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ideas for life

# Fiber Sensor Guide Book


2011.10 | panasonic-electric-works.net/sunx

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(1) Subject to the exclusions stated in 3 (EXCLUSIONS) herein below, Panasonic Electric Works SUNX warrants the Products to be free of defects in material and workmanship for a period of one (1) year from the date of shipment under normal usage in environments commonly found in manufacturing industry.

(2) Any Products found to be defective must be shipped to Panasonic Electric Works SUNX with all shipping costs paid by Purchaser or offered to Panasonic Electric Works SUNX for inspection and examination. Upon examination by Panasonic Electric Works SUNX, Panasonic Electric Works SUNX will, at its sole discretion, repair or replace at no charge, or refund the purchase price of, any Products found to be defective.

## 3. EXCLUSIONS

(1) This warranty does not apply to defects resulting from any cause:

(i) which was due to abuse, misuse, mishandling, improper installation, improper interfacing, or improper repair by Purchaser;
(ii) which was due to unauthorized modification by Purchaser, in part or in whole, whether in structure, performance or specification;
(iii) which was not discoverable by a person with the state-of-the-art scientific and technical knowledge at the time of manufacture;
(iv) which was due to an operation or use by Purchaser outside of the limits of operation or environment specified by Panasonic Electric Works SUNX;
(v) which was due to Force Majeure; and
(vi) which was due to any use or application expressly discouraged by Panasonic Electric Works SUNX in 5 (CAUTIONS FOR SAFE USE) hereunder.

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(3) The performance data presented in this catalogue is only for guidance and shall not constitute any performance warranty by Panasonic Electric Works SUNX.

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(4) The Products are each intended for use only in environments commonly found in manufacturing industry, and, unless expressly allowed in this catalogue, specification or otherwise, shall not be used in, or incorporated into, any equipment, facilities or systems, such as those:

(a) which are used for the protection of human life or body parts;
(b) which are used outdoors or in environments subject to any likelihood of chemical contamination or electromagnetic influence;
(c) which are likely to be used beyond the limits of operations or environments specified by Panasonic Electric Works SUNX in this catalogue or otherwise;
(d) which may cause risk to life or property, such as nuclear energy control equipment, transportation equipment (whether on rail or land, or in air or at sea), and medical equipment;
(e) which are operated continuously each day for 24 hours; and
(f) which otherwise require a high level of safety performance similar to that required in those equipment, facilities or systems as listed in (a) through (e) above.

## 6. EXPORT CONTROL LAWS

In some jurisdictions, the Products may be subject to local export laws and regulations. If any diversion or re-export is to be made, Purchaser is advised to abide by such local export laws and regulations, if any, at its own responsibility.

## 7. PURCHASER'S TRASFER OBLIGATIONS

If Purchaser resell or deliver the Products to a third party, Purchaser must provide such third party with a copy of this document, all specifications, manuals, catalogs, leaflets and written information of any kind provided to Purchaser by Panasonic Electric Works SUNX or its authorized local representative from time to time regarding the Products.

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# Fiber Selection Guide

## Choose by quality

### Super Quality

●The variance of beam intensity and beam axis is extremely small.

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## Choose by shape

### Threaded Type

●Standard type which is mounted using nuts.

P.10

### Cylindrical Type

●Has a slender shape that is mounted using set screws.

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### Sleeve

●Suitable for sensing in narrow locations and sensing minute objects.

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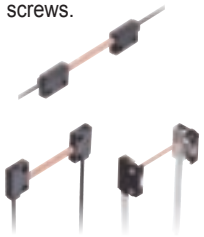
### Flat Type

●Thin and rectangular shape. Installed directly in narrow locations with screws.



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## Choose by beam shape

### Small Spot

●Senses minute objects using a spot lens.

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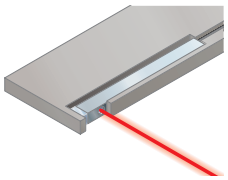
### Narrow Beam

●Not easily affected by surrounding obstacles.



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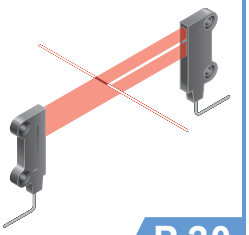
### Wide Beam

●Senses in the beam band without missing a work.



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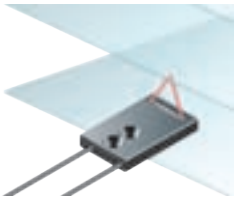
### Convergent Reflective Type

●Senses in the limited range only.



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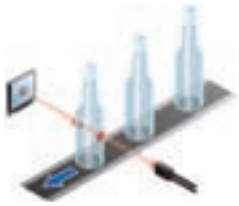
### Retroreflective Type

●Ideal for sensing transparent objects



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## Choose by environment/performance

### Chemical-resistant

●Various kinds of liquids can be detected due to the fluorine contained resin case

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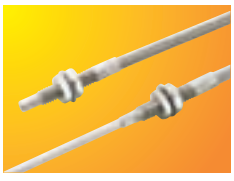
### Heat-resistant

●Withstands at -60 °C -76 °F to 350 °C 662 °F



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### Vacuum-resistant

●Usable in high-temperatures of 300 °C 572 °F and vacuum

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### Liquid Leak / Liquid Detection

●Corresponds to various liquid events.

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## Fiber amplifiers guidance

### Digital fiber sensor **FX-500** series

●At the industry's leading edge

P.56

### Digital fiber sensor **FX-100** series

●Super functionality, yet, economical price

P.66

# Fiber Selection Guide

## Viewing new models

Applies to the fiber marked NEW in the model name field (P.8~P.29)

F ② - ③ ④ *1 ⑤ ⑥

② Series Name, ③ Type, ④ Shape, etc., ⑤ ⑥ Functions/Features

*1: Excluding liquid leak / liquid detection fiber

②

| Symbol | Details |
|---|---|
| T | Thru-beam type |
| D | Reflective type |
| R | Retroreflective type |

⑤

| Symbol | Details |
|---|---|
| None | General-purpose |
| G | Coaxial reflective |
| S | Sleeve |
| H | Top sensing * |
| E | Side sensing * |
| HB | Top sensing + Bent * |
| A | Alignment |

*③ is for Flat type (**Z** and **KZ**) only

⑥

| Symbol | Details |
|---|---|
| None | General-purpose |
| W | Sharp bending |
| X | Stainless-jacketed |
| Y | Chemical-resistant |

③ ④

| Symbol | Details | Lead No. | Details |
|---|---|---|---|
| None | Treaded type | 3 | M3 |
| | | 4 | M4 |
| | | 6 | M6 |
| | | 14 | M14 |
| R | Elbow or square head | 4 | M4 |
| | | 6 | M6 |
| S | Cylindrical type | 1 | ø1 mm |
| | | 2 | ø1.5 mm |
| | | 3 | ø2.5 or ø3 mm |
| KS | Narrow beam | 4 | ø3.7 mm |
| V | Side-view | 2 | ø2 mm |
| | | 3 | ø2.5 or ø3 mm |
| | | 4 | ø4 mm |
| | | 5 | ø5 mm |
| KV | Narrow beam / Side-view | 4 | ø4 mm |
| | | 2 | 1.5 × 2 mm |
| E | Ultra small diameter | 1 | Fiber ø0.125 mm |
| | | 2 | Fiber ø0.25 mm |
| EG | Coaxial | 3 | M3 |
| Z | Flat type | 2 | Thickness 2 mm |
| | | 3 | Thickness 3 mm |
| | | 4 | Thickness 3.5 mm |
| | | 5 | Thickness 5.2 mm |
| KZ | Narrow beam | 2 | Thickness 2.2 mm |
| | | 5 | Thickness 5.2 mm |
| A | Wide beam | 3 | Sensing width 32 mm |
| | | 1 | Sensing width 10 to 19 mm |
| AL | Array | 1 | Sensing width 11.1 mm |
| | | 0 | Sensing width 5.5 mm |
| L | Convergent reflective type | 1 | Sensing range 0 to 10 mm (STD) |
| | | 2 | Sensing range 11 to 30 mm (STD) |
| | | 3 | Sensing range 31mm or more (STD) |
| F | Liquid leak / Liquid detection | 9 | Mountable on pipe |
| | | 7 | Liquid leak |

MEMO

# Tough Fiber

## Conventional 3 types rolled into 1 !!
## New standard fiber

3

**Flexible fiber**
Flexible durability
**1 million times**

**Sharp bending fiber**
Bending radius
**R2~R1 mm**

**General purpose fiber**
Bending radius
**R25mm**

in

1

**Tough Fiber**

**Break-free**
Flexible durability **10 million times** (Typical)
Bending conditions Bending radius: R10 mm
Reciprocating bending: 180°



**More flexible**
Bending radius **R2~R4 mm**

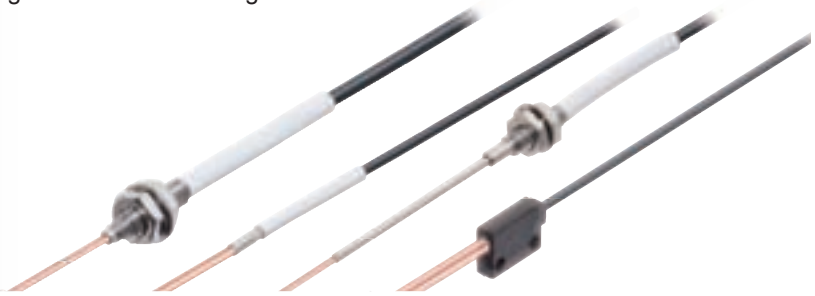


**ECO**

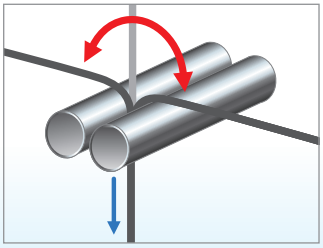

Stainless steel fittings are used for the fiber head of all models.
- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength

## Introducing a tough fiber that transcends common knowledge!

It has toughness that can be used in moving parts, toughness that can be bent with precision, and high-quality for all purposes. It changes common knowledge about fibers.



# Break-free



## Flexible durability

**10 million times (Typical)**

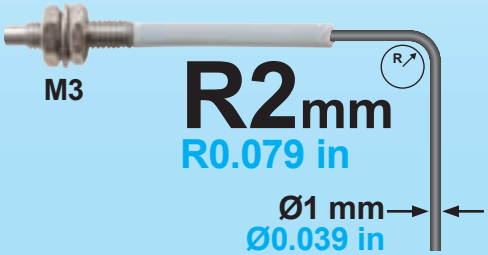
Bending conditions

Bending radius: R10 mm R0.394 in, Reciprocating bending: 180°

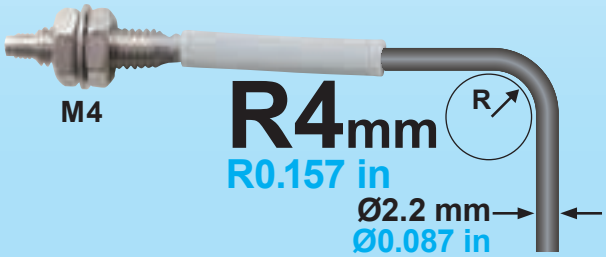
# More flexible

R2 to R4 mm R0.079 to R0.157 in

**Ex) FT-31**




**Ex) FT-42**




## Reduced the time for selecting fiber and registration numbers

### For Designers

High-quality

- High-quality in whichever tough fiber you choose!
- Easy selection!
- Reduced risk of breaking and bending during installation!

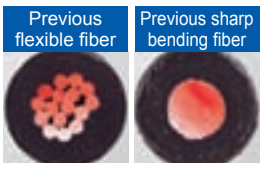
### For Buyers

Low Price

- Cost savings!
- Reduced registration numbers!
- Reduced frequency of maintenance stockpiling and replacement!

## Reduced variation in sensing

Beams at the fiber aperture are uniform, leading to stable sensing.



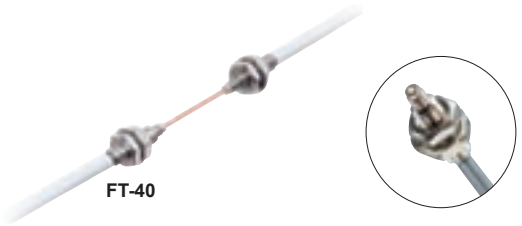

Generally flexible fibers and sharp bending fibers are composed of multiple fiber cores, often resulting in large variations in light intensity.


The new standard fiber is composed of a single fiber core, achieving uniform light intensity.

- **Uniform and highly accurate sensing**
- **Stable sensing even if the fiber is bent**

# Super Quality

- It is a fiber with superior light intensity stability and simple digital management when combined with the **FX-500** series amplifier.
- It offers stable sensing with an extremely small beam axis curvature and gap.

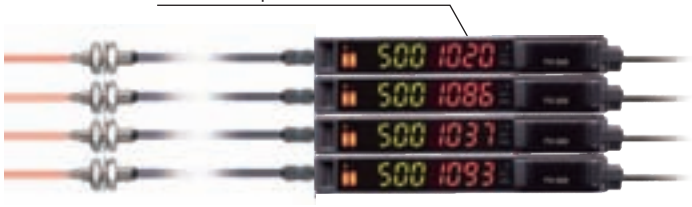



## Digital management is simple due to small differences in body.

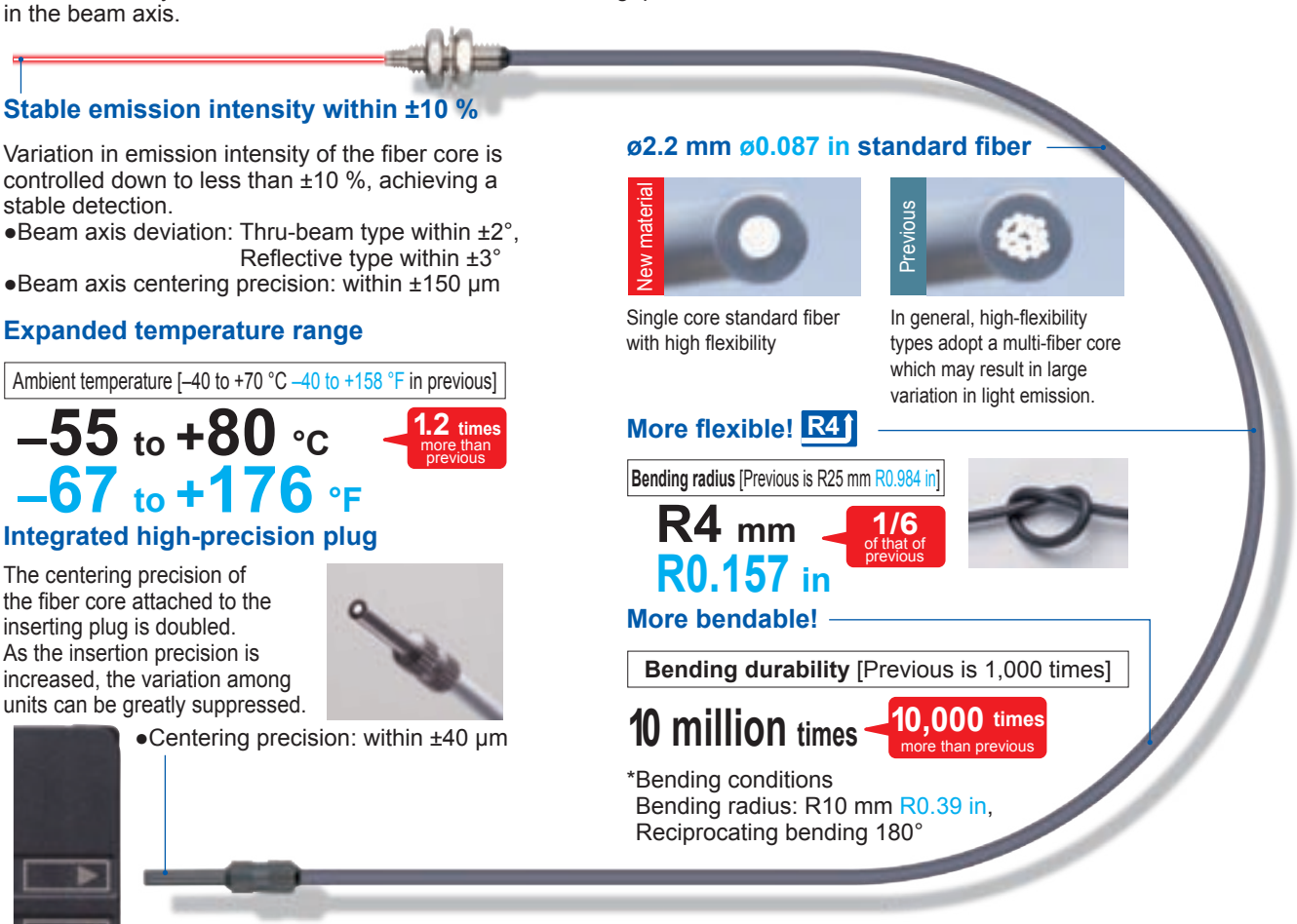
When combined with the **FX-500** series amplifiers, it has up to 4 times improved stability of incident light intensity compared with traditional fibers. Management is simple even when replacing amplifiers because the digital display shows the approximate value.

Super quality fiber + **FX-500** series

"Stabilized incident light intensities" even in multiple units




Emitter intensity is also stable due to few curvatures and gaps in the beam axis.



## Stable emission intensity within ±10 %

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

- Beam axis deviation: Thru-beam type within ±2°, Reflective type within ±3°
- Beam axis centering precision: within ±150 µm

## Expanded temperature range

Ambient temperature [–40 to +70 °C –40 to +158 °F in previous]

**–55 to +80 °C**
**–67 to +176 °F**

1.2 times more than previous

## 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.



- Centering precision: within ±40 µm

## ø2.2 mm ø0.087 in standard fiber




Single core standard fiber with high flexibility




In general, high-flexibility types adopt a multi-fiber core which may result in large variation in light emission.

## More flexible! R4

Bending radius [Previous is R25 mm R0.984 in]

**R4 mm**
**R0.157 in**

1/6 of that of previous



## More bendable!

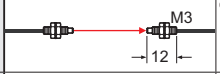
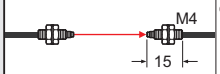
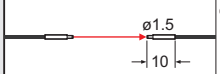
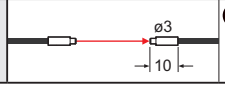
**Bending durability** [Previous is 1,000 times]

**10 million times**

10,000 times more than previous

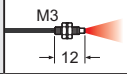
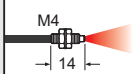
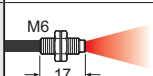
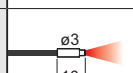
*Bending conditions
Bending radius: R10 mm R0.39 in,
Reciprocating bending 180°

## Thru-beam type (one pair set)

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) FX-500 series | Sensing range (mm in) U-LG LONG FAST H-SP | Sensing range (mm in) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Beam axis position/ Inclination of beam axis | Optical transmission loss | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Threaded | M3 |  | Tough NEW FT-30 | R2 Bending durability | 2 m | STD 400 15.748<br>HYPR 1,350 53.150 | 810 31.890<br>650 25.591<br>210 8.268<br>75 2.953 | 135 5.315<br>400 15.748 | ø0.5 | 150 µm /±2° | ±10 % | IP67 | –55 to +80 °C |
| | M4 |  | Tough NEW FT-40 | R4 Bending durability | | STD 1,200 47.244<br>HYPR (Note) 3,600 141.732 | 2,200 86.614<br>1,700 66.929<br>530 20.866<br>190 7.480 | 320 12.598<br>870 34.252 | ø1 | | | | |
| Cylindrical | ø1.5 |  | Tough NEW FT-S20 | R2 Bending durability | | STD 400 15.748<br>HYPR 1,350 53.150 | 810 31.890<br>650 25.591<br>210 8.268<br>75 2.953 | 135 5.315<br>400 15.748 | ø0.5 | | | | |
| | ø3 |  | Tough NEW FT-S30 | R4 Bending durability | | STD 1,200 47.244<br>HYPR (Note) 3,600 141.732 | 2,200 86.614<br>1,700 66.929<br>530 20.866<br>190 7.480 | 320 12.598<br>870 34.252 | ø1 | | | | |

Note: The fiber cable length practically limits the sensing range.

## Reflective type

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note) FX-500 series | Sensing range (mm in) (Note) U-LG LONG FAST H-SP | Sensing range (mm in) (Note) FX-101 (Upper value) FX-102 (Lower value) | Beam axis position/ Inclination of beam axis | Optical transmission loss | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Threaded | M3 |  | Tough NEW FD-30 | R2 Bending durability | 2 m | STD 160 6.299<br>HYPR 600 23.622 | 330 12.992<br>250 9.843<br>80 3.150<br>25 0.984 | 45 1.772<br>155 6.102 | 150 µm /±3° | ±10 % | IP67 | –55 to +80 °C |
| | M4 |  | Tough NEW FD-40 | | | | | | | | | |
| | M6 |  | Tough NEW FD-60 | R4 Bending durability | | STD 520 20.472<br>HYPR 1,550 61.024 | 900 35.433<br>740 29.134<br>260 10.236<br>90 3.543 | 140 5.512<br>420 16.535 | | | | |
| Cylindrical | ø3 |  | Tough NEW FD-S30 | | | STD 160 6.299<br>HYPR 600 23.622 | 330 12.992<br>250 9.843<br>80 3.150<br>25 0.984 | 45 1.772<br>155 6.102 | | | | |

Note: The sensing range is specified for white non-glossy paper.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

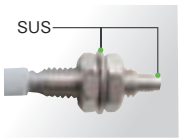
# Threaded Type

- It is a standard fiber which is mounted using nuts. It has reasonable pricing while drastically improving flexing performance.
- With the lens installable type, long distance sensing and microscopic object sensing is possible by installing a lens.
- A protective tube and a sturdy stainless jacket type that prevents disconnection are also prepared.


**<Thru-beam type> FT-31/31W/43/42/42W FT-45X/R40**
**<Reflective type> FD-31/41/62/61/R60**
More user-friendly, high quality fiber

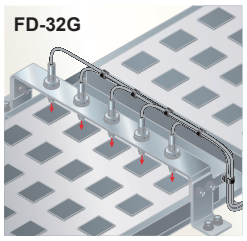
## Stainless steel fittings are used for the fiber head of all models.

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength




* Some models not included (**FT-R41W**, **FT-R42W**, **FT-140**)

## Application



Sensing the presence of workpiece

## Metal-free fiber FT-41, FD-G60, FD-G40

- Made of resin
- Metallic particulate production ratio: ZERO
- Effect on magnetic fields: ZERO

*For details, please see our website.

## Improved centering accuracy

The beam axis deviation of each unit is kept within ±3° and the beam axis centering accuracy is kept within ±150 µm.
(Within ±5° and ±90 µm for ultra small diameter fibers)

- Makes beam axis adjustment easier
- Improves mounting hole machining accuracy
- Improves sensing accuracy

## Improved specularity

High precision polishing is accomplished by using the PCTC polishing technique.
The specularity of the end face of the fiber is 5 times greater.

- Light intensity is increased, enabling stable sensing.

## Thru-beam type (one pair set)

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series: U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Beam axis position/ Inclination of beam axis | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Threaded | M3 | M3, 12 | Tough NEW FT-31 | R2 Bending durability | 2 m | STD 315 12.402 / HYPR 1,350 53.150 | 770 30.315 / 550 21.654 / 210 8.268 / 70 2.756 | 130 5.118 / 340 13.386 | ø0.5 | 150 µm /±2° | IP67 | –55 to +80 °C |
| | | M3, 12 | NEW FT-31W | R1 | | STD 260 10.236 / HYPR 990 38.976 | 590 23.228 / 440 17.323 / 150 5.906 / 53 2.087 | 80 3.150 / 240 9.449 | | 150 µm /±3° | | –40 to +60 °C |
| | M4 | Lens mountable, M4, 15 | NEW FT-43 | R4 Bending durability | | STD 1,400 55.118 / HYPR 3,600 141.732 (Note 2) | 2,800 110.236 / 2,100 82.677 / 770 30.315 / 240 9.449 | 350 13.780 / 970 38.189 | ø1.5 | 150 µm /±2° | | –55 to +80 °C |
| | | Lens mountable, M4, 15 | Tough NEW FT-42 | | | STD 1,130 44.488 / HYPR 3,600 141.732 (Note 2) | 2,050 80.709 / 1,600 62.992 / 530 20.866 / 190 7.480 | 300 11.811 / 800 31.496 | ø1 | | | |
| | | Lens mountable, M4, 15 | NEW FT-42W | R1 | | STD 800 31.496 / HYPR 3,300 129.921 | 1,900 74.803 / 1,400 55.118 / 490 19.291 / 160 6.299 | 260 10.236 / 720 28.346 | | 150 µm /±3° | | –40 to +60 °C |
| | | Lens mountable, Stainless-jacketed, M4, 20 | NEW FT-45X | R4 | 1 m | STD 1,200 47.244 / HYPR 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) / 1,600 62.992 (Note 2) / 630 24.803 / 200 7.874 | 340 13.386 / 920 36.220 | | 150 µm /±2° | | –55 to +80 °C |
| | Elbow | Lens mountable, 15, M4 | Tough NEW FT-R40 | R4 Bending durability | 2 m | STD 930 36.614 / HYPR 3,600 141.732 (Note 2) | 1,750 68.898 / 1,500 59.055 / 500 19.685 / 160 6.299 | 270 10.630 / 740 29.134 | | | | |
| | Square head | M4, W7 × H9 × D13.9 | NEW FT-R41W | R1 | | STD 800 31.496 / HYPR 3,200 125.984 | 1,800 70.866 / 1,400 55.118 / 460 18.110 / 150 5.906 | 250 9.843 / 710 27.953 | | — | IP40 | –40 to +60 °C |
| | | With expansion lens, M4, W7 × H9 × D14.4 | NEW FT-R42W | | | STD 2,200 86.614 / HYPR 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) / 3,500 137.795 / 1,300 51.181 / 460 18.110 | 510 20.079 / 2,000 78.740 | ø2.2 | — | | |
| | M14 Long range | With expansion lens, M14, 40 | Tough NEW FT-140 | R4 Bending durability | 10 m | STD (Note 2) 19,600 771.654 / HYPR (Note 2) 19,600 771.654 | 19,600 771.654 (Note 2) / 19,600 771.654 (Note 2) / 16,000 629.921 / 6,300 248.031 | 14,000 551.181 / 19,600 771.654 (Note 2) | ø10 | — | IP67 | –40 to +70 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

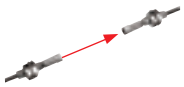
## Coaxial type FD-□G□ in which high-precision positioning can be achieved.

It is a coaxial fiber that encloses the circumference of the emitter fiber at the center with the receiver fiber. This is suitable for high-precision positioning. It can perform sensing without affecting the approach direction of the work.

**Supports spot lenses and zoom lenses!**

## Fiber options

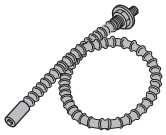
**Lens (For thru-beam type fiber)** ▸P.30~



**Protective tube** ▸P.33

·FTP-□

·FDP-□



**Lens (For reflective type fiber)** ▸P.32

## Reflective type

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value) | Beam axis position/ Inclination of beam axis | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Threaded M3 | M3 12 | Tough NEW FD-31 | R2 Bending durability | ✂ 2 m | STD 125 4.921 HYPR 515 20.276 | 290 11.417 220 8.661 80 3.150 25 0.984 | 35 1.378 140 5.512 | 150 µm /±3° | IP67 | –55 to +80 °C |
| | M3 12 | NEW FD-31W | R1 | | STD 80 3.150 HYPR 330 12.992 | 180 7.087 140 5.512 45 1.772 12 0.472 | 15 0.591 60 2.362 | — | | –40 to +60 °C |
| | Coaxial, Lens mountable M3 17 | Tough NEW FD-32G | R2 Bending durability | | STD 200 7.874 HYPR 650 25.591 | 380 14.961 270 10.630 95 3.740 27 1.063 | 70 2.756 190 7.480 | — | IP40 | –55 to +80 °C |
| | Coaxial, Lens mountable, Stainless-jacketed M3 18 | NEW FD-32GX | R2 | ✂ 1 m (Note 3) | STD 200 7.874 HYPR 630 24.803 | 410 16.142 360 14.173 100 3.937 30 1.181 | 75 2.953 210 8.268 | — | | |
| Ultra-small diameter | Coaxial, Lens mountable M3 16 | NEW FD-EG30 | R4 | 500 mm | STD 48 1.890 HYPR 170 6.693 | 130 5.118 110 4.331 30 1.181 9 0.354 | 20 0.787 70 2.756 | — | | –40 to +70 °C |
| | Coaxial, Lens mountable M3 16 | NEW FD-EG31 | | | STD 20 0.787 HYPR 85 3.346 | 45 1.772 35 1.378 12 0.472 3.5 0.138 | 7 0.276 25 0.984 | — | | –20 to +60 °C |
| Threaded M4 | M4 14 | Tough NEW FD-41 | R2 Bending durability | ✂ 2 m | STD 125 4.921 HYPR 515 20.276 | 290 11.417 220 8.661 80 3.150 25 0.984 | 35 1.378 140 5.512 | 150 µm /±3° | IP67 | –55 to +80 °C |
| | M4 14 | NEW FD-41W | R1 | | STD 270 10.630 HYPR 900 35.433 | 630 24.803 430 16.929 150 5.906 45 1.772 | 80 3.150 230 9.055 | — | | –40 to +60 °C |
| | Coaxial, Lens mountable M4 25 | Tough NEW FD-42G | R2 Bending durability | | STD 200 7.874 HYPR 650 25.591 | 380 14.961 270 10.630 95 3.740 27 1.063 | 70 2.756 190 7.480 | — | IP40 | –55 to +80 °C |
| | Coaxial, Lens mountable M4 25 | NEW FD-42GW | R1 | | STD 150 5.906 HYPR 670 26.378 | 340 13.386 280 11.024 90 3.543 25 0.984 | 45 1.772 140 5.512 | — | | –40 to +60 °C |
| M6 | M6 17 | NEW FD-62 | R4 Bending durability | | STD 520 20.472 HYPR 1,500 59.055 | 1,000 39.370 940 37.008 340 13.386 110 4.331 | 170 6.693 450 17.717 | 150 µm /±3° | IP67 | –55 to +80 °C |
| | M6 17 | Tough NEW FD-61 | | | STD 450 17.717 HYPR 1,400 55.118 | 840 33.071 670 26.378 200 7.874 70 2.756 | 120 4.724 410 16.142 | | | |
| | M6 17 | NEW FD-61W | R1 | | STD 270 10.630 HYPR 900 35.433 | 630 24.803 430 16.929 150 5.906 45 1.772 | 80 3.150 230 9.055 | — | | –40 to +60 °C |
| | Coaxial M6 17 | Tough NEW FD-61G | R4 Bending durability | | STD 420 16.535 HYPR 1,100 43.307 | 800 31.496 650 25.591 200 7.874 60 2.362 | 120 4.724 350 13.780 | — | IP40 | –55 to +80 °C |
| | Stainless-jacketed M6 22 | NEW FD-64X | R4 | 1 m | STD 280 11.024 HYPR 670 26.378 | 500 19.685 410 16.142 160 6.299 50 1.969 | 75 2.953 220 8.661 | — | | |
| Elbow | 15 M6 | Tough NEW FD-R60 | R4 Bending durability | ✂ 2 m | STD 290 11.417 HYPR 1,100 43.307 | 600 23.622 550 21.654 190 7.480 65 2.559 | 110 4.331 240 9.449 | 150 µm /±3° | IP67 | |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.
3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

# Cylindrical Type

- Has a slender shape which can be mounted in narrow locations using set screws.
- Line up that includes ultra-thin fibers with ø0.25 mm tips.


