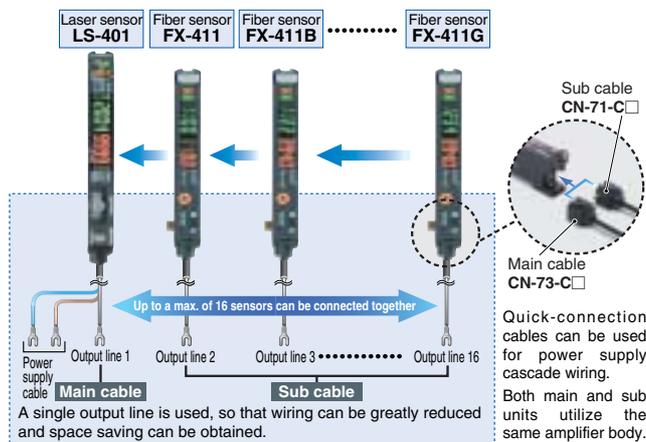
### New FX-412 can be turned by finger!

The adjuster can be turned directly by finger, without the need for a screwdriver.



### Excellent workability and ease of maintenance

The same quick-connection cable that is used for sensors such as the FX-300 series of digital fiber sensors is used. This means that they can be used together with other types of sensors such as laser sensors, and the number of power supply cables can be reduced.



Type	Red LED		Blue LED		Green LED	
Model No.	NPN output FX-411	FX-412	FX-411B	FX-412B	FX-411G	FX-412G
	PNP output FX-411P	—	FX-411BP	—	FX-411GP	—
Sensing range (Red LED type)	Thru-beam type (FT-B8): 2,000 mm (U-LG), 530 mm (STD), 400 mm (FAST) Reflective type (FD-B8): 650 mm (U-LG), 180 mm (STD), 120 mm (FAST)					
Supply voltage	12 to 24 V DC ± 10 %					
Output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor					
Output operation	Switchable either Light-ON or Dark-ON					
Response time	150 μs or less (FAST), 500 μs or less (STD), 4.5 ms or less (U-LG), selectable with setting switch					
Timer function	Incorporated with variable ON-delay / OFF-delay / ONE SHOT timer, switchable either effective or ineffective. (Timer period: 1 ms to 3 sec. approx.)					
Automatic interference prevention function	Incorporated (Up to four sets of fiber heads can be mounted close together. However, U-LG mode is 8 fiber heads.)					
Ambient temperature	- 10 to + 55 °C (If 4 to 7 units are connected in cascade: - 10 to + 50 °C, ) (If 8 to 16 units are connected in cascade: - 10 to + 45 °C )					
Dimensions	W10 × H30.5 × D64.5 mm					

Note: The cable for amplifier connection is not supplied as an accessory with the connector type amplifier. Make sure to use the optional quick-connection cable given below.  
Main cable (3-core): **CN-73-C1** (cable length 1 m), **CN-73-C2** (cable length 2 m)  
**CN-73-C5** (cable length 5 m)  
Sub cable (1-core): **CN-71-C1** (cable length 1 m), **CN-71-C2** (cable length 2 m)  
**CN-71-C5** (cable length 5 m)

# Fiber Sensors

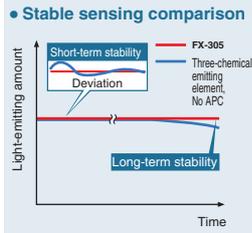
Photoelectric Sensor

## Digital Fiber Sensor FX-305

High level of stability and sensing performance!

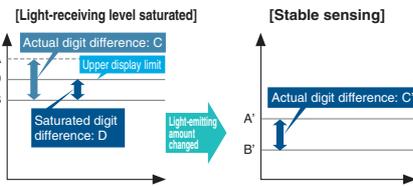
### Stable sensing over long and short periods

In addition to a "four-chemical emitting element" which suppresses changes in the light-emitting element over time so that a stable level of light emission can be maintained over long periods, a new "APC (Auto Power Control) circuit" has also been adopted. Because fluctuations over short periods of time have also been suppressed, stable sensing is possible soon after the power is turned back on after setup changes.



### Light-emitting amount selection function

If the light-receiving level becomes saturated during close-range sensing or when sensing transparent or ultra-small objects, you can adjust the light-emitting amount of the sensor to stabilize sensing without needing to change the response time. Sensing which previously required the response time or fibers to be changed can now be set much more easily using this function.



Comparison of saturation remedies	
[Conventional models]	[FX-305]
Response time: Mode selection → Affects positioning precision	Light-emitting amount selection function Makes steps such as those at left unnecessary.
Changing fiber: Change to thinner fiber to reduce light amount → Man-hour and cost inefficiencies	
Changing setting position: Increase sensing range → Space and man-hour inefficiencies	

### Large display 9999

Large display with 4 digits (9999). With a greater difference in digit value than previous models, threshold values can be set in units of 1 digit up to maximum 9999. Threshold setting can now be done more easily and accurately.



### High-speed response 65 μs

High-speed response that is about twice as fast as before has been achieved. Even small objects moving at high speeds can be detected. In addition, interference between two units is prevented in high-speed mode (H-SP).

### Automatic interference prevention of up to 16 units

Can be used even in places where fibers are installed close together.

## Manually Set Fiber Sensor FX-311 SERIES

FX-311 is remarkably easy to use, yet employs the latest technology

### 12-turn potentiometer with visible indicator

12-turn potentiometer has been incorporated for fine adjustments. It enables very fine differences to be detected. Moreover, since the pointer of indicator has a red backlight, you can confirm the position at a glance, even in a dark area.



### Three light source types (red, green, blue) are made available for expanding applications

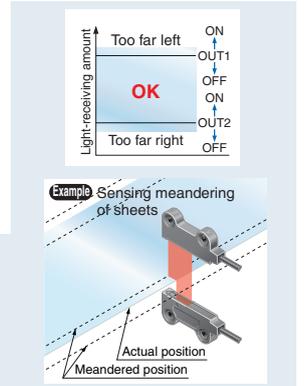


### Rapid blinking "assist function" eases adjustment for optimum sensitivity



### Independent dual outputs

Two independent output channels are provided, so that one sensor can be used for control tasks that previously required two sensors. In addition, the second output channel can be used for simple self-diagnosis and alarm output, so that ease of maintenance is improved.



[Conventional models] 2 sensors needed  
[FX-305] 1 sensor is enough!

Type	NPN output	PNP output
Model No.	<b>FX-305</b>	<b>FX-305P</b>
Sensing range (mm)	Thru-beam type (FT-B8): 1,600 (U-LG), 1,100 (LONG), 700 (STDF), 530 (STD), 400 (FAST), 200 (H-SP) Reflective type (FD-B8): 600 (U-LG), 480 (LONG), 280 (STDF), 220 (STD), 160 (FAST), 85 (H-SP)	
Supply voltage	12 to 24 V DC ± 10 %	
Output (Output 1, Output 2)	NPN open-collector transistor	PNP open-collector transistor
Output operation	Selectable either Light-ON or Dark-ON, with jog switch	
Response time	65 μs or less (H-SP), 150 μs or less (FAST), 250 μs or less (STD), 700 μs or less (STDF), 2.5 ms or less (LONG), 4.5 ms or less (U-LG), selectable with jog switch	
Sensitivity setting	Normal mode: 2-level teaching / Limit teaching / Full-auto teaching / Max. sensitivity teaching / Manual adjustment Window comparator mode: Teaching (1-level, 2-level, 3-level) / Manual adjustment	
Automatic interference prevention function	Incorporated [Up to 4 sets of fiber heads can be mounted close together (However, U-LG mode is 8 sets, H-SP mode is 2 sets.)]	
Ambient temperature	-10 to +55 °C (If 4 to 7 units are connected in cascade: -10 to +50 °C, if 8 to 16 units are connected in cascade: -10 to +45 °C)	
Emitting element	Red LED (modulated)	
Dimensions	W10 × H30.5 × D64.5 mm	

Note: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.  
Main cable (4-core): **CN-74-C1** (cable length 1 m), **CN-74-C2** (cable length 2 m)  
**CN-74-C5** (cable length 5 m)  
Sub cable (2-core): **CN-72-C1** (cable length 1 m), **CN-72-C2** (cable length 2 m)  
**CN-72-C5** (cable length 5 m)



Sensing range (Red LED type): FT-B8 1,100 mm (LONG), 530 mm (STD), 180 mm (S-D) FD-B8 480 mm (LONG), 220 mm (STD), 75 mm (S-D) Supply voltage: 12 to 24 V DC ± 10 % Output: <b>FX-311</b> □ NPN open-collector transistor <b>FX-311</b> □ P PNP open-collector transistor Dimensions: W10 × H30.5 × D64.5 mm
--

Note: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.  
Main cable (3-core): **CN-73-C1** (cable length 1 m), **CN-73-C2** (cable length 2 m)  
**CN-73-C5** (cable length 5 m)  
Sub cable (1-core): **CN-71-C1** (cable length 1 m), **CN-71-C2** (cable length 2 m)  
**CN-71-C5** (cable length 5 m)

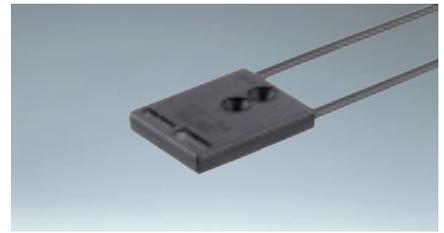
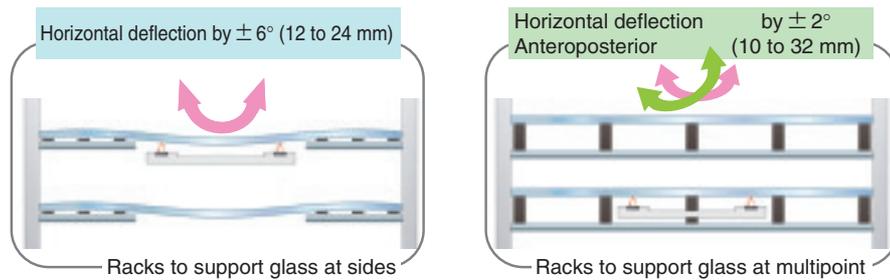
# Optical Fiber Heads

## Alignment Fiber FD-L45A

Enhanced performance to support large-generation glass substrates

### Stable detection even on complicated glass deflection

The sensing performance of previous models was sometimes unstable depending on the deflection direction. The **FD-L45A** provides stable sensing in all deflection directions. In addition, the allowable alignment distance has been increased to provide an ample scope for detection.



Applicable amplifier: **FX-100/300/311/410** series red LED type (Note 1)

Sensing range (Note 2):

12 to 24 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 6^\circ, \pm 0^\circ$ )]  
10 to 28 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 4^\circ, \pm 2^\circ$ )]  
10 to 32 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 2^\circ, \pm 2^\circ$ )]

Sensing position accuracy (Note 3): 0.2 mm or less under the following conditions.

15 to 24 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 4^\circ, \pm 2^\circ$ )]

14 to 28 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 2^\circ, \pm 0^\circ$ )]

11 to 30 mm [with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 0^\circ, \pm 0^\circ$ )]

Allowable bending radius: R25 mm or more

Fiber cable length: 3 m (free-cut)

Ambient temperature: 0 to +70 °C

Notes: 1) Each specification value is measured with **FX-301/305**, response time in STD mode.

2) This is specified for the standard sensing object (transparent glass, 0.7 mm thick).

3) This is specified for the standard sensing object (transparent glass, 0.7 mm thick, end face: rough-hewn).

## Convergent Reflective Fiber FD-L47

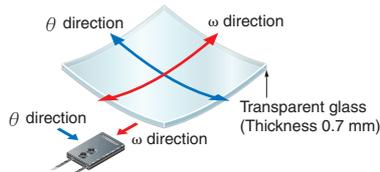
**New**

Strong against deflection on large-generation glass substrates with its superior convergent reflective property

### Strong against glass deflection

The sensing distance is 8 to 17 mm within an inclination of sensing object ( $\theta, \omega$ ) = ( $\pm 3^\circ, \pm 3^\circ$ ). Detection is possible even large-generation substrates with deflection.

<Definition of direction ( $\theta, \omega$ )>

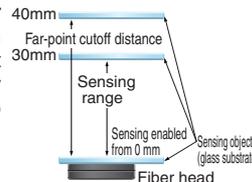


### Accurate detection

**FD-L47** stably detects the presence of glass substrates within the range from 0 to 30 mm. Moreover, objects at 40 mm or further will not be detected, which means only glass substrates inside the rack will be detected piece by piece.

### Extended fiber length

Fiber length is standardized at 3 m. It fits into robot used for large-generation substrates so that there is no worry for space taken to install amplifiers.



Applicable amplifiers: **FX-100/300/311/410** series (Note 1)

Sensing range (Note 2):

0 to 30 mm with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 0^\circ, \pm 0^\circ$ )

8 to 17 mm with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 3^\circ, \pm 3^\circ$ )

Far-point cutoff distance (Note 3): 40 mm or more

Allowable bending radius: R4 mm or more

Fiber cable length: 3 m (free-cut)

Ambient temperature: -20 to +70 °C

Notes: 1) Each specification value is measured with **FX-301/305**, response time in STD mode.

2) This is specified for the standard sensing object (transparent glass, 0.7 mm thick).

3) This is specified for the standard sensing object (mirror object: vapor deposited, reflectance on vapor-deposited surface is 85 % for wavelength of 660 nm).

## Heat-resistant • Convergent Reflective Fiber FD-H25-L43 FD-H25-L45

**New**

Heat-resistant up to 250 °C!

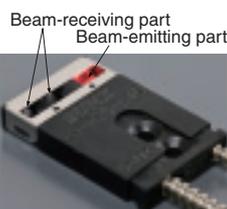
Stably detects glass substrates in hot environment

### Dual beam-receiving window enable for wide range detection

Wide receiving window corresponds to the inclination of substrate. The fiber sharply turns OFF beyond far-point.

**FD-H25-L43** Far-point cutoff distance is 40 mm or more within an inclination of sensing object ( $\theta, \omega$ ) = ( $\pm 2^\circ, \pm 0^\circ$ )

**FD-H25-L45** Far-point cutoff distance is 60 mm or more within an inclination of sensing object ( $\theta, \omega$ ) = ( $\pm 2^\circ, \pm 0^\circ$ )



### Fiber head is heat-resistant and 40 % lighter than previous models

The fiber head is made of heat-resistant ABS. With its lightness in weight, installation on a robot hand does not create any burden.

### Usable for substrates of different sizes

Models corresponding to the specific glass size are available in ordinary temperature type as well.

G5 size or smaller (Ordinary temperature) **FD-L43**

(Heat-resistant) **FD-H25-L43**

G6 size or larger (Ordinary temperature) **FD-L45A**

(Heat-resistant) **FD-H25-L45**



Applicable amplifiers: **FX-100/300/311/410** series (Note 1)

Sensing range (Note 2):

**FD-H25-L43** 5 to 15 mm with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 8^\circ, \pm 2^\circ$ )

**FD-H25-L45** 11 to 25 mm with inclination of the sensing object ( $\theta, \omega$ ) = ( $\pm 6^\circ, \pm 2^\circ$ )

Allowable bending radius: R25 mm or more

Fiber cable length: 3 m (fixed)

Ambient temperature: -20 to +250 °C

(Ordinary temperature side: -20 to +70 °C)

Notes: 1) Each specification value is measured with **FX-301/305**, response time in STD mode.

2) This is specified for the standard sensing object (transparent glass, 0.7 mm thick).

# Sensors for Semiconductor / FPD Industry

Glass Substrate / Wafer Detection

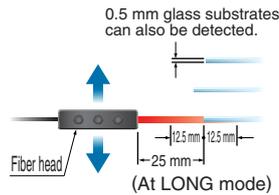
Fibers for Liquid Crystal Display Industry **Convergent Reflective Type**  
**FD-L40** SERIES **Fiber head**

## 6 types of fiber for glass substrate conveyors

**Mapping fiber** **FD-L46**

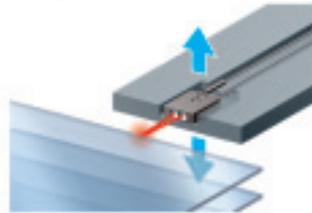
### Accurate mapping even for thin glass substrates

The adoption of a unique large lens allows even thin glass substrates to be detected directly from the side. Because the sensing range is wide ( $25 \pm 12.5$  mm), stable mapping is possible even if glass substrates are in irregular positions.



### Can be used for a variety of glass substrates

Large light amounts can be obtained for a variety of glass edge shapes such as R surfaces and C surfaces, so that accurate mapping of glass substrates inside cassettes is possible. Glass that has received black or yellow masking can also be detected in addition to clear glass.

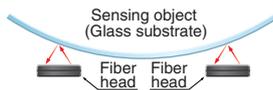


R surface *Edges with poor reflectivity can also be detected*  
 C surface

**Alignment fiber** **FD-L43 / FD-L45**

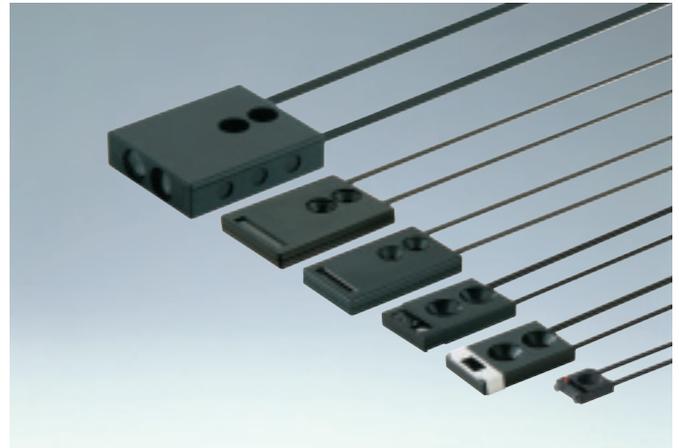
### Stable and greater performance in detecting glass with $\pm 8^\circ$ flexure

Increases in sizes of glass substrates mean greater amounts of deflection, but a single fiber can detect glass even if horizontal deflection is within  $\pm 8^\circ$  (FD-L45:  $\pm 6^\circ$ ).



