

**SHORT FORM**  
**SENSORS**



# A new performance class of innovative sensor technology

## ■ The delivery program: Innovative and extensive.

Besides through-beam and retroreflective types, reflective sensors and optical fiber photoelectric sensors, we also offer laser and eddy current analog sensors that provide precise measurement results even in the most complicated of applications. Our delivery program also includes safety sensors, photoelectric sensors for special applications, inductive proximity switches and miniature pressure sensors for relative or differential pressure measurement, and ionizers for Electro Static Discharge applications.



## ■ Service has priority.

We are constantly striving to optimize our service sector to enable us to react quickly to customer requests. Whether you have specific application requests or you simply want technical information, we are always ready to advise and assist you; you only have to call.

Our current delivery program is assembled for you in this sensor overview. Besides the most important technical data, you will find numerous illustrations of possible applications. Of course, detailed data sheets are available on our homepage [www.panasonic-electric-works.com](http://www.panasonic-electric-works.com). Our product managers, sales and application engineers will be happy to advise you.



[www.panasonic-electric-works.com](http://www.panasonic-electric-works.com)

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# FX-100

**Excellent price/performance ratio**

## Features

### ■ Easy to read

The digital dual-display allows you to check both the threshold value and incident light intensity at the same time, and it also makes the procedures for setting the various values much easier.

### ■ Multipurpose, M8 connector type

The connectors used are commercially-available M8 connectors, so that processing costs and lead time required for carrying out processing after purchase of the sensors can be greatly reduced.

### ■ Designed in a 3-layer structure to accommodate basic settings through to advanced settings.

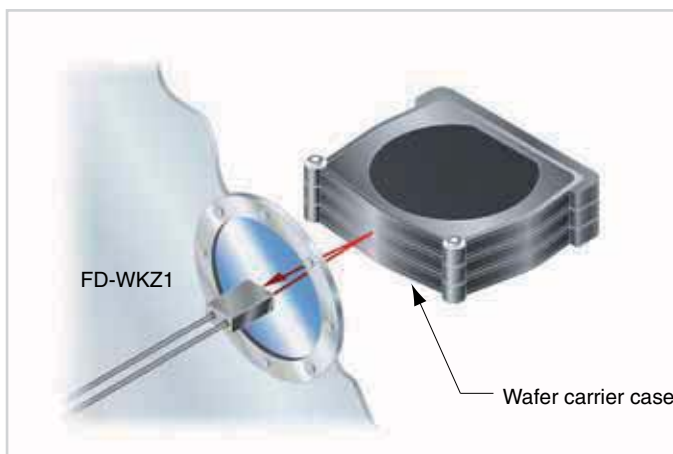
Setting details are divided into three levels for clearer operation, so that setting for normal operation are made in 'RUN mode', basic settings are made in 'SET mode', and advanced functions are set in 'PRO mode'. This makes setting operations much easier to understand and carry out.

## Typical Applications

### ■ Wafer detection

FD-WKZ + FX 10□

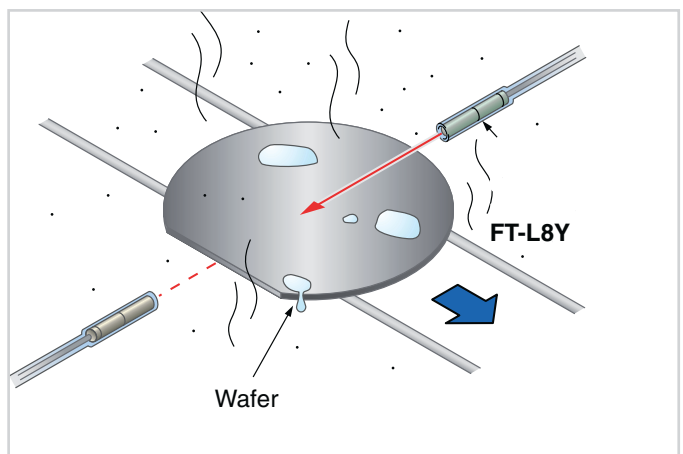
Detects wafer carrier cases through vacuum chamber's view port.



### ■ Wafer detection

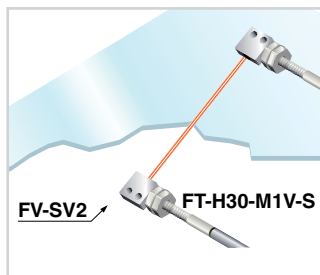
FT-L80Y + FX10□

Sensing possible in corrosive environment. Lenses at the ends of the fiber heads expand the sensing range.



### Detection of break / crack of glass

FV-SV2 + FX10□



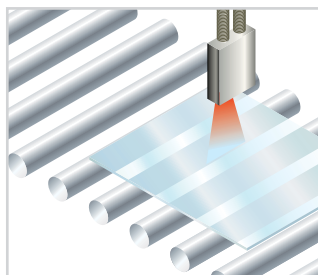
### Detection over long ranges

FT-LE1 + FX10□



### Detection of glass substrate in vacuum chamber

FD-H30-KZ1V + FX10□



### Detection of glass substrate on robot hand

FD-H30-L32V + FX10□



## Technical Specifications

| Model no.                        | Type                  | Standard type                                                                                                                                                                                         |                                                      | Long sensing range type                                                                                                              |                                                      |
|----------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|                                  |                       | Connector type                                                                                                                                                                                        | Cable set                                            | Connector type                                                                                                                       | Cable set                                            |
|                                  | NPN output            | FX-101 (-Z) (Note 2)                                                                                                                                                                                  | FX-101-CC2                                           | FX-102 (-Z) (Note 2)                                                                                                                 | FX-102-CC2                                           |
| PNP output                       | FX-101P (-Z) (Note 2) | FX-101P-CC2                                                                                                                                                                                           | FX-102P (-Z) (Note 2)                                | FX-102P-CC2                                                                                                                          |                                                      |
| Supply voltage                   |                       | 12 to 24VDC±10%, Ripple P-P 10% or less                                                                                                                                                               |                                                      |                                                                                                                                      |                                                      |
| Power consumption                |                       | Normal operation: 720mW or less (Current consumption 30mA or less at 24V supply voltage)<br>ECO mode: 600mW or less (Current consumption 25mA or less at 24V supply voltage)                          |                                                      |                                                                                                                                      |                                                      |
| Output                           |                       | <NPN output type><br>NPN open-collector transistor                                                                                                                                                    |                                                      | <PNP output type><br>PNP open-collector transistor                                                                                   |                                                      |
| Output operation                 |                       | Selectable either Light-ON or Dark-ON, at SET mode                                                                                                                                                    |                                                      |                                                                                                                                      |                                                      |
| Short-circuit protection         |                       | Incorporated                                                                                                                                                                                          |                                                      |                                                                                                                                      |                                                      |
| Response time                    |                       | Response time 0: 250μs or less<br>Response time 1: 450μs or less<br>Response time 2: 500μs or less<br>Response time 3: 600μs or less                                                                  |                                                      | Response time 1: 2.5ms or less<br>Response time 2: 2.8ms or less<br>Response time 3: 3.2ms or less<br>Response time 4: 5.0ms or less |                                                      |
| Sensitivity setting              |                       | 2-level teaching/Limit teaching/ Full-auto teaching                                                                                                                                                   |                                                      |                                                                                                                                      |                                                      |
| Digital display                  |                       | 4 digit green + 4 digit red LCD display                                                                                                                                                               |                                                      |                                                                                                                                      |                                                      |
| Timer function                   |                       | ON-delay/OFF-delay timer, switchable either effective or ineffective.<br>[Timer period:1ms, 5ms, 10ms, 20ms, 40ms, 50ms, 100ms, 500ms, 1000ms]                                                        |                                                      |                                                                                                                                      |                                                      |
| Interference prevention function |                       | Incorporated<br>Selectable response time method (Note 1)<br>(Functions at response time 1, 2 or 3)                                                                                                    |                                                      | Incorporated<br>Selectable response time method (Note 1)<br>(Functions at response time 1, 2 , 3 or 4)                               |                                                      |
| Ambient temperature              |                       | -10 to +55°C (if 4 to 7 units are mounted close together: -10 to +50°C;<br>if 8 to 16 units are mounted close together: -10 to +45°C (no dew condensation or icing allowed);<br>Storage: -20 to +70°C |                                                      |                                                                                                                                      |                                                      |
| Emitting element (modulated)     |                       | Red LED (Peak emission wavelength : 632nm)                                                                                                                                                            |                                                      |                                                                                                                                      |                                                      |
| Material                         |                       | Enclosure: polycarbonate; key switch: polycarbonate; fiber lock lever: PBT                                                                                                                            |                                                      |                                                                                                                                      |                                                      |
| Connecting method                |                       | Connector (Note 2)                                                                                                                                                                                    |                                                      |                                                                                                                                      |                                                      |
| Cable extension                  |                       | Extension up to total 100m is possible with 0.3mm <sup>2</sup> , or more, cable.                                                                                                                      |                                                      |                                                                                                                                      |                                                      |
| Weight                           |                       | Net weight: 15g approx.<br>Gross weight: 35g approx.                                                                                                                                                  | Net weight: 15g approx.<br>Gross weight: 75g approx. | Net weight: 15g approx.<br>Gross weight: 35g approx.                                                                                 | Net weight: 15g approx.<br>Gross weight: 75g approx. |
| Accessory                        |                       | —                                                                                                                                                                                                     | CN-14A-C2 (connector attached cable, 2m long): 1pc   | —                                                                                                                                    | CN-14A-C2 (connector attached cable, 2m long): 1pc   |

**Notes:** 1) When using the interference prevention function, set the response time for the amplifiers to be covered by the interference prevention function to different response time values. However, the interference prevention function does not operate at response time 0 (factory default setting) for the FX-101(P)(-Z)/FX-101(P)-CC2.  
2) Connector attached cable CN-14A-C2 is not attached to the models that have no '-CC2' at the end of the model names.  
Make sure to use the optional cable with connector CN-14A-CM.  
Model n's. having the suffix '-Z' are M8 plug-in connector type. Make sure to use the optional M8 plug-in connector cable, UZZ808xx.

# FX-301



Enhanced functions and performance but still easy to use

## Features

### ■ 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 the light-emitting amount selection function.

### ■ Super short response time of 35μs

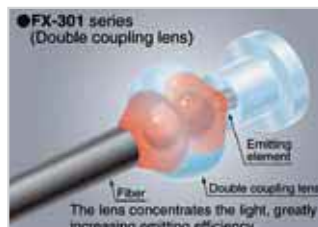
The FX-301(P)-HS model is the digital type fiber sensor realizing a super short response time of 35μs rendering it capable of sensing minute objects moving at high speeds.

### ■ Stable sensing over long and short periods

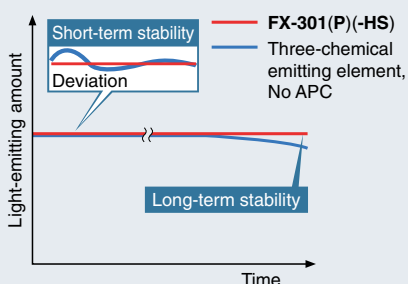
In addition to a light emitting element for fiber optic sensors a new APC (Auto Power Control) circuit has also been adopted. Both support a stable level of light emission over long periods. Because fluctuations over short periods of time have also been suppressed, stable sensing is possible very quickly once the power is turned back on after setup changes.

### ■ Sensing range has been greatly increased

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.



### ● Stable sensing comparison

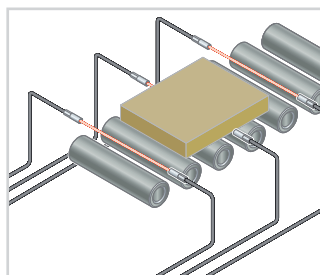


# Typical Applications

## Red LED type – FX-301(P)(-HS)

### Workpiece detection

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)

### Sensing translucent stickers

The blue LED type greatly reduces the damping rate, making it ideal for delicate sensing.



## Green LED type – FX-301G(P)

### Sensing register marks

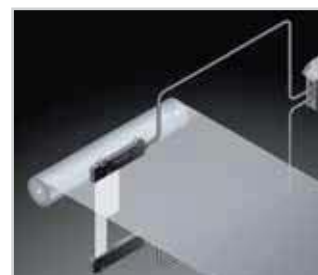
The green LED type greatly reduces the damping rate, making it ideal for delicate sensing.



## Infrared LED type – FX-301H(P)

### Sensing film meandering

Infrared LED type is ideal for sensing environments with light restrictions, such as places where light-sensitive film is being handled.



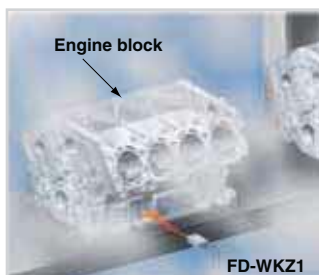
### Object sensing during the painting process

Due to a sensing range of 19.5m (FX-301 long range mode) and a 10m fiber length, it can be lead through explosive atmospheres freely.



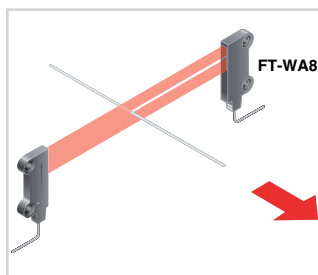
### Engine block passage confirmation

FD-WKZ1 has realized a sensing range of 480mm (FX-301 long range mode). In addition, due to its powerful beam, it can even work in adverse environments such as in areas prone to dust.



### Wire breakage detection

The blue LED type greatly reduces the damping rate, making it ideal for delicate sensing.



# Technical Specifications

| Type                                |            | Standard type <sup>1)</sup>                                                                                                                                                              | High speed                                                                                                                                                                               |
|-------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model. no.                          | NPN output | FX-301□                                                                                                                                                                                  | FX-301-HS                                                                                                                                                                                |
|                                     | PNP output | FX-301□P                                                                                                                                                                                 | FX-301P-HS                                                                                                                                                                               |
| <b>Sensing range (Red LED type)</b> |            | Thru-beam type (FT-B8): 1100mm (LONG), 530mm (STD), 400mm (FAST), 200mm (H-SP), 180mm (S-D)<br>Reflective type (FD-B8): 480mm (LONG), 220mm (STD), 160mm (FAST), 85mm (H-SP), 75mm (S-D) | Thru-beam type (FT-B8): 1100mm (LONG), 530mm (STD), 400mm (FAST), 160mm (H-SP), 180mm (S-D)<br>Reflective type (FD-B8): 480mm (LONG), 220mm (STD), 160mm (FAST), 60mm (H-SP), 75mm (S-D) |
| <b>Supply voltage</b>               |            | 12 to 24VDC ±10%                                                                                                                                                                         |                                                                                                                                                                                          |
| <b>Output</b>                       |            | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor                                                                                         |                                                                                                                                                                                          |
| <b>Output operation</b>             |            | Selectable either Light-ON or Dark-ON, with jog switch                                                                                                                                   |                                                                                                                                                                                          |
| <b>Response time</b>                |            | 65μs or less<br>[H-SP (Red LED type only)];<br>150μs or less (FAST);<br>250μs or less (STD/S-D)<br>(Red LED type only);<br>2ms or less (LONG) selectable with jog switch                 | 35μs or less (H-SP);<br>150μs or less (FAST);<br>250μs or less (STD/S-D);<br>2ms or less (LONG) selectable with jog switch                                                               |

| Type                                              |            | Standard type <sup>1)</sup>                                                                                                       | High speed |
|---------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------|------------|
| Model. no.                                        | NPN output | FX-301□                                                                                                                           | FX-301-HS  |
|                                                   | PNP output | FX-301□P                                                                                                                          | FX-301P-HS |
| <b>Sensitivity setting</b>                        |            | 2-level teaching/Limit teaching/Manual adjustment/Full-auto teaching                                                              |            |
| <b>Digital display</b>                            |            | 4-digit red LED display                                                                                                           |            |
| <b>Automatic interference prevention function</b> |            | Incorporated [(Up to 4 sets of fiber heads can be mounted close together.) (However, H-SP mode is 2 sets.)]                       |            |
| <b>Ambient temperature</b>                        |            | -10 to +55°C<br>(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) |            |
| <b>Emitting element (modulated)</b>               |            | FX-301(P): Red LED,<br>FX-301B(P): Blue LED,<br>FX-301G(P): Green LED,<br>FX-301H(P): Infrared LED                                | Red LED    |
| <b>Dimensions (W×H×D)</b>                         |            | 10×30.5×64.5mm                                                                                                                    |            |

**Note:** 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 1m), CN-73-C2 (cable length 2m),  
CN-73-C5 (cable length 5m)  
Sub cable (1-core): CN-71-C1 (cable length 1m), CN-71-C2 (cable length 2m),  
CN-71-C5 (cable length 5m)

04/2011



# FX-311

Remarkably easy to use, yet employs the latest in technology

## Features

### ■ 12-turn potentiometer with visible indicator

12-turn potentiometer has been incorporated for fine adjustments. It enables very fine differences to be detected. Since the potentiometer is illuminated, you can even make adjustments easily in dark areas.

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

Rapid blinking 'assist function' eases adjustment for optimum sensitivity.

## Typical Applications

### Detecting transparent PET bottles

The green LED type is ideal for stably sensing objects such as transparent bottles which yield only small amounts of light fluctuation.



### Register mark detection

The blue LED type can accurately sense yellow marks on white backgrounds that are difficult to sense using the red LED type.



## Technical Specifications

| Model no.                                  | NPN output                                                                                                                                                                                            | FX-311  |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|                                            | PNP output                                                                                                                                                                                            | FX-311P |
| Supply voltage                             | 12 to 24VDC±10%, Ripple P-P 10% or less                                                                                                                                                               |         |
| Power consumption                          | 840mW or less (Current consumption 35mA or less at 24V supply voltage)                                                                                                                                |         |
| Output                                     | <NPN output type> NPN open-collector transistor (FX-311)<br><PNP output type> PNP open-collector transistor (FX-311P)                                                                                 |         |
| Output operation                           | Selectable either Light-ON or Dark-ON, with selection switch                                                                                                                                          |         |
| Short-circuit protection                   | Incorporated                                                                                                                                                                                          |         |
| Response time                              | 250μs or less (STD / S-D), 2ms or less (LONG) selectable with selection switch                                                                                                                        |         |
| Operation indicator                        | Orange LED (lights up when the output is ON)                                                                                                                                                          |         |
| Timer function                             | Incorporated with OFF-delay timer, selectable either effective (approx. 10ms or 40ms) or ineffective                                                                                                  |         |
| Automatic interference prevention function | Incorporated (Up to 4 sets of fiber heads can be mounted closely.) (Note 1)                                                                                                                           |         |
| Ambient temperature                        | -10 to +55°C (if 4 to 7 units are mounted close together: -10 to +50°C;<br>if 8 to 16 units are mounted close together: -10 to +45°C (no dew condensation or icing allowed);<br>Storage: -20 to +70°C |         |
| Emitting element (modulated)               | Red LED                                                                                                                                                                                               |         |
| Material                                   | Enclosure: Heat-resistant ABS, Case cover: Polycarbonate                                                                                                                                              |         |
| Connecting method                          | Connector (Note 2)                                                                                                                                                                                    |         |
| Cable extension                            | Extension up to total 100m is possible with 0.3mm <sup>2</sup> , or more, cable                                                                                                                       |         |
| Weight                                     | 15g approx.                                                                                                                                                                                           |         |

**Notes:** 1) When the power supply is switched on, the emission timing are automatically set for interference prevention.  
2) 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 1m), CN-73-C2 (cable length 2m), CN-73-C5 (cable length 5m).  
Sub cable (1-core): CN-71-C1 (cable length 1m), CN-71-C2 (cable length 2m), CN-71-C5 (cable length 5m).

40th  
Anniversary  
MODEL



New

# FX-500

FX-500

The highest performance available

## Features

### A different stability

When used with the super quality fiber as a set, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.

### High performance

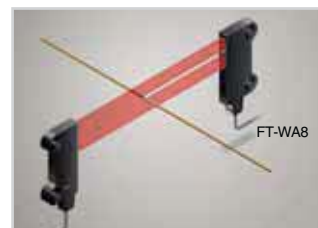
FX-500 with its ultra short response time improves productivity.

### HYPER mode incorporated

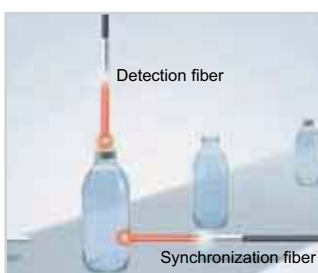
FX-500 in combination with the small diameter fiber can handle challenging detections over a super long sensing range.

### A new accuracy!

FX-500 with its accurate detection catches fractional difference in light intensity, fulfilling high precision and low-hysteresis applications.

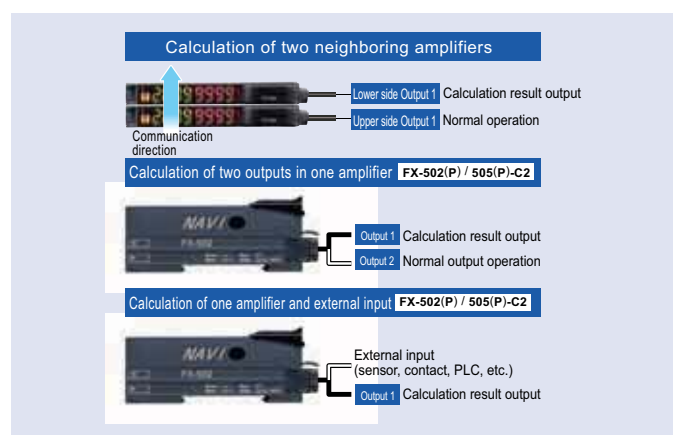


## No PLC necessary saving material and programming costs

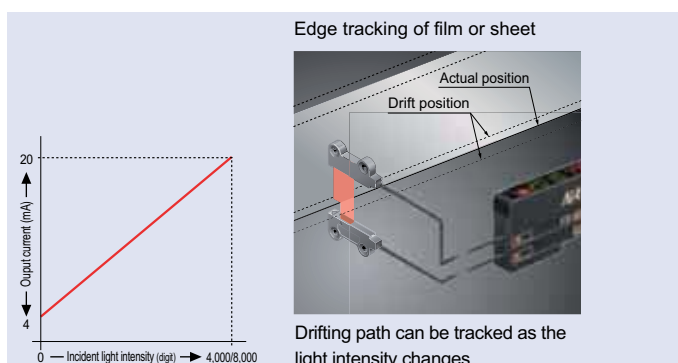


### Logical calculation functions

Three logical calculations (AND, OR, XOR), are selectable using Output 1 of multiple FX-500 series amplifiers. A PLC is not required which helps to reduce material and programming and costs.



## Analog output cable type FX505



## FX-500 Technical Specifications

|                                  | Standard type                                                                                        | Two outputs type  | Analog output type      |
|----------------------------------|------------------------------------------------------------------------------------------------------|-------------------|-------------------------|
| NPN output<br>PNP output         | FX-501<br>FX-501P                                                                                    | FX-502<br>FX-502P | FX-505-C2<br>FX-505P-C2 |
| Type of amplifier                | Digital                                                                                              |                   |                         |
| Timer function                   | Adjustable: 0.1ms to 999.9ms in 0.1ms steps, 1 to 9999ms in 1 ms steps, 1 to 32s in 1s steps         |                   |                         |
| Interference prevention function | Auto interference prevention function for up to 12 units or selectable response time method          |                   |                         |
| Sensing range                    | Depends on fiber type used                                                                           |                   |                         |
| Response time                    | 25μs/60μs/250μs/2ms/4ms/24ms or less                                                                 |                   |                         |
| Analogue output                  |                                                                                                      |                   | 4 to 20mA               |
| Output transistor                | Max. 100mA                                                                                           |                   |                         |
| Emitting element                 | Red LED (Peak emission wavelength: 650nm)                                                            |                   |                         |
| Material                         | Enclosure: ABS; switch TPEE                                                                          |                   |                         |
| Rated current consumption        | Normal operation: 40mA or less at 24V supply voltage<br>Eco mode: 30mA or less at 24V supply voltage |                   |                         |
| Protection                       | IP40                                                                                                 |                   |                         |
| Physical size (HxWxL)            | 34x10x75mm                                                                                           |                   |                         |
| Connection method                | Connector attached cable (note)                                                                      |                   | cable, 2m               |
| Operating voltage                | 12-24V DC (±10%)                                                                                     |                   |                         |
| Usable ambient temp.             | -10°C to +55°C                                                                                       |                   |                         |
| Weight approx.                   | 70g                                                                                                  |                   | 100g                    |

Note: The cable for amplifier connection is not supplied as an accessor. Make sure to use the optional quick-connection cable given below.

### For FX-501(P)

Main cable (3-core): CN-73-C1 (1m), CN-73-C2 (2m), CN-73-C5 (5m)  
Sub cable (1-core): CN-71-C1 (1m), CN-71-C2 (2m), CN-71-C5 (5m)

### For FX-502(P)

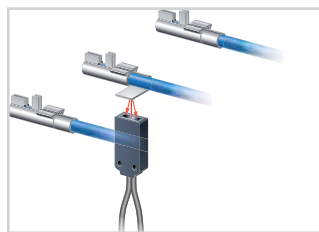
Main cable (4-core): CN-74-C1 (1m), CN-74-C2 (2m), CN-74-C5 (5m)  
Sub cable (2-core): CN-72-C1 (1m), CN-72-C2 (2m), CN-72-C5 (5m)

## Typical Applications

### Counting of IC pins



### Check crimping



### Detection of glass substrate



## ■ A quality that surpassed standard fiber

### Stable emission intensity ±10%

Variation in emission intensity of the fiber core is controlled down to less than ±10%, achieving a stable detection.



### Integrated high-precision plug

The centering precision of the fiber core attached to the inserting plug is doubled. As the insertion precision is increased, the variation among units can be greatly suppressed.



### More flexible!

Bending radius = R4mm  
[Previous was R25mm]



### More bendable!

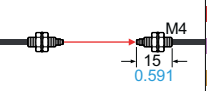
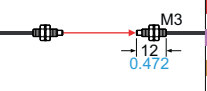
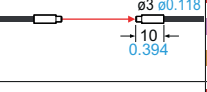
Bending durability = 10 million times  
[Previous was 1,000 times]



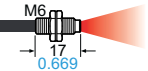
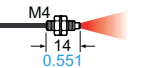
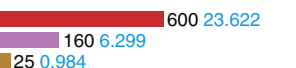
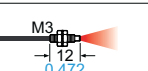
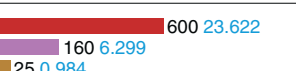
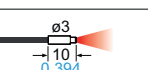
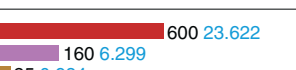
## ■ Super Quality Fibers

### LIST OF SUPER QUALITY FIBERS

#### Thru-beam type (one pair set)

| Type        |             | Shape of fiber head<br>(mm in)                                                    | Sensing range (mm in)                                                                    |                |  |                                                                       | Beam<br>axis dia.<br>(mm in) | Fiber cable<br>length | Bending<br>radius                                             | Ambient<br>temperature                | Model No. |
|-------------|-------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------|--|-----------------------------------------------------------------------|------------------------------|-----------------------|---------------------------------------------------------------|---------------------------------------|-----------|
|             |             |                                                                                   | ■ : HYPR ■ : STD ■ : H-SP                                                                | U-LG LONG FAST |  |                                                                       |                              |                       |                                                               |                                       |           |
| Threaded    | M4          |  | <div>3,600 (Note)<br/>141.732</div> <div>1,200<br/>47.244</div> <div>190<br/>7.480</div> |                |  | U-LG: 2,200<br>86.614<br>LONG: 1,700<br>66.929<br>FAST: 530<br>20.866 | ø1<br>ø0.039                 | 2 m<br>6.562 ft       | <div>R4 mm<br/>R0.157 in</div> Allowable<br>bending<br>radius | -55 to<br>+80 °C<br>-67 to<br>+176 °F | FT-40     |
|             | M3          |  | <div>1,350<br/>53.150</div> <div>400<br/>15.748</div> <div>75<br/>2.953</div>            |                |  | U-LG: 810<br>31.890<br>LONG: 650<br>25.591<br>FAST: 210<br>8.268      | ø0.5<br>ø0.020               |                       |                                                               |                                       | FT-30     |
| Cylindrical | ø3 ø0.118   |  | <div>3,600 (Note)<br/>141.732</div> <div>1,200<br/>47.244</div> <div>190<br/>7.480</div> |                |  | U-LG: 2,200<br>86.614<br>LONG: 1,700<br>66.929<br>FAST: 530<br>20.866 | ø1<br>ø0.039                 |                       |                                                               |                                       | FT-S30    |
|             | ø1.5 ø0.059 |  | <div>1,350<br/>53.150</div> <div>400<br/>15.748</div> <div>75<br/>2.953</div>            |                |  | U-LG: 810<br>31.890<br>LONG: 650<br>25.591<br>FAST: 210<br>8.268      | ø0.5<br>ø0.020               |                       |                                                               |                                       | FT-S20    |

#### Reflective type

| Type        |           | Shape of fiber head<br>(mm in)                                                      | Sensing range (mm in)                                                               |  |  |                                                          | Fiber cable<br>length | Bending<br>radius                                                                                                       | Ambient<br>temperature                | Model No. |
|-------------|-----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|--|----------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------|
|             |           |                                                                                     | ■ : HYPR ■ : STD ■ : H-SP                                                           |  |  | U-LG LONG FAST                                           |                       |                                                                                                                         |                                       |           |
| Threaded    | M6        |  |  |  |  | U-LG: 900 35.433<br>LONG: 740 29.134<br>FAST: 260 10.236 | 2 m<br>6.562 ft       | <br>Allowable<br>bending<br>radius | -55 to<br>+80 °C<br>-67 to<br>+176 °F | FD-60     |
|             | M4        |  |  |  |  | U-LG: 330 12.992<br>LONG: 250 9.843<br>FAST: 80 3.150    |                       |                                                                                                                         |                                       | FD-40     |
|             | M3        |  |  |  |  | U-LG: 330 12.992<br>LONG: 250 9.843<br>FAST: 80 3.150    |                       |                                                                                                                         |                                       | FD-30     |
| Cylindrical | ø3 ø0.118 |  |  |  |  | U-LG: 330 12.992<br>LONG: 250 9.843<br>FAST: 80 3.150    |                       |                                                                                                                         |                                       | FD-S30    |

### SUPER QUALITY FIBER SPECIFICATIONS

| Type                     |            | Thru-beam type                                                                                                                                                          | Reflective type                                                           |
|--------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Item                     | Model No.  | FT-40, FT-30, FT-S30, FT-S20                                                                                                                                            | FD-60, FD-40, FD-30, FD-S30                                               |
| Variation of fiber head  |            | Within ±10 %                                                                                                                                                            |                                                                           |
| Beam axis precision      |            | Beam axis position: Within ±150 μm, Inclination of beam axis: Within ±2 °                                                                                               | Beam axis position: Within ±150 μm, Inclination of beam axis: Within ±3 ° |
| Allowable bending radius |            | R4 mm R0.157 in or more                                                                                                                                                 |                                                                           |
| Bending durability       |            | 10 million times or more                                                                                                                                                |                                                                           |
| Ambient temperature      |            | -55 to +80 °C -67 to +176 °F (No dew condensation or icing allowed), Storage: -55 to +80 °C -67 to +176 °F                                                              |                                                                           |
| Ambient humidity         |            | 35 to 85 % RH, Storage: 35 to 85 % RH                                                                                                                                   |                                                                           |
| Material                 | Fiber core | Acrylic                                                                                                                                                                 |                                                                           |
|                          | Sheath     | Polyethylene                                                                                                                                                            |                                                                           |
|                          | Fiber head | Stainless steel (SUS303)                                                                                                                                                |                                                                           |
|                          | Plug       | ABS                                                                                                                                                                     |                                                                           |
| Accessories              |            | All fibers: <b>FX-AT2</b> (fiber attachment) 1 pc.<br>Threaded head fibers: Nuts 2 pcs. (Thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (Thru-beam type: 2 pcs.) |                                                                           |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Thru-beam type (one pair set)



| Type           | Shape of fiber head<br>(mm in) | Sensing range (mm in)                                |                                                      | Beam<br>axis dia.<br>(mm in)                                                 | Fiber cable<br>length<br>Free-cut | Bending<br>radius              | Ambient<br>temperature          | Model No. |
|----------------|--------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------|--------------------------------|---------------------------------|-----------|
|                |                                | ■ : HYPR ■ : STD ■ : H-SP                            | U-LG LONG FAST                                       |                                                                              |                                   |                                |                                 |           |
| Thru-beam type | M4                             | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 3,600<br>141.732<br>1,250<br>49.213<br>180<br>7.087  | U-LG : 2,400<br>94.488<br>LONG : 2,100<br>82.677<br>FAST : 570<br>22.441     | ø1.5<br>ø0.059                    | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FT-B8     |
|                |                                | Metal-free                                           |                                                      |                                                                              |                                   |                                |                                 | FT-41     |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 3,300<br>129.921<br>1,100<br>43.307                  | U-LG : 2,000<br>78.740<br>LONG : 1,550<br>61.024<br>FAST : 445<br>17.520     | ø1<br>ø0.039                      |                                |                                 | FT-FM2    |
|                |                                | Sleeve 90 mm 3.543 in                                | 150<br>5.906                                         |                                                                              |                                   |                                |                                 | FT-FM2S   |
|                |                                | Sleeve 40 mm 1.575 in                                |                                                      |                                                                              |                                   |                                |                                 | FT-FM2S4  |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 3,300<br>129.921<br>790<br>31.102<br>140<br>5.512    | U-LG : 1,800<br>70.866<br>LONG : 1,400<br>55.118<br>FAST : 420<br>16.535     |                                   | R1 mm<br>R0.039 in             | -40 to +60 °C<br>-40 to +140 °F | FT-W8     |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 3,300<br>129.921<br>810<br>31.890<br>160<br>6.299    | U-LG : 2,000<br>78.740<br>LONG : 1,500<br>59.055<br>FAST : 470<br>18.504     | ø1.4<br>ø0.055                    | R4 mm<br>R0.157 in<br>Flexible | -40 to +70 °C<br>-40 to +158 °F | FT-P80    |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)<br>Tough flexible | 1,600<br>62.992<br>880<br>34.646<br>160<br>6.299     | U-LG : 1,600<br>62.992<br>LONG : 1,600<br>62.992<br>FAST : 530<br>20.866     | 1 m<br>3.281 ft                   | R10 mm<br>R0.394 in            |                                 | FT-P81X   |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 1,200<br>47.244<br>350<br>13.780<br>60<br>2.362      | U-LG : 640<br>25.197<br>LONG : 560<br>22.047<br>FAST : 210<br>8.268          | ø0.7<br>ø0.028                    | R4 mm<br>R0.157 in<br>Flexible | -40 to +60 °C<br>-40 to +140 °F | FT-P60    |
|                |                                | Lens mountable<br>(FX-LE1/LE2/SV1)                   | 2,600<br>102.362<br>660<br>25.984<br>130<br>5.118    | U-LG : 1,300<br>51.181<br>LONG : 1,100<br>43.307<br>FAST : 410<br>16.142     | ø1<br>ø0.039                      | R1 mm<br>R0.039 in             |                                 | FT-WR80   |
| Thru-beam type | Square head type               | With lens                                            | 3,600<br>141.732<br>2,200<br>86.614<br>470<br>18.504 | U-LG : 3,600<br>141.732<br>LONG : 3,300<br>129.921<br>FAST : 1,300<br>51.181 | ø2<br>ø0.079                      |                                |                                 | FT-WR80L  |
|                |                                | Lens mountable<br>(FX-LE1/LE2)                       | 3,500<br>137.795<br>780<br>30.709<br>140<br>5.512    | U-LG : 1,750<br>68.898<br>LONG : 1,100<br>43.307<br>FAST : 450<br>17.717     | ø1<br>ø0.039                      | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FT-R80    |
|                | Elbow                          | Lens mountable<br>(FX-LE1/SV1)                       | 3,300<br>129.921<br>1,100<br>43.307<br>150<br>5.906  | U-LG : 2,000<br>78.740<br>LONG : 1,550<br>61.024<br>FAST : 445<br>17.520     | ø1<br>ø0.039                      | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FT-T80    |
|                |                                | Lens mountable<br>(FX-LE1/SV1)                       | 1,220<br>48.031<br>310<br>12.205<br>63<br>2.480      | U-LG : 740<br>29.134<br>LONG : 545<br>21.457<br>FAST : 192<br>7.559          | ø0.5<br>ø0.020                    |                                |                                 | FT-NFM2   |

# LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

## Thru-beam type (one pair set)



| Type               | Shape of fiber head<br>(mm in) | Sensing range (mm in)                             |                                                                         | Beam<br>axis dia.<br>(mm in)                                        | Fiber cable<br>length<br>(mm in) | Bending<br>radius               | Ambient<br>temperature                                        | Model No.                       |              |
|--------------------|--------------------------------|---------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------|---------------------------------|---------------------------------------------------------------|---------------------------------|--------------|
|                    |                                | ■ : HYPR ■ : STD ■ : H-SP                         | U-LG LONG FAST                                                          |                                                                     |                                  |                                 |                                                               |                                 |              |
| Threaded type      | M3                             | Sleeve 90 mm 3.543 in<br>                         | 1,220 48.031<br>310 12.205<br>63 2.480                                  | U-LG : 740 29.134<br>LONG : 545 21.457<br>FAST : 192 7.559          | ø0.5<br>ø0.020                   | 2 m<br>6.562 ft                 | Fiber<br>R25 mm<br>R0.984 in<br>Sleeve<br>R10 mm<br>R0.394 in | -40 to +70 °C<br>-40 to +158 °F | FT-NFM2S     |
|                    |                                | Sleeve 40 mm 1.575 in<br>                         |                                                                         |                                                                     |                                  |                                 |                                                               |                                 | FT-NFM2S4    |
|                    |                                |                                                   | 960 37.795<br>250 9.843<br>53 2.087                                     | U-LG : 590 23.228<br>LONG : 440 17.323<br>FAST : 150 5.906          | ø0.6<br>ø0.024                   |                                 | R1 mm<br>R0.039 in                                            | -40 to +60 °C<br>-40 to +140 °F | FT-W4        |
|                    |                                |                                                   | 650 25.591<br>160 6.299<br>30 1.181                                     | U-LG : 360 14.173<br>LONG : 270 10.630<br>FAST : 95 3.740           |                                  |                                 | R4 mm<br>R0.157 in<br>Flexible                                | -40 to +70 °C<br>-40 to +158 °F | FT-P40       |
| Long sensing range | With lens<br>                  | 19,600 771.652<br>19,600 771.652<br>4,000 157.480 | U-LG : 19,600 771.652<br>LONG : 19,600 771.652<br>FAST : 13,000 511.810 | ø10<br>ø0.394                                                       | 10 m<br>32.808 ft                | R25 mm<br>R0.984 in             |                                                               |                                 | FT-FM10L     |
| Cylindrical type   | ø3 ø0.118                      | With lens • Long sensing range<br>                | 3,600 141.732<br>3,300 129.921<br>640 25.197                            | U-LG : 3,600 141.732<br>LONG : 3,500 137.795<br>FAST : 1,700 66.929 | ø2<br>ø0.079                     | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in                                            | -40 to +60 °C<br>-40 to +140 °F | FT-WS8L      |
|                    |                                |                                                   | 3,300 129.921<br>790 31.102<br>150 5.906                                | U-LG : 1,900 74.803<br>LONG : 1,400 55.118<br>FAST : 460 18.110     |                                  |                                 |                                                               |                                 | ø1<br>ø0.039 |
|                    | ø2.5 ø0.098                    | With lens • Long sensing range<br>                | 3,600 141.732<br>2,600 102.362<br>440 17.323                            | U-LG : 3,600 141.732<br>LONG : 3,500 137.795<br>FAST : 1,400 55.118 | ø2<br>ø0.079                     |                                 | R25 mm<br>R0.984 in                                           | -40 to +70 °C<br>-40 to +158 °F | FT-SFM2L     |
|                    |                                |                                                   | 3,300 129.921<br>1,100 43.307<br>150 5.906                              | U-LG : 2,000 78.740<br>LONG : 1,550 61.024<br>FAST : 445 17.520     |                                  |                                 |                                                               |                                 | ø1<br>ø0.039 |
|                    |                                |                                                   | 3,300 129.921<br>790 31.102<br>140 5.512                                | U-LG : 1,800 70.866<br>LONG : 1,400 55.118<br>FAST : 420 16.535     |                                  |                                 | R1 mm<br>R0.039 in                                            | -40 to +60 °C<br>-40 to +140 °F | FT-WS8       |
|                    | ø1.5 ø0.059                    |                                                   | 1,220 48.031<br>310 12.205<br>63 2.480                                  | U-LG : 740 29.134<br>LONG : 545 21.457<br>FAST : 192 7.559          | ø0.5<br>ø0.020                   | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in                                           | -40 to +70 °C<br>-40 to +158 °F | FT-SNFM2     |
|                    |                                |                                                   | 960 37.795<br>250 9.843<br>53 2.087                                     | U-LG : 590 23.228<br>LONG : 440 17.323<br>FAST : 150 5.906          |                                  |                                 |                                                               |                                 |              |
|                    |                                |                                                   | 1,200 47.244<br>330 12.992<br>70 2.756                                  | U-LG : 770 30.315<br>LONG : 570 22.441<br>FAST : 200 7.874          | ø0.6<br>ø0.024                   | 1 m<br>3.281 ft                 | R4 mm<br>R0.157 in<br>Flexible                                | -40 to +70 °C<br>-40 to +158 °F | FT-P2        |
| ø1 ø0.039          |                                | 350 13.780<br>90 3.543<br>19 0.748                | U-LG : 210 8.268<br>LONG : 160 6.299<br>FAST : 60 2.362                 | ø0.25<br>ø0.010                                                     | 500 mm<br>19.685 in              | -40 to +60 °C<br>-40 to +140 °F |                                                               | FT-PS1                          |              |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Thru-beam type (one pair set)



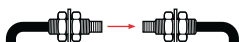
| Type             | Shape of fiber head<br>(mm in)                                                         | Sensing range (mm in)     |                                                | Beam<br>axis dia.<br>(mm in)   | Fiber cable<br>length<br>(m ft) | Bending<br>radius              | Ambient<br>temperature                | Model No.  |
|------------------|----------------------------------------------------------------------------------------|---------------------------|------------------------------------------------|--------------------------------|---------------------------------|--------------------------------|---------------------------------------|------------|
|                  |                                                                                        | ■ : HYPR ■ : STD ■ : H-SP | U-LG LONG FAST                                 |                                |                                 |                                |                                       |            |
| Cylindrical type | Side-view<br>                                                                          |                           | U-LG : 3,600<br>LONG : 141.732<br>FAST : 3,600 | ø2.5<br>ø0.098                 | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in            | -40 to<br>+60 °C<br>-40 to<br>+140 °F | FT-V10     |
|                  |                                                                                        |                           | U-LG : 1,300<br>LONG : 51.181<br>FAST : 39.370 | ø1.1<br>ø0.043                 | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in            | -20 to<br>+70 °C<br>-4 to<br>+158 °F  | FT-SFM2SV2 |
|                  |                                                                                        |                           | U-LG : 600<br>LONG : 23.622<br>FAST : 19.291   | ø0.8<br>ø0.031                 | 1 m<br>3.281 ft                 | R25 mm<br>R0.984 in            | -20 to<br>+60 °C<br>-4 to<br>+140 °F  | FT-V22     |
|                  |                                                                                        |                           | U-LG : 450<br>LONG : 17.717<br>FAST : 14.173   | ø0.55<br>ø0.022                | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in            | -40 to<br>+60 °C<br>-40 to<br>+140 °F | FT-V41     |
|                  |                                                                                        |                           | U-LG : 220<br>LONG : 8.661<br>FAST : 6.693     | ø0.5<br>ø0.020                 | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in             | -40 to<br>+60 °C<br>-40 to<br>+140 °F | FT-WV42    |
| Rectangular      | Compact<br>Easy mounting • Top<br>sensing<br>W3 × H8 × D12<br>W0.118 × H0.315 × D0.472 |                           | U-LG : 3,600<br>LONG : 141.732<br>FAST : 1,800 | 2.2 × 3<br>0.087<br>×<br>0.118 | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in             | -40 to<br>+60 °C<br>-40 to<br>+140 °F | FT-WZ8H    |
|                  |                                                                                        |                           | U-LG : 3,600<br>LONG : 3,300<br>FAST : 1,300   |                                |                                 | R4 mm<br>R0.157 in<br>Flexible |                                       | FT-Z8H     |
|                  |                                                                                        |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 1,850   |                                |                                 | R1 mm<br>R0.039 in             |                                       | FT-WZ8E    |
|                  | Easy mounting • Side<br>sensing<br>W3 × H12 × D8<br>W0.118 × H0.472 × D0.315           |                           | U-LG : 3,600<br>LONG : 141.732<br>FAST : 1,300 |                                |                                 | R4 mm<br>R0.157 in<br>Flexible |                                       | FT-Z8E     |
|                  |                                                                                        |                           | U-LG : 3,600<br>LONG : 141.732<br>FAST : 1,300 |                                |                                 | R1 mm<br>R0.039 in             |                                       | FT-WZ8     |
|                  | Easy mounting • Front<br>sensing<br>W8.5 × H12 × D3<br>W0.335 × H0.472 × D0.118        |                           | U-LG : 3,100<br>LONG : 122.047<br>FAST : 830   |                                |                                 | R4 mm<br>R0.157 in<br>Flexible |                                       | FT-Z8      |
|                  |                                                                                        |                           | U-LG : 2,700<br>LONG : 106.299<br>FAST : 750   |                                |                                 | R1 mm<br>R0.039 in             |                                       | FT-WZ4     |
|                  | Front sensing<br>W10 × H7 × D2<br>W0.394 × H0.276 × D0.079                             |                           | U-LG : 1,100<br>LONG : 43.307<br>FAST : 330    | ø1.5<br>ø0.059                 | 1 m<br>3.281 ft                 | R1 mm<br>R0.039 in             |                                       | FT-WZ4HB   |
|                  | Fiber bending type<br>W2 × H10 × D10<br>W0.079 × H0.394 × D0.394                       |                           | U-LG : 460<br>LONG : 18.110<br>FAST : 14.567   | ø0.5<br>ø0.020                 | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in             |                                       | FT-WZ7     |
|                  | Front sensing<br>W14 × H7 × D3.5<br>W0.551 × H0.276 × D0.138                           |                           | U-LG : 3,500<br>LONG : 137.795<br>FAST : 890   | ø1.5<br>ø0.059                 | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in             |                                       | FT-WZ7HB   |
|                  | Fiber bending type<br>W3.5 × H14 × D11<br>W0.138 × H0.551 × D0.433                     |                           | U-LG : 1,700<br>LONG : 66.929<br>FAST : 490    | ø1<br>ø0.039                   | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in             |                                       | FT-WZ7HB   |

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# LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

## Thru-beam type (one pair set)



| Type           | Shape of fiber head<br>(mm in)                                                 | Sensing range (mm in)     |                                                         | Beam<br>axis dia.<br>(mm in) | Fiber cable<br>length<br>(m ft) | Bending<br>radius                                       | Ambient<br>temperature           | Model No.   |
|----------------|--------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------|------------------------------|---------------------------------|---------------------------------------------------------|----------------------------------|-------------|
|                |                                                                                | ■ : HYPR ■ : STD ■ : H-SP | U-LG LONG FAST                                          |                              |                                 |                                                         |                                  |             |
| Narrow beam    |                                                                                |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 2,700<br>106.299 | ø2.2<br>ø0.087               |                                 | R25 mm<br>R0.984 in                                     |                                  | FT-K8       |
|                | Side-view type with small light dispersion<br>                                 |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 2,400<br>94.488  | ø2.5<br>ø0.098               | 2 m<br>6.562 ft                 | R1 mm<br>R0.039 in                                      | -40 to +60 °C<br>-40 to +140 °F  | FT-WKV8     |
|                |                                                                                |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 2,700<br>106.299 |                              |                                 | R25 mm<br>R0.984 in                                     |                                  | FT-KV8      |
|                |                                                                                |                           | U-LG : 1,100<br>LONG : 850<br>FAST : 430<br>16.929      | ø1<br>ø0.039                 |                                 | R10 mm<br>R0.394 in                                     |                                  | FT-KV1      |
| Wide beam      | Wide area sensing<br>                                                          |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 3,600<br>141.732 | 3.2 x 32<br>0.126 x 1.260    |                                 | R1 mm<br>R0.039 in                                      | -40 to +55 °C<br>-40 to +131 °F  | FT-WA30     |
|                |                                                                                |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 3,300<br>129.921 |                              | 2 m<br>6.562 ft                 | R10 mm<br>R0.394 in                                     | -40 to +60 °C<br>-40 to +140 °F  | FT-A30      |
|                | Wide area sensing<br>                                                          |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 3,300<br>129.921 | 2.2 x 11<br>0.087 x 0.433    |                                 | R1 mm<br>R0.039 in                                      | -40 to +55 °C<br>-40 to +131 °F  | FT-WA8      |
|                |                                                                                |                           | U-LG : 3,600<br>LONG : 3,600<br>FAST : 3,300<br>129.921 |                              |                                 | R10 mm<br>R0.394 in                                     | -40 to +70 °C<br>-40 to +158 °F  | FT-A8       |
| Array          | Top sensing<br>                                                                |                           | U-LG : 2,000<br>LONG : 1,500<br>FAST : 490<br>19.291    | 0.265 x 5.5<br>0.010 x 0.217 | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in                                     | -40 to +70 °C<br>-40 to +158 °F  | FT-AFM2     |
|                | Side sensing<br>                                                               |                           | U-LG : 2,000<br>LONG : 1,500<br>FAST : 490<br>19.291    |                              |                                 |                                                         |                                  | FT-AFM2E    |
| Heat-resistant | 350 °C 662 °F<br>Lens mountable (FX-LE1/LE2/SV1)<br>                           |                           | U-LG : 880<br>LONG : 670<br>FAST : 250<br>9.843         | ø1.2<br>ø0.047               | 2 m<br>6.562 ft                 | R25 mm<br>R0.984 in                                     | -60 to +350 °C<br>-76 to +662 °F | FT-H35-M2   |
|                | 350 °C 662 °F<br>Sleeve 60 mm 2.362 in<br>                                     |                           | U-LG : 880<br>LONG : 670<br>FAST : 250<br>9.843         |                              |                                 | Fiber<br>R25 mm R0.984 in<br>Sleeve<br>R10 mm R0.394 in |                                  | FT-H35-M2S6 |
|                | Allows flexible wiring<br>200 °C 392 °F<br>Lens mountable (FX-LE1/LE2/SV1)<br> |                           | U-LG : 1,000<br>LONG : 840<br>FAST : 300<br>11.811      | ø0.8<br>ø0.031               | 1 m<br>3.281 ft                 | R10 mm<br>R0.394 in                                     | -60 to +200 °C                   | FT-H20W-M1  |
|                | 200 °C 392 °F<br>Lens mountable (FX-LE1/LE2/SV1)<br>                           |                           | U-LG : 1,300<br>LONG : 960<br>FAST : 330<br>12.992      | ø1.2<br>ø0.047               |                                 | R25 mm<br>R0.984 in                                     | -76 to +392 °F                   | FT-H20-M1   |
|                | 130 °C 266 °F<br>Lens mountable (FX-LE2 only)<br>                              |                           | U-LG : 1,900<br>LONG : 1,300<br>FAST : 410<br>16.142    | ø1.5<br>ø0.059               | 2 m<br>6.562 ft                 |                                                         | -60 to +130 °C<br>-76 to +266 °F | FT-H13-FM2  |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Thru-beam type (one pair set)



| Type                   | Shape of fiber head<br>(mm in)                                                                      | Sensing range (mm in)     |                                                  | Beam<br>axis dia.<br>(mm in)                                         | Fiber cable<br>length<br>(mm in)<br>: Free-cut                      | Bending<br>radius                        | Ambient<br>temperature           | Model No.                                    |
|------------------------|-----------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------|----------------------------------|----------------------------------------------|
|                        |                                                                                                     | ■ : HYPR ■ : STD ■ : H-SP | U-LG LONG FAST                                   |                                                                      |                                                                     |                                          |                                  |                                              |
| Heat-resistant • Joint | Lens mountable<br>(FX-LE1/LE2/SV1)                                                                  |                           | <br>1,600 62.992<br>470 18.504<br>90 3.543       | U-LG : 1,000 39.370<br>LONG : 790 31.102<br>FAST : 300 11.811        | <br>200 mm 7.874 in<br><br>300 mm 11.811 in<br><br>500 mm 19.685 in | Heat-resistant fiber<br>R18 mm R0.709 in | -60 to +200 °C<br>-76 to +392 °F | FT-H20-J20-S<br>FT-H20-J30-S<br>FT-H20-J50-S |
|                        | Side-view                                                                                           |                           | <br>2,100 82.677<br>600 23.622<br>120 4.724      | U-LG : 1,300 51.181<br>LONG : 980 38.583<br>FAST : 390 15.354        | <br>500 mm 19.685 in<br><br>800 mm 31.496 in                        |                                          |                                  | FT-H20-VJ50-S<br>FT-H20-VJ80-S               |
|                        | Easy mounting • Rectangular head<br>SEMI S2 compliant<br>W7 × H15 × D13<br>W0.276 × H0.591 × D0.512 |                           | <br>3,600 141.732<br>3,100 122.047<br>470 18.504 | U-LG : 3,600 141.732<br>LONG : 3,600 141.732<br>FAST : 1,900 74.803  | <br>2 m 6.562 ft                                                    | R25 mm R0.984 in                         | 0 to +60 °C<br>32 to +140 °F     | FT-Z802Y                                     |
|                        | 115 °C 239 °F                                                                                       |                           | <br>3,600 141.732<br>3,600 141.732<br>740 29.134 | U-LG : 3,600 141.732<br>LONG : 3,600 141.732<br>FAST : 2,300 90.551  | <br>2 m 6.562 ft                                                    | R30 mm R1.181 in                         | -40 to +115 °C<br>-40 to +239 °F | FT-HL80Y                                     |
|                        | Side-view                                                                                           |                           | <br>3,600 141.732<br>3,600 141.732<br>920 36.220 | U-LG : 3,600 141.732<br>LONG : 3,600 141.732<br>FAST : 2,800 110.236 | <br>2 m 6.562 ft                                                    |                                          | -40 to +70 °C<br>-40 to +158 °F  | FT-L80Y<br>FT-V80Y                           |
| Vacuum-resistant       | 300 °C 572 °F<br>Lens mountable (FV-LE1/SV2 only)                                                   |                           | <br>1,000 39.370<br>270 10.630<br>55 2.165       | U-LG : 590 23.228<br>LONG : 470 18.504<br>FAST : 160 6.299           | <br>1 m 3.281 ft                                                    | R18 mm R0.709 in                         | -30 to +300 °C<br>-22 to +572 °F | FT-H30-M1V-S                                 |

# LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

## Retroreflective type



| Type                                        | Shape of fiber head<br>(mm in)                                                                   | Sensing range (mm in)                                                                             |                                                                                                                          | Fiber cable<br>length<br>: Free-cut<br>2 m<br>6.562 ft | Bending<br>radius<br>R1 mm<br>R0.039 in | Ambient<br>temperature<br>-25 to +55 °C<br>-13 to +131 °F | Model No. |
|---------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------|-----------|
|                                             |                                                                                                  | ■ : HYPR ■ : STD ■ : H-SP                                                                         | U-LG LONG FAST                                                                                                           |                                                        |                                         |                                                           |           |
| Sharp bending<br>With polarizing<br>filters | W9.5 × H5.2 × D15<br>W0.374 × H0.205 × D0.591<br>W30 × H30 × D0.5<br>W1.181 × H1.181 × D0.020    | 100 to 1,900<br>3.937 to 74.803<br>100 to 990<br>3.937 to 38.976<br>100 to 490<br>3.937 to 19.291 | U-LG : 100 to 1,400<br>3.937 to 55.118<br>LONG : 100 to 1,200<br>3.937 to 47.244<br>FAST : 100 to 780<br>3.937 to 30.709 | 2 m<br>6.562 ft                                        | R1 mm<br>R0.039 in                      | -25 to +55 °C<br>-13 to +131 °F                           | FR-WKZ11  |
| Narrow beam<br>Top sensing<br>Side sensing  | W9.5 × H5.2 × D21<br>W0.374 × H0.205 × D0.827<br>W10.6 × H28 × D10.1<br>W0.417 × H1.102 × D0.398 | 200<br>7.874<br>200<br>7.874<br>200<br>7.874                                                      | U-LG : 200<br>7.874<br>LONG : 200<br>7.874<br>FAST : 200<br>7.874                                                        | 2 m<br>6.562 ft                                        | R10 mm<br>R0.394 in                     | -40 to +60 °C<br>-40 to +140 °F                           | FR-KZ21   |
|                                             | W9.5 × H25 × D5.2<br>W0.374 × H0.984 × D0.205<br>W10.6 × H28 × D10.1<br>W0.417 × H1.102 × D0.398 | 20 to 530<br>0.787 to 20.866<br>20 to 310<br>0.787 to 12.205<br>20 to 100<br>0.787 to 3.937       | U-LG : 20 to 460<br>0.787 to 18.110<br>LONG : 20 to 410<br>0.787 to 16.142<br>FAST : 20 to 220<br>0.787 to 8.661         | 2 m<br>6.562 ft                                        | R10 mm<br>R0.394 in                     | -40 to +60 °C<br>-40 to +140 °F                           | FR-KZ21E  |
| Wafer<br>mapping                            | W7.5 × H2.2 × D11.2<br>W0.295 × H0.087 × D0.441<br>W4 × H2 × D21.5<br>W0.157 × H0.079 × D0.846   | 20 to 530<br>0.787 to 20.866<br>20 to 310<br>0.787 to 12.205<br>20 to 100<br>0.787 to 3.937       | U-LG : 20 to 460<br>0.787 to 18.110<br>LONG : 20 to 410<br>0.787 to 16.142<br>FAST : 20 to 220<br>0.787 to 8.661         | 2 m<br>6.562 ft                                        | R10 mm<br>R0.394 in                     | -40 to +60 °C<br>-40 to +140 °F                           | FR-KV1    |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Reflective type



| Type          | Shape of fiber head<br>(mm in) | Sensing range (mm in)     |                                        | Fiber cable length<br>✂ : Free-cut | Bending radius      | Ambient temperature             | Model No. |
|---------------|--------------------------------|---------------------------|----------------------------------------|------------------------------------|---------------------|---------------------------------|-----------|
|               |                                | ■ : HYPR ■ : STD ■ : H-SP | U-LG LONG FAST                         |                                    |                     |                                 |           |
| Threaded type | M6<br>                         | 1,450<br>57.087           | U-LG : 960<br>LONG : 860<br>FAST : 330 | 2 m<br>6.562 ft                    | R25 mm<br>R0.984 in | -40 to +70 °C<br>-40 to +158 °F | FD-B8     |
|               | Metal-free • Coaxial<br>       | 490<br>19.291             | U-LG : 680<br>LONG : 600<br>FAST : 200 |                                    |                     |                                 | FD-G60    |
|               | Coaxial<br>                    | 100<br>3.937              | U-LG : 800<br>LONG : 650<br>FAST : 200 |                                    |                     |                                 | FD-FM2    |
|               | Sleeve 90 mm 3.543 in<br>      | 1,000<br>39.370           | U-LG : 700<br>LONG : 540<br>FAST : 220 |                                    |                     |                                 | FD-FM2S   |
|               | Sleeve 40 mm 1.575 in<br>      | 420<br>16.535             | U-LG : 560<br>LONG : 420<br>FAST : 140 |                                    |                     |                                 | FD-FM2S4  |
|               | M6<br>                         | 60<br>2.362               | U-LG : 870<br>LONG : 250<br>FAST : 45  | 1 m<br>3.281 ft                    | R1 mm<br>R0.039 in  | -40 to +60 °C<br>-40 to +140 °F | FD-W8     |
|               | M6<br>                         | 870<br>34.252             | U-LG : 610<br>LONG : 480<br>FAST : 160 |                                    |                     |                                 | FD-P80    |
|               | Tough flexible<br>             | 280<br>11.024             | U-LG : 370<br>LONG : 330<br>FAST : 160 |                                    |                     |                                 | FD-P81X   |
|               | Elbow<br>                      | 450<br>17.717             | U-LG : 500<br>LONG : 370<br>FAST : 130 |                                    |                     |                                 | FD-R80    |
|               | M6<br>                         | 890<br>35.039             | U-LG : 700<br>LONG : 540<br>FAST : 220 |                                    |                     |                                 | FD-T80    |
|               | M4<br>                         | 220<br>8.661              | U-LG : 280<br>LONG : 215<br>FAST : 70  | 2 m<br>6.562 ft                    | R25 mm<br>R0.984 in | -40 to +70 °C<br>-40 to +158 °F | FD-NFM2   |
|               | Sleeve 90 mm 3.543 in<br>      | 40<br>1.575               | U-LG : 180<br>LONG : 140<br>FAST : 45  |                                    |                     |                                 | FD-NFM2S  |
|               | Sleeve 40 mm 1.575 in<br>      | 1,100<br>43.307           | U-LG : 510<br>LONG : 120<br>FAST : 22  |                                    |                     |                                 | FD-NFM2S4 |
|               | Sleeve 40 mm 1.575 in<br>      | 380<br>14.961             | U-LG : 870<br>LONG : 250<br>FAST : 45  |                                    |                     |                                 | FD-W44    |
|               | M4<br>                         | 70<br>2.756               | U-LG : 560<br>LONG : 420<br>FAST : 140 |                                    |                     |                                 | FD-WT8    |
|               | M4<br>                         | 870<br>34.252             | U-LG : 180<br>LONG : 140<br>FAST : 45  |                                    |                     |                                 |           |

# LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

## Reflective type



| Type          | Shape of fiber head<br>(mm in)                                                                                                  | Sensing range (mm in) (Note 1)                  |                                                                     | Fiber cable length<br>✂ : Free-cut | Bending radius                 | Ambient temperature             | Model No.       |
|---------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------|------------------------------------|--------------------------------|---------------------------------|-----------------|
|               |                                                                                                                                 | ■ : HYPR ■ : STD ■ : H-SP                       | U-LG LONG FAST                                                      |                                    |                                |                                 |                 |
| M4            | Minute objects can be detected due to the small spot beam.<br>Coaxial • Lens mountable<br>(FX-MR1/MR2/MR3/MR5/MR6)              | 590<br>23.228<br>150<br>5.906<br>25<br>0.984    | U-LG : 340<br>LONG : 280<br>FAST : 90<br>13.386<br>11.024<br>3.543  |                                    | R2 mm<br>R0.079 in             | -40 to +60 °C<br>-40 to +140 °F | FD-WG4          |
|               | M4<br>25<br>0.984                                                                                                               | 550<br>21.654<br>140<br>5.512<br>27<br>1.063    | U-LG : 330<br>LONG : 270<br>FAST : 80<br>12.992<br>10.630<br>3.150  | 2 m<br>6.562 ft                    | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FD-G4<br>FD-G40 |
|               | M4<br>15<br>0.591                                                                                                               | 490<br>19.291<br>120<br>4.724<br>22<br>0.866    | U-LG : 250<br>LONG : 190<br>FAST : 75<br>9.843<br>7.480<br>2.953    |                                    | R4 mm<br>R0.157 in<br>Flexible | -40 to +60 °C<br>-40 to +140 °F | FD-P60          |
|               | M4                                                                                                                              |                                                 |                                                                     |                                    |                                |                                 |                 |
| Threaded type | Small diameter<br>M3<br>12<br>0.472                                                                                             | 510<br>20.079<br>120<br>4.724<br>22<br>0.866    | U-LG : 280<br>LONG : 215<br>FAST : 70<br>11.024<br>8.465<br>2.756   |                                    | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FD-T40          |
|               | M3<br>12<br>0.472                                                                                                               | 330<br>12.992<br>80<br>3.150<br>12<br>0.472     | U-LG : 180<br>LONG : 140<br>FAST : 45<br>7.087<br>5.512<br>1.772    | 2 m<br>6.562 ft                    | R1 mm<br>R0.039 in             | -40 to +60 °C<br>-40 to +140 °F | FD-WT4          |
|               | M3<br>12<br>0.472                                                                                                               | 190<br>7.480<br>45<br>1.772<br>7<br>0.276       | U-LG : 100<br>LONG : 85<br>FAST : 20<br>3.937<br>3.346<br>0.787     |                                    | R4 mm<br>R0.157 in<br>Flexible | -40 to +70 °C<br>-40 to +158 °F | FD-P40          |
|               | Lens mountable (FX-MR3, FX-MR6)<br>Coaxial<br>M3<br>17<br>0.669                                                                 | 550<br>21.654<br>140<br>5.512<br>27<br>1.063    | U-LG : 330<br>LONG : 270<br>FAST : 80<br>12.992<br>10.630<br>3.150  |                                    | R25 mm<br>R0.984 in            | -40 to +60 °C<br>-40 to +140 °F | FD-G6           |
|               | Tough flexible<br>Lens mountable (FX-MR3, FX-MR6)<br>Coaxial<br>M3<br>18<br>0.709                                               | 630<br>24.803<br>170<br>6.693<br>27<br>1.063    | U-LG : 370<br>LONG : 310<br>FAST : 95<br>14.567<br>12.205<br>3.740  | 1 m<br>3.281 ft                    | R10 mm<br>R0.394 in            |                                 | FD-G6X          |
|               | High precision<br>Lens mountable (FX-MR3, FX-MR6)<br>Coaxial<br>M3<br>17<br>0.669                                               | 170<br>6.693<br>40<br>1.575<br>7.5<br>0.295     | U-LG : 100<br>LONG : 80<br>FAST : 24<br>3.937<br>3.150<br>0.945     |                                    | R25 mm<br>R0.984 in            |                                 | FD-EG1          |
|               | High precision<br>Lens mountable (FX-MR3, FX-MR6)<br>Coaxial<br>M3<br>17<br>0.669<br>Light emitting fiber element ø0.175 ø0.007 | 130<br>5.118<br>24<br>0.945<br>3<br>0.118       | U-LG : 100<br>LONG : 80<br>FAST : 19<br>3.937<br>3.150<br>0.748     | 500 mm<br>19.685 in                | R10 mm<br>R0.394 in            | -20 to +60 °C<br>-4 to +140 °F  | FD-EG2          |
|               | High precision<br>Lens mountable (FX-MR3, FX-MR6)<br>Coaxial<br>M3<br>17<br>0.669<br>Light emitting fiber element ø0.125 ø0.005 | 85<br>3.346<br>20<br>0.787<br>3.5<br>0.138      | U-LG : 45<br>LONG : 35<br>FAST : 12<br>1.772<br>1.378<br>0.472      |                                    |                                |                                 | FD-EG3          |
|               | Coaxial<br>M3<br>ø0.8 ø0.031<br>15 15<br>0.591 0.591<br>Sleeve part cannot be bent.                                             | 190<br>7.480<br>50<br>1.969<br>9<br>0.354       | U-LG : 110<br>LONG : 90<br>FAST : 28<br>4.331<br>3.543<br>1.102     | 1 m<br>3.281 ft                    | R25 mm<br>R0.984 in            |                                 | FD-ENM1S1       |
|               | ø3 ø0.118<br>15<br>0.591                                                                                                        | 1,100<br>43.307<br>380<br>14.961<br>70<br>2.756 | U-LG : 700<br>LONG : 540<br>FAST : 220<br>27.559<br>21.260<br>8.661 | 2 m<br>6.562 ft                    | R25 mm<br>R0.984 in            | -40 to +70 °C<br>-40 to +158 °F | FD-S80          |
|               | ø3 ø0.118<br>15<br>0.591                                                                                                        | 960<br>37.795<br>250<br>9.843<br>45<br>1.772    | U-LG : 550<br>LONG : 410<br>FAST : 140<br>21.654<br>16.142<br>5.512 |                                    | R1 mm<br>R0.039 in             | -40 to +60 °C<br>-40 to +140 °F | FD-WS8          |

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## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Reflective type



| Type             | Shape of fiber head<br>(mm in)                                                                    | Sensing range (mm in)                                                          |                                                                                                          | Fiber cable<br>length<br>: Free-cut | Bending<br>radius       | Ambient<br>temperature          | Model No.  |
|------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------|---------------------------------|------------|
|                  |                                                                                                   | ■ : HYPR ■ : STD ■ : H-SP                                                      | U-LG LONG FAST                                                                                           |                                     |                         |                                 |            |
| Cylindrical type | <br>ø3 ø0.118                                                                                     | <br>590 23.228<br>150 5.906<br>25 0.984                                        | U-LG : 340<br>LONG : 280<br>FAST : 90<br>13.386<br>11.024<br>3.543                                       | 2 m<br>6.562 ft                     | <br>R2 mm<br>R0.079 in  | -40 to +60 °C<br>-40 to +140 °F | FD-WSG4    |
|                  |                                                                                                   | <br>490 19.291<br>120 4.724<br>22 0.866                                        | U-LG : 250<br>LONG : 190<br>FAST : 75<br>9.843<br>7.480<br>2.953                                         |                                     |                         |                                 | FD-P50     |
|                  | <br>ø2.5 ø0.098                                                                                   | <br>510 20.079<br>120 4.724<br>22 0.866                                        | U-LG : 280<br>LONG : 215<br>FAST : 70<br>11.024<br>8.465<br>2.756                                        | 2 m<br>6.562 ft                     | R25 mm<br>R0.984 in     | -40 to +70 °C<br>-40 to +158 °F | FD-SNFM2   |
|                  | <br>ø1.5 ø0.059                                                                                   | <br>260 10.236<br>80 3.150<br>20 0.787                                         | U-LG : 170<br>LONG : 140<br>FAST : 55<br>6.693<br>5.512<br>2.165                                         | 1 m<br>3.281 ft                     | <br>R4 mm<br>R0.157 in  |                                 | FD-P2      |
|                  | <br>ø1.5 ø0.059 ø0.020<br>Sleeve part cannot be bent.                                             | <br>45 1.772<br>12 0.472<br>2 0.079                                            | U-LG : 25<br>LONG : 22<br>FAST : 7<br>0.984<br>0.866<br>0.276                                            | 1 m<br>3.281 ft                     | <br>R10 mm<br>R0.394 in | -40 to +60 °C<br>-40 to +140 °F | FD-E12     |
|                  |                                                                                                   | <br>210 8.268<br>55 2.165<br>11 0.433                                          | U-LG : 130<br>LONG : 110<br>FAST : 32<br>5.118<br>4.331<br>1.260                                         |                                     |                         |                                 | FD-E22     |
|                  | <br>ø3 ø0.118 ø0.079<br>Sleeve part cannot be bent.                                               | <br>260 10.236<br>65 2.559<br>14 0.551                                         | U-LG : 140<br>LONG : 110<br>FAST : 35<br>5.512<br>4.331<br>1.378                                         |                                     | R25 mm<br>R0.984 in     | -40 to +60 °C<br>-40 to +140 °F | FD-V41     |
|                  |                                                                                                   | <br>60 2.362<br>16 0.630<br>2 0.079                                            | U-LG : 35<br>LONG : 25<br>FAST : 8<br>1.378<br>0.984<br>0.315                                            | 2 m<br>6.562 ft                     | <br>R1 mm<br>R0.039 in  |                                 | FD-WV42    |
|                  |                                                                                                   | <br>370 14.567<br>120 4.724<br>25 0.984                                        | U-LG : 250<br>LONG : 210<br>FAST : 75<br>9.843<br>8.268<br>2.953                                         |                                     | R25 mm<br>R0.984 in     | -20 to +60 °C<br>-4 to +140 °F  | FD-SFM2SV2 |
| Rectangular      | <br>Glass substrate detection • Mapping<br>W25 × H7.3 × D30 W0.984 × H0.287 × D1.181              | <br>1 to 110 0.039 to 4.331<br>1 to 56 0.039 to 2.205<br>Cannot use            | U-LG : 1 to 87<br>LONG : 1 to 74<br>FAST : 1 to 38<br>0.039 to 3.425<br>0.039 to 2.913<br>0.039 to 1.496 | 4 m<br>13.123 ft                    | R25 mm<br>R0.984 in     | -40 to +60 °C<br>-40 to +140 °F | FD-L46     |
|                  | <br>Glass substrate detection • Alignment<br>W20 × H29 × D3.8 W0.787 × H1.142 × D0.150            | <br>43 1.693<br>40 1.575<br>24 0.945                                           | U-LG : 43<br>LONG : 43<br>FAST : 40<br>1.693<br>1.693<br>1.575                                           | 3 m<br>9.843 ft                     | <br>R4 mm<br>R0.157 in  |                                 | FD-L45     |
|                  | <br>Glass substrate detection • Alignment<br>W23.5 × H29 × D4.5 W0.925 × H1.142 × D0.177          | <br>3 to 51 0.118 to 2.008<br>4 to 44 0.157 to 1.732<br>5 to 38 0.197 to 1.496 | U-LG : 4 to 47<br>LONG : 4 to 46<br>FAST : 4 to 42<br>0.157 to 1.850<br>0.157 to 1.811<br>0.157 to 1.654 |                                     | R25 mm<br>R0.984 in     | 0 to +70 °C<br>32 to +158 °F    | FD-L45A    |
|                  | <br>Glass substrate detection • Alignment<br>W17 × H29 × D3.8 W0.669 × H1.142 × D0.150            | <br>31 1.220<br>24 0.945<br>18 0.709                                           | U-LG : 25<br>LONG : 24<br>FAST : 24<br>0.984<br>0.945<br>0.945                                           | 2 m<br>6.562 ft                     | <br>R4 mm<br>R0.157 in  | -20 to +70 °C<br>-4 to +158 °F  | FD-L43     |
|                  | <br>Glass substrate detection • Seating confirmation<br>W18 × H29 × D3.8 W0.709 × H1.142 × D0.150 | <br>30 1.181<br>29 1.142<br>1.5 to 24 0.059 to 0.945                           | U-LG : 30<br>LONG : 30<br>FAST : 28<br>1.181<br>1.181<br>1.102                                           | 3 m<br>9.843 ft                     |                         |                                 | FD-L47     |

# LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

## Reflective type



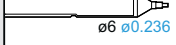
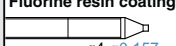
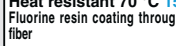
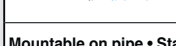
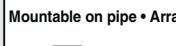
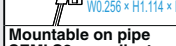
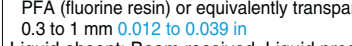
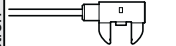
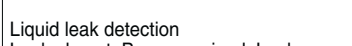
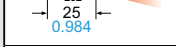
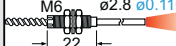
| Type        | Shape of fiber head<br>(mm in)                                                                                          | Sensing range (mm in)         |                                                            | Fiber cable<br>length<br>✂ : Free-cut | Bending<br>radius       | Ambient<br>temperature          | Model No. |
|-------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------|---------------------------------------|-------------------------|---------------------------------|-----------|
|             |                                                                                                                         | ■ : HYPR ■ : STD ■ : H-SP     | U-LG LONG FAST                                             |                                       |                         |                                 |           |
| Rectangular | <b>Glass substrate detection • Seating confirmation</b><br><br><b>W12 × H19 × D3</b><br><b>W0.472 × H0.748 × D0.118</b> |                               | U-LG : 10.5<br>LONG : 10<br>FAST : 9                       | <br>2 m<br>6.562 ft                   | <br>R10 mm<br>R0.394 in | -40 to +60 °C<br>-40 to +140 °F | FD-L44    |
|             |                                                                                                                         |                               | U-LG : 5.5<br>LONG : 5.5<br>FAST : 4.5                     |                                       |                         |                                 | FD-L44S   |
|             | <b>Glass substrate detection</b><br><br><b>W24 × H21 × D4</b><br><b>W0.945 × H0.827 × D0.157</b>                        |                               | U-LG : 2 to 14.5<br>LONG : 2 to 14.5<br>FAST : 5.5 to 13.5 | <br>1 m<br>3.281 ft                   | <br>R1 mm<br>R0.039 in  | -40 to +70 °C<br>-40 to +158 °F | FD-WL41   |
|             | <b>W6 × H18 × D14</b><br><b>W0.236 × H0.709 × D0.551</b>                                                                |                               | U-LG : 1 to 18<br>LONG : 1.5 to 16<br>FAST : 3 to 15       |                                       |                         |                                 | FD-L41    |
|             | <br><b>W7.2 × H7.5 × D2</b><br><b>W0.283 × H0.295 × D0.079</b>                                                          |                               | U-LG : 12.5<br>LONG : 11.5<br>FAST : 0.5 to 6              | <br>2 m<br>6.562 ft                   | <br>R1 mm<br>R0.039 in  | -40 to +60 °C<br>-4 to +140 °F  | FD-L4     |
|             | <b>W10 × H7 × D2</b><br><b>W0.394 × H0.276 × D0.079</b>                                                                 |                               | U-LG : 19.5<br>LONG : 18.5<br>FAST : 3 to 13               |                                       |                         |                                 | FD-L48    |
|             | <b>Small</b><br><br><b>W2 × H10 × D10</b><br><b>W0.079 × H0.394 × D0.394</b>                                            | <b>Front sensing</b><br>      | U-LG : 1 to 110<br>LONG : 1 to 85<br>FAST : 3 to 35        | <br>1 m<br>3.281 ft                   | <br>R1 mm<br>R0.039 in  | -40 to +60 °C<br>-40 to +140 °F | FD-WZ4    |
|             |                                                                                                                         | <b>Fiber bending type</b><br> | U-LG : 1 to 130<br>LONG : 1 to 90<br>FAST : 2.5 to 40      |                                       |                         |                                 | FD-WZ4HB  |
|             |                                                                                                                         | <b>Front sensing</b><br>      | U-LG : 230<br>LONG : 180<br>FAST : 1.5 to 65               |                                       |                         |                                 | FD-WZ7    |
|             |                                                                                                                         | <b>Fiber bending type</b><br> | U-LG : 0.5 to 320<br>LONG : 0.5 to 270<br>FAST : 1 to 90   |                                       |                         |                                 | FD-WZ7HB  |
| Special     | <b>Long sensing range • Rectangular head</b><br><br><b>W5.2 × H9.5 × D15</b><br><b>W0.205 × H0.374 × D0.591</b>         |                               | U-LG : 20 to 1,000<br>LONG : 20 to 820<br>FAST : 20 to 310 | <br>2 m<br>6.562 ft                   | <br>R1 mm<br>R0.039 in  | -40 to +60 °C<br>-40 to +140 °F | FD-WKZ1   |
|             | <b>Wide beam</b><br><br><b>W7 × H15 × D30</b><br><b>W0.276 × H0.591 × D1.181</b>                                        |                               | U-LG : 200<br>LONG : 200<br>FAST : 140                     | <br>2 m<br>6.562 ft                   | <br>R25 mm<br>R0.984 in |                                 | FD-A15    |
|             | <b>Top sensing</b><br><br><b>W5 × H20 × D20</b><br><b>W0.197 × H0.787 × D0.787</b>                                      |                               | U-LG : 510<br>LONG : 430<br>FAST : 160                     | <br>2 m<br>6.562 ft                   | <br>R25 mm<br>R0.984 in | -40 to +70 °C<br>-40 to +158 °F | FD-AFM2   |
|             | <b>Side sensing</b><br><br><b>W5 × H20 × D20</b><br><b>W0.197 × H0.787 × D0.787</b>                                     |                               | U-LG : 510<br>LONG : 430<br>FAST : 160                     | <br>2 m<br>6.562 ft                   | <br>R25 mm<br>R0.984 in |                                 | FD-AFM2E  |
|             |                                                                                                                         |                               |                                                            |                                       |                         |                                 |           |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Reflective type



| Type                 | Shape of fiber head<br>(mm in)                                                                                                                                                                            | Sensing range (mm in)                                                                                                                                                                                                                                                       |                                                                     | Fiber cable length<br>✂ : Free-cut                        | Bending radius                                                         | Ambient temperature              | Model No.   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------|----------------------------------|-------------|
|                      |                                                                                                                                                                                                           | ■ : HYPR ■ : STD ■ : H-SP                                                                                                                                                                                                                                                   | U-LG LONG FAST                                                      |                                                           |                                                                        |                                  |             |
| Liquid level sensing | Heat resistant 125 °C 257 °F<br>Fluorine resin coating<br><br>ø6 ø0.236                                                  | ø6 mm ø0.236 in<br>Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable)<br>Liquid surface contacted: Beam received, Liquid surface not contacted: Beam interrupted                                                                                     |                                                                     | ✂<br>2 m<br>6.562 ft                                      | Protective tube<br>R40 mm<br>R1.575 in<br>Fiber<br>R15 mm<br>R0.591 in | -40 to +125 °C<br>-40 to +257 °F | FD-F8Y      |
|                      | Heat resistant 105 °C 221 °F<br>Fluorine resin coating<br><br>ø4 ø0.157                                                  | ø4 mm ø0.157 in<br>Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable)<br>Liquid surface contacted: Beam received, Liquid surface not contacted: Beam interrupted                                                                                           |                                                                     |                                                           | Protective tube<br>R20 mm<br>R0.787 in                                 | -40 to +105 °C<br>-40 to +221 °F | FD-HF40Y    |
|                      | Heat resistant 70 °C 158 °F<br>Fluorine resin coating throughout the fiber<br><br>ø4 ø0.157                              | ø4 mm ø0.157 in<br>Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable)<br>Liquid surface contacted: Beam received, Liquid surface not contacted: Beam interrupted                                                                                           |                                                                     | ✂<br>2 m<br>6.562 ft                                      | Fiber<br>R10 mm<br>R0.394 in                                           | -40 to +70 °C<br>-40 to +158 °F  | FD-F41Y     |
|                      | Mountable on pipe • Standard<br><br>W25 × H13 × D20<br>W0.984 × H0.512 × D0.787                                          | Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe<br>PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in<br>Liquid absent: Beam received, Liquid present: Beam interrupted |                                                                     |                                                           | R10 mm<br>R0.394 in                                                    | -40 to +100 °C<br>-40 to +212 °F | FD-F41      |
|                      | Mountable on pipe • For PFA, wall thickness 1 mm 0.039 in pipe<br><br>W25 × H13 × D20<br>W0.984 × H0.512 × D0.787        | Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe<br>PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in<br>Liquid absent: Beam received, Liquid present: Beam interrupted                             |                                                                     |                                                           |                                                                        |                                  | FD-F4       |
| Liquid sensing       | Mountable on pipe • Array fiber<br><br>W6.5 × H28.3 × D17<br>W0.256 × H1.114 × D0.669                                    | Applicable pipe diameter: Outer dia. ø8 mm ø0.315 in or more transparent pipe (When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 in)<br>[PFA (fluorine resin), including translucent]<br>Liquid absent: Beam received, Liquid present: Beam interrupted         |                                                                     | ✂<br>2 m<br>6.562 ft                                      | R10 mm<br>R0.394 in                                                    | -40 to +70 °C<br>-40 to +158 °F  | FD-FA90     |
|                      | Mountable on pipe SEMI S2 compliant<br><br>W23 × H20 × D17<br>W0.906 × H0.787 × D0.669                                 | Applicable pipe diameter: Outer dia. ø3 to ø10 mm ø0.118 to ø0.394 in transparent pipe<br>PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1 mm 0.012 to 0.039 in<br>Liquid absent: Beam received, Liquid present: Beam interrupted             |                                                                     |                                                           | Protective tube<br>R20 mm<br>R0.787 in<br>Fiber<br>R4 mm<br>R0.157 in  | -20 to +60 °C<br>-4 to +140 °F   | FT-F902     |
|                      | SEMI S2 compliant<br><br>W20 × H30 × D10<br>W0.787 × H1.181 × D0.394                                                   | Liquid leak detection<br>Leak absent: Beam received, Leak present: Beam interrupted                                                                                                                                                                                         |                                                                     | ✂<br>5 m<br>16.404 ft<br>Protective tube:<br>3 m 9.843 ft | Protective tube<br>R20 mm<br>R0.787 in<br>Fiber<br>R4 mm<br>R0.157 in  | -20 to +50 °C<br>-4 to +122 °F   | FD-F705     |
| Heat-resistant       | 350 °C 662 °F • Coaxial<br><br>M6<br>25<br>0.984                                                                       | <br>720 28.346<br>260 10.236<br>45 1.772                                                                                                                                                 | U-LG : 540<br>LONG : 21.260<br>FAST : 460<br>18.110<br>150<br>5.906 | 2 m<br>6.562 ft                                           | R25 mm<br>R0.984 in                                                    | -60 to +350 °C<br>-76 to +662 °F | FD-H35-M2   |
|                      | 350 °C 662 °F • Sleeve 60 mm 2.362 in<br><br>M6<br>22<br>0.866                                                         | <br>840 33.071<br>330 12.992<br>55 2.165                                                                                                                                                 | U-LG : 550<br>LONG : 21.654<br>FAST : 500<br>19.685<br>200<br>7.874 | 1 m<br>3.281 ft                                           | Fiber<br>R25 mm<br>R0.984 in<br>Sleeve<br>R10 mm<br>R0.394 in          | -60 to +350 °C<br>-76 to +662 °F | FD-H35-M2S6 |
|                      | 200 °C 392 °F • Coaxial<br><br>M6<br>28<br>1.102                                                                       | <br>840 33.071<br>260 10.236<br>45 1.772                                                                                                                                                 | U-LG : 550<br>LONG : 21.654<br>FAST : 440<br>17.323<br>140<br>5.512 |                                                           | R25 mm<br>R0.984 in                                                    | -60 to +200 °C<br>-76 to +392 °F | FD-H20-M1   |
|                      | 350 °C 662 °F • Sleeve 90 mm 3.543 in<br><br>M4<br>27<br>1.063                                                         | <br>840 33.071<br>260 10.236<br>45 1.772                                                                                                                                                 | U-LG : 500<br>LONG : 19.685<br>FAST : 380<br>14.961<br>130<br>5.118 |                                                           | Fiber<br>R25 mm<br>R0.984 in<br>Sleeve<br>R10 mm<br>R0.394 in          | -60 to +350 °C<br>-76 to +662 °F | FD-H35-20S  |
|                      | 200 °C 392 °F • Coaxial<br><br>M4<br>27<br>1.063                                                                       | <br>770 30.315<br>230 9.055<br>45 1.772                                                                                                                                                  | U-LG : 30<br>LONG : 1.181<br>FAST : 25<br>0.984<br>12<br>0.472      | 2 m<br>6.562 ft                                           | R25 mm<br>R0.984 in                                                    | -60 to +200 °C<br>-76 to +392 °F | FD-H20-21   |
|                      | 300 °C 572 °F • Glass substrate detection<br>Convergent reflective type<br><br>W19 × H27 × D5 W0.748 × H1.063 × D0.197 | <br>40 1.575<br>17 0.669<br>1.5 to 6 0.059 to 0.236                                                                                                                                      |                                                                     |                                                           |                                                                        | -60 to +300 °C<br>-76 to +572 °F | FD-H30-L32  |

## LIST OF FIBERS

Pliable fibers (flexible and sharp bending fibers) are marked in light blue in the table.

### Reflective type



| Type    | Shape of fiber head<br>(mm in)                                                                                      | Sensing range (mm in)                                                                   |                                                                                                               | Fiber cable length<br>✂ : Free-cut | Bending radius      | Ambient temperature                                                                               | Model No.     |
|---------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------|---------------------------------------------------------------------------------------------------|---------------|
|         |                                                                                                                     | ■ : HYPR ■ : STD ■ : H-SP                                                               | U-LG LONG FAST                                                                                                |                                    |                     |                                                                                                   |               |
| Special | Heat-resistant                                                                                                      |                                                                                         |                                                                                                               |                                    |                     |                                                                                                   |               |
|         | 250 °C 482 °F • Glass substrate detection Convergent reflective type<br><br>W21×H33.2×D5 W0.827×H1.307×D0.197       | 1 to 31<br>0.039 to 1.220<br>1.5 to 26<br>0.059 to 1.024<br>2 to 18<br>0.079 to 0.709   | U-LG : 1 to 30<br>0.039 to 1.181<br>LONG : 1 to 28<br>0.039 to 1.102<br>FAST : 1.5 to 24<br>0.059 to 0.945    | 3 m<br>9.843 ft                    | R25 mm<br>R0.984 in | -20 to +250 °C<br>-4 to +482 °F<br>(Ordinary temperature side:<br>-20 to +70 °C<br>-4 to +158 °F) | FD-H25-L43    |
|         | 250 °C 482 °F • Glass substrate detection Convergent reflective type<br><br>W21×H34.5×D5 W0.827×H1.358×D0.197       | 4 to 43.5<br>0.157 to 1.713<br>5 to 42<br>0.197 to 1.654<br>6.5 to 34<br>0.256 to 1.339 | U-LG : 4 to 43<br>0.157 to 1.693<br>LONG : 4.5 to 43<br>0.177 to 1.693<br>FAST : 5 to 40<br>0.197 to 1.575    |                                    |                     |                                                                                                   | FD-H25-L45    |
|         | 180 °C 356 °F • Glass substrate detection Convergent reflective type<br><br>W19 × H27 × D5 W0.748 × H1.063 × D0.197 | 60<br>2.362<br>16<br>0.630<br>2 to 6.5<br>0.079 to 0.256                                | U-LG : 32<br>1.260<br>LONG : 24<br>0.945<br>FAST : 13<br>0.512                                                | 2 m<br>6.562 ft                    |                     | -60 to +180 °C<br>-76 to +356 °F                                                                  | FD-H18-L31    |
|         | 130 °C 266 °F<br><br>M6<br>21<br>0.827                                                                              | 880<br>34.646<br>350<br>13.780<br>65<br>2.559                                           | U-LG : 640<br>25.197<br>LONG : 600<br>23.622<br>FAST : 200<br>7.874                                           |                                    |                     | -60 to +130 °C<br>-76 to +266 °F                                                                  | FD-H13-FM2    |
|         | Vacuum-resistant                                                                                                    |                                                                                         |                                                                                                               |                                    |                     |                                                                                                   |               |
|         | 300 °C 572 °F • Rectangular head<br><br>W9.5 × H5.2 × D15<br>W0.374 × H0.205 × D0.591                               | 1 to 500<br>0.039 to 19.685<br>2 to 200<br>0.079 to 7.874<br>10 to 25<br>0.394 to 0.984 | U-LG : 1 to 340<br>0.039 to 13.386<br>LONG : 1 to 270<br>0.039 to 10.630<br>FAST : 3 to 120<br>0.118 to 4.724 | 1 m<br>3.281 ft                    | R18 mm<br>R0.709 in | -30 to +300 °C<br>-22 to +572 °F                                                                  | FD-H30-KZ1V-S |
|         | 300 °C 572 °F • Glass substrate detection Convergent reflective type<br><br>W19 × H5 × D27 W0.748 × H0.197 × D1.063 | 18<br>0.709<br>8<br>0.315<br>1.5 to 3<br>0.059 to 0.118                                 | U-LG : 12<br>0.472<br>LONG : 10<br>0.394<br>FAST : 5.5<br>0.217                                               | 3 m<br>9.843 ft                    |                     |                                                                                                   | FD-H30-L32V-S |

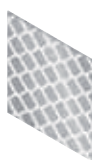
### Accessories (attached with fibers)

- RF-003 (FR-KZ21/KZ21E exclusive reflector)
- RF-13 (Reflective tape)
- FX-CT1 (Fiber cutter)
- FX-CT2 (Fiber cutter)
- FX-CT3 (Fiber cutter)
- FX-AT2 (Attachment for fixed-length fiber, Orange)
- FX-AT3 (Attachment for ø2.2 mm ø0.087 in fiber, Clear orange)
- FX-AT4 (Attachment for ø1 mm ø0.039 in fiber, Black)
- FX-AT5 (Attachment for ø1.3 mm ø0.051 in fiber, Gray)
- FX-AT6 Attachment for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber, Black / Gray

• RF-003



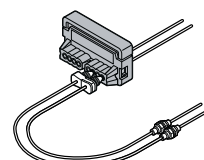
• RF-13



• FX-CT1



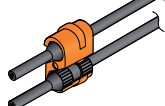
• FX-CT2



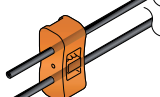
• FX-CT3



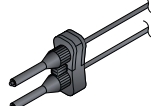
• FX-AT2



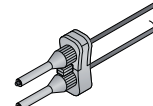
• FX-AT3



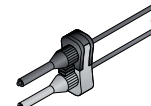
• FX-AT4



• FX-AT5



• FX-AT6





# FX-CH2

External input unit for digital sensor

## Features

### ■ Up to 16 sensors can be set/switched simultaneously by an external signal

Up to 16 digital fiber sensors can be set/switched simultaneously not by directly operating the sensors but from a PLC, a touch panel, a push button, or some other external signal generating device.

### ■ Simultaneous teaching

- Full-auto teaching
- 2-level teaching

### ■ Key lock setting

Even the enable/disable command for the key lock setting, a function designed to prevent operational mistakes, can be effectuated simultaneously from an external signal.

### ■ Batch loading and saving of bank settings

The bank settings for 3 previously set channels can be loaded and saved all together using an external signal.

## Technical Specifications

| Type                             | NPN input type                                                                                                                               | PNP input type                                 |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Model no.                        | FX-CH2                                                                                                                                       | FX-CH2-P                                       |
| Applicable sensor                | FX-301(P) (Version upgrade), FX-305(P)                                                                                                       |                                                |
| Supply voltage                   | 12 to 24VDC±10%                                                                                                                              |                                                |
| Input                            | Low: 0 to +2VDC<br>High: +5V to +VDC, or open                                                                                                | Low: 4V to +VDC<br>High: 0 to +0.6VDC, or open |
| Power indicator                  | Green LED                                                                                                                                    |                                                |
| Transmission operation indicator | Green LED (lights up when loaded, and 2-level/limit teaching blinks lights up when saved, and full-auto teaching)                            |                                                |
| Ambient temperature              | -10 to +55°C<br>(if 4 to 7 sensors are mounted close together: -10 to +50°C,<br>If 8 to 16 sensors are mounted close together: -10 to +45°C) |                                                |
| Dimensions                       | 10×27×68.5mm                                                                                                                                 |                                                |

## Typical Applications

### ■ Setup changes (external automatic teaching/ data bank switching)

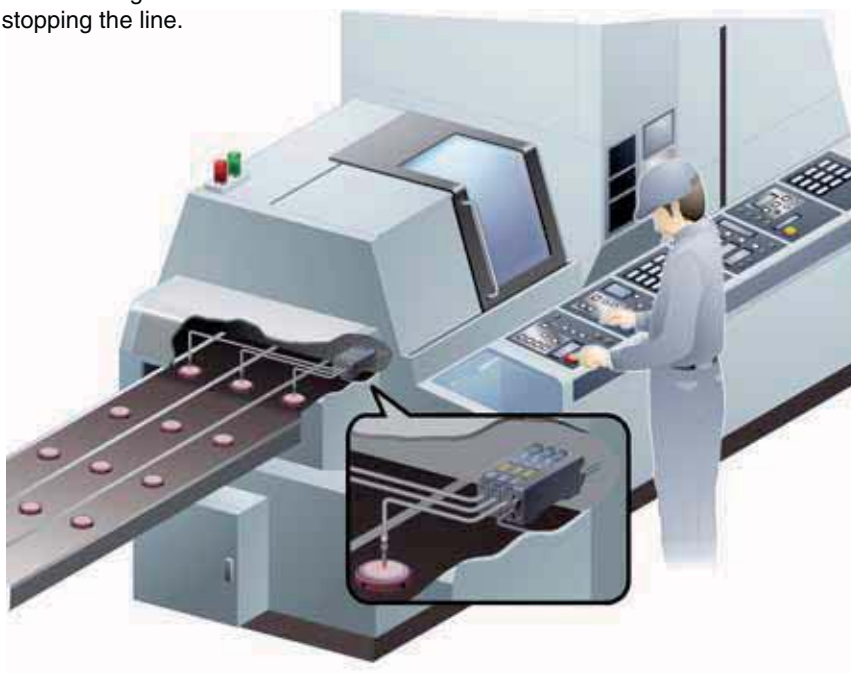
Digital fiber settings can be changed using input from a touch screen or switch, so that production line setup changes can be carried out more easily.

### ■ External teaching

Full auto-teaching is recommended for teaching when the sensing object is changed without stopping the line.

### ■ Data bank switching

Settings such as output operations (L-ON/D-ON) and timer operations can be recorded in the digital fiber sensor's data bank, and switching can be carried out externally.



## SC-GU1-485

We now offer remote maintenance for digital sensors

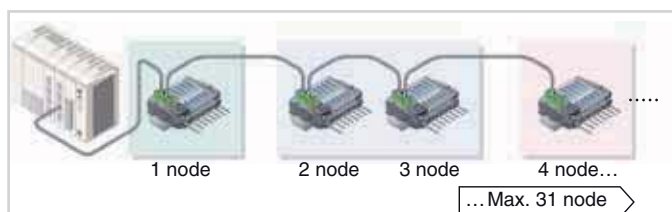
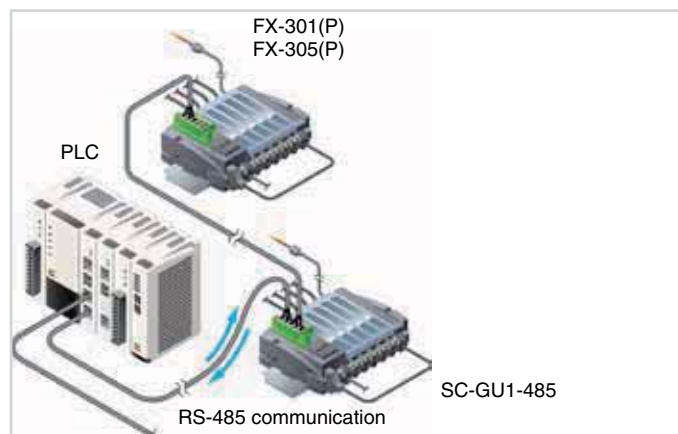
### Features

#### ■ Function handy for startup and maintenance

Using a PLC or PC, this communication unit not only facilitates inputs (teaching, bank switching) to a digital fiber sensor [FX-301(P)/305(P)] but also received-light amount and output status verifications greatly enhance workability during startup and maintenance.

#### ■ Series connection (RS485) of a maximum of 31 nodes is possible

A maximum of 31 nodes can be connected in series. This is ideal for flexible handling when the sensors are to be installed in scattered locations or when more sensors are added.



### Technical Specifications

| Type                | Main Unit                                                                                                                                                                                     |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model no.           | SC-GU1-485                                                                                                                                                                                    |
| Applicable sensor   | FX-301 (P), FX-305 (P)                                                                                                                                                                        |
| Supply voltage      | 24VDC±10% Ripple P-P10% or less                                                                                                                                                               |
| Ambient temperature | −10 to +55°C (if 4 to 7 sensors are connected: −10 to +50°C,<br>If 8 to 16 sensors are mounted close together: −10 to +45°C)<br>(No dew condensation or icing allowed), Storage: −20 to +70°C |
| Material            | Enclosure: Heat-resistant ABS                                                                                                                                                                 |
| Weight              | 35g approx. (10g approx. for SC-GU1-EU)                                                                                                                                                       |

[www.panasonic-electric-works.com](http://www.panasonic-electric-works.com)



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Sharp bending fiber  
Now, an even greater variety of sharp bending fibers

## FT/FD-W

### ■ Compact bending same as electrical wires

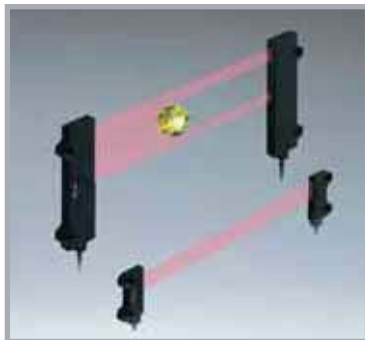
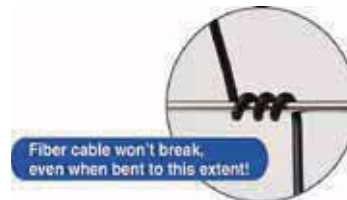
With the smallest bending radius being over R1mm and the coaxial types capable of highly accurate sensing (FD-WG4 and FD-WSG4) being over R2mm, this fiber can bend sharply like a cable to reduce wasted space.

### ■ All 24 models! Complete lineup!

13 thru-beam models and 11 reflective models are available for a total of 24 models. You are sure to find the sharp bending fiber that is best for you.

### ■ Does not break even at sharp bends

It does not break even at sharp bends. Furthermore, due to low loss in light intensity, there is almost no affect on the sensing range.



Wide beam fiber  
Sensing possible across a wide area

## FT-WA30/A30, FT-WA8/A8, FD-A15

### ■ Wide range

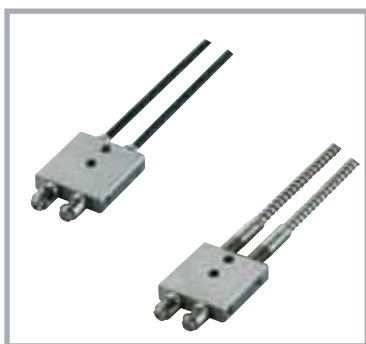
It has a wide sensing width of 11mm for FT-WA8/A8 and 32mm for FT-WA30/A30 enabling long distance sensing of objects as far as 3500mm (with FX-301 in LONG mode). Optimal for detecting unsteady objects or small objects.

### ■ Seal slit mask is available

A seal slit mask reduces the width and thereby the intensity of the emitting beam, which enables much smaller objects to be detected.

### ■ Space saving installation possible

FT-WA30/A30 and FT-WA8/A8 depth fibers boast a slim size of 20mm and 13.5mm respectively that enables mounting in even the narrowest of lines.



Heat-resistant, fixed-focus reflective fiber  
Glass substrate detection in high temperature production line

## FD-H30-L32 FD-H18-L31

■ 2 types to choose from to match your working environment

### ■ High precision detection

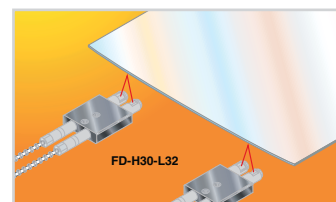
In addition to excellent heat resistance, these fibers have achieved a repeatability of 0.06mm for transparent glass substrates.

### ■ Extended detection range

Now available with full-range detection capabilities containing no dead zones (in both LONG and STD modes). Also, an extended detection distance of 15mm (in LONG mode) has been achieved, which even allows warping in glass substrates to be detected.

### ■ Glass substrate sensing

High temperature (300°C) production line glass substrate sensing possible. Accurately detects transparent glass substrates even at 300°C.



Heat-resistant reflective fiber with M4 head

## FD-H20-21 FD-H35-20S

### ■ Heat-resistant fiber saves installation space

The fiber head has M4 screw threads allowing installation space savings when using many fibers.

### ■ High-precision positioning is possible

The 200°C heat-resistant fiber (FD-H20-21) uses a coaxial fiber that makes high-precision positioning possible.

### ■ Heat-resistant fiber with sleeve (FD-H35-20S)

The sleeve is useful for cases when the fiber head cannot be installed close to the sensing location.

### ■ Can be installed in narrow spaces

A flexible metal jacket sheath that allows cables to be routed easily has been adopted.



Sharp bending fiber  
Now, an even greater variety of sharp bending fibers



Narrow beam retroreflective type fiber  
Ideal for sensing transparent objects!

## FR-KZ21/KZ21E

### ■ Stable sensing of transparent objects is possible!

A unique optical system gives excellent performance in sensing transparent objects at close ranges.

Uses an exclusive reflector (RF-003) for stable sensing of transparent objects such as transparent sheets on transparent mounts and transparent tubes.

### ■ Ultra compact fiber head & compact reflector!

The fiber head size is ultra compact at  $W9.52 \times H5.22 \times D21\text{mm}$  (side sensing type:  $W9.52 \times H252 \times D5.2\text{mm}$ ). The reflector is also a compact  $W10.62 \times H282 \times D10.1\text{mm}$  so that it is very space efficient.

### ■ Two types of fiber head for different installation directions

Two types of fiber head are available: a *Top* sensing type (FR-KZ21) and a *Side* sensing type (FR-KZ21E). Whichever type best suits the installation conditions can be selected.



## FR-WKZ11

### ■ Compact head and long sensing range

This fiber has a compact head of  $W9.5 \times H5.2 \times D15\text{mm}$ . It is a retroreflective type with a polarizing filter that has a long sensing range of 3200mm.

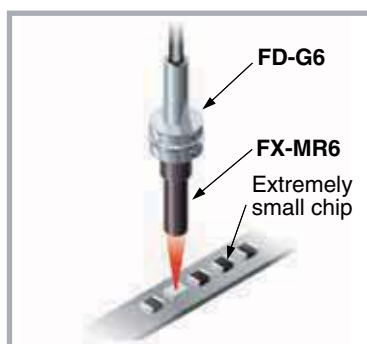
### ■ Unaffected by surface reflection from transparent objects

**FR-WKZ11** has a built-in polarizing filter in its tip, so that it is unaffected by surface reflection from transparent objects and specular objects directly in front of it.

### ■ Gives stable detection of transparent objects

Because it is a retroreflective type, light passes through transparent objects twice, so differences in the amount of light can be easily picked up and glass substrate and transparent films can be detected with good stability.





Coaxial M3 head reflective fiber  
High-precision & space saving

## FD-G6

### ■ Fiber allows installation space saving

The fiber head has M3 screw threads, allowing installation space saving when using many fibers.

### ■ High-precision positioning is possible

This coaxial fiber has the emitting fiber at the center and the receiving fiber around it. This fiber is ideal for high-precision positioning.

### ■ Allows sensing of very small objects

**FX-MR6** and **FX-MR3** finest spot lenses can be attached making this fiber ideal for sensing very small objects e.g. the orientation of chips.



Long sensing range rectangular head reflective fiber  
Narrow field of view/long distance detection!

## FD-WKZ1

### ■ Compact fiber head

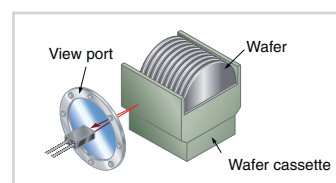
**FD-WKZ1** has a compact head with dimensions of  $9.2 \times 5.2 \times 15\text{mm}$  (W×H×D).

### ■ Narrow-view reflective type fiber allows for accurate aiming through narrow aperture obstruction

The beam spread of FD-WKZ1 has been reduced to approximately 1/5 of that of conventional fiber, enabling detection through narrow apertures.

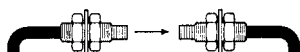
### ■ Long sensing range

Sensing can now be performed over distances of 480mm. Furthermore, the implementation of a powerful light beam allows the sensor to perform detection under difficult sensing conditions where high levels of dust and coarse particulates are present.