FT-S32


FD-S31

## <Thru-beam type> FT-S21/S21W/S31W
## <Reflective type> FD-S32/S31

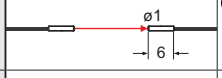
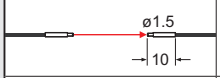
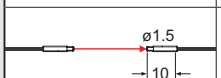
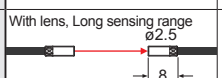
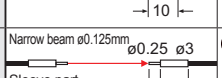
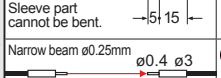
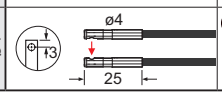


- User-friendly, high quality fiber
- Improved centering accuracy and specularity

## Stainless steel fittings are used for the fiber head of all models.

- Clearly conforms to RoHS
- Can be used for secondary battery
- Improved mounting strength

## Thru-beam type (one pair set)

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Beam axis position/ Inclination of beam axis | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cylindrical | ø1 |  | Tough NEW FT-S11 | R2 Bending durability | 500 mm | STD 90 3.543 HYPR 350 13.780 | 210 8.268 160 6.299 60 2.362 19 0.748 | 40 1.575 90 3.543 | ø0.25 | — | IP67 | –55 to +80 °C |
| | ø1.5 |  | Tough NEW FT-S21 | R2 Bending durability | ✂ 2 m | STD 315 12.402 HYPR 1,350 53.150 | 770 30.315 550 21.654 210 8.268 70 2.756 | 130 5.118 340 13.386 | ø0.5 | 150 µm /±2° | IP67 | –40 to +60 °C |
| | ø1.5 |  | NEW FT-S21W | R1 | ✂ 2 m | STD 260 10.236 HYPR 990 38.976 | 590 23.228 440 17.323 150 5.906 53 2.087 | 80 3.150 240 9.449 | ø0.5 | 150 µm /±3° | IP67 | –40 to +60 °C |
| | ø2.5 |  | NEW FT-S32 | R10 Bending durability | ✂ 2 m | STD 3,100 122.047 HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,800 70.866 600 23.622 | 1,100 43.307 3,000 118.110 | ø2 | — | IP40 | –40 to +70 °C |
| | ø3 |  | NEW FT-S31W | R1 | ✂ 2 m | STD 800 31.496 HYPR 3,300 129.921 | 1,900 74.803 1,400 55.118 490 19.291 160 6.299 | 260 10.236 720 28.346 | ø1 | 150 µm /±3° | IP67 | –40 to +60 °C |
| | Ultra-small diameter ø3 |  | Tough NEW FT-E13 | R2 Bending durability | ✂ 1 m | STD 15 0.591 HYPR 52 2.047 | 30 1.181 24 0.945 8 0.315 2 0.079 | 6 0.236 19 0.748 | ø0.125 | — | IP67 | –40 to +70 °C |
| | |  | Tough NEW FT-E23 | | | STD 75 2.953 HYPR 270 10.630 | 160 6.299 125 4.921 42 1.654 13 0.512 | 22 0.866 80 3.150 | ø0.25 | — | | |
| | Side-view ø4 |  | Tough NEW FT-V40 | R4 Bending durability | ✂ 2 m | STD 3,500 137.795 HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465 | 1,000 39.370 3,100 122.047 | ø2.5 | — | IP50 | –40 to +60 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

## Reflective type

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) **FX-500** series | | **FX-101** (Upper value) **FX-102** (Lower value) | Beam axis position/ Inclination of beam axis | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | U-LG LONG FAST H-SP | | | | |
| Cylindrical | ø1·5 | ø1.5 10 | Tough NEW **FD-S21** | R2 Bending durability | 1 m | STD 80 3.150 HYPR 190 7.480 | 130 5.118 110 4.331 37 1.457 11 0.433 | 25 0.984 70 2.756 | — | IP40 | –55 to +80 °C |
| | ø3 | ø3 15 | Tough NEW **FD-S32** | R4 Bending durability | 2 m | STD 420 16.535 HYPR 1,200 47.244 | 790 31.102 660 25.984 220 8.661 75 2.953 | 120 4.724 345 13.583 | 150 µm /±3° | IP67 | |
| | | ø3 15 | NEW **FD-S32W** | R1 | | STD 270 10.630 HYPR 900 35.433 | 630 24.803 430 16.929 150 5.906 45 1.772 | 80 3.150 230 9.055 | — | | –40 to +60 °C |
| | | ø3 10 | Tough NEW **FD-S31** | R2 Bending durability | | STD 125 4.921 HYPR 515 20.276 | 290 11.417 220 8.661 80 3.150 25 0.984 | 35 1.378 140 5.512 | 150 µm /±3° | | –55 to +80 °C |
| | | Coaxial ø3 15 | NEW **FD-S33GW** | R1 | | STD 150 5.906 HYPR 670 26.378 | 340 13.386 280 11.024 90 3.543 25 0.984 | 45 1.772 140 5.512 | — | IP40 | –40 to +60 °C |
| | Ultra-small diameter ø1·5 | ø1.5 ø0.48 15 3 Sleeve part cannot be bent. | NEW **FD-E13** | R4 | 1 m | STD 12 0.472 HYPR 50 1.969 | 29 1.142 25 0.984 7 0.276 2 0.079 | 5 0.197 15 0.591 | — | | |
| | ø3 | ø3 ø0.63 15 5 Sleeve part cannot be bent. | NEW **FD-E23** | | | STD 55 2.165 HYPR 170 6.693 | 120 4.724 80 3.150 30 1.181 9 0.354 | 20 0.787 70 2.756 | — | | –40 to +70 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

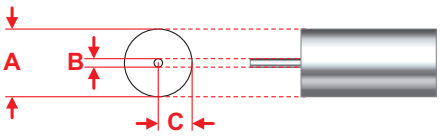
# Sleeve

- It is suitable for sensing in narrow locations and sensing minute objects because the fiber tip is a thin sleeve.
- The 40 mm sleeve type can be bent in any direction.


## <Thru-beam type> FT-E13/FT-E23 Ultra-small diameter fiber

**Centering of 1/10 mm or less**

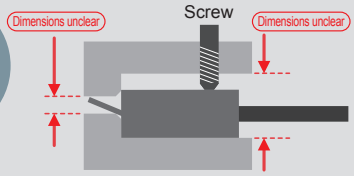
Ultra-small diameter fibers with a compact head ensure precision centering accuracy* to stably detect minute parts.




*Tolerance of A + Tolerance of B + Tolerance of C = ±0.09 mm

### Dimensions UNCLEAR

Previous general fiber

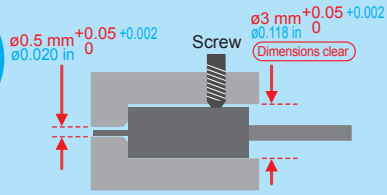



Extra clearance needs to be added when designing and machining the mounting hole due to unclear dimensions.
As a result, mounting variation increases and the beam axis deviates, resulting in a decrease in sensing accuracy or causing the sleeve to bend or break.

### Dimensions CLEAR

Ex.) **FT-E13**

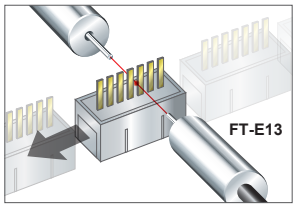
New standard fiber




Highly accurate design and machining are possible due to clear mounting hole dimensions. As a result, mounting variation is minimal, improving sensing accuracy. In addition to this, as the beam axis alignment is not affected when the fiber is changed, readjustment is not necessary.

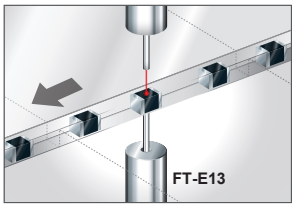
## Minute sensing only possible with ultra small fiber

●Detection of fine-pitch connector pins




Ultra-small diameter fiber with ø0.125 mm ø0.005 in beam axis is able to detect the insertion or bending of fine-pitch connector pins.

●Detection of tiny chips

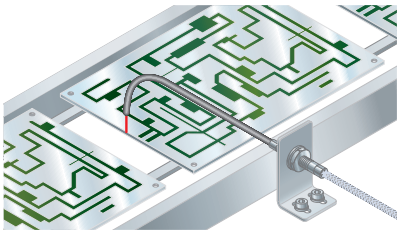



Fiber can be installed with only the ø0.25 mm ø0.010 in sleeve close to the minute section.

## Stainless steel fittings are used for the fiber head of all models.

- ●Clearly conforms to RoHS
- ●Can be used for secondary battery
- ●Improved mounting strength

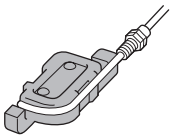
## Application



## Fiber options

### Fiber bender

·FB-1



The fiber bender bends the sleeve part of the fiber head at the proper radius.

Note: Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.

## Thru-beam type (one pair set)

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Threaded | M3 | Sleeve 40mm, M3, ø0.88, 10 | Tough NEW FT-31S | R2 Bending durability (Note 3) | ✂ 2 m | STD 315 12.402<br>HYPR 1,220 48.031 | 740 29.134<br>550 21.654<br>195 7.677<br>63 2.480 | 130 5.118<br>340 13.386 | ø0.5 | IP67 | –55 to +80 °C |
| | M4 | Sleeve 40mm, M4, ø1.48, 12 | Tough NEW FT-42S | R4 Bending durability (Note 3) | | STD 1,130 44.488<br>HYPR (Note 2) 3,600 141.732 | 2,050 80.709<br>1,600 62.992<br>530 20.866<br>190 7.480 | 300 11.811<br>800 31.496 | ø1 | | |
| Cylindrical | Ultra-small diameter ø3 | Narrow beam ø0.125mm, ø0.25, ø3, Sleeve part cannot be bent., 5, 15 | Tough NEW FT-E13 | R2 Bending durability | ✂ 1 m | STD 15 0.591<br>HYPR 52 2.047 | 30 1.181<br>24 0.945<br>8 0.315<br>2 0.079 | 6 0.236<br>19 0.748 | ø0.125 | | –40 to +70 °C |
| | | Narrow beam ø0.25mm, ø0.4, ø3, Sleeve part cannot be bent., 5, 15 | Tough NEW FT-E23 | | | STD 75 2.953<br>HYPR 270 10.630 | 160 6.299<br>125 4.921<br>42 1.654<br>13 0.512 | 22 0.866<br>80 3.150 | ø0.25 | | |
| | Side-view ø2 | ø1, ø2, Sleeve part cannot be bent., 20, 15 | Tough NEW FT-V23 | R4 Bending durability | ✂ 2 m | STD 450 17.717<br>HYPR 1,800 70.866 | 1,000 39.370<br>880 34.646<br>280 11.024<br>90 3.543 | 160 6.299<br>400 15.748 | ø0.75 | IP30 | –55 to +80 °C |
| | | ø1, ø2, Sleeve part cannot be bent., 15, 15 | Tough NEW FT-V25 | R2 Bending durability | | STD 240 9.449<br>HYPR 900 35.433 | 550 21.654<br>480 18.898<br>140 5.512<br>45 1.772 | 95 3.740<br>260 10.236 | ø0.5 | | |
| | | ø1, ø2, Sleeve part cannot be bent., 15, 15 | NEW FT-V24W | R1 | | STD 110 4.331<br>HYPR 380 14.961 | 230 9.055<br>200 7.874<br>60 2.362<br>20 0.787 | 35 1.378<br>90 3.543 | | | –40 to +60 °C |
| | ø2·5 | ø1.5, ø2.5, Sleeve part cannot be bent., 20, 15 | Tough NEW FT-V30 | R4 Bending durability | | STD 680 26.772<br>HYPR 2,200 86.614 | 1,200 47.244<br>1,000 39.370<br>340 13.386<br>100 3.937 | 180 7.087<br>480 18.898 | ø1.0 | | –55 to +80 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) Bending radius of sleeve part is R10 mm or more.

## Reflective type

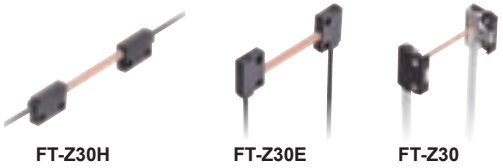
| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Threaded | Ultra-small diameter M3 | Sleeve 15 mm, M3, ø0.8, 15, Sleeve part cannot be bent. | NEW FD-EG30S | R4 | 1 m | STD 50 1.969<br>HYPR 170 6.693 | 110 4.331<br>80 3.150<br>30 1.181<br>9 0.354 | 20 0.787<br>70 2.756 | IP40 | –40 to +70 °C |
| | M4 | Sleeve 40 mm, M4, ø1.48, 12 | Tough NEW FD-41S | R2 Bending durability (Note 3) | ✂ 2 m | STD 125 4.921<br>HYPR 515 20.276 | 290 11.417<br>220 8.661<br>80 3.150<br>25 0.984 | 35 1.378<br>140 5.512 | IP67 | –55 to +80 °C |
| | | Sleeve 40 mm, M4, ø1.48, 12 | NEW FD-41SW | R1 (Note 3) | | STD 80 3.150<br>HYPR 330 12.992 | 180 7.087<br>140 5.512<br>45 1.772<br>12 0.472 | 15 0.591<br>60 2.362 | | –40 to +60 °C |
| | M6 | Sleeve 40 mm, M6, ø2.5, 15 | Tough NEW FD-61S | R4 Bending durability (Note 3) | | STD 420 16.535<br>HYPR 1,200 47.244 | 790 31.102<br>660 25.984<br>220 8.661<br>75 2.953 | 130 5.118<br>360 14.173 | | –55 to +80 °C |
| Cylindrical | Ultra-small diameter ø1·5 | ø1.5, ø0.48, 15, Sleeve part cannot be bent. | NEW FD-E13 | R4 | 1 m | STD 12 0.472<br>HYPR 50 1.969 | 29 1.142<br>25 0.984<br>7 0.276<br>2 0.079 | 5 0.197<br>15 0.591 | IP40 | –40 to +60 °C |
| | ø3 | ø3, ø0.63, 15, 5, Sleeve part cannot be bent. | NEW FD-E23 | | | STD 55 2.165<br>HYPR 170 6.693 | 120 4.724<br>80 3.150<br>30 1.181<br>9 0.354 | 20 0.787<br>70 2.756 | | –40 to +70 °C |
| | Side-view ø3 | Small diameter, 15, 15, ø3, ø1.5, Sleeve part cannot be bent. | Tough NEW FD-V30 | R2 Bending durability | ✂ 2 m | STD 65 2.559<br>HYPR 240 9.449 | 130 5.118<br>120 4.724<br>35 1.378<br>14 0.551 | 25 0.984<br>75 2.953 | IP30 | –55 to +80 °C |
| | | 15, 15, ø3, ø1.5, Sleeve part cannot be bent. | NEW FD-V30W | R1 | | STD 20 0.787<br>HYPR 80 3.150 | 40 1.575<br>30 1.181<br>10 0.394<br>2 0.079 | 6 0.236<br>20 0.787 | | –40 to +60 °C |
| | ø5 | 15, 20, ø5, ø2, Sleeve part cannot be bent. | Tough NEW FD-V50 | R4 Bending durability | | STD 120 4.724<br>HYPR 370 14.567 | 220 8.661<br>210 8.268<br>75 2.953<br>25 0.984 | 40 1.575<br>100 3.937 | | –55 to +80 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.
3) Bending radius of sleeve part is R10 mm R0.394 in or more.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

# Flat Type

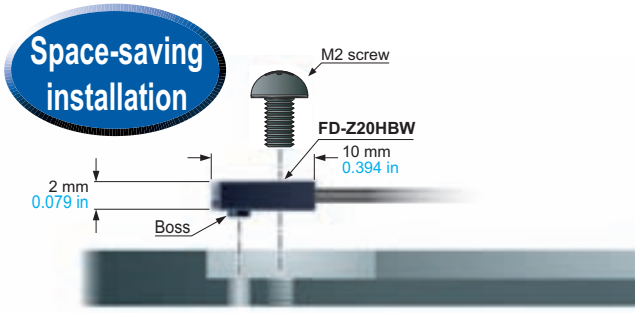
Since it has a thin, rectangular shape, it can be installed in narrow locations. It is also a fiber with good workability and can be mounted directly with screws.



FT-Z30H FT-Z30E FT-Z30

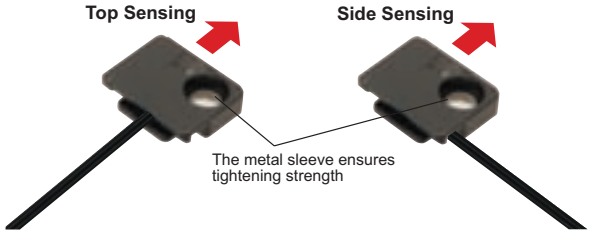
## Mounting with M2 or M3 screw

We offer; **FT-WZ4/Z20HBW**, **FD-WZ4/Z20HBW**, 1 point mounting with M2 screw and **FT-WZ7/Z40HBW**, **FD-WZ7/Z40HBW**, 1 point mounting with M3 screw.




## The built-in fiber guide allows for multiple installation angles.

**FT/FD-WZ□HBW** is equipped with a fiber guide feature. Front sensing and side sensing can be selected with one head.



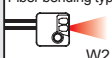
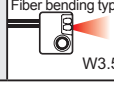

## Thru-beam type (one pair set)

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Flat | Top sensing W3 × H8 × D12 | Tough NEW FT-Z30H | R2 Bending durability | 2 m | STD 3,500 137.795<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,600 102.362<br>810 31.890 | 1,400 55.118<br>3,200 125.984 | 2 × 3 | IP40 | –40 to +60 °C |
| | Top sensing W3 × H8 × D12 | NEW FT-Z30HW | R1 | | | | | | | |
| | Side sensing W3 × H12 × D8 | Tough NEW FT-Z30E | R2 Bending durability | | STD 3,500 137.795<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,400 94.488<br>740 29.134 | 1,200 47.244<br>3,200 125.984 | | | |
| | Side sensing W3 × H12 × D8 | NEW FT-Z30EW | R1 | | STD 3,400 133.858<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,000 78.740<br>630 24.803 | 1,400 55.118<br>2,600 102.362 | | | |
| | Front sensing W8.5 × H12 × D3 | Tough NEW FT-Z30 | R2 Bending durability | | STD 2,100 82.677<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,200 47.244<br>410 16.142 | 710 27.953<br>2,300 90.551 | ø2 | | |
| | Front sensing W8.5 × H12 × D3 | NEW FT-Z30W | R1 | | STD 1,500 59.055<br>HYPR (Note 2) 3,600 141.732 | 3,300 129.921<br>3,200 125.984<br>1,000 39.370<br>280 11.024 | 540 21.260<br>1,800 70.866 | | | |
| With boss | Front sensing W10 × H7 × D2 | FT-WZ4 | | 1 m | STD 530 20.866<br>HYPR (Note 2) 1,600 62.992 | 1,100 43.307<br>900 35.433<br>330 12.992<br>100 3.937 | 230 9.055<br>670 26.378 | ø1.5 | — | |
| | Fiber bending type W2 × H10 × D10 | NEW FT-Z20HBW | | | STD 260 10.236<br>HYPR 1,100 43.307 | 670 26.378<br>570 22.441<br>180 7.087<br>55 2.165 | 100 3.937<br>320 12.598 | ø0.5 | IP67 | |
| | Front sensing W14 × H7 × D3.5 | FT-WZ7 | | 2 m | STD 1,400 55.118<br>HYPR 3,500 137.795 | 3,300 129.921<br>2,300 90.551<br>890 35.039<br>290 11.417 | 330 12.992<br>1,000 39.370 | ø1.5 | — | |
| | Fiber bending type W3.5 × H14 × D11 | NEW FT-Z40HBW | | | STD 800 31.496<br>HYPR 3,300 129.921 | 1,900 74.803<br>1,400 55.118<br>490 19.291<br>160 6.299 | 260 10.236<br>720 28.346 | ø1 | IP67 | |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

## Reflective type

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) | | | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **FX-500** series | U-LG LONG FAST H-SP | **FX-101** (Upper value) **FX-102** (Lower value) | | |
| Flat | With boss | Front sensing  W10 × H7 × D2 | **FD-WZ4** | R1 | ✂ 1 m | STD 2 to 65 0.079 to 2.559<br>HYPR 1 to 230 0.039 to 9.055 | 1 to 110 0.039 to 4.331<br>1 to 85 0.039 to 3.346<br>3 to 35 0.118 to 1.378<br>5 to 13 0.197 to 0.512 | 2 to 20 0.079 to 0.787<br>1 to 70 0.039 to 2.756 | — | –40 to +60 °C |
| | | Fiber bending type  W2 × H10 × D10 | NEW **FD-Z20HBW** | | | STD 2 to 85 0.079 to 3.346<br>HYPR 1 to 340 0.039 to 13.386 | 1 to 210 0.039 to 8.268<br>1 to 180 0.039 to 7.087<br>2 to 55 0.079 to 2.165<br>3 to 15 0.118 to 0.591 | 2 to 30 0.079 to 1.181<br>1 to 90 0.039 to 3.543 | IP67 | |
| | | Front sensing  W14 × H7 × D3.5 | **FD-WZ7** | | ✂ 2 m | STD 110 4.331<br>HYPR 430 16.929 | 230 9.055<br>180 7.087<br>1.5 to 65 0.059 to 2.559<br>3 to 25 0.118 to 0.984 | 1 to 55 0.039 to 2.165<br>160 6.299 | — | |
| | | Fiber bending type  W3.5 × H14 × D11 | NEW **FD-Z40HBW** | | | STD 260 10.236<br>HYPR 760 29.921 | 540 21.260<br>470 18.504<br>1 to 160 0.039 to 6.299<br>2 to 50 0.079 to 1.969 | 1 to 90 0.039 to 3.543<br>0.5 to 240 0.020 to 9.449 | IP67 | |

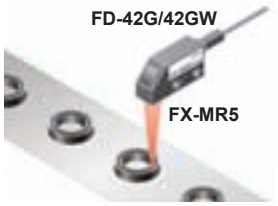
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.

# Small Spot

Sensing of minute objects can be performed by combining the fiber and spot lens. The spot diameter can also be changed.

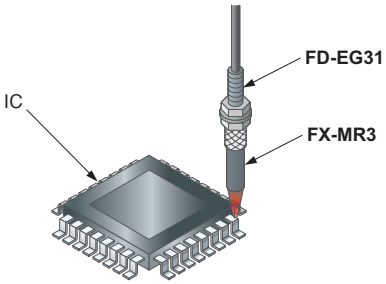
## Applications

### Packing detection

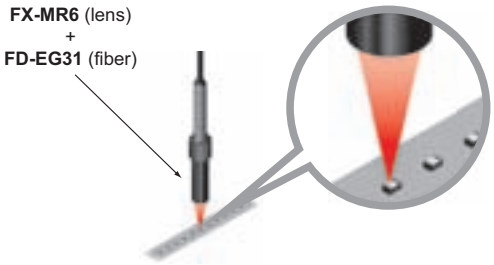



Because it's a side-view type, it can be mounted even in narrow spaces.

### Number of IC pins checking




### Discrimination of 0603 chip direction




## Small spot fiber lineup (High precision fiber & Spot lens)

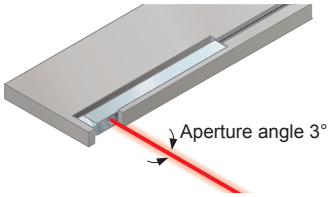
| Designation | Shape of head (mm) | Spot diameter (mm in) (Note) | Distance to focal point (mm in) (Note) | Lens | | Applicable fibers | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Model No. | Ambient temp. | Model No. | Fiber cable length ✂: Free-cut | Bending radius (mm) | Protection | Ambient temp. |
| Finest spot lens | 16 ø4 | ø0.1 ø0.004 | 7±0.5 0.276±0.020 | FX-MR6 | –20 to +60 °C | NEW FD-EG31 | 500 mm | R4 | IP40 | –20 to +60 °C |
| | | ø0.2 ø0.008 | | | | NEW FD-EG30 | | | | –40 to +70 °C |
| | | ø0.4 ø0.016 | | | | Tough NEW FD-42G | ✂ 2 m | R2 Bending durability | | –55 to +80 °C |
| | | | | | | NEW FD-42GW | | R1 | | –40 to +60 °C |
| | | | | | | Tough NEW FD-32G | | R2 Bending durability | | –55 to +80 °C |
| | | | | | | NEW FD-32GX | ✂ 1 m | R2 | | |
| | 15 ø4 | ø0.15 ø0.006 | 7.5±0.5 0.295±0.020 | FX-MR3 | –40 to +70 °C | NEW FD-EG31 | 500 mm | R4 | | –20 to +60 °C |
| | | ø0.3 ø0.012 | | | | NEW FD-EG30 | | | | –40 to +70 °C |
| | | ø0.5 ø0.020 | | | | Tough NEW FD-42G | ✂ 2 m | R2 Bending durability | | –55 to +80 °C |
| | | | | | | NEW FD-42GW | | R1 | | –40 to +60 °C |
| | | | | | | Tough NEW FD-32G | | R2 Bending durability | | –55 to +80 °C |
| | | | | | | NEW FD-32GX | ✂ 1 m | R2 | | |
| Pinpoint spot lens | 20.2 ø4 | ø0.5 ø0.020 | 6±1 0.236±0.039 | FX-MR1 | –40 to +70 °C | Tough NEW FD-42G | ✂ 2 m | R2 | | –55 to +80 °C |
| | | | | | | NEW FD-42GW | | R1 | | –40 to +60 °C |
| Zoom lens | 27.1 ø7.1 | ø0.7 to ø2.0 ø0.028 to ø0.079 | Approx.18.5 to 43 Approx. 0.728 to 1.693 | FX-MR2 | –40 to +70 °C | Tough NEW FD-42G | | R2 | | –55 to +80 °C |
| | | | | | | NEW FD-42GW | | R1 | | –40 to +60 °C |
| Zoom lens (Side-view type) | W6.3 × H20.3 × D10.3 | ø0.5 to ø3.0 ø0.020 to ø0.118 | Approx.13 to 30 Approx. 0.512 to 1.181 | FX-MR5 | –40 to +70 °C | Tough NEW FD-42G | | R2 | | –55 to +80 °C |
| | | | | | | NEW FD-42GW | | R1 | | –40 to +60 °C |

Note: Spot diameter and distance to focal point are specified for **FX-500**/**FX-100** series.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

# Narrow Beam

Since the beam is narrow, it has a feature by which it is not easily affected by surrounding obstacles even in long distances.



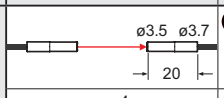
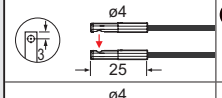
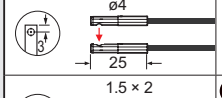
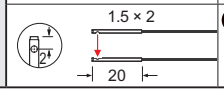

## Applications


FR-KZ50H

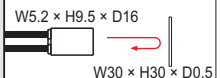
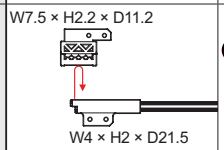
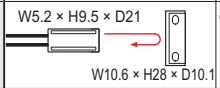
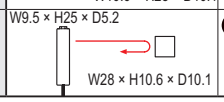

FT-KV40


FR-KZ22E

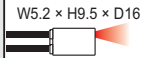
## Thru-beam type (one pair set)

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Beam axis position/ Inclination of beam axis | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Narrow beam |  ø3.5 ø3.7 20 | Tough NEW FT-KS40 | R2 Bending durability | 2 m | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,200 47.244 | 2,200 86.614<br>3,600 141.732 (Note 2) | ø2.2 | — | IP40 | –40 to +60 °C |
| |  ø4 25 | Tough NEW FT-KV40 | | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,200 47.244 | 2,200 86.614<br>3,600 141.732 (Note 2) | ø2.5 | ±0.8° | IP30 | |
| |  ø4 25 | NEW FT-KV40W | R1 | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,100 122.047<br>940 37.008 | | | | | |
| |  1.5 × 2 20 | Tough NEW FT-KV26 | R2 Bending durability | | STD 710 27.953<br>HYPR 2,500 98.425 | 1,600 62.992<br>1,200 47.244<br>440 17.323<br>160 6.299 | 135 5.315<br>560 22.047 | ø1 | X±1°<br>Z±0.5° | | |

## Retroreflective type

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 3) FX-500 series | Sensing range (mm in) (Note 1, 3) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 3) FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| With polarizing filters |  W5.2 × H9.5 × D16 W30 × H30 × D0.5 | NEW FR-Z50HW | R1 | ✂ 2 m | STD 100 to 990 3.937 to 38.976<br>HYPR 100 to 1,900 3.937 to 74.803 | 100 to 1,400 3.937 to 55.118<br>100 to 1,200 3.937 to 47.244<br>100 to 780 3.937 to 30.709<br>100 to 490 3.937 to 19.291 | 100 to 550<br>3.937 to 21.654<br>100 to 830<br>3.937 to 32.677 | IP40 | –25 to +55 °C |
| Wafer mapping |  W7.5 × H2.2 × D11.2 W4 × H2 × D21.5 | Tough NEW FR-KZ22E | R2 Bending durability | | STD 15 to 310 0.591 to 12.205<br>HYPR 15 to 570 0.591 to 22.441 | 15 to 460 0.591 to 18.110<br>15 to 410 0.591 to 16.142<br>15 to 220 0.591 to 8.661<br>15 to 100 0.591 to 3.937 | 15 to 200<br>0.591 to 7.874<br>15 to 360<br>0.591 to 14.173 | IP30 | –40 to +60 °C |
| Narrow beam Top sensing |  W5.2 × H9.5 × D21 W10.6 × H28 × D10.1 | Tough NEW FR-KZ50H | | | STD 20 to 300 0.787 to 11.811<br>HYPR 20 to 1,000 0.787 to 39.370 | 20 to 800 0.787 to 31.496<br>20 to 400 0.787 to 15.748<br>20 to 200 0.787 to 7.874<br>20 to 200 0.787 to 7.874 | 20 to 200<br>0.787 to 7.874<br>20 to 350<br>0.787 to 13.780 | | |
| Narrow beam Side sensing |  W9.5 × H25 × D5.2 W28 × H10.6 × D10.1 | Tough NEW FR-KZ50E | | | | | | | |

## Reflective type

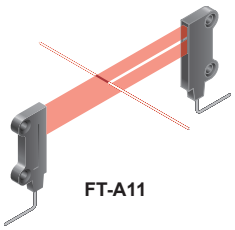
| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| Long range |  W5.2 × H9.5 × D16 | NEW FD-Z50HW | R1 | ✂ 2 m | STD 10 to 650 0.394 to 25.591<br>HYPR 10 to 2,500 0.394 to 98.425 | 10 to 1,100 0.394 to 43.307<br>10 to 1,000 0.394 to 39.370<br>10 to 410 0.394 to 16.142<br>15 to 130 0.591 to 5.118 | 10 to 200<br>0.394 to 7.874<br>10 to 530<br>0.394 to 20.866 | IP40 | –40 to +60 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. Refer to P.22 for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

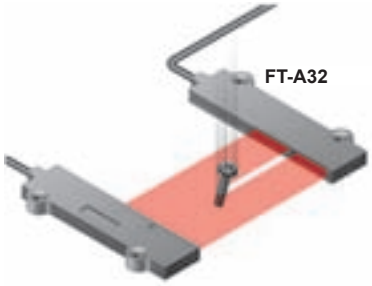
# Wide Beam

Senses work with indefinite shape or position in the beam band without missing. It can also be used to determine shape.