### Improved high-precision detection over wide range

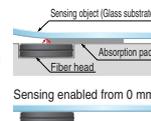
A sensing range of 3 to 17 mm (FD-L45: 10 to 25 mm) and a positioning error of 0.2 mm or less make high-precision detection possible.



**Seating confirmation fiber** **FD-L44 / FD-L44S / FD-WL48**

### Sensing range 0 to 7 mm **FD-L44**

0 to 7 mm of long sensing range for seating confirmation. Detection is even possible if absorption pads are used.



### The short range type FD-L44S is also available

### Ultra-compact type FD-WL48 saves space

The ultra-compact size of  $W7.2 \times H7.5 \times D2$  mm holds a fixed-focus reflective optical system. These fiber heads can now be mounted in locations and devices that were previously impossible because of the lack of space. As a result, an even wider range of applications is now available. They can be used for a variety of different applications in addition to glass substrate detection.

Applicable amplifiers: **FX-100/300/311/410** series red LED type  
 Sensing range (Note 1): **FD-L46** 12.5 to 37.5 mm (LONG mode)(Note 2), **FD-L43** 0 to 23 mm (STD mode)  
**FD-L44** 0 to 7 mm (LONG mode)(Note 3), **FD-L44S** 0 to 4.5 mm (LONG mode)(Note 4)  
**FD-L45** 0 to 36 mm (LONG mode)(Note 5), **FD-WL48** 0.5 to 7.5 mm (LONG mode)(Note 6)  
 Allowable bending radius: **FD-L46** R25 mm or more, **FD-L45 / FD-L43** R4 mm or more  
**FD-L44(S)** R10 mm or more, **FD-WL48** R1 mm or more  
 Fiber cable length: **FD-L46** 4 m (free-cut), **FD-L43/L44(S)** 2 m (free-cut)  
**FD-L45** 3 m (free-cut), **FD-WL48** 1 m (free-cut)

Notes: 1) The values for the **FD-L46** are for R edge of glass substrate ( $100 \times 100 \times t0.7$  mm for LCDs; the values for the **FD-L43**, **FD-L44** and **FD-L45** are for glass substrate ( $100 \times 100 \times t0.7$  mm) for LCD; the values for the **FD-L44S** are for silicon wafer (polished surfaces) and the values for the **FD-WL48** are for white non-glossy paper ( $100 \times 100$  mm).  
 2) 16 to 30 mm for the **FX-101**. 12 to 50 mm for the **FX-411** (U-LG mode).  
 3) 0 to 6 mm for the **FX-101**. 0 to 8.2 mm for the **FX-411** (U-LG mode).  
 4) 0 to 4.5 mm for the **FX-101**. 0 to 4.4 mm for the **FX-411** (U-LG mode).  
 5) 0 to 40 mm for the **FX-101**. 0 to 50 mm for the **FX-411** (U-LG mode).  
 6) **FX-411** specifications are in U-LG mode.

# Sensors for Semiconductor / FPD Industry

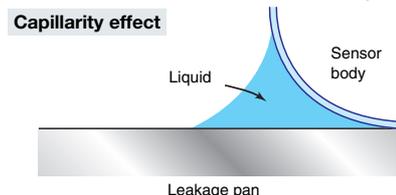
Liquid Leak / Liquid Level Detection

Amplifier Built-in • Leak Detection Sensor **Photoelectric sensor**  
**EX-F70/F60** SERIES

## High-speed detection of even a little liquid leak

### Reliable detection

The unique effect of capillarity enables reliable detection of small leaks and viscous liquids.



### PFA enclosure gives excellent chemical resistance

Accurate detection can be obtained even if there is leakage of chemicals such as sulfuric acid, hydrochloric acid or ammonia.

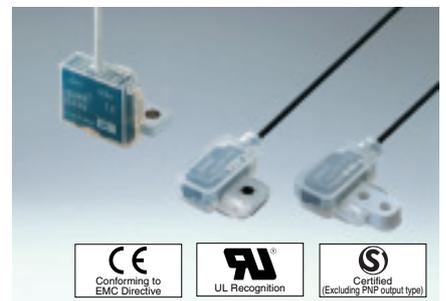
### Safe design

If the sensor is not mounted correctly, if the cable is cut or disconnected, or if the sensor is not operating correctly, the output is the same as when the beam is not received (LEAK).

Design deals with human errors such as, forgetting to mount, etc.

### Compact, space-saving

The **EX-F70** series is slim (10 mm) side mounting sensor. The **EX-F60** series is compact at  $W26 \times H19 \times D9$  mm, so that it can be used even in narrow spaces.



Sensing object: **EX-F70** Water, Fluorinert™ (Note 1)  
**EX-F60** Agent, such as sulfuric acid, Hydrochloric acid, Phosphoric acid or Ammonia etc.  
 Supply voltage: 12 to 24 V DC  $\pm 10\%$   
 Output: **EX-F70/F60** NPN open-collector transistor  
**EX-F70/F60-PN** PNP open-collector transistor  
 Response time: 50 ms or less  
 Emitting element: Infrared LED (non-modulated)

Notes: 1) Fluorinert™ is the world wide TradeMark of 3M.  
 2) 5 m cable length type (standard: **EX-F70** 2 m, **EX-F60** 3 m) is also available.

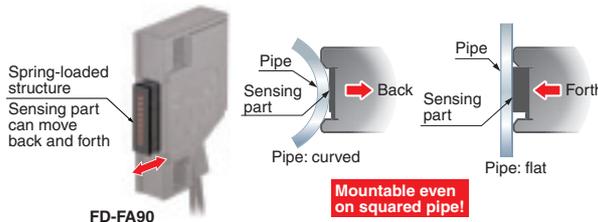
## Pipe Mountable type Liquid Detection Fiber FD-FA90

**New**

The fiber array is strong against bubbles. Ensures detection of liquid in a pipe

**Spring-loaded structure incorporated! Close contact your detection surface allows stable detection**

A spring-loaded mechanism is incorporated so that the sensing part is held firmly against the detection surface. From curved surfaces of  $\phi 8$  mm or more to flat surfaces, the sensing part is consistently positioned without leaving an opening to ensure a stable detection.



Applicable amplifiers: FX-100/300/311/410 series red LED type  
Sensing object: Liquid (Note)  
Applicable pipe diameter:  $\phi 8$  to  $\phi 80$  mm (transparent)  
(When using the attached tying bands) (including PFA translucent)  
Allowable bending radius: R10 mm or more  
Fiber cable length: 2 m (free-cut)

Note: Unclear or highly viscous liquid may not be detected stably.

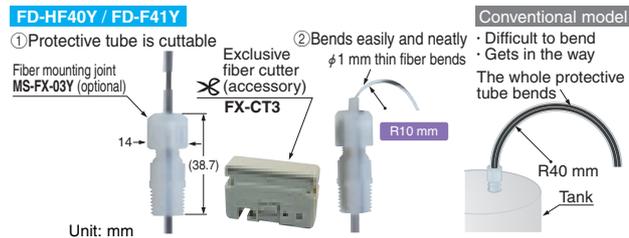
## Contact type Liquid Detection Fiber FD-HF40Y/F41Y

**New**

Ensures detection of liquid level in a tank

**Space-saving, construction-saving**

The slim sensing part enables the fiber to turn in a small space. Furthermore, the protective tube is cuttable to keep excess length of the protective tube and fiber to a minimum.

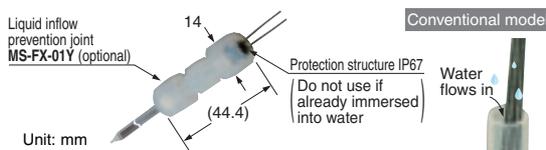


**No metal ionization**

The fiber is made of 100 % resin. Hence, it does not release metal ions. It can also be safely used in semiconductor manufacturing cleaning equipment.

**Liquid inflow prevention joint MS-FX-01Y**

This joint suppresses false operations due to liquid slip-in from the top of the protective tube.

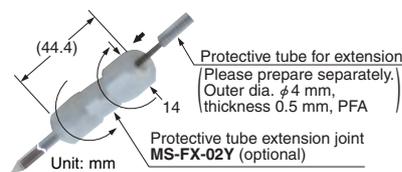


**Strong against chemical agents**

The fiber is totally covered with the fluorine resin tube. It can be immersed in chemicals.

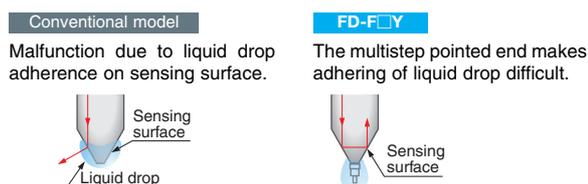
**Protective tube can be extended**

The protective tube can be extended using the protective tube extension joint MS-FX-02Y.



**Avoids liquid drop adherence**

Reduces malfunction due to adhering of a liquid drop.



Type	Contact type	
	FD-HF40Y	FD-F41Y
Model No.		
Applicable amplifiers	FX-100 / FX-300 / FX-311 / FX-410 series (Note 1, 2)	
Sensing object	Liquid (Note 3)	
Repeatability	0.5 mm or less (for water)	
Allowable bending radius	Protective tube: R20 mm or more (Do not bend approx. 17 mm length from the tip) Fiber cable: R10 mm or more	
Fiber cable length	2 m (free-cut)	
Ambient temperature (Note 4)	-40 to +105 °C (Note 5)	-40 to +70 °C (Note 5)
Ambient pressure (Note 6)	-49 to +490 kPa	
Protection	IP67 (protective tube) (Note 7)	
Material	Protective tube: PFA (fluorine resin) Fiber sheath: Polyethylene (first sheath) PFA (fluorine resin) (second sheath, FD-F41Y only)	

Notes: 1) This product cannot be used with FX-301B□, FX-301G□, FX-301H□, FX-301F□, FX-311B□, FX-311G□, FX-411B□, or FX-411G□.  
2) Where measurement conditions have not been specified precisely, the value is when used with FX-301 / FX-305 (STD mode).  
3) Unclear or highly viscous liquid may not be detected stably.  
4) Liquid being detected should also be kept within the rated ambient temperature range.  
5) The ambient temperature is measured in dried condition. If using the products in a high humidity environment, ambient temperature differs. The ambient temperature is -40 to +85 °C when using or storing the products at a high humidity of 85 % RH.  
6) Take care that the product is used outside the ambient pressure range of -49 to +490 kPa; the product may break.  
7) Excluding liquid entering from the rear end of protective tube.

# Mark Sensor Photoelectric Sensor

## Digital Mark Sensor LX-100 SERIES

### Introducing the 3-LED mark sensor!

#### Equipped with 3 red, green and blue LEDs

To detect any marking, this sensor is equipped with red, green and blue LED light emitting elements all in one. In addition, it uses a coaxial reflective optics system and has high precision sensing when used with a 1/4000 resolution 12-bit A/D converter.



### 2 selectable sensing modes for any application

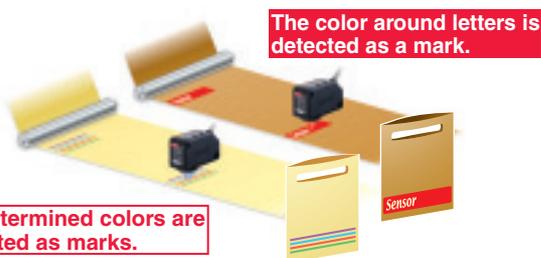
#### Mark mode

This sensing mode automatically selects a single color from the 3 R•G•B LEDs to achieve an ultra quick 45 μs response time. The automatic optimal LED selection function automatically selects the LED that is most suitable for the sensing. This function is perfect for ultra quick sensing.



#### Color mode

All 3 R•G•B LEDs light up and high precision mark color discrimination occurs using the R•G•B reflective light ratio. This function enables effective detection of films with patterns around the area of the mark.



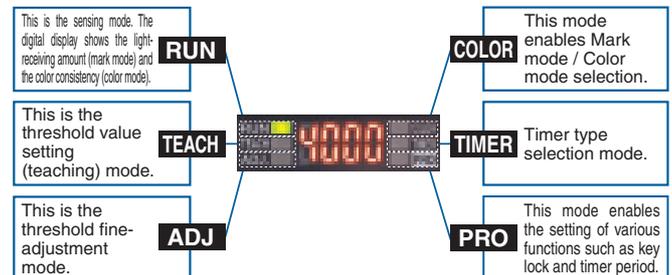
Type	Cable type	Plug-in connector type (Note)
Model No.	NPN output	<b>LX-101</b>
	PNP output	<b>LX-101-P</b>
		<b>LX-101-Z</b>
Sensing range	10 ± 3 mm	
Supply voltage	12 to 24 V DC ± 10 %	
Output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor	
Output operation	Mark mode: Light-ON / Dark-ON (Auto-setting on teaching) Color mode: Consistent-ON / Inconsistent-ON (Setting on teaching)	
Response time	Mark mode: 45 μs or less, Color mode: 150 μs or less	
Sensitivity setting	Mark mode: 2-level teaching / Full-auto teaching, Color mode: 1-level teaching	
Protection	IP67 (IEC)	
Ambient temperature	- 10 to + 55 °C	
Emitting element	Combined Red / Green / Blue LEDs (Peak emission wavelength: 640 nm / 525 nm / 470 nm)	

Note: Mating cable is not supplied with the plug-in connector type. Please order it separately.



### Even beginners can quickly master MODE NAVI operation

The sensor's basic operations are represented by 6 indicators (MODE NAVI). The user can check what mode the sensor is presently in with a quick glance making operation simple.



### Sensing status digitally controllable

The sensing status, displayed numerically, can be verified at a glance. Also, the sensor settings for each type of packing film can be digitally indicated.

### Direct codes enable settings verification at a glance

The settings for the LX-100 series sensors are displayed using a 4-digit direct code. Direct codes enable easy settings verification and maintenance by phone.

### Super simple teaching

Teaching (setting the threshold value) can be effectuated by a super simple operation even in "Mark Mode" or "Color Mode". In addition, because teaching via an operation panel or other external input device is also possible, models can be easily interchanged.

### Compact design for significant space saving

High precision sensing and multiple functions are provided all in a compact W57 × D24 × H38 mm body. Cable and plug-in connector types are available depending on the equipment used. These sensors can be easily introduced to already existing facilities.



# Photoelectric Sensors

## Amplifier Built-in • Compact Photoelectric Sensor CX-400 SERIES

We have a full lineup of world standard photoelectric sensors!

### Great lineup of 116 models

The CX-400 series has a high level of basic functionality and excellent cost performance. Moreover, a wide number of variations means that there sure will be a sensor that fits your needs.

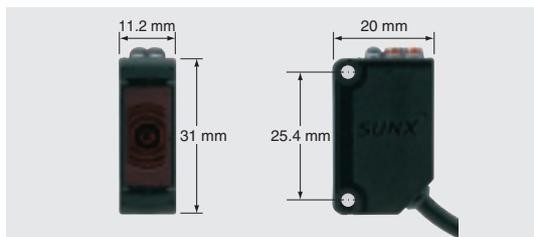
Type	Sensing range
Thru-beam (long sensing range)	15 m
Thru-beam	10 m
Retroreflective (long sensing range)	5 m
Retroreflective (with polarizing filters)	3 m
Retroreflective (transparent object sensing)	0.1 to 2 m
Retroreflective (transparent object sensing)	50 to 500 mm
Diffuse reflective (800 mm type)	800 mm
Diffuse reflective (300 mm type)	300 mm
Diffuse reflective (100 mm type)	100 mm
Diffuse reflective (narrow-view)	70 to 200 mm
Adjustable range reflective	20 to 300 mm
Adjustable range reflective	15 to 100 mm
Adjustable range reflective	2 to 50 mm
Adjustable range reflective (small spot)	2 to 50 mm

<b>Output</b>	NPN, PNP
<b>Connecting method (Note 1)</b>	Cable type, M8 plug-in connector type, M12 pigtailed type
<b>Cable length of cable type (Note 2)</b>	0.5 m, 2 m, 5 m

Notes: 1) Only the cable type and M8 plug-in connector type are available for the adjustable range reflective type.  
2) Only the 2 m cable length type (standard) is available for the adjustable range reflective type.