### Optical Fibers for FX 100 Series

#### Thru-beam type (one pair set)



Fibers are listed in alphabetic order.

| Model no.     | Sensing range (mm)    |                                 |
|---------------|-----------------------|---------------------------------|
|               | Standard type FX-101□ | Long sensing range type FX-102□ |
| FT-A8         | 1500                  | 3500                            |
| FT-A30        | 3500                  | 3500                            |
| FT-AFM2       | 280                   | 720                             |
| FT-AFM2E      | 240                   | 670                             |
| FT-B8         | 400                   | 1,150                           |
| FT-E12        | 6                     | 19                              |
| FT-E22        | 15                    | 60                              |
| FT-FM2        | 300                   | 800                             |
| FT-FM2S       |                       |                                 |
| FT-FM2S4      |                       |                                 |
| FT-FM10L      | 9300                  | 15,000                          |
| FT-H13-FM2    | 250                   | 700                             |
| FT-H20-J20-S  | 135                   | 420                             |
| FT-H20-J30-S  |                       |                                 |
| FT-H20-J50-S  |                       |                                 |
| FT-H20-M1     | 210                   | 540                             |
| FT-H20-VJ50-S | 150                   | 500                             |
| FT-H20-VJ80-S |                       |                                 |
| FT-H20W-M1    | 100                   | 300                             |
| FT-H30-M1V-S  | 110                   | 280                             |
| FT-H35-M2     | 170                   | 490                             |
| FT-H35-M2S6   |                       |                                 |
| FT-HL80Y      | 990                   | 2340                            |
| FT-K8         | 1000                  | 3000                            |
| FT-KV1        | 135                   | 500                             |
| FT-KV8        | 1000                  | 3000                            |
| FT-L80Y       | 1100                  | 2600                            |
| FT-NFM2       | 130                   | 280                             |
| FT-NFM2S      |                       |                                 |
| FT-NFM2S4     |                       |                                 |
| FT-P2         | 120                   | 330                             |
| FT-P40        | 80                    | 240                             |
| FT-P60        | 130                   | 300                             |
| FT-P80        | 230                   | 650                             |
| FT-P81X       | 260                   | 800                             |

| Model no.  | Sensing range (mm)    |                                 |
|------------|-----------------------|---------------------------------|
|            | Standard type FX-101□ | Long sensing range type FX-102□ |
| FT-PS1     | 40                    | 90                              |
| FT-R80     | 180                   | 430                             |
| FT-SFM2    | 300                   | 800                             |
| FT-SFM2L   | 760                   | 2400                            |
| FT-SFM2SV2 | 180                   | 470                             |
| FT-SNFM2   | 130                   | 280                             |
| FT-T80     | 300                   | 800                             |
| FT-V10     | 1000                  | 2350                            |
| FT-V22     | 140                   | 380                             |
| FT-V41     | 40                    | 120                             |
| FT-V80Y    | 340                   | 800                             |
| FT-W4      | 80                    | 220                             |
| FT-W8      | 260                   | 650                             |
| FT-WA8     | 1500                  | 3500                            |
| FT-WA30    | 3500                  | 3500                            |
| FT-WKV8    | 700                   | 2200                            |
| FT-WR80    | 215                   | 570                             |
| FT-WR80L   | 430                   | 1150                            |
| FT-WS3     | 150                   | 600                             |
| FT-WS4     | 80                    | 220                             |
| FT-WS8     | 260                   | 650                             |
| FT-WS8L    | 600                   | 1500                            |
| FT-WV42    | 30                    | 80                              |
| FT-WZ4     | 230                   | 670                             |
| FT-WZ4HB   | 80                    | 230                             |
| FT-WZ7     | 330                   | 1000                            |
| FT-WZ7HB   | 190                   | 580                             |
| FT-WZ8     | 330                   | 950                             |
| FT-WZ8E    | 700                   | 2100                            |
| FT-WZ8H    | 1200                  | 2800                            |
| FT-Z8      | 360                   | 1000                            |
| FT-Z8E     | 800                   | 1850                            |
| FT-Z8H     | 1400                  | 3100                            |
| FT-Z802Y   | 520                   | 3100                            |

## Optical Fibers for FX 100 Series

### Retroreflective type



Fibers are listed in alphabetic order.

| Model no. | Sensing range (mm) (Notes 1, 2) |                                 |
|-----------|---------------------------------|---------------------------------|
|           | Standard type FX-101□           | Long sensing range type FX-102□ |
| FR-KV1    | 15 to 200                       | 15 to 360                       |
| FR-KZ21   | 200                             | 200                             |
| FR-KZ21E  | 200                             | 200                             |
| FR-WKZ11  | 100 to 550                      | 100 to 830                      |

| Reflector \ Amplifier | FX-101□     | FX-102□     |
|-----------------------|-------------|-------------|
| FR-WKZ11 + RF-210     | 100 to 700  | 100 to 1100 |
| FR-WKZ11 + RF-220     | 100 to 1300 | 100 to 2600 |
| FR-WKZ11 + RF-230     | 100 to 2000 | 100 to 4000 |

### Reflective type



Fibers are in alphabetic order.

| Model no.  | Sensing range (mm) (Notes 1, 2)                                                                                                                                        |                                 |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|            | Standard type FX-101□                                                                                                                                                  | Long sensing range type FX-102□ |
| FD-A15     | 125                                                                                                                                                                    | 250                             |
| FD-AFM2    | 105                                                                                                                                                                    | 285                             |
| FD-AFM2E   | 85                                                                                                                                                                     | 245                             |
| FD-B8      | 170                                                                                                                                                                    | 440                             |
| FD-E12     | 3.5                                                                                                                                                                    | 13                              |
| FD-E22     | 16                                                                                                                                                                     | 45                              |
| FD-EG1     | 18                                                                                                                                                                     | 50                              |
| FD-EG2     | 10                                                                                                                                                                     | 30                              |
| FD-EG3     | 7                                                                                                                                                                      | 22                              |
| FD-EN500S1 | 1                                                                                                                                                                      | 4                               |
| FD-ENM1S1  | 15                                                                                                                                                                     | 48                              |
| FD-F4      | Applicable pipe diameter:<br>Outer dia. ø6 to ø26mm transparent pipe<br>[PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1mm]                    |                                 |
| FD-F41     | Applicable pipe diameter:<br>Outer dia. ø6 to ø26mm transparent pipe<br>[PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3mm] |                                 |
| FD-F8Y     | —                                                                                                                                                                      |                                 |
| FD-FM2     | 100                                                                                                                                                                    | 410                             |
| FD-FM2S    | 100                                                                                                                                                                    | 345                             |
| FD-FM2S4   |                                                                                                                                                                        |                                 |
| FD-G4      | 50                                                                                                                                                                     | 120                             |

| Model no.                 | Sensing range (mm) (Notes 1, 2) |                                   |
|---------------------------|---------------------------------|-----------------------------------|
|                           | Standard type FX-101□           | Long sensing range type FX-102□   |
| FD-G6                     | 50                              | 120                               |
| FD-G6X                    | 45                              | 160                               |
| FD-H13-FM2                | 100                             | 280                               |
| FD-H18-L31                | 0 to 10                         | 0 to 25                           |
| FD-H20-21                 | 90                              | 280                               |
| FD-H20-M1                 | 120                             | 300                               |
| FD-H30-KZ1V-S<br>(Note 3) | 25 to 80                        | 10 to 220                         |
| FD-H30-L32                | 2 to 9                          | 0 to 17                           |
| FD-H30-L32V-S<br>(Note 3) | 2.5 to 6.5                      | 0 to 11                           |
| FD-H35-20S                | 85                              | 200                               |
| FD-H35-M2                 | 75                              | 280                               |
| FD-H35-M2S6               |                                 |                                   |
| FD-L4                     | 5 to 8<br>(Convergent point 6)  | 1 to 17<br>(Convergent point 6)   |
| FD-L41                    | 3 to 14<br>(Convergent point 8) | 1.5 to 16<br>(Convergent point 8) |
| FD-L43                    | 0 to 19                         | 0 to 25                           |
| FD-L44                    | 0 to 6                          | 0 to 8                            |
| FD-L44S                   | 0 to 4.5                        | 0 to 5.5                          |
| FD-L45                    | 0 to 40                         | 0 to 50                           |
| FD-L46                    | 16 to 30                        | 12 to 50                          |
| FD-NFM2                   | 35                              | 100                               |
| FD-NFM2S                  |                                 |                                   |
| FD-NFM2S4                 |                                 |                                   |
| FD-P2                     | 25                              | 65                                |

### Optical Fibers for FX 100 Series

#### Reflective type



Fibers are listed in alphabetic order.

| Model no.  | Sensing range (mm)    |                                 |
|------------|-----------------------|---------------------------------|
|            | Standard type FX-101□ | Long sensing range type FX-102□ |
| FD-P40     | 8                     | 30                              |
| FD-P50     | 45                    | 150                             |
| FD-P60     | 45                    | 150                             |
| FD-P80     | 90                    | 200                             |
| FD-P81X    | 70                    | 220                             |
| FD-R80     | 70                    | 180                             |
| FD-S80     | 100                   | 345                             |
| FD-SFM2SV2 | 30                    | 90                              |
| FD-SNFM2   | 35                    | 100                             |
| FD-T40     | 35                    | 100                             |
| FD-T80     | 100                   | 345                             |
| FD-V41     | 25                    | 70                              |
| FD-W8      | 80                    | 230                             |
| FD-W44     | 15                    | 40                              |

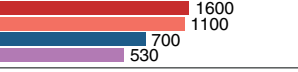
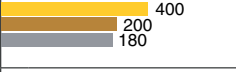
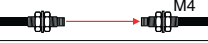
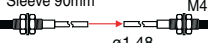
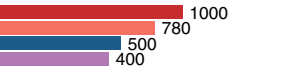
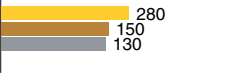
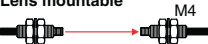
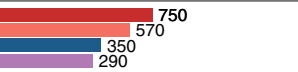
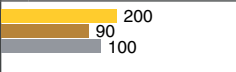
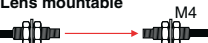
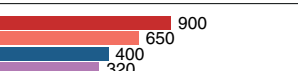
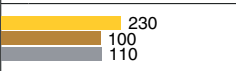
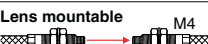
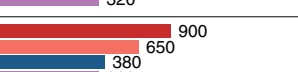
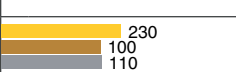
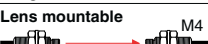
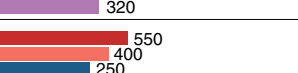
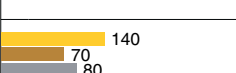
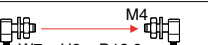
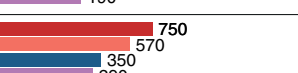
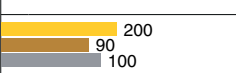
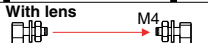
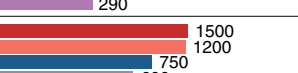
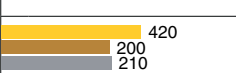
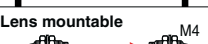
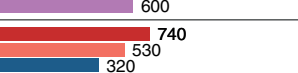
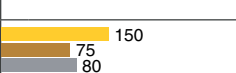
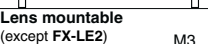
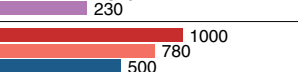
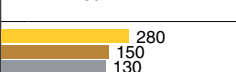
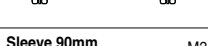
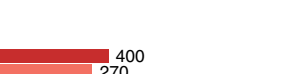
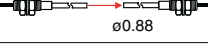
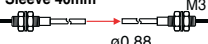
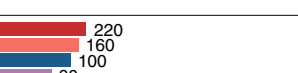
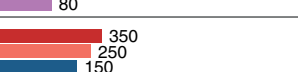
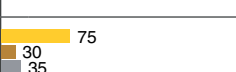
| Model no. | Sensing range (mm)              |                                   |
|-----------|---------------------------------|-----------------------------------|
|           | Standard type FX-101□           | Long sensing range type FX-102□   |
| FD-WG4    | 28                              | 75                                |
| FD-WKZ1   | 20 to 180                       | 20 to 480                         |
| FD-WL41   | 7 to 12<br>(Convergent point 8) | 6 to 13.5<br>(Convergent point 8) |
| FD-WL48   | 1 to 4.5                        | 0.5 to 6.5                        |
| FD-WS8    | 80                              | 230                               |
| FD-WSG4   | 28                              | 75                                |
| FD-WT4    | 15                              | 40                                |
| FD-WT8    | 80                              | 230                               |
| FD-WV42   | 6                               | 20                                |
| FD-WZ4    | 2 to 20                         | 1 to 70                           |
| FD-WZ4HB  |                                 |                                   |
| FD-WZ7    | 1 to 55                         | 160                               |
| FD-WZ7HB  | 1 to 60                         | 0.5 to 180                        |

# Optical Fibers for FX 300 Series

## Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS):** S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type           | Shape of fiber head (mm) | Sensing range (mm) (Note 1)                                                                                           | U-LG<br>LONG<br>STDF<br>STD                                                         | FAST<br>H-SP<br>S-D                                                                 | Min. sensing object    | Fiber cable length<br>✂ : Free-cut                                                           | Bending radius                                                                              | Model no.                                                                             |         |
|----------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------|
| Thru-beam type | M4                       | Lens mountable<br>                   |    |    | ø0.04mm opaque object  | <br>2m    | R25mm                                                                                       | FT-B8                                                                                 |         |
|                |                          | Lens mountable<br>                   |                                                                                     |                                                                                     |                        |                                                                                              |                                                                                             | FT-FM2                                                                                |         |
|                |                          | Sleeve 90mm<br>                      |    |    | ø0.03mm opaque object  |                                                                                              | Fiber R25mm Sleeve                                                                          | FT-FM2S                                                                               |         |
|                |                          | Sleeve 40mm<br>                      |                                                                                     |                                                                                     |                        |                                                                                              |          | FT-FM2S4                                                                              |         |
|                |                          | Lens mountable<br>                   |    |    | ø0.03mm opaque object  |                                                                                              |          | FT-W8                                                                                 |         |
|                |                          | Lens mountable<br>                   |    |    | ø0.04mm opaque object  |                                                                                              |          | FT-P80                                                                                |         |
|                |                          | Lens mountable<br>                   |    |    | ø0.05mm opaque object  |                                                                                              | 1m                                                                                          |    | FT-P81X |
|                |                          | Lens mountable<br>                 |   |   | ø0.04mm opaque object  |                                                                                              | <br>2m |  | FT-P60  |
|                | Square head type         |                                    |  |  | ø0.06mm opaque object  | <br>2m  |        | FT-WR80                                                                               |         |
|                |                          | With lens<br>                      |  |  | ø0.04mm opaque object  |                                                                                              |                                                                                             | FT-WR80L                                                                              |         |
|                | Elbow                    |                                    |  |  | ø0.04mm opaque object  | <br>2m  | R25mm                                                                                       | FT-R80                                                                                |         |
|                | M3                       | Lens mountable (except FX-LE2)<br> |  |  | ø0.03mm opaque object  | <br>2m  | R25mm                                                                                       | FT-T80                                                                                |         |
|                |                          |                                    |                                                                                     |                                                                                     |                        |                                                                                              |                                                                                             | FT-NFM2                                                                               |         |
|                |                          | Sleeve 90mm<br>                    |  |  | ø0.025mm opaque object |                                                                                              | Fiber R25mm Sleeve                                                                          | FT-NFM2S                                                                              |         |
|                |                          | Sleeve 40mm<br>                    |                                                                                     |                                                                                     |                        |                                                                                              |        | FT-NFM2S4                                                                             |         |
|                |                          |                                    |  |  | ø0.02mm opaque object  |                                                                                              |        | FT-W4                                                                                 |         |
|                |                          |                                    |  |  |                        |                                                                                              |        | FT-P40                                                                                |         |
|                | Long sensing range       | With lens<br>                      |  |  | ø0.4mm opaque object   | <br>10m | R25mm                                                                                       | FT-FM10L                                                                              |         |

Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

# Standard Fibers

## Optical Fibers for FX 300 Series

### Thru-beam type (one pair set)



The FX-305 and FX-301(-HS) have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS):** S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type                            | Shape of fiber head (mm) | Sensing range (mm)                                                  |                                                                         | U-LG<br>LONG<br>STDF<br>STD                           | FAST<br>H-SP<br>S-D            | Min. sensing object (Note 2) | Fiber cable length<br>✂ : Free-cut | Bending radius                              | Model no. |
|---------------------------------|--------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------|------------------------------|------------------------------------|---------------------------------------------|-----------|
| Cylindrical type                | ø3                       | With lens • Long sensing range<br>                                  | <div><div>1500</div><div>1200</div><div>750</div><div>600</div></div>   | <div><div>420</div><div>200</div><div>210</div></div> | ø0.02mm<br>opaque object       | <br>2m                       | <div>R1 mm<br/>R0.039 in</div>     | FT-WS8L                                     |           |
|                                 |                          |                                                                     | <div><div>780</div><div>570</div><div>340</div><div>290</div></div>     | <div><div>200</div><div>90</div><div>100</div></div>  | ø0.05mm<br>opaque object       |                              |                                    | FT-WS3                                      |           |
|                                 | ø2.5                     | With lens • Long sensing range<br>                                  | <div><div>2000</div><div>1600</div><div>820</div><div>800</div></div>   | <div><div>580</div><div>170</div><div>280</div></div> | ø0.02mm<br>opaque object       | <br>2m                       | R25mm                              | FT-SFM2L                                    |           |
|                                 |                          |                                                                     | <div><div>1000</div><div>780</div><div>500</div><div>400</div></div>    | <div><div>280</div><div>150</div><div>130</div></div> | ø0.03mm<br>opaque object       |                              |                                    | FT-SFM2                                     |           |
|                                 |                          |                                                                     | <div><div>750</div><div>570</div><div>350</div><div>290</div></div>     | <div><div>200</div><div>90</div><div>100</div></div>  |                                |                              |                                    | <div>R1 mm<br/>R0.039 in</div>              | FT-WS8    |
|                                 | ø1.5                     |                                                                     | <div><div>400</div><div>270</div><div>200</div><div>140</div></div>     | <div><div>100</div><div>55</div><div>49</div></div>   | ø0.025mm<br>opaque object      | <br>2m                       | R25mm                              | FT-SNFM2                                    |           |
|                                 |                          |                                                                     | <div><div>220</div><div>160</div><div>100</div><div>80</div></div>      | <div><div>55</div><div>25</div><div>28</div></div>    | ø0.02mm<br>opaque object       |                              |                                    | <div>R1 mm<br/>R0.039 in</div>              | FT-WS4    |
|                                 |                          |                                                                     | <div><div>350</div><div>280</div><div>160</div><div>120</div></div>     | <div><div>90</div><div>40</div><div>42</div></div>    |                                |                              |                                    | <div>R4 mm<br/>R0.157 in<br/>Flexible</div> | FT-P2     |
|                                 | ø1                       |                                                                     | <div><div>100</div><div>80</div><div>50</div><div>40</div></div>        | <div><div>30</div><div>13</div><div>17</div></div>    | ø0.02mm<br>opaque object       | 500mm                        |                                    | FT-PS1                                      |           |
|                                 | Ultra small diameter     | Beam diameter ø0.25 ø3<br>                                          | <div><div>20</div><div>18</div><div>13</div><div>10</div></div>         | <div><div>8</div><div>3</div><div>3</div></div>       | ø0.02mm<br>opaque object       | 500mm                        | <div>R5mm</div>                    | FT-E12                                      |           |
|                                 |                          | Sleeve part cannot be bent.<br>Beam diameter ø0.4 ø3<br>            | <div><div>130</div><div>80</div><div>60</div><div>50</div></div>        | <div><div>36</div><div>18</div><div>15</div></div>    |                                | 1m                           |                                    | FT-E22                                      |           |
|                                 | Side-view                |                                                                     | <div><div>2350</div><div>2000</div><div>1400</div><div>1000</div></div> | <div><div>800</div><div>340</div><div>350</div></div> | ø0.05mm<br>opaque object       | <br>2m                       | R25mm                              | FT-V10                                      |           |
|                                 |                          | <div><div>550</div><div>400</div><div>240</div><div>200</div></div> | <div><div>140</div><div>65</div><div>70</div></div>                     |                                                       | FT-SFM2SV2                     |                              |                                    |                                             |           |
| Sleeve part cannot be bent.<br> |                          | <div><div>410</div><div>390</div><div>220</div><div>180</div></div> | <div><div>125</div><div>60</div><div>63</div></div>                     | ø0.02mm<br>opaque object                              | 1m                             | FT-V22                       |                                    |                                             |           |
| Sleeve part cannot be bent.<br> |                          | <div><div>220</div><div>175</div><div>100</div><div>80</div></div>  | <div><div>60</div><div>25</div><div>27</div></div>                      |                                                       | <br>2m                         | FT-V41                       |                                    |                                             |           |
|                                 |                          | <div><div>120</div><div>90</div><div>55</div><div>40</div></div>    | <div><div>30</div><div>13</div><div>15</div></div>                      |                                                       | <div>R1 mm<br/>R0.039 in</div> | FT-WV42                      |                                    |                                             |           |
| Sleeve part cannot be bent.<br> |                          |                                                                     |                                                                         |                                                       |                                |                              |                                    |                                             |           |

Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

# Optical Fibers for FX 300 Series

## Thru-beam type (one pair set)



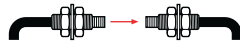
The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS):** S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type        | Shape of fiber head (mm)                      | Sensing range (mm) (Note 1)                                                                                      | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 2)       | Fiber cable length<br>✂ : Free-cut | Bending radius                 | Model no.       |
|-------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|--------------------------------|-----------------|
| Rectangular | Easy mounting • Top sensing<br>W3 × H8 × D12  | <div> <div>3500</div> <div>2500</div> <div>1600</div> <div>1200</div> </div>                                     | <div> <div>850</div> <div>400</div> <div>410</div> </div>                                                                               | ø0.08mm opaque object              | 2m                                 | R1 mm<br>R0.039 in             | FT-WZ8H         |
|             |                                               | <div> <div>3100</div> <div>2700</div> <div>1550</div> <div>1400</div> </div>                                     | <div> <div>1000</div> <div>420</div> <div>490</div> </div>                                                                              | ø0.03mm opaque object              |                                    | R4 mm<br>R0.157 in<br>Flexible | FT-Z8H          |
|             |                                               | <div> <div>2100</div> <div>1500</div> <div>950</div> </div>                                                      | <div> <div>500</div> <div>200</div> <div>210</div> </div>                                                                               | ø0.05mm opaque object              |                                    | R1 mm<br>R0.039 in             | FT-WZ8E         |
|             | Easy mounting • Side sensing<br>W3 × H12 × D8 | <div> <div>1850</div> <div>1600</div> <div>950</div> <div>800</div> </div>                                       | <div> <div>600</div> <div>250</div> <div>280</div> </div>                                                                               | ø0.03mm opaque object              |                                    | R4 mm<br>R0.157 in<br>Flexible | FT-Z8E          |
|             |                                               | <div> <div>950</div> <div>700</div> <div>420</div> <div>330</div> </div>                                         | <div> <div>240</div> <div>100</div> <div>120</div> </div>                                                                               | ø0.04mm opaque object              | 1m                                 | R1 mm<br>R0.039 in             | FT-WZ8          |
|             |                                               | <div> <div>1100</div> <div>800</div> <div>500</div> <div>400</div> </div>                                        | <div> <div>300</div> <div>120</div> <div>140</div> </div>                                                                               | ø0.03mm opaque object              |                                    | R4 mm<br>R0.157 in<br>Flexible | FT-Z8           |
|             | Front sensing<br>W10 × H7 × D2                | <div> <div>300</div> <div>200</div> <div>140</div> <div>100</div> </div>                                         | <div> <div>70</div> <div>40</div> <div>40</div> </div>                                                                                  | ø0.08mm opaque object              | 2m                                 | R1 mm<br>R0.039 in             | NEW<br>FT-WZ4   |
|             | Fiber bending type<br>W2 × H10 × D10          | <div> <div>220</div> <div>150</div> <div>105</div> <div>75</div> </div>                                          | <div> <div>50</div> <div>30</div> <div>30</div> </div>                                                                                  | ø0.08mm opaque object              |                                    | R1 mm<br>R0.039 in             | NEW<br>FT-WZ4HB |
|             | Front sensing<br>W14 × H7 × D3.5              | <div> <div>660</div> <div>440</div> <div>308</div> <div>220</div> </div>                                         | <div> <div>150</div> <div>80</div> <div>80</div> </div>                                                                                 | ø0.08mm opaque object              | 2m                                 | R1 mm<br>R0.039 in             | NEW<br>FT-WZ7   |
|             | Fiber bending type<br>W3.5 × H14 × D11        | <div> <div>870</div> <div>580</div> <div>406</div> <div>290</div> </div>                                         | <div> <div>210</div> <div>110</div> <div>110</div> </div>                                                                               | ø0.03mm opaque object              |                                    | R1 mm<br>R0.039 in             | NEW<br>FT-WZ7HB |
| Special     | Narrow beam                                   | <div> <div>3000</div> <div>2000</div> <div>1500</div> <div>1000</div> </div>                                     | <div> <div>800</div> <div>300</div> <div>350</div> </div>                                                                               |                                    |                                    | R25mm<br>R0.984 in             | FT-K8           |
|             |                                               | <div> <div>2200</div> <div>1700</div> <div>1000</div> <div>700</div> </div>                                      | <div> <div>600</div> <div>280</div> <div>300</div> </div>                                                                               | ø0.06mm opaque object              | 2m                                 | R1 mm<br>R0.039 in             | FT-WKV8         |
|             |                                               | <div> <div>3000</div> <div>2000</div> <div>1500</div> <div>1000</div> </div>                                     | <div> <div>800</div> <div>300</div> <div>350</div> </div>                                                                               |                                    |                                    | R25mm<br>R0.984 in             | FT-KV8          |
|             | W2 × H1.5 × D20                               | <div> <div>600</div> <div>500</div> <div>300</div> <div>250</div> </div>                                         | <div> <div>180</div> <div>90</div> <div>100</div> </div>                                                                                | ø0.02mm opaque object              |                                    | R10 mm<br>R0.394 in            | FT-KV1          |
|             | Wide beam                                     | <div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> </div> | <div> <div>(Note 4) 3500</div> <div>(Note 4) 3000</div> <div>(Note 4) 3500</div> </div>                                                 | ø0.3mm opaque object               | 2m                                 | R1 mm<br>R0.039 in             | FT-WA30         |
|             |                                               | <div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> </div>                          | <div> <div>1100</div> <div>1080</div> <div>750</div> </div>                                                                             | ø0.25mm opaque object              |                                    | R10 mm<br>R0.394 in            | FT-A30          |
|             |                                               | <div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> <div>(Note 3) 3500</div> </div>                          | <div> <div>1100</div> <div>1080</div> <div>750</div> </div>                                                                             | ø0.25mm opaque object              |                                    | R1 mm<br>R0.039 in             | FT-WA8          |
|             | Array                                         | <div> <div>850</div> <div>650</div> <div>380</div> <div>330</div> </div>                                         | <div> <div>220</div> <div>100</div> <div>115</div> </div>                                                                               | Horizontal: ø0.025mm opaque object | 2m                                 | R10 mm<br>R0.394 in            | FT-A8           |
|             |                                               | <div> <div>800</div> <div>590</div> <div>350</div> <div>290</div> </div>                                         | <div> <div>200</div> <div>90</div> <div>100</div> </div>                                                                                | Vertical: ø0.45mm opaque object    |                                    | R10 mm<br>R0.394 in            | FT-AFM2         |
|             | Side sensing<br>W5 × H15 × D15                | <div> <div>800</div> <div>590</div> <div>350</div> <div>290</div> </div>                                         | <div> <div>200</div> <div>90</div> <div>100</div> </div>                                                                                | Vertical: ø0.45mm opaque object    |                                    | R25mm                          | FT-AFM2E        |

Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

### Optical Fibers for FX 300 Series

#### Thru-beam type (one pair set)



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type             | Shape of fiber head (mm)                                                    | Sensing range (mm) (Note 2) | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> | <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 3) | Fiber cable length<br>✂ : Free-cut                 | Bending radius                            | Model no.                                                                                    |
|------------------|-----------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------|----------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------|
| Heat-resistant   | 350°C<br>Lens mountable<br>                                                 |                             |                                                                             |                                                             | ø0.04mm opaque object        | 2m                                                 | R25mm                                     | <b>FT-H35-M2</b>                                                                             |
|                  | 350°C<br>Sleeve 60mm<br>                                                    |                             |                                                                             |                                                             | ø0.04mm opaque object        | 2m                                                 | Fiber R25mm Sleeve<br>R10 mm<br>R0.394 in | <b>FT-H35-M2S6</b>                                                                           |
|                  | Allows flexible wiring, 200°C<br>Lens mountable<br>                         |                             |                                                                             |                                                             | ø0.02mm opaque object        | 1m                                                 | R10 mm<br>R0.394 in                       | <b>FT-H20W-M1</b>                                                                            |
|                  | 200°C<br>Lens mountable<br>                                                 |                             |                                                                             |                                                             | ø0.04mm opaque object        | 1m                                                 | R25mm                                     | <b>FT-H20-M1</b>                                                                             |
|                  | 130°C<br>Lens mountable (FX-LE2 only)<br>                                   |                             |                                                                             |                                                             | ø0.06mm opaque object        | 2m                                                 | ✂                                         | <b>FT-H13-FM2</b>                                                                            |
| Special          | Lens mountable (FX-LE1)<br>                                                 |                             |                                                                             |                                                             | ø0.12mm opaque object        | 200mm (Note 4)<br>300mm (Note 4)<br>500mm (Note 4) | Heat-resistant fiber R18mm (Note 5)       | <b>FT-H20-J20-S (Note 6)</b><br><b>FT-H20-J30-S (Note 6)</b><br><b>FT-H20-J50-S (Note 6)</b> |
|                  | Side-view<br>                                                               |                             |                                                                             |                                                             | ø0.16mm opaque object        | 500mm (Note 4)<br>800mm (Note 4)                   |                                           | <b>FT-H20-VJ50-S (Note 6)</b><br><b>FT-H20-VJ80-S (Note 6)</b>                               |
|                  | Easy mounting · Rectangular head<br>SEMI S2 compliant<br>W7 × H15 × D13<br> |                             |                                                                             |                                                             | ø4mm opaque object           | 2m                                                 | R25mm                                     | <b>FT-Z802Y</b>                                                                              |
|                  | Heat-resistant 115°C<br>                                                    |                             |                                                                             |                                                             | ø0.2mm opaque object         | 2m (Note 7)                                        | R30mm                                     | <b>FT-HL80Y</b><br><b>FT-L80Y</b><br><b>FT-V80Y</b>                                          |
|                  | Side-view<br>                                                               |                             |                                                                             |                                                             |                              |                                                    |                                           |                                                                                              |
| Vacuum-resistant | 300°C<br>Lens mountable (FX-LE1/SV2 only)<br>                               |                             |                                                                             |                                                             | ø0.03mm opaque object        | 1m                                                 | R1mm                                      | <b>FT-H30-M1V-S</b>                                                                          |

## Optical Fibers for FX 300 Series

### Retroreflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type                                     | Shape of fiber head (mm)                                                            | Sensing range (mm) (Notes 2, 3)                                                                  | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> | <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div>  | Min. sensing object (Note 4)     | Fiber cable length<br>✂ : Free-cut | Bending radius      | Model no. |
|------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------|------------------------------------|---------------------|-----------|
| Sharp bending<br>With polarizing filters | W9.5 × H5.2 × D15<br>                                                               | <div>100 to 910</div> <div>100 to 730</div> <div>100 to 600</div> <div>100 to 520 (Note 3)</div> | Cannot use                                                                  | 100 to 460                                                   | ø0.3mm opaque object             | 2m                                 | R1 mm<br>R0.039 in  | FR-WKZ11  |
| Narrow beam                              | Top sending<br>W30 × H30 × D0.5<br>                                                 |                                                                                                  |                                                                             | 200                                                          | Horizontal: ø5.5mm opaque object | 2m                                 | R10 mm<br>R0.394 in | FR-KZ21   |
|                                          | Side sending<br>W10.6 × H28 × D10.1<br>W8.5 × H25 × D5.2<br>W10.6 × H28 × D10.1<br> | <div>200</div> <div>200</div> <div>200</div> <div>200</div>                                      |                                                                             | 200                                                          | Vertical: ø0.06mm opaque object  |                                    |                     | FR-KZ21E  |
| Water mapping                            | W7.5 × H2.2 × D11.2<br><br>W4 × H2 × D21.5                                          | <div>15 to 370</div> <div>15 to 330</div> <div>15 to 240</div> <div>15 to 210</div>              |                                                                             | <div>15 to 170</div> <div>15 to 80</div> <div>15 to 90</div> | ø0.12mm opaque object            | 2m                                 | R10 mm<br>R0.394 in | FR-KV1    |

### Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type          | Shape of fiber head (mm)      | Sensing range (mm) (Notes 1, 2)                             | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> | <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 3) | Fiber cable length<br>✂ : Free-cut | Bending radius                            | Model no. |
|---------------|-------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------|------------------------------------|-------------------------------------------|-----------|
| Threaded type | M6<br>                        | <div>600</div> <div>480</div> <div>280</div> <div>220</div> |                                                                             | 160                                                         | ø0.02mm gold wire            | 2m                                 | R25mm                                     | FD-B8     |
|               | Coaxial M6<br>                | <div>410</div> <div>310</div> <div>200</div> <div>140</div> |                                                                             | 100                                                         |                              |                                    |                                           | FD-FM2    |
|               | Sleeve 90mm<br>M6<br>ø2.5<br> | <div>370</div> <div>270</div> <div>170</div> <div>110</div> |                                                                             | 85                                                          |                              |                                    | Fiber R25mm Sleeve<br>R10 mm<br>R0.394 in | FD-FM2S   |
|               | Sleeve 40mm<br>M6<br>ø2.5<br> |                                                             |                                                                             | 45                                                          |                              |                                    |                                           | FD-FM2S4  |
|               | M6<br>                        | <div>250</div> <div>190</div> <div>110</div> <div>90</div>  |                                                                             | 60                                                          |                              |                                    | R1 mm<br>R0.039 in                        | FD-W8     |
|               | M6<br>                        | <div>300</div> <div>220</div> <div>130</div> <div>100</div> |                                                                             | 70                                                          |                              |                                    | R4 mm<br>R0.157 in Flexible               | FD-P80    |
|               | M6<br>                        | <div>270</div> <div>185</div> <div>100</div> <div>80</div>  |                                                                             | 60                                                          |                              |                                    | R10 mm<br>R0.394 in                       | FD-P81X   |
|               | Tough flexible<br>            |                                                             |                                                                             | 30                                                          |                              | 1m                                 |                                           |           |
| Elbow         | M6<br>                        | <div>240</div> <div>185</div> <div>110</div> <div>85</div>  |                                                                             | 60                                                          | ø0.02mm gold wire            | 2m                                 | R25mm                                     | FD-R80    |

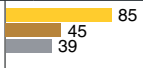
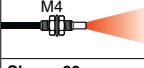
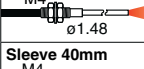
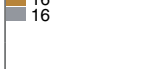
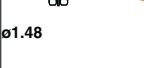
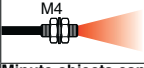
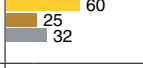
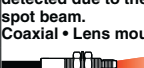
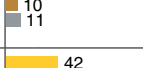
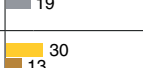
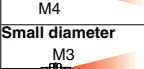
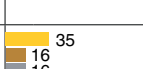
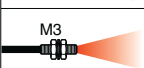
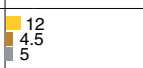
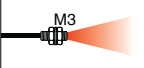
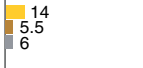
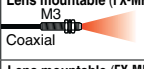
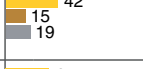
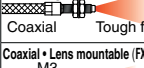
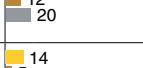
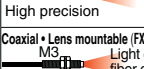
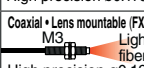
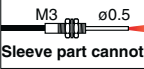
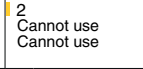
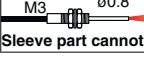
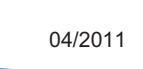
Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

### Optical Fibers for FX 300 Series

#### Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type          | Shape of fiber head (mm)                                                                                 | Sensing range (mm) (Notes 1, 2)                                                                               | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 3) | Fiber cable length<br>✂ : Free-cut                                                                   | Bending radius                                         | Model no.  |
|---------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------|
| Threaded type | M4                                                                                                       | <br>370<br>270<br>170<br>110 | <br>85<br>45<br>39                                     | ø0.02mm gold wire            | <br>2m            | R25mm                                                  | FD-T80     |
|               | M4                                                                                                       |                              |                                                                                                                                         |                              |                                                                                                      | R25mm                                                  | FD-NFM2    |
|               | Sleeve 90 mm<br>M4<br>ø1.48                                                                              | <br>140<br>90<br>60<br>45    | <br>35<br>16<br>16                                     |                              |                                                                                                      | Fiber R25mm Sleeve<br>R10 mm<br>R0.394 in              | FD-NFM2S   |
|               | Sleeve 40mm<br>M4<br>ø1.48                                                                               |                              |                                                                                                                                         |                              |                                                                                                      | R10 mm<br>R0.394 in                                    | FD-NFM2S4  |
|               | Sleeve 40mm 1.575 in<br>M4<br>ø1.48                                                                      | <br>40<br>30<br>18<br>15     | <br>12<br>4.5<br>5                                     |                              |                                                                                                      | Fiber R1 mm<br>R0.039 in<br>Sleeve R10 mm<br>R0.394 in | FD-W44     |
|               | M4                                                                                                       | <br>250<br>190<br>110<br>90 | <br>60<br>25<br>32                                    |                              |                                                                                                      | R1 mm<br>R0.039 in                                     | FD-WT8     |
|               | Minute objects can be detected due to the small spot beam.<br>Coaxial • Lens mountable                   | <br>85<br>65<br>37<br>32   | <br>25<br>10<br>11                                   |                              |                                                                                                      | R2 mm<br>R0.079 in                                     | FD-WG4     |
|               | M4                                                                                                       | <br>150<br>110<br>65<br>55 | <br>42<br>15<br>19                                   |                              |                                                                                                      | R25mm                                                  | FD-G4      |
|               | M4                                                                                                       | <br>130<br>90<br>55<br>45  | <br>30<br>13<br>16                                   |                              |                                                                                                      | R4 mm<br>R0.157 in<br>Flexible                         | FD-P60     |
|               | Small diameter<br>M3                                                                                     | <br>140<br>90<br>60<br>45  | <br>35<br>16<br>16                                   | ø0.02mm gold wire            | <br>2m          | R25mm                                                  | FD-T40     |
|               | M3                                                                                                       | <br>40<br>30<br>18<br>15   | <br>12<br>4.5<br>5                                   |                              |                                                                                                      | R1 mm<br>R0.039 in                                     | FD-WT4     |
|               | M3                                                                                                       | <br>50<br>36<br>20<br>18   | <br>14<br>5.5<br>6                                   |                              |                                                                                                      | R4 mm<br>R0.157 in<br>Flexible                         | FD-P40     |
|               | Lens mountable (FX-MR3, FX-MR6)<br>M3<br>Coaxial                                                         | <br>150<br>110<br>65<br>55 | <br>42<br>15<br>19                                   |                              |                                                                                                      | R25mm                                                  | FD-G6      |
|               | Lens mountable (FX-MR3, FX-MR6)<br>M3<br>Coaxial Tough flexible                                          | <br>150<br>90<br>48<br>45  | <br>35<br>12<br>20                                   |                              | <br>1m (Note 4) | R10 mm<br>R0.394 in                                    | FD-G6X     |
|               | Coaxial • Lens mountable (FX-MR3, FX-MR6)<br>M3<br>High precision                                        | <br>50<br>38<br>25<br>18   | <br>14<br>5<br>6                                     |                              |                                                                                                      | R25mm                                                  | FD-EG1     |
|               | Coaxial • Lens mountable (FX-MR3, FX-MR6)<br>M3<br>Light emitting fiber element<br>High precision ø0.175 | <br>40<br>25<br>14<br>12   | <br>9<br>3<br>5                                      | ø0.04mm gold wire            | 500mm                                                                                                | R10 mm<br>R0.394 in                                    | FD-EG2     |
|               | Coaxial • Lens mountable (FX-MR3, FX-MR6)<br>M3<br>Light emitting fiber element<br>High precision ø0.125 | <br>20<br>15<br>9<br>8     | <br>5<br>2.5<br>3                                    |                              |                                                                                                      |                                                        | FD-EG3     |
|               | M3<br>Sleeve part cannot be bent.                                                                        | <br>6.5<br>5<br>3<br>3     | <br>2<br>Cannot use<br>Cannot use                    | ø0.02mm gold wire            | 1m                                                                                                   | R25mm                                                  | FD-EN500S1 |
|               | Coaxial<br>M3<br>Sleeve part cannot be bent.                                                             | <br>50<br>38<br>20<br>18   | <br>14<br>5<br>6                                     |                              |                                                                                                      |                                                        | FD-ENM1S1  |

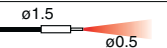
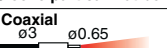
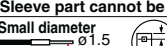
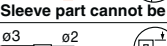
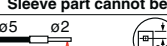
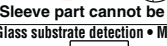
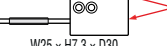
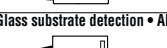
Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

## Optical Fibers for FX 300 Series

### Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type                                                                                                                                                  | Shape of fiber head (mm)   | Sensing range (mm) (Notes 1, 2)                                                                                                                                                                                                                                   | <div><div>U-LG</div><div>LONG</div><div>STDF</div><div>STD</div></div> <div><div>FAST</div><div>H-SP</div><div>S-D</div></div>         | Min. sensing object (Note 3)                                                                | Fiber cable length<br>✂ : Free-cut                                                          | Bending radius                                                     | Model no. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-----------|
| Cylindrical type                                                                                                                                      | ø3                         |  <div><div>370</div><div>270</div><div>170</div><div>110</div></div>                                                                                                             | <div><div>85</div><div>45</div><div>39</div></div>                                                                                     | ø0.02mm gold wire                                                                           | <br>2m   | R25mm                                                              | FD-S80    |
|                                                                                                                                                       |                            |  <div><div>250</div><div>190</div><div>110</div><div>90</div></div>                                                                                                              | <div><div>60</div><div>25</div><div>32</div></div>                                                                                     | ø0.02mm gold wire                                                                           | <br>2m   | <div><div>R1 mm</div><div>R0.039 in</div></div>                    | FD-WS8    |
|                                                                                                                                                       |                            |  <div><div>85</div><div>65</div><div>37</div><div>32</div></div>                                                                                                                 | <div><div>25</div><div>10</div><div>11</div></div>                                                                                     | ø0.02mm gold wire                                                                           | <br>2m   | <div><div>R2 mm</div><div>R0.079 in</div></div>                    | FD-WSG4   |
|                                                                                                                                                       |                            |  <div><div>130</div><div>90</div><div>55</div><div>45</div></div>                                                                                                                | <div><div>30</div><div>13</div><div>16</div></div>                                                                                     | ø0.02mm gold wire                                                                           | <br>2m   | <div><div>R4 mm</div><div>R0.157 in</div><div>Flexible</div></div> | FD-P50    |
|                                                                                                                                                       | ø2.5                       |  <div><div>140</div><div>90</div><div>60</div><div>45</div></div>                                                                                                                | <div><div>35</div><div>16</div><div>16</div></div>                                                                                     | ø0.02mm gold wire                                                                           | <br>2m   | R25mm                                                              | FD-SNFM2  |
|                                                                                                                                                       | ø1.5                       |  <div><div>80</div><div>50</div><div>30</div><div>25</div></div>                                                                                                                 | <div><div>19</div><div>7.5</div><div>9</div></div>                                                                                     | ø0.02mm gold wire                                                                           | 1m                                                                                          | <div><div>R4 mm</div><div>R0.157 in</div><div>Flexible</div></div> | FD-P2     |
|                                                                                                                                                       | Ultra small diameter       |  <div><div>15</div><div>11</div><div>8</div><div>6</div></div>                                                                                                                   | <div><div>4</div><div>2</div><div>1</div></div>                                                                                        | ø0.02mm gold wire                                                                           | 1m                                                                                          | <div><div>R10 mm</div><div>R0.394 in</div></div>                   | FD-E12    |
|                                                                                                                                                       |                            |  <div><div>65</div><div>45</div><div>28</div><div>23</div></div>                                                                                                                 | <div><div>17</div><div>8</div><div>7</div></div>                                                                                       | ø0.02mm gold wire                                                                           |                                                                                             | R25mm                                                              | FD-E22    |
|                                                                                                                                                       | Side-view                  |  <div><div>80</div><div>55</div><div>30</div><div>25</div></div>                                                                                                               | <div><div>17</div><div>8</div><div>9</div></div>                                                                                       | ø0.02mm gold wire                                                                           | <br>2m | R25mm                                                              | FD-V41    |
|                                                                                                                                                       |                            |  <div><div>20</div><div>15</div><div>8.5</div><div>7</div></div>                                                                                                               | <div><div>5</div><div>Cannot use</div><div>Cannot use</div></div>                                                                      | ø0.02mm gold wire                                                                           | <br>2m | <div><div>R1 mm</div><div>R0.039 in</div></div>                    | FD-WV42   |
|  <div><div>170</div><div>100</div><div>55</div><div>45</div></div> |                            | <div><div>32</div><div>15</div><div>16</div></div>                                                                                                                                                                                                                | ø0.02mm gold wire                                                                                                                      | <br>2m | R25mm                                                                                       | FD-SFM2SV2                                                         |           |
| Rectangular                                                                                                                                           | Convergent reflective type |  <div><div>12 to 50</div><div>12.5 to 37.5</div><div>15 to 36</div><div>15 to 35</div></div>                                                                                   | <div><div>16 to 29</div><div>Cannot use</div><div>Cannot use</div></div>                                                               | ø0.3mm gold wire                                                                            | <br>4m | R25mm                                                              | FD-L46    |
|                                                                                                                                                       |                            |  <div><div>0 to 50</div><div>0 to 36</div><div>0 to 33</div><div>0 to 30</div></div>                                                                                           | <div><div>0 to 30</div><div>0 to 15</div><div>0 to 21</div></div>                                                                      | (LCD glass)                                                                                 | <br>3m | <div><div>R4 mm</div><div>R0.157 in</div></div>                    | FD-L45    |
|                                                                                                                                                       |                            |  <div><div>0 to 23</div></div>                                                                                                                                                 | <br>2m                                            |                                                                                             | FD-L43                                                                                      |                                                                    |           |
|                                                                                                                                                       |                            |  <div><div>0 to 8.2</div><div>0 to 7</div><div>0 to 6.5</div><div>0 to 6</div></div>                                                                                           | <div><div>0 to 5.7</div><div>0 to 5</div><div>0 to 5.2</div></div>                                                                     | ø0.03mm gold wire                                                                           | <br>2m | <div><div>R10 mm</div><div>R0.394 in</div></div>                   | FD-L44    |
|                                                                                                                                                       |                            | <div><div>0 to 4.7</div><div>0 to 4.5</div><div>0 to 4</div><div>0 to 4</div></div>                                                                                                                                                                               | <div><div>0 to 3.8</div><div>0 to 3</div><div>0 to 3.5</div></div>                                                                     |                                                                                             |                                                                                             |                                                                    | FD-L44S   |
|                                                                                                                                                       |                            |  <div><div>6.5 to 14.5 (Convergent point 8)</div><div>6.5 to 14 (Convergent point 8)</div><div>7 to 14 (Convergent point 8)</div><div>7 to 12 (Convergent point 8)</div></div> | <div><div>7.5 to 12 (Convergent point 8)</div><div>Cannot use</div><div>Cannot use</div></div>                                         | ø1.9mm metal pipe (gray)                                                                    | <br>2m | <div><div>R1 mm</div><div>R0.039 in</div></div>                    | FD-WL41   |
|                                                                                                                                                       |                            | <div><div>2 to 19 (Convergent point 8)</div><div>2.5 to 18 (Convergent point 8)</div><div>3 to 16 (Convergent point 8)</div><div>3 to 16 (Convergent point 8)</div></div>                                                                                         | <div><div>3.5 to 15 (Convergent point 8)</div><div>Cannot use</div><div>Cannot use</div></div>                                         | ø0.06mm gold wire                                                                           | <br>2m | <div><div>R10 mm</div><div>R0.394 in</div></div>                   | FD-L41    |
|                                                                                                                                                       |                            |  <div><div>2 to 20 (Convergent point 6)</div><div>2.5 to 18 (Convergent point 6)</div><div>4 to 12 (Convergent point 6)</div><div>4 to 12 (Convergent point 6)</div></div>     | <div><div>4.5 to 11 (Convergent point 6)</div><div>5 to 8.5 (Convergent point 6)</div><div>4.8 to 9.5 (Convergent point 6)</div></div> | ø0.02mm gold wire                                                                           | <br>2m |                                                                    | FD-L4     |
|                                                                                                                                                       |                            |  <div><div>0.5 to 8.5</div><div>0.5 to 7.5</div><div>1 to 6.5</div><div>1 to 5.5</div></div>                                                                                   | <div><div>1 to 5</div><div>Cannot use</div><div>Cannot use</div></div>                                                                 | ø0.3mm copper wire                                                                          | <br>1m | <div><div>R1 mm</div><div>R0.039 in</div></div>                    | FD-WL48   |

Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

# Standard Fibers

## Optical Fibers for FX 300 Series

### Reflective type

FX-305 / FX-301 (Red LED type) sensing range (Note 1)



The FX-305 and FX-301(-HS) have different sensing modes.  
**FX-305:** H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS):** S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type        | Shape of fiber head (mm)                                  | Sensing range (mm) (Notes 1, 2)                                                                                                                                      | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div> <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 3) | Fiber cable length<br>✂ : Free-cut | Bending radius                                          | Model no. |
|-------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------|---------------------------------------------------------|-----------|
| Rectangular | Front sensing<br>                                         | <div> <div>1 to 50</div> <div>1.5 to 34</div> <div>2 to 24</div> <div>3 to 17</div> </div>                                                                           | <div>3 to 10</div> <div>Cannot use</div> <div>Cannot use</div>                                                                          | ø0.16mm copper wire          | ✂<br>1m                            |                                                         | FD-WZ4    |
|             | Fiber bending type<br>                                    | <div> <div>1 to 70</div> <div>1 to 46</div> <div>1 to 32.2</div> <div>2.5 to 23</div> </div>                                                                         | <div>2.5 to 15</div> <div>3 to 7</div> <div>3 to 7</div>                                                                                |                              |                                    |                                                         | FD-WZ4HB  |
|             | Front sensing<br>                                         | <div> <div>200</div> <div>120</div> <div>1 to 84</div> <div>1 to 60</div> </div>                                                                                     | <div>1.5 to 35</div> <div>2.5 to 18</div> <div>2.5 to 18</div>                                                                          | ø0.03mm gold wire            | ✂<br>2m                            |                                                         | FD-WZ7    |
|             | Fiber bending type<br>                                    | <div> <div>0.5 to 270</div> <div>0.5 to 180</div> <div>1 to 126</div> <div>1 to 90</div> </div>                                                                      | <div>1 to 70</div> <div>1 to 35</div> <div>1 to 35</div>                                                                                |                              |                                    | R1 mm<br>R0.039 in                                      | FD-WZ7HB  |
| Special     | Long sensing range • Rectangular head<br>                 | <div> <div>20 to 660</div> <div>20 to 480</div> <div>20 to 300</div> <div>20 to 230</div> </div>                                                                     | <div>20 to 170</div> <div>25 to 90</div> <div>25 to 100</div>                                                                           | ø0.3mm copper wire           | ✂<br>2m                            | R1 mm<br>R0.039 in                                      | FD-WKZ1   |
|             | Wide beam<br>                                             | <div> <div>230</div> <div>200</div> <div>150</div> <div>150</div> </div>                                                                                             | <div>100</div> <div>45</div> <div>50</div>                                                                                              | ø0.02mm gold wire            | ✂<br>2m                            | R25mm                                                   | FD-A15    |
|             | Top sensing<br>                                           | <div> <div>290</div> <div>220</div> </div>                                                                                                                           | <div>78</div> <div>35</div>                                                                                                             | ø0.02mm gold wire            | ✂<br>2m                            | R25mm                                                   | FD-AFM2   |
|             | Side sensing<br>                                          | <div> <div>135</div> <div>110</div> </div>                                                                                                                           | <div>39</div>                                                                                                                           |                              |                                    |                                                         | FD-AFM2E  |
|             | Contact type<br>                                          | —                                                                                                                                                                    | —                                                                                                                                       | (Liquid)                     | ✂<br>2m<br>(Note 5)                | Protective tube<br>R40mm<br>Fiber<br>R15mm              | FD-F8Y    |
|             | Mountable on pipe • Standard<br>                          | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe<br>PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass,<br>wall thickness 1 to 3mm |                                                                                                                                         |                              | ✂<br>2m                            | R10 mm<br>R0.394 in                                     | FD-F41    |
|             | Mountable on pipe • For PFA, wall thickness 1 mm pipe<br> | Applicable pipe diameter: Outer dia. ø6 to ø26mm transparent pipe<br>PFA (fluorine resin) or equivalently transparent pipe,<br>wall thickness 1mm                    |                                                                                                                                         |                              |                                    |                                                         | FD-F4     |
| Special     | Mountable on pipe SEMI S2 compliant<br>                   | Applicable pipe diameter: Outer dia. ø3 to ø10mm transparent pipe<br>PFA (fluorine resin) or equivalently transparent pipe,<br>wall thickness 0.3 to 1mm             |                                                                                                                                         | (Liquid)                     | ✂<br>2m                            | Protective tube<br>R20mm<br>Fiber<br>R4 mm<br>R0.157 in | FT-F902   |
|             | SEMI S2 compliant<br>                                     | —                                                                                                                                                                    | —                                                                                                                                       | (Liquid)                     | ✂<br>5m<br>(Protective tube: 3m)   | Protective tube<br>R20mm<br>Fiber<br>R4 mm<br>R0.157 in | FD-F705   |

Pliable fibers (flexible and sharp bending fibers) are marked with light red in the table.