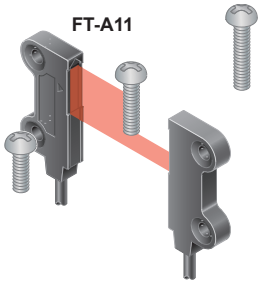



## Applications

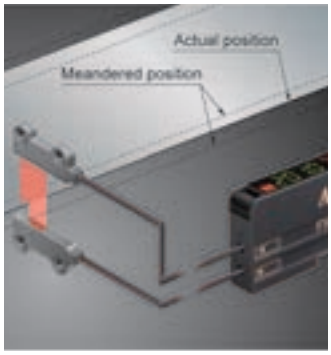
### Sensing tiny moving objects



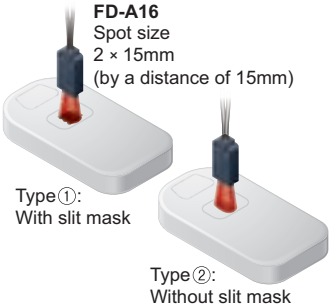

### Inspecting screw height




### Control the amount of meandering




### Confirming presence of slit mask




## Thru-beam type (one pair set)

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Wide beam | Sensing width 32mm<br>W5 × H69 × D20 | Tough NEW<br>FT-A32 | R2<br>Bending durability | 2 m | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,100 82.677 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2) | 3.2 × 32 | IP40 | –40 to +60 °C |
| Allows flexible wiring<br>Wide beam | Sensing width 32mm<br>W5 × H69 × D20 | NEW<br>FT-A32W | R1 | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,000 118.110 | | | | –40 to +55 °C |
| Wide beam | Sensing width 11mm<br>W4.2 × H31 × D13.5 | Tough NEW<br>FT-A11 | R2<br>Bending durability | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,100 43.307 | 1,900 74.803<br>3,600 141.732 (Note 2) | 2.2 × 11 | | –40 to +70 °C |
| Allows flexible wiring<br>Wide beam | Sensing width 11mm<br>W4.2 × H31 × D13.5 | NEW<br>FT-A11W | R1 | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,300 51.181 | 1,700 66.929<br>3,400 133.858 | | | –40 to +55 °C |
| Array | Sensing width 5.5mm<br>W5 × H15 × D15 | Tough NEW<br>FT-AL05 | R2<br>Bending durability | | STD 860 33.858<br>HYPR 2,300 90.551 | 1,550 61.024<br>1,500 59.055<br>500 19.685<br>170 6.693 | 250 9.843<br>660 25.984 | 0.25 × 5.5 | | –55 to +80 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range to 3,600 mm 141.72 in long.

## Reflective type

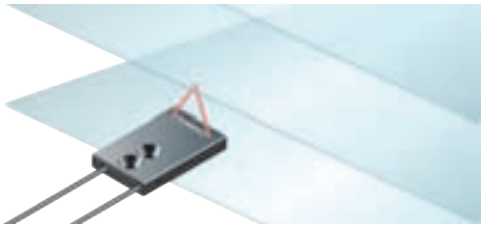
| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| Wide beam | W7 × H15 × D30 | Tough NEW<br>FD-A16 | R4<br>Bending durability | 2 m | STD 200 7.874<br>HYPR Cannot use | 200 7.874<br>200 7.874<br>140 5.512<br>75 2.953 | 120 4.724<br>240 9.449 | IP40 | –40 to +60 °C |
| Array | W5 × H20 × D20 | Tough NEW<br>FD-AL11 | R2<br>Bending durability | | STD 320 12.598<br>HYPR 670 26.378 | 530 20.866<br>510 20.079<br>180 7.087<br>50 1.969 | 100 3.937<br>285 11.220 | | –55 to +80 °C |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

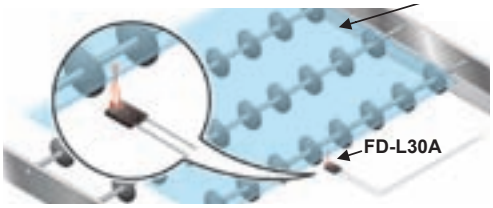
# Convergent Reflective Type

It is a fiber in which the sensing distance is limited to a specific range so it is not easily affected by the background. It is effective when work has accumulated or when the background is near.

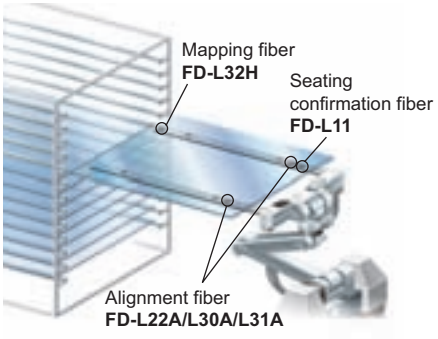


## Applications

### Detecting glass substrate




### Substrate conveyors




### Mounting in handring arms


## Reflective type

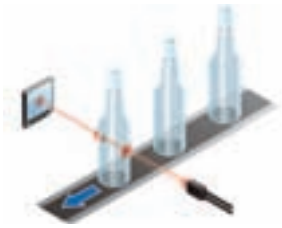
| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | U-LG LONG FAST H-SP | FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| Glass substrate detection | Mapping W25 × H7.3 × D30 | NEW FD-L32H | R4 Bending durability | ✂ 4 m | STD 0 to 56 0 to 2.205<br>HYPR 0 to 110 0 to 4.331 | 0 to 87 0 to 3.425<br>0 to 74 0 to 2.913<br>1 to 38 0.039 to 1.496<br>Cannot use | 16 to 30 0.630 to 1.181<br>0 to 50 0 to 1.969 | IP40 | –40 to +60 °C |
| | Alignment W20 × H29 × D3.8 | Tough NEW FD-L30A | R2 Bending durability | ✂ 3 m | STD 0 to 43 0 to 1.693<br>HYPR 0 to 43 0 to 1.693 | 0 to 43 0 to 1.693<br>0 to 43 0 to 1.693<br>0 to 42 0 to 1.654<br>0 to 29 0 to 1.142 | 0 to 40 0 to 1.575<br>0 to 50 0 to 1.969 | | 0 to +70 °C |
| | Alignment W23.5 × H29 × D4.5 | Tough NEW FD-L31A | R4 Bending durability | | STD 4 to 33 0.157 to 1.299<br>HYPR 3 to 35 0.118 to 1.378 | 4 to 33 0.157 to 1.299<br>4 to 33 0.157 to 1.299<br>4 to 32 0.157 to 1.260<br>5 to 25 0.197 to 0.984 | 5 to 30 0.197 to 1.181<br>4 to 33 0.157 to 1.299 | | |
| | Alignment W17 × H29 × D3.8 | Tough NEW FD-L22A | R2 Bending durability | ✂ 2 m | STD 0 to 24 0 to 0.945<br>HYPR 0 to 31 0 to 1.220 | 0 to 28 0 to 1.102<br>0 to 27 0 to 1.063<br>0 to 24 0 to 0.945<br>0 to 18 0 to 0.709 | 0 to 19 0 to 0.748<br>0 to 25 0 to 0.984 | | |
| | Seating confirmation W18 × H29 × D3.8 | Tough NEW FD-L23 | | ✂ 3 m | STD 0 to 29 0 to 1.142<br>HYPR 0 to 30 0 to 1.181 | 0 to 30 0 to 1.181<br>0 to 30 0 to 1.181<br>0 to 28 0 to 1.102<br>1.5 to 24 0.059 to 0.945 | 0 to 28 0 to 1.102<br>0 to 30 0 to 1.181 | | –20 to +70 °C |
| | Seating confirmation W12 × H19 × D3 | Tough NEW FD-L11 | R4 Bending durability | | STD 0 to 9.5 0 to 0.374<br>HYPR 0 to 11.5 0 to 0.453 | 0 to 10.5 0 to 0.413<br>0 to 10 0 to 0.394<br>0 to 9 0 to 0.354<br>0 to 8 0 to 0.315 | 0 to 8 0 to 0.315<br>0 to 9 0 to 0.354 | | |
| | Seating confirmation W12 × H19 × D3 | Tough NEW FD-L10 | | | STD 0 to 5 0 to 0.197<br>HYPR 0 to 6 0 to 0.236 | 0 to 5.5 0 to 0.217<br>0 to 5.5 0 to 0.217<br>0 to 4.5 0 to 0.177<br>0 to 4 0 to 0.157 | 0 to 4.5 0 to 0.177<br>0 to 5.5 0 to 0.217 | | –40 to +60 °C |
| | W24 × H21 × D4 | Tough NEW FD-L21 | R2 Bending durability | ✂ 2 m | STD 1.5 to 16 0.059 to 0.630<br>HYPR 1 to 19 0.039 to 0.748 | 1 to 18 0.039 to 0.709<br>1 to 18 0.039 to 0.709<br>2 to 15 0.079 to 0.591<br>3 to 12 0.118 to 0.472 | 3 to 15 0.118 to 0.591<br>1.5 to 16 0.059 to 0.630 | | |
| | W24 × H21 × D4 | NEW FD-L21W | R1 | | STD 3 to 14 0.118 to 0.551<br>HYPR 1.5 to 15 0.059 to 0.591 | 2 to 15 0.079 to 0.591<br>2 to 15 0.079 to 0.591<br>4 to 14 0.157 to 0.551<br>6.5 to 10 0.256 to 0.394 | 7 to 12 0.276 to 0.472<br>3 to 14 0.118 to 0.551 | | |
| General purpose | W6 × H18 × D14 | Tough NEW FD-L20H | R2 Bending durability | | STD 23 0.906<br>HYPR 45 1.772 | 35 1.378<br>32 1.260<br>2 to 15 0.079 to 0.591<br>5 to 9 0.197 to 0.354 | 5 to 15 0.197 to 0.591<br>1 to 30 0.039 to 1.181 | | –40 to +70 °C |
| Ultra-small | W7.2 × H7.5 × D2 | NEW FD-L12W | R1 | ✂ 1 m | STD 8 0.315<br>HYPR 14 0.551 | 12.5 0.492<br>12 0.472<br>0.5 to 7 0.020 to 0.276<br>0.5 to 4 0.020 to 0.157 | 1 to 4.5 0.039 to 0.177<br>0.5 to 7 0.020 to 0.276 | IP30 | –40 to +60 °C |

Notes: 1) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (**FD-L32H**: R edge, **FD-L21** and **FD-L21W**: t2 mm t0.079 in) (**FD-L20H**: white non-glossy paper, **FD-L10**: silicon wafers 100 × 100 mm 3.937 × 3.937 in).
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

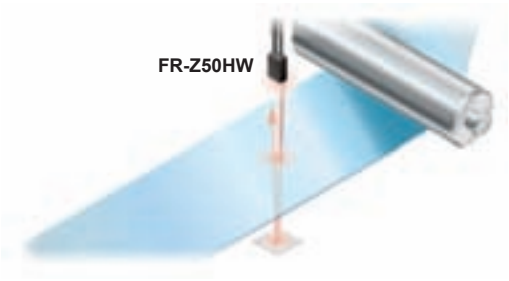
# Retroreflective Type

Compared with the thru-beam type, it is easier to rotate the fibers since one side is a reflector. Sensing transparent objects is also its advantage.



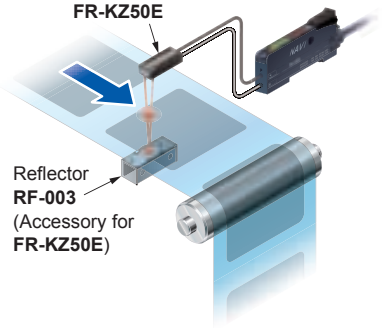
## Applications

### Detecting transparent film




### Detecting wafer


### Detection of transparent seals on transparent sheet




## Retroreflective type

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) FX-500 series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| With polarizing filters | W5.2 × H9.5 × D16<br>W30 × H30 × D0.5 | NEW<br>FR-Z50HW | R1 | ✂<br>2 m | STD 100 to 990 3.937 to 38.976<br>HYPR 100 to 1,900 3.937 to 74.803 | 100 to 1,400 3.937 to 55.118<br>100 to 1,200 3.937 to 47.244<br>100 to 780 3.937 to 30.709<br>100 to 490 3.937 to 19.291 | 100 to 550<br>3.937 to 21.654<br>100 to 830<br>3.937 to 32.677 | IP40 | –25 to +55 °C |
| Wafer mapping | W7.5 × H2.2 × D11.2<br>W4 × H2 × D21.5 | Tough NEW<br>FR-KZ22E | R2<br>Bending durability | | STD 15 to 310 0.591 to 12.205<br>HYPR 15 to 570 0.591 to 22.441 | 15 to 460 0.591 to 18.110<br>15 to 410 0.591 to 16.142<br>15 to 220 0.591 to 8.661<br>15 to 100 0.591 to 3.937 | 15 to 200<br>0.591 to 7.874<br>15 to 360<br>0.591 to 14.173 | IP30 | –40 to +60 °C |
| Narrow beam Top sensing | W5.2 × H9.5 × D21<br>W10.6 × H28 × D10.1 | Tough NEW<br>FR-KZ50H | | | STD 20 to 300 0.787 to 11.811<br>HYPR 20 to 1,000 0.787 to 39.370 | 20 to 800 0.787 to 31.496<br>20 to 400 0.787 to 15.748<br>20 to 200 0.787 to 7.874<br>20 to 200 0.787 to 7.874 | 20 to 200<br>0.787 to 7.874<br>20 to 350<br>0.787 to 13.780 | | |
| Narrow beam Side sensing | W9.5 × H25 × D5.2<br>W28 × H10.6 × D10.1 | Tough NEW<br>FR-KZ50E | | | | | | | |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector.

## Sensing range when FR-Z50HW is used in combination with a reflector (optional)

| Reflector model No. | Sensing range (mm in) FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101 | FX-102 |
|---|---|---|---|---|---|---|---|---|
| RF-230 | 100 to 19,000<br>3.937 to 748.030 | 100 to 8,000<br>3.937 to 314.960 | 100 to 5,000<br>3.937 to 196.850 | 100 to 3,600<br>3.937 to 141.732 | 100 to 2,900<br>3.937 to 114.173 | 100 to 1,400<br>3.937 to 55.118 | 100 to 2,400<br>3.937 to 94.488 | 100 to 5,000<br>3.937 to 196.850 |
| RF-220 | 100 to 8,000<br>3.937 to 314.960 | 100 to 4,700<br>3.937 to 185.039 | 100 to 3,500<br>3.937 to 137.795 | 100 to 3,000<br>3.937 to 118.110 | 100 to 1,800<br>3.937 to 70.866 | 100 to 830<br>3.937 to 32.677 | 100 to 1,300<br>3.937 to 51.181 | 100 to 2,600<br>3.937 to 102.362 |
| RF-210 | 100 to 5,500<br>3.937 to 216.535 | 100 to 2,700<br>3.937 to 106.299 | 100 to 2,400<br>3.937 to 94.488 | 100 to 1,500<br>3.937 to 59.055 | 100 to 1,200<br>3.937 to 47.244 | 100 to 530<br>3.937 to 20.866 | 100 to 980<br>3.937 to 38.583 | 100 to 1,300<br>3.937 to 51.181 |

Note: The sensing range of retroreflective type is the possible setting range for the attached reflector. The fiber can detect an object less than 100 mm. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use.

## Fiber option

Reflector (for FR-Z50HW) ▸P.33

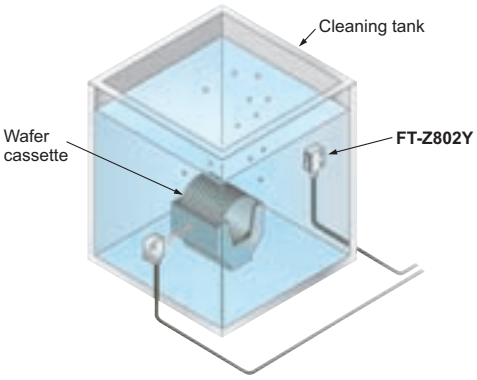
Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

# Chemical-resistant

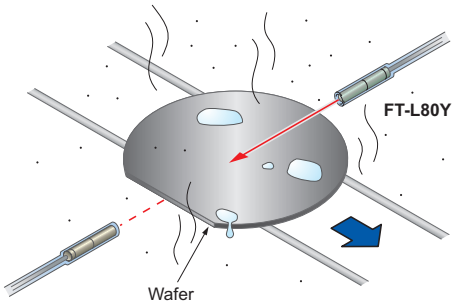
With the case and fiber sheath made of PFA, the fiber can be used with various types of chemical liquids.

## Applications

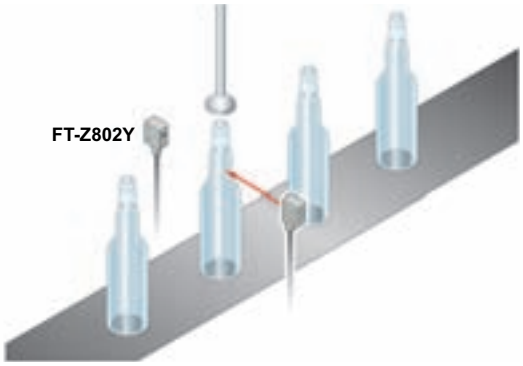
### Detecting wafer cassette in cleaning tank




### Sensing wafer in corrosive environment




### Chemical filler




## Thru-beam type (one pair set)

| Type | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical-resistant | Easy mounting • Rectangular head SEMI S2 compliant W7 × H15 × D13 | FT-Z802Y | R25 | ✂ 2 m | STD 3,100 122.047<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>1,900 74.803<br>470 18.504 | 520 20.472<br>3,100 122.047 | ø3.7 | IP67 | 0 to +60 °C |
| | Heat-resistant 115 °C | FT-HL80Y | R30 | ✂ 2 m (Note 3) | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,300 90.551<br>740 29.134 | 990 38.976<br>2,340 92.126 | | IP67g | –40 to +115 °C |
| | | FT-L80Y | | | STD (Note 2) 3,600 141.732<br>HYPR (Note 2) 3,600 141.732 | 3,600 141.732 (Note 2)<br>3,600 141.732 (Note 2)<br>2,800 110.236<br>920 36.220 | 1,100 43.307<br>2,600 102.362 | | | –40 to +70 °C |
| | Side-view | FT-V80Y | | | STD 1,300 51.181<br>HYPR (Note 2) 3,600 141.732 | 2,800 110.236<br>2,200 86.614<br>800 31.496<br>240 9.449 | 340 13.386<br>800 31.496 | ø2.8 | | |

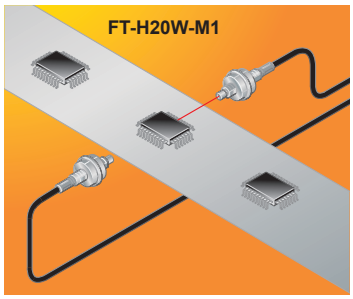
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.

# Heat-resistant

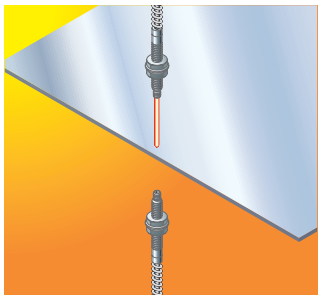
- It can be used under environments of -60 to +350 °C -76 to +662 °F.
- A wide joint type for workability is also prepared.

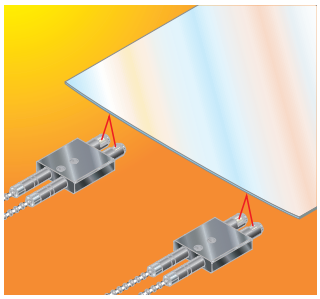
## Applications

**IC detection within a high temperature handler**




**Detecting glass substrates**



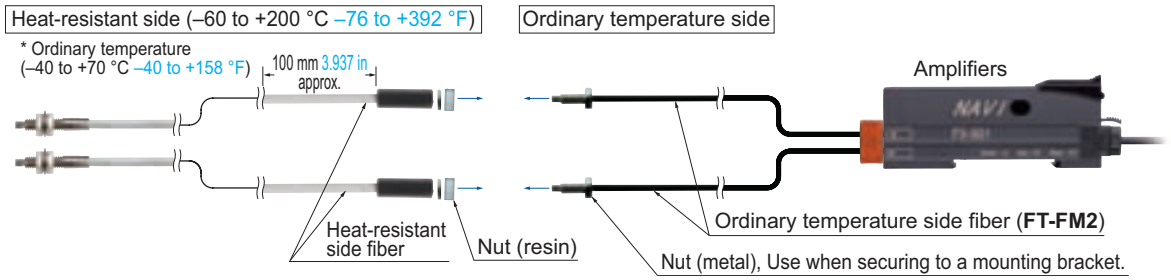


## Thru-beam type (one pair set)

| Type | Heat-resistant temp. | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1) FX-500 series | Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value) | Beam axis dia. (mm) | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Heat-resistant | 350 °C | Lens mountable (**FX-LE1/LE2/SV1**) M4 30 | **FT-H35-M2** | R25 | 2 m | STD 430 16.929<br>HYPR 1,200 47.244 | 880 34.646<br>670 26.378<br>250 9.843<br>80 3.150 | 170 6.693<br>490 19.291 | ø1.2 | –60 to +350 °C |
| | | Sleeve 60 mm M4 ø2.1 27 | **FT-H35-M2S6** | Fiber R25 Sleeve R10 | | | | | | |
| | 200 °C | Allows flexible wiring Lens mountable (**FX-LE1/LE2/SV1**) M4 23 | **FT-H20W-M1** | R10 | 1 m | STD 470 18.504<br>HYPR (Note2) 1,600 62.992 | 1,000 39.370<br>840 33.071<br>300 11.811<br>90 3.543 | 100 3.937<br>300 11.811 | ø0.8 | –60 to +200 °C |
| | | Lens mountable (**FX-LE1/LE2/SV1**) M4 23 | **FT-H20-M1** | R25 | | STD 540 21.260<br>HYPR (Note2) 1,600 62.992 | 1,300 51.181<br>960 37.795<br>330 12.992<br>110 4.331 | 210 8.268<br>540 21.260 | ø1.2 | |
| | 130 °C | Lens mountable (**FX-LE2** only) M4 16 | **FT-H13-FM2** | | ✂ 2 m | STD 700 27.559<br>HYPR 3,300 129.921 | 1,900 74.803<br>1,300 51.181<br>410 16.142<br>140 5.512 | 250 9.843<br>700 27.559 | ø1.5 | –60 to +130 °C |
| Heat-resistant (joint) | 200 °C | Lens mountable (**FX-LE1/LE2/SV1**) M4 23 | **FT-H20-J20-S** (Note 5) | Heat-resistant side R18 (Note 4) | ✂ 200 mm (Note 3) | STD 470 18.504<br>HYPR 1,600 62.992 | 1,000 39.370<br>790 31.102<br>300 11.811<br>90 3.543 | 135 5.315<br>420 16.535 | ø1.2 | –60 to +200 °C |
| | | | **FT-H20-J30-S** (Note 5) | | ✂ 300 mm (Note 3) | | | | | |
| | | | **FT-H20-J50-S** (Note 5) | | ✂ 500 mm (Note 3) | | | | | |
| | | Side-view 24 ø3.8 ø4 | **FT-H20-VJ50-S** (Note 5) | | | STD 600 23.622<br>HYPR 2,100 82.677 | 1,300 51.181<br>980 38.583<br>390 15.354<br>120 4.724 | 150 5.906<br>500 19.685 | | |
| | | | **FT-H20-VJ80-S** (Note 5) | | ✂ 800 mm (Note 3) | | | | | |

Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
4) R25 mm R0.984 in or more for ordinary temperature side.
5) Heat-resistant side fiber + ordinary temperature fiber (**FT-FM2**) are sold together as a set.

## Heat-resistant joint fiber set contents




## Model No. when ordering individual parts from spare parts

- Heat-resistant side fiber one pair set
  **FT-H20-J20**, **FT-H20-J30**, **FT-H20-J50**, **FT-H20-VJ50**, **FT-H20-VJ80**
- Ordinary temperature side fiber one pair set
  **FT-FM2**

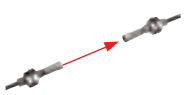
## Reflective type

| Type | | Heat-resistant temp. | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) (Note 1, 2) **FX-500** series | Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP | Sensing range (mm in) (Note 1, 2) **FX-101** (Upper value) **FX-102** (Lower value) | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Heat-resistant | Threaded | 350 °C | Coaxial M6, 25 | **FD-H35-M2** | R25 | 2 m | STD 260 10.236<br>HYPR 720 28.346 | 540 21.260<br>460 18.110<br>150 5.906<br>45 1.772 | 75 2.953<br>280 11.024 | –60 to +350 °C |
| | | | Sleeve 60 mm, M6, ø2.8, 22 | **FD-H35-M2S6** | Fiber R25 Sleeve R10 | | | | | |
| | | | Sleeve 90 mm, M4, ø2.1, 27 | **FD-H35-20S** | | 1 m | STD 260 10.236<br>HYPR 840 33.071 | 550 21.654<br>440 17.323<br>140 5.512<br>45 1.772 | 85 3.346<br>200 7.874 | |
| | | 200 °C | Coaxial M6, 28 | **FD-H20-M1** | R25 | | STD 330 12.992<br>HYPR 840 33.071 | 550 21.654<br>500 19.685<br>200 7.874<br>55 2.165 | 120 4.724<br>300 11.811 | –60 to +200 °C |
| | | | Coaxial M4, 27 | **FD-H20-21** | | | STD 230 9.055<br>HYPR 770 30.315 | 500 19.685<br>380 14.961<br>130 5.118<br>45 1.772 | 90 3.543<br>280 11.024 | |
| | | 130 °C | M6, 21 | **FD-H13-FM2** | | ✂ 2 m | STD 350 13.780<br>HYPR 880 34.646 | 640 25.197<br>600 23.622<br>200 7.874<br>65 2.559 | 100 3.937<br>280 11.024 | –60 to +130 °C |
| | Glass substrate detection convergent reflective | 300 °C | W19 × H27 × D5 | **FD-H30-L32** | | 2 m | STD 17 0.669<br>HYPR 40 1.575 | 30 1.181<br>25 0.984<br>12 0.472<br>1.5 to 6 0.059 to 0.236 | 2 to 9<br>0.079 to 0.354<br>0 to 17<br>0 to 0.669 | –60 to +300 °C |
| | | 250 °C | W21 × H33.2 × D5 | **FD-H25-L43** | | 3 m | STD 1.5 to 26 0.059 to 1.024<br>HYPR 1 to 31 0.039 to 1.220 | 1 to 30 0.039 to 1.181<br>1 to 28 0.039 to 1.102<br>1.5 to 24 0.059 to 0.945<br>2 to 18 0.079 to 0.709 | 4 to 16<br>0.157 to 0.630<br>4 to 23<br>0.157 to 0.906 | –20 to +250 °C (Ordinary temp. side: –20 to +70 °C) |
| | | | W21 × H34.5 × D5 | **FD-H25-L45** | | | STD 5 to 42 0.197 to 1.654<br>HYPR 4 to 43.5 0.157 to 1.713 | 4 to 43 0.157 to 1.693<br>4.5 to 43 0.177 to 1.693<br>5 to 40 0.197 to 1.575<br>6.5 to 34 0.256 to 1.339 | 7 to 35<br>0.276 to 1.378<br>7 to 38<br>0.276 to 1.496 | |
| | | 180 °C | W19 × H27 × D5 | **FD-H18-L31** | | ✂ 2 m | STD 16 0.630<br>HYPR 60 2.362 | 32 1.260<br>24 0.945<br>13 0.512<br>2 to 6.5 0.079 to 0.256 | 0 to 10<br>0 to 0.394<br>0 to 25<br>0 to 0.984 | –60 to +180 °C |

Notes: 1) The sensing range of reflective type is the value for white non-glossy paper (50 × 50 mm 1.969 × 1.969 in glass substrate for **FD-H30-L32**, **FD-H18-L31**, transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in for **FD-H25-L43** and **FD-H25-L45**).
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

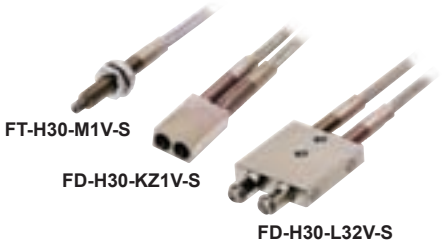
## Fiber options

### Lens (For thru-beam fiber) ▸P.30~



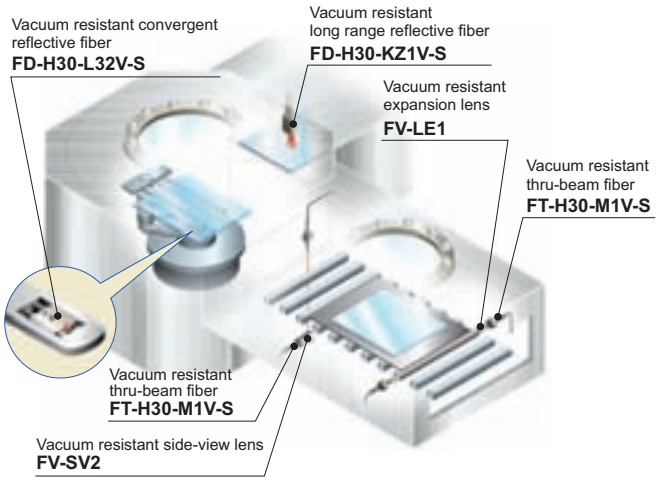
# Vacuum-resistant

- Usable in high-temperatures of 300 °C 572 °F vacuum
- The leakage of **FV-BR1** is still less than a very slight $1.33 \times 10^{-10}$ Pa · $m^3$/s [He], so that it can be used in vacuums with confidence.



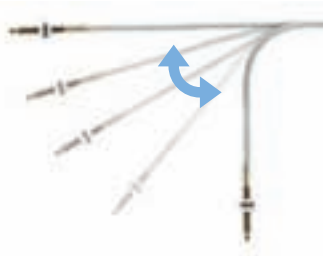

## Applications

### Detection of glass substrate in vacuum chamber




## Highly resistant to repeated bending

Because it has a bending durability of over 100,000 times (R20 mm R0.79 in), it is highly resistant to repeated bending and is optimal for mounting on moving robot hand.