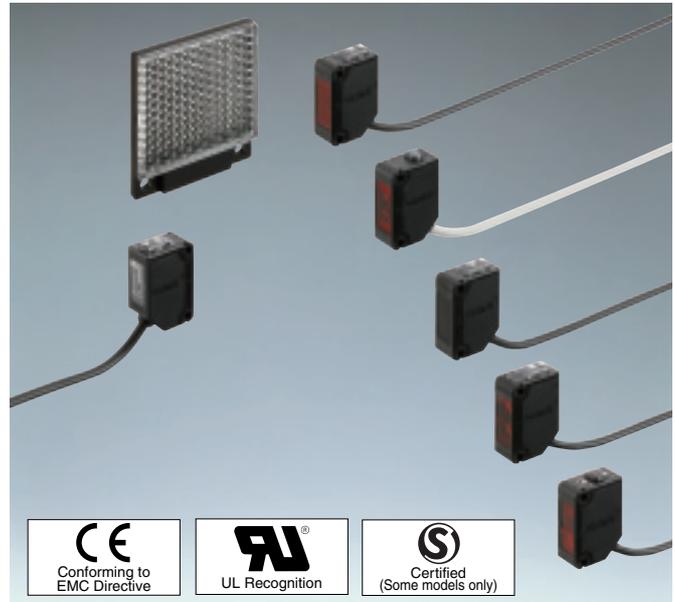
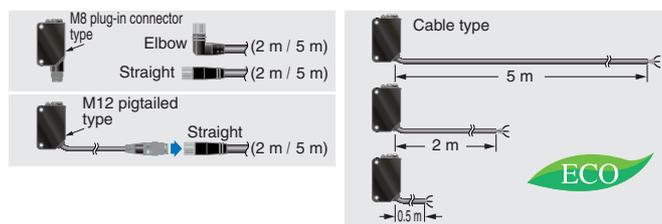
### Compact size

The sensors are compact in size at W11.2 × H31 × D20 mm. The mounting pitch is also at the world standard size of 25.4 mm (1 in).



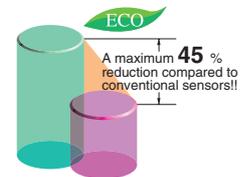
### Less processing

M8 plug-in connector type and M12 pigtailed type are available. This contributes to less time spent in setting up. In addition, cable types are available with cable lengths of 0.5 m, 2 m and 5 m. This results in less wastage.



### Less power consumed

The CX-400 series sensors achieve a maximum of approx. 55 % the power consumption of conventional sensors. Contributes to preserving the environment.



### Less resources used

Based on environmental considerations, simplified packaging is used in order to reduce waste.

In addition, the bag is made from polyethylene which produces no toxic gases even when burned.

### Strong against oil and coolant liquids CX-41□/42□/49□

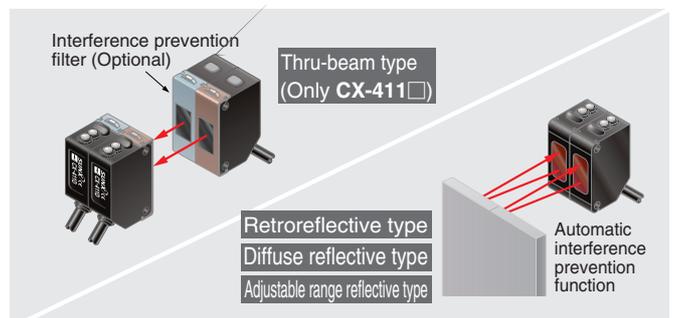
The lens material for the thru-beam type, retroreflective type (excluding the CX-48□) and the diffuse reflective type are made of a strong acrylic that resists the harmful effects of coolants. These sensors can be used with confidence even around metal processing machinery that disperses oil mists. The protection mechanism also conforms to IP67 (IEC).

### Strong against ethanol CX-44□/48□

A strong, ethanol resistant polycarbonate was used for the front and display covers. Safe even for installing near food processing machinery that disperses ethanol based detergents. The protection mechanism also conforms to IP67 (IEC).

### Strong against interference

The interference prevention function lets two sensors to be mounted close together precisely.



### Strong against noise

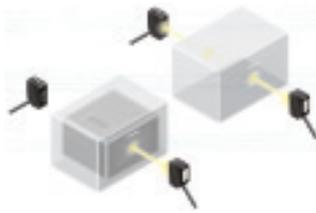
Significantly stronger against inverter light and other extraneous light as well as high frequency and electromagnetic noise generated by high-pressure inverter motors and other devices.

### Thru-beam type



#### Strong infrared beam CX-412

It realizes a 15 m long-distance sensing range. Remarkable penetrating ability enables applications such as package content detection.

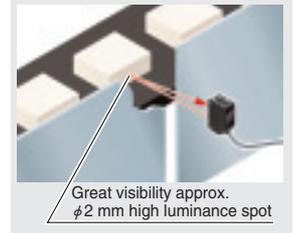


### Diffuse reflective type



#### Beam axis alignment made easy with a high luminance spot beam CX-423

These sensors realize a high luminance red LED spot that provides bright visibility enabling the sensing position to be checked at a glance. Because it has the small spot, approx.  $\phi 2$  mm, even the minutest object can be accurately detected.



### Retroreflective type



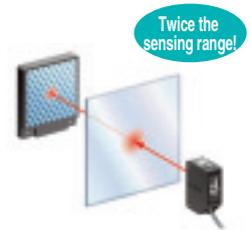
#### Strongest sensing range in its class CX-493

A long 5 m sensing range is possible with the red LED type that is easy to align with the beam axis. Can be used for wide automatic door shutters.



#### Introducing the transparent object sensing type sensor CX-481/482

Our unique optical system and transparent object sensing circuitry provide stable sensing of even thinner transparent objects than the conventional models.



Type	Thru-beam		Retroreflective				Diffuse reflective			
	NPN output	PNP output	Long sensing range	With polarizing filters	Long sensing range	For transparent object sensing				Narrow-view
Model No.	CX-411	CX-412	CX-491	CX-493	CX-481	CX-482	CX-424	CX-421	CX-422	CX-423
	CX-411-P	CX-412-P	CX-491-P	CX-493-P	CX-481-P	CX-482-P	CX-424-P	CX-421-P	CX-422-P	CX-423-P
Sensing range	10 m	15 m	3 m	5 m	50 to 500 mm	0.1 to 2 m	100 mm	300 mm	800 mm	70 to 200 mm
Supply voltage	12 to 24 V DC $\pm 10\%$									
Output	NPN output type: NPN open-collector transistor, PNP output type: PNP open-collector transistor									
	Switchable either Light-ON or Dark-ON									
Response time	1 ms or less									
Automatic interference prevention function	Two units of sensors can be mounted close together with interference prevention filters. (Sensing range: 5 m)		Incorporated (Two units of sensors can be mounted close together.)							
Protection	IP67 (IEC)									
Ambient temperature	$-25$ to $+55$ °C									
Emitting element (modulated)	Red LED	Infrared LED	Red LED		Infrared LED				Red LED	

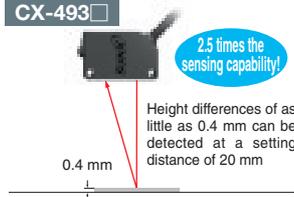
Note: 0.5 m / 5 m cable length type (standard: 2 m), M8 plug-in connector type, and M12 pigtailed type are available.

### Adjustable range reflective type



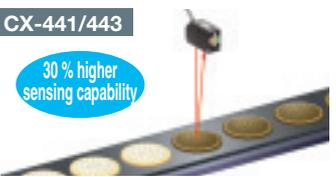
#### Can detect differences as small as 0.4 mm, with hysteresis of 2 % or less CX-493

An advanced optical system provides sensing performance that is approx. 2.5 times than conventional models. Even ultra-small differences of 0.4 mm can be detected accurately.



#### Not affected by colors CX-441/443

Both black and white objects can be sensed at almost the same distances. No adjuster control is needed, even when products of different colors are moving along the production line.



[Sensing range difference is 1 % or less between white non-glossy paper and non-glossy paper (gray) with brightness level: 5 at a setting distance of 50 mm.]

#### BGS / FGS functions make even the most challenging settings possible!

##### BGS

**Background not present**

- When object and background are separated



##### FGS

**Background present**

- When object and background are close together
- When the object is glossy or uneven



Type	Small spot		Adjustable range reflective	
	NPN output	PNP output	CX-443	CX-444
Model No.	CX-441	CX-442	CX-443	CX-444
	CX-441-P	CX-442-P	CX-443-P	CX-444-P
Adjustable range (Note 1)	20 to 50 mm		20 to 100 mm	40 to 300 mm
Sensing range (with white non-glossy paper)	2 to 50 mm		15 to 100 mm	20 to 300 mm
Supply voltage	12 to 24 V DC $\pm 10\%$			
Output	NPN output type: NPN open-collector transistor, PNP output type: PNP open-collector transistor			
	Switchable either Detection-ON or Detection-OFF			
Response time	1 ms or less			
Sensing mode	BGS / FGS functions Switchable with wiring of sensing mode selection input			
Protection	IP67 (IEC)			
Ambient temperature	$-25$ to $+55$ °C			
Emitting element	Red LED (modulated)			

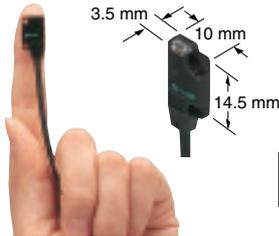
Notes: 1) The adjustable range stands for the maximum sensing range which can be set with the distance adjuster. The sensor can detect an object 2 mm [CX-444(-P): 15 mm, CX-442(-P): 20 mm], or more away.  
2) M8 plug-in connector type is also available.

# Photoelectric Sensors

## Amplifier Built-in • Ultra-slim Photoelectric Sensor EX-10 SERIES

**Smallest body: 3.5 mm thick**

**Freely mountable fingertip size**



Freely mountable W10 × H14.5 × D3.5 mm size (thru-beam, front sensing type). Moreover, easy alignment is possible with the visible red LED beam source.

Six types of mounting brackets, fixable with M3 screws, are available.



**Long sensing range 1 m: EX-19□**

**Sensor with operation mode switch: EX-15□/17□**

**Ten times durable: EX-□-R**

Flexible cable on EX-□-R is 10 times as durable as conventional model. It is most suitable for moving parts, such as robot arm, etc.

**Slit mask available for EX-13□/17□/19□**

• OS-EX10-12 / OS-EX10-15

• OS-EX10E-12



Type	Thru-beam						Thru-beam • with operation mode switch on bifurcation		Convergent reflective	
	EX-11A(-R)	EX-11B(-R)	EX-13A(-R)	EX-13B(-R)	EX-19A(-R)	EX-19B(-R)	EX-15	EX-17	EX-14A(-R)	EX-14B(-R)
Model No. (Note 1)										
Sensing range	150 mm		500 mm		1 m		150 mm	500 mm	2 to 25 mm (Conv. point: 10 mm)	
Min. sensing object	φ1 mm opaque object		φ2 mm opaque object				φ1 mm opaque object	φ2 mm opaque object	φ0.1 mm copper wire (Setting distance: 10 mm)	
Supply voltage	12 to 24 V DC ± 10 %									
Output	NPN open-collector transistor (Note 2)									
Output operation	Light-ON	Dark-ON	Light-ON	Dark-ON	Light-ON	Dark-ON	Switchable either Light-ON or Dark-ON		Light-ON	Dark-ON
Response time	0.5 ms or less									
Protection	IP67 (IEC)									
Ambient temperature	- 25 to + 55 °C									
Dimensions	W10 × H14.5 × D3.5 mm						W10 × H14.5 × D3.5 mm (sensor head)		W13 × H14.5 × D3.5 mm	

Notes: 1) EX-□-R is flexible cable type.

2) PNP output type is also available. (Excluding flexible cable type, EX-15 and EX-17)

3) Side sensing type (excluding EX-19□ and EX-14□) is also available.

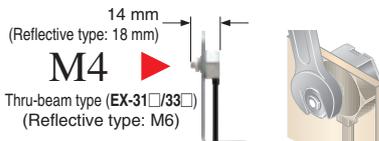
4) 5 m cable length type (standard: 2m) is also available.

## Amplifier Built-in • Threaded Miniature Photoelectric Sensor EX-30 SERIES

**A new alternative to fiber sensors**

**Can be installed in the same way as standard fibers**

The EX-30 series can be screw-mounted (M4 for thru-beam type, M6 for reflective type) in the same way as standard fiber sensors. This means that they can be inserted into production lines in exactly the same way as conventional high-priced fiber sensors.



**New design solves all weak points of fiber sensors**

The EX-30 series solves all of the difficulties associated with fiber sensors, such as "Difficulty finding a suitable place for the amplifier", "Fragility of the fiber", "Extra space needed because of difficulty in bending the fiber", "The nuisance of having to use a protective tube to prevent fiber breakages".

**Unbreakable**



**Takes up very little space**



**No protective tube needed**



**800 mm thru-beam type available EX-33□**

The sensing range is 1.5 times greater than previous models! It also has a sensitivity adjuster to enable compatibility with a wide range of applications.

**Low price**

The recommended price is much lower than the price for fiber sensor sets.

Type	Thru-beam						Diffuse reflective		
	NPN output	EX-31A	EX-31B	EX-33	EX-32A	EX-32B	EX-32A-PN	EX-32B-PN	
Model No.	PNP output	EX-31A-PN	EX-31B-PN	EX-33-PN					
Sensing range		500 mm		800 mm	50 mm				
Sensing object		φ2 mm or more opaque object				Opaque, translucent or transparent object			
Supply voltage		12 to 24 V DC ± 10 %							
Output		NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor							
Output operation		Light-ON	Dark-ON	Variable (Switching method)	Light-ON	Dark-ON			
Response time		0.5 ms or less							
Protection		IP67 (IEC)							
Ambient temperature		- 25 to + 55 °C							

Note: 5 m cable length type (standard: 2 m) is also available. [excluding EX-33(-PN)]

# Photoelectric Sensors

Amplifier Built-in • Ultra-compact Photoelectric Sensor

## EX-20 SERIES

Miniature-sized and still mountable with M3 screws

Mountable with M3 screws in spite of miniature size

Mountable with M3 screws. Moreover, ultra-compact size is realized. It is mountable in a tight space.

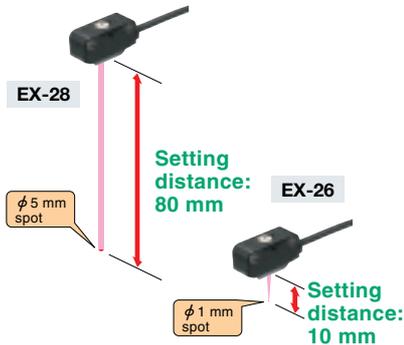
Long sensing range

The EX-20 series achieves long distance sensing [thru-beam type: 2 m, retroreflective type: 200 mm (when using the attached reflector), diffuse reflective type: 160 mm], despite its miniature size. Hence, it is usable even on a wide conveyor.



Clear beam spot using red LED dot light source

The emission area of a dot light source is smaller than that of a conventional LED flat light source, and it is possible to design a high power, narrow beam. Since a red LED dot light source is used, the red beam spot is clear even at a far place, so that alignment and confirmation of sensing position is easy.



Type	Thru-beam		Retroreflective	Diffuse reflective	Convergent reflective		Narrow-view reflective
	Front sensing	Side sensing	Side sensing	Side sensing	Diffuse beam	Small spot beam	Long distance spot beam
Model No. (Note 1)	Light-ON EX-21A(-PN)	EX-23(-PN)	EX-29A(-PN)	EX-22A(-PN)	EX-24A(-PN)	EX-26A(-PN)	EX-28A(-PN)
	Dark-ON EX-21B(-PN)		EX-29B(-PN)	EX-22B(-PN)	EX-24B(-PN)	EX-26B(-PN)	EX-28B(-PN)
Sensing range	1 m	2 m	30 to 200 mm	5 to 160 mm	2 to 25 mm (Conv. point: 10 mm)	6 to 14 mm (Conv. point: 10 mm)	45 to 115 mm
Sensing object	Min. $\phi$ 2.6 mm opaque object	Min. $\phi$ 3 mm opaque object	$\phi$ 15 mm or more opaque or translucent object	Opaque, translucent or transparent object	Min. $\phi$ 0.1 mm copper wire (Setting distance: 10 mm)		Opaque, translucent or transparent object
Supply voltage	12 to 24 V DC $\pm$ 10 %						
Output	NPN output type: NPN open-collector transistor, PNP output type: PNP open-collector transistor						
Response time	0.5 ms or less						
Protection	IP67 (IEC)						
Ambient temperature	- 25 to + 55 °C						
Dimensions (mm)	W16 × H18 × D4.5	W8.2 × H19 × D10.5	W8.2 × H22 × D12.3	W16 × H18 × D4.5	W8.2 × H22 × D12.3		

Notes: 1) EX-□-PN is PNP output type.  
2) 5 m cable length type (standard: 2 m) is also available.

Adjustable Range Reflective Photoelectric Sensor

## EQ-30 SERIES

Unaffected by color or material, 2 m distance adjustable fixed-focus sensing

Not affected by object color or background

Long sensing range 2 m

Compact size

It saves space, since a miniaturized enclosure of W20 × H68 × D40 mm has been designed for the fixed-focus sensing sensor.

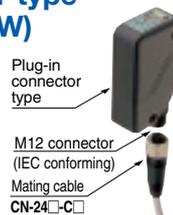


Two setting distances are possible: EQ-34W

With EQ-34W, two sensing distances, Far (Main) and Near (Sub), can be set. Hence, one sensor can suffice where earlier two were required.

Plug-in connector type (excluding EQ-34W)

Plug-in connector type of the EQ-30 series can be easily disconnected for replacement. Should a trouble occur, anyone can replace the sensor in a minute.



Adjustable range: EQ-34(-PN) 0.2 to 2 m
EQ-34W Far 0.2 to 2 m, Near 1 to 2 m
Sensing range: EQ-34(-PN) 0.1 to 2 m
EQ-34W Far 0.1 to 2 m, Near 0.2 to 2 m
Supply voltage: 10 to 30 V DC
Output: EQ-34(W) NPN open-collector transistor
EQ-34-PN PNP open-collector transistor
Dimensions: W20 × H68 × D40 mm

Note: Plug-in connector type (EQ-34-J, EQ-34-PN-J) and 5 m cable length type (EQ-34-C5, EQ-34W-C5) (standard: 2 m) are also available.