## Optical Fibers for FX 300 Series

### Reflective type



The **FX-305** and **FX-301(-HS)** have different sensing modes.  
**FX-305**: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
**FX-301(-HS)**: S-D, H-SP (Note 1), FAST, STD, LONG (no STDF or U-LG mode)

| Type    | Shape of fiber head (mm)                                                          | Sensing range (mm) (Notes 1, 2)                                                                  | <div> <div>U-LG</div> <div>LONG</div> <div>STDF</div> <div>STD</div> </div>   | <div> <div>FAST</div> <div>H-SP</div> <div>S-D</div> </div> | Min. sensing object (Note 3) | Fiber cable length<br><div> <div>Free-cut</div> </div> | Bending radius                         | Model no.     |
|---------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------|--------------------------------------------------------|----------------------------------------|---------------|
| Special | Heat-resistant                                                                    |                                                                                                  |                                                                               |                                                             |                              |                                                        |                                        |               |
|         | 350°C • Coaxial<br>M6                                                             |                                                                                                  |                                                                               |                                                             |                              | 2m                                                     | R25mm                                  | FD-H35-M2     |
|         | 350°C • Sleeve 60mm<br>M6, ø2.8                                                   | <div> <div>300</div> <div>270</div> <div>150</div> <div>140</div> </div>                         | <div> <div>35</div> <div>47</div> </div>                                      | 100                                                         |                              |                                                        | Fiber R25mm Sleeve<br>R10 mm R0.394 in | FD-H35-M2S6   |
|         | 200°C • Coaxial<br>M6                                                             |                                                                                                  |                                                                               |                                                             |                              |                                                        | R25mm                                  | FD-H20-M1     |
|         | 350°C • Sleeve 90mm<br>M4, ø2.1                                                   | <div> <div>190</div> <div>160</div> <div>80</div> <div>80</div> </div>                           | <div> <div>57</div> <div>20</div> <div>26</div> </div>                        |                                                             |                              | 1m                                                     | Fiber R25mm Sleeve<br>R10 mm R0.394 in | FD-H35-20S    |
|         | 200°C • Coaxial<br>M4                                                             | <div> <div>300</div> <div>270</div> <div>150</div> <div>140</div> </div>                         | <div> <div>35</div> <div>47</div> </div>                                      | 100                                                         |                              |                                                        |                                        | FD-H20-21     |
|         | 300°C • Glass substrate detection<br>Convergent reflective type<br>W19 × H27 × D5 | <div> <div>0 to 20</div> <div>0 to 15</div> <div>0 to 10</div> <div>0 to 10</div> </div>         | <div> <div>1 to 8</div> <div>Cannot use</div> <div>2 to 6</div> </div>        |                                                             |                              | 2m                                                     |                                        | FD-H30-L32    |
|         | 180°C • Glass substrate detection<br>Convergent reflective type<br>W19 × H27 × D  | <div> <div>0 to 20</div> <div>0 to 15</div> <div>0 to 10</div> <div>0 to 10</div> </div>         | <div> <div>1 to 8</div> <div>Cannot use</div> <div>2 to 6</div> </div>        |                                                             |                              |                                                        | R25mm                                  | FD-H18-L31    |
|         | 130°C • Coaxial<br>M6                                                             | <div> <div>410</div> <div>310</div> <div>200</div> <div>140</div> </div>                         | <div> <div>55</div> <div>47</div> </div>                                      | 100                                                         |                              | 2m                                                     |                                        | FD-H13-FM2    |
|         | Vacuum-resistant                                                                  |                                                                                                  |                                                                               |                                                             |                              |                                                        |                                        |               |
|         | 300°C • Rectangular head<br>W9.5 × H5.2 × D15                                     | <div> <div>20 to 300</div> <div>20 to 200</div> <div>20 to 150</div> <div>25 to 130</div> </div> | <div> <div>30 to 100</div> <div>Cannot use</div> <div>Cannot use</div> </div> |                                                             |                              | 1m                                                     | R18mm                                  | FD-H30-KZ1V-S |
|         | 300°C • Glass substrate detection<br>Convergent reflective type<br>W19 × H5 × D27 | <div> <div>0 to 11</div> <div>0 to 8</div> <div>1.5 to 6</div> <div>1.5 to 5</div> </div>        | <div> <div>2 to 4</div> <div>Cannot use</div> <div>Cannot use</div> </div>    |                                                             |                              | 3m                                                     |                                        | FD-H30-L32V-S |

### Accessories (attached with fibers)

- RF-003 (FR-KZ21/KZ21E exclusive reflector)
- RF-13 (Reflective tape)
- FX-CT1 (Fiber cutter)
- FX-CT2 (Fiber cutter)
- FX-AT2 (Attachment for fixed-length fiber, Orange)
- FX-AT3 (Attachment for ø2.2mm fiber, Transparent orange)
- FX-AT4 (Attachment for ø1mm fiber, Black)
- FX-AT5 (Attachment for ø1.3mm fiber, Gray)
- FX-AT6 (Attachment for ø1mm / ø1.3mm mixed fiber, Black / Gray)

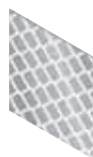
### If connecting to the FX2 / FX3 series

- FX-AT10 (Attachment for ø1mm fiber)
- FX-AT13 (Attachment for ø1.3mm fiber)
- FX-AT15 (Attachment for ø1mm / ø1.3mm mixed fiber)

• RF-003



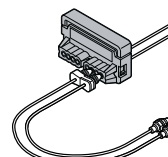
• RF-13



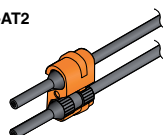
• FX-CT1



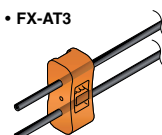
• FX-CT2



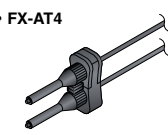
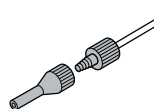
• FX-AT2



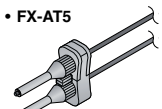
• FX-AT3



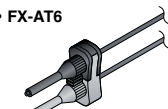
• FX-AT4


• FX-AT10  
• FX-AT13  
• FX-AT15


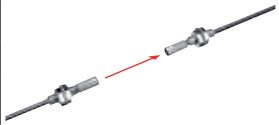
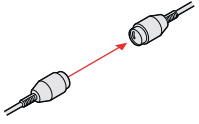
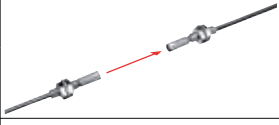
• FX-AT5



• FX-AT6



### Accessories for the FX 300 Series

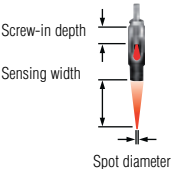
| Accessories for retroreflective fiber optics                                       |                                                                                                             |              |                |                 |           |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------|----------------|-----------------|-----------|
| Figure                                                                             | Description                                                                                                 | Fiber optics | Sensing range* | Sensing range** | Model no. |
|    | Effective distance expanded 5 times or more;<br>Ambient temperature: -60°C to +350°C                        | FT-B8        | 2500           | 3500            | FX-LE1    |
|                                                                                    |                                                                                                             | FT-FM2       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-T80       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-R80       | 2300           | 3500            |           |
|                                                                                    |                                                                                                             | FT-W8        | 2900           | 3500            |           |
|                                                                                    |                                                                                                             | FT-P80       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-P60       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-H35M2     | 2000           | 3500            |           |
|                                                                                    |                                                                                                             | FT-H20WM1    | 1300           | 1600            |           |
|                                                                                    |                                                                                                             | FT-H20WM2    | 1300           | 3500            |           |
|                                                                                    |                                                                                                             | FT-H20M1     | 1600           | 1000            |           |
|                                                                                    |                                                                                                             |              |                |                 |           |
|  | Tremendously increases the sensing range with large diameter lenses<br>Ambient temperature: -60°C to +350°C | FT-B8        | 3500           | 3500            | FX-LE2    |
|                                                                                    |                                                                                                             | FT-FM2       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-T80       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-R80       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-W8        | 2900           | 3500            |           |
|                                                                                    |                                                                                                             | FT-P80       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-P60       | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-H35M2     | 3500           | 3500            |           |
|                                                                                    |                                                                                                             | FT-H20WM1    | 1600           | 1600            |           |
|                                                                                    |                                                                                                             | FT-H20WM2    | 3500           | 1600            |           |
|                                                                                    |                                                                                                             | FT-H20M1     | 1600           | 1600            |           |
|                                                                                    |                                                                                                             | FT-H13       | 3500           | 1600            |           |
|  | Beam axis is bent by 90°<br>Ambient temperature: -60°C to +350°C                                            | FT-B8        | 530            | 1100            | FX-SV1    |
|                                                                                    |                                                                                                             | FT-FM2       | 600            | 1200            |           |
|                                                                                    |                                                                                                             | FT-T80       | 600            | 1200            |           |
|                                                                                    |                                                                                                             | FT-W8        | 450            | 900             |           |
|                                                                                    |                                                                                                             | FT-P80       | 600            | 1200            |           |
|                                                                                    |                                                                                                             | FT-P60       | 300            | 650             |           |
|                                                                                    |                                                                                                             | FT-H35M2     | 280            | 550             |           |
|                                                                                    |                                                                                                             | FT-H20WM1    | 140            | 310             |           |
|                                                                                    |                                                                                                             | FT-H20WM2    | 140            | 310             |           |
|                                                                                    |                                                                                                             | FT-H20M1     | 280            | 550             |           |
|  | Sensing range increases by 15 times or more<br>Ambient temperature: -40°C to +120°C                         | FT-6V        | 2700           | 3500            | FV-LE1    |
|                                                                                    |                                                                                                             | FT-60V       | 1450           | 3500            |           |

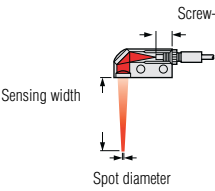
\* Refers to response time "Standard"

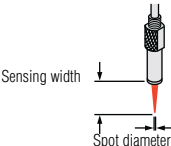
\*\* Refers to response time "Ultralong"

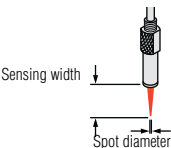
## Accessories for the FX Series

| Accessories for retroreflective fiber optics                                      |                                                                                                                                                         |                                  |                |               |           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|---------------|-----------|
| Figure                                                                            | Description                                                                                                                                             | Effective distance (with FX-301) |                |               | Model no. |
|                                                                                   |                                                                                                                                                         | Fiber                            | Screw-in depth | Spot diameter |           |
|  | Pinpoint spot of Ø 0.5mm enables detection of minute objects or small marks<br>Applicable fibers: FD-WG4 / FD-G4<br>Ambient temperature: -40°C to +70°C | FD-WG4                           | 6mm ± 1mm      | Ø 0.5mm       | FX-MR1    |
|                                                                                   |                                                                                                                                                         | FD-G4                            | 6mm ± 1mm      | Ø 0.5mm       |           |

| Figure                                                                             | Description                                                                                                                             | Effective distance (with FX-301) |                |                |               | Model no. |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|----------------|---------------|-----------|
|                                                                                    |                                                                                                                                         | Fiber                            | Screw-in depth | Sensing width  | Spot diameter |           |
|  | The spot diameter is adjustable from 0.7mm to Ø2mm according to how far the fiber is screwed in.<br>Ambient temperature: -40°C to +70°C | FD-WG4                           | 7mm            | approx. 18.5mm | Ø 0.7mm       | FX-MR2    |
|                                                                                    |                                                                                                                                         |                                  | 12mm           | approx. 27mm   | Ø 1.2mm       |           |
|                                                                                    |                                                                                                                                         |                                  | 14mm           | approx. 43mm   | Ø 2.0mm       |           |
|                                                                                    |                                                                                                                                         | FD-G4                            | 7mm            | approx. 18.5mm | Ø 0.7mm       |           |
|                                                                                    |                                                                                                                                         |                                  | 12mm           | approx. 27mm   | Ø 1.2mm       |           |
|                                                                                    |                                                                                                                                         |                                  | 14mm           | approx. 43mm   | Ø 2.0mm       |           |

| Figure                                                                              | Description                                                                                                                   | Effective distance (with FX-301) |                |               |               | Model no. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|---------------|---------------|-----------|
|                                                                                     |                                                                                                                               | Fiber                            | Screw-in depth | Sensing width | Spot diameter |           |
|  | FX-MR2 is converted into a side sensing type and can be mounted in a very small space.<br>Ambient temperature: -40°C to +70°C | FD-WG4                           | 8mm            | approx. 13mm  | Ø 0.5mm       | FX-MR5    |
|                                                                                     |                                                                                                                               |                                  | 10mm           | approx. 15mm  | Ø 0.8mm       |           |
|                                                                                     |                                                                                                                               |                                  | 14mm           | approx. 30mm  | Ø 3.0mm       |           |
|                                                                                     |                                                                                                                               | FD-G4                            | 8mm            | approx. 13mm  | Ø 0.5mm       |           |
|                                                                                     |                                                                                                                               |                                  | 10mm           | approx. 15mm  | Ø 0.8mm       |           |
|                                                                                     |                                                                                                                               |                                  | 14mm           | approx. 30mm  | Ø 3.0mm       |           |

| Figure                                                                              | Description                                                                            | Effective distance (with FX-301) |                |               | Model no. |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------|----------------|---------------|-----------|
|                                                                                     |                                                                                        | Fiber                            | Screw-in depth | Spot diameter |           |
|  | Extremely fine spot of approx. Ø 0.3mm achieved<br>Ambient temperature: -40°C to +70°C | FD-WG4                           | 7.5mm ± 0.5mm  | Ø 0.5mm       | FX-MR3    |
|                                                                                     |                                                                                        | FD-G4                            | 7.5mm ± 0.5mm  | Ø 0.5mm       |           |
|                                                                                     |                                                                                        | FD-EG1                           | 7.5mm ± 0.5mm  | Ø 0.3mm       |           |
|                                                                                     |                                                                                        | FD-EG3                           | 7.5mm ± 0.5mm  | Ø 0.15mm      |           |

| Figure                                                                              | Description                                                                            | Effective distance (with FX-301) |                |               | Model no. |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------|----------------|---------------|-----------|
|                                                                                     |                                                                                        | Fiber                            | Screw-in depth | Spot diameter |           |
|  | Extremely fine spot of approx. Ø 0.3mm achieved<br>Ambient temperature: -40°C to +70°C | FD-WG4                           | 7mm ± 0.5mm    | Ø 0.4mm       | FX-MR6    |
|                                                                                     |                                                                                        | FD-G4                            | 7mm ± 0.5mm    | Ø 0.4mm       |           |
|                                                                                     |                                                                                        | FD-EG1                           | 7mm ± 0.5mm    | Ø 0.2mm       |           |
|                                                                                     |                                                                                        | FD-EG3                           | 7mm ± 0.5mm    | Ø 0.1mm       |           |

FD-L40

# FD-L40

Fibers for liquid crystal display industry

## Features

### Mapping Fiber

FD-L46

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

### Variety of glass substrates

FD-L46

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 sensed in addition to clear glass.

### Alignment fiber

FD-L43 / FD-L45

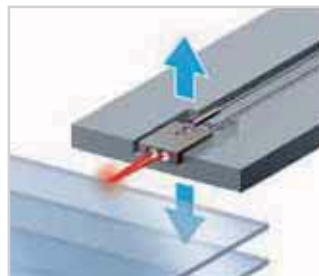
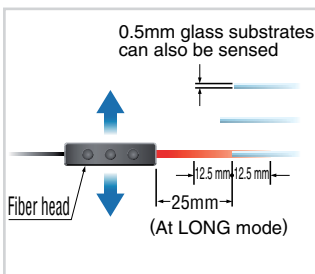
Increases in size of glass substrates mean greater amounts of flexure, but a single fiber can sense glass even if horizontal flexure is within  $\pm 8^\circ$  (FD-L45%  $\pm 6^\circ$ ).

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

### Seating confirmation fiber

FD-L44 / FD-L44S / FD-WL48

Long sensing range of 0 to 7mm for seating confirmation. Sensing is even possible if absorption pads are present.



## Technical Specifications

|                           |                                                  |
|---------------------------|--------------------------------------------------|
| Applicable amplifiers:    | FX-100/301/305/311/411 series red LED type       |
|                           | FD-L46 12.5 to 37.5mm (LONG mode)                |
|                           | FD-L43 0 to 23mm (STD mode)                      |
|                           | FD-L44 0 to 7mm (LONG mode)                      |
| Sensing range (Note 1):   | FD-L44S 0 to 4.5mm (LONG mode)                   |
|                           | FD-L45 0 to 36mm (LONG mode)                     |
|                           | FD-WL48 0.5 to 7.5mm (LONG mode)                 |
| Allowable bending radius: | FD-L46 R25mm or more, FD-L45/FD-L43 R4mm or more |
|                           | FD-L44(S) R10mm or more, FD-WL48 R1mm or more    |
| Fiber cable length:       | FD-L46 4m (free-cut), FD-L43/44(S) 2m (free-cut) |
|                           | FD-L45 3m (free-cut), FD-WL48 1m (free-cut)      |

# FT/FD-V

FT/FD-V

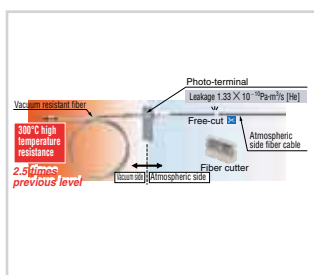


## Vacuum resistant fiber

### Features

#### ■ Usable in high temperatures of 300°C and vacuum

Highly reliable sensing of objects is possible even after high-temperature processing used in FPD manufacturing.



#### ■ Compact routing

We have realized a bending radius of R18mm.



#### ■ Highly durable

It can be bent over 100,000 times (at R20mm).



### Technical Specifications

|                                                  |                                                                                                   |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Applicable amplifiers:                           | FX-100/301/305/311/411 series                                                                     |
| Sensing range<br>(at LONG mode of red LED type): | FT-H30-M1V 250mm<br>FD-H30-KZ1V 20 to 200mm<br>FD-H30-L32V 0 to 8mm                               |
| Allowable bending radius:                        | FD-L46 R25mm or more, FD-L45/FD-L43 R4mm or more<br>FD-L44(S) R10mm or more, FD-WL48 R1mm or more |
| Fiber cable length:                              | FD-L46 4m (free-cut), FD-L43/44(S) 2m (free-cut)<br>FD-L45 3m (free-cut), FD-WL48 1m (free-cut)   |

## EX-F70/F60

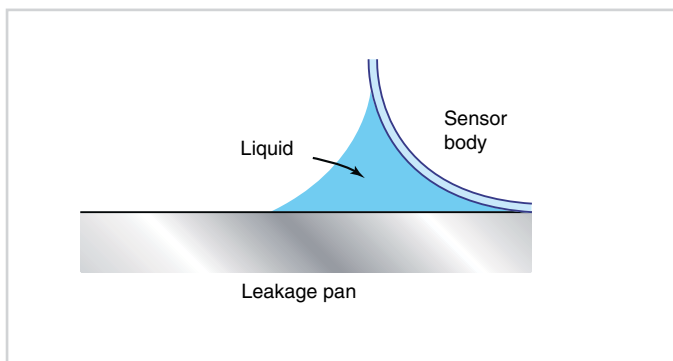


High-speed detection of even small liquid leaks

### Features

#### ■ Reliable detection

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



#### ■ PFA enclosure gives excellent chemical resistance

Accurate sensing can be obtained even if there are leaks of chemicals such as sulfuric acid, hydrochloric acid or ammonia

#### ■ Safe design

If the sensor is installed incorrectly, the cable breaks or a sensor problem occurs, the same output is used as for a liquid leak. This guards against human error in setup that might occur during maintenance.

#### ■ Compact, space-saving

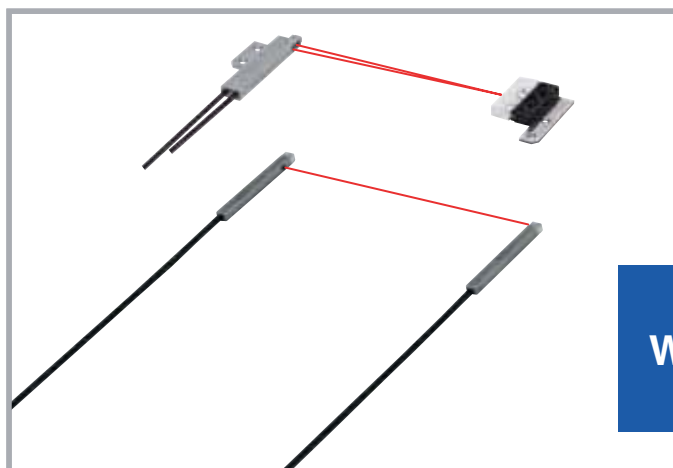
The **EX-F70** series is a slim (10mm) side mounting sensor. The **EX-F60** series is compact at 26×19×9mm (W×H×D), so that it can be used even in narrow spaces.

### Technical Specifications

|                          |                                                                                                                                    |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sensing object:</b>   | <b>EX-F7□</b> Water, Fluorinert™<br><b>EX-F6□</b> Agent, such as sulfuric acid, hydrochloric acid, phosphoric acid or ammonia etc. |
| <b>Supply voltage:</b>   | 12 to 24VDC±10%                                                                                                                    |
| <b>Output:</b>           | <b>EX-F7□/F6□</b> NPN open-collector transistor<br><b>EX-F7□/F6□</b> PNP open-collector transistor                                 |
| <b>Response time:</b>    | 50ms or less                                                                                                                       |
| <b>Emitting element:</b> | Infrared LED (non-modulated)                                                                                                       |

# FR-KV1

FR-KV1



## Wafer mapping fiber

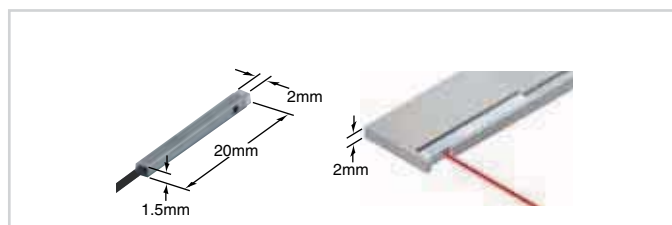
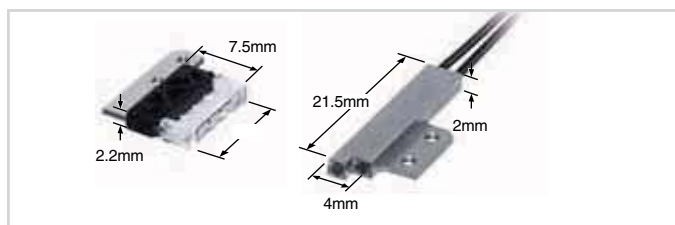
## Features

### ■ Retroreflective type: new concept

A 2.0mm fiber head and an ultrathin 2.2mm reflector allow these sensors to be mounted even in thin robot hands. Since they are retroreflective type fibers, the amount of wiring needed can be reduced, and the robot hands require less processing and so can be kept strong. A heat-resistant type that can resist heat of +105°C is also available.

### ■ Thru-beam type: ultra compact size

The ultra compact size of 2×1.52×20mm (W×H×D) means that mounting is possible even in places such as robot hands where space is limited. Furthermore, a heat-resistant type that can resist heat of +105°C is also available.



FT-KV1 fiber can be embedded into a plate with a thickness of 2mm.

## Technical Specifications

|                                                  |                                                                  |
|--------------------------------------------------|------------------------------------------------------------------|
| Applicable amplifiers:                           | FX-100/301/305/311/411 series                                    |
| Sensing range:<br>(at LONG mode of red LED type) | Retroreflective type 15 to 330mm<br>(Note: thru-beam type 500mm) |
| Allowable bending radius:                        | R10mm or more                                                    |
| Fiber cable length:                              | 2m (free-cut)                                                    |

# FD-F705

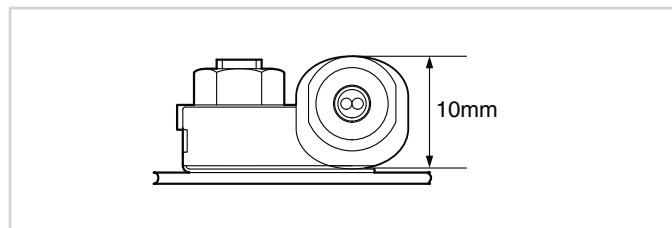


**A new slim fiber sensor ideal for sensing chemical leaks**

## Features

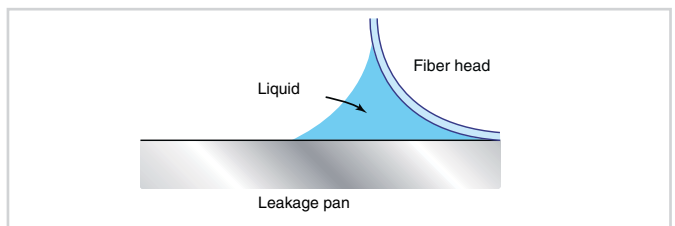
### ■ Reliable detection

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



### ■ Compact, space-saving

This slim (10mm) side-mounting sensor is especially well suited for use in confined spaces.



### ■ Ideal for chemicals and volatile materials

This fiber type sensor is safe to use with volatile materials (SEMI S2 compliant). The PFA (fluorine resin) fiber head makes it ideal for use with chemicals.

## Technical Specifications

|                         |                     |
|-------------------------|---------------------|
| Applicable amplifiers:  | FX-301-F, FX-301P-F |
| Sensing object:         | Liquid              |
| Fiber cable length:     | 5m (free-cut)       |
| Protective tube length: | 3m                  |
| Dimensions (W×H×D):     | 20×30×10mm          |

Notes: 1) Fluorinert™ is the worldwide TradeMark of 3M.

# FT-F902

FT-F902



Reliably detect liquid in pipes

## Features

### ■ Safe fiber type sensor

Because it is a fiber sensor, it is safe to use in dangerous areas where there is a risk of fire or explosion. It meets the stringent demands for higher safety levels placed by international standards including SEMI S2.

### ■ Easy to use and reliable detection

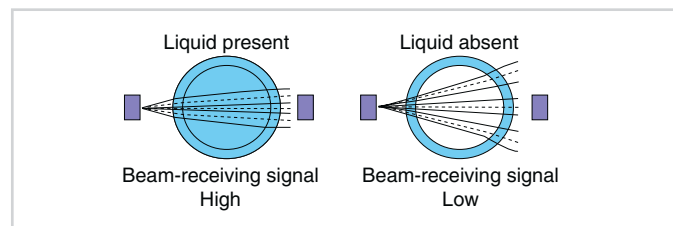
Even when shape and thickness of the pipe vary, this sensor uses a method where the beam axis follows the diameter of the pipe, and so, when compared to conventional methods, the shape and thickness of the pipe have no influence on the performance of this sensor.

### ■ Reliable detection not affected by bubbles or droplets

Problems encountered by conventional pipe-mountable sensors, such as bubbles, droplets or liquid leakage, have been solved using the latest optical fiber techniques.

### ■ Worry-free design that doesn't overlook liquid-absent condition and sensor malfunction

When liquid is present in the pipe, the lens effect of the liquid condenses the beam so that the sensor is in beam receiving condition.



## Technical Specifications

|                           |                                                       |
|---------------------------|-------------------------------------------------------|
| Applicable amplifiers:    | FX-301-F, FX-301P-F                                   |
| Sensing object:           | Liquid                                                |
| Applicable pipe diameter: | Outer dia. $\varnothing 3.0$ to $\varnothing 10.0$ mm |
| Fiber cable length:       | 2m (free-cut)                                         |
| Protective tube length:   | 1m                                                    |
| Dimensions (W×H×D):       | 23×17×20mm                                            |

# M18-L

## Thru-beam and retroreflective laser sensors



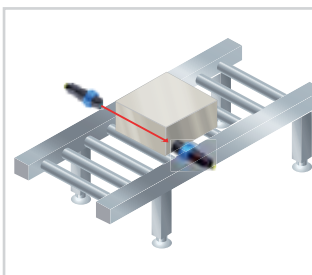
## Features

### ■ Great lineup of 48 models

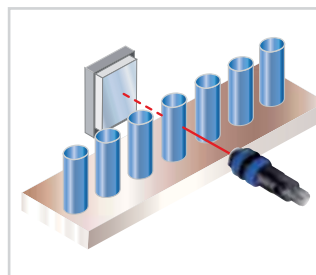
The M18-L series offers all optical functions in an M18 housing. The visible laser light spot makes the sensor simple to align. It is easy to install and requires little space due to its ultra-compact size.

- Available types: thru-beam laser sensor up to 60m, retroreflective type up to 16m, diffuse reflective type up to 350mm
- Complete range of optic functions, laser class 1
- Flat plastic tubular housing for improved versatility, or metal cylindrical housing
- Cable or M12 connection
- NPN or PNP
- Radial and axial versions

## Typical Applications



Packaging



Precise object detection

## Technical Specifications

|                                                                                                |                                                                                                            |                                                    |                                                                                                                                                        |                                                    |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| NPN-Output                                                                                     | M18-LT5000-<br>[R]-[M/P]-[J]                                                                               | M18-LT6000-<br>[A]-[M/P]-[J]                       | M18-LP0900-<br>[R]-[M/P]-[J]                                                                                                                           | M18-LP1600-<br>[A]-[M/P]-[J]                       |
| PNP-Output                                                                                     | M18-LT5000-<br>[R]-[M/P]-<br>PN-[J]                                                                        | M18-LT6000-<br>[A]-[M/P]-<br>PN-[J]                | M18-LP0900-<br>[R]-[M/P]-<br>PN-[J]                                                                                                                    | M18-LP1600-<br>[A]-[M/P]-<br>PN-[J]                |
| Sensor type                                                                                    | Thru-beam                                                                                                  |                                                    | Retroreflective                                                                                                                                        |                                                    |
|                                                                                                | Radial                                                                                                     | Axial                                              | Radial                                                                                                                                                 | Axial                                              |
| Maximum operation distance                                                                     | 50m                                                                                                        | 60m                                                | 9m                                                                                                                                                     | 16m                                                |
| Sensing range                                                                                  | 0 to 50m                                                                                                   | 0 to 60m                                           | 0.1 to 9m                                                                                                                                              | 0.1 to 16m                                         |
| Sensing object                                                                                 | Metal, black                                                                                               |                                                    |                                                                                                                                                        |                                                    |
|                                                                                                | Ø 10mm                                                                                                     |                                                    | Ø 5mm                                                                                                                                                  |                                                    |
| Detectable target                                                                              | Opaque                                                                                                     |                                                    | Opaque, translucent                                                                                                                                    |                                                    |
| Hysteresis                                                                                     | —                                                                                                          |                                                    |                                                                                                                                                        |                                                    |
| Response time                                                                                  | 333µs                                                                                                      |                                                    |                                                                                                                                                        |                                                    |
| Output                                                                                         | Max. 100mA                                                                                                 |                                                    |                                                                                                                                                        |                                                    |
| Emitting element                                                                               | Red semiconductor laser, 650nm (class 1)                                                                   |                                                    |                                                                                                                                                        |                                                    |
| Current consumption without load                                                               | Emitter: max. 35mA<br>Receiver: max. 30mA                                                                  |                                                    | Max. 35mA                                                                                                                                              |                                                    |
| Material                                                                                       | Metal version: nickel-plated brass<br>Plastic version: PBT<br>Lens: PMMA                                   |                                                    |                                                                                                                                                        |                                                    |
| Protection                                                                                     | IP67                                                                                                       |                                                    |                                                                                                                                                        |                                                    |
| Dimensions (H×W×D)                                                                             | Cable type: M18×89mm<br>Connector type: M18×93.5mm                                                         | Cable type: M18×77mm<br>Connector type: M18×81.5mm | Cable type: M18×89mm<br>Connector type: M18×93.5mm                                                                                                     | Cable type: M18×77mm<br>Connector type: M18×81.5mm |
| Connection                                                                                     | Cable 2m or M12 connector                                                                                  |                                                    |                                                                                                                                                        |                                                    |
| Supply voltage                                                                                 | 10 to 30VDC                                                                                                |                                                    |                                                                                                                                                        |                                                    |
| Ambient temperature                                                                            | Operation: −10 to +50°C, storage: −25 to +70°C                                                             |                                                    |                                                                                                                                                        |                                                    |
| Weight                                                                                         | Cable type: Emitter and receiver each approx. 75g<br>Connector type: Emitter and receiver each approx. 25g |                                                    | Cable type: approx. 75g (plastic version) or approx. 110g (metal version)<br>Connector type: Approx. 25g (plastic version) or approx. 60g (metal type) |                                                    |
| [R] = Radial • [A] = Axial<br>[P] = Plastic<br>[M] = Metal • [PN] = PNP<br>[J] = M12 connector |                                                                                                            |                                                    |                                                                                                                                                        |                                                    |

\*Reflector not included

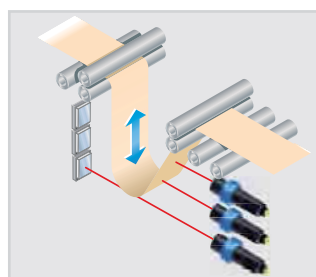


## Reflective laser sensors

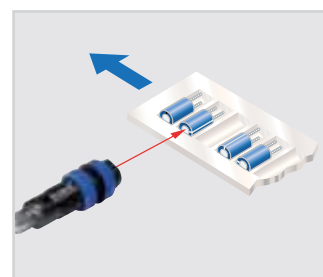
## Technical Specifications

|                                                                                                  |                                                                                                                                                       |                           |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| NPN-output                                                                                       | M18-LD0025-R-[M/P]-[J]                                                                                                                                | M18-LD0035-A-[M/P]-[J]    |
| PNP output                                                                                       | M18-LD0025-R-[M/P]-PN-[J]                                                                                                                             | M18-LD0035-A-[M/P]-PN-[J] |
| Sensor type                                                                                      | Reflective                                                                                                                                            |                           |
|                                                                                                  | Radial                                                                                                                                                | Axial                     |
| Maximum operation distance                                                                       | 250mm                                                                                                                                                 | 350mm                     |
| Sensing range                                                                                    | 0 to 250mm                                                                                                                                            | 0 to 350mm                |
| Spot diameter                                                                                    | 0.3mm at 50mm                                                                                                                                         |                           |
| Sensing object                                                                                   | Paper, white                                                                                                                                          |                           |
|                                                                                                  | 100×100mm                                                                                                                                             | 200×200mm                 |
| Detectable target                                                                                | Opaque, translucent                                                                                                                                   |                           |
| Hysteresis                                                                                       | <1%                                                                                                                                                   |                           |
| Response time                                                                                    | 333µs                                                                                                                                                 |                           |
| Output                                                                                           | Max. 100mA                                                                                                                                            |                           |
| Emitting element                                                                                 | Red semiconductor laser, 650nm (class 1)                                                                                                              |                           |
| Current consumption without load                                                                 | Max. 35mA                                                                                                                                             |                           |
| Material                                                                                         | Metal version: nickel-plated brass<br>Plastic version: PBT<br>Lens: PMMA                                                                              |                           |
| Protection                                                                                       | IP67                                                                                                                                                  |                           |
| Dimensions (Ø × L)                                                                               | M18 × 81.5mm                                                                                                                                          |                           |
| Connection                                                                                       | Cable 2m or M12 connector                                                                                                                             |                           |
| Supply voltage                                                                                   | 10 to 30V DC                                                                                                                                          |                           |
| Ambient temperature                                                                              | Operation: −10 to +50°C, storage: −25 to +70°C                                                                                                        |                           |
| Weight                                                                                           | Cable type: approx. 75g (plastic version), approx. 110g (metal version)<br>Connector type: approx. 25g (plastic version), approx. 60g (metal version) |                           |
| • [R] = Radial • [A] = Axial • [P] = Plastic • [M] = Metal • [PN] = PNP •<br>[J] = M12 connector |                                                                                                                                                       |                           |

## Typical Applications



Control of sag



Detection of capacitors

## Options

### Cables

| UZZ81220    | UZZ81221 | UZZ81250    | UZZ81251 |
|-------------|----------|-------------|----------|
| 2m straight | 2m elbow | 5m straight | 5m elbow |
|             |          |             |          |

### Mounting brackets

| M18L-ST20 | M18-SPM |
|-----------|---------|
|           |         |

### Reflector

| M18-RF48 |
|----------|
|          |

# LC-100

## Digital laser sensor



## Features

### ■ Multifunction optoelectronic sensors

The **LC100 series** with a standard 50×50×15mm compact housing, offers all the most advanced optic functions including safety class 1 laser emission. This series offers versions with cable or M12 connection that can be rotated for either straight or right-angle positions. All versions have NPN or PNP output and standard configuration conforming to the EN 60947-5-2 standard. 16 types of LC100 are available.

### ■ Available in 4 versions

#### Laser through-beam

- Visible class 1 laser red light emission (typ. 650nm)
- Operating distance up to 60m with highest excess gain
- Resolution better than 6mm at 0.5m and 10mm over 2m
- Very high switching frequency up to 1.5kHz
- Double NO-NC output with NPN or PNP version
- Test input
- Plastic housing with compact dimensions 50×50×15mm

#### Laser polarized retroreflective

- Visible class 1 laser red light emission (typ. 650nm)
- Operating distance up to 20m
- Resolution better than 10mm
- Trimmer setting for fine sensitivity adjustment
- Very high switching frequency up to 2kHz
- Double NO-NC output with NPN or PNP version
- Plastic housing with compact dimensions 50×50×15mm

#### Diffuse reflective

- Visible class 1 laser red light emission (typ. 650nm)
- Operating distance 0 to 60cm
- Resolution approx. 0.2mm at 15cm
- Trimmer setting for fine sensitivity adjustment
- Very high switching frequency up to 2kHz
- Double NO-NC output with NPN or PNP version
- Plastic housing with compact dimensions 50×50×15mm

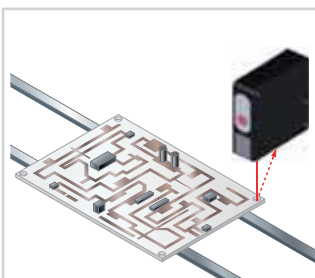
#### Background suppression

- Visible class 1 laser red light emission (typ. 650nm)
- Operating distance 5 to 10cm
- Resolution approx. 0.5mm at 6cm
- Teach-in setting
- Double NO-NC output with NPN or PNP version
- External teach-in
- Plastic housing with compact dimensions 50×50×15mm

## Typical Applications

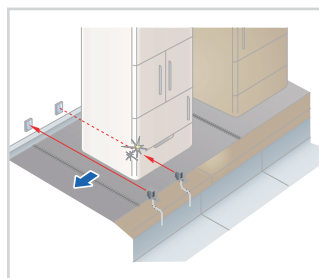
### Positioning of printed circuit boards

Electronic industry



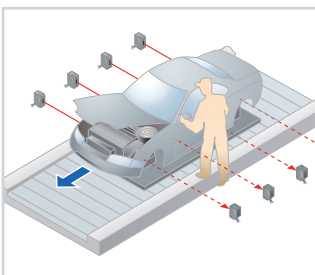
### Detection of refrigerators

Packaging industry



### Detection of automobiles on conveyers

Automotive industry



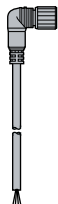
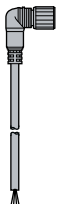
# Technical Specifications

|                                  |                                                                      |                          |                          |                             |
|----------------------------------|----------------------------------------------------------------------|--------------------------|--------------------------|-----------------------------|
| NPN-Output                       | LC-100-TL6000-A-P-[J]                                                | LC-100-PL2000-A-P-[J]    | LC-100-DL0060-A-P-[J]    | LC-100-BL0010-A-P-[J]       |
| PNP-Output                       | LC-100-TL6000-A-P-PN-[J]                                             | LC-100-PL2000-A-P-PN-[J] | LC-100-DL0060-A-P-PN-[J] | LC-100-BL0010-A-P-PN-[J]    |
| Sensor type                      | Thru-beam                                                            | Retroreflective          | Diffuse reflective       | Diffuse reflective with BGS |
| Maximum operation distance       | 60m                                                                  | 20m                      | 600mm                    | 100mm                       |
| Sensing range                    | 0 to 60m                                                             | 0.1 to 20m               | 0 to 600mm               | 50 to 100mm                 |
| Sensing object                   | Metal, black                                                         |                          | Paper, white             |                             |
|                                  | Ø 6mm                                                                |                          | 200 x 200mm              | 100 x 100mm                 |
| Detectable target                | Opaque                                                               | Opaque, translucent      | Opaque, transparent      |                             |
| Hysteresis                       | –                                                                    | –                        | ±1%                      |                             |
| Response time                    | Approx. 333µs                                                        | Approx. 250µs            |                          | 500µs                       |
| Output                           | Max. 100mA                                                           |                          |                          |                             |
| Emitting element                 | Red semiconductor laser, 650nm (Class 1)                             |                          |                          |                             |
| Current consumption without load | Emitter: max. 35mA<br>Receiver: max. 35mA                            | Max. 35mA                |                          | Max. 60mA                   |
| Material                         | Enclosure: Plastic                                                   |                          |                          |                             |
| Protection                       | IP67                                                                 |                          |                          |                             |
| Dimensions (H×W×D)               | Cable type: approx. 50×50×15mm<br>Connector type: approx. 50×66×15mm |                          |                          |                             |
| Connection                       | Cable 2m or M12 connector                                            |                          |                          |                             |
| Supply voltage                   | 10 to 30VDC                                                          |                          |                          |                             |
| Ambient temperature              | Operation: –10 to +50°C, storage: –25 to +70°C                       |                          |                          |                             |
| Weight                           | Cable type: approx. 90g<br>Connector type: approx. 40g               |                          |                          |                             |
| [PN] = PNP • [J] = M12 connector |                                                                      |                          |                          |                             |

\*Reflector not included

## Options

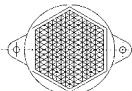
### Cables

| UZZ81220                                                                            | UZZ81221                                                                            | UZZ81250                                                                             | UZZ81251                                                                              |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2m straight                                                                         | 2m elbow                                                                            | 5m straight                                                                          | 5m elbow                                                                              |
|  |  |  |  |

### Mounting brackets

| LC1-ST60                                                                            | LC1-ST26                                                                            | LC10-ST62                                                                            |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |

### Reflector

| M18-RF48                                                                            |
|-------------------------------------------------------------------------------------|
|  |

# LC-120

High-performance sensors



## Features

### ■ Maximum performance in compact housing

The **LC120 series** comes in a 50×50×18mm compact plastic housing and offers the maximum performance of optic detection functions for industrial automation.

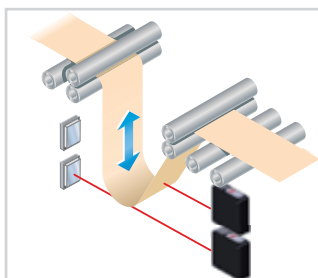
Furthermore, versions with visible red laser emission are available with 50–350mm background suppression and polarized retroreflex reaching more than 20m.

These laser sensors are characterized by a very small light spot as well as a low response time that guarantee excellent detection repeatability, even of very small objects or movements.

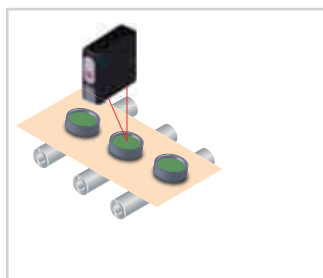
- High-resolution sensors with LED or laser emission
- Background suppression models ranging up to 350mm
- Polarized retroreflex with operating distance of up to 20m
- Plastic housing with compact dimensions of 50×50×18mm
- NPN or PNP double output with standard NO-NC
- Visible class 2 laser red light emission (typ. 658nm)
- Very fast response time less than 200µs
- Very high switching frequency of up to 2.5kHz

## Typical Applications

### Foil detection



### Pharmaceutical industry



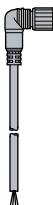
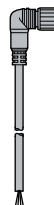
# Technical Specifications

|                                  |                                                 |                        |                        |
|----------------------------------|-------------------------------------------------|------------------------|------------------------|
| NPN-Output                       | LC-120-PL2000-A-P-J                             | LC-120-BL0015-A-P-J    | LC-120-BL0035-A-P-J    |
| PNP-Output                       | LC-120-PL2000-A-P-PN-J                          | LC-120-BL0015-A-P-PN-J | LC-120-BL0035-A-P-PN-J |
| Sensor type                      | Retroreflective                                 | Reflective with BGS    |                        |
| Maximum operation distance       | 20m                                             | 150mm                  | 350mm                  |
| Sensing range                    | 0.3 to 20m                                      | 30 to 150mm            | 50 to 350mm            |
| Spot diameter                    | Ø 0.5mm (at 0.5m)                               | 0.2mm (at 60mm)        | 0,4mm (at 150mm)       |
| Sensing object                   | Metal, black<br>Opaque, translucent             | Paper, white<br>Opaque |                        |
|                                  | Ø 6mm                                           | 100 x 100mm            |                        |
| Detectable target                | Opaque                                          |                        |                        |
| Hysteresis                       | —                                               | <1%                    |                        |
| Response time                    | 200µs                                           | 140µs                  | 200µs                  |
| Output                           | Max. 100mA                                      |                        |                        |
| Emitting element                 | Red semiconductor laser, 645 to 665nm (Class 2) |                        |                        |
| Current consumption without load | Max. 30mA                                       |                        |                        |
| Material                         | Enclosure: Plastic                              |                        |                        |
| Protection                       | IP67                                            |                        |                        |
| Dimensions (H×W×D)               | Connector type: approx. 50×66×18mm              |                        |                        |
| Connection                       | M12 connector                                   |                        |                        |
| Supply voltage                   | 10 to 30VDC                                     |                        |                        |
| Ambient temperature              | Operation: −10 to +50°C, storage: −25 to +70°C  |                        |                        |
| Weight                           | Approx. 40g                                     |                        |                        |
| [PN] = PNP • [J] = M12 connector |                                                 |                        |                        |

\*Reflector not included

## Options

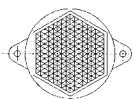
### Cables

| UZZ81220                                                                            | UZZ81221                                                                            | UZZ81250                                                                             | UZZ81251                                                                              |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2m straight                                                                         | 2m elbow                                                                            | 5m straight                                                                          | 5m elbow                                                                              |
|  |  |  |  |

### Mounting brackets

| LC12-ST50                                                                           | LC1-ST60                                                                            | LC1-ST26                                                                             |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |  |

### Reflector

| M18-RF48                                                                            |
|-------------------------------------------------------------------------------------|
|  |



# EX-L200

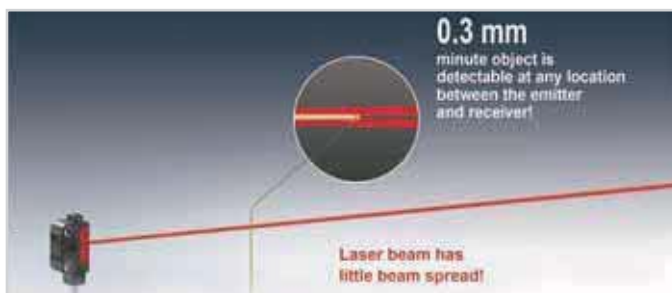


**World's smallest laser sensor with built-in amplifier**

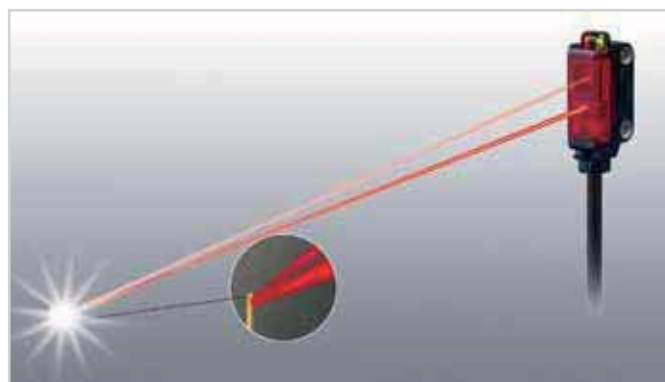
## Features

### ■ Minute object sensing type EX-L211 (through beam)

The beam is purposely widened to have a lower beam density and little beam spread so that when detecting minute objects, even a slight change in the light received intensity will not be missed.



### ■ Minute detection (reflective)



### ■ Environmental resistance

#### **Strong against water and dust with protection structure IP67**

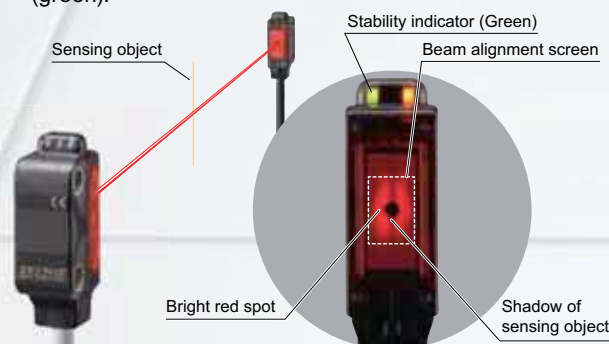
The sensor can be used even in environments where water or dust is present.



### ■ Easy alignment

#### **Beam alignment is easy**

Beam alignment is carried out by looking at the red spot reflected on the beam alignment screen to match with the actual object. The optimum position can be understood at a glance by looking at the beam alignment screen and stability indicator (green).



**Even the shadow of the sensing object is reflected to make alignment effortless!**

## Typical Applications

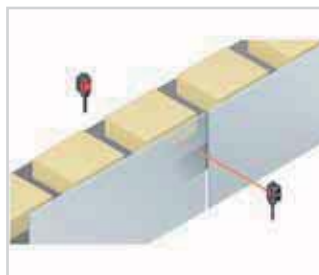
Detecting ICs that are out of position in multiple palettes



Detecting tip of very thin pipe



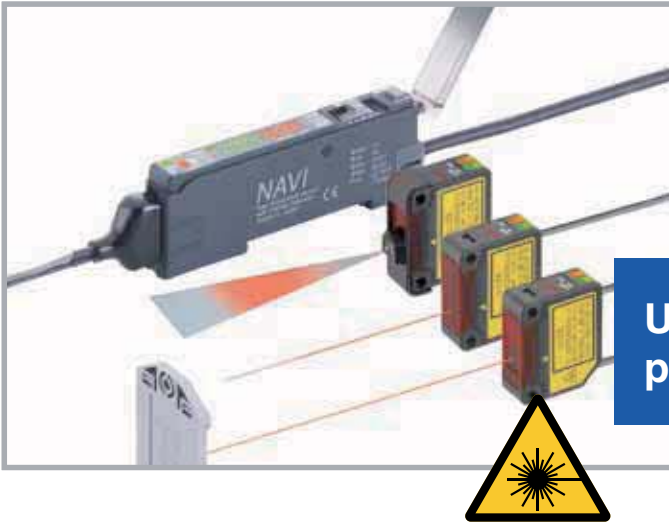
Detecting objects from an opening



## Technical Specifications

**NEW**

| NPN output<br>PNP output              | EX-L211<br>EX-L211-P                                             | EX-L212<br>EX-L212-P | EX-L221<br>EX-L221-P                                               |
|---------------------------------------|------------------------------------------------------------------|----------------------|--------------------------------------------------------------------|
| Sensor type                           | Thru-beam<br>Minute object sensing      Long range sensing       |                      | Spot reflective<br>Minute object sensing                           |
| Maximum operation distance            | 1m                                                               | 3m                   | 300mm                                                              |
| Sensing range                         | 0 to 1m                                                          | 0 to 3m              | 45 to 300mm                                                        |
| Spot diameter (approx.)               | 6x4mm at 1m                                                      | 8x5.5mm at 1m        | dia. 1mm at 300mm                                                  |
| Sensing object                        | Opaque<br>Ø 2mm or more      Ø 3mm or more                       |                      | Opaque<br>translucent or transparent<br>gold wire with dia. 0,01mm |
| Response time                         | 0.5ms or less                                                    |                      |                                                                    |
| Output                                | Max. 100mA                                                       |                      |                                                                    |
| Emitting element                      | Red laser diode, 655nm (class 1)                                 |                      |                                                                    |
| Current consumption without load      | Ermitter: max. 10mA<br>Receiver: max. 10mA                       |                      | max 15mA                                                           |
| Material                              | Body: PBT<br>Front cover: Acrylic<br>Lens: Glas                  |                      |                                                                    |
| Protection                            | IP67                                                             |                      |                                                                    |
| Dimension (HxWxD)                     | 25.9x8.2x12mm                                                    |                      | 29.9x8.2x13mm                                                      |
| Connection                            | Cable 2m                                                         |                      |                                                                    |
| Supply voltage<br>ambient temperature | 10 to 30VDC<br>Operation: -10 to +55°C,<br>Storage: -30 to +70°C |                      |                                                                    |
| Weight                                | Approx. 90g                                                      |                      | Approx. 60g                                                        |

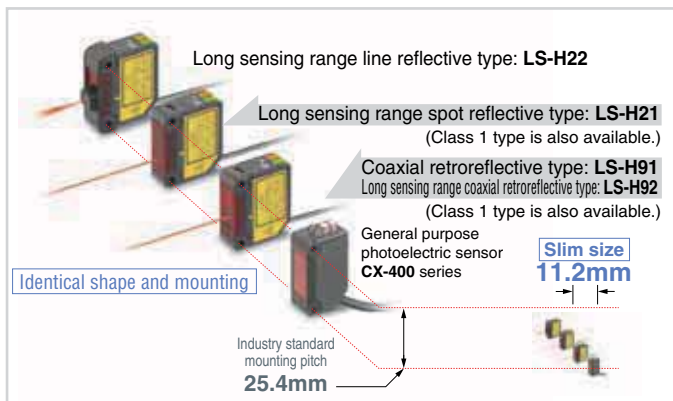


User-friendly, advanced high precision laser sensing!

## Features

### ■ 4 types of identically sized sensor heads available

They are approximately the same size as general purpose photoelectric sensors, and the mounting method is identical.

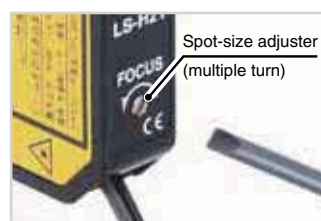


### ■ Coaxial reflective type with a long sensing range of 30m

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

### ■ Spot size adjustment

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.

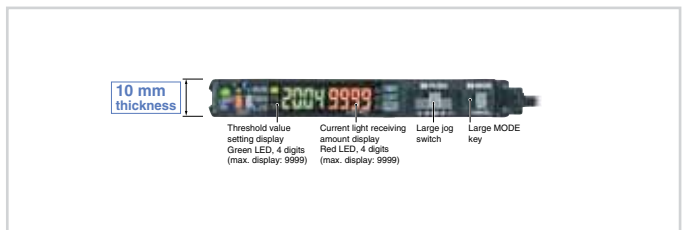


### ■ Accurately senses the minutest variations

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.

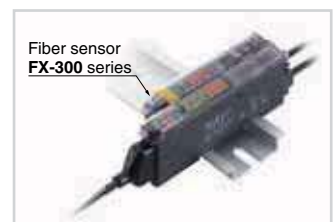
### ■ Easy setting, dual display

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



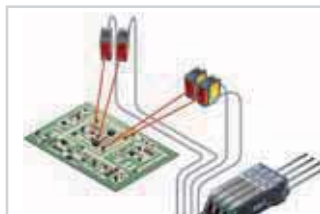
### ■ Wiring and space savings

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



### Interference prevention function

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



### Emission halt function

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



### External teaching function

Teaching can be conveniently performed externally for laser sensors installed inside a device.



## Typical Applications

### IC pin check from remote position



### Checking protrusion of glass substrate



## Technical Specifications

### Sensor heads

| Type                | Coaxial retroreflective                                                                                                                                                                                               |                                                                 | Diffuse reflective                                                  |                                                                     |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
|                     |                                                                                                                                                                                                                       | Long sensing range type                                         | Long sensing range spot reflective                                  | Long sensing range line reflective                                  |
| Model no. (Note 1)  | LS-H91(F)(-A)(Note 2)                                                                                                                                                                                                 | LS-H92(F)                                                       | LS-H21(F)(-A)(Note 2)                                               | LS-H22(F)(Note 3)                                                   |
| Sensing range       | 0.1 to 7m (U-LG)<br>0.1 to 5m (STD)<br>0.1 to 3m (FAST/H-SP)                                                                                                                                                          | 0.2 to 30m (U-LG)<br>0.2 to 20m (STD)<br>0.2 to 10m (FAST/H-SP) | 30 to 1000mm (U-LG)<br>30 to 500mm (STD)<br>30 to 300mm (FAST/H-SP) | 30 to 1000mm (U-LG)<br>30 to 500mm (STD)<br>30 to 300mm (FAST/H-SP) |
| Ambient temperature | -10 to +55°C                                                                                                                                                                                                          |                                                                 |                                                                     |                                                                     |
| Emitting element    | Red semiconductor laser, Class 2 (LS-HM: IEC/JIS/GB, LS-HMF: FDA/IEC/JIS) [LS-H91(F)-A, LS-H21(F)-A: Class 1]<br>[Max. output: 3mW or less (LS-H91(F)-A, LS-H21(F)-A: 1 mW or less), Peak emission wavelength: 655nm] |                                                                 |                                                                     |                                                                     |
| Dimensions (W×H×D)  | 11.2×31×25mm                                                                                                                                                                                                          |                                                                 |                                                                     |                                                                     |

- Notes: 1) LS-H□□ conforms to IEC/JIS/GB standards.  
LS-H□□F conforms to FDA/IEC/JIS standards.  
2) LS-H91(F)-A, LS-H21(F)-A: Class 1 type.  
3) LS-H22(F) = LS-H21(F) long sensing range spot reflective type sensor head combined with the LS-MR1 lens attachment for line reflective. LS-H22(F) is only the order number.  
LS-H21(F) appears on the sensor itself.

### Amplifiers

| Type                                       |            | Connector (Note)                                                                                                                                                                                                                                                                      | Cable      |
|--------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Model no.                                  | NPN output | LS-401                                                                                                                                                                                                                                                                                | LS-401-C2  |
|                                            | PNP output | LS-401P                                                                                                                                                                                                                                                                               | LS-401P-C2 |
| Supply voltage                             |            | 12 to 24VDC ±10%                                                                                                                                                                                                                                                                      |            |
| Output (Output 1, Output 2)                |            | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor                                                                                                                                                                                      |            |
| Output operation                           |            | Selectable either Light-ON or Dark-ON, with jog switch                                                                                                                                                                                                                                |            |
| Response time                              |            | 80μs or less (H-SP), 150μs or less (FAST), 500μs or less (STD), 4ms or less (U-LG), selectable with jog switch                                                                                                                                                                        |            |
| Sensitivity setting                        |            | Normal mode: 2-level teaching/limit teaching/full auto teaching/manual adjustment<br>Window comparator mode: teaching (1-level, 2-level, 3-level)/manual adjustment<br>Hysteresis mode: teaching (1-level, 2-level, 3-level)/manual adjustment<br>Differential mode: 5-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, disabled when in H-SP mode)]                                                                                                                                                                    |            |
| Ambient temperature                        |            | -10 to +55°C<br>(if 4 to 7 units are mounted close together: -10 to +50°C<br>if 8 to 16 units are mounted close together: -10 to +45°C)                                                                                                                                               |            |
| Dimensions (W×H×D)                         |            | 10×30×75mm                                                                                                                                                                                                                                                                            |            |

Notes: 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 listed below.