## Thru-beam type (one pair set)

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in) | | | Beam axis dia. (mm) | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **FX-500** series | U-LG LONG FAST H-SP | **FX-101** (Upper value) **FX-102** (Lower value) | | |
| Vacuum-resistant | Thru-beam | 300 °C<br>Lens mountable (**FV-LE1/SV2**) M4<br>30 | **FT-H30-M1V-S** (Note) | R18 | 1 m | STD 270 10.630<br>HYPR 1,000 39.370 | 590 23.228<br>470 18.504<br>160 6.299<br>55 2.165 | 110 4.331<br>280 11.024 | ø1.2 | –30 to +300 °C |

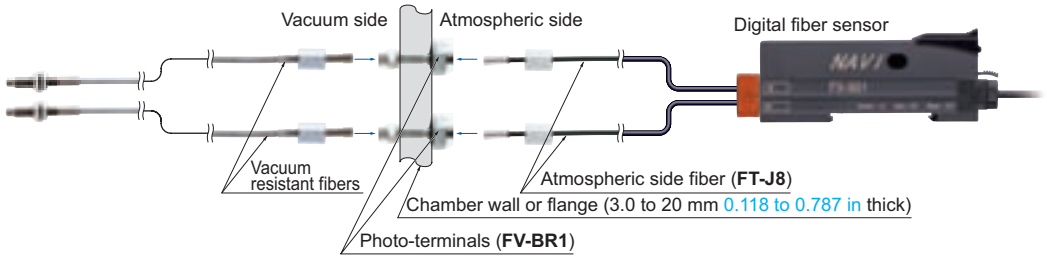
Note: Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).

## Reflective type

| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Sensing range (mm in)(Note 2) | | | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **FX-500** series | U-LG LONG FAST H-SP | **FX-101** (Upper value) **FX-102** (Lower value) | |
| Vacuum-resistant | Reflective | 300 °C, Rectangular head<br>W9.5 × H5.2 × D15 | **FD-H30-KZ1V-S** (Note 1) | R18 | 1 m | STD 20 to 200 0.787 to 7.874<br>HYPR 5 to 500 0.197 to 19.685 | 10 to 340 0.394 to 13.386<br>15 to 270 0.591 to 10.630<br>20 to 120 0.787 to 4.724<br>20 to 45 0.787 to 1.772 | 25 to 80 0.984 to 3.150<br>10 to 220 0.394 to 8.661 | –30 to +300 °C |
| | Convergent reflective | 300 °C, Glass substrate detection<br>W19 × H5 × D27 | **FD-H30-L32V-S** (Note 1) | | 3 m | STD 8 0.315<br>HYPR 18 0.709 | 12 0.472<br>10 0.394<br>5.5 0.217<br>1.5 to 3 0.059 to 0.118 | 2.5 to 6.5 0.098 to 0.256<br>0 to 11<br>0 to 0.433 | |

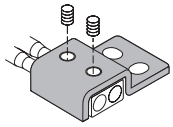
Notes: 1) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
2) The sensing range of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

## Set contents



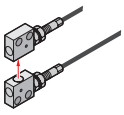

## Model No. when ordering individual parts from repair parts

- Vacuum resistant fiber
  **FT-H30-M1V** (one pair set)
  **FD-H30-KZ1V**
  **FD-H30-L32V**
- Photo-terminal
  **FV-BR1** (one pair set)
- Atmospheric side fiber
  **FT-J8** (one pair set)
- Mounting bracket for **FD-H30-KZ1V**(**-S**)
  **MS-FD-2**



## Fiber options

### Lens (For thru-beam fiber)

| Designation | | Model No. | | Description |
|---|---|---|---|---|
| For thru-beam type fiber | Vacuum resistant expansion lens (Note 1) | **FV-LE1** |  | Increases the sensing range 4 times or more.<br>• Ambient temperature: –60 to +350 °C –76 to +662 °F (Note 3)<br>• Beam axis dia: ø3.6 mm ø0.142 in<br>Sensing range (mm in) [Lens on both sides] (Note 4) |
| | Vacuum resistant side-view lens (Note 1) | **FV-SV2** |  | Beam axis is bent by 90°.<br>• Ambient temperature: –60 to +300 °C –76 to +572 °F (Note 3)<br>• Beam axis dia: ø3.7 mm ø0.146 in<br>Sensing range (mm in) [Lens on both sides] (Note 4) |

Sensing range (mm in) [Lens on both sides] (Note 4)

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| **FT-H30-M1V-S** | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,400 133.858 | 1,500 59.055 | 900 35.433 | 370 14.567 | 450 17.717 | 1,600 62.992 |

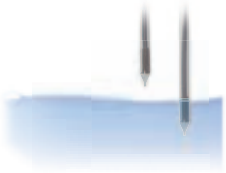
Notes: 1) Be careful when installing the thru-beam type fiber equipped with the lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) Refer to P.26 for the ambient temperature of fibers to be used in combination.
4) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.281 ft. The sensing ranges in HYPR, U-LG and LONG of **FX-500** series, in **FX-102**□ take into account the length of the **FT-J8** atmospheric side fiber.

# Liquid Leak / Liquid Detection

It corresponds to various liquid events, from the contact (wetted) type to the pipe mounting type, and up to leak detection.

## Applications

**Detecting liquid level in a tank**



**Leak detection for use in semiconductor device manufacturing**


### For liquid surface level upper limit sensing, a "without fluid" incident light sensor is recommended.

**The sensor will turn OFF during abnormal conditions (excess fluid, fiber disconnection, etc.)!**
Liquid absent: Beam received (Output ON)
Liquid present / fiber is cutoff: Beam not received (Output OFF)

**FD-FA93** Strong against air bubbles

Applicable pipe: Transparent pipe, Outer diameter ø8 mm ø0.315 in or more
(When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 in)

**FD-F41** Standard type

**FD-F4** For 1 mm 0.039 in thick pipes manufactured by PFA


### We recommend using the sensor so that the output is ON when liquid is present at lower limit detection level.

**The sensor will turn OFF during abnormal conditions (insufficient liquid, fiber disconnection, etc.) !**
Liquid present: Beam received (Output ON)
Liquid absent / fiber is cutoff: Beam not received (Output OFF)

**FT-F93** Thru-beam


## Reflective type / Thru-beam type

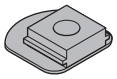
| Type | | Shape of fiber head (mm) | Model No. | Bending radius (mm) | Fiber cable length ✂: Free-cut | Description: FX-500 series (STD mode) | Description: FX-101 FX-102 | Protection | Ambient temp. |
|---|---|---|---|---|---|---|---|---|---|
| Contact type | Liquid level sensing | Heat resistant 125 °C Fluorine resin coating ø6 | FD-F8Y | Protective tube R40 Fiber R15 | ✂ 2 m (Note 1) | ø6 mm ø0.236 in<br>Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable)<br>Liquid surface not contacted: Beam received,<br>Liquid surface contacted: Beam not received | | IP68 | –40 to +125 °C |
| | | Heat resistant 105 °C Fluorine resin coating ø4 | FD-HF40Y (Note 2) | Protective tube R20 Fiber R10 | ✂ 2 m | ø4 mm ø0.157 in<br>Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable)<br>Liquid surface not contacted: Beam received,<br>Liquid surface contacted: Beam not received | | IP67 | –40 to +105 °C |
| | | Heat resistant 70 °C Fluorine resin coating throughout the fiber ø4 | FD-F41Y (Note 2) | | | ø4 mm ø0.157 in<br>Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable)<br>Liquid surface not contacted: Beam received,<br>Liquid surface contacted: Beam not received | | | –40 to +70 °C |
| Pipe-mountable type | Liquid leak detection | SEMI S2 compliant W20 × H30 × D10 | Tough NEW FD-F71 | Protective tube R20 Fiber R4 Bending durability | ✂ 5 m | Liquid leak detection<br>Leak absent: Beam received, Leak present: Beam interrupted | | | –20 to +60 °C |
| | Liquid level sensing | Standard W25 × H13 × D20 | FD-F41 | R10 | ✂ 2 m | Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [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 not received | | — | –40 to +100 °C |
| | | For 1 mm thick PFA pipe W25 × H13 × D20 | FD-F4 | | | Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]<br>Liquid absent: Beam received, Liquid present: Beam not received | | | |
| | Liquid sensing | Mountable on pipe-array fiber W6.5 × H28.3 × D17 | Tough NEW FD-FA93 | R4 Bending durability | | 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) [PFA (fluorine resin), including translucent]<br>Liquid absent: Beam received, Liquid present: Beam not received | | IP40 | –40 to +70 °C |
| | | SEMI S2 compliant W23 × H20 × D17 | Tough NEW FT-F93 | Protective tube R20 Fiber R2 Bending durability | | Applicable pipe diameter: Outer dia. ø3 to ø10 mm ø0.118 to ø0.394 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1 mm 0.012 to 0.039 in]<br>Liquid absent: Beam not received, Liquid present: Beam received | | | –40 to +60 °C |

Notes: 1) The allowable cutting range is 1,000 mm 39.370 in from the end that the amplifier inserted.
2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available. Please refer to next page for details.

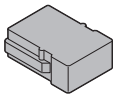
Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

## Accessories

- **MS-FD-F7-1**
  (SUS mounting bracket for **FD-F71**)



- **MS-FD-F7-2**
  (PVC mounting bracket for **FD-F71**)



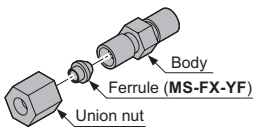
## Fiber options

| Designation | Model No. | Description | | |
|---|---|---|---|---|
| Liquid inflow prevention joint (Note) | **MS-FX-01Y** | Applicable fibers | **FD-HF40Y**<br>**FD-F41Y** | This joint suppresses false operations due to liquid slip-in from the top of the protective tube. |
| Protective tube extension joint (Note) | **MS-FX-02Y** | | | The protective tube can be extended. |
| Fiber mounting joint (Note) | **MS-FX-03Y** | | | The joint is used for mounting fibers on a tank. |

Note: The joint internal ferrule (**MS-FX-YF**) is available as a spare part. A distorted ferrule may result in leakage.

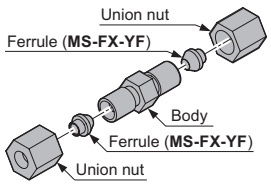
### Liquid inflow prevention joint

- **MS-FX-01Y**



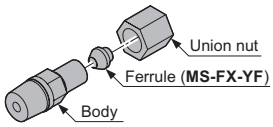

### Protective tube extension joint

- **MS-FX-02Y**




### Fiber mounting joint

- **MS-FX-03Y**

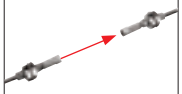


# Fiber options

## Lens (For thru-beam type fiber)

### For thru-beam type fiber

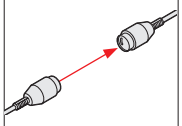
#### Expansion lens (Note 1) — FX-LE1



Increases the sensing range by 5 times or more.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 3)
• Beam dia: ø3.6 mm ø0.142 in
**Sensing range (mm in) [Lens on both sides]**

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| FT-43 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 1,600 62.992 | 2,400 94.488 | 3,600 141.732 (Note 2) |
| FT-42 FT-42W | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 2,200 86.614 | 3,400 133.858 | 3,600 141.732 (Note 2) |
| FT-45X | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,500 59.055 | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) |
| FT-R40 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 1,900 74.803 | 3,100 122.047 | 3,600 141.732 (Note 2) |
| FT-H35-M2 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,300 129.921 | 1,400 55.118 | 2,000 78.740 | 3,500 137.795 (Note 2) |
| FT-H20W-M1 | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 850 33.465 | 1,300 51.181 | 1,600 62.992 (Note 2) |
| FT-H20-M1 | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,200 47.244 | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) |
| FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,500 137.795 | 2,000 78.740 | 1,600 62.992 | 500 19.685 | 1,000 39.370 | 3,500 137.795 (Note 2) |

#### Super-expansion lens (Note 1) — FX-LE2



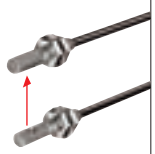
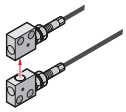
Tremendously increases the sensing range with large diameter lenses.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 3)
• Beam dia: ø9.8 mm ø0.386 in
**Sensing range (mm in) [Lens on both sides]**

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| FT-43 FT-42 FT-42W | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) |
| FT-45X | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) |
| FT-R40 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) |
| FT-H35-M2 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,500 137.795 (Note 2) | 3,500 137.795 (Note 2) |
| FT-H20W-M1 FT-H20-M1 | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) |
| FT-H13-FM2 | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,500 137.795 (Note 2) | 3,500 137.795 (Note 2) |
| FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,500 137.795 (Note 2) | 3,500 137.795 (Note 2) |

Notes: 1) Be careful sure to use it only after you have adjusted it sufficiently when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) Refer to P.10~ for the ambient temperature of fibers to be used in combination.

# Fiber options

## Lens (For thru-beam type fiber)

| Designation | | Model No. | | Description |
|---|---|---|---|---|
| For thru-beam type fiber | Side-view lens | **FX-SV1** |  | Beam axis is bent by 90°.<br>• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)<br>• Beam dia: ø2.8 mm ø0.110 in<br>**Sensing range (mm in) [Lens on both sides]** |
| | Expansion lens for vacuum fiber (Note 1) | **FV-LE1** |  | Sensing range increases by 4 times or more.<br>• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4)<br>• Beam dia: ø3.6 mm ø0.142 in<br>**Sensing range (mm in) [Lens on both sides]** (Note 3) |
| | Vacuum-resistant side-view lens (Note 1) | **FV-SV2** |  | Beam axis is bent by 90°.<br>• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)<br>• Beam dia: ø3.7 mm ø0.146 in<br>**Sensing range (mm in) [Lens on both sides]** (Note 3) |

**Side-view lens — FX-SV1**

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| **FT-43** | 3,600 141.732 (Note 2) | 3,400 133.858 | 2,600 102.362 | 1,700 66.929 | 970 38.189 | 310 12.205 | 510 20.079 | 1,400 55.118 |
| **FT-42** | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 2,100 82.677 | 1,150 45.276 | 370 14.567 | 500 19.685 | 1,700 66.929 |
| **FT-42W** | 3,600 141.732 (Note 2) | 3,500 137.795 | 2,700 106.299 | 1,800 70.866 | 990 38.976 | 320 12.598 | 480 18.898 | 1,300 51.181 |
| **FT-45X** | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,400 55.118 | 800 31.496 | 210 8.268 | 540 21.260 | 1,600 62.992 (Note 2) |
| **FT-H35-M2** | 3,500 137.795 | 1,600 62.992 | 1,200 47.244 | 780 30.709 | 500 19.685 | 150 5.906 | 280 11.024 | 800 31.496 |
| **FT-H20W-M1** | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,500 59.055 | 950 37.402 | 560 22.047 | 190 7.480 | 140 5.512 | 400 15.748 |
| **FT-H20-M1** | 1,600 62.992 (Note 2) | 1,600 62.992 (Note 2) | 1,300 51.181 | 780 30.709 | 500 19.685 | 150 5.906 | 280 11.024 | 840 33.071 |
| **FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S** | 1,600 62.992 (Note 2) | 960 37.795 | 740 29.134 | 450 17.717 | 290 11.417 | 80 3.150 | 150 5.906 | 410 16.142 |

**Expansion lens for vacuum fiber (Note 1) — FV-LE1**

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| **FT-H30-M1V-S** | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,400 133.858 | 1,500 59.055 | 900 35.433 | 370 14.567 | 450 17.717 | 1,600 62.992 |

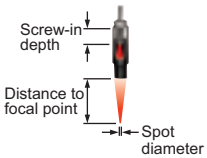
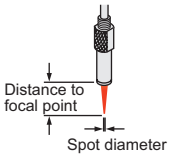
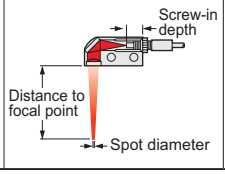
**Vacuum-resistant side-view lens (Note 1) — FV-SV2**

| Fiber \ Amplifier / Mode | FX-500 series HYPR | U-LG | LONG | STD | FAST | H-SP | FX-101□ | FX-102□ |
|---|---|---|---|---|---|---|---|---|
| **FT-H30-M1V-S** | 3,600 141.732 (Note 2) | 3,600 141.732 (Note 2) | 3,400 133.858 | 1,500 59.055 | 900 35.433 | 370 14.567 | 450 17.717 | 1,600 62.992 |

Notes: 1) Be careful sure to use it only after you have adjusted it sufficiently when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) The fiber cable length for the **FT-H30-M1V-S** is 1 m 3.28 ft. The sensing ranges in HYPR, U-LG and LONG of **FX-500** series, in **FX-102**□ take into account the length of the **FT-J8** atmospheric side fiber.
4) Refer to P.10~ for the ambient temperature of fibers to be used in combination.

# Fiber options

## Lens (For reflective type fiber)

| Designation | | Model No. | | Description | |
|---|---|---|---|---|---|
| For reflective type fiber | Pinpoint spot lens | **FX-MR1** |  | Pinpoint spot of ø0.5 mm ø0.020 in. Enables detection of minute objects or small marks.<br>• Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in • Applicable fibers: **FD-42G**, **FD-42GW**<br>• Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) | |
| | Zoom lens | **FX-MR2** |  | The spot diameter is adjustable from ø0.7 to ø2 mm ø0.028 to ø0.079 in according to how much the fiber is screwed in.<br>• Applicable fibers: **FD-42G**, **FD-42GW**<br>• Ambient temperature:-40 to +70 °C -40 to +158 °F (Note)<br>• Accessory: **MS-EX3** (mounting bracket) | **Sensing range**<br>Screw-in depth / Distance to focal point / Spot diameter<br>7 mm / 18.5 mm approx. / ø0.7 mm<br>12 mm / 27 mm approx. / ø1.2 mm<br>14 mm / 43 mm approx. / ø2.0 mm |
| | Finest spot lens | **FX-MR3** |  | Extremely fine spot of ø0.15 mm ø0.006 in approx. achieved.<br>• Applicable fibers: **FD-EG31**, **FD-EG30**, **FD-42G**, **FD-42GW**, **FD-32G**, **FD-32GX**<br>• Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) | **Sensing range**<br>Fiber model No. / Distance to focal point / Spot diameter<br>**FD-EG31** / 7.5 ± 0.5 mm / ø0.15 mm approx.<br>**FD-EG30** / 7.5 ± 0.5 mm / ø0.3 mm approx.<br>**FD-42G/42GW FD-32G/32GX** / 7.5 ± 0.5 mm / ø0.5 mm approx. |
| | Finest spot lens | **FX-MR6** | | Extremely fine spot of ø0.1 mm ø0.004 in approx. achieved.<br>• Applicable fibers: **FD-EG31**, **FD-EG30**, **FD-42G**, **FD-42GW**, **FD-32G**, **FD-32GX**<br>• Ambient temperature: -20 to +60 °C -4 to +140 °F (Note) | **Sensing range**<br>Fiber model No. / Distance to focal point / Spot diameter<br>**FD-EG31** / 7 ± 0.5 mm / ø0.1 mm approx.<br>**FD-EG30** / 7 ± 0.5 mm / ø0.2 mm approx.<br>**FD-42G/42GW FD-32G/32GX** / 7 ± 0.5 mm / ø0.4 mm approx. |
| | Zoom lens (side-view type) | **FX-MR5** |  | **FX-MR2** is converted into a side-view type and can be mounted in a very small space.<br>• Applicable fibers: **FD-42G**, **FD-42GW**<br>• Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) | **Sensing range**<br>Screw-in depth / Distance to focal point / Spot diameter<br>8 mm / 13 mm approx. / ø0.5 mm<br>10 mm / 15 mm approx. / ø0.8 mm<br>14 mm / 30 mm approx. / ø3.0 mm |

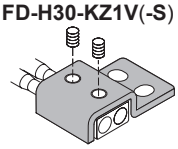
Note: Refer to P.11~ for the ambient temperature of fibers to be used in combination.

## Model No. when ordering heat-resistant fibers individually as replacement parts

- Heat-resistant side fiber one pair set
  **FT-H20-J20**, **FT-H20-J30**, **FT-H20-J50**, **FT-H20-VJ50**, **FT-H20-VJ80**

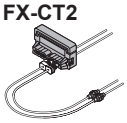
## Model No. when ordering vacuum-resistant fibers individually as replacement parts

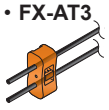
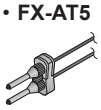
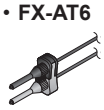
- Vacuum-resistant fiber
  **FD-H30W-M1V** (one pair set)
  **FD-H30-KZ1V**
  **FD-H30-L32V**
- Fiber at atmospheric side
  **FT-J8** (one pair set)
- Photo-terminal
  **FV-BR1** (one pair set)
- Mouting bracket for **FD-H30-KZ1V**(**-S**)
  **MS-FD-2**

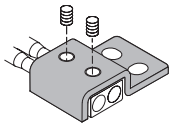


## Accessories (attached with fibers)

- **RF-003** (**FR-KZ50E/KZ50H** 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)
- **MS-FD-2** (Fiber mounting bracket)

• **RF-003** 
• **RF-13** 
• **FX-CT1** 
• **FX-CT2** 
• **FX-CT3** 

• **FX-AT2** 
• **FX-AT3** 
• **FX-AT4** 
• **FX-AT5** 
• **FX-AT6** 

• **MS-FD-2** 

# Fiber options

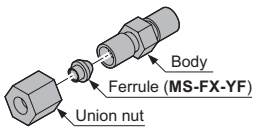
## Others

| Designation | Model No. | Description | | | | |
|---|---|---|---|---|---|---|
| Protective tube (For thru-beam type fiber) | **FTP-500** (0.5 m 1.640 ft) | For M4 thread | Applicable fibers | **FT-42** **FT-42S** **FT-42W** | **FT-43** **FT-H13-FM2** | The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces. |
| | **FTP-1000** (1 m 3.281 ft) | | | | | |
| | **FTP-1500** (1.5 m 4.921 ft) | | | | | |
| | **FTP-N500** (0.5 m 1.640 ft) | For M3 thread | | **FT-31** **FT-31S** **FT-31W** | **FD-31** **FD-31W** | |
| | **FTP-N1000** (1 m 3.281 ft) | | | | | |
| | **FTP-N1500** (1.5 m 4.921 ft) | | | | | |
| Protective tube (For reflective type fiber) | **FDP-500** (0.5 m 1.640 ft) | For M6 thread | | **FD-61** **FD-61G** **FD-61S** **FD-61W** | **FD-62** **FD-H13-FM2** | |
| | **FDP-1000** (1 m 3.281 ft) | | | | | |
| | **FDP-1500** (1.5 m 4.921 ft) | | | | | |
| | **FDP-N500** (0.5 m 1.640 ft) | For M4 thread | | **FD-41** **FD-41W** | **FD-41S** **FD-41SW** | |
| | **FDP-N1000** (1 m 3.281 ft) | | | | | |
| | **FDP-N1500** (1.5 m 4.921 ft) | | | | | |
| Fiber bender | **FB-1** | The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1) | | | | |
| Universal sensor mounting stand (Note 2) | **MS-AJ1-F** | Horizontal mounting type | | Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fiber) | | |
| | **MS-AJ2-F** | Vertical mounting type | | | | |
| Liquid inflow prevention joint (Note 2) | **MS-FX-01Y** | Applicable fibers | **FD-HF40Y** **FD-F41Y** | This joint suppresses false operations due to liquid slip-in from the top of the protective tube. | | |
| Protective tube extension joint (Note 2) | **MS-FX-02Y** | | | The protective tube can be extended. | | |
| Fiber mounting joint (Note 2) | **MS-FX-03Y** | | | The joint is used for mounting fibers on a tank. | | |
| Single core holder | **FX-AT15A** | The incident light intensity may vary when using a multi-core fiber or a thin type sharp bending fiber. This holder suppresses the variation in the incident light intensity. (Brown) | | | | |
| Reflector | **RF-210** | It is available for **FR-Z50HW**. Refer to P.22 for the sensing range of **FR-Z50HW** to be used in combination. | | | | |
| | **RF-220** | | | | | |
| | **RF-230** | | | | | |

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) The joint internal ferrule (**MS-FX-YF**) is available as a spare part. A distorted ferrule may result in leakage.

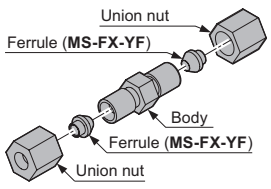
## Liquid inflow prevention joint

• **MS-FX-01Y**



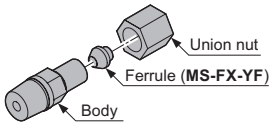

## Protective tube extension joint

• **MS-FX-02Y**



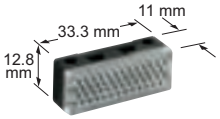

## Fiber mounting joint

• **MS-FX-03Y**

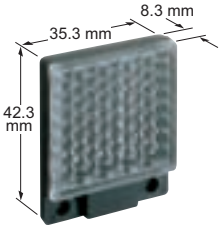



## Reflector

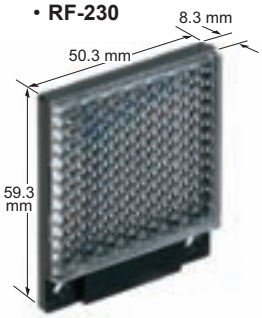
• **RF-210**




• **RF-220**

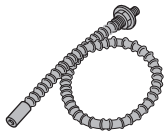



• **RF-230**



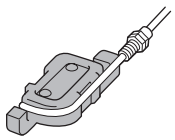

## Protective tube

• **FTP-□**
• **FDP-□**



## Fiber bender

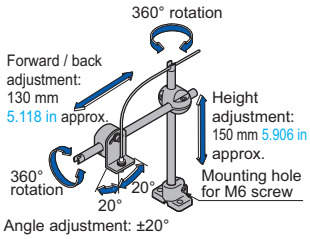
• **FB-1**



## Universal sensor mounting stand

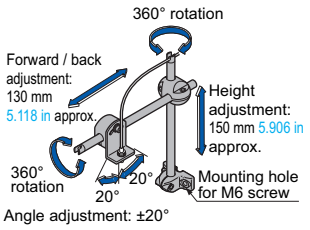
Using the arm which enables adjustment in the horizontal direction, sensing can also be done from above an assembly line.

• **MS-AJ1-F**




Angle adjustment: ±20°

• **MS-AJ2-F**




Angle adjustment: ±20°

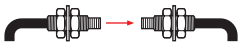
## Single core holder

• **FX-AT15A**

# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## Thru-beam type fibers

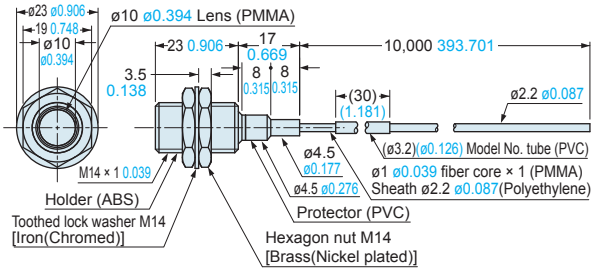


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FT-140

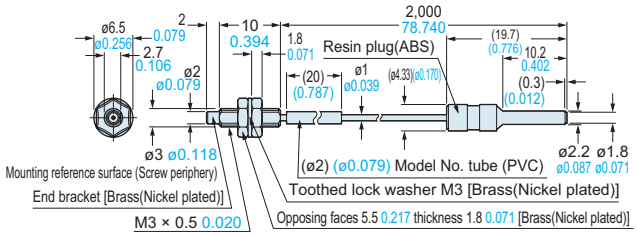
Free-cut

<with **FX-AT3**>




### FT-30

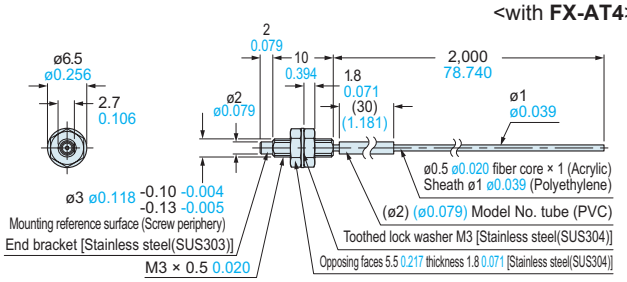
<with **FX-AT2**>




### FT-31

Free-cut

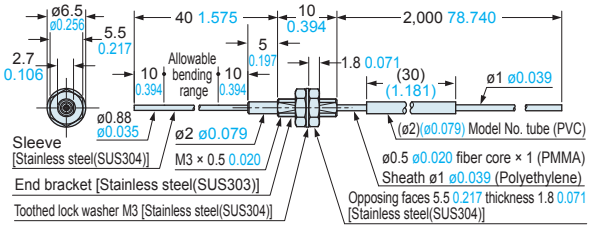
<with **FX-AT4**>




### FT-31S

Free-cut

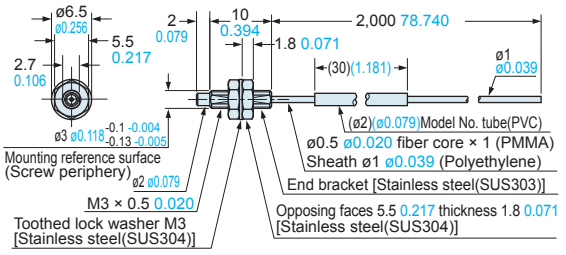
<with **FX-AT4**>




### FT-31W

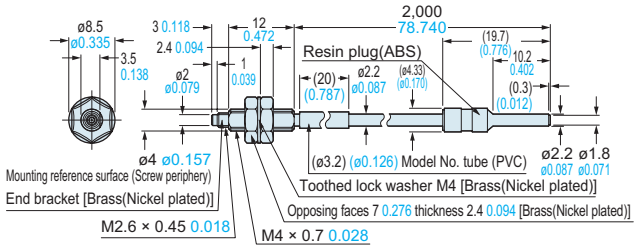
Free-cut

<with **FX-AT4**>




### FT-40

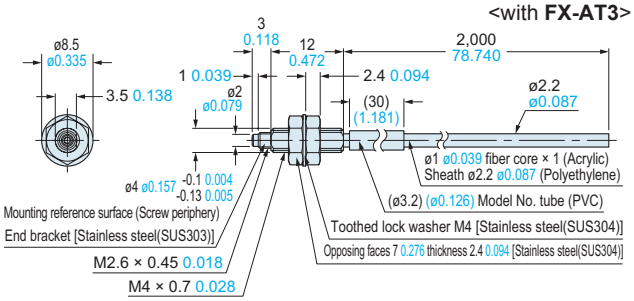
<with **FX-AT2**>




### FT-42

Free-cut

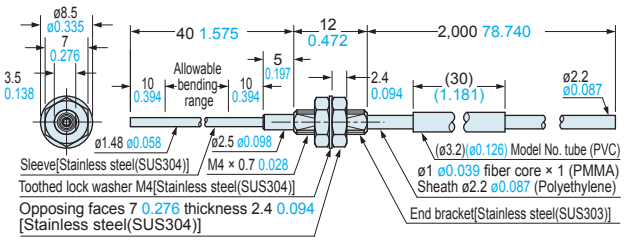
<with **FX-AT3**>




### FT-42S

Free-cut

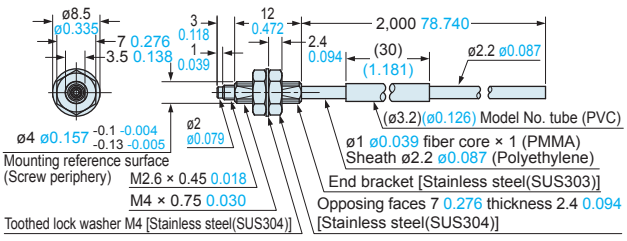
<with **FX-AT3**>




### FT-42W

Free-cut

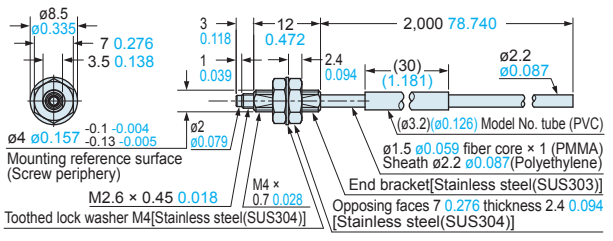
<with **FX-AT3**>




### FT-43

Free-cut

<with **FX-AT3**>



# DIMENSIONS (Unit: mm in)

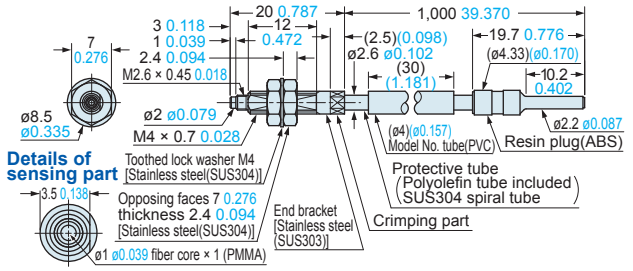
Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## Thru-beam type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FT-45X