# Photoelectric Sensors

## Multi-voltage • Amplifier Built-in Adjustable Range Reflective Photoelectric Sensor EQ-500 SERIES

**Long range sensing capability to 2.5 m**  
**Stable sensing unaffected by color or gloss**

### Long sensing range!

An adjustable to 2.5 m allows plenty of space for installation.

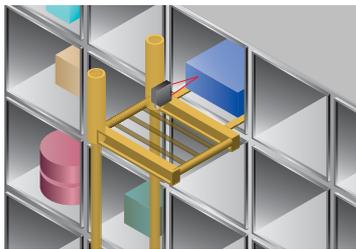
### Introducing the 1 m sensing range type!

**EQ-502(T)/512(T)**

### Impervious to variations color or angle

Due to its advanced optical system, the sensor is not affected by variations in the object's angle or gloss compared to conventional sensors.

Moreover sensing can be performed at a somewhat constant distance even if the sensing object is black or white.



Note: Sensing range difference is 5 % or less between white non-glossy paper and non-glossy paper (gray) with lightness: 5 at a setting distance of 2 m. [EQ-51(T)]

### Not affected by background objects

Because the sensor doesn't detect objects outside the preset sensing field by using the 2-segment photodiode adjustable range system, it will not malfunction even if someone walks behind the sensing object or machines or conveyors are in the background.



**CE**  
Conforming to Low Voltage and EMC Directives (DC-voltage type conforms to EMC directive only)

**CULUS**  
Recognition

**CCC**  
Certified (Multi-voltage type only)

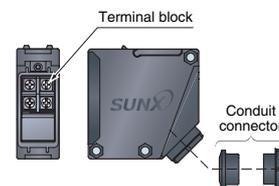
### Introducing the new DC-voltage type equipped with BGS / FGS function **EQ-511(T)/512(T)**

We've added a DC-voltage type with NPN and PNP transistor outputs all in one sensor. Its BGS / FGS function controls any background effects for more stable sensing.



### Convenient terminal block type

Cabling enabled by way of a terminal block that eliminates waste.



Type	Multi-voltage				DC-voltage			
	EQ-501	EQ-501T	EQ-502	EQ-502T	EQ-511	EQ-511T	EQ-512	EQ-512T
Adjustable range (Note)	0.2 to 2.5 m		0.2 to 1.0 m		0.2 to 2.5 m		0.2 to 1.0 m	
Sensing range (at maximum setting distance)	0.1 to 2.5 m		0.1 to 1.0 m		0.1 to 2.5 m		0.1 to 1.0 m	
Supply voltage	24 to 240 V AC $\pm 10\%$ or 12 to 240 V DC $\pm 10\%$				12 to 24 V DC $\pm 10\%$			
Output	Relay contact 1a				NPN open-collector transistor and PNP open-collector transistor 2 outputs			
Output operation	Switchable either Detection-ON or Detection-OFF							
Response time	20 ms or less (For EQ-50□T depends on the setting timer period)				2 ms or less (For EQ-51□T depends on the setting timer period)			
Timer function	—	Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer	—	Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer	—	Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer	—	Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer
Protection	IP67 (IEC)							
Ambient temperature	-20 to +55 °C							
Emitting element	Infrared LED (modulated)							
Dimensions	W26 × H68 × D68 mm							

Note: The adjustable range stands for the maximum sensing range which can be set with the distance adjuster. The sensor can also detect an object 0.1 m, or more, away.

## Compact Size • Multi-voltage Photoelectric Sensor NX5 SERIES

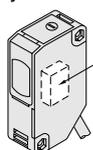
### World-wide usable sensor

#### Multi-voltage

24 to 240 V AC and 12 to 240 V DC, suitable for supply voltages all over the world.

#### High reliability

It has IP66 protection. Moderate dust or water splashes do not affect it. The new hermetically sealed output relay significantly increases its reliability.



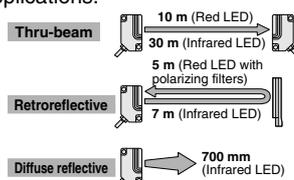
Hermetically sealed relay eliminates worries about bad contact

#### Interference prevention

Two sensors will operate normally even if mounted close together. (Excluding the 30 m thru-beam type sensor)

#### Long sensing range

Most suitable for conveyor lines and parking lot applications.



**CE**  
Conforming to Low Voltage and EMC Directives

**CCC**  
Certified

Supply voltage: 24 to 240 V AC  $\pm 10\%$  or 12 to 240 V DC  $\pm 10\%$

Output: Relay contact 1c

Response time: 10 ms or less

Protection: IP66 (IEC)

Ambient temperature: -20 to +55 °C

Dimensions: W18 × H62 × D35 mm

**SUNX**

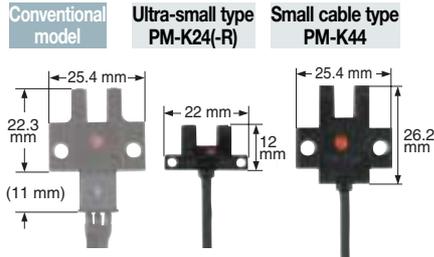
# Micro Photoelectric Sensors

## Amplifier Built-in • U-shaped Micro Photoelectric Sensor PM SERIES

Enables equipment miniaturization and quick construction

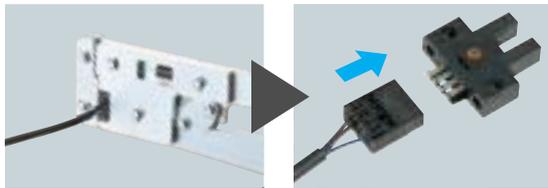
### Extremely compact

Ultra-small type **PM-□24(-R)** achieves an extremely compact size. It contributes to the miniaturization of your equipment.



### Quick fitting hook-up connector

Easy to maintain connector type models are available. Its exclusive connector is the hook-up connector. Since only crimping with exclusive pliers is to be done, cumbersome soldering or insulation is absolutely not required. Further, connector attached cable (**CN-14H-C1/C3**) is also available.



Crimp the connector on the cable. Quick connection to the sensor

### Equipped with two independent outputs

All models are equipped with two independent outputs – Light-ON and Dark-ON. Hence, one model suffices even if the output is to be used differently, depending upon the location of use.

### Flexible cable type

Flexible cable is used, which allows bending repeatedly. It is suited to use in moving part of a robot arm.

## Amplifier Built-in • Convergent Reflective Micro Photoelectric Sensor PM2 SERIES

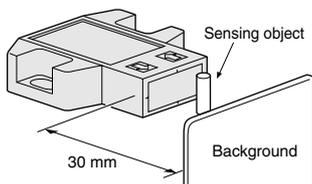
Convergent reflection sensing ensures stable detection

### Stable detection by convergent reflective mode

Stable detection characteristics are obtained since it is convergent reflective type and detects within a limited area.

### Hardly affected by background

Even a specular background does not affect the sensing performance if the sensor is located 30 mm away from it (when directly opposite).



### Dark object detectable

Since the sensor is very sensitive, it can detect even a dark object of low reflectivity.

### Minute object detectable

A  $\phi 0.05$  mm copper wire can be detected at a distance of 5 mm under the optimum condition.

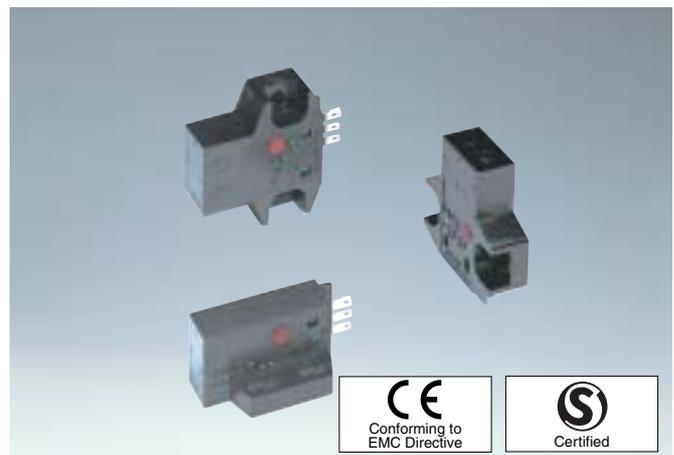


### Quick-connector connections with commercially-available connectors

**PM-□64:** Built-in connector type  
The connector is built-in, allowing greater space savings. Commercially-available general-purpose connectors can be used with some types for improved reliability.

Type	Ultra-small type		Small type		
	With cable	With cable	With connector	Built-in connector	
Model No.	NPN output PM-□24(-R) (Note)	PM-□44	PM-□54	PM-□64	
	PNP output PM-□24P	PM-□44P	PM-□54P	PM-□64P	
Sensing range	5 mm (fixed)				
Min. sensing object	0.8 × 1.8 mm opaque object				
Repeatability	0.03 mm or less			0.01 mm or less	
Supply voltage	5 to 24 V DC ± 10 %				
Output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor				
Output operation	Incorporated with 2 outputs: Light-ON / Dark-ON				
Response time	Under light incident condition: 20 $\mu$ s or less Under light interrupted condition: 100 $\mu$ s or less (Response frequency: 1 kHz or more)				
Emitting element	Infrared LED (non-modulated)				

Notes 1): **PM-□24(-R)** is flexible cable type.  
2): 3 m cable length type (standard: 1 m) is also available [**PM-□24** and **PM-□44(P)** only].



Type	Connector type			Cable type		
	Top sensing	Front sensing	L type (Top sensing)	Top sensing	Front sensing	L type (Top sensing)
Model No.	Light-ON PM2-LH10	PM2-LF10	PM2-LL10	PM2-LH10-C1	PM2-LF10-C1	PM2-LL10-C1
	Dark-ON PM2-LH10B	PM2-LF10B	PM2-LL10B	PM2-LH10B-C1	PM2-LF10B-C1	PM2-LL10B-C1
Sensing range	2.5 to 8 mm (Conv. point: 5 mm) with white non-glossy paper (15 × 15 mm)					
Min. sensing object	$\phi 0.05$ mm copper wire (Setting distance: 5 mm)					
Repeatability (perpendicular to sensing axis)	0.08 mm					
Supply voltage	5 to 24 V DC ± 10 %					
Output	NPN open-collector transistor					
Response time	0.8 ms or less					
Emitting element	Infrared LED (modulated)					

# Light Curtains for Safeguard

Light Curtain **Type 4**  
SF4B SERIES Ver.2

**New**

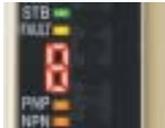
**New version with improved environmental resistance performance! Protection structure IP67 is achieved**

## Seamless structure and IP67 protection New structure

A seamless structure with least seam area possible is newly developed. The inner unit is protected by a cylindrical inner case. Seams such as unit and lens surfaces have been greatly reduced, so that particles such as oil mists and dust are prevented from getting in, rising its environmental resistance performance.

## Equipped with a digital error indicator

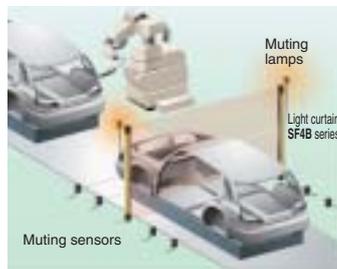
If an error occurs, details of the error appear on the digital display, so that maintenance can be carried out quickly.



An image in which all indicators light up.

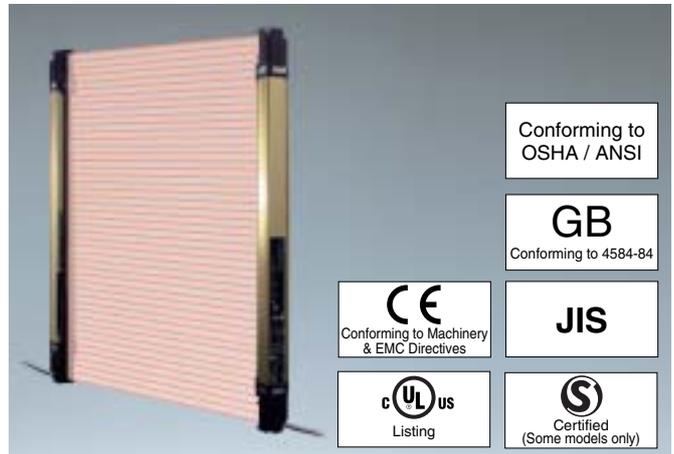
## A muting control function is provided

The light curtain is equipped with a muting control function that causes the line to stop only when a person passes through the light curtain, and does not stop the line when an object passes through.



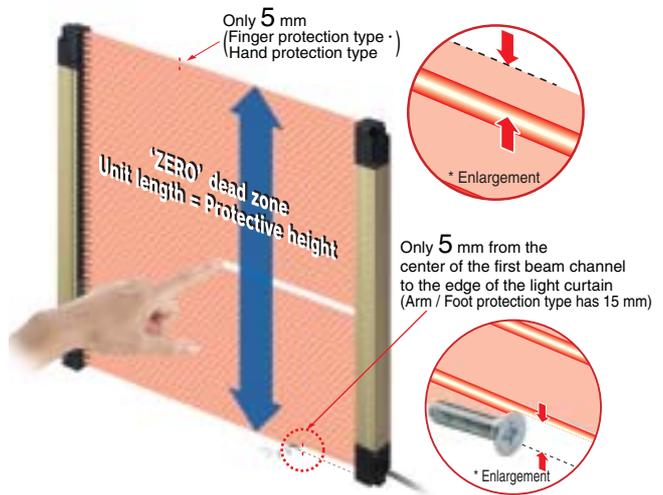
## The safety relay unit capability is built into the light curtain, so component costs can be reduced

The light curtain has a built-in external device monitoring function (such as for fused relay monitoring) and an interlock function. The safety circuit is constructed so that a separate safety relay unit is not needed, and the control board has become smaller, which both contribute to lower costs.



## "ZERO" dead zone

The length of the main unit equals the protective height, so that installation is possible in places where space is limited, with no wastage. No dead zone occurs at the joints between light curtains when light curtains are connected in series.



Type	Finger protection type	Hand protection type	Arm / Foot protection type
Model No.	SF4B-F□<V2>	SF4B-H□<V2>	SF4B-A□<V2>
Beam pitch	10 mm	20 mm	40 mm
Operating range	0.3 to 7 m	0.3 to 9 m (72 beam channels or more: 0.3 to 7 m)	0.3 to 9 m (36 beam channels or more: 0.3 to 7 m)
Protective height	230 to 1,270 mm	230 to 1,910 mm	230 to 1,910 mm
Min. sensing object	φ 14 mm opaque object	φ 25 mm opaque object	φ 45 mm opaque object
Supply voltage	24 V DC ± 10 %		
Control output	PNP open-collector transistor / NPN open-collector transistor (selectable using wiring)		
Response time	OFF response: 14 ms or less, ON response: 80 to 90 ms		
Dimensions	W28 × H protective height × D30 mm		

## Remote I/O Unit with Connectors for Light Curtain CC-Link Safety system SF-CL1T264T

**A total solution for safety systems**

### Control light curtains and safety components in one network!

CC-Link Safety is an expanded safety field network which reinforces the communication error sensing function of CC-Link field network to provide greater equipment safety features. It complies with Category 4 control as specified in the ISO 13849-1 (JIS B 9705-1) international standard.

### Wire-saving! Easy connection to the SF4B series of light curtains

Up to two sets of the SF4B series of light curtains can be easily connected using connectors. (If a terminal block is used, more than two sets can be connected.)



Connectable light curtain: SF4B series  
Applicable standard: IEC 61508 SIL3  
Supply voltage: 24 V DC ± 10 %  
Dimensions: W190 × H83 × D98 mm

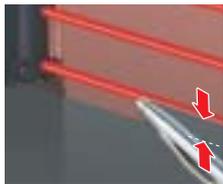
# Light Curtains for Safeguard

Light Curtain **Type 2**

**SF2B** SERIES Ver.2

**Improved environmental resistance performance!**  
**Protection structure IP67 is achieved**

**Unit length = Protective height, "ZERO" dead zone**

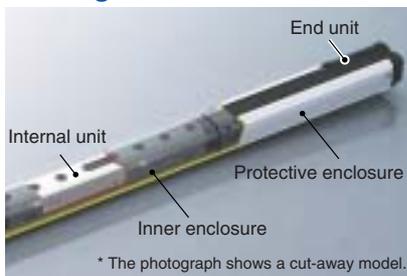


Non-wasteful installation is possible, with no dead corners in the sensing width.

Only 6 mm  
 (Bottom edge for arm / foot type is 26 mm)

**Seamless structure using an inner enclosure**

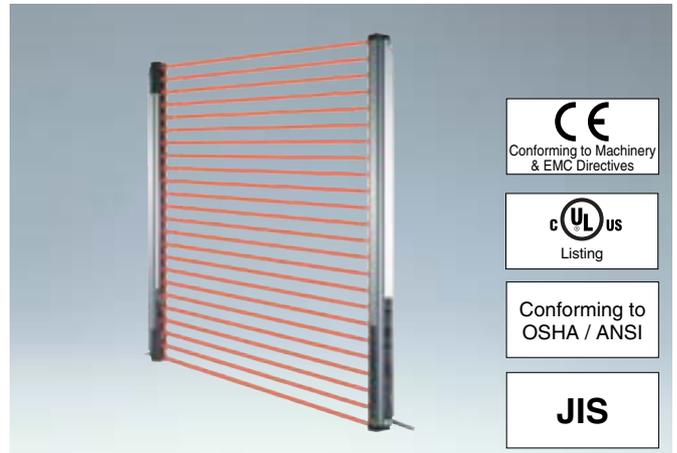
The internal unit fits into an inner enclosure, so that seams (joints) can be completely eliminated inside the product.