Main cable (4-core): CN-74-C1 (cable length 1m), CN-74-C2 (cable length 2m)  
CN-74-C5 (cable length 5m)

Sub cable (2-core): CN-72-C1 (cable length 1m), CN-72-C2 (cable length 2m)  
CN-72-C5 (cable length 5m)

Sensing range:  
LS-H91(F)-A 0.1 to 5m (U-LG), 0.1 to 3m (STD), 0.1 to 1m (FAST/H-SP)  
LS-H21(F)-A 30 to 500mm (U-LG), 30 to 250mm (STD), 30 to 150mm (FAST/H-SP)

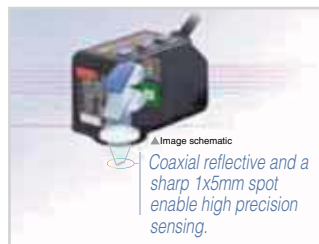
# LX-100

## Introducing the 3-LED mark sensor

### Features

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

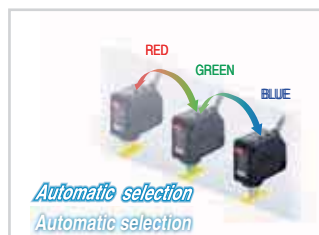
To detect any marking, this sensor is equipped with red, green and blue LED light emitting elements all in one. In addition, it uses a coaxial reflective optics system and realizes high precision sensing when used with a 1/4000 resolution 12-bit A/D converter.



#### ■ 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 realize an ultra quick 45μs 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 areas of the mark.



#### ■ Even beginners can quickly master MODE NAVI operation

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

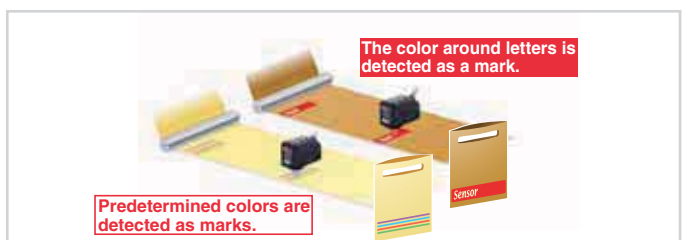
The settings for the LX-100 series sensors are displayed using a 4-digit direct code. Direct codes enable easy settings verification and maintenance by phone.

##### Super simple teaching

Teaching (setting the threshold value) is simple, 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 savings

High precision sensing and multiple functions are provided in a compact 57×24×35mm (W×D×H) body. Cable and plug-in connector types are available depending on the equipment used. These sensors can be easily integrated into already existing systems.



## Typical Applications

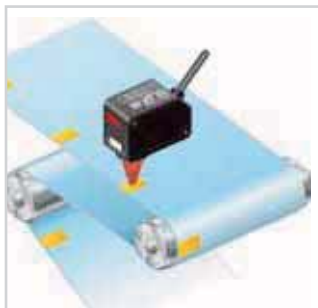
### Tube positioning

Detects printed marks to align tubes



### Mark detection

Mark detection of packaging film



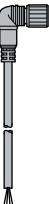
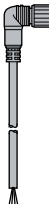
## Technical Specifications

| Type                |            | Cable                                                                                                                     | Plug-in connector |
|---------------------|------------|---------------------------------------------------------------------------------------------------------------------------|-------------------|
| Model. no.          | NPN output | LX-101                                                                                                                    | LX-101-Z (Note)   |
|                     | PNP output | LX-101-P                                                                                                                  | LX-101-P-Z (Note) |
| Sensing range       |            | 10 ±3mm                                                                                                                   |                   |
| Supply voltage      |            | 12 to 24VDC ±10%                                                                                                          |                   |
| Output              |            | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor                          |                   |
| Output operation    |            | Mark mode: Light-ON/Dark-ON (auto-setting on teaching)<br>Color mode: Consistent-ON/Inconsistent-ON (Setting on teaching) |                   |
| Response time       |            | Mark mode: 45µs or less; color mode: 150µs or less                                                                        |                   |
| Sensitivity setting |            | Mark mode: 2-level teaching/full-auto teaching;<br>Color mode: 1-level teaching                                           |                   |
| Protection          |            | IP67 (IEC)                                                                                                                |                   |
| Ambient temperature |            | -10 to +55°C                                                                                                              |                   |
| Emitting element    |            | Combined Red/Green/Blue LEDs<br>(Peak emission wave length: 640nm/525nm/470nm)                                            |                   |
| Dimensions (W×H×D)  |            | 71.5×24×35mm                                                                                                              |                   |

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

## Options

### ■ Cables

| UZZ81220                                                                            | UZZ81221                                                                            | UZZ81250                                                                             | UZZ81251                                                                              |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2m straight                                                                         | 2m elbow                                                                            | 5m straight                                                                          | 5m elbow                                                                              |
|  |  |  |  |

# CX-400

A full lineup of world standard photoelectric sensors

## Features

### ■ Great lineup of 116 models

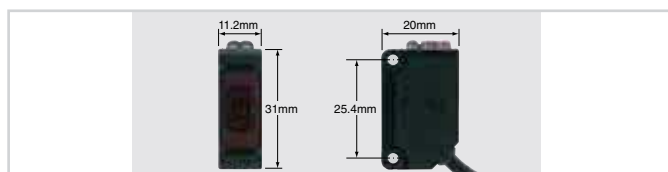
The **CX-400** series has a high level of basic functionality and excellent cost performance. Moreover, a wide number of variations means that there is sure to be a sensor that fits your needs.

| Type                                                 | Sensing range                                             |
|------------------------------------------------------|-----------------------------------------------------------|
| CX-412□ Thru-beam (long sensing range)               | 15m                                                       |
| CX-411□ Thru-beam                                    | 10m                                                       |
| CX-493□ Retroreflective (long sensing range)         | 5m                                                        |
| CX-491□ Retroreflective (with polarizing filters)    | 3m                                                        |
| CX-482□ Retroreflective (transparent object sensing) | 0.1 to 2m                                                 |
| CX-481□ Retroreflective (transparent object sensing) | 50 to 500mm                                               |
| CX-422□ Diffuse reflective (800mm type)              | 800mm                                                     |
| CX-421□ Diffuse reflective (300mm type)              | 300mm                                                     |
| CX-424□ Diffuse reflective (100mm type)              | 100mm                                                     |
| CX-423□ Diffuse reflective (narrow-view)             | 70 to 200mm                                               |
| CX-442□ Adjustable range reflective                  | 20 to 300mm                                               |
| CX-444□ Adjustable range reflective                  | 15 to 100mm                                               |
| CX-443□ Adjustable range reflective                  | 2 to 50mm                                                 |
| CX-441□ Adjustable range reflective (small spot)     | 2 to 50mm                                                 |
| Output                                               | NPN, PNP                                                  |
| Connecting method (Note 1)                           | Cable type, M8 plug-in connector type, M12 pigtailed type |
| Cable length of cable type (Note 2)                  | 0.5m, 2m, 5m                                              |

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

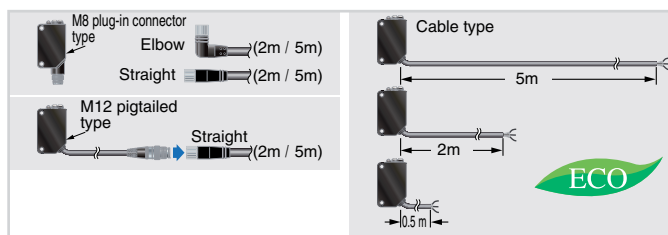
### ■ Compact size

The sensors are compact in size at 11.2×31×20mm (W×H×D). The mounting pitch is also at the world standard size of 25.4mm (1inch).



### ■ Less processing

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



### ■ Less power consumed

The **CX-400** series sensors achieve a maximum of approx. 55% of the power consumption of conventional sensors. This 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 of polyethylene, which produces no toxic gases even when burned.

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

The lens material for the thru-beam type, retroreflective type (excluding the CX-48□) and the diffuse reflective type is 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 is 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 allows two sensors to be mounted close together.

# Typical Applications

### Detecting car on conveyor line



Thru-beam type CX-412□

### Strong infrared beam

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

### Detecting transparent bottles

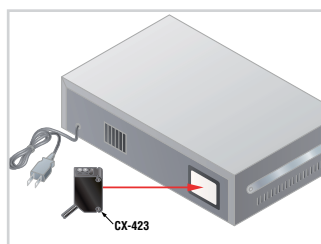


Retroreflective type CX-493□

### Strongest sensing range in its class

A long 5m 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.

### Detecting label



Diffuse reflective type CX-423□

### Beam axis alignment made easy

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.  $\varnothing 2\text{mm}$ , even the minutest object can be accurately detected.

### Introducing the transparent object sensing type sensor

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



CX-441/443□

### Can sense differences as small as 0.4mm, with hysteresis of 2% or less

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



CX-44□

### Not affected by color

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.



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

#### Background not present

When object and background are separated.

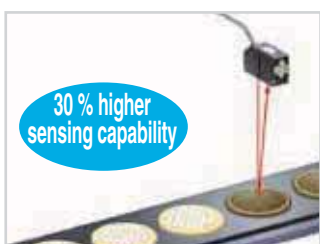


#### Background present

When object and background are close together.



When the object is glossy or uneven.



## CX-400 Technical Specifications

| Type                                       |     | Thru-beam                                                                                                    |                         | Retroreflective                                                    |                                |              |           | Diffuse reflective |          |          |             |
|--------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------|--------------------------------|--------------|-----------|--------------------|----------|----------|-------------|
|                                            |     | Long sensing range                                                                                           | With polarizing filters | Long sensing range                                                 | For transparent object sensing |              |           |                    |          |          |             |
| Model. no.                                 | NPN | CX-411                                                                                                       | CX-412                  | CX-491                                                             | CX-493                         | CX-481       | CX-482    | CX-424             | CX-421   | CX-422   | CX-423      |
|                                            | PNP | 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                              |     | 10m                                                                                                          | 15m                     | 3m                                                                 | 5m                             | 50 to 500mm  | 0.1 to 2m | 100mm              | 300mm    | 800mm    | 70 to 200mm |
| Supply voltage                             |     | 12 to 24V 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                              |     | 1ms or less                                                                                                  |                         |                                                                    |                                |              |           |                    |          |          |             |
| Automatic interference prevention function |     | Two units of sensors can be mounted close together with interference prevention filters. (Sensing range: 5m) | —                       | 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     |

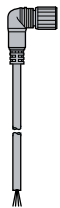
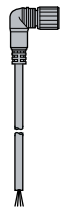
Note: 0.5m/5m cable length type (standard: 2m), M8 plug-in connector type, and M12 pigtailed type are available.

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

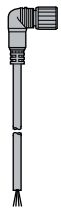
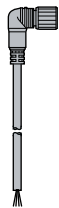
Notes: 1) The adjustable range stands for the maximum sensing range which can be set with the distance adjuster.  
The sensor can detect an object at a distance of 2mm [CX-444(-P): 15mm, CX-442(-P): 20mm] or more.  
2) M8 plug-in connector type is also available.

# Options

## Cables for M8

| UZZ80820                                                                          | UZZ80821                                                                          | UZZ80850                                                                          | UZZ80851                                                                          |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 2m straight                                                                       | 2m elbow                                                                          | 5m straight                                                                       | 5m elbow                                                                          |
|  |  |  |  |

## Cables for M12

| UZZ81220                                                                          | UZZ81221                                                                            | UZZ81250                                                                            | UZZ81251                                                                            |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 2m straight                                                                       | 2m elbow                                                                            | 5m straight                                                                         | 5m elbow                                                                            |
|  |  |  |  |



# NX5

Sensor world-wide usable

## Features

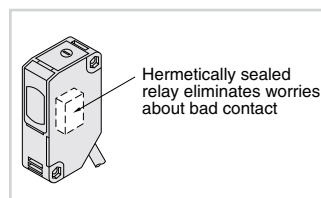
### ■ Multi-voltage

24 to 240VAC and 12 to 240VDC, suitable for supply voltages all over the world.

### ■ High reliability

The **NX5** has IP66 protection. Moderate dust or water splashes do not affect it.

The hermetically sealed output relay significantly increases its reliability.

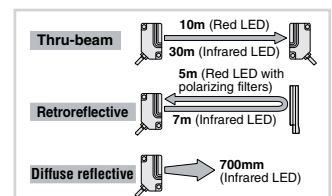


### ■ Interference prevention

Two sensors operate normally even when mounted close together (excluding the 30m thru-beam type sensor).

### ■ Long sensing range

Suitable for conveyor lines and parking lot applications.



## Typical Applications

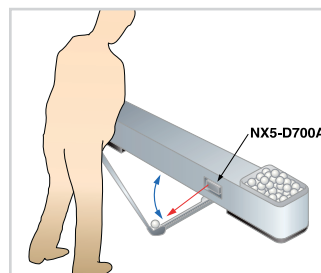
### Multistoried parking

Detects if the car is protruding from the elevator door.



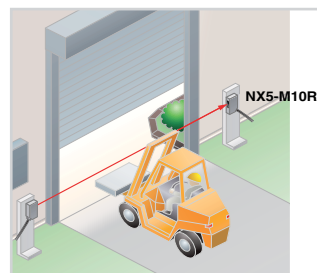
### Golf driving range

The sensor detects the presence of a golf ball. The sensor is multi-voltage type so no DC power supply is needed.



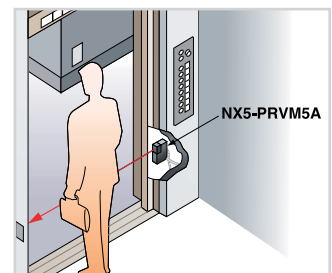
### Arresting shutter closing

The long sensing range sensor with a visible red beam can be used to control the shutter operation at the gate of a factory.



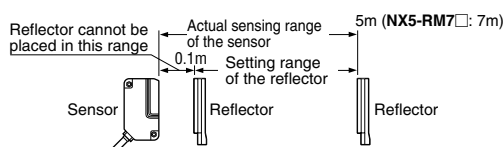
### Arresting door closing

The sensor detects a person or an object and prevents the door from closing as long as its beam is interrupted.

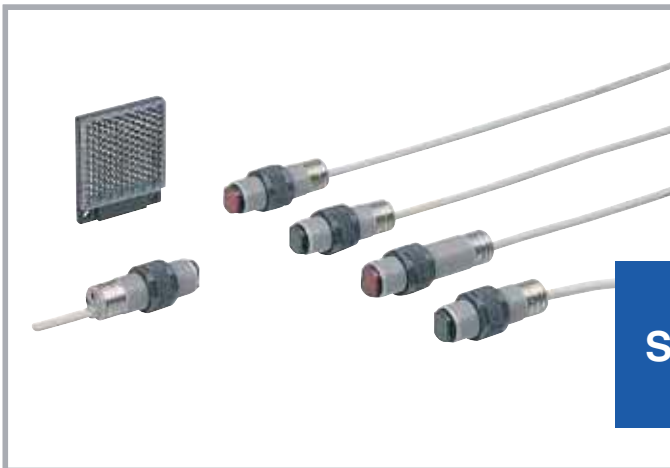


# Technical Specifications

|                                               |                           | Type                                                                                                                                                                                                                                                                                                                | Thru-beam |                                                  |                    |                                                                | Retroreflective         |                                                     |                    |                                           | Diffuse reflective                |  |
|-----------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------|--------------------|----------------------------------------------------------------|-------------------------|-----------------------------------------------------|--------------------|-------------------------------------------|-----------------------------------|--|
|                                               |                           |                                                                                                                                                                                                                                                                                                                     |           |                                                  | Long sensing range |                                                                | With polarizing filters |                                                     | Long sensing range |                                           |                                   |  |
| Item                                          | Model no.                 | NX5-M10RA                                                                                                                                                                                                                                                                                                           | NX5-M10RB | NX5-M30A                                         | NX5-M30B           | NX5-PRVM5A                                                     | NX5-PRVM5B              | NX5-RM7A                                            | NX5-RM7B           | NX5-D700A                                 | NX5-D700B                         |  |
| Sensing range                                 |                           | 10m                                                                                                                                                                                                                                                                                                                 |           | 30m                                              |                    | 0.1 to 5 m (Note 1)                                            |                         | 0.1 to 7m (Note 1)                                  |                    | 700mm (Note 2)                            |                                   |  |
| Sensing object                                |                           | Ø20mm or more opaque object (Note 3)                                                                                                                                                                                                                                                                                |           |                                                  |                    | Ø50mm or more opaque, translucent or specular object (Note 1)  |                         | Ø50mm or more opaque or translucent object (Note 1) |                    | Opaque, translucent or transparent object |                                   |  |
| Hysteresis                                    |                           | —                                                                                                                                                                                                                                                                                                                   |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           | 15% or less of operation distance |  |
| Repeatability (perpendicular to sensing axis) |                           | 0.1mm or less                                                                                                                                                                                                                                                                                                       |           | 0.2mm or less                                    |                    |                                                                |                         |                                                     |                    | 0.3mm or less                             |                                   |  |
| Supply voltage                                |                           | 24 to 240VAC ±10%, or 12 to 240VDC ±10%<br>Ripple P-P 10% or less                                                                                                                                                                                                                                                   |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Power consumption                             |                           | Emitter: 1 VA or less<br>Receiver: 2 VA or less                                                                                                                                                                                                                                                                     |           | Emitter: 1.5VA or less<br>Receiver: 2 VA or less |                    | 2VA or less                                                    |                         |                                                     |                    |                                           |                                   |  |
| Output                                        |                           | Relay contact 1c<br>• Switching capacity: 250VAC 1A (resistive load)<br>30VDC 2A (resistive load)<br>• Electrical life: 500,000 or more switching operations (switching frequency 3600 operations/hour)<br>• Mechanical life: 100 million or more switching operations (switching frequency 36,000 operations/hour) |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Output operation          | Light-ON                                                                                                                                                                                                                                                                                                            | Dark-ON   | Light-ON                                         | Dark-ON            | Light-ON                                                       | Dark-ON                 | Light-ON                                            | Dark-ON            | Light-ON                                  | Dark-ON                           |  |
| Response time                                 |                           | 10ms or less                                                                                                                                                                                                                                                                                                        |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Operation indicator                           |                           | Red LED (lights up when the output is ON)                                                                                                                                                                                                                                                                           |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Stability indicator                           |                           | Green LED (lights up under stable light received condition or stable dark condition)                                                                                                                                                                                                                                |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Power indicator                               |                           | —                                                                                                                                                                                                                                                                                                                   |           | Red LED (lights up when the power is ON)         |                    | —                                                              |                         |                                                     |                    |                                           |                                   |  |
| Sensitivity adjuster                          |                           | Continuously variable adjuster                                                                                                                                                                                                                                                                                      |           | —                                                |                    | Continuously variable adjuster                                 |                         | —                                                   |                    | Continuously variable adjuster            |                                   |  |
| Automatic interference prevention function    |                           | Use optional interference prevention filters                                                                                                                                                                                                                                                                        |           | —                                                |                    | Incorporated (two sensor units can be mounted close together.) |                         |                                                     |                    |                                           |                                   |  |
| Environmental resistance                      | Pollution degree          | 3 (industrial environment)                                                                                                                                                                                                                                                                                          |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Protection                | IP66 (IEC)                                                                                                                                                                                                                                                                                                          |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Ambient temperature       | −20 to +55°C (no dew condensation or icing allowed)(Note 4); storage: −30 to +70°C                                                                                                                                                                                                                                  |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Ambient humidity          | 35 to 85% RH; storage: 35 to 85% RH                                                                                                                                                                                                                                                                                 |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Ambient illuminance       | Sunlight: 11,000 ℓx at the light-receiving face; incandescent light: 3500 ℓx at the light-receiving face                                                                                                                                                                                                            |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | EMC                       | EN 50081-2, EN 50082-2, EN 61000-6-2                                                                                                                                                                                                                                                                                |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Voltage with standability | 1500VAC for one min. between power supply and output terminals; 1000VAC for one min. between relay contact terminals                                                                                                                                                                                                |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Insulation resistance     | 20MΩ, or more, with 500VDC megger between power supply and output terminals, and between relay contact terminals                                                                                                                                                                                                    |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Vibration resistance      | 10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each                                                                                                                                                                                                                                   |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
|                                               | Shock resistance          | 500m/s² (50G approx.) in X, Y and Z directions for three times each                                                                                                                                                                                                                                                 |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Emitting element (modulated)                  |                           | Red LED (modulated)                                                                                                                                                                                                                                                                                                 |           | Infrared LED (modulated)                         |                    | Red LED (modulated)                                            |                         | Infrared LED (modulated)                            |                    |                                           |                                   |  |
| Material                                      |                           | Enclosure: Polycarbonate; lens: polycarbonate; cover: polycarbonate; front cover (retroreflective type sensor only): acrylic                                                                                                                                                                                        |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Cable                                         |                           | 0.3mm² 5-core (thru-beam type emitter: 2-core) cabtyre cable, 2m long                                                                                                                                                                                                                                               |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Cable extension                               |                           | Extension up to total 100m is possible with 0.3mm², or more, cable (thru-beam type: both emitter and receiver)                                                                                                                                                                                                      |           |                                                  |                    |                                                                |                         |                                                     |                    |                                           |                                   |  |
| Weight                                        |                           | Emitter: 100g approx.<br>Receiver: 140g approx.                                                                                                                                                                                                                                                                     |           | Emitter: 125g approx.<br>Receiver: 140g approx.  |                    | 140g approx.                                                   |                         |                                                     |                    |                                           |                                   |  |
| Accessory                                     |                           | Adjusting screwdriver: 1 pc                                                                                                                                                                                                                                                                                         |           | —                                                |                    | RF-230 (reflector): 1 pc.<br>Adjusting screwdriver: 1 pc.      |                         | RF-230 (reflector): 1 pc.                           |                    | Adjusting screwdriver: 1 pc.              |                                   |  |



- Notes:**
- 1) The sensing range and the sensing object of the retroreflective type sensor is specified for the **RF-230** reflector. Further, the sensing range is the possible setting range for the reflector. The sensor can detect an object less than 0.1m away.
  - 2) The sensing range of the diffuse reflective type sensor is specified for white non-glossy paper (200×200mm) as the object.
  - 3) If slit masks (optional) are fitted, an object as small as 3×6mm can be detected.
  - 4) In the event that the sensor is to be used at an ambient temperature of −15°C, or less, please contact our office.



Simple mounting with M18 thread

## Features

### ■ M18 thread

This sensor has an M18 thread on the enclosure, which is convenient for mounting.

### ■ Easy to replace

A pigtailed type sensor with M12 connector (CY-□-J) is easy to replace.

### ■ Environmentally robust

Both the sensor and connector have an IP67 degree of protection. In addition, it is resistant to vibration since it is filled with resin.



### ■ Wide product range

#### Supply voltage

- ① AC supply type (24 to 240VAC)
- ② DC supply type (10 to 30VDC)

#### Output

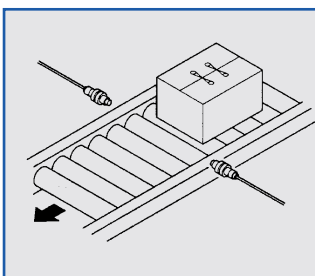
- ① NPN open-collector transistor
- ② PNP open-collector transistor
- ③ AC non-contact (thyristor) output

#### Connection

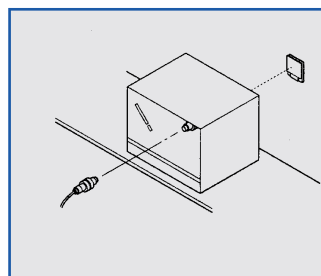
- ① Cable type
- ② Pigtailed type

A total of 32 models are available.

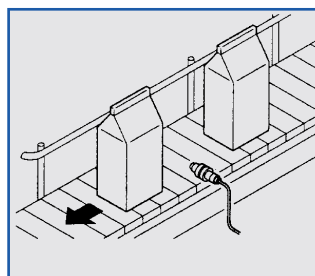
## Typical Applications



Object detection



Position detection



Object detection

# Technical Specifications

## ■ AC supply type

|                                        |                                                |                         |                                          |                            |
|----------------------------------------|------------------------------------------------|-------------------------|------------------------------------------|----------------------------|
| Light ON                               | CY-11A (-J)                                    | CY-17A (-J)             | CY-19A (-J)                              | CY-12A (-J)                |
| Dark ON                                | CY-11B (-J)                                    | CY-17B (-J)             | CY-19B (-J)                              | CY-12B (-J)                |
| Sensor type                            | Thru-beam                                      | Retroreflective         | Retroreflective with polarization filter | Diffuse                    |
| Rated sensing distance                 | 12m                                            | 3m                      | 1.5m                                     | 0.12m                      |
| Standard detectable object             | Metal, matt black                              |                         |                                          | White drawing paper        |
|                                        | Ø ≥/ 8mm                                       | Ø ≥/ 50mm               |                                          | 5 x 5cm                    |
| Detectable target                      | Opaque                                         | Opaque, semitransparent |                                          | Opaque, transparent        |
| Hysteresis                             | --                                             | --                      | --                                       | < 15% of measurement range |
| Response time                          | Max. 20ms                                      |                         |                                          |                            |
| Output thyristor                       | Min. 5mA, max. 200mA                           |                         |                                          |                            |
| Emitting diode                         | Infrared LED                                   |                         | Red LED                                  | Infrared LED               |
| Rated current consumption without load | Transmitter: max. 1.5VA<br>Receiver: max. 2.5V | Max. 2.7VA              |                                          |                            |
| Housing material                       | Plastic                                        |                         |                                          |                            |
| Protection                             | IP67                                           |                         |                                          |                            |
| Physical size (ØxL)                    | M18 x 71mm                                     |                         |                                          |                            |
| Connection method                      | Cable 2m or M12 connector (-J)                 |                         |                                          |                            |
| Operating voltage                      | 24 - 240VAC (±10%)                             |                         |                                          |                            |
| Usable ambient temp.                   | −25°C to +55°C                                 |                         |                                          |                            |
| Weight (approx.)                       | 190g                                           | 100g                    |                                          |                            |

# Technical Specifications

## ■ DC supply type

|                                        |                                               |                         |                                          |                            |
|----------------------------------------|-----------------------------------------------|-------------------------|------------------------------------------|----------------------------|
| NPN output                             | CY-21 (-J)                                    | CY-27 (-J)              | CY-29 (-J)                               | CY-22 (-J)                 |
| PNP output                             | CY-21-PN (-J)                                 | CY-27-PN (-J)           | CY-29-PN (-J)                            | CY-22-PN (-J)              |
| Sensor type                            | Thru-beam                                     | Retroreflective         | Retroreflective with polarization filter | Diffuse                    |
| Rated sensing distance                 | 12m                                           | 3m                      | 1.5m                                     | 12cm                       |
| Standard detectable object             | Metal, matt black                             |                         |                                          | White drawing paper        |
|                                        | Ø ≥/ 8mm                                      | Ø ≥/ 50mm               |                                          | 5 x 5cm                    |
| Detectable target                      | Opaque                                        | Opaque, semitransparent |                                          | Opaque, transparent        |
| Hysteresis                             | --                                            | --                      | --                                       | < 15% of measurement range |
| Response time                          | Max. 2ms                                      |                         |                                          |                            |
| Output transistor                      | Max. 100mA                                    |                         |                                          |                            |
| Emitting diode                         | Infrared LED                                  |                         | Red LED                                  | Infrared LED               |
| Rated current consumption without load | Transmitter: max. 20mA<br>Receiver: max. 25mA | Max. 25mA               |                                          |                            |
| Housing material                       | Plastic                                       |                         |                                          |                            |
| Protection                             | IP67                                          |                         |                                          |                            |
| Physical size (ØxL)                    | M18 x 56mm                                    |                         |                                          |                            |
| Connection method                      | Cable 2m or connector (-J)                    |                         |                                          |                            |
| Operating voltage                      | 10 - 30V DC (±10%)                            |                         |                                          |                            |
| Usable ambient temp.                   | −25°C to +55°C                                |                         |                                          |                            |
| Weight (approx.)                       | 190g                                          | 100g                    |                                          |                            |



## Photoelectric sensor basic line

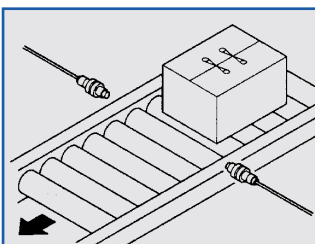
## Features

- Basic models available with axial or radial optics
- Versions with NPN or PNP output, cable or M12 connector
- Standard 3-wire connection configuration
- Selectable dark or light output
- Plastic or metal housing

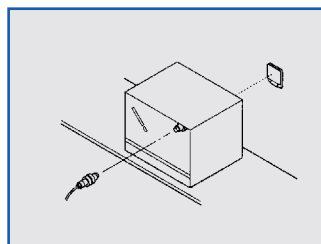
## Technical Specifications

|                                  |                                        |                                             |                                              |                                            |
|----------------------------------|----------------------------------------|---------------------------------------------|----------------------------------------------|--------------------------------------------|
| Plastic PNP                      | M18-T120P-PN(-J)                       | M18-R020P-PN(-J)                            | M18-P015P-PN(-J)                             | M18-D003P-PN(-J)                           |
| Plastic NPN                      | M18-T120P(-J)                          | M18-R020P(-J)                               | M18-P015P(-J)                                | M18-D003P(-J)                              |
| Metal PNP                        | M18-T120M-PN(-J)                       | M18-R020M-PN(-J)                            | M18-P015M-PN(-J)                             | M18-D003M-PN(-J)                           |
| Metal NPN                        | M18-T120M(-J)                          | M18-R020M(-J)                               | M18-P015M(-J)                                | M18-D003M(-J)                              |
| Sensor type                      | Through-beam                           | Retroreflective                             | Retroreflective with polarizing filter       | Reflective                                 |
| Rated sensing distance           | 12m                                    | 2m                                          | 1.5m                                         | 30cm                                       |
| Standard detectable object       | Metal, black matt finish               |                                             |                                              |                                            |
| Detectable target                | Ø5mm or more, opaque object            | Ø35mm or more, opaque or transparent object | Ø7.5mm or more, opaque or transparent object | Ø5mm or more, opaque or transparent object |
| Hysteresis                       | —                                      | —                                           | —                                            | ≤ 15% of the measurement range             |
| Response time                    | Max. 2ms                               | Max. 1ms                                    |                                              |                                            |
| Output transistor                | Max. 100mA                             |                                             |                                              |                                            |
| Emitting diode                   | Infrared LED                           |                                             | Red LED                                      | Infrared LED                               |
| Current consumption without load | Emitter: max. 20mA Receiver: max. 25mA | Max. 30mA                                   |                                              |                                            |
| Housing material                 | Plastic/nickel-plated brass            |                                             |                                              |                                            |
| Protection                       | IP67                                   |                                             |                                              |                                            |
| Physical size (Ø x L)            | M18×57mm                               |                                             |                                              |                                            |
| Connection method                | Cable 2m; plug connection (J)          |                                             |                                              |                                            |
| Operating voltage                | 10 to 30VDC (±10%)                     |                                             |                                              |                                            |
| Usable ambient temperature       | −25°C to +55°C                         |                                             |                                              |                                            |
| Weight                           | Max. 210g                              | Max. 110g                                   |                                              |                                            |

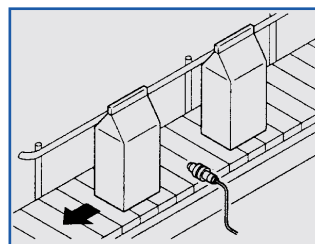
## Typical Applications



Object detection



Position detection



Object detection

# EX-10

EX-10



The smallest: 3.5mm thick

## Features

### ■ Freely mountable fingertip size

Freely mountable 10×14.5×3.5mm (W×H×D) size (thru-beam, front sensing type). Moreover, easy alignment is possible with the visible red LED beam source.

### ■ Long sensing range 1m: EX-19□

### ■ 2-color indicator

A convenient bright, 2-color indicator has been incorporated in the miniature body.

### ■ High-speed response time: 0.5 ms

The sensor is suitable for detecting small and high-speed traveling objects.

### ■ Flexible setup

The EX-10 series is available as a front sensing or side sensing type, allowing for flexible mounting in the narrowest of spaces.

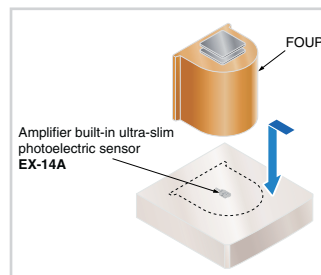


## Typical Applications

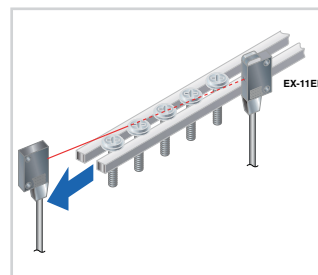
### Detecting the float for a flow meter



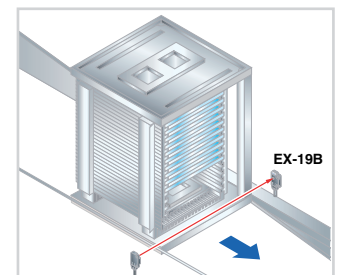
### Seating confirmation of FOUF



### Detecting end of screw supply



### Sensing PCB rack

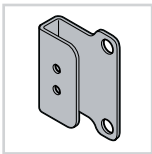


## EX10 Technical Specifications

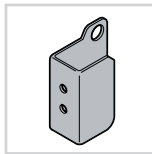
| Type                | Thru-beam                           |             |                    |             |             |             | Convergent reflective                          |             |
|---------------------|-------------------------------------|-------------|--------------------|-------------|-------------|-------------|------------------------------------------------|-------------|
| Model. no.          | EX-11A(-PN)                         | EX-11B(-PN) | EX-13A(-PN)        | EX-13B(-PN) | EX-19A(-PN) | EX-19B(-PN) | EX-14A(-PN)                                    | EX-14B(-PN) |
| Sensing range       | 150mm                               |             | 500mm              |             | 1m          |             | 2 to 25mm (conv. point: 10mm)                  |             |
| Min. sensing object | Ø1mm opaque object                  |             | Ø2mm opaque object |             |             |             | Ø0.1mm copper wire<br>(Setting distance: 10mm) |             |
| Supply voltage      | 12 to 24VDC±10%                     |             |                    |             |             |             |                                                |             |
| Output              | PNP / NPN open-collector transistor |             |                    |             |             |             |                                                |             |
| Output operation    | Light-ON                            | Dark-ON     | Light-ON           | Dark-ON     | Light-ON    | Dark-ON     | Light-ON                                       | Dark-ON     |
| Response time       | 0.5ms or less                       |             |                    |             |             |             |                                                |             |
| Protection          | IP67 (IEC)                          |             |                    |             |             |             |                                                |             |
| Ambient temperature | -25 to +55°C                        |             |                    |             |             |             |                                                |             |
| Dimensions (W×H×D)  | 10×14.5×3.5mm                       |             |                    |             |             |             | 13×14.5×3.5mm                                  |             |

## Options

■ Slit mask available for EX-13□/19□



OS-EX10-12  
OS-EX10-15



OS-EX10E-12

# EX-20

EX20



Miniature-sized and still mountable with M3 screws

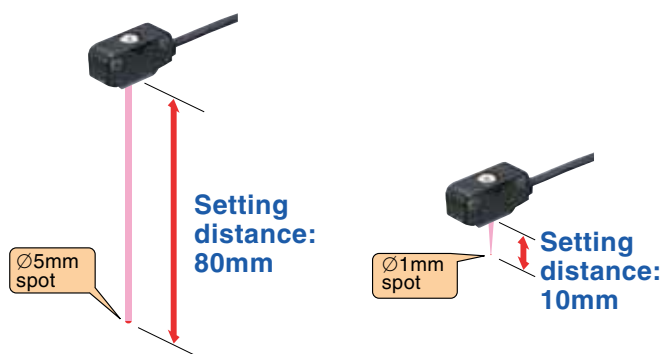
## Features

### ■ Long sensing range

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

### ■ Clear beam spot using red LED dot light source

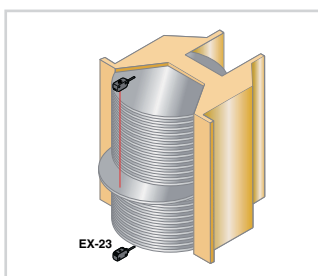
The emission area of a dot light source is smaller than that of a conventional LED flat light source, and it is possible to design a high power, narrow beam. Since a red LED dot light source is used, the red beam spot is clearly visible even at a long distance so that alignment and confirmation of sensing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



## Typical Applications

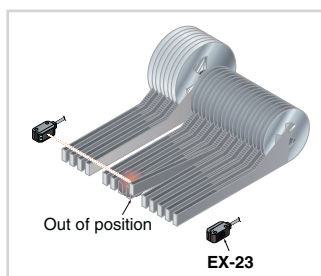
### Checking protrusion of wafer

The ultra compact photoelectric sensor EX-23 has a sufficiently long sensing range of 2m. Further, its visible red LED beam makes beam alignment very easy.



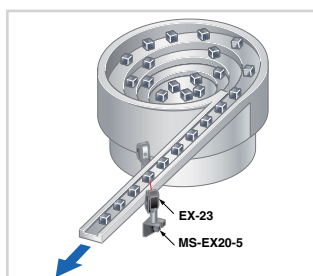
### Detecting tape feeder cassette out of position

Ultra compact in size with an ample sensing range of 2m, ideal for monitoring tape feeder cassettes that are out of position.



### Detecting fill-up of parts in feeder

The sensor setting can be finely adjusted since a universal sensor mounting bracket, with which the height and the angle of the sensor can be freely adjusted, is available.



## EX-20 Technical Specifications

| Type                |          | Thru-beam                                                                                      |                         | Retroreflective                            | Diffuse reflective                        | Convergent reflective                               |                                  | Narrow-view reflective                   |
|---------------------|----------|------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------|-------------------------------------------|-----------------------------------------------------|----------------------------------|------------------------------------------|
|                     |          |                                                                                                |                         |                                            |                                           | Diffuse beam                                        | Small spot beam                  | Long distance spot beam                  |
|                     |          | Front sensing                                                                                  | Side sensing            | Side sensing                               | Side sensing                              | Front sensing                                       | Side sensing                     | Side sensing                             |
| Model. no.          | 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       |          | 1m                                                                                             | 2m                      | 30 to 200mm                                | 5 to 160mm                                | 2 to 25mm<br>(Conv. point: 10mm)                    | 6 to 14mm<br>(Conv. point: 10mm) | 45 to 115mm                              |
| Sensing object      |          | Min. Ø2.6mm opaque object                                                                      | Min. Ø3mm opaque object | Ø15mm or more opaque or translucent object | Opaque, translucent or transparent object | Min. Ø0.1mm copper wire<br>(Setting distance: 10mm) |                                  | Opaque,translucent or transparent object |
| Supply voltage      |          | 12 to 24VDC±10%                                                                                |                         |                                            |                                           |                                                     |                                  |                                          |
| Output              |          | NPN output type: NPN open-collector transistor; PNP output type: PNP open-collector transistor |                         |                                            |                                           |                                                     |                                  |                                          |
| Response time       |          | 0.5ms or less                                                                                  |                         |                                            |                                           |                                                     |                                  |                                          |
| Protection          |          | IP67 (IEC)                                                                                     |                         |                                            |                                           |                                                     |                                  |                                          |
| Ambient temperature |          | -25 to +55°C                                                                                   |                         |                                            |                                           |                                                     |                                  |                                          |
| Dimensions (W×H×D)  |          | 16×18×4.5mm                                                                                    | 8.2×22×10.5mm           | 8.2×25×12.3mm                              |                                           | 16×18×4.5mm                                         | 8.2×25×12.3mm                    | 10×14.5×3.5mm                            |

# EX-30

EX-30



A new alternative to fiber sensors

## Features

### ■ 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 fiber sensors.

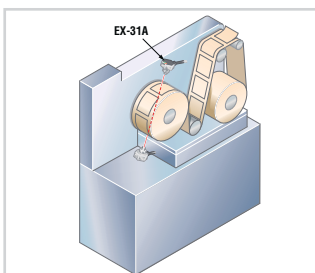
### ■ 800mm thru-beam type available

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.

## Typical Applications

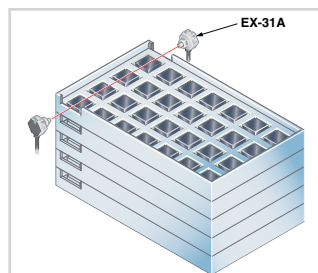
### Detecting quantity of labels in label magazine

Detects the remaining amount of labels by the thickness of the roll.



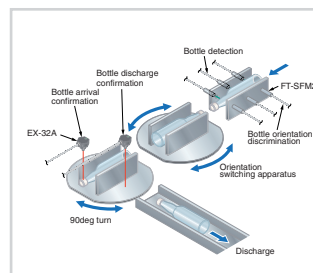
### Detecting IC height

Detects whether ICs are accurately placed in IC trays.



### Resin bottle detection

The **EX-32A** threaded photoelectric sensor confirms the arrival of bottles.



## EX30 Technical Specifications

| Type                |                  | Thru-beam                                                                                        |           |                             | Diffuse reflective                        |           |
|---------------------|------------------|--------------------------------------------------------------------------------------------------|-----------|-----------------------------|-------------------------------------------|-----------|
| Model. no.          | NPN output       | EX-31A                                                                                           | EX-31B    | EX-33                       | EX-32A                                    | EX-32B    |
|                     | PNP output       | EX-31A-PN                                                                                        | EX-31B-PN | EX-33-PN                    | EX-32A-PN                                 | EX-32B-PN |
| Sensing range       |                  | 500mm                                                                                            |           | 800mm                       | 50mm                                      |           |
| Sensing object      |                  | Min. Ø2mm or more opaque object                                                                  |           |                             | Opaque, translucent or transparent object |           |
| Supply voltage      |                  | 12 to 24VDC±10%                                                                                  |           |                             |                                           |           |
| Output              |                  | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor |           |                             |                                           |           |
|                     | Output operation | Light-ON                                                                                         | Dark-ON   | Variable (switching method) | Light-ON                                  | Dark-ON   |
| Response time       |                  | 0.5ms or less                                                                                    |           |                             |                                           |           |
| Protection          |                  | IP67 (IEC)                                                                                       |           |                             |                                           |           |
| Ambient temperature |                  | −25 to +55°C                                                                                     |           |                             |                                           |           |

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

# PM



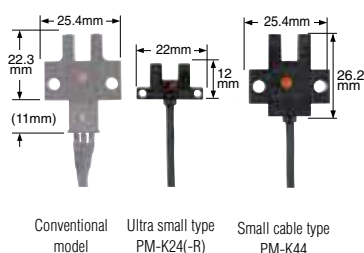
**Enables equipment miniaturization and quick construction**

## Features

### ■ Extremely compact

Ultra small type

**PM-□24(-R)** achieves an extremely compact size and can contribute to the miniaturization of your equipment.



### ■ 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.

### ■ Flexible cable type

Flexible cable is used, which allows repeated bending. It is suitable for use in the moving part of a robot arm.

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

The connector is built-in, allowing greater space savings. Commercially available general-purpose connectors can be used with some types for improved reliability.

### ■ Quick fitting hook-up connector

Easy to maintain hook-up connector type models are available.

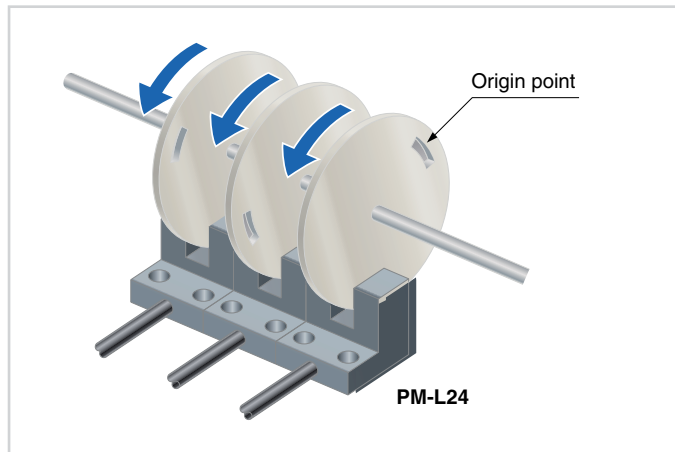
Since only crimping with exclusive pliers needs to be done, cumbersome soldering or insulation is not required.

Further, a connector attached cable (CN-14H-C1/C3) is also available.

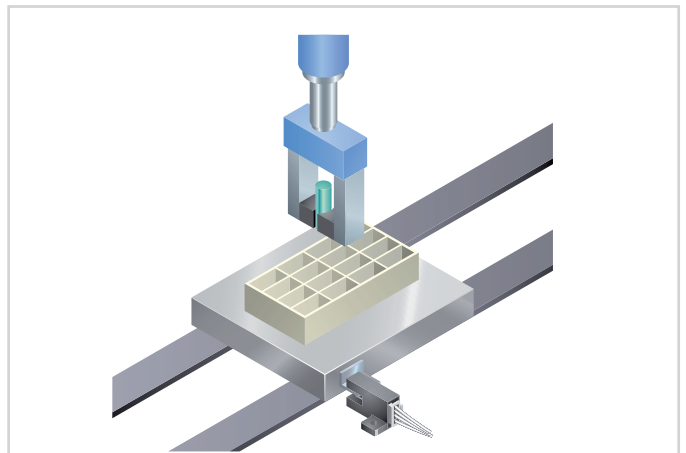
## PM Typical Applications

### Sensing rotating bodies

By incorporating a slit in the rotating body, the origin point can be sensed.



### Determine the pallet position



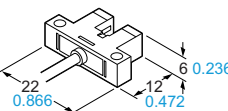
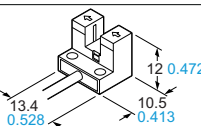
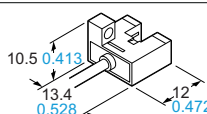
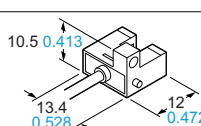
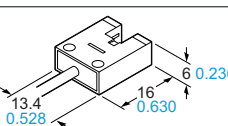
## Technical Specifications

| Type                |            | Ultra small type                                                                                                                       | Small type |                |                    |
|---------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|--------------------|
|                     |            | With cable                                                                                                                             | With cable | With connector | Built-in connector |
| Model no.           | NPN output | PM-□24(-R)<br>(Note)                                                                                                                   | PM-□44     | PM-□54         | PM-□64             |
|                     | PNP output | PM-□24P                                                                                                                                | PM-□44P    | PM-□54P        | PM-□64P            |
| Sensing range       |            | 5mm (fixed)                                                                                                                            |            |                |                    |
| Min. sensing object |            | 0.821 × 1.8mm opaque object                                                                                                            |            |                |                    |
| Repeatability       |            | 0.03mm or less                                                                                                                         |            | 0.01mm or less |                    |
| Supply voltage      |            | 5 to 24VDC ±10%                                                                                                                        |            |                |                    |
| Output              |            | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor                                       |            |                |                    |
| Output operation    |            | Incorporated with 2 outputs: Light-ON / Dark-ON                                                                                        |            |                |                    |
| Response time       |            | Under light incident condition: 20μs or less<br>Under light interrupted condition: 100μs or less<br>(Response frequency: 1kHz or more) |            |                |                    |
| Emitting element    |            | Infrared LED (non-modulated)                                                                                                           |            |                |                    |

**Note:** PM-□24-R is flexible cable type.  
3m cable length type (standard: 1m) is also available (excluding flexible cable type and PNP output type).

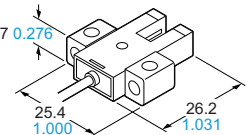
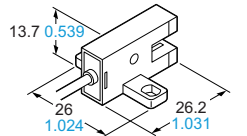
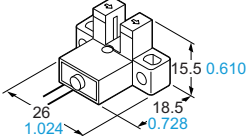
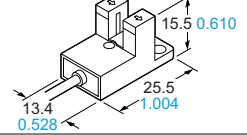
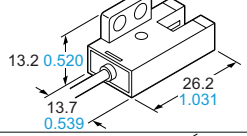
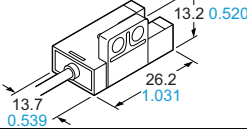
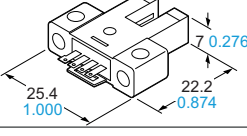
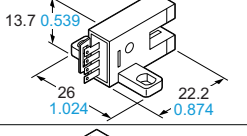
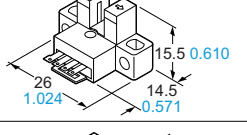
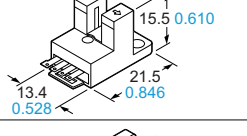
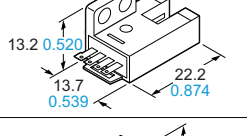
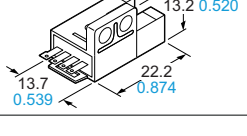
Example: PM-K44  
K = K-Type  
L = L-Type  
F = F-Type  
R = R-Type  
U = U-Type

## Order Guide

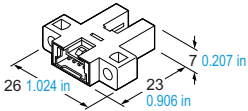
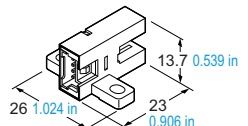
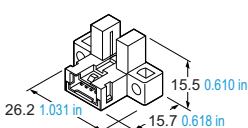
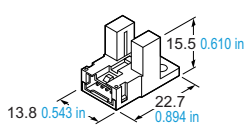
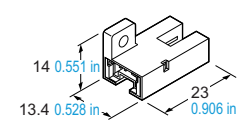
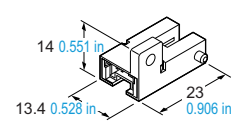
| Type        | Appearance (mm in)                                                                             | Sensing range | Model no. (Note) |
|-------------|------------------------------------------------------------------------------------------------|---------------|------------------|
| Ultra-small | K type<br> | 5 mm (fixed)  | PM-K24           |
|             |                                                                                                |               | PM-K24P          |
|             |                                                                                                |               | PM-K24-R         |
|             | L type<br> |               | PM-L24           |
|             |                                                                                                |               | PM-L24P          |
|             |                                                                                                |               | PM-L24-R         |
|             | F type<br> |               | PM-F24           |
|             |                                                                                                |               | PM-F24P          |
|             |                                                                                                |               | PM-F24-R         |
|             | R type<br> |               | PM-R24           |
|             |                                                                                                |               | PM-R24P          |
|             |                                                                                                |               | PM-R24-R         |
|             | U type<br> |               | PM-U24           |
|             |                                                                                                |               | PM-U24P          |
|             |                                                                                                |               | PM-U24-R         |

**Note:** The suffix "-R" indicates a flexible cable type.

# Order Guide

| Type  |                | Appearance (mm in)                                                                            | Sensing range | Model no. |
|-------|----------------|-----------------------------------------------------------------------------------------------|---------------|-----------|
| Small | With cable     | K type<br>   | 5 mm (fixed)  | PM-K44    |
|       |                |                                                                                               |               | PM-K44P   |
|       |                | T type<br>   |               | PM-T44    |
|       |                |                                                                                               |               | PM-T44P   |
|       |                | L type<br>   |               | PM-L44    |
|       |                |                                                                                               |               | PM-L44P   |
|       |                | Y type<br>   |               | PM-Y44    |
|       |                |                                                                                               |               | PM-Y44P   |
|       |                | F type<br>  |               | PM-F44    |
|       |                |                                                                                               |               | PM-F44P   |
|       |                | R type<br> |               | PM-R44    |
|       |                |                                                                                               |               | PM-R44P   |
|       | With connector | K type<br> |               | PM-K54    |
|       |                |                                                                                               |               | PM-K54P   |
|       |                | T type<br> |               | PM-T54    |
|       |                |                                                                                               |               | PM-T54P   |
|       |                | L type<br> |               | PM-L54    |
|       |                |                                                                                               |               | PM-L54P   |
|       |                | Y type<br> |               | PM-Y54    |
|       |                |                                                                                               |               | PM-Y54P   |
|       |                | F type<br> |               | PM-F54    |
|       |                |                                                                                               |               | PM-F54P   |
|       |                | R type<br> |               | PM-R54    |
|       |                |                                                                                               |               | PM-R54P   |

## PM Order Guide

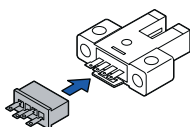
| Type                              | Appearance (mm in)                                                                                                                               | Sensing range                                                                                  | Model no. |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------|
| Small and built-in connector type |  <p>K type</p> <p>26 1.024 in 23 0.906 in 7 0.207 in</p>        |  5 mm (fixed) | PM-K64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-K64P   |
|                                   |  <p>T type</p> <p>26 1.024 in 23 0.906 in 13.7 0.539 in</p>     |                                                                                                | PM-T64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-T64P   |
|                                   |  <p>L type</p> <p>26.2 1.031 in 15.7 0.618 in 15.5 0.610 in</p> |                                                                                                | PM-L64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-L64P   |
|                                   |  <p>Y type</p> <p>13.8 0.543 in 22.7 0.894 in 15.5 0.610 in</p> |                                                                                                | PM-Y64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-Y64P   |
|                                   |  <p>F type</p> <p>14 0.551 in 23 0.906 in 13.4 0.528 in</p>    |                                                                                                | PM-F64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-F64P   |
|                                   |  <p>R type</p> <p>14 0.551 in 23 0.906 in 13.4 0.528 in</p>   |                                                                                                | PM-R64    |
|                                   |                                                                                                                                                  |                                                                                                | PM-R64P   |

## Options

| Designation              | Model no. | Description                                                                                                                                                                             |                                                                                                                 |
|--------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Connector                | CN-14     | Connector for soldering                                                                                                                                                                 |                                                                                                                 |
| Hook-up connector        | CN-14H    | This connector can be hooked-up on 0.08 to 0.2 mm² cable simply in one grip.<br>Wire diameter: ø0.7 to ø1.2 mm <a href="#">ø0.028 to ø0.047 in</a>                                      |                                                                                                                 |
|                          | CN-14H-2  | Suitable for UL standard cable.<br>This connector can be hooked-up on 0.18 to 0.22 mm² cable simply in one grip.<br>Wire diameter: ø1.2 to ø1.52 mm <a href="#">ø0.047 to ø0.060 in</a> |                                                                                                                 |
| Connector attached cable | CN-14H-C1 | Length: 1 m <a href="#">3.281 ft</a><br>Net weight: 20 g approx.                                                                                                                        | For the connector type, with 0.18 mm² 4-core cabtyre cable<br>Cable diameter: ø3.8 mm <a href="#">ø0.150 in</a> |
|                          | CN-14H-C3 | Length: 3 m <a href="#">9.843 ft</a><br>Net weight: 65 g approx.                                                                                                                        |                                                                                                                 |
| Hook-up pliers           | CN-HP     | These are exclusive pliers for hook-up connectors CN-14H and CN-14H-2                                                                                                                   |                                                                                                                 |

### ■ Connector

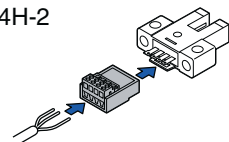
#### ■ CN-14



### ■ Hook-up connector

#### ■ CN-14H

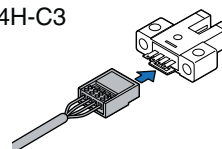
#### ■ CN-14H-2



### ■ Connector attached cable

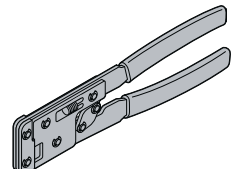
#### ■ CN-14H-C1

#### ■ CN-14H-C3



### ■ Hook-up pliers

#### ■ CN-HP



# PM2

PM2



**Convergent reflection sensing ensures stable detection**

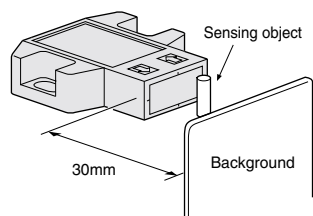
## Features

### ■ Stable detection by convergent reflective mode

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

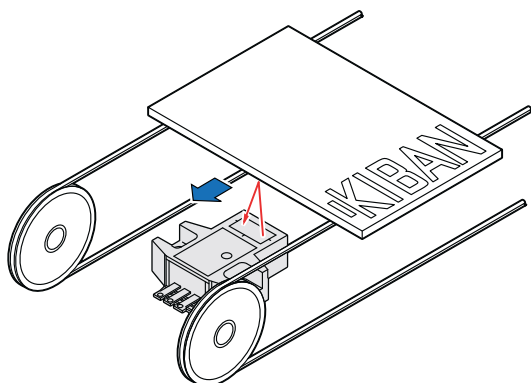
### ■ Not affected by background

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



### ■ Sensing printed circuit boards

Minute object detectable.