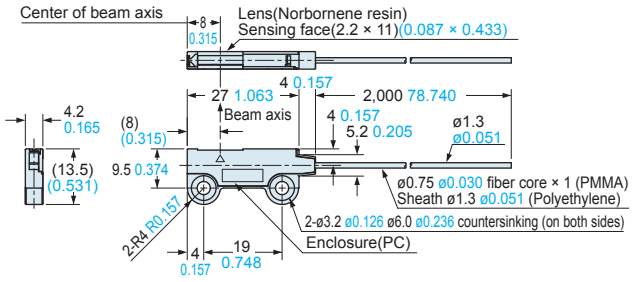
<with **FX-AT2**>




### FT-A11

Free-cut

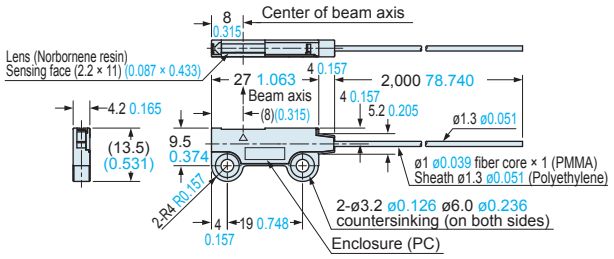
<with **FX-AT5**>




### FT-A11W

Free-cut

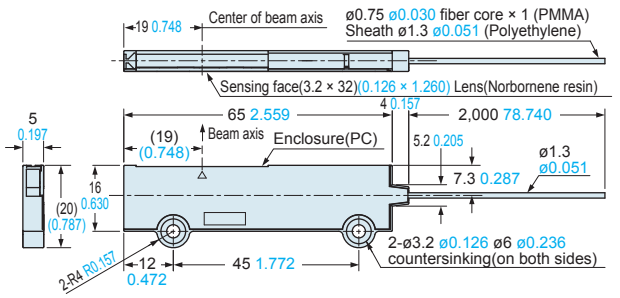
<with **FX-AT5**>




### FT-A32

Free-cut

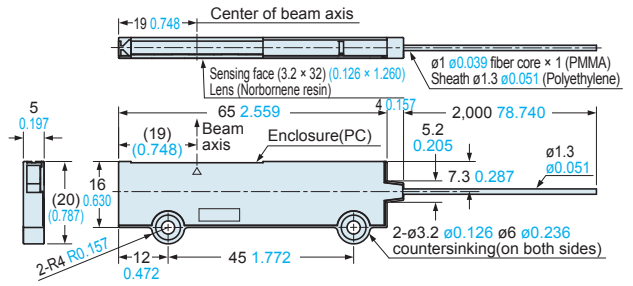
<with **FX-AT5**>




### FT-A32W

Free-cut

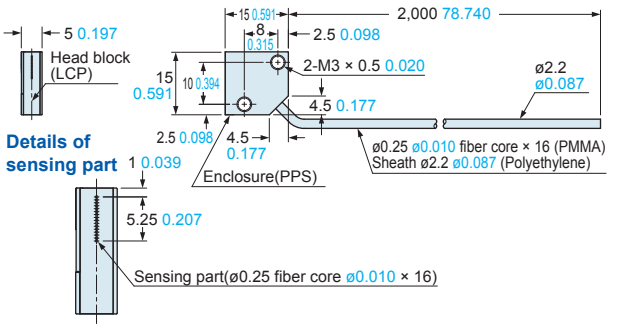
<with **FX-AT5**>




### FT-AL05

Free-cut

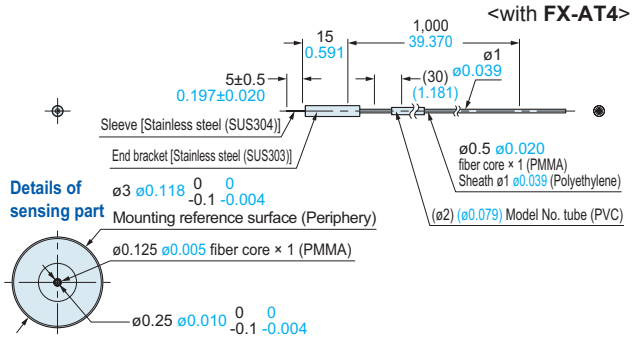
<with **FX-AT3**>




### FT-E13

Free-cut

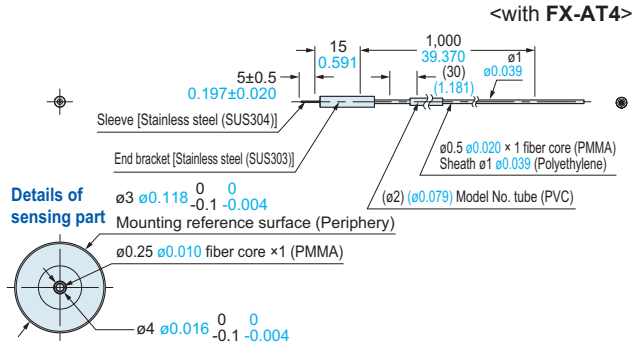
<with **FX-AT4**>




### FT-E23

Free-cut

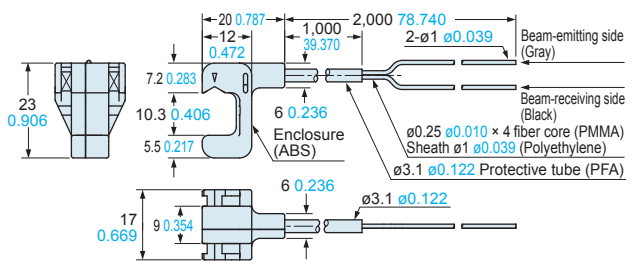
<with **FX-AT4**>




### FT-F93

Free-cut

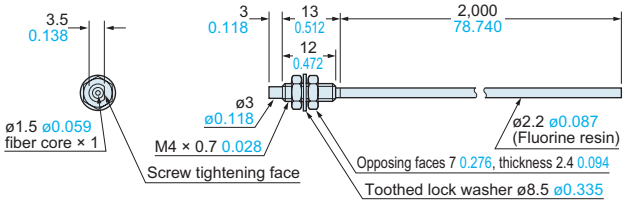
<with **FX-AT4**>




### FT-H13-FM2

Free-cut

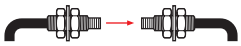
<with **FX-AT3**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

## Thru-beam type fibers

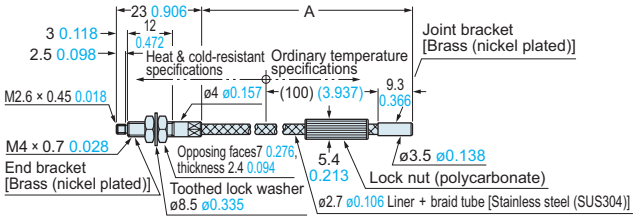


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

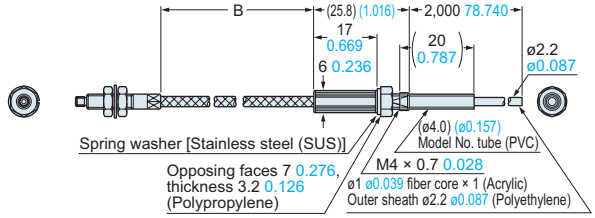
### FT-H20-J20-S FT-H20-J30-S FT-H20-J50-S ✂ Free-cut (Note)

<with **FX-AT3**>

#### Heat-resistant side unit diagram (side view)



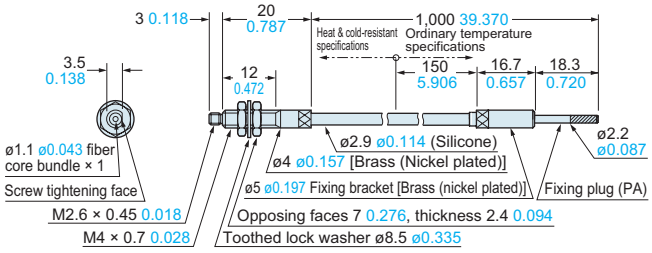

#### Ordinary temperature side fiber (FT-FM2) connection diagram (front view)



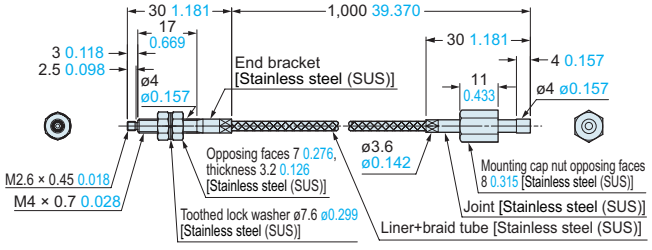

| Model No. | A | B |
|---|---|---|
| **FT-H20-J20-S** | 200 $^{+25}_{0}$ 7.874 $^{+0.984}_{0}$ | 185 $^{+30}_{0}$ 7.284 $^{+1.181}_{0}$ |
| **FT-H20-J30-S** | 300 $^{+25}_{0}$ 11.811 $^{+0.984}_{0}$ | 285 $^{+30}_{0}$ 11.221 $^{+1.181}_{0}$ |
| **FT-H20-J50-S** | 500 $^{+25}_{0}$ 19.685 $^{+0.984}_{0}$ | 485 $^{+30}_{0}$ 19.095 $^{+1.181}_{0}$ |

Note: Ordinary temperature side fiber (**FT-FM2**) only.

### FT-H20-M1

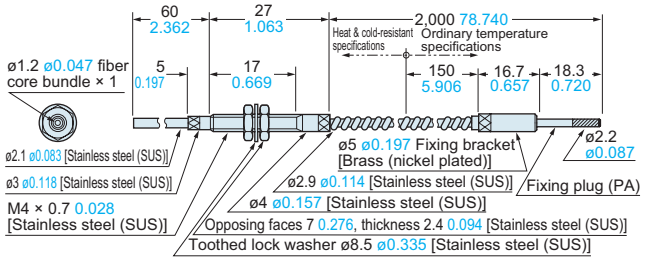



### FT-H30-M1V-S




Note: The **FT-H30-M1V-S** is a set with the **FT-H30-M1V**, photo-terminal **FV-BR1**, and atmospheric side fiber **FT-J8**. Refer to p.51 for dimensions of the atmospheric side fiber and photo-terminals.

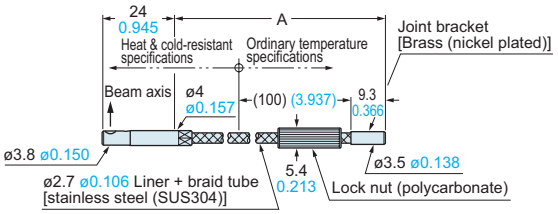
### FT-H35-M2S6



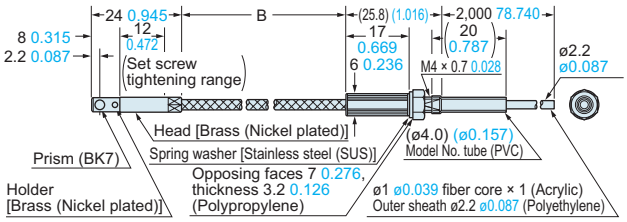

### FT-H20-VJ50-S FT-H20-VJ80-S ✂ Free-cut (Note)

<with **FX-AT3**>

#### Heat-resistant side unit diagram (side view)




#### Ordinary temperature side fiber (FT-FM2) connection diagram (front view)

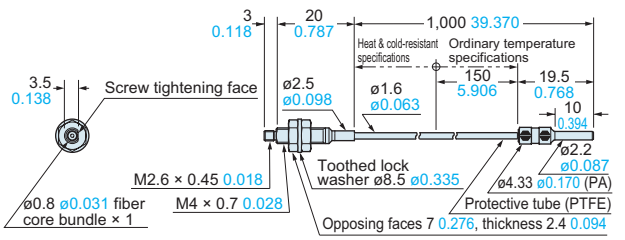



| Model No. | A | B |
|---|---|---|
| **FT-H20-VJ50-S** | 500 $^{+25}_{0}$ 19.685 $^{+0.984}_{0}$ | 485 $^{+30}_{0}$ 19.095 $^{+1.181}_{0}$ |
| **FT-H20-VJ80-S** | 800 $^{+50}_{0}$ 31.496 $^{+1.969}_{0}$ | 785 $^{+55}_{0}$ 30.906 $^{+2.165}_{0}$ |

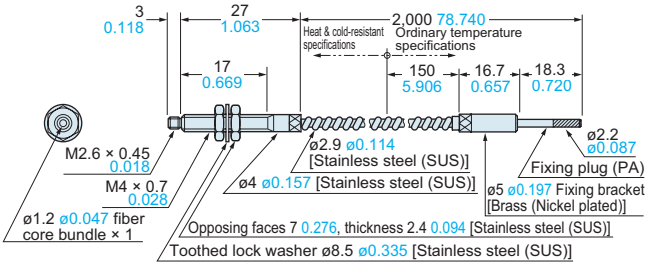
Note: Ordinary temperature side fiber (**FT-FM2**) only.

### FT-H20W-M1

<with **FX-AT2**>

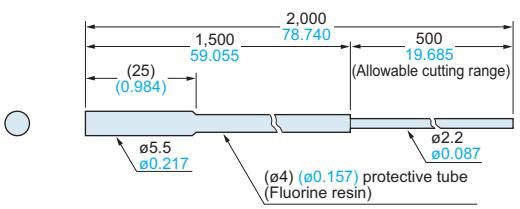



### FT-H35-M2




### FT-HL80Y ✂ Free-cut

<with **FX-AT3**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

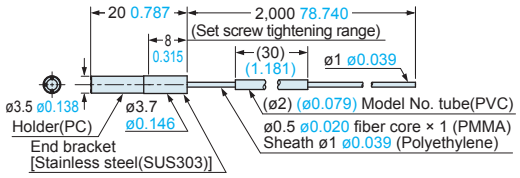
## Thru-beam type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FT-KS40

Free-cut

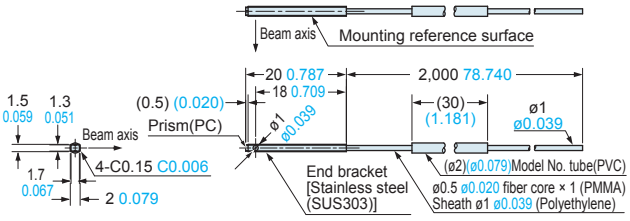
<with **FX-AT4**>




### FT-KV26

Free-cut

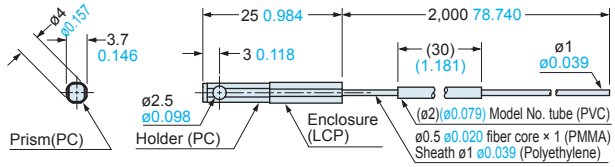
<with **FX-AT4**>



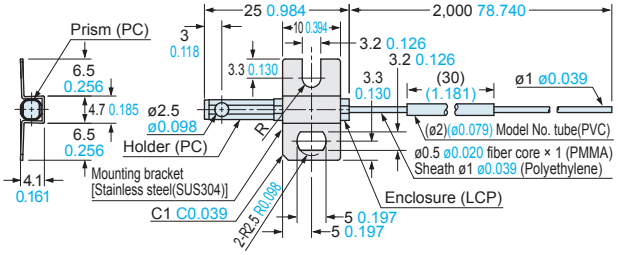

### FT-KV40, FT-KV40W

Free-cut

<with **FX-AT4**>



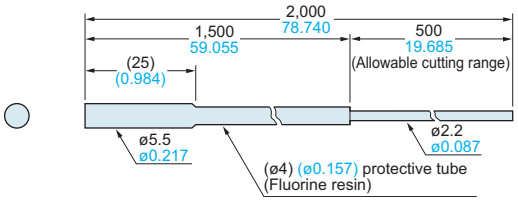

#### Assembly dimensions with MS-FD-3 (attached mounting bracket)




### FT-L80Y

Free-cut

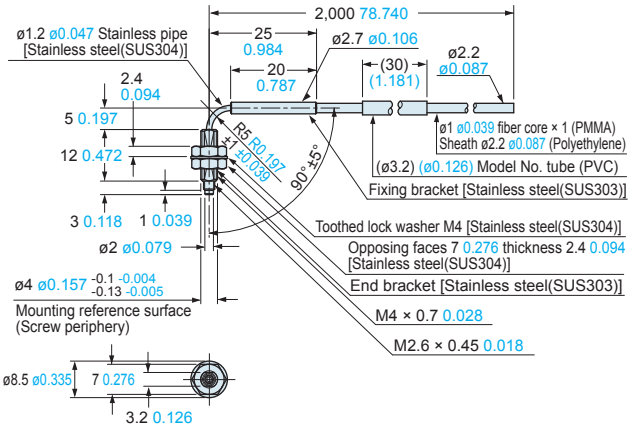
<with **FX-AT3**>




### FT-R40

Free-cut

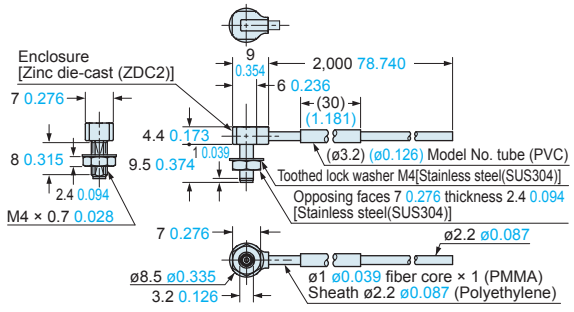
<with **FX-AT3**>




### FT-R41W

Free-cut

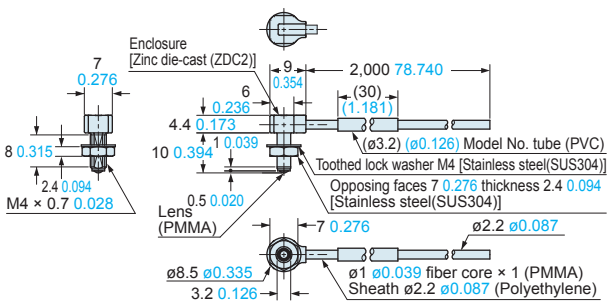
<with **FX-AT3**>




### FT-R42W

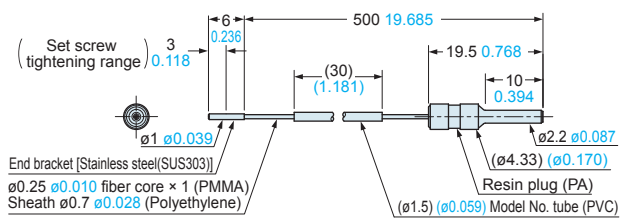
Free-cut

<with **FX-AT3**>




### FT-S11

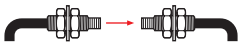
<with **FX-AT2**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

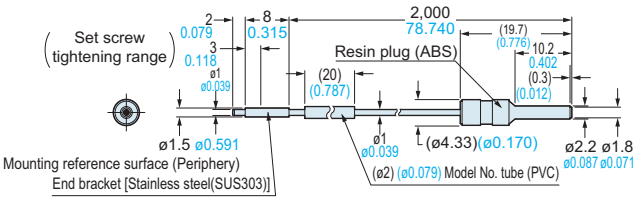
## Thru-beam type fibers



Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

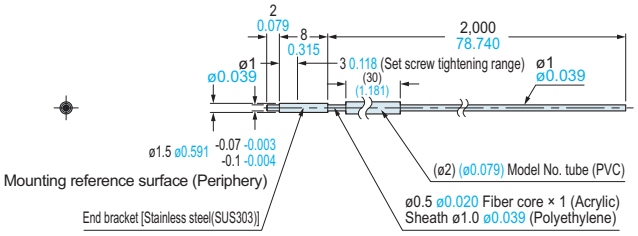
### FT-S20

<with **FX-AT2**>



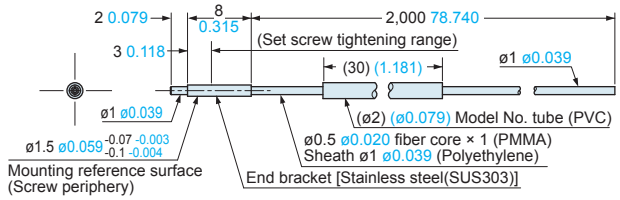

### FT-S21 Free-cut

<with **FX-AT4**>



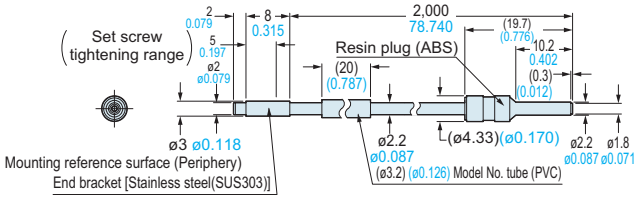

### FT-S21W Free-cut

<with **FX-AT4**>



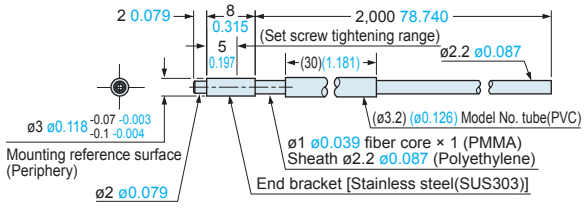

### FT-S30

<with **FX-AT2**>



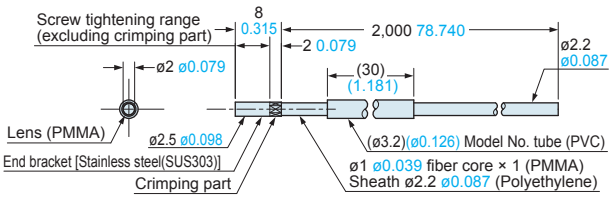

### FT-S31W Free-cut

<with **FX-AT3**>



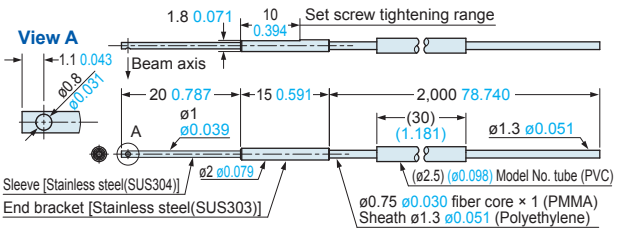

### FT-S32 Free-cut

<with **FX-AT3**>



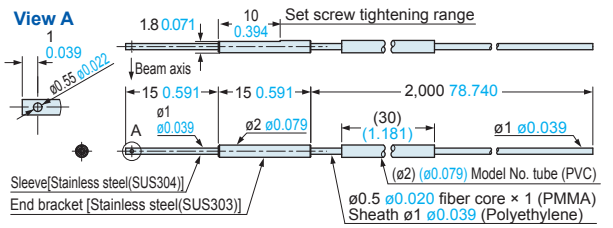

### FT-V23 Free-cut

<with **FX-AT5**>



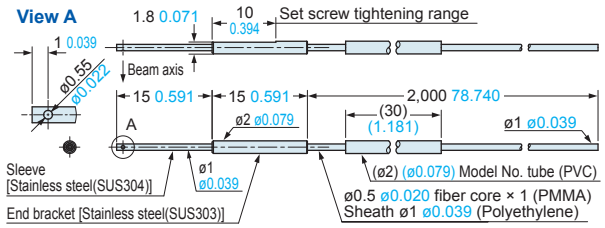

### FT-V24W Free-cut

<with **FX-AT4**>



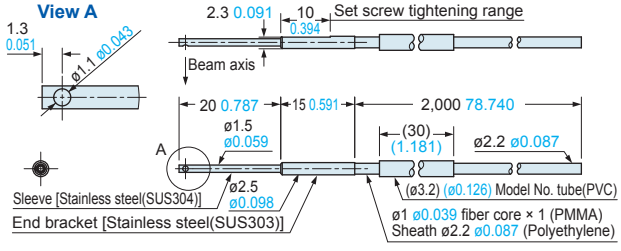

### FT-V25 Free-cut

<with **FX-AT4**>




### FT-V30 Free-cut

<with **FX-AT3**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

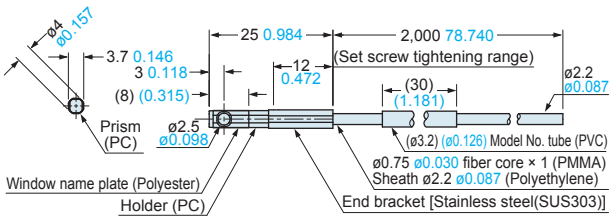
## Thru-beam type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FT-V40

Free-cut

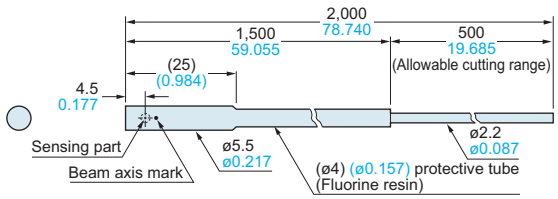
<with **FX-AT3**>




### FT-V80Y

Free-cut

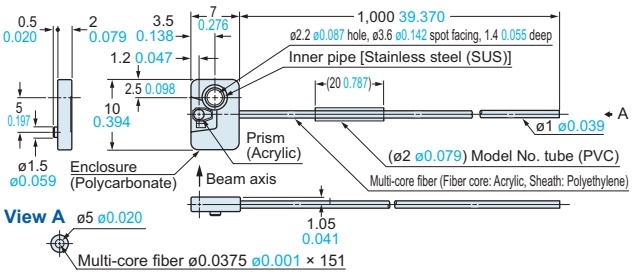
<with **FX-AT3**>




### FT-WZ4

Free-cut

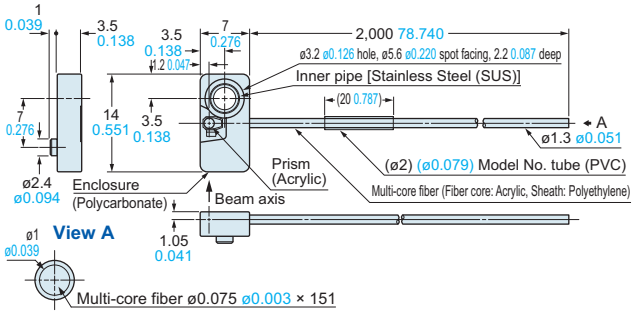
<with **FX-AT4**>




### FT-WZ7

Free-cut

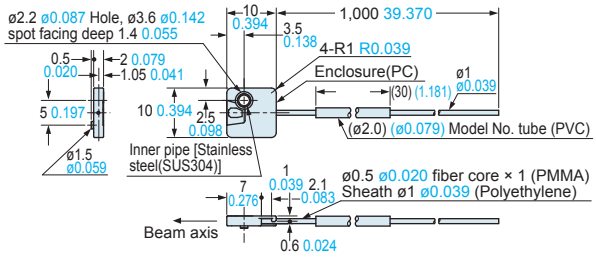
<with **FX-AT5**>




### FT-Z20HBW

Free-cut

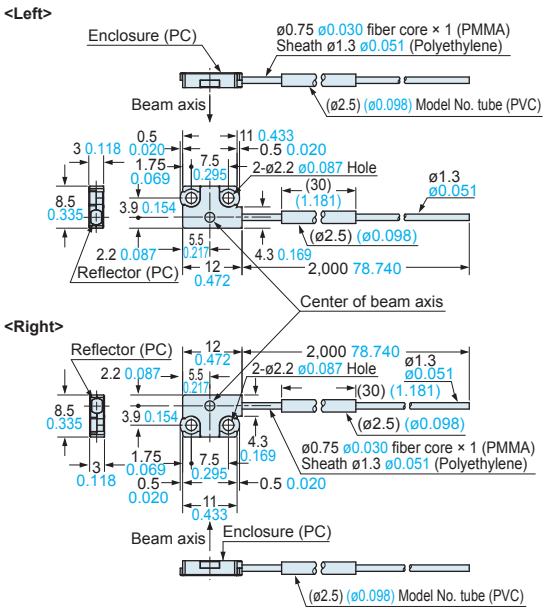
<with **FX-AT4**>




### FT-Z30

Free-cut

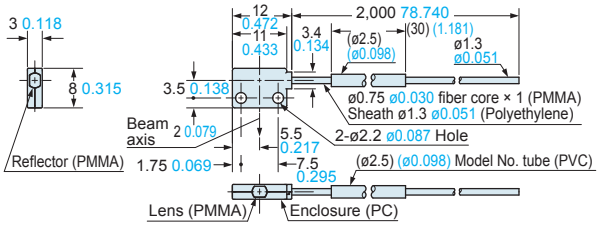
<with **FX-AT5**>




### FT-Z30E

Free-cut

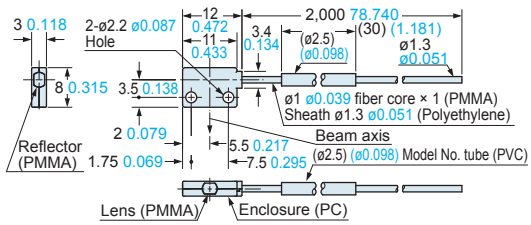
<with **FX-AT5**>




### FT-Z30EW

Free-cut

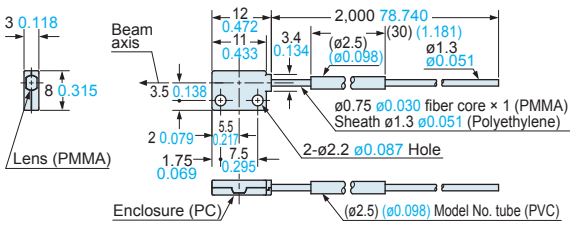
<with **FX-AT5**>




### FT-Z30H

Free-cut

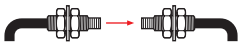
<with **FX-AT5**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## Thru-beam type fibers