\* The photograph shows a cut-away model.

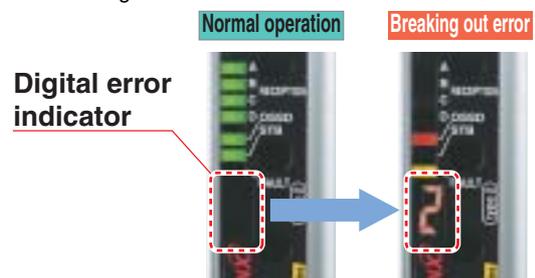
**Suppresses mutual interference and effects of extraneous light**

The tried and proven ELCA function suppresses operating errors resulting from mutual interference and the effects of extraneous light, and prevents drops in line efficiency rates from occurring.



**Supports resolution of electrical problems when starting up lines**

Equipped with a digital error indicator so that error details can be understood at a glance!



Type	Hand protection type		Arm / Foot protection type	
	NPN output	PNP output	NPN output	PNP output
Model No.	SF2B-H□-N	SF2B-H□-P	SF2B-A□-N	SF2B-A□-P
Beam pitch	20 mm		40 mm	
Operating range	0.2 to 13 m			
Protective height	168 to 1,912 mm		168 to 1,912 mm	
Min. sensing object	φ27 mm opaque object		φ47 mm opaque object	
Supply voltage	24 V DC ± 10 %			
Control output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor			
Response time	OFF response: 15 ms or less, ON response: 40 to 60 ms			
Ambient temperature	- 10 to + 55 °C			
Dimensions	W28 × H protective height × D24 mm			

## Light Curtain Exclusive Control Unit **SF-C10** SERIES

**Less setup time for safety circuits**

**Supports both PNP and NPN polarities**

A single unit can be used for PNP / NPN input switching, reducing the number of parts that need to be registered.

**Removable terminal blocks reduce maintenance time** SF-C11, SF-C14EX(-01)

Removable terminal blocks reduce the work required for reconnecting wiring during maintenance.



**Metal enclosure with a IP65 protective structure** SF-C12

The strong metal enclosure has a built-in safety relay. It has an IP65 protective structure, so that it can be set up individually without the need to be inserted into a control panel.

**Slim design** SF-C13

22.5 mm thickness, so it can even be inserted into narrow spaces inside panels.

**Three safety circuit systems packaged into a single unit!** SF-C14EX(-01)

Three safety circuit systems ① Light curtain output circuit, ② Muting control circuit, and ③ Emergency stop circuit are packaged into a single unit. This allows safety to be maintained for different sections of the equipment.



Supply voltage:	24 V DC ± 10 %
Enabling path:	NO contact × 3 (SF-C12: NO contact × 2)
Dimensions:	SF-C11 W46 × H130 × D100 mm SF-C12 W127 × H67.5 × D130 mm SF-C13 W22.5 × H130 × D80.8 mm SF-C14EX(-01) W46 × H130 × D99 mm

# Light Curtains for Safeguard

Ultra-slim Light Curtain Type 4 PLe SIL3  
**SF4C** SERIES

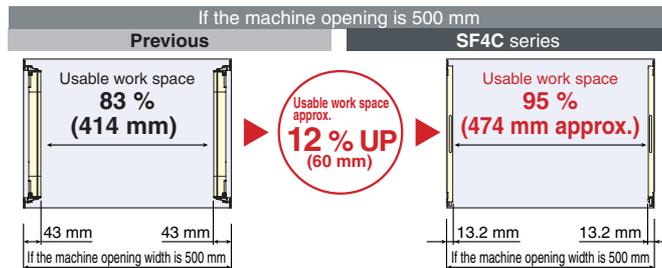
**Machine safeguarding without sacrificing productivity**  
**Ultra-slim Light Curtain**

**With a slimness of 13 mm, SF4C fits efficiently into small equipment**

Introducing a Type 4 light curtain that combines high end performance with an ultra-slim enclosure.

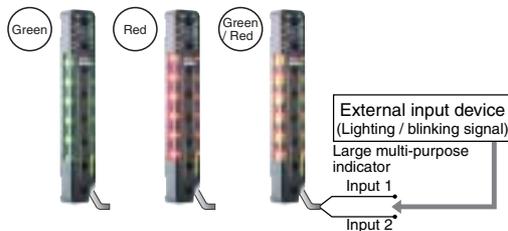
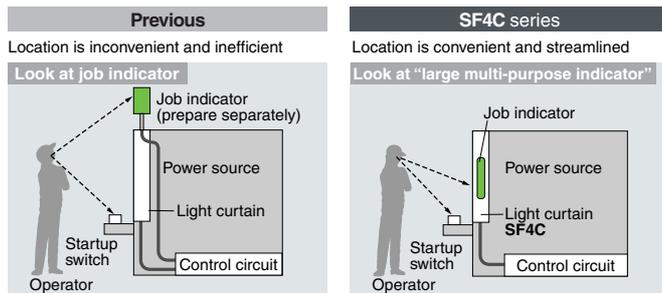
**Slim size for efficient applications**

Available work space is expanded from the previous model, and productivity is improved.



**Can be used in a variety of applications for simplified equipment [Large multi-purpose indicator]**

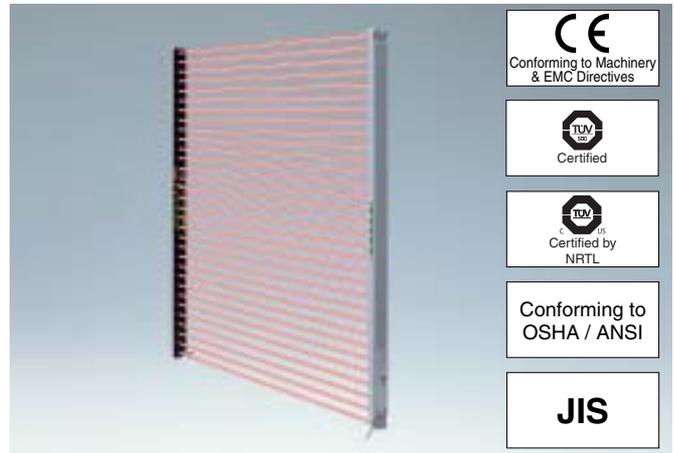
The bright LED indicators located in the center of both sides of each light curtain can be illuminated green or red by using external inputs. There is no need for setting up a separate indicator, so that equipment is consolidated.



**IP67 protection structure**

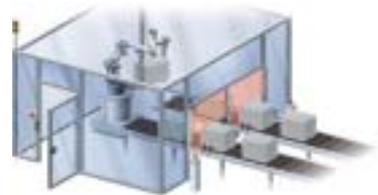
An IP67 (IEC / JIS) rating is achieved with an ultra-slim size for protection from environmental factors.

Type		Min. sensing object $\phi$ 25 mm type (20 mm beam pitch)						
Model No.	Pigtailed type Cable type	SF4C-H8-J05	SF4C-H12-J05	SF4C-H16-J05	SF4C-H20-J05	SF4C-H24-J05	SF4C-H28-J05	SF4C-H32-J05
No. of beam channels		8	12	16	20	24	28	32
Protective height		160 mm	240 mm	320 mm	400 mm	480 mm	560 mm	640 mm
Operating range		0.1 to 3 m						
Min. sensing object		$\phi$ 25 mm opaque object						
Supply voltage		24 V DC $\pm 10\%$ Ripple P-P 10 % or less						
Control output		PNP open-collector transistor / NPN open-collector transistor (switching method)						
Response time		OFF response: 7 ms or less, ON response: 90 ms or less						
PFHd		$1.66 \times 10^{-9}$	$1.90 \times 10^{-9}$	$2.10 \times 10^{-9}$	$2.33 \times 10^{-9}$	$2.54 \times 10^{-9}$	$2.77 \times 10^{-9}$	$2.98 \times 10^{-9}$
MTTFd		100 years or more						
Dimensions		W30 × H protective height × D13 mm						



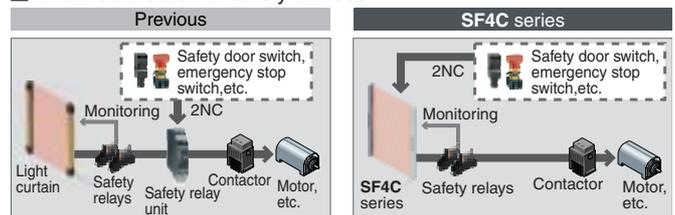
**Industry first\*! Wire-saving when connecting to safety devices [Safety input function]**

Contact outputs such as an emergency stop switches or a safety door switches can be connected to the light curtain. Also, by using the handy-controller **SFC-HC** up to three sets of light curtains can be cascade connected for a consolidated safety output.



\* Based on research conducted by SUNX as of March 2009.

**Direct connection of safety devices**



A safety relay unit is needed for connecting safety devices other than light curtain.

Direct connection of various safety devices is possible for a simplified safety circuit.

**Lightweight!**

The **SF4C** series is made of resin that is approx. 45 % lighter than the conventional aluminum case type. Its lightweight body eases the burden on the mounting surface of the equipment and contributes to overall reduced weight during equipment transportation or overseas shipment.

\*Except the cable part

**A fast response time of 7 ms\* for all models**

A fast response time of 7 ms\* is unified for all models regardless of the number of beam channels. This reduces the safety distance as well as the calculation work required for the safety distance among models with different beam channels.

\* When connecting safety sensors (light curtains, etc) to the safety input, the response time will be the total time of connected units.

# Safety Sensors

## Compact Safety Beam Sensor **Type 4** **New** ST4 SERIES Control Category 4

From wide areas to narrow spaces, full support for both safety and productivity!

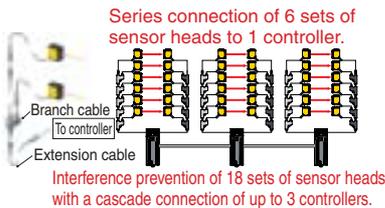
### Long sensing range of up to 15 m

Secures safety of large facilities where installation of guardian fence is difficult.



### Series connection of sensors and interference prevention

The numbers of sensor heads and controllers can be freely adjusted to meet the heights and the required numbers of the protection area.



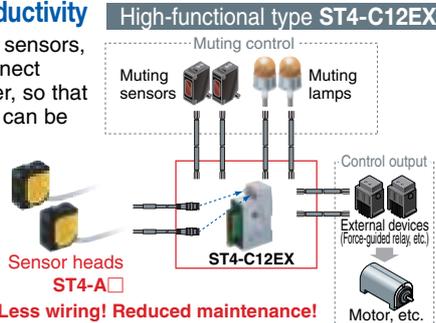
### Safety in small openings is ensured

Ensures safety at places in which light curtains cannot be installed and in small openings that are often missed.



### Three patterns of muting control function for greater safety with no loss in productivity

Sensor heads, muting sensors, and muting lamps connect directly to the controller, so that muting control circuits can be built easily.



Less wiring! Reduced maintenance!

## Safety Laser Scanner **Type 3** **New** SD3-A1 Control Category 3

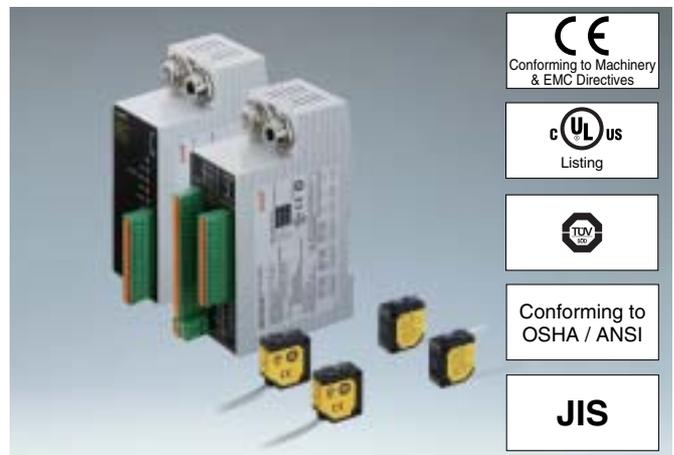
Monitor dangerous areas for unauthorized entry using flexible detection zones!

### Freely configurable zones

Two zones can be widely monitored with the SD3-A1, the warning zone (within a radius 15 m) and the detection zone (protection zone) (within a radius 4 m). The contours of these zones are fully configurable for a perfect fit in every application. Up to eight zone patterns can be set and switched over at any given time, even during operation.



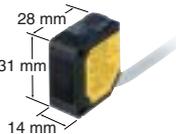
Model No.	SD3-A1					
Detection zone	Min. sensing object setting	φ 150 mm	φ 70 mm	φ 50 mm	φ 40 mm	φ 30mm
	Sensing range (radius)	0 to 4.0 m	0 to 4.0 m	0 to 2.8 m	0 to 2.2 m	0 to 1.6m
	Sensing object reflectance	Minimum 1.8 %				
Warning zone	Min. sensing object setting	φ 150 mm (fixed)				
	Sensing range (radius)	0 to 15 m				
	Sensing object reflectance	Minimum 20 %				
Measurement zone	Max. measurement range (radius)	50 m (fixed)				
Number of zone setting	Max. 7 + 1 (without detection zone) (Zone pairs in combination of detection zone and warning zone can be switched over by external input)					
Min. zone setting range	200 mm					
Supply voltage (U <sub>B</sub> )	24 V DC $\pm 20\%$ (IEC 60742)					
Control outputs (OSSD 1, OSSD 2)	PNP open-collector transistor 2 outputs					
	Response time	Min. 80 ms (2 scans) to max. 640 ms (16 scans) switching method				
Degree of protection	IP65					
Ambient temperature	0 to +50 °C					



- Conforming to Machinery & EMC Directives
- Listing
- 
- Conforming to OSHA / ANSI
- JIS**

### Compact sensor head saves space

The Type 4 long sensing range type has a compact size that is equivalent to those of general-purpose photoelectric sensors.

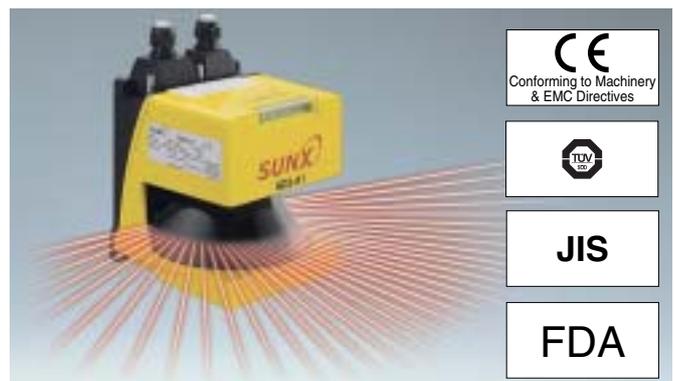


### Sensor heads

Type	Cable length 0.2 m		Cable length 1 m	
	With emission amount adjuster		With emission amount adjuster	
Model No.	ST4-A1-J02	ST4-A1-J02V	ST4-A1-J1	ST4-A1-J1V
Operating range	0.1 to 15 m			
Sensing object	ø9 mm or more opaque object			
Supply voltage	Supplied from controller			
Degree of protection	IP67 (IEC)			
Ambient temperature	-10 to +55 °C			

### Controllers

Type	Controller	High-functional controller
Model No.	ST4-C11	ST4-C12EX
Applicable sensor head	ST4-A□ (Interference prevention possible when up to a maximum of 6 sets are connected)	
Supply voltage	24 V DC $\pm 18\%$	
Control outputs	PNP open-collector transistor / NPN open-collector transistor Dual output × 1 system	
Response time	OFF response: 25 ms or less, ON response: 90 ms or less (automatic reset) / 140 ms or less (manual reset)	
Degree of protection	Enclosure: IP40 (IEC), Terminal: IP20 (IEC)	
Ambient temperature	-10 to +55 °C	



- Conforming to Machinery & EMC Directives
- 
- JIS**
- FDA**

### Smallest size in its class\*

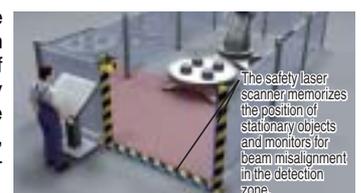
W140 × H195 × D135 mm smallest in class.

\* In the class of detection zone 4 m. Based on research conducted by SUNX as of July 2008.



### Monitors beam misalignment after installation of safety laser scanner

By activating the reference boundary function which enables constant detection of stationary objects, the safety laser scanner memorizes the position of stationary objects, and monitors for beam misalignment after installation.



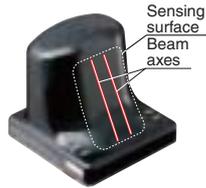
# Optical Touch Switch

## Optical Touch Switch SW-100 SERIES

Gentle start-up switches in accordance with ergonomics

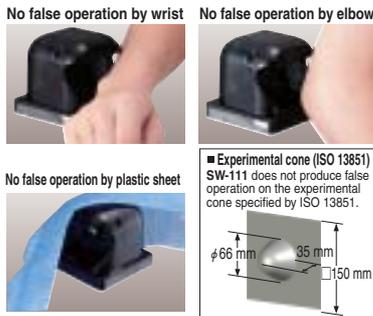
### Operate the switch simply by touching it **SW-101**

This is an optical-type switch (two beam axes) which allows you to start equipment simply by touching the sensing surface to interrupt the light beams. Provides a zero force, low impact, machine control solution. The switch reduces the possibility of medical problems that are associated with high impact push buttons, such as tendonitis or carpal tunnel syndrome.