### ■ Dark object detectable

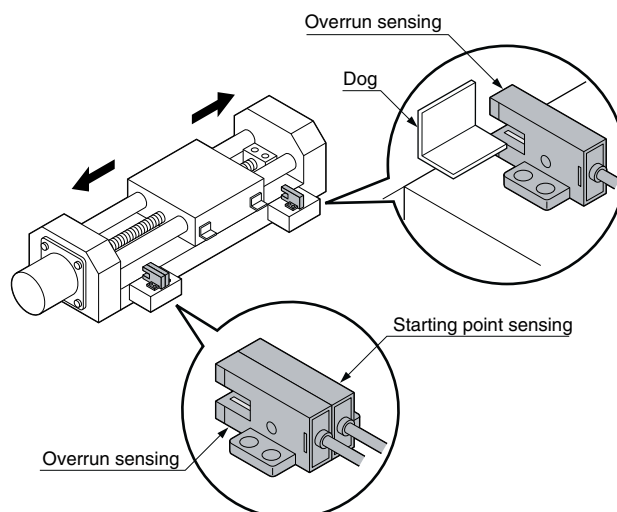
Since the sensor is very sensitive, it can detect even a dark object of low reflectivity.

### ■ Minute object detectable

A  $\varnothing 0.05\text{mm}$  copper wire can be detected at a distance of 5mm.

### ■ Sensing the starting point and overrun of a moving body

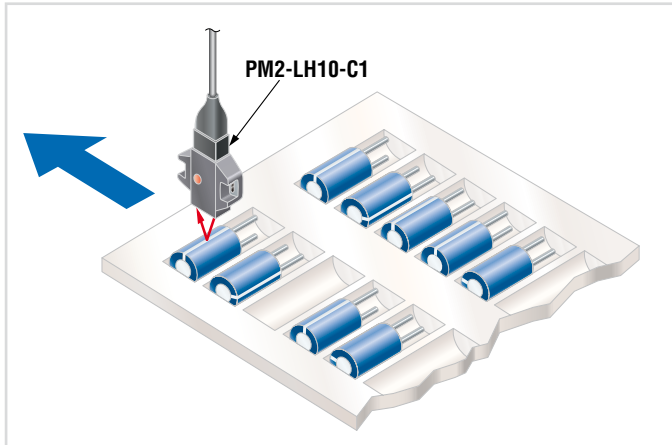
Starting point and overrun is sensed using the dog on the base.



## Typical Applications

### Detecting capacitors in tray

The convergent reflective type sensor reliably detects capacitors in a tray without being affected by their color, characters, marks, or glossiness.



## Order Guide

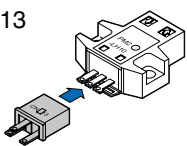
| Type           | Appearance           | Sensing range | Model no.    |
|----------------|----------------------|---------------|--------------|
| Connector type | Top sensing          | 2.5 to 8mm    | PM2-LH10     |
|                | Front sensing        |               | PM2-LH10B    |
|                | L type (Top sensing) |               | PM2-LF10     |
| Cable type     | Top sensing          |               | PM2-LF10B    |
|                | Front sensing        |               | PM2-LL10     |
|                | L type (Top sensing) |               | PM2-LL10B    |
|                | Top sensing          |               | PM2-LH10-C1  |
|                | Front sensing        |               | PM2-LH10B-C1 |
|                | L type (Top sensing) |               | PM2-LF10-C1  |
|                | Top sensing          |               | PM2-LF10B-C1 |
|                | Front sensing        |               | PM2-LL10-C1  |
|                | L type (Top sensing) |               | PM2-LL10B-C1 |

## Options

| Designation              | Model no. | Description                                      |
|--------------------------|-----------|--------------------------------------------------|
| Connector                | CN-14     | Connector for soldering                          |
| Connector attached cable | CN-14H-C1 | 0.2mm <sup>2</sup> 3-core cabtyre cable, 1m long |
|                          | CN-14H-C3 | 0.2mm <sup>2</sup> 3-core cabtyre cable, 3m long |

### ■ Connector

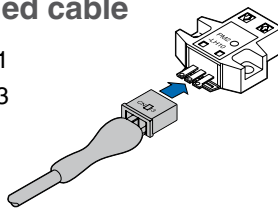
#### ■ CN-13



### ■ Connector attached cable

#### ■ CN-13-C1

#### ■ CN-13-C3



## Technical Specifications

| Type                                          |          | Connector                                                           |               |                      | Cable        |               |                      |
|-----------------------------------------------|----------|---------------------------------------------------------------------|---------------|----------------------|--------------|---------------|----------------------|
|                                               |          | 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 8mm (conv. point: 5mm) with white non-glossy paper (15×15mm) |               |                      |              |               |                      |
| Min. sensing object                           |          | ∅0.05mm copper wire (setting distance: 5mm)                         |               |                      |              |               |                      |
| Repeatability (perpendicular to sensing axis) |          | 0.08mm                                                              |               |                      |              |               |                      |
| Supply voltage                                |          | 5 to 24VDC±10%                                                      |               |                      |              |               |                      |
| Output                                        |          | NPN open-collector transistor                                       |               |                      |              |               |                      |
| Response time                                 |          | 0.8ms or less                                                       |               |                      |              |               |                      |
| Emitting element                              |          | Infrared LED (modulated)                                            |               |                      |              |               |                      |

# NA1-11

NA1-11



**Cross-beam scanning system to detect slim objects**

## Features

### ■ Letter or business card detectable

Thin objects can be detected by using the cross-beam scanning system.

### ■ Emitting and receiving element pitch: 10mm

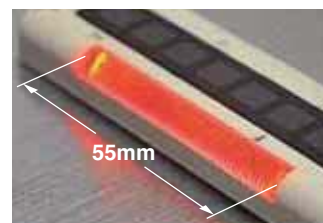
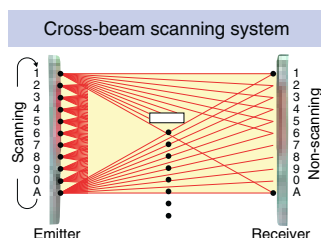
A minimum sensing object size of  $\varnothing 13.5\text{mm}$  is realized by using an emitting and receiving element pitch of 10mm.

### ■ Wide area

Though very slim a wide sensing area of 1m length and 100mm width is realized. It is most suitable for object detection on a wide assembly line, or for detecting the dropping of, or incursion by, small objects whose travel path is uncertain.

### ■ Clearly visible large indicator

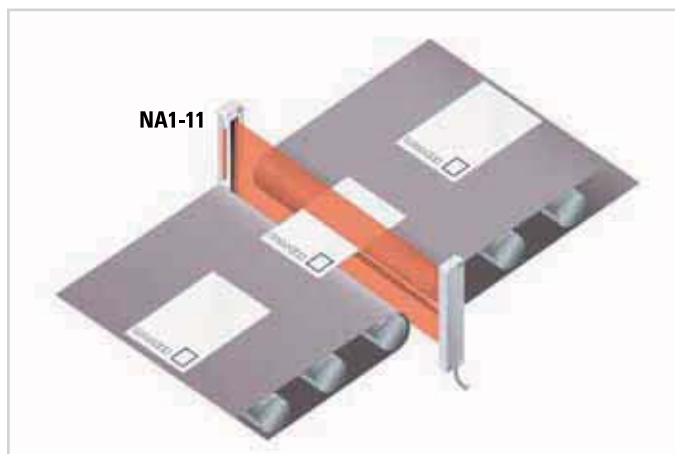
A clearly visible large indicator having a 55mm width is incorporated on both the emitter and the receiver.



## Typical Applications

### Detecting postcards

NA1-11 can detect thin postcards due to its crossbeam scanning system.



## Technical Specifications

| Model no.                             | NA1-11                                                | NA1-11-PN                     |
|---------------------------------------|-------------------------------------------------------|-------------------------------|
| Sensing height                        | 100mm                                                 |                               |
| Sensing range                         | 0.17 to 1m                                            |                               |
| Element pitch                         | 10mm                                                  |                               |
| Number of emitting/receiving elements | 11 each on the emitter and the receiver, respectively |                               |
| Sensing object                        | $\varnothing 13.5\text{mm}$ or more opaque object     |                               |
| Supply voltage                        | 12 to 24VDC $\pm 10\%$                                |                               |
| Output                                | NPN open-collector transistor                         | PNP open-collector transistor |
| Ambient temperature                   | $-10$ to $+55^{\circ}\text{C}$                        |                               |
| Dimensions                            | W30×H140×D10mm                                        |                               |

## NA1-PK5/ NA1-PK3

Ultra-slim body pick-to-light sensor

### Features

#### ■ 10 mm thick: half the thickness of conventional models

Space saving now possible; ultra-thin design does not obstruct picking operations.

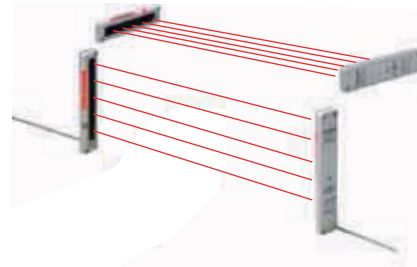


Cable can be freely arranged in any position

#### ■ Two unit installations are possible

Sensor units can now be set to different light emission frequencies in order to prevent mutual interference.

Two units can now be operated in a side-by-side configuration without interference for problem-free detection over wider areas.



#### ■ Lighting pattern selectable

The job indicator operation can be selected as either continuous lighting or blinking.

Continuous lighting



Blinking

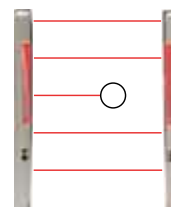


Changeover

#### ■ Selectable detection operation

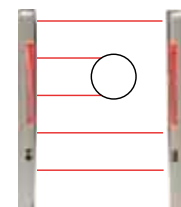
Sensor units can be set to detect the interruption of 1 beam channel or 2 or more beam channels.

Single beam interruption



All opaque bodies with  $\varnothing 35 \text{ mm } \varnothing 1.378 \text{ in}$  or greater will be detected.

Double beam interruption



The accidental passage of small objects through the beam axis will not trigger detection, yet the operator's hands will always be accurately detected. This function is also useful when small objects regularly interrupt the beam axis.

Changeover

## Typical Applications

### ■ Cell production line



### ■ Assembly line



## Technical Specifications

|                         | NPN output                                  |                                    | PNP output                                  |                                    |
|-------------------------|---------------------------------------------|------------------------------------|---------------------------------------------|------------------------------------|
|                         | NA1-PK5                                     | NA1-PK3                            | NA1-PK5-PN                                  | NA1-PK3-PN                         |
| Sensor type             | Picking sensor                              |                                    |                                             |                                    |
| Sensing height          | 100mm                                       | 49.2mm                             | 100mm                                       | 49.2mm                             |
| Sensing range           | 0.1 to 1.2m                                 | 0.03 to 0.3m                       | 0.1 to 1.2m                                 | 0.03 to 0.3m                       |
| Beam pitch              | 25mm                                        | 24.6mm                             | 25mm                                        | 24.6mm                             |
| Number of beam channels | 5 beam channels                             | 3 beam channels                    | 5 beam channels                             | 3 beam channels                    |
| Sensing object          | ≥ Ø 35mm or more,<br>opaque object          | ≥ Ø 29mm or more,<br>opaque object | ≥ Ø 35mm or more,<br>opaque object          | ≥ Ø 29mm or more,<br>opaque object |
| Supply voltage          | 12 to 24V DC ±10%                           |                                    |                                             |                                    |
| Output                  | NPN open-collector transistor,<br>max.100mA |                                    | PNP open-collector transistor,<br>max.100mA |                                    |
| Dimensions (W×H×D)      | 30×140×10mm                                 | 24×70×8mm                          | 30×140×10mm                                 | 24×70×8mm                          |

# EQ-500

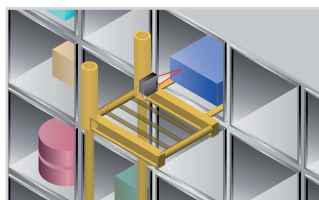
**Long range sensing capability  
up to 2.5m**

## Features

1m sensing range type EQ-502(T)/512(T)

### ■ Impervious to variations in color or angle

Due to its advanced optical system, the sensor is not affected by variations in the object's angle or gloss as compared to conventional sensors. Moreover, sensing can be performed at a somewhat constant distance even if the sensing object is black or white.



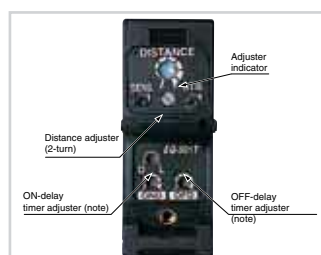
### ■ Not affected by background objects

Due to the 2-segment photodiode adjustable range system, the sensor does not detect objects outside the preset sensing field; it will not malfunction even if someone walks behind the sensing object, or machines or conveyors are in the background.

### ■ An easy-to-set adjuster with indicator

Equipped with a 2-turn adjuster with indicator, making it easy to set for short or long distances.

It can function with 24 to 240VAC and 12 to 240VDC. Therefore, almost any power supply anywhere in the world will work.



Multi-voltage type EQ-501(T)/502(T)

### ■ Equipped with BGS/FGS function

We have 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.

DC-voltage type EQ-511(T)/512(T)

### ■ Convenient timer function models

Types with an ON-delay/OFF-delay timer available. (EQ-5□T) OFF-delay, e.g. useful when the response of the connected device is slow, ON-delay, e.g. useful to detect objects that take a long time to move.

- Operation: ON-delay  
OFF-delay
- Timer period: 0.1 to 5sec.  
(individual setting possible)



### ■ Little affected by contamination on lens

Even if the lens surface gets somewhat dirty from dust particles, there is very little change in the operation field, rendering stable and consistent detection even for objects appearing close to the front surface of the unit.

### ■ Convenient terminal block type

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



# Technical Specifications

| Type                                        | Multi-voltage                                                    |                                                                      |             |                                                                      | DC-voltage                                                                |                                                                      |             |                                                                      |
|---------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------|-------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|-------------|----------------------------------------------------------------------|
|                                             |                                                                  | With timer                                                           |             | With timer                                                           |                                                                           | With timer                                                           |             | With timer                                                           |
| Model. no.                                  | EQ-501                                                           | EQ-501T                                                              | EQ-502      | EQ-502T                                                              | EQ-511                                                                    | EQ-511T                                                              | EQ-512      | EQ-512T                                                              |
| Adjustable range (Note)                     | 0.2 to 2.5m                                                      |                                                                      | 0.2 to 1.0m |                                                                      | 0.2 to 2.5m                                                               |                                                                      | 0.2 to 1.0m |                                                                      |
| Sensing range (at maximum setting distance) | 0.1 to 2.5m                                                      |                                                                      | 0.1 to 1.0m |                                                                      | 0.1 to 2.5m                                                               |                                                                      | 0.1 to 1.0m |                                                                      |
| Supply voltage                              | 24 to 240VAC ±10% or 12 to 24VDC ±10%                            |                                                                      |             |                                                                      | 12 to 24VDC ±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                               | 20ms or less (for EQ-50XT dependent on the setting timer period) |                                                                      |             |                                                                      | 2ms or less (for EQ-51XT dependent on the setting timer)                  |                                                                      |             |                                                                      |
| Timer function                              | —                                                                | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | —           | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | —                                                                         | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer | —           | Incorporated with variable (0.1 to 5sec.) ON-delay / OFF-delay timer |
| Protection                                  | IP67 (IEC)                                                       |                                                                      |             |                                                                      |                                                                           |                                                                      |             |                                                                      |
| Ambient temperature                         | −20 to +55°C                                                     |                                                                      |             |                                                                      |                                                                           |                                                                      |             |                                                                      |
| Emitting element (modulated)                | Infrared LED (modulated)                                         |                                                                      |             |                                                                      |                                                                           |                                                                      |             |                                                                      |
| Dimensions (W×H×D)                          | 26×68×68mm                                                       |                                                                      |             |                                                                      |                                                                           |                                                                      |             |                                                                      |

## EQ-30



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

### Features

■ Not affected by object color or background

■ Long sensing range 2m

■ Compact size

The EQ-30 saves space, since a miniaturized housing of 20×68×40mm (W×H×D) 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 previously two were required.

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

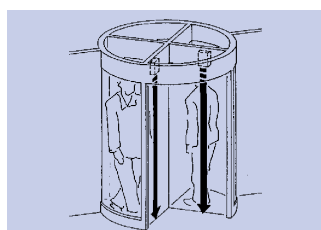
Plug-in connector type of the **EQ-30** series can be easily disconnected for replacement. Should a problem occur, anyone would be able to replace the sensor in a minute.

### Technical Specifications

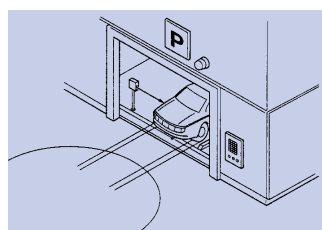
| NPN output                             | EQ-34 (J)                        | EQ-34W *                        |
|----------------------------------------|----------------------------------|---------------------------------|
| PNP output                             | EQ-34PN (J)                      |                                 |
| Sensor type                            | Diffuse                          | Diffuse/double output           |
| Rated sensing distance                 | 200cm                            |                                 |
| Sensing range                          | 10–200cm                         | Near: 10–200cm<br>Far: 20–200cm |
| Standard detectable object             | White drawing paper 20×20cm      |                                 |
| Detectable target                      | Transparent and opaque material  |                                 |
| Hysteresis                             | ≤10% of measurement              |                                 |
| Response time                          | Max. 2ms                         |                                 |
| Outputs                                | Transistor max. 100mA            |                                 |
| Emitting diode                         | Infrared LED 880nm               |                                 |
| Rated current consumption without load | NPN type: 50mA<br>PNP type: 55mA | 2 x NPN type: 90mA              |
| Housing material                       | Plastic                          |                                 |
| Protection                             | IP67                             |                                 |
| Physical size (H×W×D)                  | 68×20×40mm                       |                                 |
| Connection method                      | 2m cable or M12 connector (J)    |                                 |
| Operating voltage                      | 10 to 30V DC (±10%)              |                                 |
| Usable ambient temperature             | –20°C to +55°C                   |                                 |
| Weight                                 | Approx. 150g                     |                                 |

\* (Two outputs)

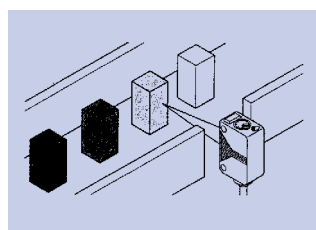
### Typical Applications



Long distance sensing



Object detection



Color-independent presence  
sensing



# MQ-W

**Very accurate detection by triple beam triangulation sensing method in a compact package**

## Features

### ■ Accurate detection

Regardless of color, material, or shape of objects area reflective type sensor can detect white or black objects at the same distance. In case of diffuse reflective types, which cannot always detect objects of various color with the same sensitivity setting, the MQ-W area reflective type sensor is a worthy substitute.

### ■ No-miss operation regardless of backgrounds

Area reflective type sensors do not detect objects beyond the set range.

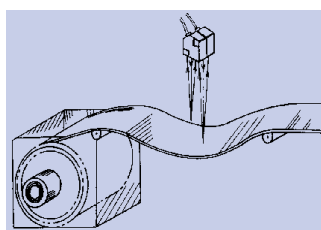
### ■ Resistant to lens surface soiling

Area reflective type sensors detect the distance by the angle, not the intensity of received light. Even if the lens surface is soiled by dust or powdery material, there is little variation in sensing range.

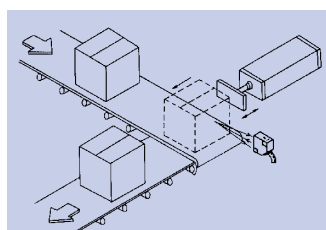
## Technical Specifications

|                              |                                 |            |                           |
|------------------------------|---------------------------------|------------|---------------------------|
| NPN output                   | MQ-W3A(R)                       | MQ-W20A(R) | MQ-W70A                   |
| PNP output                   | MQ-W3C(R)                       | MQ-W20C(R) | MQ-W70C                   |
| Sensor type                  | Diffuse                         |            |                           |
| Rated sensing distance       | 3cm                             | 20cm       | 70cm                      |
| Sensing range                | 2–4cm                           | 4–20cm     | 20–70cm                   |
| Standard detectable object   | White drawing paper             |            |                           |
|                              | 1×1cm                           | 2×2cm      | 7.5×7.5cm                 |
| Detectable target            | Transparent and opaque material |            |                           |
| Hysteresis                   | ≤10% of measurement range       |            | ≤20% of measurement range |
| Detection frequency          | 250Hz                           |            |                           |
| Response time                | 2ms                             |            |                           |
| Output relay                 | –                               |            |                           |
| Output transistor            | Max. 100mA, NPN/PNP             |            |                           |
| Wavelength of emitting diode | Type R: 660nm<br>910nm          |            | 880nm                     |
| Rated current consumption    | Max. 30mA                       |            |                           |
| Housing material             | Zinc die cast                   |            |                           |
| Protection                   | IP67                            |            |                           |
| Physical size (H×W×L)        | 32×12.6×32mm                    |            | 52×18.6×52mm              |
| Connection method            | 2m cable                        |            |                           |
| Operating voltage            | 12 to 24VDC (–20%/+25%)         |            |                           |
| Usable ambient temperature   | –25°C to +55°C                  |            |                           |
| Weight                       | Approx. 126g                    |            | Approx. 235g              |

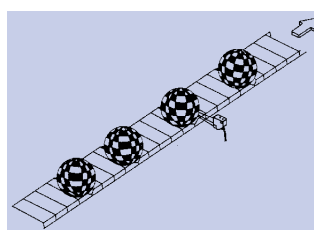
## Typical Applications



Distance detection



Position detection



Color-independent detection



# ST4

Type 4 · PLe · SIL3

**Excellent basic functions at a reasonable price**

## Features

### ■ Series connection of 6 sets of sensor heads to 1 controller

The new concept of connecting 6 sets of sensor heads to 1 controller in series offers you maximum flexibility to solve your safety application.

### ■ Beam axis alignment and operation confirmation

The beam interruption indicator is incorporated in both the emitter and receiver. This indicator can be used not only to confirm operation but also to align the beam axis.

### ■ Compact sensor head saves space

The size of the type 4 long sensing range type is similar to general purpose photoelectric sensors.

### ■ IP67 degree of protection

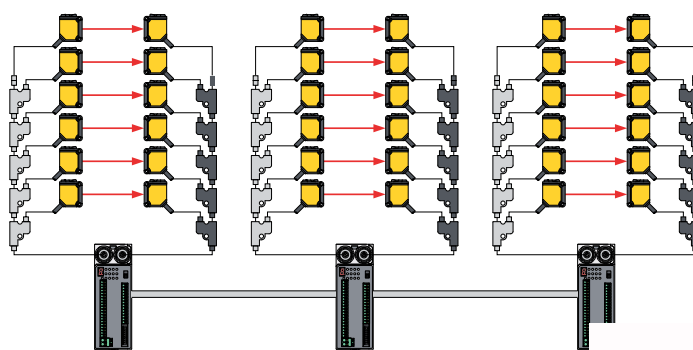
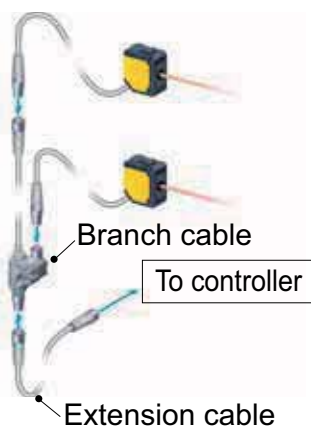
The sensor heads can be used safely even on lines where water splashes.

### ■ Interference prevention

The emission amount adjuster can be used to prevent interference to the surrounding sensors.

### ■ Supports both PNP and NPN polarities

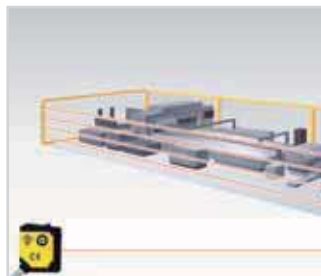
A single unit supports both PNP and NPN polarities, easing stock management.



## Typical Applications

### Protection for long sensing ranges

Guard areas up to 15m in length, for example where protective fences are difficult to install.



### Protection for small openings

For small openings where light curtains do not fit, ST4 sensor heads ensure safety.



### Protection against non-authorized entry

Sensor heads can be mounted flexibly and muting control implemented easily.



## Technical Specifications

| Sensor Heads               | Cable length 0.2m                                                                    |                               | Cable length 1m                        |                               |
|----------------------------|--------------------------------------------------------------------------------------|-------------------------------|----------------------------------------|-------------------------------|
|                            |                                                                                      | 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 15m                                                                           |                               |                                        |                               |
| Sensing object             | ø9 mm or more opaque object                                                          |                               |                                        |                               |
| Supply voltage             | Supplied from controller                                                             |                               |                                        |                               |
| Current consumption        | Emitter: 11mA or less, Receiver: 9mA or less                                         |                               |                                        |                               |
| Protection                 | IP67                                                                                 |                               |                                        |                               |
| Weight                     | 45g                                                                                  |                               | 100g                                   |                               |
| Usable ambient temperature | -10 to +55 °C (No dew condensation or icing allowed), Storage: -25 to +70°C          |                               |                                        |                               |
| Emitting element           | Infrared LED (Peak emission wavelength: 870nm)                                       |                               |                                        |                               |
| Material                   | Enclosure: PBT (Polybutylene terephthalate), Lens: Acrylic, Indicator cover: Acrylic |                               |                                        |                               |
| Cable                      | Shielded cable with connector, 0.2m long                                             |                               | Shielded cable with connector, 1m long |                               |
| Safety category            | EN 13849-1 (Category 4)                                                              |                               |                                        |                               |

| Sensor type         | Controller                                                                                        | High-functional controller                |
|---------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------|
|                     | ST4-C11                                                                                           | ST4-C12EX                                 |
| Supply voltage      | 24VDC +10/ -15% Ripple P-P 10% or less                                                            |                                           |
| Current consumption | 100mA or less<br>(excluding sensor heads)                                                         | 120mA or less<br>(excluding sensor heads) |
| Output transistors  | OSSD1 and OSSD2 (PNP or NPN, switchable), max. 200mA                                              |                                           |
| Response time       | ON -> OFF: 25ms or less<br>OFF -> ON: 90ms or less (auto reset) /<br>140ms or less (manual reset) |                                           |
| Protection          | Enclosure: IP40 (IEC), Terminal: IP20 (IEC)                                                       |                                           |
| Ambient temperature | -10 to +55 °C (No dew condensation or icing allowed),<br>Storage: -25 to +70°C                    |                                           |
| Material            | Enclosure: ABS                                                                                    |                                           |
| Weight              | 180g                                                                                              | 240g                                      |

# SF2B

Type 2 · PLd · SIL2

**Excellent basic functions  
at a reasonable price**

## Features

### ■ Unit length = Protective height, 'ZERO' dead zone

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



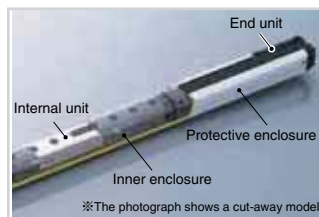
### ■ Also suppresses mutual interference and effects of extraneous light

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.



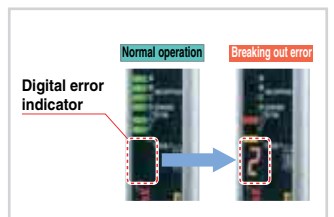
### ■ Seamless structure using an inner enclosure

The internal unit fits into an inner enclosure completely eliminating seams (joints) inside the product.



### ■ 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!



## Technical Specifications

| Type                | Hand protection type                                                                             |            | Arm / Foot protection |            |
|---------------------|--------------------------------------------------------------------------------------------------|------------|-----------------------|------------|
|                     | NPN output                                                                                       | PNP output | NPN output            | PNP output |
| Model no.           | SF2B-H□-N                                                                                        | SF2B-H□-P  | SF2B-A□-N             | SF2B-A□-P  |
| Safety category     | Type 2, PLd, SIL2                                                                                |            |                       |            |
| Beam pitch          | 20mm                                                                                             |            | 40mm                  |            |
| Operating range     | 0.2 to 13m                                                                                       |            |                       |            |
| Protective height   | 168 to 1912mm                                                                                    |            |                       |            |
| Min. sensing object | Ø27mm opaque object                                                                              |            | Ø47mm opaque object   |            |
| Supply voltage      | 24VDC ±10%                                                                                       |            |                       |            |
| Control output      | NPN output type: NPN open collector transistor<br>PNP output type: PNP open collector transistor |            |                       |            |
| Response time       | OFF response: 15ms or less, ON response: 40 to 60ms                                              |            |                       |            |
| Ambient temperature | -10 to +55°C                                                                                     |            |                       |            |
| Dimensions          | W28×H protective height×D24mm                                                                    |            |                       |            |

# SF4B<V2>

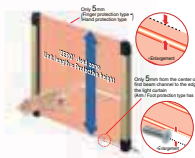
Type 4 · PLe · SIL3

**New concepts combining greater safety and higher productivity!**

## Features

### ■ 'ZERO' dead zone

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



### ■ 3 types available for different workplace conditions

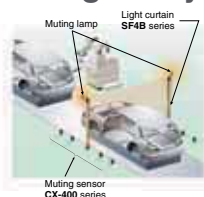


### ■ Same response time of 14ms and constant safety distance

A fast response time of 14ms has been achieved regardless of the number of beam channels, the beam axis pitches and the number of units connected in series. This reduces calculation work required for the safety distances.

### ■ A muting control function is provided to increase without compromising safety productivity

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



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

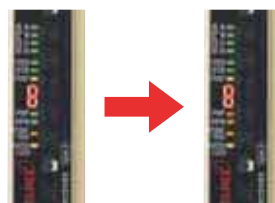
The light curtain has a built-in external device monitoring function (such as for fused relay monitoring) and an interlock function. The safety circuit is constructed so that a separate safety relay unit is not needed, and the control board is also more compact, both of which contribute to lower costs.

### ■ Reduces malfunction due to mutual interference and extraneous light

The advanced ELCA function used in the SF4-A that has been widely acclaimed in the marketplace has also been adopted into the SF4B in order to suppress mutual interference. In addition, the unique double scanning method and retry processing greatly reduce malfunctions due to extraneous light.

### ■ 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 more quickly.



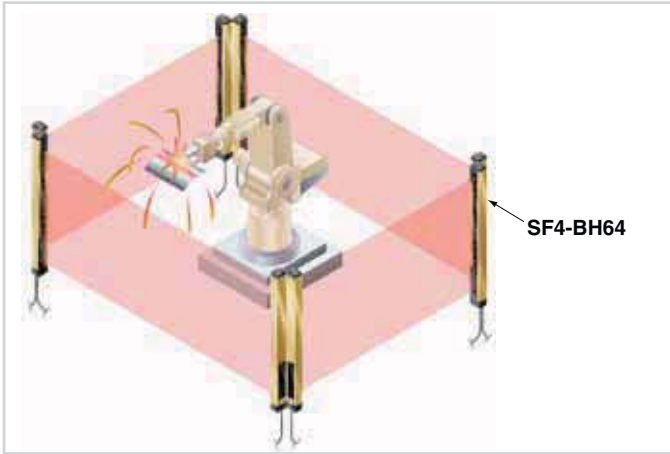
### ■ Universal design that can be used anywhere in the world

The SF4B series combines PNP transistor output and NPN transistor output in a single model. Overseas equipment that uses PNP, replacement with NPN sensors, factories that are positively grounded, and transfer of equipment overseas are all situations where the control circuits for a single model are suitable for use worldwide.

## Typical Applications

### Guarding space around welding robot

The spatter protection hood type perfect for welding devices is also available.



## Technical Specifications

| Type                | Finger protection type                                                                  | Hand protection type                            | Arm / Foot protection type                      |
|---------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Model no.           | SF4B-F□□<V2>                                                                            | SF4B-H□□<V2>                                    | SF4B-A□□<V2>                                    |
| Safety category     | Type 4, PLe, SIL3                                                                       |                                                 |                                                 |
| Beam pitch          | 10mm                                                                                    | 20mm                                            | 40mm                                            |
| Operating range     | 0.3 to 7m                                                                               | 0.3 to 9m (72 beam channels or more: 0.3 to 7m) | 0.3 to 9m (36 beam channels or more: 0.3 to 7m) |
| Protective height   | 230 to 1270mm                                                                           | 230 to 1910mm                                   | 230 to 1910mm                                   |
| Min. sensing object | 14mm or more in opaque object                                                           | 25mm or more in opaque object                   | 45mm or more in opaque object                   |
| Supply voltage      | 24VDC±10%                                                                               |                                                 |                                                 |
| Control output      | PNP open collector transistor / NPN open collector transistor (selectable using wiring) |                                                 |                                                 |
| Response time       | OFF response: 14ms or less, ON response: 80 to 90ms                                     |                                                 |                                                 |
| Dimensions          | W28×protective height×D30mm                                                             |                                                 |                                                 |

□□ Number of beams

40th  
Anniversary  
MODEL

# SF4C

Type 4 · PLe · SIL3

SF4C

**New**

**Ultra-slim light curtain  
machines safeguards without  
sacrificing productivity**

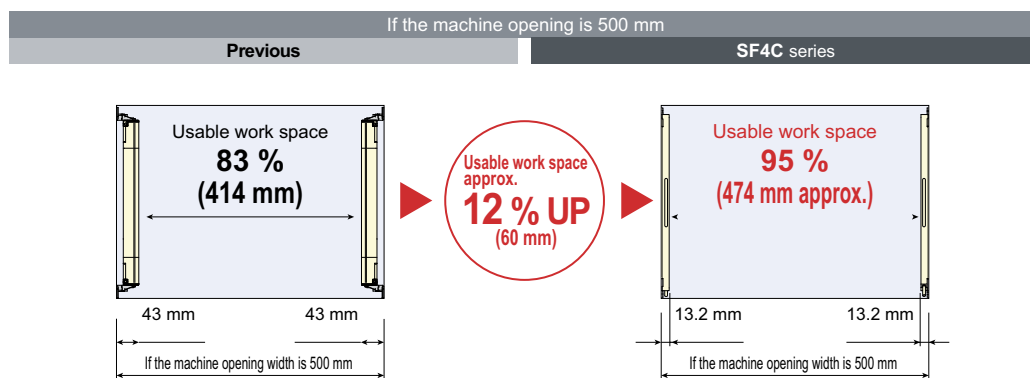
## Features

### ■ Large built-in multi-purpose indicators

Large LED bars on each side of the light curtain provide a wide visibility indicator that can be customized for various applications by means of independent external inputs. The indicator can be used as an operation indicator, job indicator, etc.

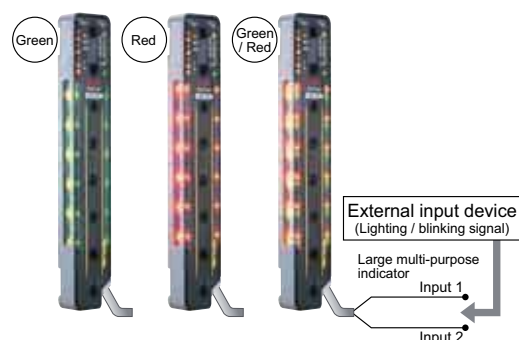
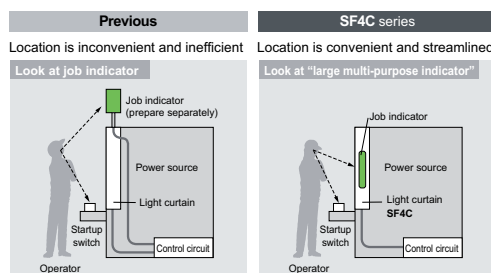
### ■ Slim size for efficient applications

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



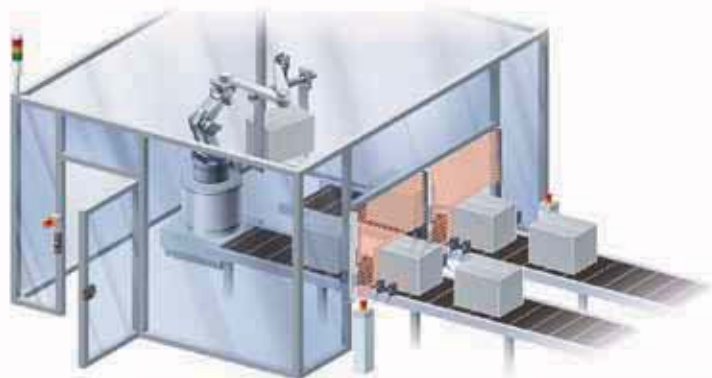
### ■ Can be used in a variety of applications for simplified equipment (Large multi-purpose indicator)

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 to set up a separate indicator..

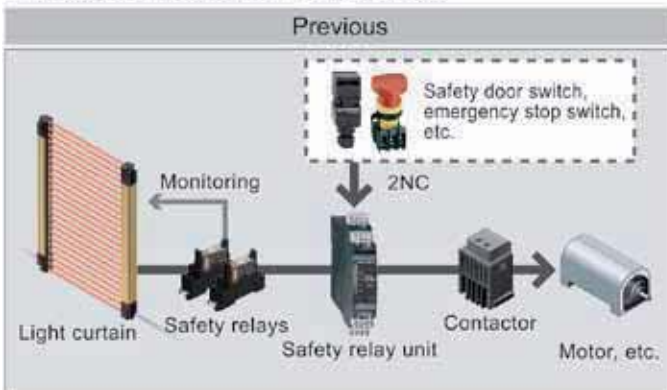


## SF4C ■ Wire-saving when connecting to safety devices [safety input functions]

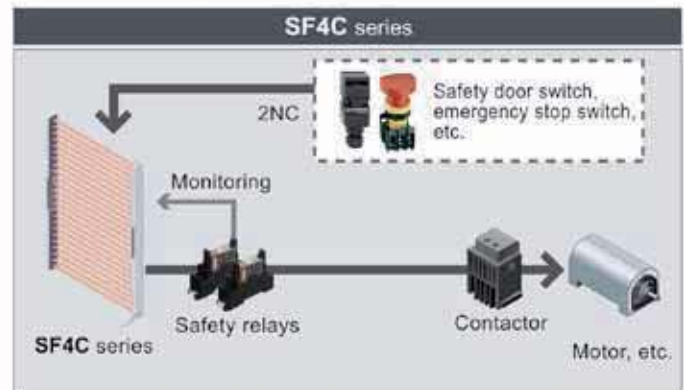
Contact outputs such as emergency stop switches or safety door switches can be connected to the light curtain. Also, by using the handy-controller **SFC-HC**, up to three sets of light curtains can be cascade connected for a consolidated safety output.



### ■ Direct connection of safety devices

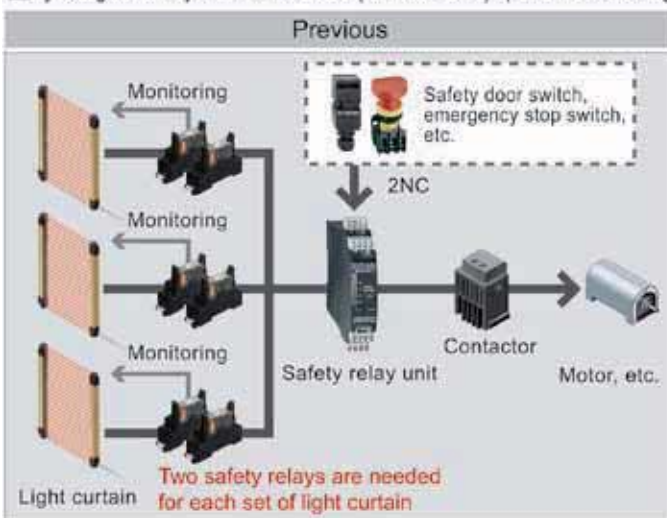


A safety relay unit is needed for connecting safety devices other than light curtain.

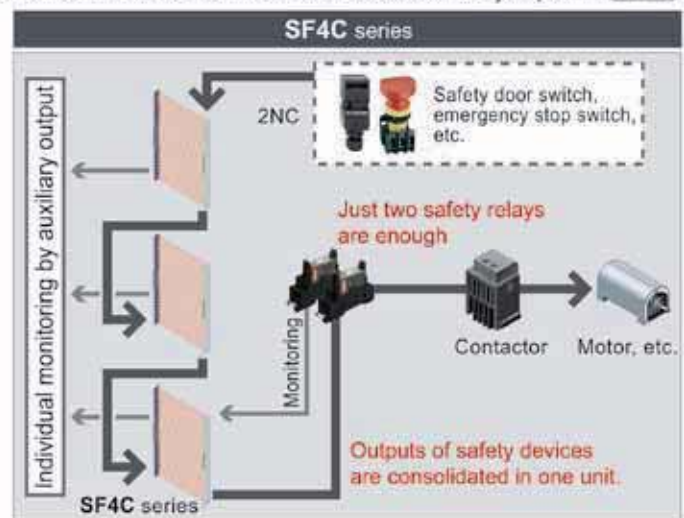


Direct connection of various safety devices is possible for a simplified safety circuit.

■ By using the handy-controller SFC-HC (available soon) up to three sets of light curtains can be cascade connected for a consolidated safety output. **HC**



Three sets of light curtains require three sets of safety relays.



Individual monitoring on light curtains is possible while the outputs of three sets of light curtains and other safety devices are consolidated in one unit.

## ■ IP67 protection structure

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

## ■ Mutual interference is reduced without needing interference prevention lines

The light curtain is equipped with the ELCA (Extraneous Light Check & Avoid) function, which has been proven to be strong against mutual interference. Because it automatically shifts the scan timing of the light curtain in order to avoid interference, it is not necessary to wire interference prevention lines between machinery.

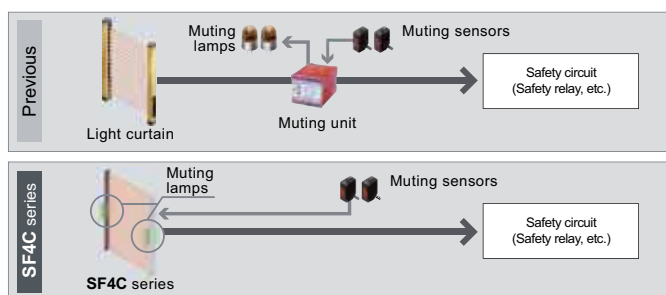
## ■ Safety, productivity, and cost reduction [muting control function]

The light curtain has a built-in 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 muting sensors and muting lamps can be connected directly to the light curtain. Furthermore, the large multi-purpose indicators can be used as muting lamps, which contribute to less wiring troubles, improvement of safety and productivity, and cost reduction.

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

A fast response time of 7ms\* 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.



\* If a failure diagnosis of muting lamp is needed as by the result of risk assessment, use the handy-controller **SFC-HC** to change the setting, and connect the muting lamp output wire (red) of this light curtain to an incandescent lamp separately.

## Typical Applications

### Use a muting lamp

There is no need to buy and install a separate muting lamp.



### Selective muting area

Separate muting control function for each beam channel.



### Industry first!

Wire-saving when connecting to safety devices (safety input function)



## SF4C Technical Specifications

|                     | SF4C pigtailed type                                         | SF4C cable type |
|---------------------|-------------------------------------------------------------|-----------------|
| Type                | Hand protection type                                        |                 |
| Beam pitch          | 20mm                                                        |                 |
| Safety category     | Type 4, PLe, SIL3                                           |                 |
| Operating range     | 0.1 to 3m                                                   |                 |
| Protective height   | 160mm to 640mm                                              |                 |
| Min. sensing object | Ø25mm or more in opaque object                              |                 |
| Supply voltage      | 24V DC (+10/-15%)                                           |                 |
| Control output      | OSSD1 and OSSD2 (2xPNP or 2xNPN, switchable),<br>max. 200mA |                 |
| Response time       | OFF response: 7ms or less /<br>ON response: 90ms or less    |                 |
| Dimensions          | W13,2 x protective height x 30mm                            |                 |

# SD3-A1

Type 3 · PLd · SIL2



**Monitor dangerous areas for unauthorized entry using flexible detection zones!**

## Features

### ■ Freely configurable zones

Two zones can be monitored with the SD3-A1: the warning zone within a radius of 15m, and the protection zone within a radius of 4m. You can configure the contours of these zones to perfectly accommodate any application. You can configure up to eight zone patterns and switch between them at any given time, even during operation. This flexible zone configuration can be done by PC.



Compatible OS: Windows XP/2000/  
NT/98/95

Note: Windows is a registered trademark  
or trademark of Microsoft Corp. in  
the U.S. and/or other countries.

### ■ 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.



### ■ Adjustment of response times enables interference prevention

The response time can be adjusted from 80 to 640ms. Mutual interference can be prevented by adjusting the response time when setting up multiple safety laser scanners in close vicinity.



### ■ Memorized configurations make post-maintenance recovery easy (optional)

Configurations can be saved in the optional configuration plug's built-in memory and reloaded after maintenance or exchanging safety laser scanners.

## Typical Applications

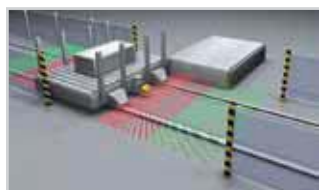
### Detecting entry into dangerous areas at processing machines

Warning and machine halt zones are implemented to detect workers in dangerous areas.



### Confirming safety around automatic guided vehicles

The scanner is used to slow down the vehicle upon detection in the warning zone and stop the vehicle upon entering the protection zone.



### Detecting presence in a defined field

Install two safety laser scanners to build a protection zone surrounding the object in question. Deactivating the zone is also possible.



### Guarding the sides of automatic guided vehicles (AGV)

Prevent injuries from a moving AGV. Monitor fallen cargo to avoid collisions.



### Detecting entry into dangerous areas of circular cycle tables

One safety laser scanner can safeguard the front opening where in the past two sets of light curtains were needed.



### Detecting entry into areas with robots

The scanner detects a human body whenever it enters the field.



## Technical Specifications

|                                  |                                                                                                                                                                                                                                                                                                                                                            |                |           |           |           |           |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|-----------|-----------|-----------|
| Type                             | Safety laser scanner                                                                                                                                                                                                                                                                                                                                       |                |           |           |           |           |
| Model no.                        | SD3-A1                                                                                                                                                                                                                                                                                                                                                     |                |           |           |           |           |
| Safety category                  | Type 3, PLd, SIL2                                                                                                                                                                                                                                                                                                                                          |                |           |           |           |           |
| Detection zone                   | Min. sensing object setting                                                                                                                                                                                                                                                                                                                                | ø150mm         | ø70mm     | ø50mm     | ø40mm     | ø30mm     |
|                                  | Sensing range (radius)                                                                                                                                                                                                                                                                                                                                     | 0 to 4.0m      | 0 to 4.0m | 0 to 2.8m | 0 to 2.2m | 0 to 1.6m |
| Warning zone                     | Min. sensing object setting                                                                                                                                                                                                                                                                                                                                | ø150mm (fixed) |           |           |           |           |
|                                  | Sensing range (radius)                                                                                                                                                                                                                                                                                                                                     | 0 to 15m       |           |           |           |           |
| Scanning angle                   | 190° / 180° (by setting)                                                                                                                                                                                                                                                                                                                                   |                |           |           |           |           |
| Measurement zone                 | Max. measurement range (radius) 50m (fixed)                                                                                                                                                                                                                                                                                                                |                |           |           |           |           |
| Number of zone settings          | Max. 7 + 1 (without detection zone)                                                                                                                                                                                                                                                                                                                        |                |           |           |           |           |
| Min. zone setting range          | 200mm                                                                                                                                                                                                                                                                                                                                                      |                |           |           |           |           |
| Supply voltage                   | 24V DC+20 -30%                                                                                                                                                                                                                                                                                                                                             |                |           |           |           |           |
| Current consumption              | 300mA approx. (excluding external connection load)                                                                                                                                                                                                                                                                                                         |                |           |           |           |           |
| Control outputs (OSSD 1, OSSD 2) | PNP open-collector transistor 2 outputs<br>Rated operating voltage: supply voltage (UB) -3.2V<br>Max. source current: 250mA<br>Residual voltage: 3.2V or less                                                                                                                                                                                              |                |           |           |           |           |
| Laser protection class           | Class 1 (IEC 60825)                                                                                                                                                                                                                                                                                                                                        |                |           |           |           |           |
| Degree of protection             | IP65                                                                                                                                                                                                                                                                                                                                                       |                |           |           |           |           |
| Ambient temperature              | 0 to +50°C, Storage: -20 to + 60°C                                                                                                                                                                                                                                                                                                                         |                |           |           |           |           |
| Material                         | Main body: Die-cast aluminium, Scanner window: Thermoplastic resin                                                                                                                                                                                                                                                                                         |                |           |           |           |           |
| Accessories                      | SD3-PS (exclusive 15-pin connector): 1 pc., SD3-RS232 (exclusive 9-pin connector): 1 pc., Mounting screws [M5 (length 20 mm) hexagon-socket-head bolt: 2 pcs., M5 (length 16mm) hexagon-socket-head bolt: 2 pcs., attached to SD3-PS]: 1 set, Simplified instruction manual: 1 copy, Installation CD-ROM (includes detailed instruction manual data): 1 CD |                |           |           |           |           |
| Weight                           | Net weight: 2.1kg approx., Gross weight: 2.9kg approx.                                                                                                                                                                                                                                                                                                     |                |           |           |           |           |

# SF-C10

SF-C10



**Less setup time for safety light curtains**

## Features

### ■ 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 are used. This reduces the work required for reconnecting wiring during maintenance.



### ■ Metal enclosure with an 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 needing to be inserted into a control panel.

### ■ Slim design

SF-C13

22.5mm thickness for insertion even into narrow spaces inside panels.

### ■ Three safety circuit systems packaged into a single unit!

SF-C14EX(-01)

Three safety circuit systems, light curtain output circuit, muting control circuit, and emergency stop circuit, are packaged into a single unit. This allows safety to be maintained for different sections of the equipment.

# FM-200



## Flow sensor with dual display

## Features

### ■ Easy-to-read, 2-color display with sub display

The setting conditions appear on the sub display, making it much easier to keep track of operations. In addition, the 2-color digital display lets you check the sensor's operation status 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 silicon sensor chip and result in an extremely small heat capacity, high precision of  $\pm 3\%$  F.S. and high-speed response. Two temperature sensors, one on either side of the heater, detect heat distribution and make bidirectional detection possible.

### ■ One sensor for both intake and exhaust

A single sensor can detect flows bidirectionally, or the forward or reverse direction only, making it suitable for a variety of applications.

### ■ Integrated output and pulse output mode incorporated

The FM-200 series can control and manage flows for a wide variety of applications. The integrated output mode will turn the output ON or OFF at the specified integrated value, allowing you to control air blowing volumes, for example. In pulse output mode, a pulse is generated once at each specified integrated value, allowing you to monitor the amount of air consumed, for example.

### ■ Economical, ecological

The pulse output can be input to the pulse counter of an Eco-POWER METER so that air consumption and power consumption can be measured simultaneously.

### ■ Integrated value reset function

During integrated mode, an external input can reset the integrated value.

### ■ Analog voltage output

1 to 5V analog voltage output is incorporated.

### ■ Key lock function

Key operation can be disabled to prevent inadvertent operation.

### ■ Rattle prevention function

To prevent rattling from rapid changes in flow or from noise, the response time can be set to one of seven steps from 50ms to approximately 1,500ms.

### ■ Display rate setting

The display update period can be changed to 250ms, 500ms or 1,000ms in order to eliminate flickering.

### ■ ECO mode

In ECO mode, the backlight is turned off after approximately 1 minute if no operation occurs to reduce power consumption.