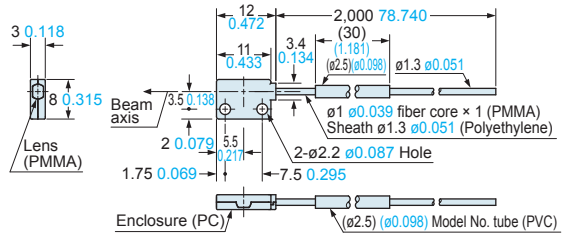


Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FT-Z30HW

Free-cut

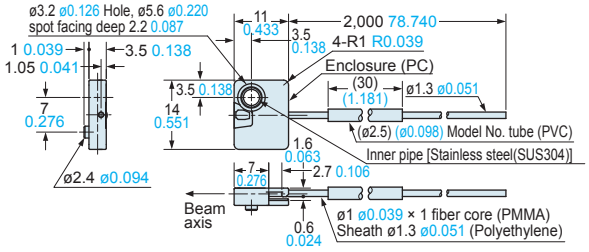
<with **FX-AT5**>




### FT-Z40HBW

Free-cut

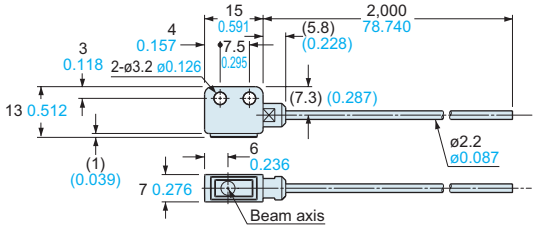
<with **FX-AT5**>




### FT-Z802Y

Free-cut

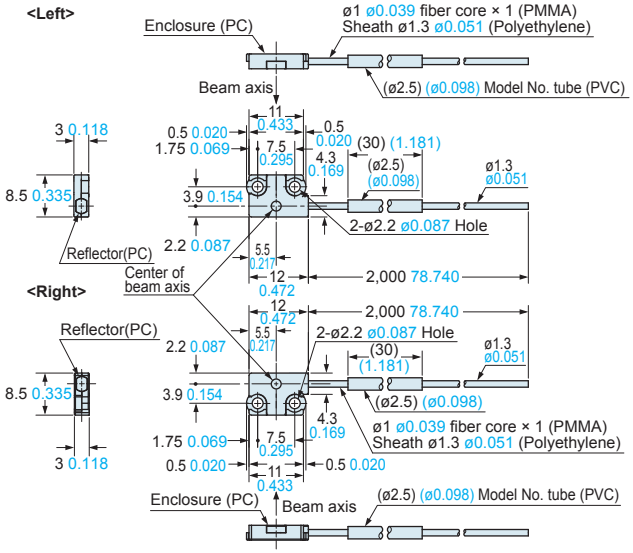
<with **FX-AT3**>




### FT-Z30W

Free-cut

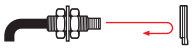
<with **FX-AT5**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## Retroreflective type fibers



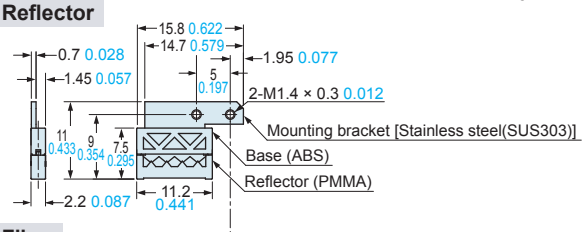
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FR-KZ22E

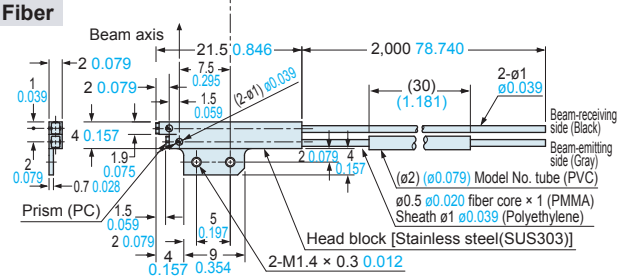
Free-cut

<with **FX-AT4**>

**Reflector**




**Fiber**

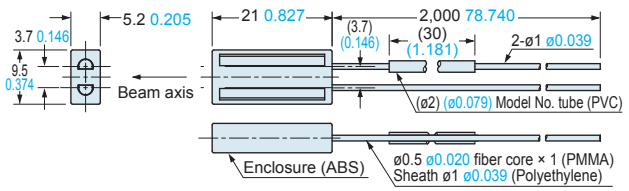



### FR-KZ50H

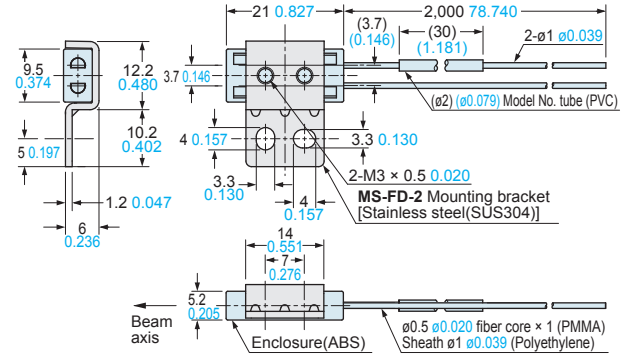
Free-cut

<with **FX-AT4**>

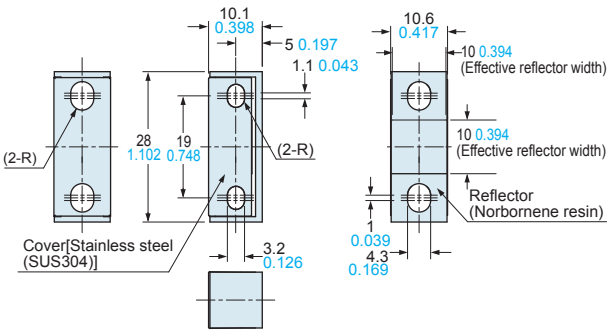
**Fiber**




**Assembly dimensions with MS-FD-2 (attached mounting bracket)**




**Reflector RF-003** (Accessory for **FR-KZ50H**)

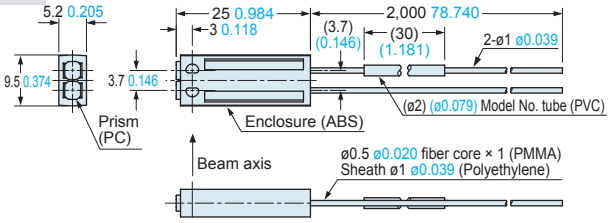



### FR-KZ50E

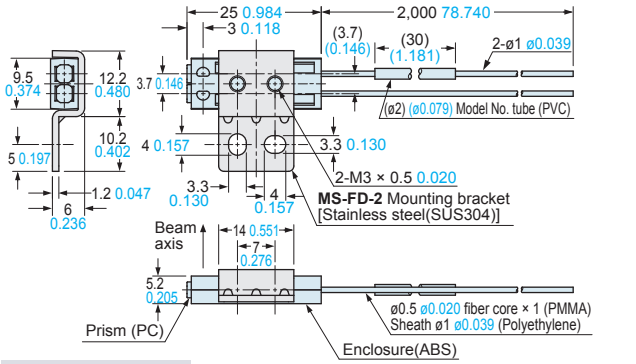
Free-cut

<with **FX-AT4**>

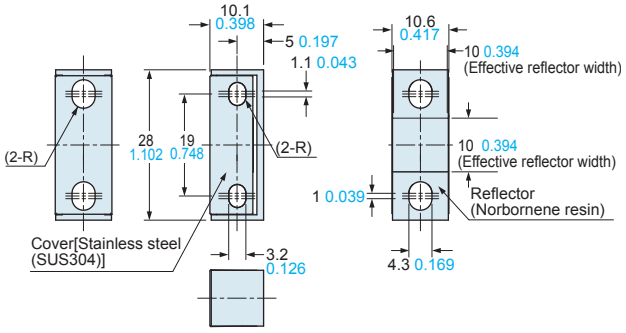
**Fiber**




**Assembly dimensions with MS-FD-2 (attached mounting bracket)**




**Reflector RF-003** (Accessory for **FR-KZ50E**)

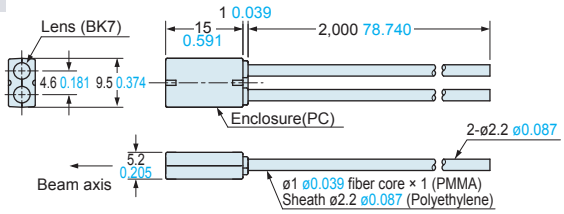



### FR-Z50HW

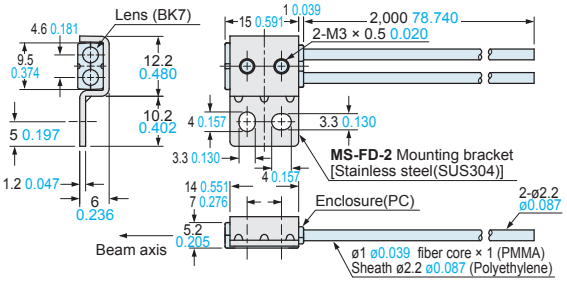
Free-cut

<with **FX-AT3**>

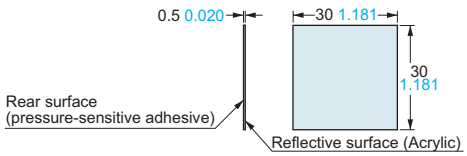
**Fiber**




**Assembly dimensions with MS-FD-2 (attached mounting bracket)**




**Reflective tape RF-13** (Accessory for **FR-Z50HW**)



# DIMENSIONS (Unit: mm in)

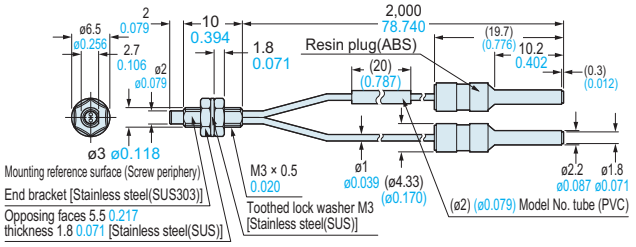
Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

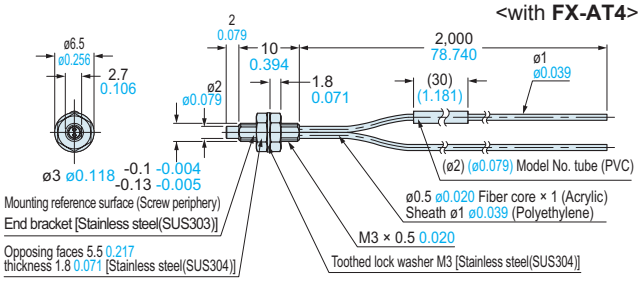
### FD-30

<with **FX-AT2**>



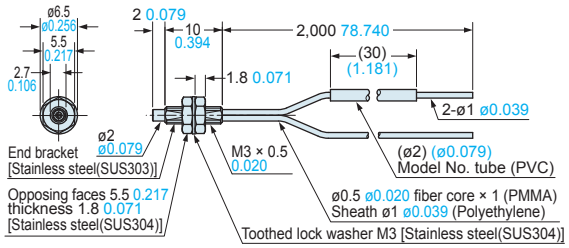

### FD-31 Free-cut

<with **FX-AT4**>



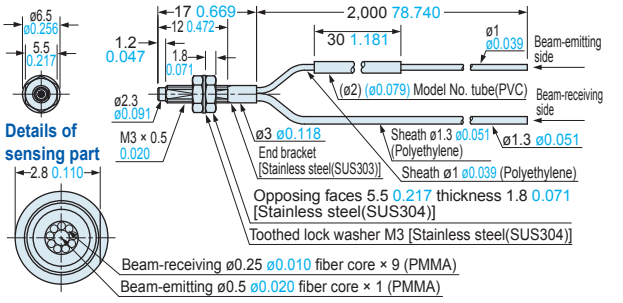

### FD-31W Free-cut

<with **FX-AT4**>



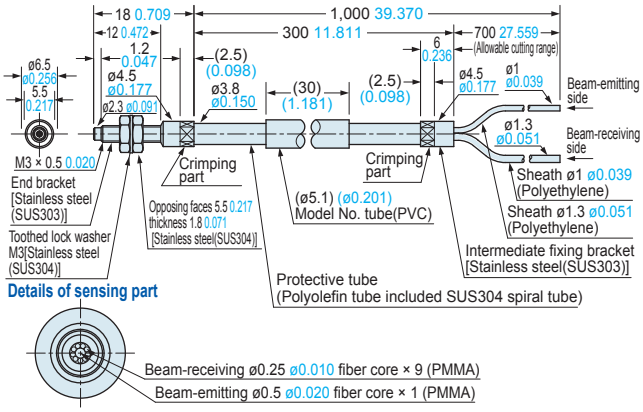

### FD-32G Free-cut

<with **FX-AT6**>



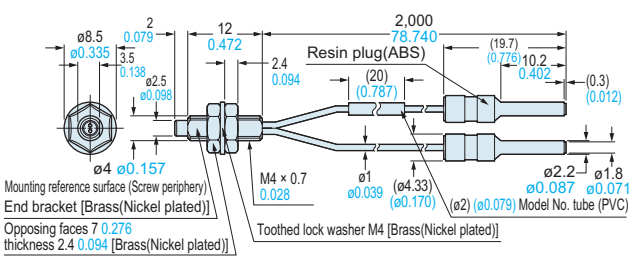

### FD-32GX Free-cut

<with **FX-AT6**>



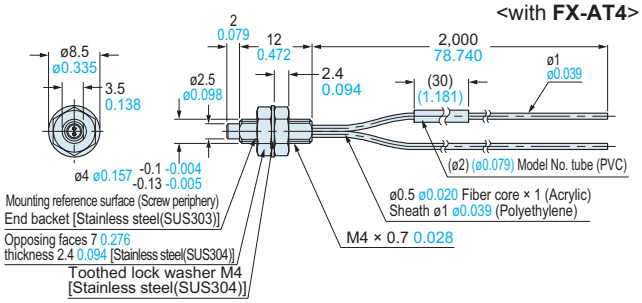

### FD-40

<with **FX-AT2**>



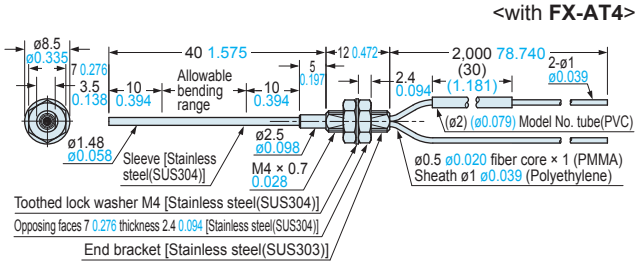

### FD-41 Free-cut

<with **FX-AT4**>



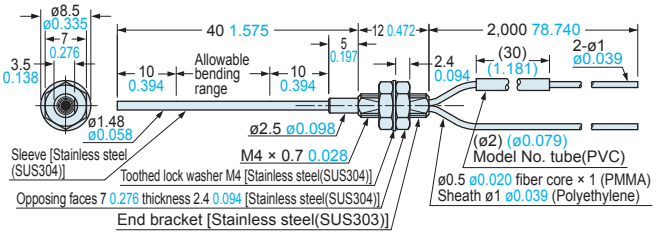

### FD-41S Free-cut

<with **FX-AT4**>



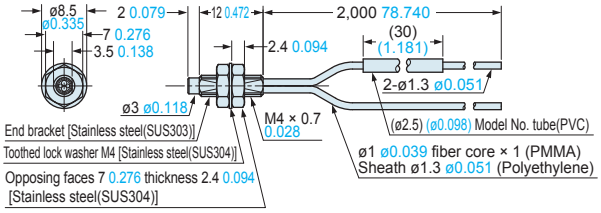

### FD-41SW Free-cut

<with **FX-AT4**>




### FD-41W Free-cut

<with **FX-AT5**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

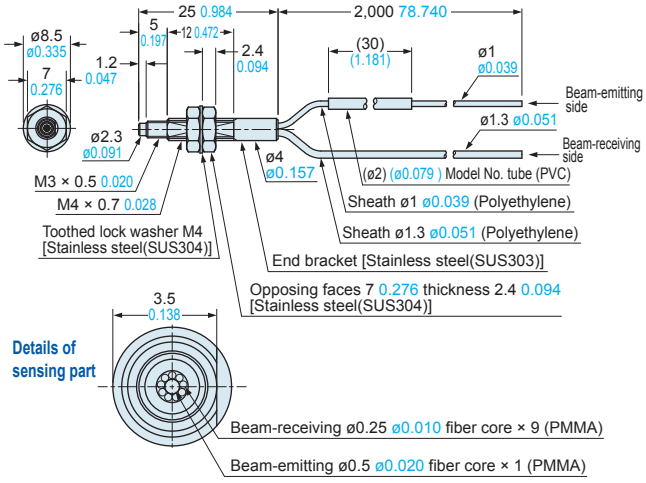
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-42G

Free-cut

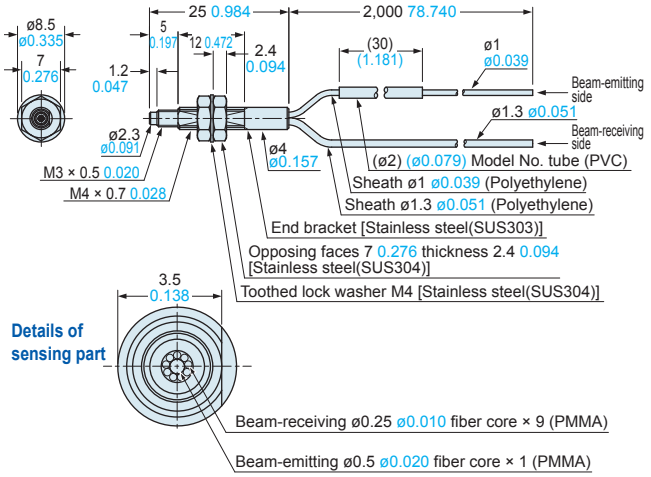
<with **FX-AT6**>




### FD-42GW

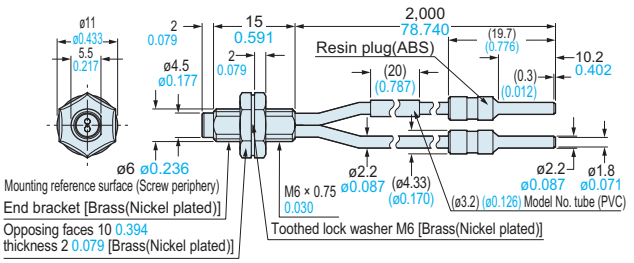
Free-cut

<with **FX-AT6**>




### FD-60

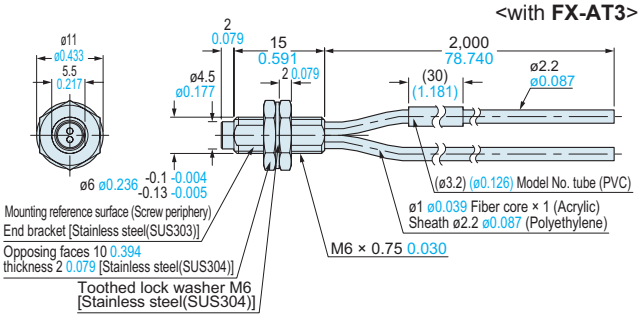
<with **FX-AT2**>




### FD-61

Free-cut

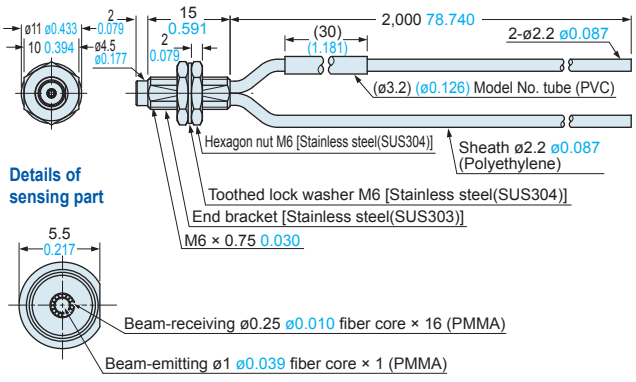
<with **FX-AT3**>




### FD-61G

Free-cut

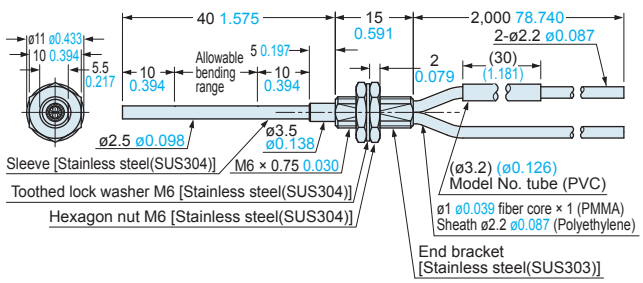
<with **FX-AT3**>




### FD-61S

Free-cut

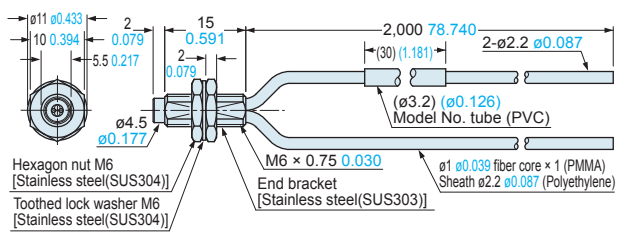
<with **FX-AT3**>




### FD-61W

Free-cut

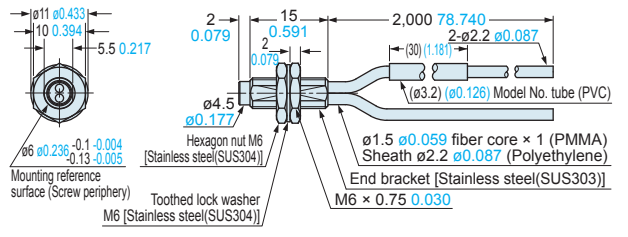
<with **FX-AT3**>




### FD-62

Free-cut

<with **FX-AT3**>



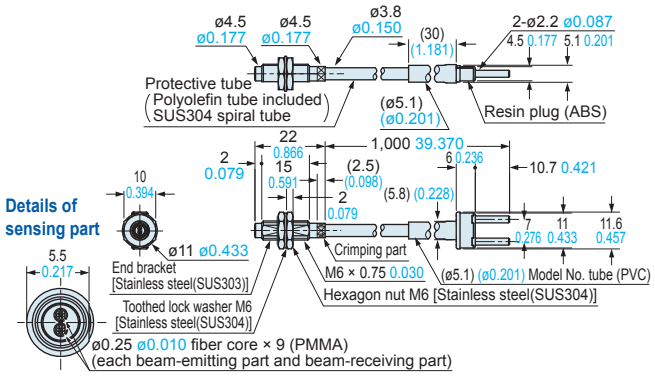
# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

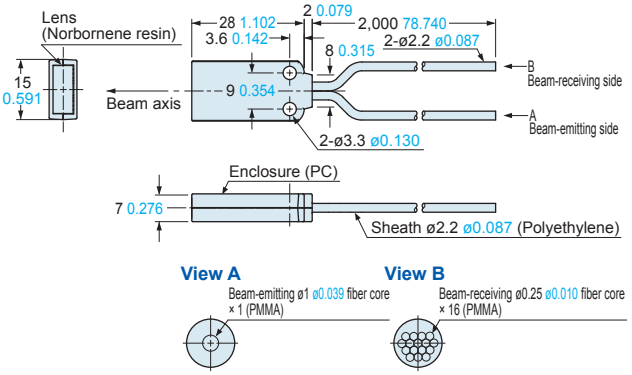
### FD-64X




### FD-A16

Free-cut

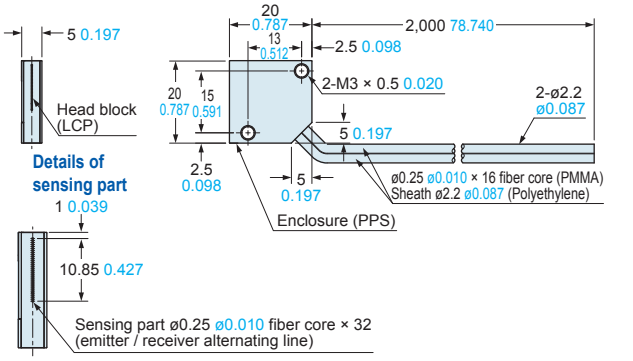
<with **FX-AT3**>



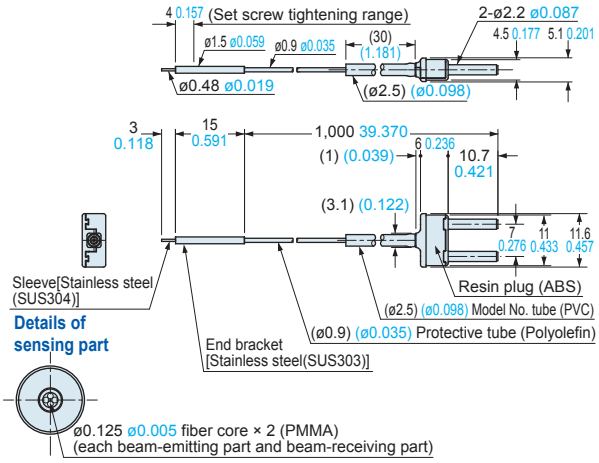

### FD-AL11

Free-cut

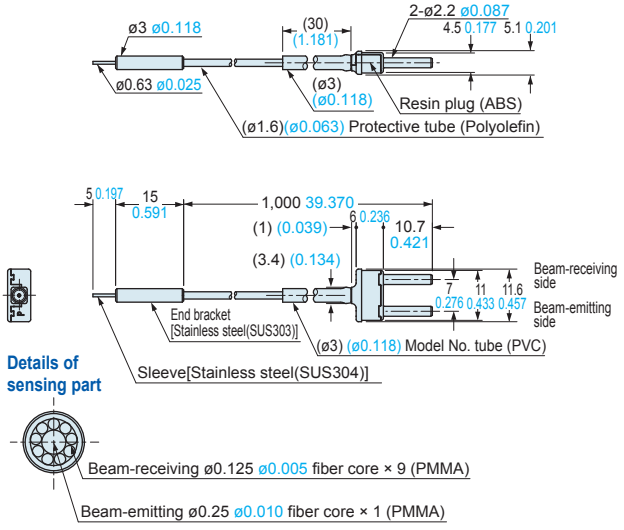
<with **FX-AT3**>



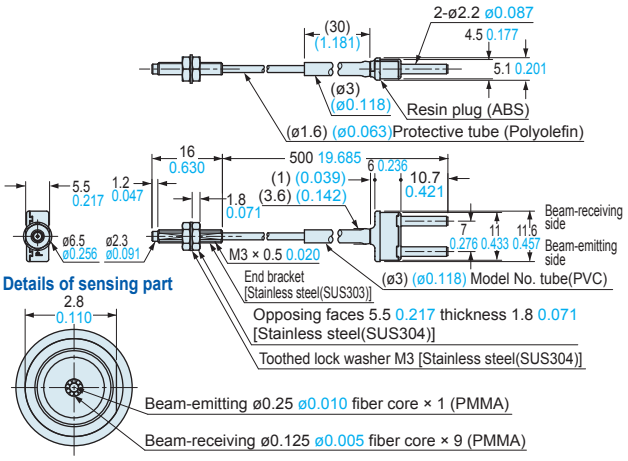

### FD-E13




### FD-E23




### FD-EG30



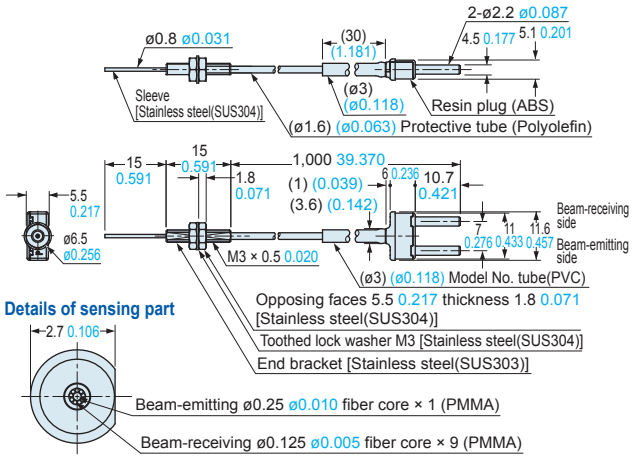
# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

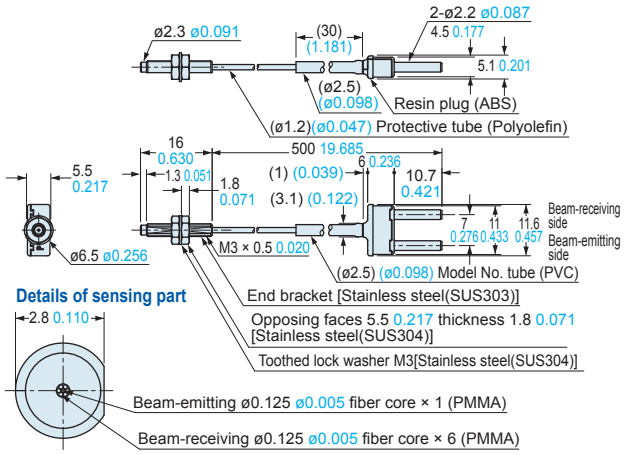
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-EG30S