### Safeguard prevents false operation **SW-111**

**SW-111** saves the hassle of making an additional safeguard. In addition, with its ISO 13851 complying shape, even a knock on the elbow will not cause a false operation (light interruption).



### Equipped with external input indicators

Two sets of external input indicators (two colors) are provided, so that they can be used as operation indicators for a variety of purposes.

Designation	Optical touch switch	
	With safeguard	
Model No.	<b>SW-101</b>	<b>SW-111</b>
Sensing method	Thru-beam type photoelectric sensor (2 beam axes)	
Supply voltage	12 to 24 V DC $\pm 10\%$	
Outputs	Semiconductor Photo-MOS relay output $\times 3$	
Response time	100 ms or less when an object is detected, 50 ms or less when an object is not detected	
Ambient temperature	$-25$ to $+50$ °C	
Dimensions	W80 $\times$ H104.3 $\times$ D80 mm	

# Wire-saving System

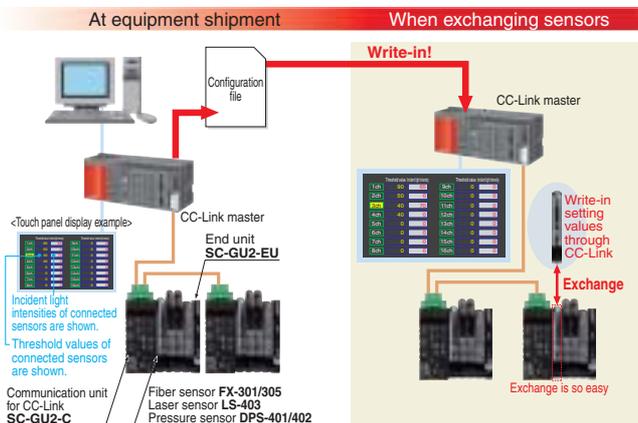
## Communication Unit for CC-Link SC-GU2-C

**New**

Now it is possible to directly connect digital sensors to CC-Link!  
Contributes to traceability, preventive maintenance

### Efficiency in maintenance and traceability as backup

Before shipping out equipment which contains digital fiber sensor **FX-301/305**, digital laser sensor **LS-403**, or digital pressure sensor **DPS-400** series, simply save the threshold values and other configurations as "configuration file", so that later on when it comes to exchanging the sensors, the configurations can be simply written into CC-Link contributing to significantly-reduced man-hours. By having configuration file saved beforehand, if a production line problem ever occurs, simply check the "configuration file" to solve the failure in early stages, promoting traceability.



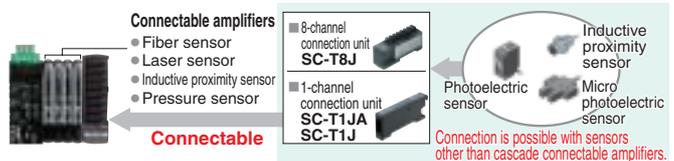
### Preventive maintenance

Take in current values of digital sensors (incident light intensity, pressure value) periodically and graph them out for preventive maintenance.



### Make use of spare channels

For sensors that cannot connect in cascade, connect a connector input extension unit **SC-T1JA**, **SC-T1J**, **SC-T8J** to **SC-GU2-C** to enable cascade connection to save more wiring. **SC-T1JA** can also connect with sensors of analog input (1 to 5 V).



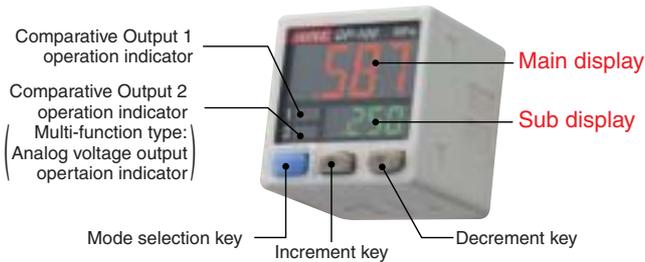
Designation	Communication unit for CC-Link
Model No.	<b>SC-GU2-C</b>
Applicable sensor amplifiers	Sensor amplifiers (NPN output type) that can connect to non-line connector <b>CN-70</b> (optional)
Number of connectable units	Max. 16 units per <b>SC-GU2-C</b>
Supply voltage	24 V DC $\pm 10\%$ to $-15\%$
Communication method	CC-Link Ver.1.10
Number of occupied station	Switchable 1 or 4 station
Baud rate	156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, 10 Mbps (setting by <b>SC-GU2-C</b> )
Station No. setting	1 to 64 (0 and 65 or more: Error)
Remote station type	Remote device station
Ambient temperature	$-10$ to $+55$ °C (If 4 to 7 units are connected in cascade: $-10$ to $+50$ °C, if 8 to 16 units are connected in cascade: $-10$ to $+45$ °C)

# Pressure / Flow Sensors for Gas

## Dual Digital Display Pressure Sensor DP-100 SERIES

**A new global standard, dual display**

**Current value and threshold value can be checked at the same time!**



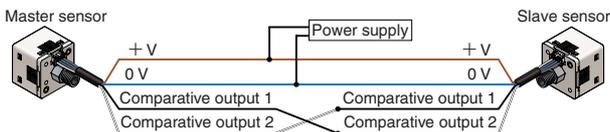
### Copy function reduces man-hours and human error

Sensors can be connected to a master sensor one by one, and a copy of the setting details for the master sensor can be transmitted as data to the other sensors. If making the same settings for multiple sensors, this prevents setting errors from occurring with the other sensors and also reduces the number of changes required to instruction manuals when equipment designs are changed.

#### Copying via copy unit



#### Copying via wiring



### High accuracy accomplished

#### Low pressure type

The low pressure type displays measurements in 0.1 kPa at a resolution of 1/2,000 and has a response time of 2.5 ms (variable up to 5,000 ms),  $\pm 0.5\%$  F.S. temperature characteristics and  $\pm 0.1\%$  F.S. repeatability, giving it high accuracy sensing.

Type	Compound pressure			
	For low pressure	For high pressure	Multi-function	
Model No.	DP-101(-M)	DP-102(-M)	DP-101A(-M)	DP-102A(-M)
Asia	DP-101(-M)	DP-102(-M)	DP-101A(-M)	DP-102A(-M)
Europe	DP-101-E-P	DP-102-E-P	DP-101A-E-P	DP-102A-E-P
MS plug-in connector type	DP-111-E-P-J	DP-112-E-P-J	DP-111A-E-P-J	DP-112A-E-P-J
North America	DP-101-N(-P)	DP-102-N(-P)	DP-101A-N(-P)	DP-102A-N(-P)
Rated pressure range	-100.0 to +100.0 kPa	-0.100 to +1.000 MPa	-100.0 to +100.0 kPa	-0.100 to +1.000 MPa
Applicable fluid	Non-corrosive gas			
Supply voltage	12 to 24 V DC $\pm 10\%$			
Output	NPN output type: NPN open-collector transistor PNP output type: PNP open-collector transistor			
Dimensions	W30 X H30 X D42.5 mm (DP-10-M: D30 mm, DP-11-E-P-J: D47.5 mm)			

Note: Types without connector attached cable are also available.

## Integrated Display Type Digital Flow Sensor FM-200 SERIES

**Dual color with sub display at a glance**

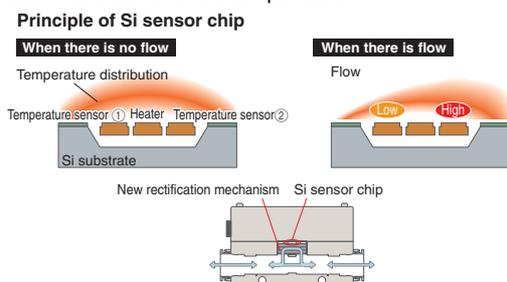
**Easy-to-see dual color with sub display!**

The setting conditions are displayed on the sub display, making it much easier to keep track of operations. In addition, the digital display which switches between 2 colors lets you check the status of sensor operation at a glance.



### High precision of $\pm 3\%$ F.S.

A new rectification mechanism and Micro Electro Mechanical System (MEMS) technology allow the sensor to be mounted on a Si sensor chip ( $3 \times 3.5$  mm). This provides an extremely small heat capacity, high precision of  $\pm 3\%$  F.S. and high-speed response. The two temperature sensors on each side of the heater detect the heat distribution to make bidirectional detection possible.



### One sensor for both intake and exhaust

A single sensor can detect flows bidirectionally. In addition, it can be set to detect flows in either the forward or reverse direction only, making it suitable for a variety of applications.

Type	NPN output type	PNP output type
Model No.	FM-2-M	FM-2-P
Full scale flow rate	Six types: 500 m <sup>3</sup> /min., 1,000 m <sup>3</sup> /min., 10 l/min., 50 l/min., 100 l/min.	
Rated pressure range	-0.09 to +0.7 MPa	
Pressure withstandability	1 MPa	
Applicable fluid	Clean air, compressed air, nitrogen gas	
Supply voltage	12 to 24 V DC $\pm 10\%$	
Comparative outputs (Comparative output 1 / Comparative output 2)	NPN open-collector transistor	PNP open-collector transistor
Output modes	Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode	
Analog voltage output	Output voltage: 1 to 5 V	
Ambient temperature	0 to +50 °C	

# Pressure / Flow Sensors for Gas

## Head-separated • Dual Display Digital Pressure Sensor DPC-100 SERIES DPH-100 SERIES

Single axis type! Mountable to the sensor head using a hexagonal wrench

Single axis type and free-turning structure allow hexagonal wrench installation for space-saving and construction-saving

Obstructions can be avoided and installation from above can be done much more easily using a hexagonal wrench. This also eliminates wasted installation space and contributes to a smaller installation footprint.



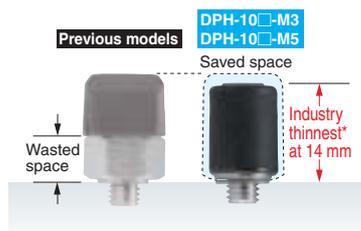
### Unconventional embedded installation of sensor head is possible

Because the bolts can be turned from directly above, embedding the sensor heads into narrow spaces is possible. In addition, the flat installation leaves no worries for danger of objects striking against the sensor and damaging it.



### Industry's thinnest at 14 mm\*, takes up less space during installation

Because the dead zone caused by the nut is eliminated, the narrowed-down thickness after installation contributes to space saving.

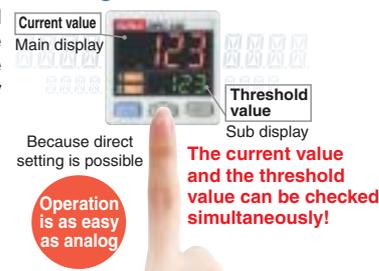


\* Based on research conducted by SUNX as of March 2008.



### Dual display + Direct setting

Simply change the "threshold value" while checking the "current value" at the same time. Dual display greatly enhances operability.



### Sensor heads

Type	Compound pressure	Positive pressure	Vacuum pressure
Model No.	DPH-101□	DPH-102□	DPH-103□
Type of pressure	Gauge pressure		
Rated pressure range	-100.0 to +100.0 kPa	0 to +1.000 MPa	0 to -101.0 kPa
Applicable fluid	Air, non-corrosive gas		
Supply voltage	12 to 24 V DC ±10 %		
Analog voltage output	Output voltage: 1 to 5 V (over rated pressure range)		
Ambient temperature	0 to +50 °C		
Pressure port	R1/8 male thread + M5 female thread, M3 male thread, M5 male thread, three types are available		

### Controllers

Type	NPN output type	PNP output type
Model No.	DPC-101	DPC-101-P
Rated pressure range	Compound pressure: -100.0 to +100.0 kPa, Positive pressure: 0 to +1.000 MPa, Vacuum pressure: 0 to -101.0 kPa	
Supply voltage	12 to 24 V DC ±10 %	
Comparative outputs (Two outputs)	NPN open-collector transistor	PNP open-collector transistor
Response time	0.5 to 5,000 ms (12 types), selectable by key operation	
Analog output	Analog voltage output: 1 to 5 V DC, Analog current output: 4 to 20 mA	
Ambient temperature	-10 to +50 °C	

## Slim • Dual Digital Display Head-separated Pressure Sensor

### DPS-400 SERIES

**New**

Introducing thin body pressure sensor controller!  
Network communication compatible

### Network communication

Connection to CC-Link open network is possible through the communication unit for CC-Link SC-GU2-C. Monitoring or setting changes can be carried out via a PLC, PC, etc.



### Current value and threshold value can be checked simultaneously on the dual display

Equipped with a large 4-digit dual digital display. The threshold value (green) can be set easily while checking at the current pressure value (red).



Operation is as easy as analog



### Ultra high-speed response time at 150 μs

Industry fastest\* response time contributes to even greater productivity.

\* Based on research conducted by SUNX as of October 2008.

### Connection to sensor head of DPH-100 series is possible

Applicable sensor heads:
Using DPS-401; DPH-101□ / DPH-103□
Using DPS-402; DPH-102
Supply voltage: 12 to 24 V DC ±10 %
Comparative outputs: NPN open-collector transistor 2 outputs
Ambient temperature: -10 to +50 °C
Dimensions: W10×H30×D81 mm

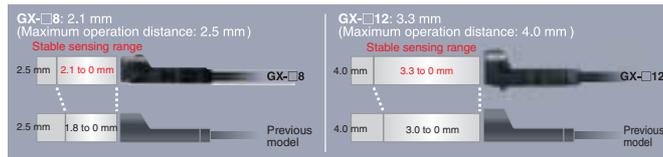
# Inductive Proximity Sensors

## Amplifier Built-in • Rectangular-shaped Inductive Proximity Sensor GX-F/H SERIES

**Industry No. 1\* in stable sensing** \* Based on research conducted by SUNX as of August 2007 among equivalent rectangular inductive sensors.

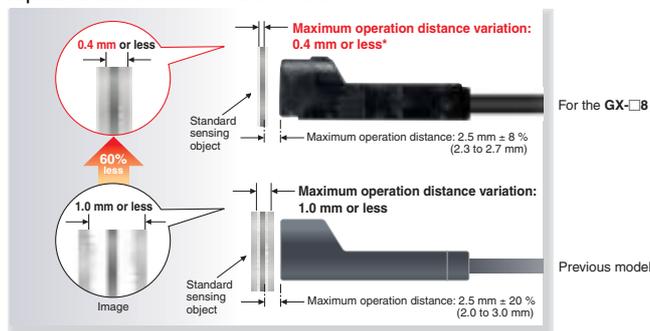
### Can be installed with ample space

This sensor has the longest stable sensing range among the same level of rectangular inductive proximity sensors in the industry. It is easy to install the sensor.



### Variation at the maximum operation distance is within ± 8 %

Thorough adjustment and control of sensitivity greatly reduces individual sensor differences and variations. The work of adjusting sensor positions when using multiple sensors and when sensors have been replaced has become much easier.



\* Not including temperature characteristics.  
GX-□12 has a variation of 0.64 mm or less for a maximum operation distance of 4 mm

### Temperature characteristics vary within ± 8 %

Components such as the sensor coil and core and product design have been totally revised to provide excellent temperature characteristics. Stable sensing can be obtained regardless of the time of day or the yearly season.

## Amplifier-separated Inductive Proximity Sensor GA-311 / GH SERIES

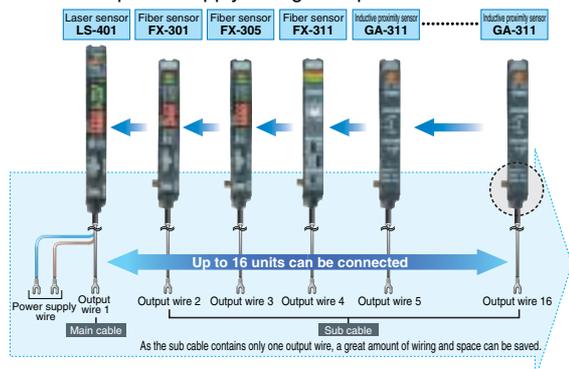
### High-speed response and one-touch connectors

#### Suitable for high-speed applications

Performance matches the 3.3 kHz response frequency. These sensors are ideal for sensing objects moving at high speeds.

#### Excellent workability and ease of maintenance

They all have the same form as the FX-300 series of fiber sensors. The one-touch cables are also of the same shape, so that fiber sensors and laser sensors can all be used together and less power supply wiring is required.



#### IP67g (JEM) sensor head variations

The lineup includes 5 different models, from an ultra-compact 2.8 mm diameter type to a spatter-resistant type. Furthermore, all except for the GH-2SE are IP67g (JEM) oil-resistant models so that they can be used with confidence even in adverse environments.



### Highly resistant to water or oil! IP68g protective construction

The new integrated construction method used improves environmental resistance performance. The IP68g prevents damage to the sensor by stopping water and oil getting inside.