## Typical Applications

### Checking suction



### Checking seating



# Technical Specifications

| PNP                            | FM-252-4-P                                                                                                     | FM-213-4-P | FM-253-4-P | FM-214-4-P | FM-254-8-P              | FM-215-8-P |
|--------------------------------|----------------------------------------------------------------------------------------------------------------|------------|------------|------------|-------------------------|------------|
| NPN                            | FM-252-4                                                                                                       | FM-213-4   | FM-253-4   | FM-214-4   | FM-254-8                | FM-215-8   |
| Sensor type                    | Digital flow sensor                                                                                            |            |            |            |                         |            |
| Full scale flow rate           | 500ml/min                                                                                                      | 1l/min     | 5l/min     | 10l/min    | 50 l/min                | 100 l/min  |
| Display range (bar)            | ±9999999ml                                                                                                     |            | ±99999.99l |            | ±999999.9l              |            |
| Setting and display resolution | 1ml/min                                                                                                        |            | 0.01l/min  |            | 0.1 l/min               |            |
| Rated pressure range           | -0.09 to +0.7 MPa                                                                                              |            |            |            |                         |            |
| Pressure resistance (bar)      | 1Mpa                                                                                                           |            |            |            |                         |            |
| Applicable fluid               | Clean air, compressed air, nitrogen gas                                                                        |            |            |            |                         |            |
| Linearity                      | 3%F.S.                                                                                                         |            |            |            |                         |            |
| Response time                  | 50ms to 1.5s selectable                                                                                        |            |            |            |                         |            |
| Transistor output              | Max. 50mA                                                                                                      |            |            |            |                         |            |
| Output modes                   | Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode |            |            |            |                         |            |
| Analog voltage output          | 1.0 to 5.0V                                                                                                    |            |            |            |                         |            |
| Rated current consumption      | Normal mode: 60mA or less, ECO mode: 40mA or less                                                              |            |            |            |                         |            |
| Housing material               | Resin body type                                                                                                |            |            |            |                         |            |
| Protection                     | IP40                                                                                                           |            |            |            |                         |            |
| Physical size (HxWxL)          | 37x55x17mm                                                                                                     |            |            |            | 43x55x17mm              |            |
| Connection method              | Connector                                                                                                      |            |            |            |                         |            |
| Operating voltage              | 12 to 24VDC ± 10%                                                                                              |            |            |            |                         |            |
| Ambient temperature            | 0 to + 50°C                                                                                                    |            |            |            |                         |            |
| Temperature characteristics    | Within ±0.2% F.S./°C (+15°C to +35°C)                                                                          |            |            |            |                         |            |
| Weight                         | Net weight: 50g approx.                                                                                        |            |            |            | Net weight: 70g approx. |            |
| Port size                      | ø4 push-in                                                                                                     |            |            |            | ø8 push-in              |            |

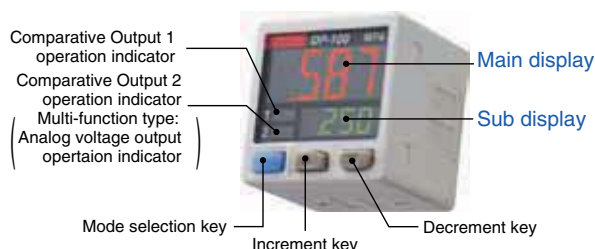
| PNP                            | FM-255-AR2-P                                                                                                   | FM-255-AG2-P     | FM-216-AR2-P      | FM-216-AG2-P     |
|--------------------------------|----------------------------------------------------------------------------------------------------------------|------------------|-------------------|------------------|
| NPN                            | FM-255-AR2                                                                                                     | —                | FM-216-AR2        | —                |
| Sensor type                    | Digital flow sensor                                                                                            |                  |                   |                  |
| Full scale flow rate           | 500l/min                                                                                                       |                  | 1.000l/min        |                  |
| Display range (bar)            | ±9999999l                                                                                                      |                  |                   |                  |
| Setting and display resolution | 1l/min                                                                                                         |                  |                   |                  |
| Rated pressure range           | -0.09 to +0.7MPa                                                                                               |                  |                   |                  |
| Pressure resistance (bar)      | 1Mpa                                                                                                           |                  |                   |                  |
| Applicable fluid               | Clean air, compressed air, nitrogen gas                                                                        |                  |                   |                  |
| Linearity                      | 3%F.S.                                                                                                         |                  |                   |                  |
| Response time                  | 50ms to 1.5s selectable                                                                                        |                  |                   |                  |
| Transistor output              | Max. 50mA                                                                                                      |                  |                   |                  |
| Output modes                   | Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode |                  |                   |                  |
| Analog voltage output          | 1.0 to 5.0V                                                                                                    |                  |                   |                  |
| Rated current consumption      | Normal mode: 60mA or less, ECO mode: 40mA or less                                                              |                  |                   |                  |
| Housing material               | Resin/Aluminum body type                                                                                       |                  |                   |                  |
| Protection                     | IP40                                                                                                           |                  |                   |                  |
| Physical size (HxWxL)          | 50x80x30mm                                                                                                     |                  |                   |                  |
| Connection method              | Connector                                                                                                      |                  |                   |                  |
| Operating voltage              | 12 to 24VDC ± 10%                                                                                              |                  |                   |                  |
| Ambient temperature            | 0 to + 50°C                                                                                                    |                  |                   |                  |
| Temperature characteristics    | Within ±0.2 % F.S./°C (+15°C to +35°C)                                                                         |                  |                   |                  |
| Weight                         | Net weight: 155g approx.                                                                                       |                  |                   |                  |
| Port size                      | Rc½ female thread                                                                                              | G½ female thread | Rc½ female thread | G½ female thread |

# DP-100

A new global standard, dual display

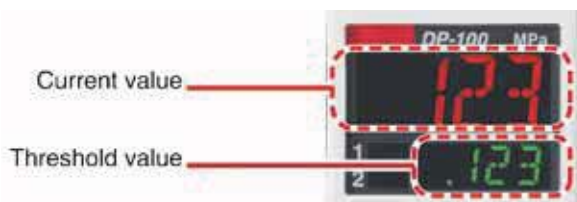
## Features

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



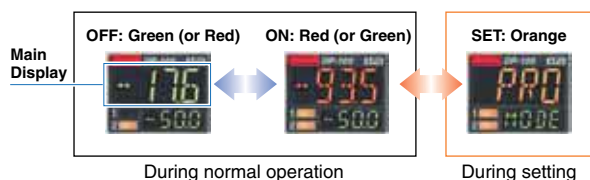
- Dual display allows direct setting of threshold value

Equipped with a 30mm square compact-sized dual display. Because the current value and the threshold value can be checked at the same time, the threshold value can be set and checked smoothly without having to switch screen modes.



- 3-color display (Red, Green, Orange)

The main display changes color according to changes in the status of output ON/OFF operation, and it also changes color while setting is in progress. The sensor status can therefore be understood easily, and operating errors can be reduced.



- Readable digital display!

12 segments are used and an alphanumeric display has been adopted. This improves visual checking of letters and numbers.

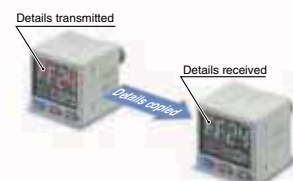


- Realizes high performance

Low pressure type

The low pressure type displays measurements in 0.1kPa at a resolution of 1/2000 and has a response time of 2.5ms (variable up to 5000ms),  $\pm 0.5\%$  F.S. temperature characteristics and  $\pm 0.1\%$  F.S. repeatability, giving it high performance.

- 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.

- Equipped with auto-reference/remote zero-adjustment functions. More precise pressure management is possible with a minimum of effort

Multi-function type

If the reference pressure of the device changes, the auto-reference function partially shifts the comparative output judgment level by the amount that the reference pressure shifts, and the remote zero-adjustment function can reset the display value to zero via external input. These functions are ideal for places where the reference pressure fluctuates wildly, or where fine settings are desired.

## Typical Applications

Confirming suction of electronic component



Confirming reference pressure



Air-leak test for PET bottles



## Technical Specifications

### Cable types

| Type                 |                   | Compound pressure                                                                                                                                              |                     |                     |                     |
|----------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|
|                      |                   |                                                                                                                                                                |                     | Multi-function      |                     |
|                      |                   | For low pressure                                                                                                                                               | For high pressure   | For low pressure    | For high pressure   |
| Model no.            | Asian             | DP-101                                                                                                                                                         | DP-102              | DP-101A             | DP-102A             |
|                      | European          | DP-101-E-P                                                                                                                                                     | DP-102-E-P          | DP-101A-E-P         | DP-102-E-P          |
|                      | North American    | DP-101-N(-P)                                                                                                                                                   | DP-102-N(-P)        | DP-101A-N(-P)       | DP-102A-N(-P)       |
|                      | G 1/8 male thread | Short port type                                                                                                                                                | DP-101-FE-P         | DP-101A-FE-P        | DP-102A-FE-P        |
|                      | M5 female thread  |                                                                                                                                                                | DP-101-M-P          | DP-101A-M-P         | DP-102A-M-P         |
| Rated pressure range |                   | -100.0 to +100.0kPa                                                                                                                                            | -0.100 to +1.000kPa | -100.0 to +100.0kPa | -0.100 to +100.0kPa |
| Applicable fluid     |                   | Non-corrosive gas                                                                                                                                              |                     |                     |                     |
| Supply voltage       |                   | 12 to 24VDC $\pm 10\%$                                                                                                                                         |                     |                     |                     |
| Output               |                   | NPN output type: NPN open-collector transistor<br>PNP output type: PNP open-collector transistor                                                               |                     |                     |                     |
| Response time        |                   | 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms, selectable by key operation                                                               |                     |                     |                     |
| Display              |                   | 4 digits + 4 digits 3-color LCD display                                                                                                                        |                     |                     |                     |
| Pressure port        |                   | Asian: M5 female thread + R (PT) 1/8 male thread,<br>European: M5 female thread + G 1/8 male thread,<br>North American: M5 female thread + NPT 1/8 male thread |                     |                     |                     |
| Connecting method    |                   | Connector                                                                                                                                                      |                     |                     |                     |
| Accessories          |                   | CN-14A-C2 (Connector attached cable 2m): 1pc.                                                                                                                  |                     |                     |                     |
| Dimensions (W×H×D)   |                   | 30×30×42.5mm                                                                                                                                                   |                     |                     |                     |

### M8 connector types

| Type                                                      | Standard                                                                                                                                                                                                                                                            |                      | Multi-function       |                      |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|
|                                                           | For low pressure                                                                                                                                                                                                                                                    | For high pressure    | For low pressure     | For high pressure    |
| Model. no.                                                | DP-111-E-P-J                                                                                                                                                                                                                                                        | DP-112-E-P-J         | DP-111A-E-P-J        | DP-112A-E-P-J        |
| Rated pressure range                                      | −100.0 to +100.0kPa                                                                                                                                                                                                                                                 | −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 24VDC ±10%; Ripple P-P 10% or less                                                                                                                                                                                                                            |                      |                      |                      |
| Comparative output                                        | PNP open-collector transistor                                                                                                                                                                                                                                       |                      |                      |                      |
| Response time                                             | 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms, selectable by key operation                                                                                                                                                                    |                      |                      |                      |
| Auto-reference function / Remote zero-adjustment function | —                                                                                                                                                                                                                                                                   |                      | Incorporated         |                      |
| Analog voltage output                                     | —                                                                                                                                                                                                                                                                   |                      | Incorporated         |                      |
| Ambient temperature                                       | −10 to +50°C, Storage: −10 to 60°C                                                                                                                                                                                                                                  |                      |                      |                      |
| Pressure port                                             | G1/8 male thread +M5 female thread                                                                                                                                                                                                                                  |                      |                      |                      |
| Material                                                  | Enclosure: PBT (glass fiber reinforced); LCD display: acrylic; pressure port: stainless steel (SUS303); mounting threaded part: brass (nickel plated); switch part: silicone rubber, M8 connector part: brass • nickel plated (shell)/brass • gold plated (contact) |                      |                      |                      |
| Accessories                                               | Unit selection plate: 1                                                                                                                                                                                                                                             |                      |                      |                      |

**Note:** Where measurement conditions have not been specified precisely, the conditions used were ambient temperature +20°C.



## DPH-100/ DPC-100

Single-axis type digital pressure sensor with optional dual 3-color display

### Features

#### ■ Direct installation using a hexagonal wrench

The sensor head is tightened with a hexagonal wrench, making installation easy, especially in tight spaces.

#### ■ Dual display + Direct setting

The dual display allows you to check current and threshold values simultaneously.

To facilitate setting operations, three modes have been devised:

- "RUN mode" is for operation settings that are carried out daily
- "MENU SETTING mode" for basic settings
- "PRO mode" for special and detailed setting

Controllers can be connected to a master controller one by one, and the master can transmit settings to the slave controllers. This significantly reduces time required when you need to make multiple, identical settings, or during production change-overs. Moreover, it reduces the possibility for error in such cases.

#### ■ Automatic sensor head recognition

The controller automatically recognizes sensor heads when they are connected, even if their rated pressure ranges are different.

### Typical Applications

#### Checking suction



#### Reference pressure checking



# Technical Specifications

| Type                      | Pressure sensor                                                                                                                                                                       |                |                |                                 |               |                                  |                |                |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------------------------|---------------|----------------------------------|----------------|----------------|
|                           | Compound pressure<br>±100 kPa type                                                                                                                                                    |                |                | Positive pressure<br>1 MPa type |               | Vacuum pressure<br>−101 kPa type |                |                |
| PN                        | DPH-101(-R)                                                                                                                                                                           | DPH-101-M3(-R) | DPH-101-M5(-R) | DPH-102                         | DPH-102-M5    | DPH-103(-R)                      | DPH-103-M3(-R) | DPH-103-M5(-R) |
| Type of pressure          | Gauge pressure                                                                                                                                                                        |                |                |                                 |               |                                  |                |                |
| Rated pressure range      | −100.0 to +100.0kPa                                                                                                                                                                   |                |                | 0 to +1.000Mpa                  |               | 0 to −101.0kPa                   |                |                |
| Pressure resistance       | 500kPa                                                                                                                                                                                |                |                | 1.5Mpa                          |               | 500kPa                           |                |                |
| Applicable fluid          | Air, non-corrosive gas                                                                                                                                                                |                |                |                                 |               |                                  |                |                |
| Supply voltage            | 12 to 24VDC ± 10% Ripple P-P 10% or less                                                                                                                                              |                |                |                                 |               |                                  |                |                |
| Analog voltage output     | Output voltage: 1 to 5V (overrated pressure range)                                                                                                                                    |                |                |                                 |               |                                  |                |                |
| Protection                | IP40 (IEC)                                                                                                                                                                            |                |                |                                 |               |                                  |                |                |
| Ambient temperature       | 0 to +50°C (No dew condensation allowed), Storage: −10 to +60°C                                                                                                                       |                |                |                                 |               |                                  |                |                |
| Ambient humidity          | 35 to 85% RH, Storage: 35 to 85% RH                                                                                                                                                   |                |                |                                 |               |                                  |                |                |
| Pressure port             | DPH-10x(-R): R1/8 male thread + M5 female thread, DPH-10x-M3(-R): M3 male thread (for installing gasket)<br>DPH-10x-M5(-R): M5 male thread (for installing gasket)                    |                |                |                                 |               |                                  |                |                |
| Rated current consumption | 15mA or less                                                                                                                                                                          |                |                |                                 |               |                                  |                |                |
| Housing material          | Front case: PBT, Rear case: PBT (glass fiber reinforced),<br>Pressure port: Stainless steel (SUS303)                                                                                  |                |                |                                 |               |                                  |                |                |
| Connecting method         | Connector                                                                                                                                                                             |                |                |                                 |               |                                  |                |                |
| Physical size (HxWxL), mm | 23x13.2x 23.4                                                                                                                                                                         | 17x10x 20.5    | 17.5x10x 20.5  | 17x10x 20.5                     | 17.5x10x 20.5 | 17x10x 20.5                      |                | 17.5x 10x 20.5 |
| Weight                    | Net weight: DPH-10x(-R): Head 10g approx. / Cable 40g approx.,<br>DPH-10x-M3/M5(-R): Head 6 g approx. / Cable 40g approx.<br>DPH-10x(-R): 80g approx., DPH-10x-M3/M5(-R): 70g approx. |                |                |                                 |               |                                  |                |                |
| Accessory                 | Connector (e-CON): 1pc.                                                                                                                                                               |                |                |                                 |               |                                  |                |                |

| Type                   | Controller                                                                                                                                                                                                                                                                                                                                                  |                 |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                        | NPN output type                                                                                                                                                                                                                                                                                                                                             | PNP output type |
| PN                     | DPC-101                                                                                                                                                                                                                                                                                                                                                     | DPC-101-P       |
| Applicable sensor head | DPH-101x, DPH-102x, DPH-103x                                                                                                                                                                                                                                                                                                                                |                 |
| Rated pressure range   | Compound pressure: -100.0 to +100.0kPa,<br>Positive pressure: 0 to +1.000MPa,<br>Vacuum pressure: 0 to -101.0kPa                                                                                                                                                                                                                                            |                 |
| Supply voltage         | 12 to 24 VDC ± 10% Ripple P-P 10% or less                                                                                                                                                                                                                                                                                                                   |                 |
| Power consumption      | Normal operation: 960mW or less (Current consumption 40mA or less at 24V supply voltage)<br>ECO mode (STD): 720mW or less (Current consumption 30mA or less at 24V supply voltage)<br>ECO mode (FULL): 600mW or less (Current consumption 25mA or less at 24V supply voltage)<br>Excluding the current consumption of sensor head and analog output current |                 |
| Protection             | IP40 (IEC)                                                                                                                                                                                                                                                                                                                                                  |                 |
| Ambient temperature    | -10 to +50°C (No dew condensation or icing allowed),<br>Storage: -10 to +60°C                                                                                                                                                                                                                                                                               |                 |
| Ambient humidity       | 35 to 85% RH, Storage: 35 to 85% RH                                                                                                                                                                                                                                                                                                                         |                 |
| Material               | Enclosure: PBT (glass fiber reinforced),<br>LCD display: Acrylic,<br>Mounting threaded part: Brass (nickel plated),<br>Switch part: Silicone rubber                                                                                                                                                                                                         |                 |
| Ambient humidity       | 35 to 85% RH, Storage: 35 to 85% RH                                                                                                                                                                                                                                                                                                                         |                 |
| Connecting method      | Connector                                                                                                                                                                                                                                                                                                                                                   |                 |
| Cable length           | Total length up to 100m is possible with cable of 0.3mm <sup>2</sup> or more                                                                                                                                                                                                                                                                                |                 |
| Weight                 | Net weight: approx. 25g (excluding connector attached cable),<br>Gross weight: approx. 140g                                                                                                                                                                                                                                                                 |                 |
| Accessories            | CN-66A-C2 (Cable (2m) with attached connector),<br>Pressure unit label: 1 set                                                                                                                                                                                                                                                                               |                 |



# DP2

## High-performance digital pressure sensors

## Features

### ■ High accuracy, high resolution, high speed

The DP2 series achieves a 2.5ms or less response time at a high resolution of 1/1,000. It enables highly accurate sensing with its excellent repeatability and temperature characteristics.

### ■ Clearly visible LED display with 3.5 digits

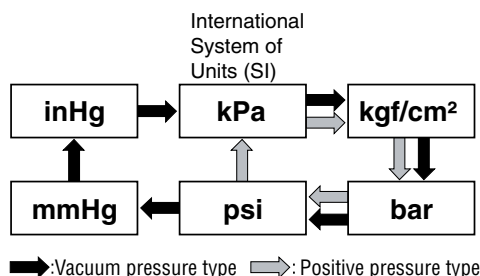
Bright red LED 7-segment display having 3.5 digits, 10mm high. The displayed figures are remarkably noticeable not only in a dark area, but also in a well-lit place.

### ■ Setting with easy key operation

Initialization and threshold value settings are easily done by key operation while seeing the values on the display.

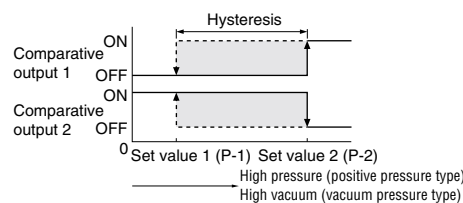
### ■ Selection from six pressure units

The pressure unit can be selected from six different systems to suit your requirement.

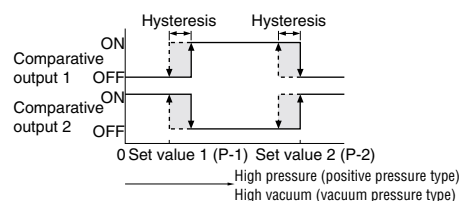


### ■ Four output modes enable versatile pressure level control

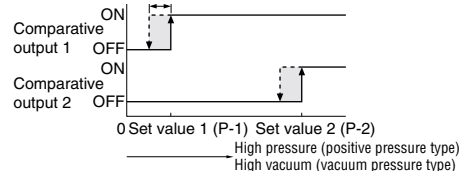
#### 1) Hysteresis mode



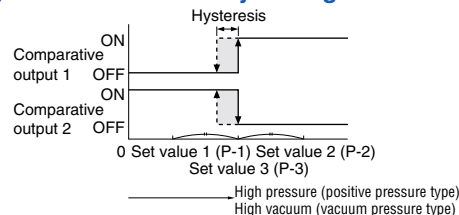
#### 2) Window comparator mode



#### 3) Dual output mode



#### 4) Automatic sensitivity setting mode



# Technical Specifications

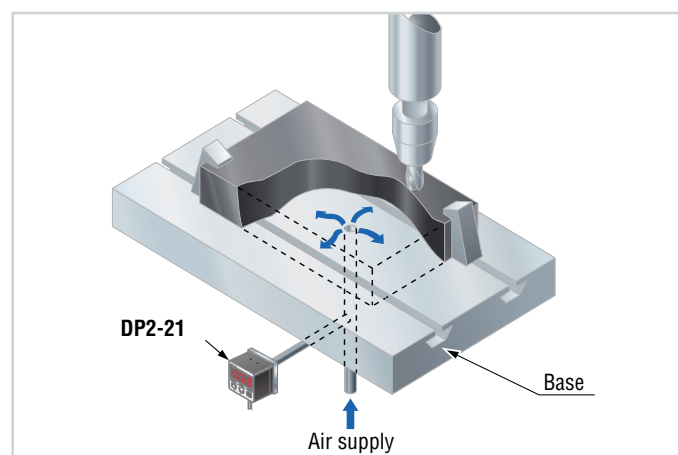
| Type                  |                | Vacuum pressure                                                                                                                                                                                                                                                              |              |         |         | Positive pressure |                                                                                          |         |               |         |         |
|-----------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|---------|-------------------|------------------------------------------------------------------------------------------|---------|---------------|---------|---------|
|                       |                | - 101kPa type                                                                                                                                                                                                                                                                |              |         |         | 100kPa type       |                                                                                          |         | 1MPa type     |         |         |
|                       |                | Standard                                                                                                                                                                                                                                                                     | Light weight | Flat    | IP67    | Standard          | Flat                                                                                     | IP67    | Standard      | Flat    | IP67    |
| Asian                 |                | DP2-20                                                                                                                                                                                                                                                                       | DP2-80       | —       | DP2-60  | DP2-21            | DP2-41                                                                                   | DP2-61  | DP2-22        | DP2-42  | DP2-62  |
| North American (Note) |                | DP2-20F (-P)                                                                                                                                                                                                                                                                 | —            | DP2-40N | DP2-60N | DP2-21F (-P)      | DP2-41N                                                                                  | DP2-61N | DP2-22F (-P)  | DP2-42N | DP2-62N |
| European              |                | —                                                                                                                                                                                                                                                                            | —            | DP2-40E | DP2-60E | —                 | DP2-41E                                                                                  | DP2-61E | —             | DP2-42E | DP2-62E |
| Type of pressure      |                | Gauge pressure                                                                                                                                                                                                                                                               |              |         |         |                   |                                                                                          |         |               |         |         |
| Rated pressure range  |                | 0 to −101.3kPa                                                                                                                                                                                                                                                               |              |         |         | 0 to 100.0kPa     |                                                                                          |         | 0 to 1.000MPa |         |         |
| Applicable fluid      |                | Non-corrosive gas                                                                                                                                                                                                                                                            |              |         |         |                   |                                                                                          |         |               |         |         |
| Supply voltage        |                | 12 to 24VDC +10% /-15% Ripple P-P 10% or less                                                                                                                                                                                                                                |              |         |         |                   |                                                                                          |         |               |         |         |
| Output                |                | < Asian, North American (Standard NPN output, flat and IP67types)><br>NPN open-collector transistor                                                                                                                                                                          |              |         |         |                   | < North American (Standard PNP output type), European><br>PNP open-collector transistor) |         |               |         |         |
| Analog voltage output |                | Output voltage: 1 to 5 V (over rated pressure range)<br>Zero-point: within 1 V ±5% F.S.<br>Span: within 4 V ±5% F.S<br>Linearity: within ±1% F.S<br>Output impedance: 1kΩ approx.                                                                                            |              |         |         |                   |                                                                                          |         |               |         |         |
| Pressure port         | Asian          | Standard, Flat and IP67 types: Rc (PT) 1/8 female thread, Light weight type: M5 female thread                                                                                                                                                                                |              |         |         |                   |                                                                                          |         |               |         |         |
|                       | North American | Standard type: , NPTF 1/8 female thread, Flat and IP67 types: NPT 1/8 female thread                                                                                                                                                                                          |              |         |         |                   |                                                                                          |         |               |         |         |
|                       | European       | Flat and IP67 types: G (PF) 1/8 female thread                                                                                                                                                                                                                                |              |         |         |                   |                                                                                          |         |               |         |         |
| Housing material      |                | Front case: ABS, Rear case: PPS (glass fiber reinforced), Display surface: Acrylic<br>Pressure port attachment: Die-cast zinc alloy (Light weight type: POM (glass fiber reinforced), pressure port is brass (nickel plated))<br>Front cover (IP67 type only): Polycarbonate |              |         |         |                   |                                                                                          |         |               |         |         |
| Weight                |                | Standard type: 95g approx., Flat type: 120g approx., IP67 type: 370g approx., Light weight type: 70g approx.                                                                                                                                                                 |              |         |         |                   |                                                                                          |         |               |         |         |
| Accessories           |                | Hexagon-socket-head plug for preeure port: 1 pc. (Standard type only), Pressure unit label: 1 pc.                                                                                                                                                                            |              |         |         |                   |                                                                                          |         |               |         |         |

**Note:** Model Nos. of North American standard type having the suffix "P" are PNP output type.

## Typical Applications

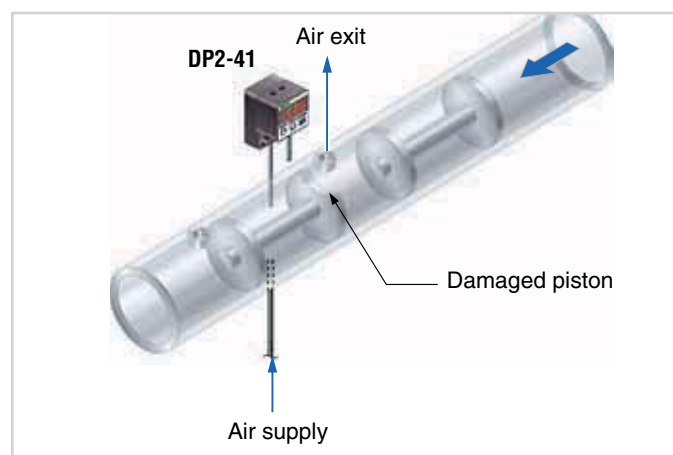
### Verifying proper workpiece seating

Air is supplied from under the base, and the pressure sensor checks for air leakage from any gap between the base and the workpiece.



### Detecting broken spool

The pressure sensor detects if a spool is chipped by sensing even slight air leakage in the air-supply system shown below.



DP4



# DP4

**Suitable for panel installation  
due to new shape**

## Features

### ■ Lightweight, compact design

A compact form specifically designed for mounting on an equipment panel.

It uses only half the space of our conventional product and boasts the lightest weight of just 30g (cable excluded).



### ■ Supplied with a simple-to-mount panel mounting bracket

A panel mounting bracket (**MS-DP-1**) is enclosed to enable simple mounting of the sensor onto the panel surface, thus contributing to the total cost reduction.

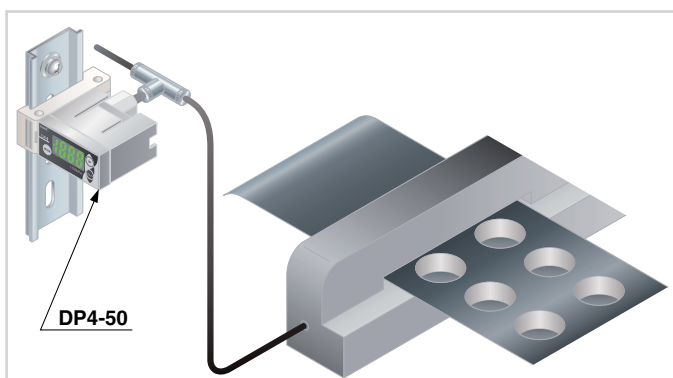
### ■ Bright, easy-to-view 2-color digital display

The digital display is a large, easy-to-view 2-color digital display. It also functions as an output indicator as it changes from green to red when the output turns ON, enabling you to confirm the output status at a glance.

## Typical Applications

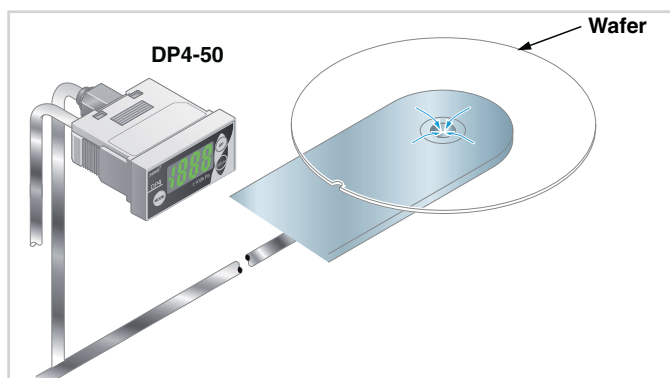
### Vacuum level confirmation for vacuum moulding

Detects the smallest air leaks from pinholes and other minute imperfections.



### Confirming suction of wafer

While a wafer is being carried, the pressure sensor checks the vacuum level in the vacuum pad to verify that the wafer is being securely gripped.



# Technical Specifications

| Type                 | Vacuum pressure                                                                                                                       |            | Positive pressure |                                                     | Compound pressure   |            |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|-----------------------------------------------------|---------------------|------------|
|                      | - 101kPa type                                                                                                                         |            | 1MPa type         |                                                     | ±100kPa type        |            |
|                      | NPN output                                                                                                                            | PNP output | NPN output        | PNP output                                          | NPN output          | PNP output |
| PN                   | DP4-50                                                                                                                                | DP4-50P    | DP4-52            | DP4-52P                                             | DP4-57              | DP4-57P    |
| Type of pressure     | Gauge pressure                                                                                                                        |            |                   |                                                     |                     |            |
| Rated pressure range | 0 to −101.3kPa                                                                                                                        |            | 0 to 1.000MPa     |                                                     | − 100.0 to 100.0kPa |            |
| Applicable fluid     | Non-corrosive gas                                                                                                                     |            |                   |                                                     |                     |            |
| Supply voltage       | 12 to 24VDC +10% /-15% Ripple P-P 10% or less                                                                                         |            |                   |                                                     |                     |            |
| Output               | <NPN output type><br>NPN open-collector transistor                                                                                    |            |                   | < PNP output type><br>PNP open-collector transistor |                     |            |
| Response time        | 2ms, 16ms, 128ms, 512ms or less (selectable by key operation)                                                                         |            |                   |                                                     |                     |            |
| Protection           | IP40 (IEC)                                                                                                                            |            |                   |                                                     |                     |            |
| Pressure port        | M5 female thread                                                                                                                      |            |                   |                                                     |                     |            |
| Housing material     | Front case: ABS, LCD display: PET, Rear case: PBT((M5 threaded part: Brass (nickel plated))                                           |            |                   |                                                     |                     |            |
| Connecting method    | Connector                                                                                                                             |            |                   |                                                     |                     |            |
| Weight               | 30g approx.                                                                                                                           |            |                   |                                                     |                     |            |
| Accessories          | Panel mounting bracket ( <b>MS-DP-1</b> ): 1 set, Pressure unit label: 1 pc. Connector: 1 set (Housing: 1 pc., Connector pin: 3 pcs.) |            |                   |                                                     |                     |            |

## DP5/DPH

**New**



**1/1000 second high-speed response**

### Features

#### ■ Response time 1ms

Mounting the detachable head close to the detecting section minimizes piping and enables response time of 1ms, as well as greatly decreasing tact time delay. In addition, the ultra small and lightweight design of the head means it can easily be mounted on moving sections.

#### ■ Sensor head with operation indicator

The sensor head is also equipped with an operation indicator. Output ON/OFF can be checked on the sensor head, so that it is suitable for checking operation at the suction head.

#### ■ Lightweight, compact design

The controller inherits its lightweight, compact design from the popular **DP4** series of digital pressure sensors. Control panel setup is low cost and requires minimal space.

#### ■ Convenient intermediate cable with connector

Intermediate cable with connectors for connecting the sensor head and the controller makes operation and maintenance easier.

### Typical Applications

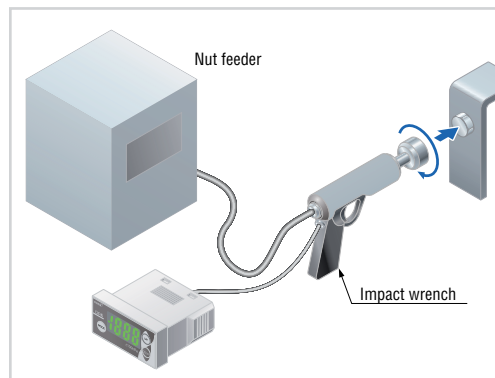
#### IC suction confirmation

With a light 6g head and a 1ms high-speed response time, it can be used with a high-speed mounter.



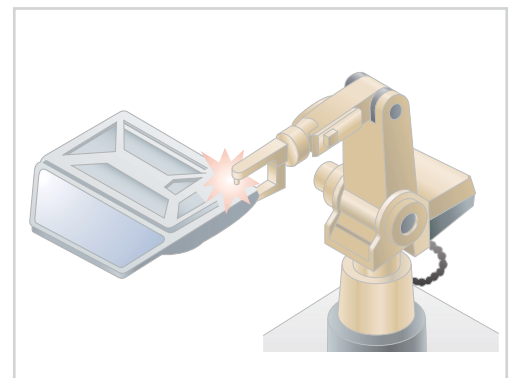
#### Verifying tightening of nut by impact wrench

The pressure sensor senses the back pressure of the impact wrench to verify that the nut is securely tightened.



#### Verifying clamping pressure of welding hand

Since the pressure sensor incorporates two outputs, the clamping pressure can be classified into three levels: low, OK and high.



# Technical Specifications

## Pressure Sensor

| Type                  | Vacuum pressure                                                                                                                                                                                                                                                          |         |         |         | Positive pressure |         |         | Compound pressure  |         |         |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|-------------------|---------|---------|--------------------|---------|---------|
|                       | - 101kPa type                                                                                                                                                                                                                                                            |         |         |         | 1MPa type         |         |         | ±100kPa type       |         |         |
| PN                    | DPH-A00                                                                                                                                                                                                                                                                  | DPH-A10 | DPH-A20 | DPH-A30 | DPH-A02           | DPH-A12 | DPH-A22 | DPH-A07            | DPH-A17 | DPH-A27 |
| Type of pressure      | Gauge pressure                                                                                                                                                                                                                                                           |         |         |         |                   |         |         |                    |         |         |
| Rated pressure range  | 0 to −101.3kPa                                                                                                                                                                                                                                                           |         |         |         | 0 to 1.000MPa     |         |         | −100.0 to 100.0kPa |         |         |
| Applicable fluid      | Non-corrosive gas                                                                                                                                                                                                                                                        |         |         |         |                   |         |         |                    |         |         |
| Supply voltage        | 12 to 24VDC +10% /-15% Ripple P-P 10% or less                                                                                                                                                                                                                            |         |         |         |                   |         |         |                    |         |         |
| Analog voltage output | <ul style="list-style-type: none"><li>• Output voltage: 1 to 5V (over rated pressure range)</li><li>• Zero point: within 1V ± 2% F.S. (vacuum / positive pressure type)<br/>within 3V ± 3% F.S. (compound pressure type)</li><li>• Span: within 4V ± 3.5% F.S.</li></ul> |         |         |         |                   |         |         |                    |         |         |
| Pressure port         | DPH-A0□: M5 female thread (for installing gasket), DPH-A1□: R (PT) 1/8 male thread / M5 female thread<br>DPH-A2□: NPT 1/8 male thread / 10-32UNF female thread, DPH-A30: 10-32UNF male thread (for installing gasket),                                                   |         |         |         |                   |         |         |                    |         |         |
| Housing material      | Enclosure: PBT, Pressure port: Brass (nickel plated) (however, stainless steel (SUS303) in case of DPH-A0□ )                                                                                                                                                             |         |         |         |                   |         |         |                    |         |         |
| Connecting method     | Connector                                                                                                                                                                                                                                                                |         |         |         |                   |         |         |                    |         |         |
| Weight                | DPH-A0□/ DPH-A30: 6g approx., DPH-A1□/ DPH-A2: 10g approx.                                                                                                                                                                                                               |         |         |         |                   |         |         |                    |         |         |
| Accessories           | Gasket (DPH-A0□, DPH-A30 only)                                                                                                                                                                                                                                           |         |         |         |                   |         |         |                    |         |         |

## Controller

| Type                            | NPN output type                                                                                                                                                                                                                                                                     | PNP output type |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PN                              | DP5-C                                                                                                                                                                                                                                                                               | DP5-C-P         |
| Applicable pressure sensor head | DPH-A00, DPH-A02, DPH-A07, DPH-A10, DPH-A12, DPH-A17, DPH-A20, DPH-A22, DPH-A27, DPH-A30                                                                                                                                                                                            |                 |
| Rated pressure range            | Vacuum pressure: 0 to -101.3kPa, Positive pressure: 0 to 1.000MPa, Compound pressure: -100.0 to 100.0kPa                                                                                                                                                                            |                 |
| Supply voltage                  | 12 to 24VDC +10%/-15% Ripple P-P 10% or less                                                                                                                                                                                                                                        |                 |
| Analog voltage output           | <ul style="list-style-type: none"> <li>• Output voltage: 1 to 5V (over rated pressure range)</li> <li>• Zero point: within 1V ± 2.5% F.S. (vacuum / positive pressure type)</li> <li>within 3V ± 3.5% F.S. (compound pressure type)</li> <li>• Span: within 4V ± 4% F.S.</li> </ul> |                 |
| Housing material                | Front case: ABS, LCD display selection: PET, Rear case: PBT                                                                                                                                                                                                                         |                 |
| Connecting method               | Connector                                                                                                                                                                                                                                                                           |                 |
| Weight                          | 20g approx.                                                                                                                                                                                                                                                                         |                 |
| Accessories                     | Panel mounting bracket ( <b>MS-DP-1</b> ): 1 set, Connector: 1 set (Housing: 1 pc., Connector pin: 6 pcs.), Pressure unit label: 1 set., Connector cap: 1 pc.                                                                                                                       |                 |

# DP-M



Precisely detects minute differences in pressure levels

## Features

### ■ High accuracy and resolution

Due to differential pressure sensing, the pressure can be set with a high resolution of 0.01kPa.D (1mm H<sub>2</sub>O.D) over a pressure range of 0 to 2.00kPa.D (0 to 204mm H<sub>2</sub>O.D) and, moreover, the detection accuracy is within 51% F.S.

### ■ Bright digital display

Three bright red 7-segment LEDs, 12mm high, are incorporated in the compact body.

### ■ Simple key setting

Initialization or pressure settings can be easily done with key operation while looking at the display.

### ■ Analog current output (4 to 20mA) incorporated DP-M2A is also available

## Technical Specifications

| Type                  | Vacuum pressure                                                          | Positive pressure                                                                                                                                                                                                                                   |
|-----------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PN                    | DP-M2                                                                    | DP-M2A                                                                                                                                                                                                                                              |
| Type of pressure      | Differential pressure                                                    |                                                                                                                                                                                                                                                     |
| Rated pressure range  | 0 to 2.00kPa.D (0 to 204mmH <sub>2</sub> O.D)                            |                                                                                                                                                                                                                                                     |
| Applicable fluid      | Non-corrosive gas                                                        |                                                                                                                                                                                                                                                     |
| Supply voltage        | 12 to 24VDC +10%/-15% Ripple P-P 10% or less                             |                                                                                                                                                                                                                                                     |
| Analog current output | —                                                                        | <ul style="list-style-type: none"> <li>Output current: 4 to 20mA (from 0 to 1.96kPa.D (0 to 200mmH<sub>2</sub>O.D))</li> <li>Zero point: within 4mA ± 12% F.S.</li> <li>Span: within 16mA ± 3% F.S.</li> <li>Linearity: within ± 1% F.S.</li> </ul> |
| Ambient temperature   | 0 to +50°C (No dew condensation), Storage: -10 to +60°C                  |                                                                                                                                                                                                                                                     |
| Ambient humidity      | 35 to 85% RH, Storage: 35 to 85% RH                                      |                                                                                                                                                                                                                                                     |
| Pressure port         | ø4.8mm resin pipe                                                        |                                                                                                                                                                                                                                                     |
| Housing material      | Front case: ABS, Rear case: ABS, LED display: Acrylic, Pressure port: PA |                                                                                                                                                                                                                                                     |
| Connecting method     | 0.18mm <sup>2</sup> 3-core oil resistance cabtyre cable, 2m long         | 0.18mm <sup>2</sup> 4-core oil resistance cabtyre cable, 2m long                                                                                                                                                                                    |
| Weight                | 75g approx.                                                              |                                                                                                                                                                                                                                                     |

[www.panasonic-electric-works.com](http://www.panasonic-electric-works.com)



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# CC Link

## Network communication

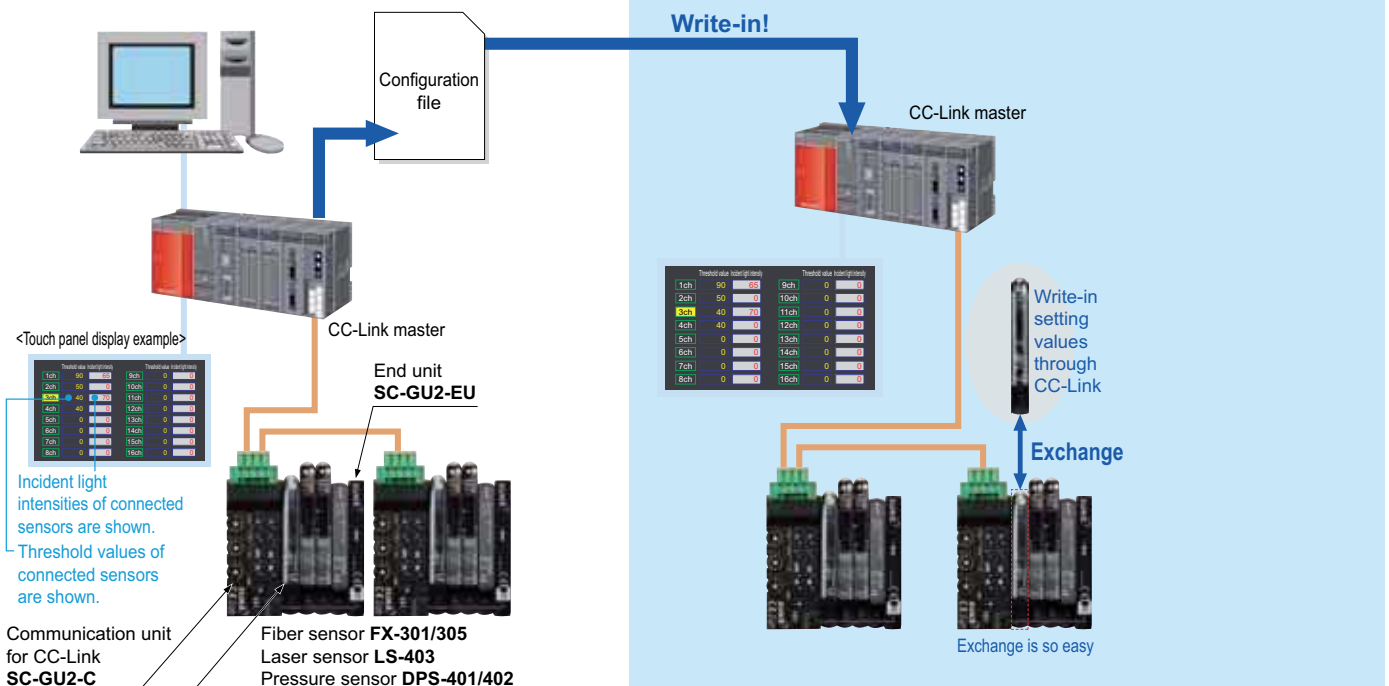
## Features

### ■ Network communication

With the CC-Link SC-GU2-C communication unit, you can connect to a CC-Link open network, allowing you to monitor or change settings via a PLC, PC, etc.

### ■ Ultra high-speed response time of 150μs

### ■ Independent dual outputs and 5 output modes



## Features

### ■ Thin controller lineup

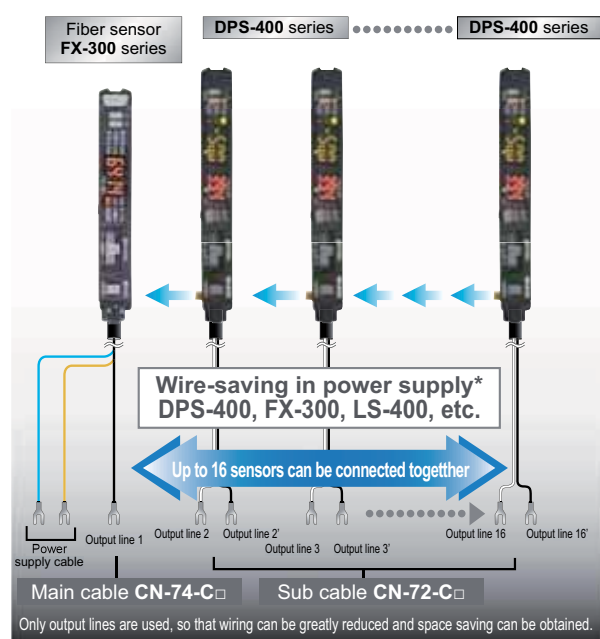
The DPS-400 series has answered industry's call to downsize pressure sensors at production sites and conveniently fit into most machines and reduction of man-hours when it comes to replacement.

### ■ Saves wire and space

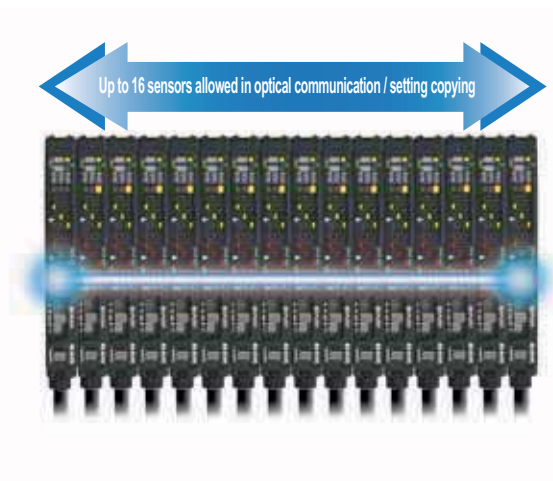
Quick-connection cables not only reduce wiring, they reduce the time necessary for setting up relay terminals, and they save space. DPS-400 series controllers can be connected side-by-side with FX-300 series fiber sensors or LS series laser sensors.

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

The controller is equipped with a 4-digit dual digital display, which allows you to adjust the threshold value while checking the current value (current pressure value), i.e. it is no longer necessary to switch screen modes.



\* Check the instruction manual of each model for the arrangement order such when connecting as communication varies depending on the model.



### ■ Network communication

With the CC-Link SC-GU2-C communication unit, you can to connect to a CC-Link open network, allowing you to monitor or change settings via a PLC, PC, etc. Batch communication can even be executed when connected to FX-301/305 series digital fiber sensors or DPS-401/402 series digital pressure sensors.

### ■ Threshold tracking function

This function tracks changes in the light emitting amount over long periods, such as those caused by dust levels, and threshold values can be reset automatically, helping reduce maintenance costs.



## GX-F/H

Industry No. 1 in stable sensing

### Features

#### ■ Environmental resistance

#### ■ 10 times the durability! (Compared to previous models)

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.

- Highly resistant to water or oil!
- Can be installed with ample space
- IP68g\* protective construction

The new, integrated construction method improves environmental resistance performance.

\* The IP68g prevents damage to the sensor by stopping water and oil from getting inside.

#### ■ Indicators are easy to see over a wide field of view

A prism with a wide field of view has been developed, thereby greatly improving the visibility of the operation indicators.

### Typical Applications

#### Checking up/down operation of compact molding equipment



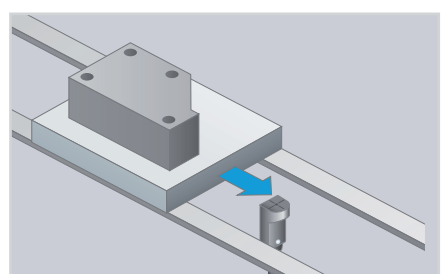
Shock resistance: 5000G

#### Sensing presence of metallic objects on a part feeder



Vibration resistance: 500Hz

#### Positioning metal pallets



# Technical Specifications

| Model no.                           | GX-F8A(I)                                                                                                                                                                                                                                                                           | GX-F8B(I)  | GX-F8A(I)-P                                                                                                                                                                                                                                                                               | GX-F8B(I)-P  |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                                     | GX-H8A(I)                                                                                                                                                                                                                                                                           | GX-H8B(I)  | GX-H8A(I)-P                                                                                                                                                                                                                                                                               | GX-H8B(I)-P  |
|                                     | GX-F12A(I)                                                                                                                                                                                                                                                                          | GX-F12B(I) | GX-F12A(I)-P                                                                                                                                                                                                                                                                              | GX-F12B(I)-P |
|                                     | GX-H12A(I)                                                                                                                                                                                                                                                                          | GX-H12B(I) | GX-H12A(I)-P                                                                                                                                                                                                                                                                              | GX-H12B(I)-P |
| Maximum operation distance (Note 1) | 2.5mm ±8% GX-□8                                                                                                                                                                                                                                                                     |            |                                                                                                                                                                                                                                                                                           |              |
| Max. operation distance (Note1)     | 4.0mm ±8% GX-□12                                                                                                                                                                                                                                                                    |            |                                                                                                                                                                                                                                                                                           |              |
| Supply voltage                      | 12 to 24VDC ±15% Ripple P-P 10% or less                                                                                                                                                                                                                                             |            |                                                                                                                                                                                                                                                                                           |              |
| Current consumption                 | 15mA or less                                                                                                                                                                                                                                                                        |            |                                                                                                                                                                                                                                                                                           |              |
| Output                              | NPN open-collector transistor <ul style="list-style-type: none"><li>• Maximum sink current: 100mA</li><li>• Applied voltage: 30VDC or less (between output and 0V)</li><li>• Residual voltage: 1V or less (at 100mA sink current)<br/>0.4V or less (at 16mA sink current)</li></ul> |            | PNP open-collector transistor <ul style="list-style-type: none"><li>• Maximum source current: 100mA</li><li>• Applied voltage: 30VDC or less (between output and 0V)</li><li>• Residual voltage: 1V or less (at 100mA source current)<br/>0.4V or less (at 16mA source current)</li></ul> |              |
| Protection                          | IP68 (IEC), IP68g (JEM) (Note 2, 3)                                                                                                                                                                                                                                                 |            |                                                                                                                                                                                                                                                                                           |              |
| Temperature characteristics         | Over ambient temperature range −25 to +70°C: Within ±8% of sensing range at 23°C                                                                                                                                                                                                    |            |                                                                                                                                                                                                                                                                                           |              |
| Net weight                          | Front sensing type: 15g approx., top sensing type: 20g approx.                                                                                                                                                                                                                      |            |                                                                                                                                                                                                                                                                                           |              |
| Material                            | Enclosure: PBT, Indicator part: polyester                                                                                                                                                                                                                                           |            |                                                                                                                                                                                                                                                                                           |              |

## GX-S

**New**



**Easy-to-use, cylindrical proximity sensors**

### Features

#### ■ Variety

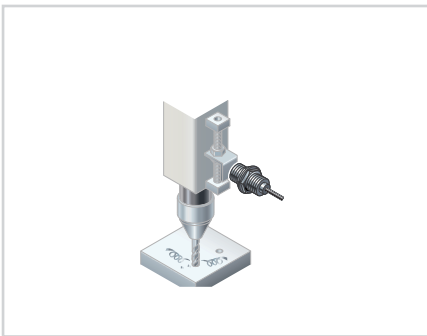
- Stainless steel or chrome plated brass housings
- PNP or NPN output
- Cylinder or thread types
- Connection or cable types

#### ■ Cost effective

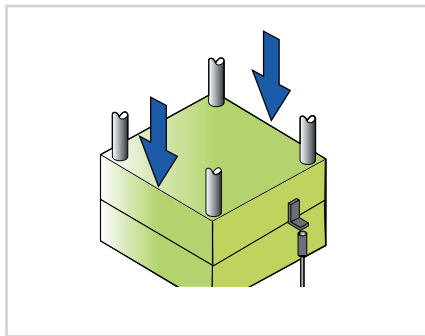
- With a widely used M8/M12/M18
- Cylindrical shape housing means quick and easy installation

### Typical Applications

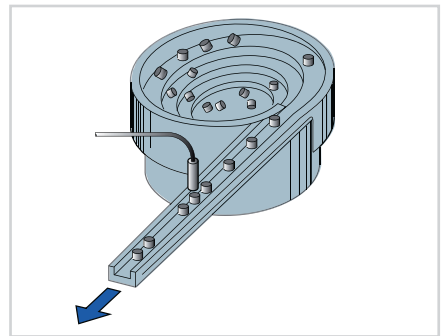
#### Controlling depth of drilling



#### Sensing the punch of a die



#### Counting parts



# Technical Specifications

|                            | GXS-E015-DV2-(P/ )(J/Z/ )                     | GXS-E020-DV2-(P/ )(J/Z/ ) | GXS-E015-CV2-(P/ )(J/Z/ ) | GXS-E020-CV2-(P/ )(J/Z/ ) | GXS-N025-CV2-(P/ )(J/Z/ ) | GXS-E020-BBCS-(P/ )(Z/ ) | GXS-E020-BBC-(P/ )(Z/ ) | GXS-N040-BBC-(P/ )(Z/ ) | GXS-N040-BBCS-(P/ )(Z/ ) |
|----------------------------|-----------------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------------------|-------------------------|-------------------------|--------------------------|
| Mounting                   | Embedable                                     | Embedable                 | Embedable                 | Embedable                 | Non-embedable             | Embedable                | Embedable               | Non-embedable           | Non-embedable            |
| Sensor type                | Cylinder type                                 | Cylinder type             | Thread type               | Thread type               | Thread type               | Thread type              | Thread type             | Thread type             | Thread type              |
| (Ø in mm)                  | Ø 6.5                                         | Ø 6.5                     | M8                        | M8                        | M8                        | M12                      | M12                     | M12                     | M12                      |
| Maximum operating distance | 1.5mm ±10%                                    | 2.0mm ±10%                | 1.5mm ±10%                | 2.0mm ±10%                | 2.5mm ±10%                | 2.0mm ±10%               | 2.0mm ±10%              | 4.0mm ±10%              | 4.0mm ±10%               |
| Stable sensing range       | 0 - 1.2mm                                     | 0 - 1.6mm                 | 0 - 1.2mm                 | 0 - 1.6mm                 | 0 - 2.0mm                 | 0 - 1.6mm                | 0 - 1.6mm               | 0 - 3.2mm               | 0 - 3.2mm                |
| Detection frequency        | 5kHz                                          | 3kHz                      | 5kHz                      | 3kHz                      | 3kHz                      | 3kHz                     | 3kHz                    | 2kHz                    | 2kHz                     |
| Standard                   | Steel                                         | Steel                     | Steel                     | Steel                     | Steel                     | Steel                    | Steel                   | Steel                   | Steel                    |
| Detectable object          | 6.5x6.5x1mm                                   | 6.5x6.5x1mm               | 8.0x8.0x1mm               | 8.0x8.0x1mm               | 8.0x8.0x1mm               | 12.0x12.0x1mm            | 12.0x12.0x1mm           | 12.0x12.0x1mm           | 12.0x12.0x1mm            |
| Supply voltage             | ±20%                                          |                           |                           |                           |                           |                          |                         |                         |                          |
| Hysteresis                 | Max. 15% of maximum operating range           |                           |                           |                           |                           |                          |                         |                         |                          |
| Output transistor          | Max. 200mA                                    |                           |                           |                           |                           |                          |                         |                         |                          |
| Current consumption        | Max. 10mA                                     |                           |                           |                           |                           |                          |                         |                         |                          |
| Housing material           | Stainless steel                               |                           |                           |                           |                           | Chrome plated brass      |                         |                         |                          |
| Protection                 | IP67                                          |                           |                           |                           |                           |                          |                         |                         |                          |
| Connection                 | J=Connector M8    Z=Connector M12    =cable2m |                           |                           |                           |                           |                          |                         |                         |                          |

P=PNP    =NPN    J=Connector M8    Z=Connector M12    =cable2m

|                                   | GXS-E040-BBC-(P/ )(Z/ )                       | GXS-E040-BBCS-(P/ )(Z/ ) | GXS-E050-ABC-(P/ )(Z/ ) | GXS-E050-ABCS-(P/ )(Z/ ) | GXS-N080-ABC-(P/ )(Z/ ) | GXS-N080-ABCS-(P/ )(Z/ ) | GXS-Q080-ABC-(P/ )(Z/ ) | GXS-Q080-ABCS-(P/ )(Z/ ) |
|-----------------------------------|-----------------------------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|
| <b>Mounting</b>                   | Embedable                                     | Embedable                | Embedable               | Embedable                | Non-embedable           | Non-embedable            | Quasi-embedable         | Quasi-embedable          |
| <b>Sensor type</b>                | Thread type                                   | Thread type              | Thread type             | Thread type              | Thread type             | Thread type              | Thread type             | Thread type              |
| <b>(Ø in mm)</b>                  | M12                                           | M12                      | M18                     | M18                      | M18                     | M18                      | M18                     | M18                      |
| <b>Maximum operating distance</b> | 4.0mm ±10%                                    | 4.0mm ±10%               | 5.0mm ±10%              | 5.0mm ±10%               | 8.0mm ±10%              | 8.0mm ±10%               | 8.0mm ±10%              | 8.0mm ±10%               |
| <b>Stable sensing range</b>       | 0 - 3.2mm                                     | 0 - 3.2mm                | 0 - 4.0mm               | 0 - 4.0mm                | 0 - 5.4mm               | 0 - 5.4mm                | 0 - 5.4mm               | 0 - 5.4mm                |
| <b>Detection frequency</b>        | 2.5kHz                                        | 2.5kHz                   | 2kHz                    | 2kHz                     | 1.4kHz                  | 1kHz                     | 1kHz                    | 1kHz                     |
| <b>Standard</b>                   | Steel                                         | Steel                    | Steel                   | Steel                    | Steel                   | Steel                    | Steel                   | Steel                    |
| <b>Detectable object</b>          | 12.0x12.0x1mm                                 | 12.0x12.0x1mm            | 18.0x18.0x1mm           | 18.0x18.0x1mm            | 24.0x24.0x1mm           | 24.0x24.0x1mm            | 24.0x24.0x1mm           | 24.0x24.0x1mm            |
| <b>Supply voltage</b>             | 10 to 30VDC ±20%                              |                          |                         |                          |                         |                          |                         |                          |
| <b>Hysteresis</b>                 | Max. 15% of maximum operating range           |                          |                         |                          |                         |                          |                         |                          |
| <b>Output transistor</b>          | 200mA                                         |                          |                         |                          |                         |                          |                         |                          |
| <b>Current consumption</b>        | Max. 10mA                                     |                          |                         |                          |                         |                          |                         |                          |
| <b>Housing material</b>           | Chrome plated brass                           |                          |                         |                          |                         |                          |                         |                          |
| <b>Protection</b>                 | IP67                                          |                          |                         |                          |                         |                          |                         |                          |
| <b>Connection</b>                 | J=Connector M8    Z=Connector M12    =cable2m |                          |                         |                          |                         |                          |                         |                          |

P=PNP    =NPN    J=Connector M8    Z=Connector M12    =cable2m

# GP-X



**High-speed sampling 25 $\mu$ s  
and high resolution 0.02% eddy  
current type**

## Features

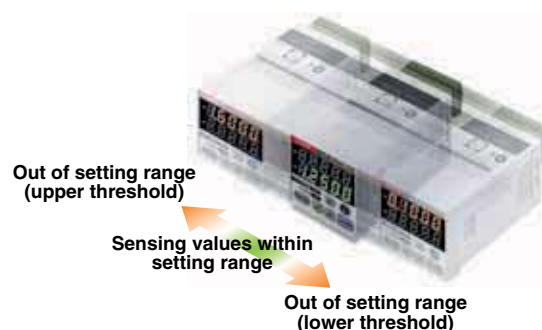
- We have realized a 25 $\mu$ s (40,000 times/sec.) ultra high sampling speed
- These devices boast 0.07% F.S./IC temperature characteristics
- They perform with a  $\pm 0.3\%$  F.S. linearity for stainless steel and iron

Because they perform with a  $\pm 0.3\%$  F.S. linearity, they can be used for sensing stainless steel and iron, enabling precise measurements not affected by the workpiece's material.