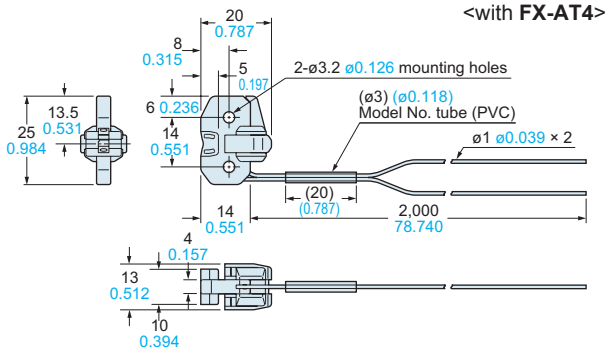

### FD-EG31




### FD-F4 FD-F41

Free-cut

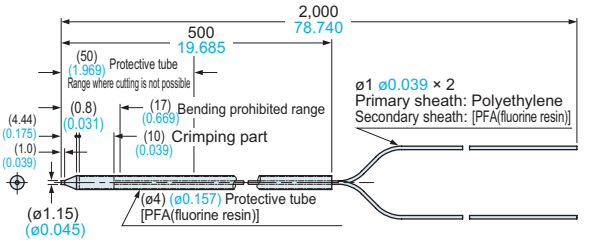
<with **FX-AT4**>




### FD-F41Y

Free-cut

<with **FX-AT4**>

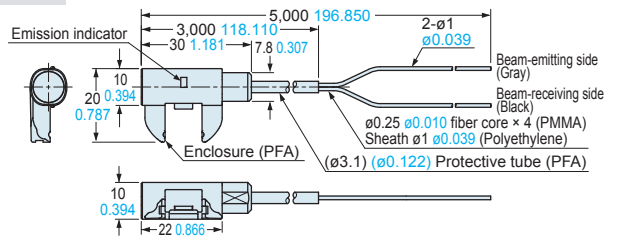



### FD-F71

Free-cut

<with **FX-AT4**>

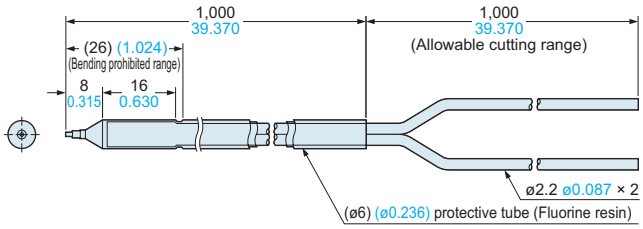
**Fiber**



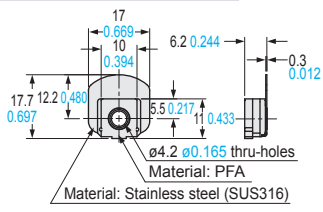

### FD-F8Y

Free-cut

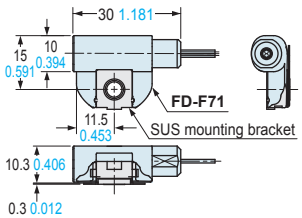
<with **FX-AT3**>



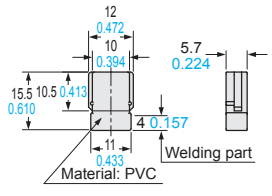

### SUS mounting bracket



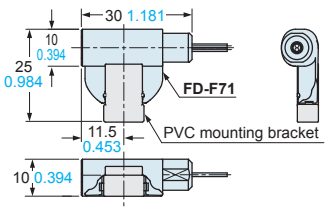

### Assembly dimensions




### PVC mounting bracket



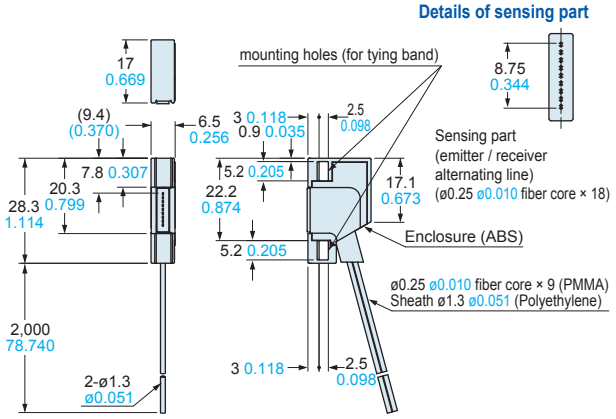

### Assembly dimensions




### FD-FA93

Free-cut

<with **FX-AT15A**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

## Reflective type fibers

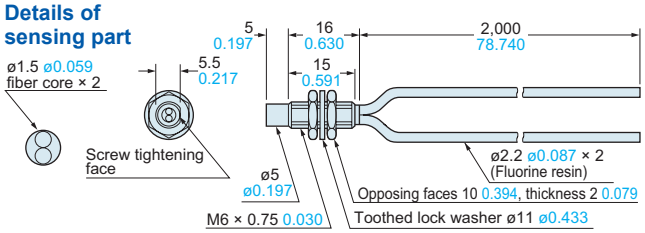
Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-H13-FM2

Free-cut

<with **FX-AT3**>

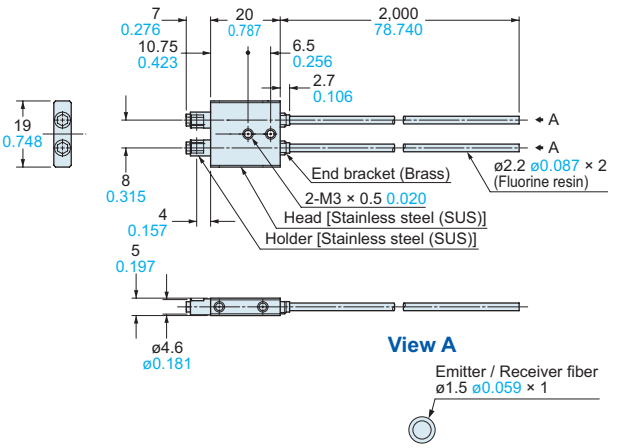
**Details of sensing part**




### FD-H18-L31

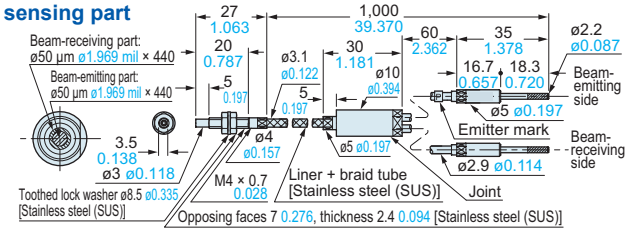
Free-cut

<with **FX-AT3**>



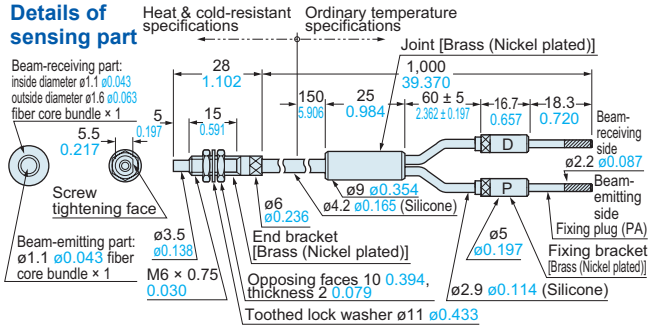

### FD-H20-21

**Details of sensing part**



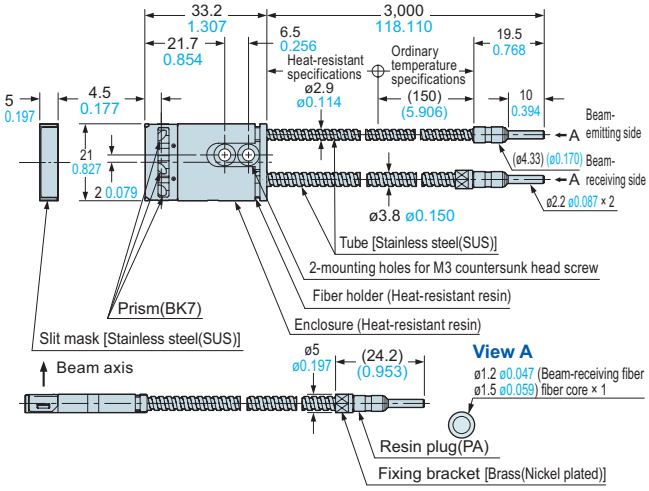

### FD-H20-M1

**Details of sensing part**



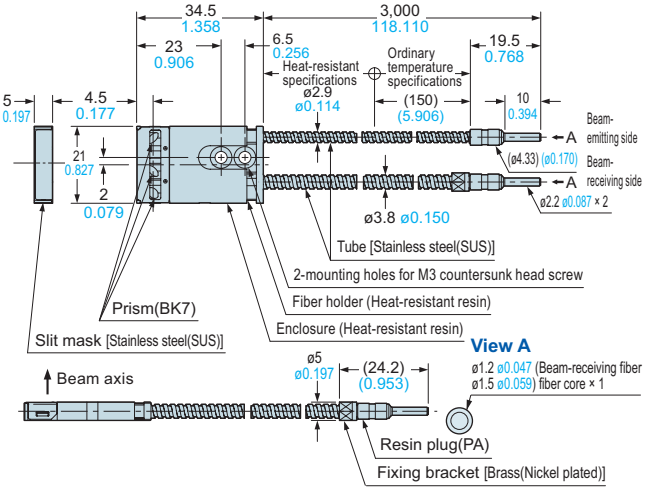

### FD-H25-L43

<with **FX-AT2**>




### FD-H25-L45

<with **FX-AT2**>



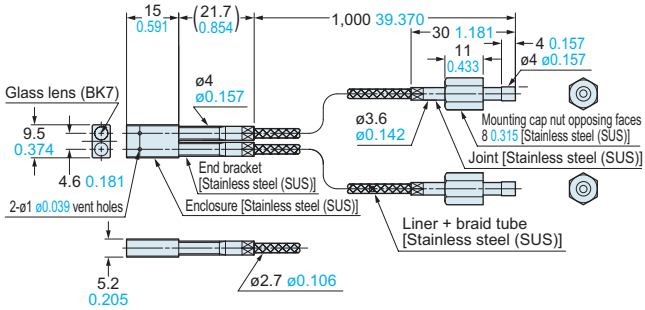
# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

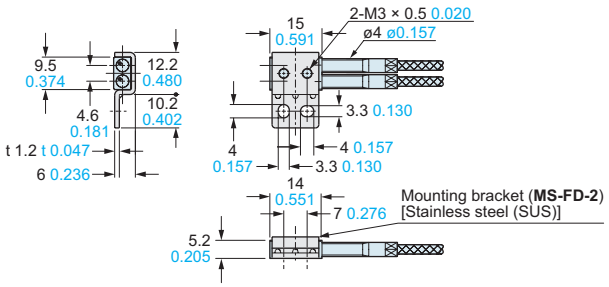
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-H30-KZ1V-S

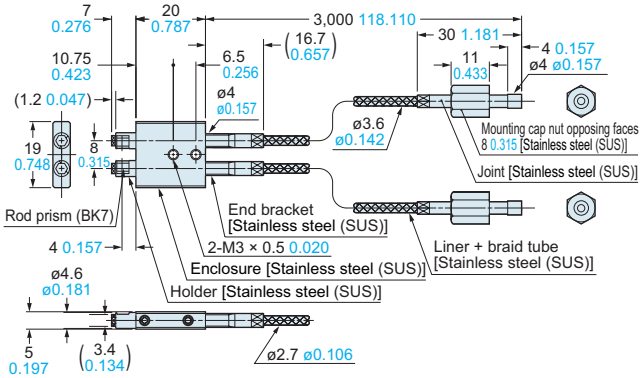



#### Assembly dimensions with MS-FD-2 (attached mounting bracket)



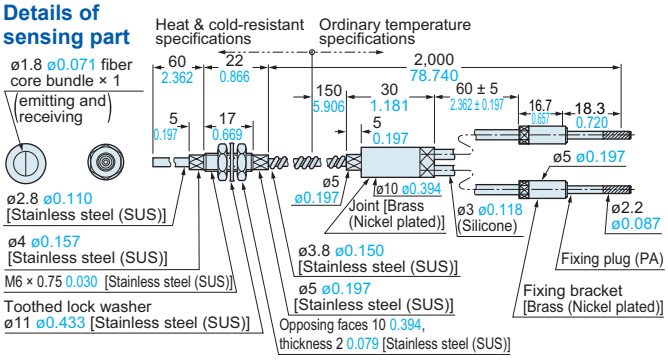

Note: The **FD-H30-KZ1V-S** is a set with the **FD-H30-KZ1V**, photo-terminal **FV-BR1**, and atmospheric side fiber **FT-J8**. Refer to p.51 for dimensions of the atmospheric side fiber and photo-terminals.

### FD-H30-L32V-S

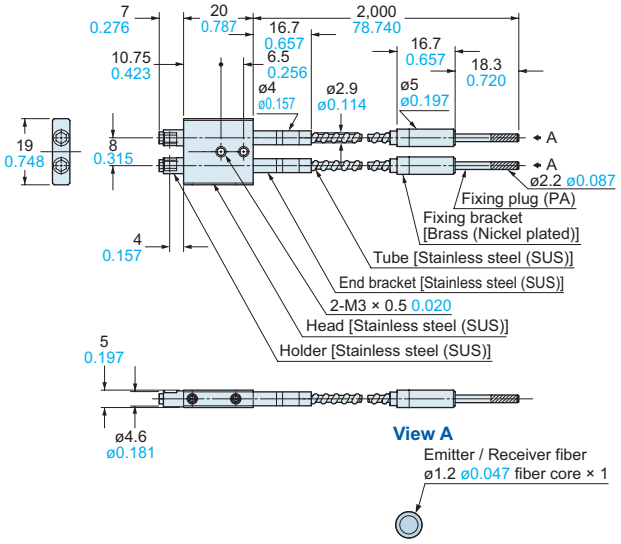



Note: The **FD-H30-L32V-S** is a set with the **FD-H30-L32V**, photo-terminal **FV-BR1**, and atmospheric side fiber **FT-J8**. Refer to p.51 for dimensions of the atmospheric side fiber and photo-terminals.

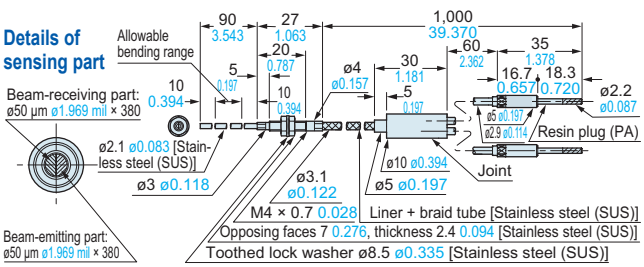
### FD-H35-M2S6



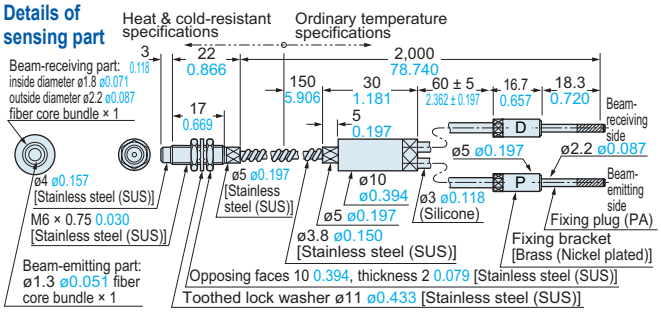

### FD-H30-L32




### FD-H35-20S



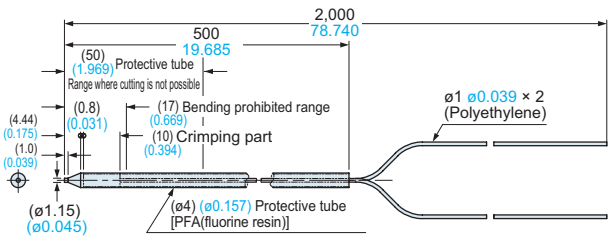

### FD-H35-M2




### FD-HF40Y

Free-cut

<with **FX-AT4**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

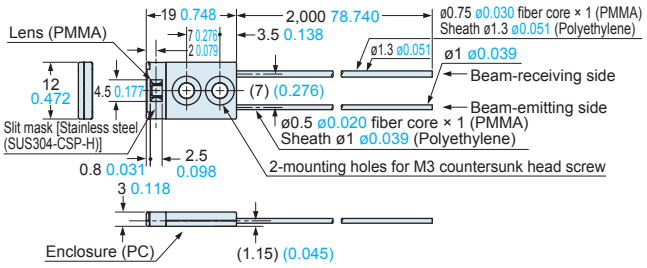
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-L10

Free-cut

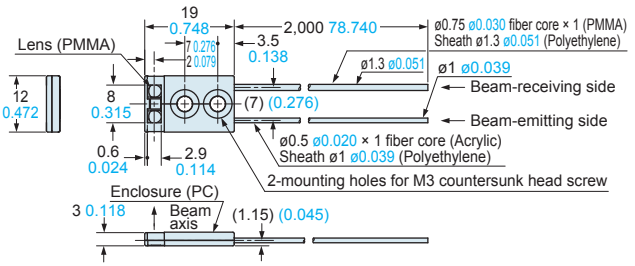
<with **FX-AT6**>




### FD-L11

Free-cut

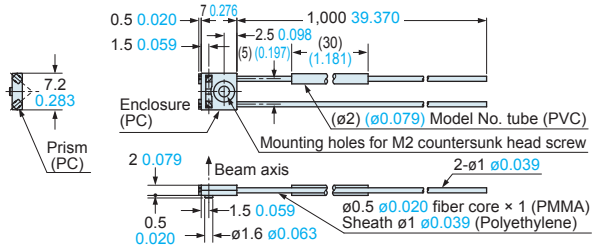
<with **FX-AT6**>




### FD-L12W

Free-cut

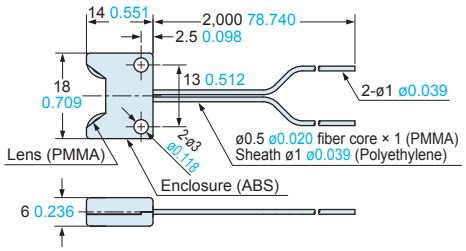
<with **FX-AT4**>




### FD-L20H

Free-cut

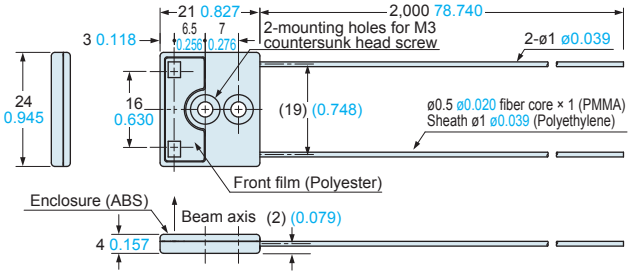
<with **FX-AT4**>




### FD-L21

Free-cut

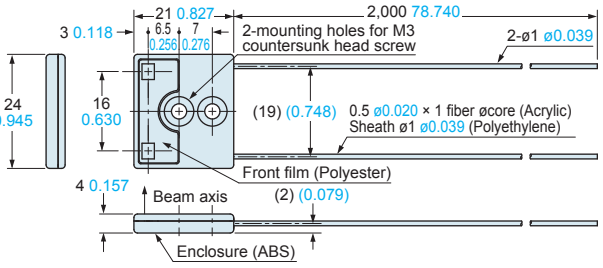
<with **FX-AT4**>




### FD-L21W

Free-cut

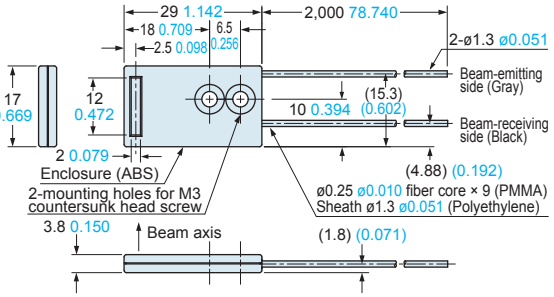
<with **FX-AT4**>




### FD-L22A

Free-cut

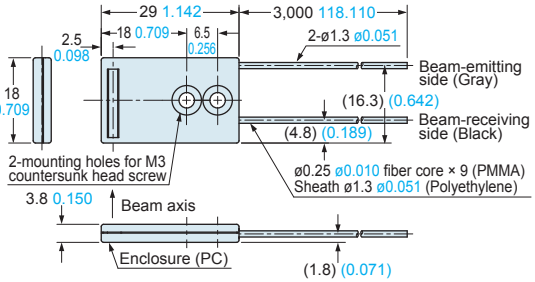
<with **FX-AT5**>




### FD-L23

Free-cut

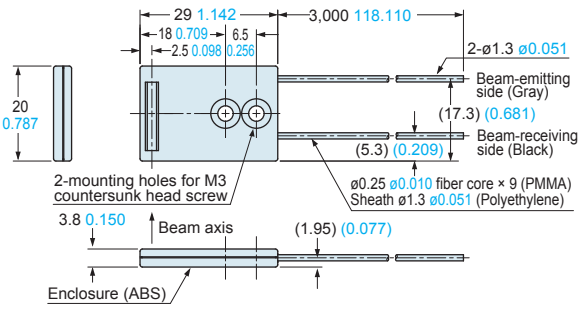
<with **FX-AT5**>




### FD-L30A

Free-cut

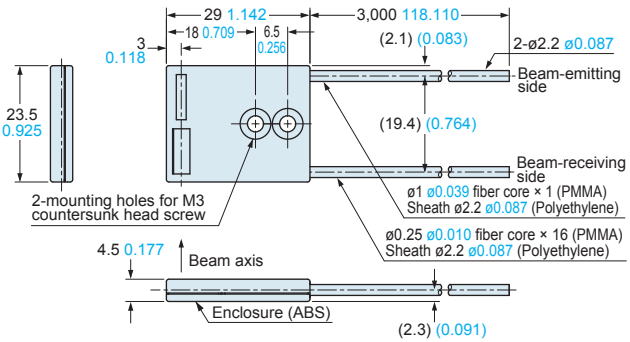
<with **FX-AT5**>




### FD-L31A

Free-cut

<with **FX-AT3**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

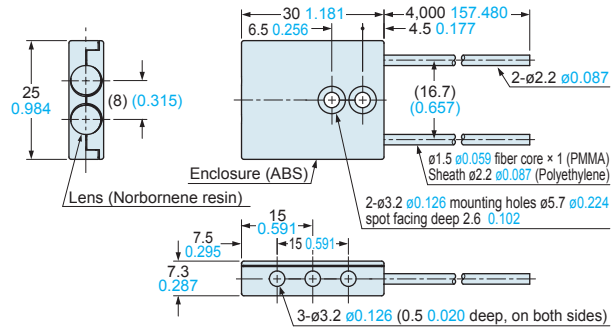
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-L32H

Free-cut

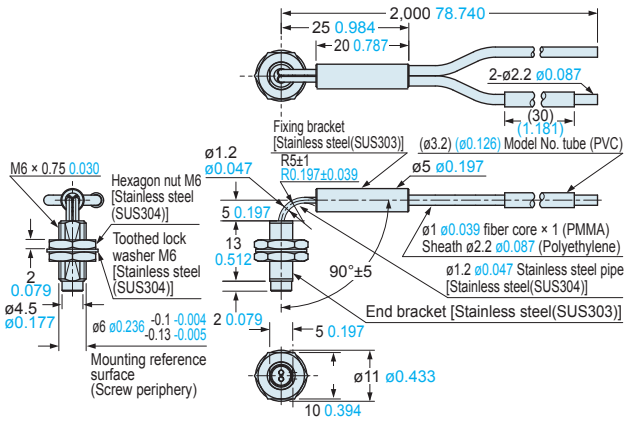
<with **FX-AT3**>



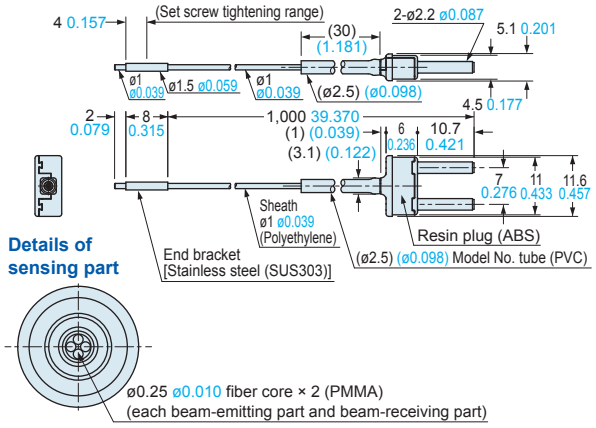

### FD-R60

Free-cut

<with **FX-AT3**>

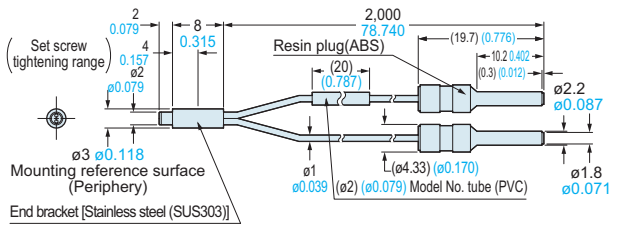



### FD-S21




### FD-S30

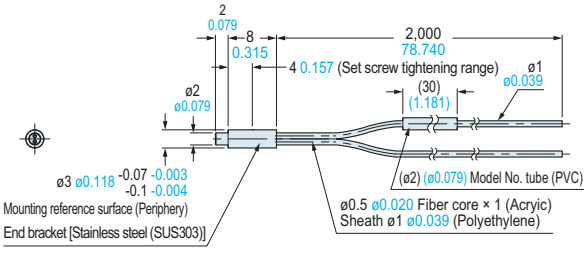
<with **FX-AT2**>




### FD-S31

Free-cut

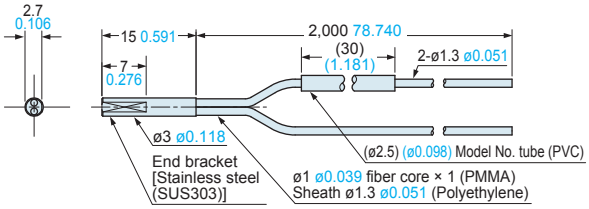
<with **FX-AT4**>




### FD-S32

Free-cut

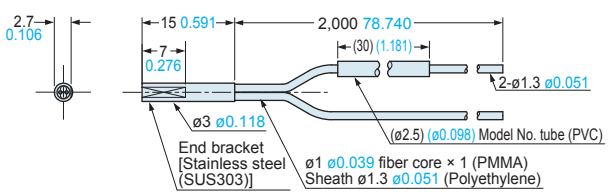
<with **FX-AT5**>




### FD-S32W

Free-cut

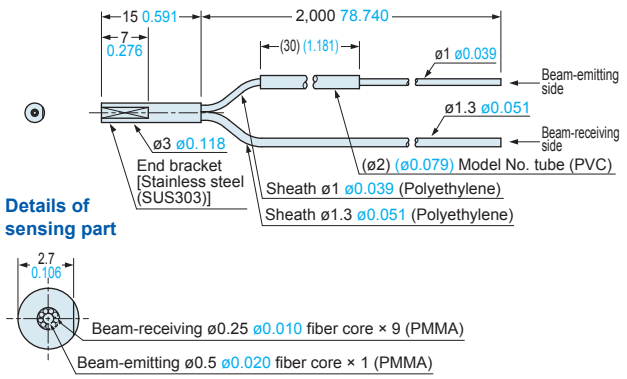
<with **FX-AT5**>




### FD-S33GW

Free-cut

<with **FX-AT6**>



# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers. The CAD data in the dimensions can be downloaded from our website.

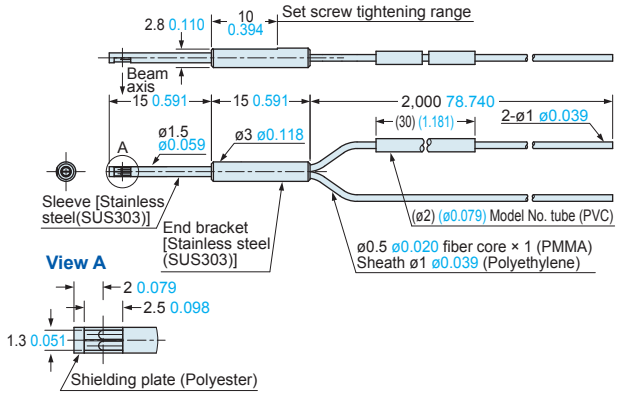
## Reflective type fibers

Dimensions are listed in the order of thru-beam type, retroreflective type, and reflective type, and in alphabetic order of the model No.

### FD-V30

Free-cut

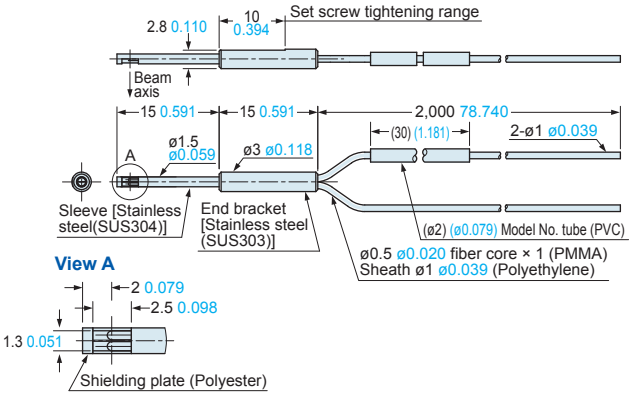
<with **FX-AT4**>




### FD-V30W

Free-cut

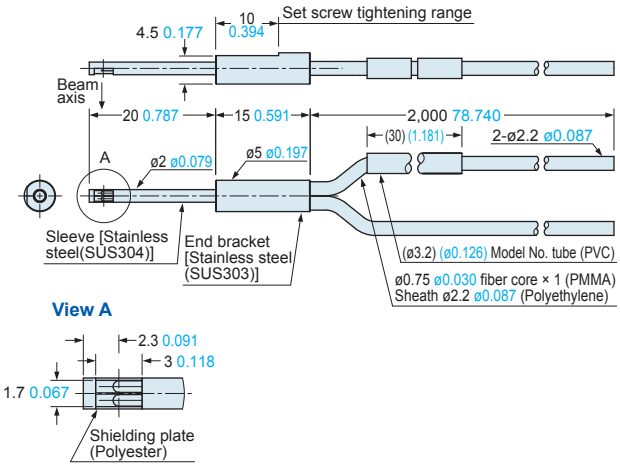
<with **FX-AT4**>




### FD-V50

Free-cut

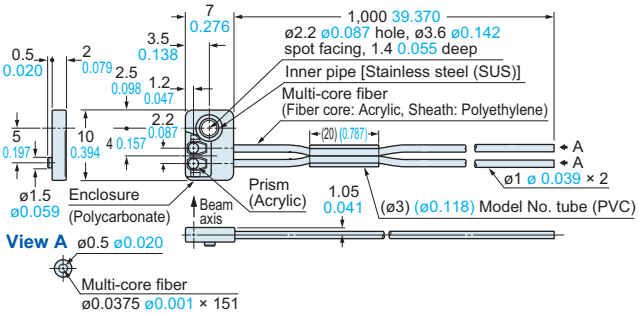
<with **FX-AT3**>




### FD-WZ4

Free-cut

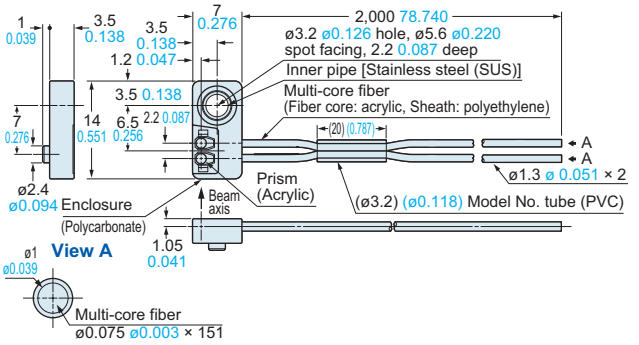
<with **FX-AT4**>




### FD-WZ7

Free-cut

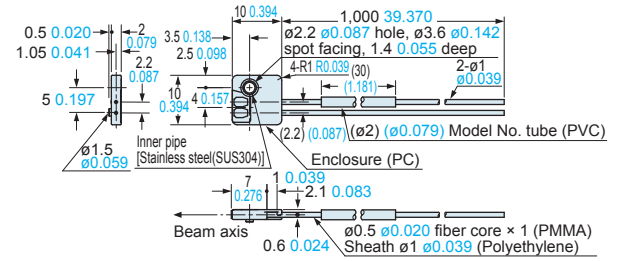
<with **FX-AT5**>




### FD-Z20HBW

Free-cut

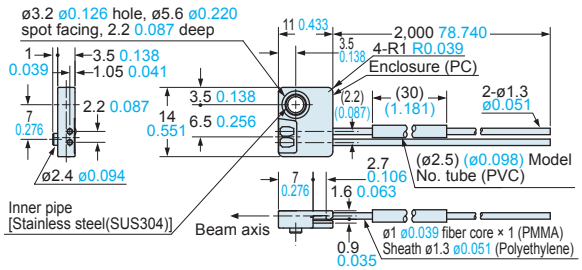
<with **FX-AT4**>




### FD-Z40HBW

Free-cut

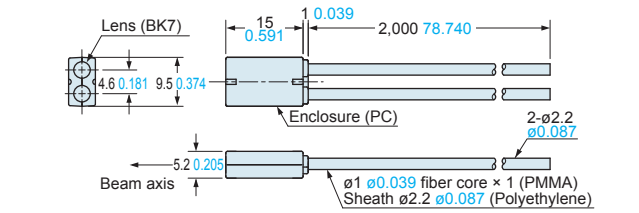
<with **FX-AT5**>



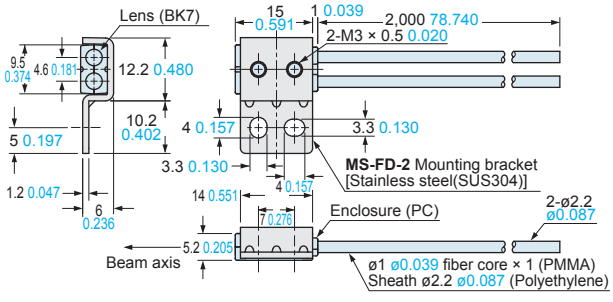

### FD-Z50HW

Free-cut

<with **FX-AT3**>




### Assembly dimensions with MS-FD-2 (attached mounting bracket)



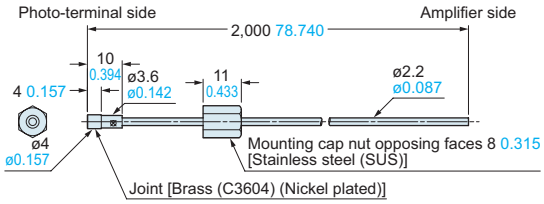
## DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