### 6 mm type is available **New**



Maximum operation distance:	GX-F6□/H6□	1.6 mm ± 8 %
	GX-F8□/H8□	2.5 mm ± 8 %
	GX-F12□/H12□	4.0 mm ± 8 %
Supply voltage:	12 to 24 V DC $\pm 10\%$	
Output (Note 2):	GX-□	NPN open-collector transistor
	GX-□-P	PNP open-collector transistor
Protection:	IP68 (IEC), IP68g (JEM)	
Dimensions:	GX-F6□	W6 × H25 × D6 mm
	GX-H6□	W6 × H6.5 × D25 mm
	GX-F8□	W8 × H24 × D7.4 mm
	GX-H8□	W8 × H9.1 × D26 mm
	GX-F12□	W12 × H32.2 × D7.1 mm
	GX-H12□	W12 × H13 × D31.8 mm

Model No.	Sensor head	GH-2SE	GH-3SE	GH-5SE	GH-8SE	GH-F8SE
	Amplifier	GA-311				
Stable sensing range		0 to 0.6 mm	0 to 0.8 mm	0 to 1.0 mm	0 to 2.0 mm	
Max. operation distance		1.2 mm	1.8 mm	2.4 mm	4.0 mm	
Supply voltage		12 to 24 V DC $\pm 10\%$				
Repeatability		Along sensing axis, Perpendicular to sensing axis: 1 μm or less				
Output		NPN open-collector transistor				
Protection (Sensor head)		IP50 (IEC)	IP67 (IEC), IP67g (JEM)			
Dimensions	Sensor head	φ2.8 × 12 mm	φ3.8 × 15 mm	φ5.4 × 15 mm	φ8 × 15 mm	
	Amplifier	W10 × H30.5 × D64.5 mm				

Note: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.  
Main cable (3-core): CN-73-C1 (cable length 1 m), CN-73-C2 (cable length 2 m), CN-73-C5 (cable length 5 m)  
Sub cable (1-core): CN-71-C1 (cable length 1 m), CN-71-C2 (cable length 2 m), CN-71-C5 (cable length 5 m)

## Ultra High-speed · High-precision Laser Displacement Sensor HL-C2 SERIES

Ultra high-speed, high-precision laser displacement sensors using a combination of new technology

### Excellent basic performance

These sensors achieve an excellent level of performance in the three basic functions which are required of reflective type laser displacement sensors. They can provide "Surplus", "Reliability" and "Confidence" to production sites which demand high speeds and high precision.



\* These products are introduced to limited countries only, because of falling under WA (Wassenaar Arrangement) 2.B.6.b.1.a and NSG (Nuclear Suppliers Group) 1.B.3.b.1. Some models, which fall outside of WA and NSG, are available. Please contact our office for details.

Particularly for specular reflection use, best suited for high precise measurement of the thickness and spacing of FPD glass

#### HL-C201F / HL-C201F-MK

Sampling	Linearity	Resolution
100 kHz	±0.02 %	0.01 μm



10 ± 1 mm Red semiconductor laser Class 1 (IEC / JIS)

Flagship model combined with high-speed and high-precision by our exclusive technology

#### HL-C203F / HL-C203F-MK

Sampling	Linearity	Resolution
100 kHz	±0.03 %	0.025 μm



30 ± 5 mm Red semiconductor laser Class 2 (IEC / JIS)

Applicable from metal to rubber, range and precision achieved at a high usability

#### HL-C211F5 / HL-C211F5-MK

Sampling	Linearity	Resolution
100 kHz	±0.03 %	0.1 μm



110 ± 15 mm Red semiconductor laser Class 3R (IEC / JIS)

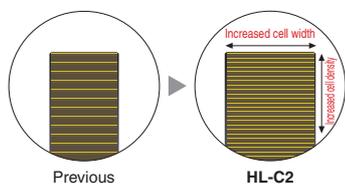
### HDLC-CMOS sensors

Resolution	Sampling
------------	----------

The HDLC-CMOS sensors have been developed specially for the HL-C2 series. High density light-receiving cells and a processing speed which is close to maximum limits result in high resolutions and high speeds which exceed all expectations for laser displacement sensors.

HDLC: High Density Linear Cell

■ Comparison of cell structures (image)

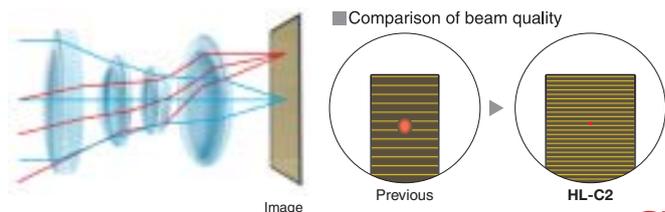


### High-resolution lens

Linearity	Resolution
-----------	------------

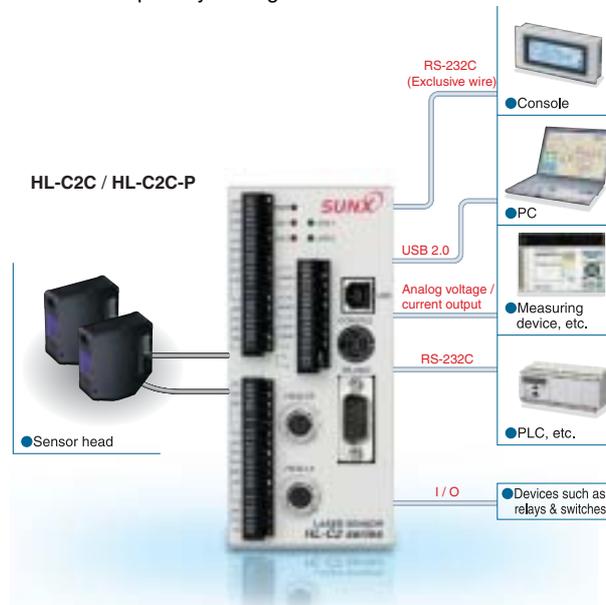
High-resolution lens has been newly designed to perfectly suit HDLC-CMOS sensors.

The light-receiving part can create images at a minimum point from light received from a variety of different angles to produce images with even greater precision.



### Compact controller equipped with a wide range of functions

This controller can be connected to a wide variety of devices, and is equipped with an extensive list of functions including a data buffering function for temporarily storing measurement values.



# Measurement Sensors

Light / Reflective Type

## Ultra High-speed Laser Displacement Sensor **CCD Style** HL-C1 SERIES

**Ultra high-speed & stable measurement for a variety of measurement objects**

### 100 $\mu$ s of sampling rate

Ultra high-speed sampling has been achieved for displacement sensors utilizing linear image sensors, thus enabling ultra high-speed measurement of rotating, vibrating and moving objects.

### Resolution of 1 $\mu$ m, linearity of $\pm 0.1$ % F.S.

Now available with ultra-precise 1  $\mu$ m resolution measurement capability (HL-C105B-BK, HL-C105F-BK, HL-C105B, HL-C105F) and a linearity of  $\pm 0.1$  % F.S. (for all models).

### Touch panel operation, easy and compact

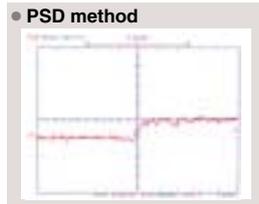
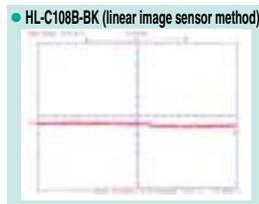
A variety of setting and measurement data can be displayed easily. (Optional)



Compact console  
HL-C1DP1-E

### High precision measurement is now possible, unaffected by the surface condition of the detected object

All deficiencies inherent in the conventional PSD sensing method have now been completely solved. Whereas the PSD method measures position information from the center of gravity of the total light quantity distribution of the light spots connected along each light element, the linear image sensor method measures the peak position values of the light spots themselves. This advancement now makes high-precision measurement possible, regardless of the surface condition of the object whether for metal hairline surface cracks or for non-reflective black rubber.



Change in measurement data due to color difference (White ceramic / Black rubber)



### Two sensor heads can be connected! Reduces costs and saves space

#### Sensor heads

Type	Diffuse reflective		Specular reflective	
	General propose	High precision	General propose	High precision
Model No. (Note 1)	HL-C108B(F)-BK	HL-C105B(F)-BK	HL-C108B(F)	HL-C105B(F)
Measurement center distance	85 mm	50 mm	81.4 mm	46 mm
Measuring range	$\pm 20$ mm	$\pm 5$ mm	$\pm 16$ mm	$\pm 4$ mm
Resolution (Note 2)	2 $\mu$ m	1 $\mu$ m	2 $\mu$ m	1 $\mu$ m
Linearity	$\pm 0.1$ %F.S.			
Emitting element	Red semiconductor laser, Class 2 (class II for FDA standards conforming type) IEC/JIS standards conforming type: IEC / JIS, FDA standards conforming type: JIS / IEC / FDA Max. output: 1 mW, Peak emission wavelength: 685 nm			
Beam diameter	100 $\times$ 140 $\mu$ m approx.	70 $\times$ 120 $\mu$ m approx.	100 $\times$ 140 $\mu$ m approx.	70 $\times$ 120 $\mu$ m approx.
Protection	IP67 (excluding connector)			
Ambient temperature	0 to +45 $^{\circ}$ C			
Dimensions	W26.6 $\times$ H82 $\times$ D87 mm			

Notes: 1) HL-C10□B(-BK) is IEC / JIS standards conforming type.

HL-C10□F(-BK) is FDA standards conforming type.

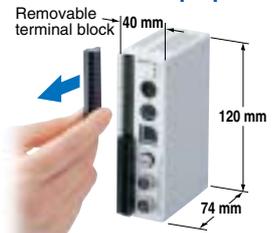
- Where measurement conditions have not been specified precisely, the conditions used were as follows: supply voltage 24 V DC, ambient temperature +20  $^{\circ}$ C, sampling rate 100  $\mu$ s, average number of samples: 256, object measured at measurement center distance, is made of white ceramic (an aluminum vapor deposition surface reflection mirror was used with specular reflective type). Linearity also depends upon the characteristics of the object being measured.
- These values were obtained with an average number of samples: 256, when using an object made of our company's standard white ceramic for measurement (an aluminum vapor deposition surface reflection mirror was used with specular reflective types).



CE Conforming to EMC Directive  
FDA [HL-C10□F(-BK) only]

### Controller is compact, front connection reduces setup space

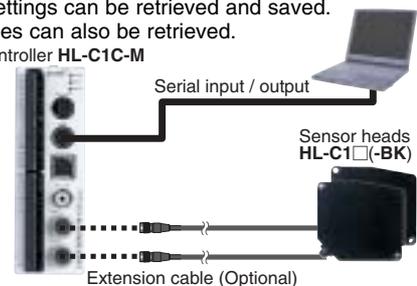
The ultra-compact and thin controller with dimensions of W40  $\times$  H120  $\times$  D74 mm requires extremely little space for installation. Tight installation is also possible. Furthermore, the cables can be connected directly or to a removable terminal block, so that all connections come from the same direction in order to further save space.



### Equipped with serial input / output

An RS-232C interface for serial input and output is provided so that settings can be retrieved and saved. Measurement values can also be retrieved.

Controller HL-C1C-M



### FDA standards conforming types are available

#### Special version for measurement of raw and completed rubber tire

HL-C105C-BK5  
HL-C108C-BK5

The HL-C1 series has added a new line up of tire measuring special-version for tire making processes. High-powered 5 mW type enabled high accuracy and stable measurement of raw tire and completed tire which were previously considered as difficult to measure.

#### Controller

Model No.	HL-C1C-M	
Connectable sensor head	Max. 2 sensor heads	
Supply voltage	24V DC $\pm 10$ %	
Sampling rate	Selectable from 100 $\mu$ s / 144 $\mu$ s / 200 $\mu$ s / 255 $\mu$ s / 332 $\mu$ s / 498 $\mu$ s / 1,000 $\mu$ s	
Analog output	Voltage	Output voltage: $\pm 5$ V/F.S., Output current: Max. 2 mA Output impedance: 50 $\Omega$
	Current	Output current: 4 to 20 mA/F.S., Load resistance: 250 $\Omega$ or less
	Output range	Voltage: -10.9 to +10.9 V, Current: 0 to 29.5 mA
Judgment outputs (O1, O2)	Photo-MOS relay	
Average number of samples	OFF, 2 to 32,768 cycles (switching in 16 steps)	
Ambient temperature	0 to +50 $^{\circ}$ C	
Dimensions	W40 $\times$ H120 $\times$ D74 mm	

# Measurement Sensors

Light / Reflective Type

Wide Range · Ultra High-speed Laser Displacement Sensor **CCD Style**  
**HL-C135C-BK10** Sensor head **HL-C1C-WL** Controller

Superior wide-range measurement with a small head

## Measures wide changes over long ranges

The long-and wide-range capabilities over **350 mm ± 200 mm** allow large changes to be measured. Even if the object position changes, there is no need to change the sensor head settings or position.

## High speed and high precision even over long and wide ranges

High-speed and high-precision measurement is possible with a high-speed sampling of **100 μs** at a resolution of **10 μm** and a linearity of **±0.1 % F.S.**



**Sensor heads**  
 Measurement center distance: 350 mm  
 (Measuring range: ± 200 mm)  
 Emitting element: Red semiconductor laser, Class 3B (IEC / JIS)  
 Beam diameter: 400 × 200 μm approx.  
 Dimensions: W26.6 × H82 × D87 mm  
**Controller**  
 Specifications are the same as for the **HL-C1C-M** controller on the previous page.

# Measurement Sensors

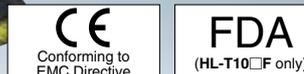
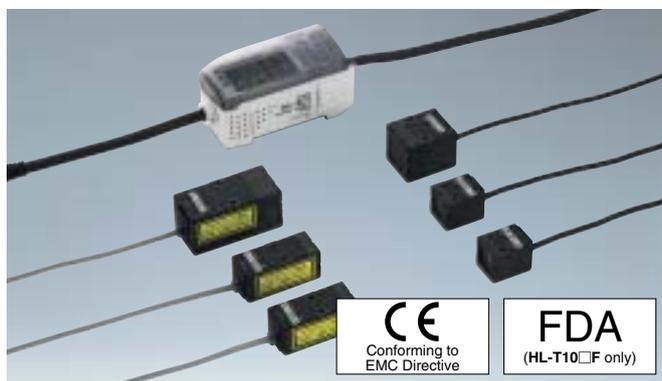
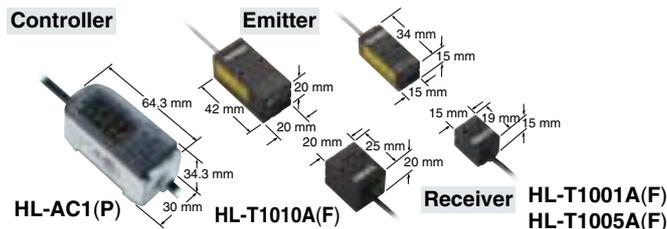
Light / Thru-beam Type

Ultra-compact Laser Collimated Beam Sensor Class 1  
**HL-T1** SERIES

Ultra-compact sensor head  
 A high-functionality intelligent controller

## Ultra-compact sensor head

The ultra-compact size and yet at a high level of performance in its class. These sensors save space.



## Calculations for 2 sensors are possible

The calculation unit (optional) just needs to be connected between the two controllers to enable calculations (addition and subtraction) to be carried out for two sensors. No digital panel controller is needed either.



Sheet width measurement

## Resolution of 4 μm

A high resolution of 4 μm (at an average 64 cycles) allows high-precision positioning and size judgment.

## High-precision judgment even from minute differences in light intensity

The sensors are sensitive to minute differences in light intensity, so that they can judge even the opacity of glass and turbidity of liquids. In addition, the amount of light received can be displayed as a percentage to allow you to determine permeation rates.



Distinguishing opacity of glass

## FDA standards conforming types are available

FDA standards conforming types, most suitable for equipment used in the USA, are now available.

[FDA : ClassII, IEC / JIS : Class1]

### Sensor heads

Type	Beam diameter φ 1 mm type	Sensing width 5 mm type	Sensing width 10 mm type
Model No. (Note 1)	<b>HL-T1001A(F)</b> <b>HL-T1005A(F)</b> <b>HL-T1010A(F)</b>		
Sensing range	0 to 500 mm	500 to 2,000 mm	500 mm
Sensing width	φ 1 mm	φ 1 to φ 2.5 mm	5 mm   10 mm
Min. sensing object	φ 8 μm opaque object	φ 50 μm opaque object	φ 0.05 mm opaque object   φ 0.1 mm opaque object
Repeatability (During the state in which light is half blocked)	4 μm (Note 2)	—	4 μm (Note 2)
Linear output resolution	4 μm (Note 2)	—	4 μm (Note 2)
Ambient temperature	0 to + 50 °C		
Emitting element	IEC / JIS standards conforming type		
	Red semiconductor laser, Class 1 (IEC / JIS) (modulated, max. output 0.35 mW (HL-T1001A(F): 0.2 mW), emission peak wavelength: 650 nm)		
Emitting element	FDA standards conforming type		
	Red semiconductor laser, Class II (FDA) (modulated, max. output 0.35 mW (HL-T1001A(F): 0.2 mW), emission peak wavelength: 650 nm) (IEC / JIS: class 1)		

Notes: 1) **HL-T10□A** is IEC / JIS standards conforming type.  
**HL-T10□F** is FDA standards conforming type.  
 2) In case of an average sampling rate of 64 times.