- Intelligent monitor GP-XAiM (optional) optimal for collecting and analyzing measurement data

- The 5-digit, dual, 2-color digital display offers great visibility

If the measurement results fall within the setting range (GO), they will appear on the lower digital display in green. If they are out of range (HI, LO), they will be displayed in the upper digital display in orange. The display position and color change permit accurate visibility even for momentary changes.



## Technical Specifications

### Sensor heads

| Model no.               | GP-X3SE                                       | GP-X5SE  | GP-X8S   | GP-X10M  | GP-X12ML | GP-X22KL  |
|-------------------------|-----------------------------------------------|----------|----------|----------|----------|-----------|
| Sensing range           | 0 to 0.8mm                                    | 0 to 1mm | 0 to 2mm | 0 to 2mm | 0 to 5mm | 0 to 10mm |
| Standard sensing object | Stainless steel (SUS304)/iron sheet 60×60×1mm |          |          |          |          |           |
| Ambient temperature     | -10 to +55°C                                  |          |          |          |          |           |
| Dimensions (mm)         | Ø3.8×17                                       | Ø5.4×17  | Ø8×17    | M10×17   | M12×21   | Ø22×35    |

### Controller

| Set model no.                    | NPN output type GP-XC□, PNP output type GP-XC□-P                                                   |
|----------------------------------|----------------------------------------------------------------------------------------------------|
| Supply voltage                   | 24VDC $\pm 10\%$                                                                                   |
| Resolution                       | (64 times average processing): GP-XC3SE/XC5SE 0.04% F.S.<br>GP-XC8S/XC10M/XC12ML/XC22KL 0.02% F.S. |
| Analog voltage output:           | Output voltage 15 to +5V                                                                           |
| Comparative outputs (HI, GO, LO) | GP-XC□ NPN open-collector transistor<br>GP-XC□-P PNP open-collector transistor                     |
| Dimensions (mm)                  | W48×H48×D83                                                                                        |

# New



# HL-G1

Introducing the new standard in CMOS laser displacement sensors

## Features

### ■ High resolution of 0.5 $\mu\text{m}$ Fast response Sampling rate 200 $\mu\text{s}$

Thanks to high-precision measurement at a resolution of 0.5  $\mu\text{m}$  and an LED digital display that provides exceptional ease of use, the HL-G1 series will see use in a variety of applications on production lines worldwide.

### ■ Fast, compact and user-friendly

Setup is fast and efficient by using the built-in digital display to set measurement parameters such as sampling cycle and output options. The HL-G1 series features a compact design despite its built-in controller and digital readout. Thanks to our miniaturization technology, it can easily be installed on robot arms and in confined spaces. And the series now features a user-friendly interface that offers improved ease of use when operating via computer software or HMI unit for more sophisticated operation and analysis.

### ■ Featuring 3 digital plus 2 analog outputs

With three outputs, the **HL-G1** can be used to generate HI/GO/LOW judgment output or alarm output. The analog output can be used in both current and voltage modes.

### ■ Lightweight body that can be used on moving machinery

The sensor weighs 70g and can be installed on moving parts such as sliders and robot arms. The sensor ships standard with flexible cables.

### ■ Smooth setup changes

Memory switching function

Up to four groups of sensor settings can be stored for fast recall.

### ■ HMI screen for the HL-G1 series

The GT02 / GT12 HMI touch panel can be used in combination with the HL-G1 to allow easy confirmation of sensor status and configuration of sensor settings from a remote location.

Selection of Panasonic HMI touch panels:

- AIG02GQ 14D
- AIG02MQ 15D
- AIG12GQ 14D/15D
- AIG12MQ 14D/15D



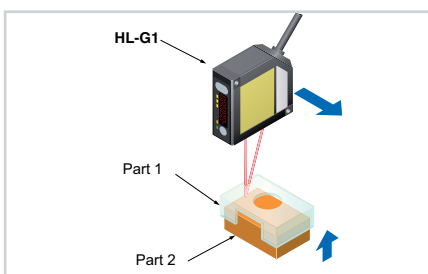
## HL-G1 Technical Specifications

|                                    | Displacement sensor (standard type)               |              |               |              |
|------------------------------------|---------------------------------------------------|--------------|---------------|--------------|
| Model no.                          | HL-G103-A-C5                                      | HL-G105-A-C5 | HL-G108-A-C5  | HL-G112-A-C5 |
| Laser class                        | 2                                                 |              |               |              |
| Analog output                      | 0 - 10V / 4 - 20mA                                |              |               |              |
| Measurement range                  | 30 ± 4mm                                          | 50 ± 10mm    | 85 ± 20mm     | 120 ± 60mm   |
| Beam diameter                      | 0.1 x 0.1mm                                       | 0.5 x 1mm    | 0.75 x 1.25mm | 1.0 x 1.5mm  |
| Sampling rate                      | 200µs, 500µs, 1ms, 2ms                            |              |               |              |
| Resolution                         | 0.5µm                                             | 1.5µm        | 2.5µm         | 8µm          |
| Linearity                          | ±0.1% F.S.                                        |              |               |              |
| Laser wavelength                   | 655nm                                             |              |               |              |
| Max. power of the emitting element | 1mW                                               |              |               |              |
| Output transistor                  | 50mA or less (NPN/PNP)                            |              |               |              |
| Material                           | Enclosure: PBT, Front cover: Acrylic / cable: PVC |              |               |              |
| Degree of protection               | IP67                                              |              |               |              |
| Dimensions (HxWxL)                 | 60 x 57 x 20.4mm                                  |              |               |              |
| Connection method                  | Cable 5m                                          |              |               |              |
| Supply voltage                     | 24V DC (±10%)                                     |              |               |              |
| Ambient temperature                | -10°C to +45°C, storage: -20°C to +60°C           |              |               |              |
| Ambient humidity                   | 35 to 85% RH, storage: 35 to 85% RH               |              |               |              |
| Weight (approx.)                   | 320g                                              |              |               |              |

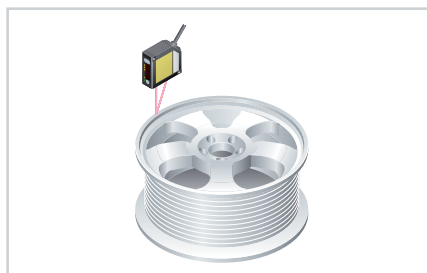
|                                    | Displacement sensor (multifunction type)          |             |               |             |
|------------------------------------|---------------------------------------------------|-------------|---------------|-------------|
| Model no.                          | HL-G103-S-J                                       | HL-G105-S-J | HL-G108-S-J   | HL-G112-S-J |
| Laser class                        | 2                                                 |             |               |             |
| Analog output                      | 0 - 10V / 4 - 20mA                                |             |               |             |
| Measurement range                  | 30 ± 4mm                                          | 50 ± 10mm   | 85 ± 20mm     | 120 ± 60mm  |
| Beam diameter                      | 0.1 x 0.1mm                                       | 0.5 x 1mm   | 0.75 x 1.25mm | 1.0 x 1.5mm |
| Sampling rate                      | 200µs, 500µs, 1ms, 2ms                            |             |               |             |
| Resolution                         | 0.5µm                                             | 1.5µm       | 2.5µm         | 8µm         |
| Linearity                          | ±0.1% F.S.                                        |             |               |             |
| Laser wavelength                   | 655nm                                             |             |               |             |
| Max. power of the emitting element | 1mW                                               |             |               |             |
| Output transistor                  | 50mA or less (NPN/PNP)                            |             |               |             |
| Communication port                 | RS422 or RS485                                    |             |               |             |
| Material                           | Enclosure: PBT, Front cover: Acrylic / cable: PVC |             |               |             |
| Degree of protection               | IP67                                              |             |               |             |
| Dimensions (HxWxL)                 | 60 x 57 x 20.4mm                                  |             |               |             |
| Connection method                  | 0.5 m cable, connector M12                        |             |               |             |
| Supply voltage                     | 24V DC (±10%)                                     |             |               |             |
| Ambient temperature                | -10°C to +45°C, storage: -20°C to +60°C           |             |               |             |
| Ambient humidity                   | 35 to 85% RH, storage: 35 to 85% RH               |             |               |             |
| Weight (approx.)                   | 110g                                              |             |               |             |

## Typical Applications

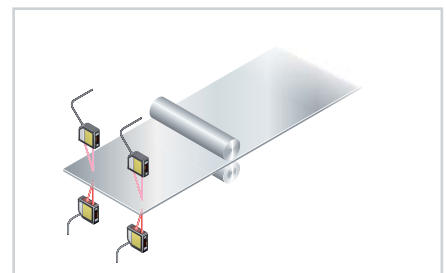
### Measurement of actuator part insertion depth



### Detection of aluminum wheel grooves



### Measurement of sheet thickness



# LM-10

LM-10



The entrance model in  $\mu\text{m}$  resolution distance measurement

## Features

### ■ High-precision measurements, comparative output (amount of light) function

In addition to conventional analog output, it is equipped with standard ON/OFF control output (single /double comparator) enabling its use as a photoelectric sensor. It is compatible for 'micro-spotting' and 'high-precision' applications normally reserved for lasers.

### ■ Laser class 1, visible red light version

The LM-10 series is the newest generation of laser sensors and offers excellent performance. The new single channel technology and the automatic gain adjustment allow high resolution measurements at a wide dynamic range. The LM-10 series is especially suitable for accurate thickness and position measurements.

### ■ Laser class 2, visible red light version

The LM-10 series also includes a wide range of class 2 sensor heads which offer an even smaller resolution. Also a long distance type with a measuring range from 100mm to 400mm is available. The cable length of all class 2 types is expandable to up to 30m.

### ■ LCD display for analog values and set points (double comparator type)

In addition to the analog output, the LM-10 controllers have one (single comparator type) or two (double comparator type) set-point judgement outputs. The double comparator type shows the analog values on an LCD.

## LM-10 Technical Specifications

### Sensor heads

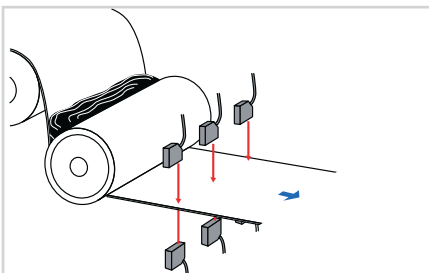
| Type                       | ANR1250        | ANR1251     | ANR1282   | ANR1215   | ANR1226      |
|----------------------------|----------------|-------------|-----------|-----------|--------------|
| Laser class                | 2              |             |           |           |              |
| Measurement range (mm)     | 50 ± 10        | 50 ± 10     | 80 ± 20   | 130 ± 50  | 250 ± 150    |
| Beam dimensions (mm)       | 0.6 x 1.1      | 0.09 x 0.05 | 0.7 x 1.2 | 0.7 x 1.4 | 0.8 x 1.5    |
| Response frequency         | 10/100/1000Hz  |             |           |           |              |
| Resolution (µm)            | 1/3.5/10       | 1/3.5/10    | 4/13/40   | 20/65/200 | 150/500/1500 |
| Laser wavelength           | 685nm          |             |           |           |              |
| Lasser class               | 1              |             |           |           |              |
| Max. output of laser diode | 1.6mW          |             |           |           |              |
| Housing material           | Zinc die cast  |             |           |           |              |
| Degree of protection       | IP67           |             |           |           |              |
| Size                       | 60 x 60 x 20mm |             |           |           |              |
| Connection method          | Connector      |             |           |           |              |
| Ambient temperature        | 0°C to +50°C   |             |           |           |              |
| Weight (approx.)           | 300g           |             |           |           |              |

### Controllers

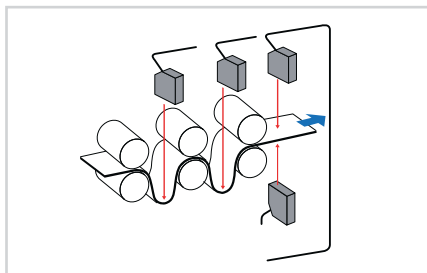
| NPN output          | ANR5131                        | ANR5141  | ANR5231           | ANR5241  |
|---------------------|--------------------------------|----------|-------------------|----------|
| PNP output          | ANR5132                        | ANR5142  | ANR5232           | ANR5242  |
| Type                | Single comparator              |          | Double comparator |          |
| Indication          | LED                            |          | LCD display       |          |
| Analog output       | ±5V, max. 100mA                | 4 - 20mA | ±5V, max. 100mA   | 4 - 20mA |
| Evaluation output   | Transistor, max. 100mA, 30V DC |          |                   |          |
| Intensity output    | ±5V                            |          |                   |          |
| Alarm output        | Transistor, max. 100mA, 30V DC |          |                   |          |
| Housing material    | Plastic                        |          |                   |          |
| Size                | 35 x 96 x 55mm                 |          |                   |          |
| Connection method   | Cable                          |          |                   |          |
| Operating voltage   | 12 to 24 V DC ( -15% / +10%)   |          |                   |          |
| Ambient temperature | 0°C to +50°C                   |          |                   |          |
| Weight (approx.)    | 180g                           |          |                   |          |

## Typical Applications

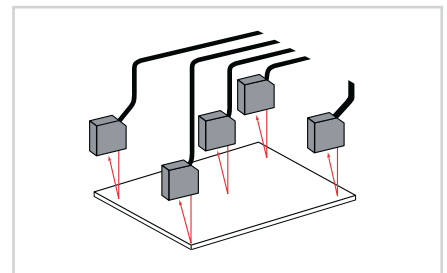
### Measuring packing tape thickness



### Slack detection



### Asymmetry detection



# HL-C1

HL-C1



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

## Features

### ■ 100μs of sampling rate is now available

The most amazing, ultra high-speed sampling in the industry has now been achieved for displacement sensors utilizing linear image sensors, thus enabling ultra high-speed measurement of rotating, vibrating and moving objects.

### ■ Resolution of 1μm, linearity of $\pm 0.1\%$ F.S.

Now available with ultra-precise 1μm 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-C1DP-E

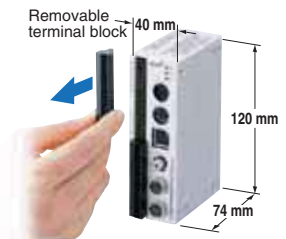
### ■ High accuracy measurement is now possible, unaffected by the surface condition of the detected object

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 sensing method measures the peak position values for the light spots themselves. This advance now makes high-precision measurement possible, regardless of the surface condition of the object, whether for metal hairline surface cracks or for non-reflective surfaces, e.g. black rubber.

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

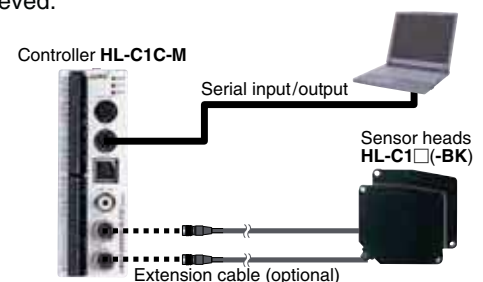
### ■ Controller compact and front connection reduces setup space

The ultra compact controller with dimensions of W40×H120×D74mm requires extremely little space for installation. Adhesive installation is also possible. Furthermore, the cables can be connected directly or to a removable terminal board, 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.



### ■ FDA standards conforming types are available

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

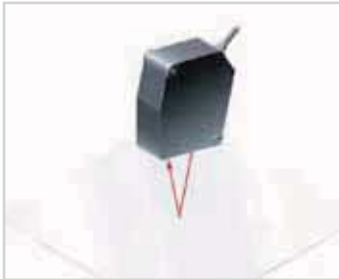
The **HL-C1** series has added a new line of tire measuring specialized versions for tire making processes.

The high-powered 5mW type enables high accuracy and stable measurement of raw tires and completed tires which were previously considered difficult to measure.

## Typical Applications

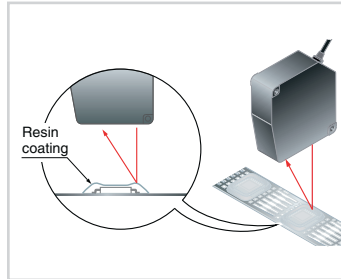
### Measuring glass substrate thickness

The HL-C1 series specular reflective type realizes stable distance measurements even for specular and transparent objects.



### Detecting the presence of a resin coating

The HL-C1 series detects translucent resin coating.



### Measuring the eccentricity of a metal shaft

By using the filter function, it can quickly and stably measure even workpieces with tiny scratches.



## Technical Specifications

### Sensor heads

| Type                        | Diffuse reflective                                                                                                                                                                                                               |                  | Specular reflective |                  |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------------------|
|                             | General propose                                                                                                                                                                                                                  | High accuracy    | General propose     | High accuracy    |
| Model no. (Note 1)          | HL-C108B(F)-BK                                                                                                                                                                                                                   | HL-C105B(F)-BK   | HL-C108B(F)         | HL-C105B(F)      |
| Measurement center distance | 85mm                                                                                                                                                                                                                             | 50mm             | 81.4mm              | 46mm             |
| Measuring range             | ±20mm                                                                                                                                                                                                                            | ±5mm             | ±16mm               | ±4mm             |
| Resolution (Note 2)         | 2μm                                                                                                                                                                                                                              | 1μm              | 2μm                 | 1μm              |
| Linearity                   | ±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               | 100×140μm approx.                                                                                                                                                                                                                | 70×120μm approx. | 100×140μm approx.   | 70×120μm approx. |
| Protection                  | IP67 (excluding connector)                                                                                                                                                                                                       |                  |                     |                  |
| Ambient temperature         | 0 to +45°C                                                                                                                                                                                                                       |                  |                     |                  |
| Dimensions (W×H×D)          | 26.6×82×87mm                                                                                                                                                                                                                     |                  |                     |                  |

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

2) Where measurement conditions have not been specified precisely, the conditions used were as follows: supply voltage 24V DC, ambient temperature +20°C, sampling rate 100μs, average number of samples: 256, measurement center distance, object measured 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.

### Controller

| Model no.                 |              | HL-C1C-M                                                                   |
|---------------------------|--------------|----------------------------------------------------------------------------|
| Connectable sensor head   |              | Max. 2 sensor heads                                                        |
| Supply voltage            |              | 24VDC±10%                                                                  |
| Sampling rate             |              | Selectable from 100μs/144μs/200μs/255μs/332μs/498μs/1000μs                 |
| Analog output             | Voltage      | Output voltage ±5 V/VS, Output current: Max. 2mA<br>Output impedance: 50 Ω |
|                           | Current      | Output current: 4 to 20mA/F.S., Load resistance: 250 Ω or less             |
|                           | Output range | Voltage: 110.9 to -10.9V, Current: 0 to 29.5mA                             |
| Judgment outputs (O1, O2) |              | PhotoMOS relay                                                             |
| Average number of samples |              | OFF, 2 to 32,768 cycles (switching in 16 steps)                            |
| Ambient temperature       |              | 0 to +50°C                                                                 |
| Dimensions (mm)           |              | W40×H120×D74                                                               |



# HL-C135C-BK10 HL-C1C-M-WL

**Superlative wide-range measurement  
with small head**

## Features

### ■ Measures wide changes over long ranges

The long-range and wide-range capabilities over **350mm**  $\pm 200\text{mm}$  allow large changes to be measured. Even if the object's 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 high-speed sampling of **100 $\mu\text{s}$**  at a resolution of **10 $\mu\text{m}$**  and a linearity of  $\pm 0.1\%$  F.S.

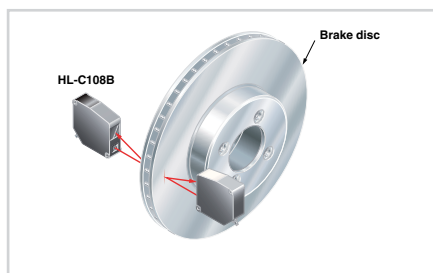


### Sensor heads

|                             |                                                                                 |
|-----------------------------|---------------------------------------------------------------------------------|
| Measurement center distance | 350mm                                                                           |
| Measuring range             | $\pm 200\text{mm}$                                                              |
| Emitting element            | Red semiconductor laser, Class 3B (IEC/JIS)                                     |
| Beam diameter               | 400 $\times$ 200 $\mu\text{m}$ approx.                                          |
| Controller                  | Specifications are the same as for the HL-C1C-M controller on the previous page |
| Dimensions (mm)             | W48 $\times$ H48 $\times$ D83                                                   |

## Typical Applications

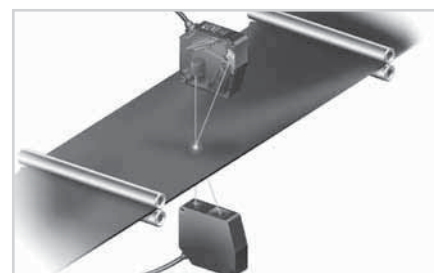
### Measuring brake disk thickness



### Inspecting tire form



### Measuring the thickness of a rubber sheet



# HL-C2

**New**



**Ultra high-speed, precision laser displacement sensors**

## Features

### ■ Excellent basic performance

### ■ 10μs sampling rate available

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

### ■ Resolution up to 0.01μm, linearity up to ±0.02%F.S

Superior resolution of 0.01μm. Linearity of ±0.02%F.S enabled by latest high resolution lens technology.



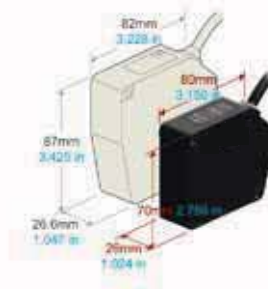
### ■ Touch panel simplifies operation

Measurement values and wavelength of the light intensity are displayed. Via the menu, you can set the sensor head function and output conditions.



### ■ Compact sensor head saves space

The volume ratio has been reduced by 23% compared to the previous model, minimizing installation space.



### ■ Compact but with a wide array of functions

You can connect two sensor heads and a variety of devices to the ultra compact controller. Measurement values can be analyzed and displayed while the sensors are being controlled.

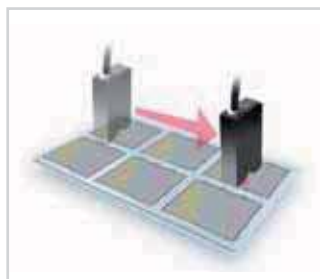


### ■ Detection tolerance improved for tilted objects

Detection tolerance for tilted objects has increased by 50% over the previous model, allowing you more flexibility in applications in which the position of the object being sensed fluctuates.

## Typical Applications

Measurement of the position of patterned glass



Control of the camera focus



Measurement of the shape of a camshaft



Measurement of the heights of chip parts



## Technical Specifications

| Model no.                          | Sensor heads                        |                    |                     |                        |                     |                    |                     |
|------------------------------------|-------------------------------------|--------------------|---------------------|------------------------|---------------------|--------------------|---------------------|
|                                    | HL-C201F[E]                         | HL-C203F[E]        |                     | HL-C211F[E]            |                     | HL-C211F5[E]       |                     |
| Type                               | Small beam spot type                |                    |                     |                        |                     |                    |                     |
|                                    | Specular reflective                 | Diffuse reflective | Specular reflective | Diffuse reflective     | Specular reflective | Diffuse reflective | Specular reflective |
| Laser class                        | 1                                   | 2                  |                     |                        |                     | 3R                 |                     |
| Measuring range                    | 10 ± 1mm                            | 30 ± 5mm           | 26.4 ± 4.6mm        | 110 ± 15mm             | 106.7 ± 14.5mm      | 110 ± 15mm         | 106.7 ± 14.5mm      |
| Beam diameter                      | ø20µm                               | ø30µm              | ø30µm               | ø80µm                  |                     |                    |                     |
| Sampling frequency                 | up to 100kHz                        |                    |                     |                        |                     |                    |                     |
| Resolution                         | 0.01µm                              | 0.025µm            | 0.25µm              | 0.1µm                  | 0.25µm              | 0.1µm              | 0.25µm              |
| Laser wavelength                   | 658nm                               |                    |                     |                        |                     |                    |                     |
| Max. power of the emitting element | 0.1mW                               | 1mW                |                     | 5mW                    |                     |                    |                     |
| Housing material                   | Die-cast aluminum                   |                    |                     |                        |                     |                    |                     |
| Protection                         | IP67                                |                    |                     |                        |                     |                    |                     |
| Physical size (HxWxL)              | 54 x 95 x 20mm                      | 80 x 70 x 26mm     |                     | 95 x 54 x 20mm         |                     |                    |                     |
| Cable                              | 0.5m with connector                 |                    |                     |                        |                     |                    |                     |
| Ambient temp.                      | 0°C to +45°C                        |                    |                     |                        |                     |                    |                     |
| Ambient humidity                   | 35 to 85% RH, Storage: 35 to 85% RH |                    |                     |                        |                     |                    |                     |
| Weight (approx.)                   | 250g (including cable)              |                    |                     | 300g (including cable) |                     |                    |                     |
|                                    | [E] = Reduced resolution types      |                    |                     |                        |                     |                    |                     |

## HL-C2 Technical Specifications

| Model no.                          | Sensor heads (linear beam spot type) |                    |                     |                        |                     |                    |                     |
|------------------------------------|--------------------------------------|--------------------|---------------------|------------------------|---------------------|--------------------|---------------------|
|                                    | HL-C201F[E]-MK                       | HL-C203F[E]-MK     |                     | HL-C211F[E]-MK         |                     | HL-C211F5[E]-MK    |                     |
| Type                               | Linear beam spot type                |                    |                     |                        |                     |                    |                     |
|                                    | Specular reflective                  | Diffuse reflective | Specular reflective | Diffuse reflective     | Specular reflective | Diffuse reflective | Specular reflective |
| Laser class                        | 1                                    | 2                  |                     |                        |                     | 3R                 |                     |
| Measuring range                    | 10 ± 1mm                             | 30 ± 5mm           | 26.4 ± 4.6mm        | 110 ± 15mm             | 106.7 ± 14.5mm      | 110 ± 15mm         | 106.7 ± 14.5mm      |
| Beam diameter                      | 20 x 700m                            | 30 x 1200m         |                     | 80 x 1700μm            |                     |                    |                     |
| Sampling frequency                 | up to 100kHz                         |                    |                     |                        |                     |                    |                     |
| Resolution                         | 0.01μm                               | 0.025μm            | 0.25μm              | 0.1μm                  | 0.25μm              | 0.1μm              | 0.25μm              |
| Laser wavelength                   | 658nm                                |                    |                     |                        |                     |                    |                     |
| Max. power of the emitting element | 0.1mW                                | 1mW                |                     | 5mW                    |                     |                    |                     |
| Housing material                   | Die-cast aluminum                    |                    |                     |                        |                     |                    |                     |
| Protection                         | IP67                                 |                    |                     |                        |                     |                    |                     |
| Physical size (HxWxL)              | 54 x 95 x 20mm                       | 80 x 70 x 26mm     |                     | 95 x 54 x 20mm         |                     |                    |                     |
| Cable                              | 0.5m with connector                  |                    |                     |                        |                     |                    |                     |
| Ambient temp.                      | 0°C to +45°C                         |                    |                     |                        |                     |                    |                     |
| Ambient humidity                   | 35 to 85% RH, Storage: 35 to 85% RH  |                    |                     |                        |                     |                    |                     |
| Weight (approx.)                   | 250g (including cable)               |                    |                     | 300g (including cable) |                     |                    |                     |
|                                    | [E] = Reduced resolution types       |                    |                     |                        |                     |                    |                     |

| Model no.                   | Controllers                                             |                                                 |
|-----------------------------|---------------------------------------------------------|-------------------------------------------------|
|                             | HL-C2C                                                  | HL-C2C-P                                        |
| Type                        | Controller (NPN) for up to 2 HL-C2 sensor heads         | Controller (PNP) for up to 2 HL-C2 sensor heads |
| Analog output               | ±10.8V, 1-25mA                                          |                                                 |
| Outputs                     | Alarm, judgment, strobe, max. 100mA 30VDC               |                                                 |
| Inputs                      | Timer, zero set, remote interlock, reset 12 to 24VDC    |                                                 |
| USB interface               | USB 2.0                                                 |                                                 |
| Serial input/output         | RS-232C (300 - 19.200bps)                               |                                                 |
| Current consumption         | With 1 sensor head: 350mA<br>With 2 sensor heads: 500mA |                                                 |
| Housing material            | Die-cast aluminum                                       |                                                 |
| Physical size (HxWxL)       | 105.5 x 120 x 59mm                                      |                                                 |
| Connection method           | Input terminal                                          |                                                 |
| Supply voltage              | 24VDC (±10%)                                            |                                                 |
| Ambient temp.               | 0°C to + 50°C                                           |                                                 |
| Temperature characteristics | ±0.01% F.S. (25°C)                                      |                                                 |
| Weight (approx.)            | 450g                                                    |                                                 |

# HL-T1

HL-T1



## A high-functionality intelligent controller

## Features

### ■ Small sensor head

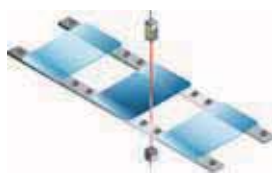
The most compact size and yet the highest level of performance in their class. These sensors save space.

### ■ Resolution of 4μm

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

### ■ High-precision measurement even of minute differences in light intensity

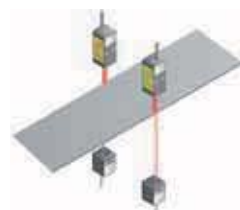
The sensors are sensitive to minute differences in light intensity so that they can judge even the opacity of glass and turbidity of liquids. In addition, the amount of light received can be displayed as a percentage to allow you to determine permeation rates.



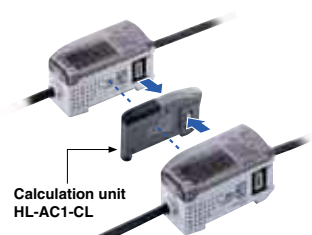
Distinguishing opacity of glass

### ■ 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.



Sheet width measurement



### ■ FDA standards conforming types are available

FDA standards conforming types, most suitable for equipment used in the USA, are now available (FDA: class II, IEC/JIS: class 1).

## Technical Specifications

### Sensor heads

| Type                                                            | Beam diameter Ø1mm type       |                                                                                                                                                      | Sensing width 5mm     | Sensing width 10mm type |
|-----------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------|
| Model no. (Note 1)                                              | HL-T1001A(F)                  |                                                                                                                                                      | HL-T1005A(F)          | HL-T1010A(F)            |
| Sensing range                                                   | 0 to 500mm                    | 500 to 2000mm                                                                                                                                        | 500mm                 |                         |
| Sensing width                                                   | Ø1mm                          | Ø1 to Ø2.5mm                                                                                                                                         | 5mm                   | 10mm                    |
| Min. sensing object                                             | Ø8µm opaque object            | Ø50µm opaque object                                                                                                                                  | Ø0.05mm opaque object | Ø0.1mm opaque object    |
| Repeatability (during the state in which light is half blocked) | 4µm (Note 2)                  | —                                                                                                                                                    | 4µm (Note 2)          |                         |
| Linear output resolution                                        | 4µm (Note 2)                  | —                                                                                                                                                    | 4µm (Note 2)          |                         |
| Ambient temperature                                             | 0 to +50°C                    |                                                                                                                                                      |                       |                         |
| Emitting element                                                | IEC/JIS standards             | Red semiconductor laser, Class 1 (IEC/JIS) [modulated, max. output 0.35mW (HL-T1001A(F): 0.2mW), emission peak wavelength: 650nm]                    |                       |                         |
|                                                                 | FDA standards conforming type | Red semiconductor laser, Class 2 (FDA) [modulated, max. output 0.35mW (HL-T1001A(F): 0.2 mW), emission peak wavelength: 650nm]<br>(IEC/JIS: class 1) |                       |                         |

Notes: 1) HL-T10MA is IEC/JIS standards conforming type.

HL-T10MF is FDA standards conforming type.

2) With an average sampling rate of 64 times.

### Controllers

| Type                              | NPN output                                                                                                                                                                                                                                                   | PNP output                    |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Model no.                         | HL-AC1                                                                                                                                                                                                                                                       | HL-AC1P                       |
| Supply voltage                    | 12 to 24VDC ±10%                                                                                                                                                                                                                                             |                               |
| Measuring cycle                   | 150μs                                                                                                                                                                                                                                                        |                               |
| Linear output                     | Current / voltage output switchable                                                                                                                                                                                                                          |                               |
|                                   | <ul style="list-style-type: none"> <li>During current output: 4 to 20mA/F.S., max. load resistance 300Ω</li> <li>During voltage output: 54V/F.S., output impedance 100Ω (In the monitor focus function, it can also be set at 55V, 0 to 5V, etc.)</li> </ul> |                               |
| Temperature characteristics       | ±0.2% F.S./°C                                                                                                                                                                                                                                                |                               |
| Settable average sampling rate    | 1 / 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096                                                                                                                                                                                          |                               |
| Judgment output (HIGH, PASS, LOW) | NPN open-collector transistor                                                                                                                                                                                                                                | PNP open-collector transistor |
| Ambient temperature               | 0 to +50°C                                                                                                                                                                                                                                                   |                               |
| Dimensions (mm)                   | W30×H34.3×D64.3                                                                                                                                                                                                                                              |                               |

**New**



# ER-F Series

Low-volume fan type

## Features

### ■ Two exchangeable louvers to suit your needs

- Just simply replace the louver to change configuration between long distance and wide area ionization.
- The two louvers come with the ionizer main body.

### ■ Remove the louver for effortless maintenance

- Because the discharge needle unit is attached to the louver, exchange or maintenance of the needles is made easy without touching the main unit.
- A safe design where once the louver is removed, the high-voltage circuit and the fan will halt.

Straight louver



Removes charges quickly at long distance

Angle louver



Removes charges completely in wide area



## Technical Specifications

| Type                     | Standard fan type                                                                                    | Low-volume fan type       |
|--------------------------|------------------------------------------------------------------------------------------------------|---------------------------|
| Model no.                | ER-F12                                                                                               | ER-F12S                   |
| Charge removal time      | 1 sec. approx. (Note 1)                                                                              | 1.5 sec. approx. (Note 1) |
| Ion balance              | ±10 V or less (Note 2)                                                                               |                           |
| Power supply voltage     | 24 V DC ±10%                                                                                         |                           |
| Power consumption        | 700 mA or less                                                                                       | 400 mA or less            |
| Discharge method         | High-frequency AC method                                                                             |                           |
| Discharge output voltage | ± 2 kV approx.                                                                                       |                           |
| Max. fan speed           | 5.3 m/s (Note 2)                                                                                     | 4.0 m/s (Note 2)          |
| Max. fan volume          | 3.68 m³/min                                                                                          | 2.50 m³/min               |
| Main functions           | Error output, Discharge halt input                                                                   |                           |
| Indicators               | Discharge error (Red), Fan error (Red),<br>Power (Green), Discharge (Green)                          |                           |
| Ozone generation amount  | 0.04 ppm or less (Note 1)                                                                            |                           |
| Ambient temperature      | 0 to +50°C (No dew condensation) / Storage: -10 to +65°C                                             |                           |
| Ambient humidity         | 35 to 65% RH (No dew condensation) / Storage: 35 to 65% RH                                           |                           |
| Grounding method         | C (capacitor) grounding                                                                              |                           |
| Material                 | Enclosure: ABS, Louver: ABS, Discharge needle unit: PBT<br>Discharge needle: Tungsten, Bracket: SPHC |                           |
| Weight                   | Main unit: 790 g approx.                                                                             |                           |
| Accessories              | Straight louver: 1 pc. (Note 3), Angle louver: 1 pc.<br>Caution label: 1 set, Rubber cushion: 1 pc.  |                           |

Notes: 1) Typical value at 200 mm from directly in front of air outlet, fan speed MAX, straight louver, with no filter installed.  
 2) Typical value at 300 mm from directly in front of air outlet, fan speed MAX, straight louver, with no filter installed.  
 3) The discharge needle unit is loaded on the straight louver before shipment.

# ER-TF

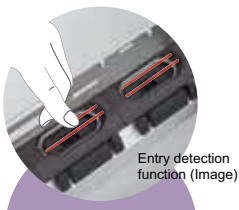
**New**

**Wide-area ionizer**

## Features

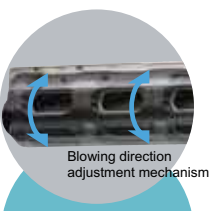
### ■ Flexible layout

The air blowing direction can be easily adjusted even after installation.



### ■ Safe design

Detection of entry to the discharger interrupts the high voltage circuit.



### ■ Easy maintenance

Discharge needle units can be detached or attached quickly by sliding open the cover.



### ■ Easy filter cleaning

The fan air intake filter can be easily removed. This greatly reduces the time needed for cleaning.



### ■ Airflow can be set to 4 different speeds

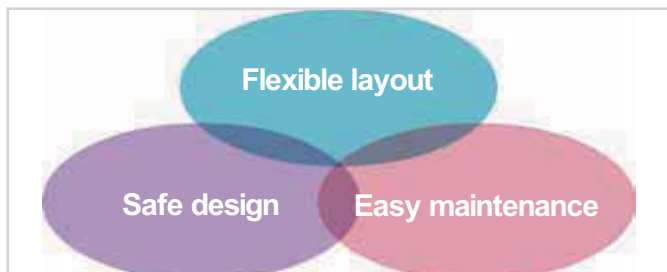
Fan can be set to 4 different speeds. The MAX setting quickly removes static charge over a wide area.



The new, wide-area ionizer provides you with a new opportunity to effectively remove static from your production line. ER-TF ionizers are safe in design, easy to maintain and come in a variety of sizes to meet your workstation requirements. Moreover, there is no need for compressed air, which makes installation easy and keeps costs under control.

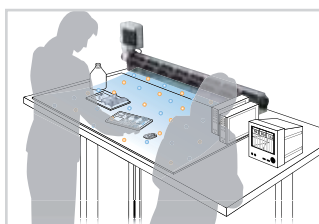
## ■ Characteristics of ER-TF series

A style not seen before that pursues performance in cell production lines and resolves dissatisfaction with existing ionizers.

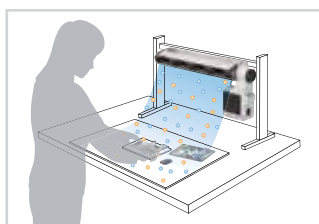


## Typical Applications

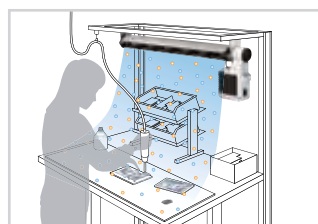
**Desktop setup, 800mm type to accommodate wide workbench**



**Front setup, 400mm type to suit operation space**



**Overhead setup, 600mm type to cover cell production**



## Technical Specifications

| Type                                                      | Wide-area fan type                                                                                    |                   |                   |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| Model no.                                                 | ER-TF04-EX                                                                                            | ER-TF06-EX        | ER-TF08-EX        |
| Charge removal time ( $\pm 1,000V \rightarrow \pm 100V$ ) | Approx. 1s (Note 1)                                                                                   |                   |                   |
| Ion balance                                               | $\pm 10V$ or less (Note 2)                                                                            |                   |                   |
| Supply voltage                                            | Accessory AC adapter input: 100 to 240VAC $\pm 10\%$ 50/60Hz<br>(Output: 24VDC)                       |                   |                   |
| Ambient temperature                                       | 0 to + 50°C (No dew condensation), AC adapter: 0 to + 40°C                                            |                   |                   |
| Material                                                  | Bar unit enclosure: ABS, Fan unit enclosure: ABS, Discharge needles: Tungsten, Mounting bracket: SPCC |                   |                   |
| Weight (approx.)                                          | Net weight: 1.0kg                                                                                     | Net weight: 1.2kg | Net weight: 1.4kg |

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

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

# ER-VW



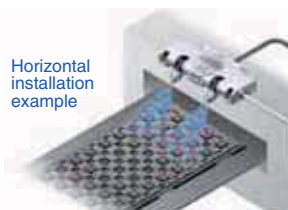
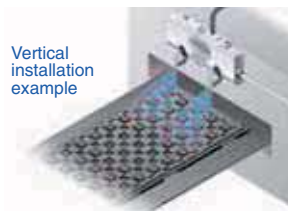
Nozzle angle adjustment and joint layout can be selected as desired

## Features

### ■ 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.

Installation examples



Includes angle adjustment scale

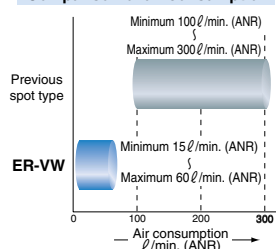
### ■ Compact and ultrathin design

The thickness of the unit is 18.9mm. 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.

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

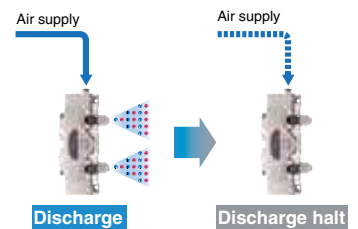
ER-VW can utilize air flow levels starting from a minimum of 15 ℓ/min. Because the amount of air consumed is so low, the loads placed on air supply equipment can be reduced and costly clean air can be used much more economically.

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 up and the discharge output (DSC) turns off. This prevents objects which are not charged from being overlooked when the air supply has been stopped.

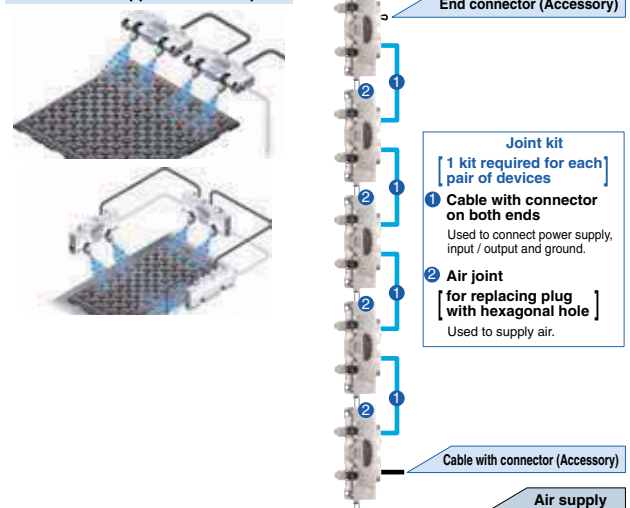


### ■ Easy connection possible

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.

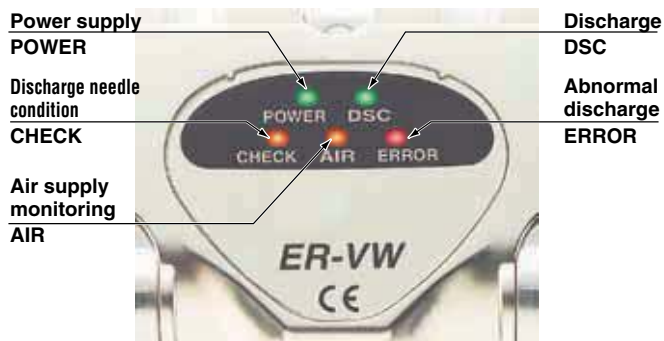
Multiple ER-VW units can be connected to provide charge removal layouts that suit the target equipment.

Connection application example



## ■ Functions to support accurate charge removal

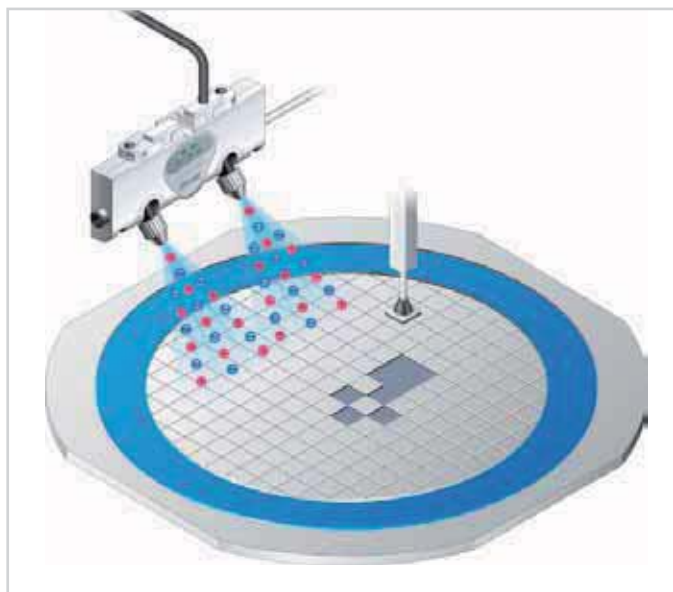
In addition to the air supply monitoring function, the ER-VW is equipped with the following functions to ensure accurate charge removal.



## Typical Applications

### Removing charge during pickup from dicing type

Ideal for preventing damage to devices from static electricity.



### Removing charges from surfaces of CDs / DVDs

Adjustment of the nozzle angle allows the charge removal area to be laid out in accordance with the position of the object.



| Type                                                                       | Spot type                        |
|----------------------------------------------------------------------------|----------------------------------|
| Model no.                                                                  | ER-VW                            |
| Charge removal time<br>( $\pm 1,000\text{V} \rightarrow \pm 100\text{V}$ ) | 1 sec. or less (Note 1)          |
| Ion balance                                                                | Within $\pm 15\text{V}$ (Note 1) |
| Supply voltage                                                             | 24VDC $\pm 10\%$                 |
| Output<br>Check (CHECK)<br>Error (ERROR)<br>Discharge (DSC)<br>(Note 2)    | NPN open-collector transistor    |
| Ambient temperature                                                        | 0 to $+55^\circ\text{C}$         |

Notes: 1) A typical sample applied with a supply voltage of 24V, a distance of 100mm from the front surface of the air flow outlet and a pressure of 0.25MPa (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'.

# ER-V



## 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.

### ■ High performance but no controller needed

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

### ■ Nozzle variations can be selected to suit the application



### ■ Ultra compact design accurately removes charges of objects even from narrow spaces

The main unit is merely 109×27×28mm 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.

## Typical Applications

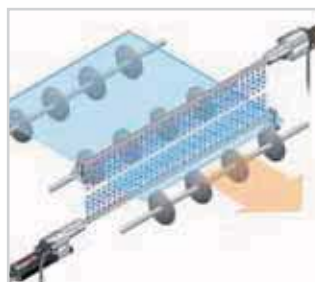
### Change removal and dust removal of lenses



### Prevent discharge damage in circuit board LEDs



### Charge removal of FPD glass surfaces



## Technical Specifications

| Type                                                                      |                                | Spot type                        |
|---------------------------------------------------------------------------|--------------------------------|----------------------------------|
| Model no.                                                                 |                                | ER-VS01                          |
| Charge removal time<br>( $\pm 1000\text{V} \rightarrow \pm 100\text{V}$ ) |                                | 1 sec. or less (Note 1)          |
| Ion balance                                                               |                                | Within $\pm 15\text{V}$ (Note 1) |
| Supply voltage                                                            |                                | 24V DC $\pm 10\%$                |
| Output                                                                    | Check (CHECK)<br>Error (ERROR) | NPN open-collector transistor    |
| Ambient temperature                                                       |                                | 0 to $+55^{\circ}\text{C}$       |

**Note:** A typical sample applied with a supply voltage of 24V, a distance of 100mm from the front surface of the air flow outlet and a pressure of 0.25MPa 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).

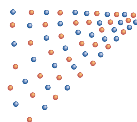
## EC-G



### Pulse air-gun ionizer

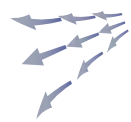
#### ■ Direct ionized air emission

With the new pulse air-gun ionizer, operators can comfortably neutralize static electricity while manually cleaning.



#### ■ Pulsed ionized air

Instant pulse air emission with high air pressure removes dust all at once. The pulse air-gun's light-weight, ergonomic design combined with an oil- and heat-resistant 2m cable make it ideal for flexible use at the production line.



#### ■ White LED illumination

A white LED on the front of the gun illuminates target objects.

## Typical Applications

#### Remove dust on PCB



#### Remove dust on FPD



#### Remove dust before painting



## Technical Specifications

|                             |                                                                                 |
|-----------------------------|---------------------------------------------------------------------------------|
| <b>Model no.</b>            | <b>EC-G01</b>                                                                   |
| <b>Charge removal time</b>  | 0.5s or less ( $\pm 1,000V \rightarrow \pm 100V$ ) (Note 1)                     |
| <b>Applicable fluid</b>     | Air (dried clean air) (Note 2)                                                  |
| <b>Supplied air flow</b>    | Max. 300l/min. (ANR) or less                                                    |
| <b>Air pressure range</b>   | 0.05 to 0.50MPa                                                                 |
| <b>Power supply voltage</b> | Accessory AC adapter INPUT: 100 to 240VAC $\pm 10\%$ 50/60Hz<br>(OUTPUT: 24VDC) |
| <b>Power consumption</b>    | 30VA or less                                                                    |
| <b>Discharge method</b>     | High-frequency AC method                                                        |
| <b>Pulse air mode</b>       | Pulse 1 (long) / Pulse 2 (short) / CONT (continuous) selectable by switch       |
| <b>Weight</b>               | 270g approx. (main unit only)                                                   |

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

2) Dried clean air is the air passing through an air dryer (dewpoint  $-20^{\circ}\text{C}$  approx.) and an airfilter (mesh size  $0.01\mu\text{m}$  approx.)



# EF-S1

Constantly checks static electricity  
in process lines

## Features

### ■ Maintains and regulates product quality by eliminating static electric damage

The static electricity that can build up in various places in a process line can be monitored constantly so that abnormalities can be prevented before they occur. This makes it possible to determine if damage or malfunctions are being caused by static electricity so that stable product quality can be maintained.

### ■ Reduces man hours for ionizer inspections

The de-ionizing effectiveness of ionizers can be understood in real-time so that things such as ionizer damage and the replacement period for worn components can be checked objectively, reducing the number of man hours required for inspection and testing.

#### Sensor head

| Type          | Spot type                                                               |
|---------------|-------------------------------------------------------------------------|
| Model no.     | EF-S1HS                                                                 |
| Sensing range | 8.0 to 20.5mm ( $\pm 1$ kV range)<br>21.0 to 40.5mm ( $\pm 2$ kV range) |

#### Controller

| Type                              | Spot type                                                             |
|-----------------------------------|-----------------------------------------------------------------------|
| Model no.                         | EF-S1C                                                                |
| Supply voltage                    | 24VDC $\pm 10\%$                                                      |
| Display range (Measurement range) | 11,000 to 1000 $\pm 1$ kV range<br>12,000 to 2000 ( $\pm 2$ kV range) |
| Judgment output                   | NPN open-collector transistor                                         |
| Analog output                     | Output voltage 1 to 5V<br>Output impedance 100 $\Omega$ approx.       |

## Typical Applications

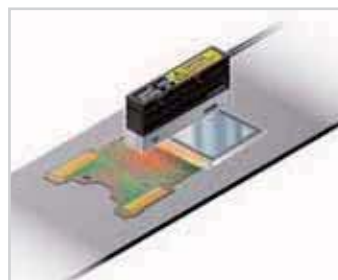
Measuring surface potential  
when removing BG sheets



Measuring static electric charges  
in lead frames



Measuring frictional electrification  
of LCD modules





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