### Controllers

Type	NPN output	PNP output
Model No.	<b>HL-AC1</b>	<b>HL-AC1P</b>
Supply voltage	12 to 24 V DC ± 10 %	
Measuring cycle	150 μs	
Linear output	Current / voltage output switchable	
	• During current output: 4 to 20 mA/F.S., Max. load resistance 300 Ω • During voltage output: ± 4 V/F.S., output impedance 100 Ω (In the monitor focus function, it can also be set at ± 5 V, 0 to 5 V, etc.)	
Temperature characteristics	± 0.2 % F.S./°C	
Settable average sampling rate	1 / 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1,024 / 2,048 / 4,096	
Judgment output (HIGH, PASS, LOW)	NPN open-collector transistor	PNP open-collector transistor
Ambient temperature	0 to + 50 °C	
Dimensions	W30 × H34.3 × D64.3 mm	

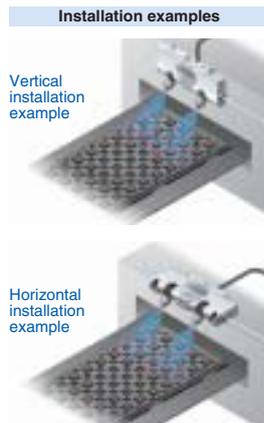
# Static Removers

## Thin Type Ionizer **High-frequency AC Method** ER-VW

Nozzle angle adjustment and joint layout can be selected as desired

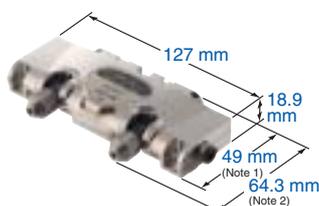
### Nozzle angle adjustment mechanism

The angles of the two nozzles can be adjusted within a range of approximately 190° by screwing down the ends of the nozzles. After adjusting the angle, turn the ends of the nozzles to tighten them and secure them at that angle. This allows the nozzle angles of the ER-VW to be adjusted easily after installation.



### Compact and ultra-thin design

The thickness of the unit is 18.9 mm. Even so, the nozzle angles can be adjusted, so that they can still be installed in places where there are space restrictions, such as inside other equipment or along several adjacent production lines.

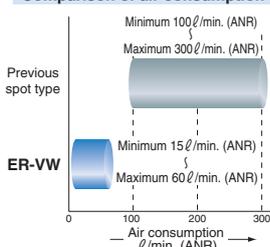


Notes: 1) Minimum width dimensions after nozzle angle adjustment.  
2) Maximum width dimensions after nozzle angle adjustment.

### Minimum air consumption 15 ℓ/min. (ANR)

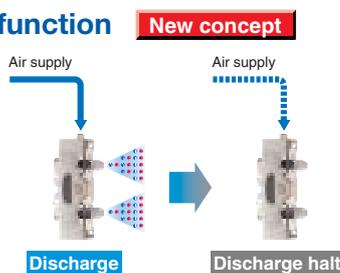
ER-VW can utilize air flow levels starting from a minimum of 15 ℓ/min. Because the amount of air consumed is so low, the loads placed on air supply equipment can be reduced and costly clean air can be used much more economically.

#### Comparison of air consumption



### Air supply monitoring function

This function causes discharging to stop automatically if the supply of air drops below a certain pressure. Notification of this is given when the AIR indicator lights and the discharge output (DSC) turns off. This prevents objects which are not charged from being overlooked when the air supply has been stopped.



Type	Spot type
Model No.	<b>ER-VW</b>
Charge removal time (±1,000V → ±100V)	1 sec. or less (Note 1)
Ion balance	Within ±10 V (Note 1)
Supply voltage	24 V DC ±10 %
Output	NPN open-collector transistor
Check (CHECK) ↑	
Error (ERROR) ↓	
Discharge (DSC) (Note 2) ↓	
Ambient temperature	0 to +55 °C

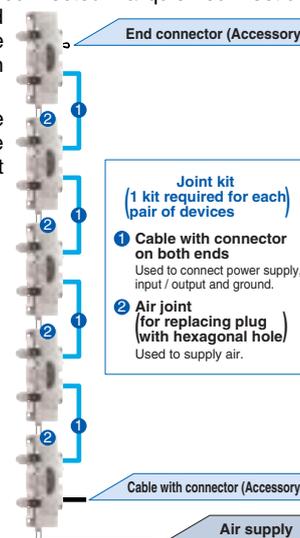
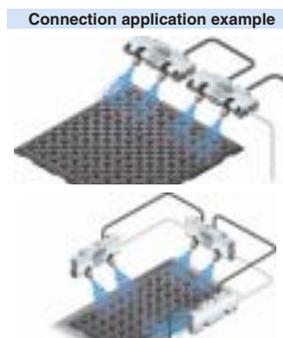
Notes: 1) A typical sample applied with a supply voltage of 24 V, a distance of 100 mm from the front surface of the air flow outlet and a pressure of 0.25 MPa. (Measured on a sample left in the atmosphere at a relative humidity of 65 % RH or less for 24 hours or more.)  
2) 'DSC' is the abbreviated symbol for 'DISCHARGE'.



### Easy connection possible

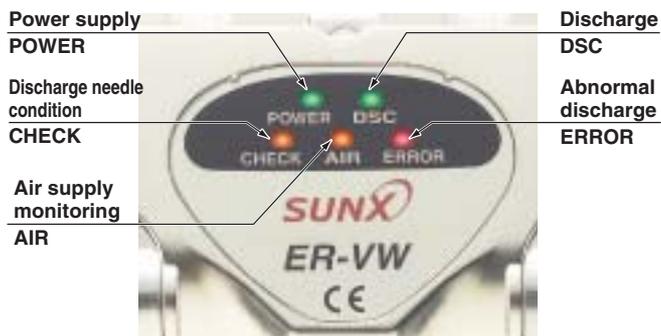
The joint kit (optional) can be used to connect up to a maximum of 5 ER-VW units. The air supply part is connected via quick connection joints, and the power supply and input / output signals can also be connected easily using connection cables with connectors at both ends.

Multiple ER-VW units can be connected together to provide charge removal layouts that suit the target equipment.



### The functions support accurate charge removal

In addition to the air supply monitoring function, the ER-VW is equipped with the following functions to ensure accurate charge removal.



**Discharge halt function:** Uses external input to forcibly stop discharge.

**Check function** : The CHECK indicator as an output notifies the operator when it is time to clean or replace the discharge needle.

**Abnormal discharge monitoring function** : The ERROR indicator as an output notifies the operator when a problem with discharge occurs, and stops discharge. It can be canceled by reset input.

**Discharge output** : Output is ON during discharge. This lets you check when discharge is being carried out.

**Check output** : Output turns ON when the discharge needle is dirty.

**Error output** : Output turns OFF when there is a problem with discharge (normally it is ON). It also allows you to check the power supply to the ionizer.

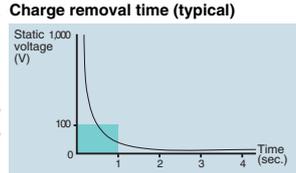
# Static Removers

Ultra-compact Ionizer **High-frequency AC Method**  
ER-V SERIES

**New ultra-compact, high-performance ionizer**

**Produces excellent ion balance**

The adoption of high-frequency AC method allows extremely stable ion balance to be achieved. Because the ion balance is not affected by the pressure of air supplied or by the setup distance, no troublesome adjustments are required after setup.

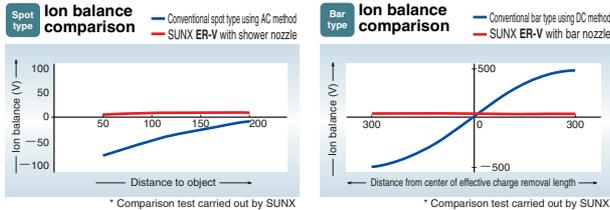


**Ultra-compact design accurately removes charges of objects even from narrow spaces**

The main unit is merely W109 × H27 × D28 mm, so it can easily be combined with other devices and also be installed as an add-on. Furthermore, the high-voltage power supply is built-in, so no extra space is required except for the ionizer itself.



It can be installed in places where the conventional bar type cannot, so it can be placed closer to the object for more accurate charge removal.



**High performance with no controller needed**

A full range of functions have been provided with full consideration for ease of use in the workplace. No separate controller is needed.

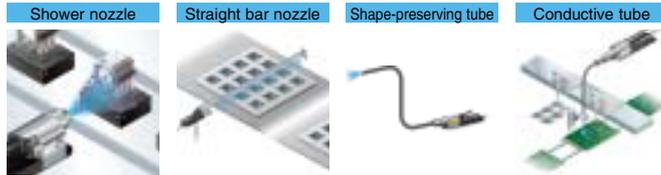
**Discharge halt input**

A signal from an external device can be used to turn discharge ON and OFF. Sensors can be used to detect the objects so that the ion air is generated only when required.

**Discharge indicator**

The discharge ON / OFF status can be checked using an LED display. This lets you avoid problems such as when the power is on but no discharge is occurring.

**Nozzle variations can be selected to suit the application**



Type	Spot type
Model No.	<b>ER-VS01</b>
Charge removal time (±1,000 V → ±100 V)	1 sec. or less (Note)
Ion balance	Within ± 10 V (Note)
Supply voltage	24 V DC ± 10 %
Output	NPN open-collector transistor
[Check (CHECK)] [Error (ERROR)]	
Ambient temperature	0 to + 55 °C

Note: A typical sample applied with a supply voltage of 24 V, a distance of 100 mm from the front surface of the air flow outlet and a pressure of 0.25 MPa while the shower nozzle is in use. (Measured on a sample left in the atmosphere at a relative humidity of 65 % RH or less for 24 hours or more.)

## Cleaning Box EC-B SERIES

**Bench top ionizer cleaning box**

**Direct ion emission from an ultra-compact ionizer together with powerful air pressure from an exclusive nozzle to remove dust**

Direct ion emission paired with pulsed air emission provides quick dust removal.



**Different pulsed air emissions can be selected by the solenoid valve**

Other than the continuous mode, two other pulsed air modes are available. Select the mode that best suits your application.

**White LED illumination**

The three white LED's illuminate the work piece to ensure complete dust removal.



Model No.	EC-B01-EX	EC-B02-EX
Charge removal time	0.5 sec. or less (Note 1)	
Ion balance	± 10 V or less	
Applicable fluid	Air (dried clean air)	
Supplied air flow	Max. 300 ℓ/min. (ANR) or less	Max. 500 ℓ/min. (ANR) or less
Air pressure range	less	
Supply voltage	0.05 to 0.5 MPa	
Power consumption	Accessory AC adapter (Note 2) INPUT: 100 to 240V AC ± 10 % 50/60 Hz (OUTPUT: 24V DC)	
Timer mode	80 VA or less	90 VA or less
Pulse air mode	2 sec. / 5 sec. / 10 sec. / synchronized with sensor or with external input selectable by switch	
Net weight	Pulse 1 (long) / Pulse 2 (short) / OFF (continuous) selectable by switch	

Notes: 1) Typical value at 100 mm from the front of air outlet at an applied pressure of 0.50 MPa.

2) Please prepare an AC cable separately as it is needed. The following cables are available as optionals: **CN-ACCN-C2**: AC cable (conforming to CCC), **CN-ACKR-C2**: AC cable (conforming to KTL)

# Static Removers

Wide-area Ionizer

ER-TF SERIES

**Slim in shape. Wide in charge removal area.  
An evolutionary form in expression.**

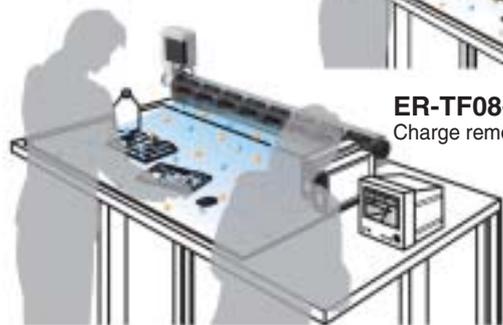
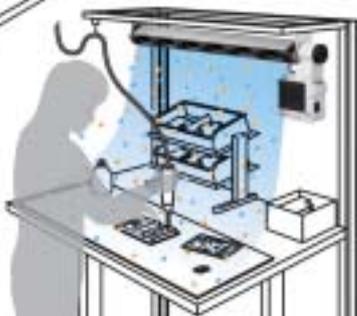
**Greater flexibility in the workplace with three charge removal areas**

This series provides a wide charge removal area and high charge removal performance which are ideal for cell production. It can be installed to racks and pipe materials, and can also be set up on table tops, providing a flexible range of options in the workplace.



**ER-TF04-EX**  
Charge removal area : 450 mm

**ER-TF06-EX**  
Charge removal area : 600 mm



**ER-TF08-EX**  
Charge removal area : 750 mm

## Flexible layout

The air blowing direction can be easily adjusted even after installation



Blowing direction adjustment mechanism

## Safe design

Detection of entry to the discharger interrupts the high voltage circuit



Entry detection function (Image)

## Easy maintenance

Discharge needle units can be detached or attached quickly



Discharge needle unit

Type	Charge removal area 450 mm	Charge removal area 600 mm	Charge removal area 750 mm
Model No.	<b>ER-TF04-EX</b>	<b>ER-TF06-EX</b>	<b>ER-TF08-EX</b>
Charge removal time	Approx. 1 sec. (Note 1)		
Ion balance	± 10 V or less (Note 2)		
Supply voltage	Accessory AC adapter INPUT: 100 to 240 V AC ± 10 % 50/60 Hz (Note 3) (OUTPUT: 24 V DC)		
Discharge method	Steady-state DC		
Dimensions	W414 ( <b>ER-TF06-EX</b> : 574, <b>ER-TF08-EX</b> : 734) × H187 × D60 mm		

Notes: 1) Typical value at a distance of 200 mm from the front surface of the air outlet at the unit center at maximum fan speed.

2) Typical value at a distance of 300 mm from the front surface of the air outlet at the unit center at maximum fan speed.

3) Please prepare an AC cable separately as it is needed.

The following cables are available as optionals:

**CN-ACCN-C2**: AC cable (conforming to CCC), **CN-ACKR-C2**: AC cable (conforming to KTL)

Pulse Air-gun Ionizer

EC-G SERIES

**Air-gun type ionizer**

**Three emission modes**

Other than the continuous mode, two other pulsed air modes are available. Select the mode that best suits your application.



**High operability while being compact**

The main unit only weighs 270g despite the high-voltage power circuits and the solenoid valve inside.

**The white LED illuminates on the target dust**

A white LED is incorporated above the air nozzle which helps to locate the dust for ion air emission.



Model No.	<b>EC-G01</b>
Charge removal time	0.5 sec. or less (1,000 V → 100 V) (Note 1)
Applicable fluid	Air (dried clean air) (Note 2)
Supplied air flow	Max. 300 ℓ/min. (ANR) or less
Air pressure range	0.05 to 0.50 MPa
Supply voltage	Accessory AC adapter INPUT: 100 to 240 V AC ± 10 % 50/60 Hz (OUTPUT: 24 V DC)
Power consumption	30 VA or less
Discharge method	High-frequency AC method
Pulse air mode	Pulse 1 (long) / Pulse 2 (short) / CONT (continuous) selectable by switch
LED illumination mode	ON (always ON) / SYNC (synchronized with trigger) / OFF (always OFF)
Weight	270 g approx. (main unit only)

Notes: 1) Typical value for pulse air mode: CONT at 100 mm from the front of discharge nozzle at an applied air pressure of 0.50 MPa.

2) Dried clean air is the air passing through air dryer (dew point -20 °C approx.) and air filter (mesh size 0.01 μm approx.)

# Industrial Use Video Endoscope

## Industrial Use Handy Video Endoscope MV-R SERIES

### Easy inspection of hard-to-see places

#### ALL-IN-ONE

Introducing the all-in-one type **MV-R** series: Handy Video Endoscope for industrial use with a built-in LCD monitor. Simply by carrying it to perform a variety of inspections while being able to confirm live videos at hand. Compact and high-functional, the **MV-R** series has introduced a new concept to the endoscope field.



\* Video screen is an image.

#### Portability

At just 350 g in weight, the compact body fits right in the palm of your hand. Image recording function (SD memory card) is equipped to eliminate unnecessary external devices. Commercially available batteries are ready to be used to further enhance its portability.

#### High-quality image

The outer tip of the scope with a diameter of 6 mm has a 110,000 pixel CCD and a high-illumination white LED to create exceptional pictures with enhanced color and imaging clarity.

#### Durability

The camera head has been safely designed to be water-proof. There is no harmful effect on the controller due to water splashes from any direction, allowing movements even in the outdoors.

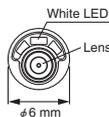
### Small diameter camera head achieves high-quality image

**Advanced environment resistance**  
Even objects with water drops remained can be inspected at ease.



#### High-illumination white LED

The built-in high-illumination white LED on the camera head produces bright and clear live videos.



### Two types of scope to suit your needs

#### Flexible cable

The soft and bendable cable can fit right in the shapes of the interior of the inspected objects.



#### Fixed cable

Camera head's direction can be freely adjusted, and the shape can be kept.



### Sample images



Inside a mechanical device



A substrate after being processed

### Portable compact body equipped with high-functionality

#### Built-in color LCD monitor features high-quality image

The body contains a 2-inch color LCD monitor (TFT).

#### Functionally allocated control buttons

Control buttons and live video monitor are functionally designed to be operable together without keeping your eyes away — all-in-one design for a total control.



#### Controller

Power supply: AA dry battery × 4 or 5 V DC input (using exclusive AC adapter)  
Display: 2 inch QVGA TFT color LCD  
Video signal output: NTSC composite

#### Scope (Camera)

Scope length: 1,500 mm  
Image sensing element: Color CCD  
Effective pixels: Approx. 110,000 pixels 368 (H) × 296 (V)

All information is subject to change without prior notice.

**SUNX**  
Sensing the Future

<http://www.sunx.com>

#### SUNX Limited

2431-1 Ushiyama-cho, Kasugai-shi, Aichi,  
486-0901, Japan  
Phone: +81-568-33-7211  
FAX: +81-568-33-2631

#### Overseas Sales Division

Phone: +81-568-33-7861  
FAX: +81-568-33-8591