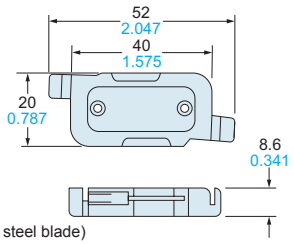
### Vacuum-resistant Atmospheric side fiber

#### FT-J8 — Free-cut

(Accessory for vacuum-resistant fiber) <with **FX-AT3**>

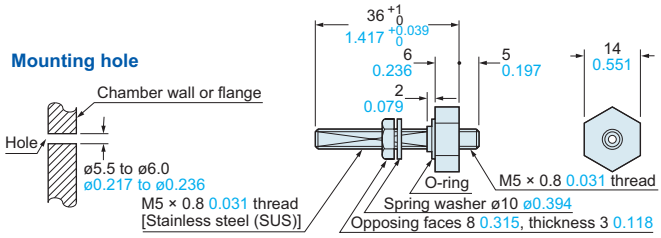



#### FB-1 — Fiber bender (Optional)

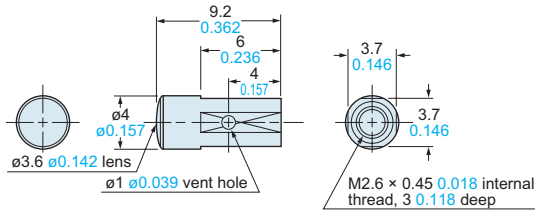



Material: PP (Containing steel blade)

#### FV-BR1 — Photo-terminal (for vacuum-resistant) (with vacuum-resistant fiber)

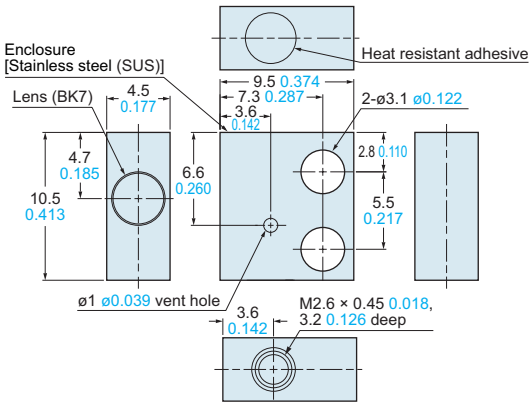



#### FV-LE1 — Vacuum-resistant expansion lens (Optional)



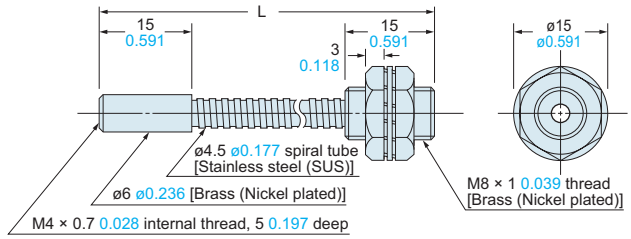

Material: Enclosure.....Aluminum alloy (A6061-T6)
Lens.....BK-7

#### FV-SV2 — Vacuum-resistant side-view lens (Optional)

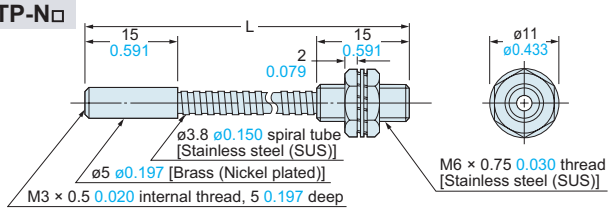



#### FTP-□ FDP-□ — Protective tube (Optional)

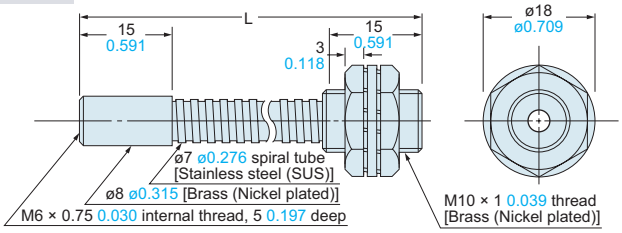
##### FTP-□, FDP-N□




##### FTP-N□




##### FDP-□



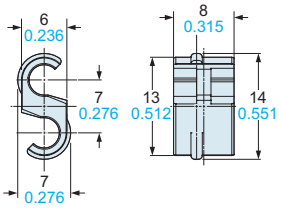

• Length L

| Model No. | Length L |
|---|---|
| **FTP-500, FTP-N500, FDP-N500, FDP-500** | $500^{+10}_{0}$ $19.685^{+0.394}_{0}$ |
| **FTP-1000, FTP-N1000, FDP-N1000, FDP-1000** | $1{,}000^{+10}_{0}$ $39.370^{+0.394}_{0}$ |
| **FTP-1500, FTP-N1500, FDP-N1500, FDP-1500** | $1{,}500^{+10}_{0}$ $59.055^{+0.394}_{0}$ |

# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

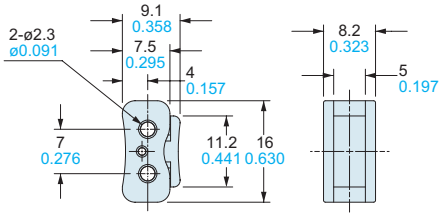
## FX-AT2 Attachment for fixed-length fiber (Accessory for fixed-length fiber)




Material: POM

## FX-AT3 Attachment for ø2.2 mm ø0.087 in fiber

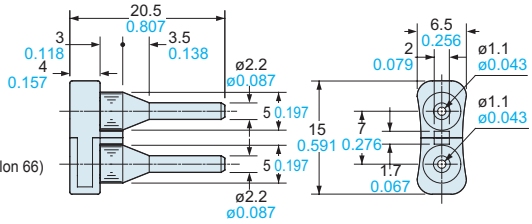
(Accessory for ø2.2 mm ø0.087 in fiber)




Material: Polycarbonate

## FX-AT4 Attachment for ø1 mm ø0.039 in fiber

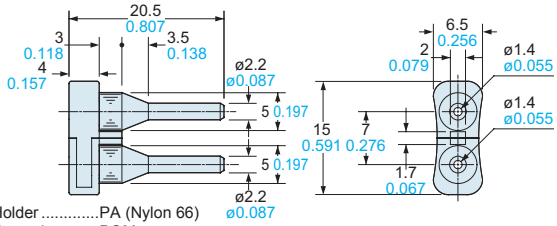
(Accessory for ø1 mm ø0.039 in fiber)




Material:
Holder....PA (Nylon 66)
Ground...POM

## FX-AT5 Attachment for ø1.3 mm ø0.051 in fiber

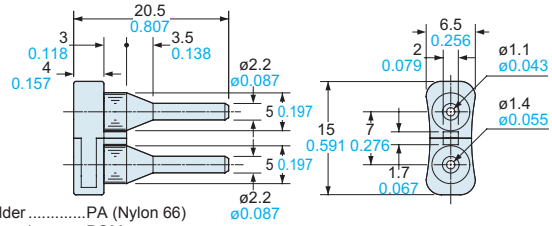
(Accessory for ø1.3 mm ø0.051 in fiber)




Material: Holder.....PA (Nylon 66)
Ground.....POM

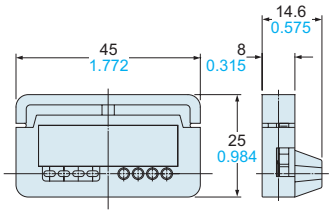
## FX-AT6 Attachment for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber

(Accessory for ø1 mm ø0.039 in / ø1.3 mm ø0.051 in mixed fiber)



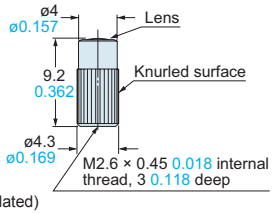

Material: Holder.....PA (Nylon 66)
Ground.....POM

## FX-CT2 Fiber cutter (Accessory for free-cut type fiber)



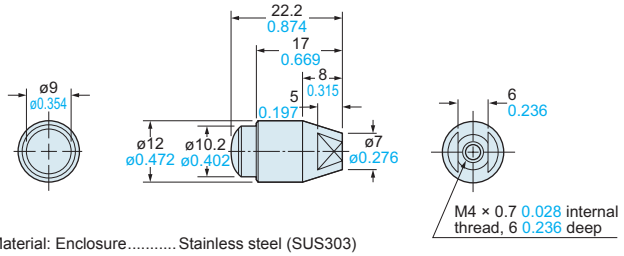

Material: ABS

## FX-LE1 Expansion lens (Optional)



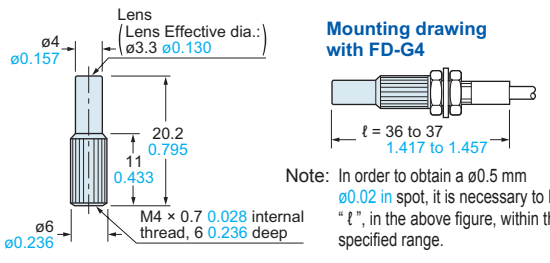

Material: Enclosure.....Brass (Nickel plated)
Lens.....Glass

## FX-LE2 Super-expansion lens (Optional)




Material: Enclosure.....Stainless steel (SUS303)
Lens.....Glass

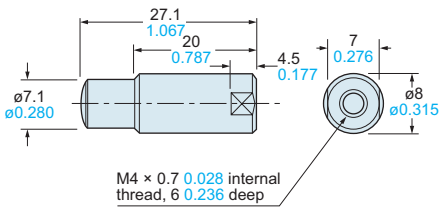
## FX-MR1 Pinpoint spot lens (Optional)




Note: In order to obtain a ø0.5 mm ø0.02 in spot, it is necessary to keep "ℓ", in the above figure, within the specified range.

Material: Enclosure.....Aluminum (Black ALMITE)
Lens.....Glass

## FX-MR2 Zoom lens (Optional)



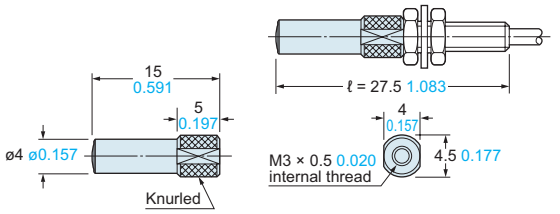

Material: Enclosure.....Aluminum (Black ALMITE)
Lens.....Glass

# DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

## FX-MR3 Finest spot lens (Optional)

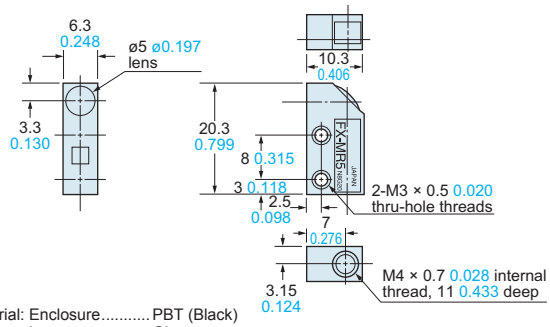
**Mounting drawing with FD-EG30**




Material: Enclosure..... Aluminum (Black ALMITE)
Lens..... Glass

Note: When inserting the fiber, insert fully till it stops.

## FX-MR5 Zoom lens (Optional)

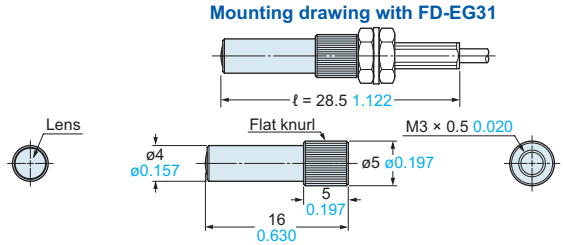



Material: Enclosure..... PBT (Black)
Lens..... Glass

**NT-FX-MR5** (exclusive nut) is attached.

## FX-MR6 Finest spot lens (Optional)

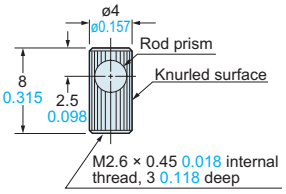
**Mounting drawing with FD-EG31**




Material: Enclosure..... Aluminum (Black ALMITE)
Lens..... Acrylic

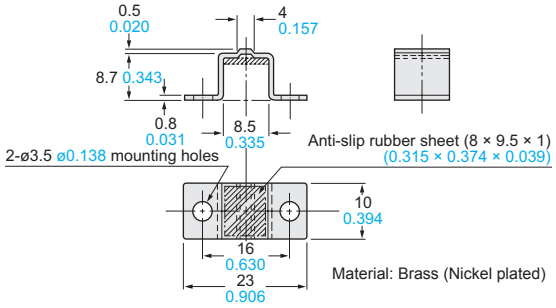
Note: When inserting the fiber, insert fully till it stops.

## FX-SV1 Side-view lens (Optional)



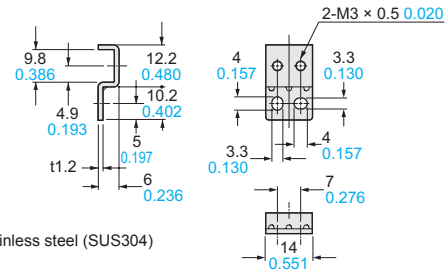

Material: Enclosure..... Brass (Nickel plated)
Lens..... Glass

## MS-EX3 Mounting bracket for FX-MR2 (Accessory for FX-MR2)




## MS-FD-2 Fiber mounting bracket

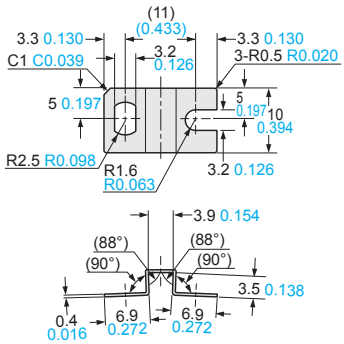
Accessory for **FD-Z50HW**, **FR-KZ50E/KZ50H/Z50HW**, **FD-H30-KZ1V-S**




Material: Stainless steel (SUS304)

## MS-FD-3 Fiber mounting bracket

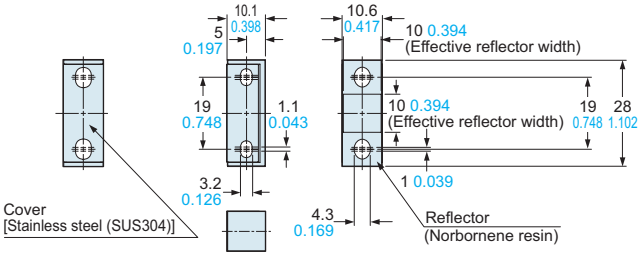
Accessory for **FT-KV40/FT-KV40W**




Material: Stainless steel (SUS304)

## RF-003 Reflector for FR-KZ50E/KZ50H

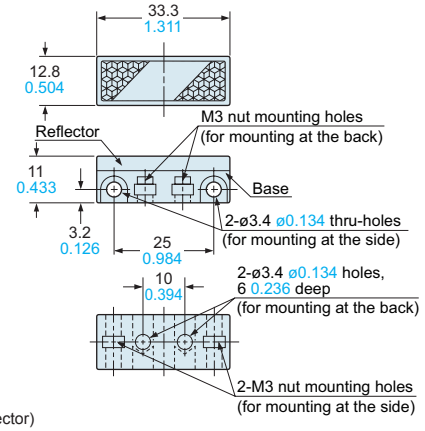
Accessory for **FR-KZ50E/KZ50H**



## DIMENSIONS (Unit: mm in)

Refer to the **FX-500** series (p.64), **FX-100** series (p.74) for dimensions of the amplifiers.
The CAD data in the dimensions can be downloaded from our website.

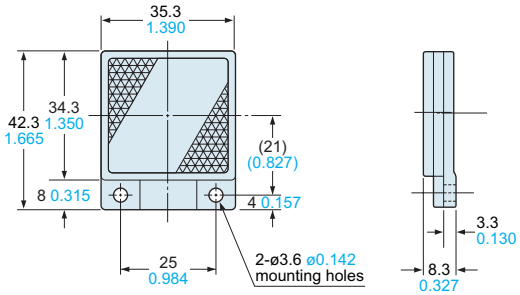
### RF-210 Reflector (Optional)




Material: Acrylic (Reflector)
ABS (Base)

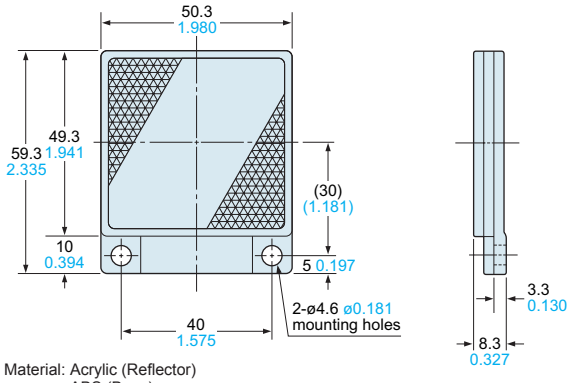
Two M3 (length 8 mm 0.315 in) screws with washers and two nuts are attached.

### RF-220 Reflector (Optional)




Material: Acrylic (Reflector)
ABS (Base)

### RF-230 Reflector (Optional)




Material: Acrylic (Reflector)
ABS (Base)

MEMO

# Digital Fiber Sensor
# FX-500 SERIES

## At the industry's leading edge

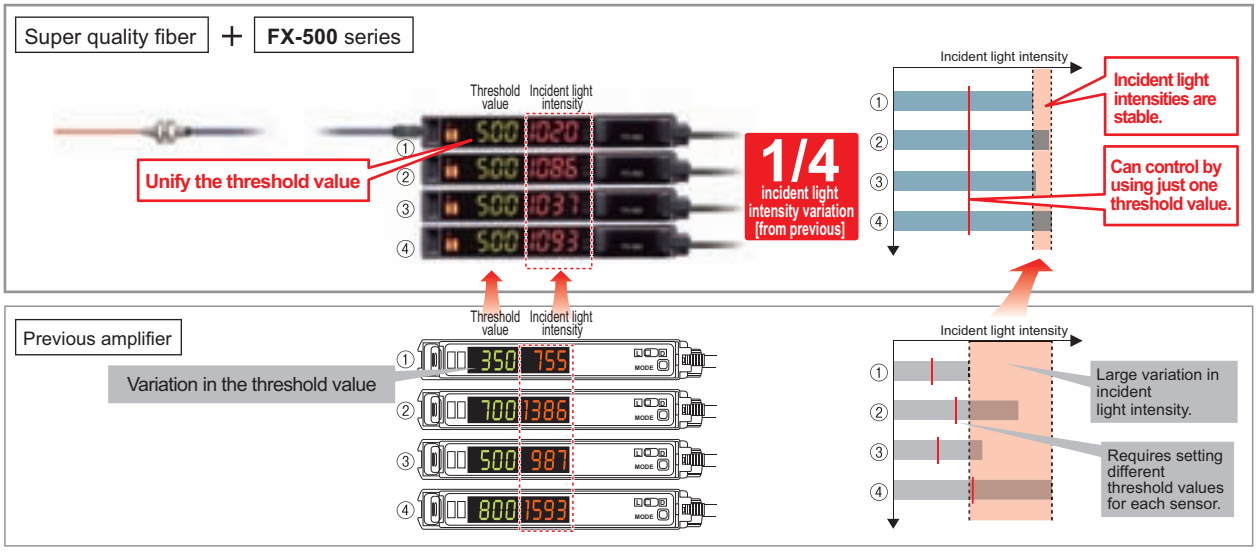

Conforming to EMC Directive

Listing

Certified

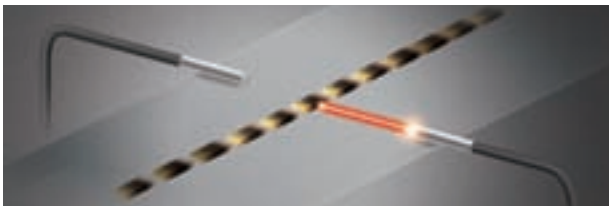
### High stability! Decrease the variation among fiber sensors

When the **FX-500** series is used together with our super quality fiber, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.
By being close to absolute values instead of modified digital values, changes in detection that could not be found in the past can now be monitored.




### Max. 25 µs response time

Performing minute object detection when using a small diameter fiber is now possible with a high response time and longer sensing range.



Hyper
### HYPR mode incorporated

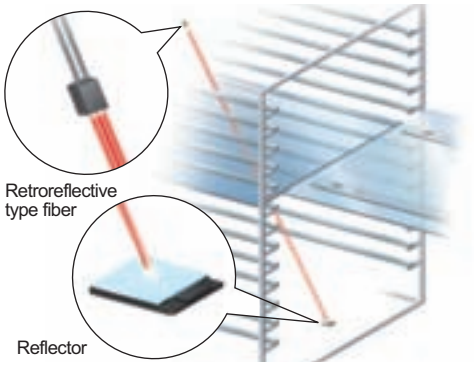
**FX-500** in combination with small diameter fibers which can handle challenging detections, allows super long sensing range.


Note: When using **FD-NFM2**.

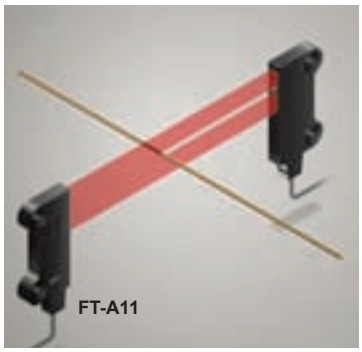
## A different accuracy! Sharp detection with suppressed hysteresis

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

- Long range detection of small objects with small difference in light intensity **H-02 mode**

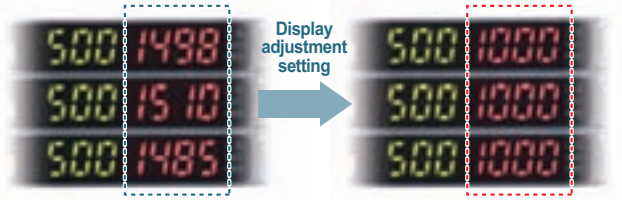



- Highly accurate detection while avoiding saturation **H-01 mode**




## Incident light intensity to a comprehensible value (Display adjustment setting)

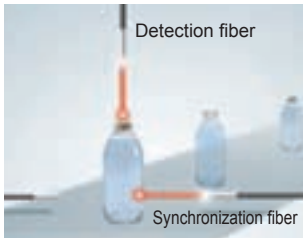
The display can be corrected to show any value using the display adjustment settings. It is effective in using multiple units with the same condition.

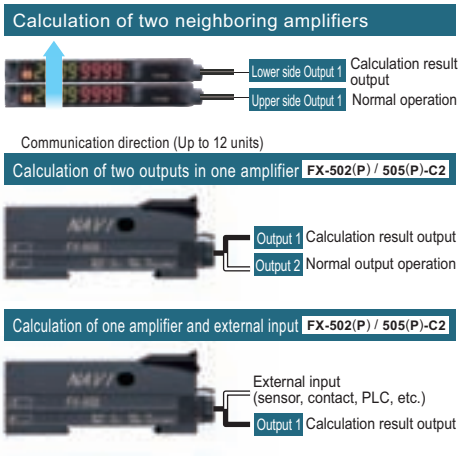



## Built-in logic functions No PLC necessary saving material and programming costs

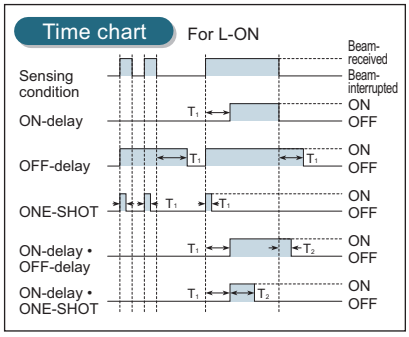
### Logical calculation functions

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.




### Equipped with 5 types timers



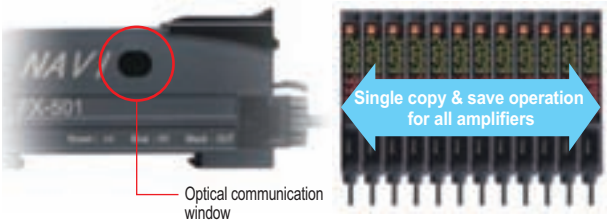

Timer period: 0.05 ms to 32 s
Output 1 has ON-delay • OFF-delay and ON-delay • ONE-SHOT timers.

## Smooth setup changes by 8 data banks

Setup conditions can be saved and loaded to make setup changes easy at worksite that manufactures multiple models.

## An optical communication function allows sensors to be adjusted simultaneously

The optical communication function allows the data that is currently set to be copied and saved all at once for all amplifiers connected together from the right side.




## Remote control improves work efficiency by external input **FX-502(P) FX-505(P)-C2**

Various types of functions, such as teaching and data load/save, can be performed by PLC external signal, using external input*.

* The **FX-502** (**P**) switches Output 2 for an external input.

## No need to specify a main unit or sub unit

Just use a main cable or a sub cable to distinguish the two. This reduces the costs of inventory management.

# ORDER GUIDE

## Amplifiers

Quick-connection cable is not supplied with **FX-501**(**P**) and **FX-502**(**P**). Please order it separately.

| Type | Appearance | Model No. | Emitting element | Output | External input |
|---|---|---|---|---|---|
| Standard type |  | **FX-501** | Red LED | NPN open-collector transistor | — |
| | | **FX-501P** | | PNP open-collector transistor | |
| 2-output type | | **FX-502** | | NPN open-collector transistor 2 outputs | Incorporated (Switchable with Output 2) |
| | | **FX-502P** | | PNP open-collector transistor 2 outputs | |
| Cable type |  | **FX-505-C2** | | NPN open-collector transistor 2 outputs, analog output | Incorporated |
| | | **FX-505P-C2** | | PNP open-collector transistor 2 outputs, analog output | |

## Quick-connection cables

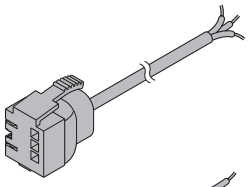
### For FX-501(P)

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

| Type | Model No. | Description | |
|---|---|---|---|
| Main cable (3-core) | **CN-73-C1** | Length: 1 m 3.281 ft | 0.15 mm² 3-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.0 mm ø0.118 in |
| | **CN-73-C2** | Length: 2 m 6.562 ft | |
| | **CN-73-C5** | Length: 5 m 16.404 ft | |
| Sub cable (1-core) | **CN-71-C1** | Length: 1 m 3.281 ft | 0.15 mm² 1-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.0 mm ø0.118 in<br>Connectable to a main cable up to 15 cables. |
| | **CN-71-C2** | Length: 2 m 6.562 ft | |
| | **CN-71-C5** | Length: 5 m 16.404 ft | |

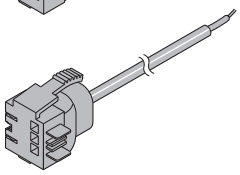
**Main cable**

• **CN-73-C□**



**Sub cable**

• **CN-71-C□**



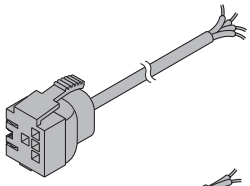
### For FX-502(P)

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

| Type | Model No. | Description | |
|---|---|---|---|
| Main cable (4-core) | **CN-74-C1** | Length: 1 m 3.281 ft | 0.15 mm² 4-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.0 mm ø0.118 in |
| | **CN-74-C2** | Length: 2 m 6.562 ft | |
| | **CN-74-C5** | Length: 5 m 16.404 ft | |
| Sub cable (2-core) | **CN-72-C1** | Length: 1 m 3.281 ft | 0.15 mm² 2-core cabtyre cable, with connector on one end<br>Cable outer diameter: ø3.0 mm ø0.118 in<br>Connectable to a main cable up to 15 cables. |
| | **CN-72-C2** | Length: 2 m 6.562 ft | |
| | **CN-72-C5** | Length: 5 m 16.404 ft | |

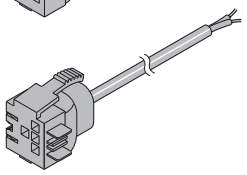
**Main cable**

• **CN-74-C□**



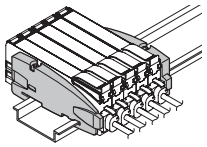
**Sub cable**

• **CN-72-C□**



## End plates

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

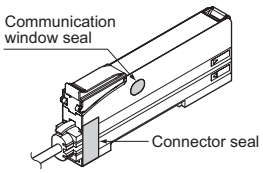
| Appearance | Model No. | Description |
|---|---|---|
|  | **MS-DIN-E** | When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers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

# OPTIONS

| Designation | Model No. | Description |
|---|---|---|
| Amplifier mounting bracket | **MS-DIN-2** | Mounting bracket for amplifier |

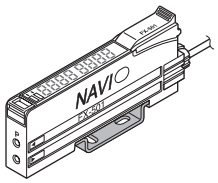
## Accessory

• **FX-MB1** (Amplifier protection seal)
10 sets of 2 communication window seals and 1 connector seal




## Amplifier mounting bracket

• **MS-DIN-2**



# SPECIFICATIONS

| Item \ Type | | Standard type | 2-output type | Cable type (Analog output type) |
|---|---|---|---|---|
| Model No. | NPN output | **FX-501** | **FX-502** | **FX-505-C2** |
| | PNP output | **FX-501P** | **FX-502P** | **FX-505P-C2** |
| Supply voltage | | 12 to 24 V DC $^{+10}_{-15}$ % Ripple P-P 10 % or less | | |
| Power consumption | | Normal operation: 960 mW or less (current consumption 40 mA or less at 24 V supply voltage, excluding analog output of cable type)<br>ECO mode: 680 mW or less (current consumption 28 mA or less at 24 V supply voltage, excluding analog output of cable type) | | |
| Output (2-output type and cable type: Output 1, Output 2) | | <NPN output type><br>NPN open-collector transistor<br>• Maximum sink current: 100 mA (2-output type and cable type are 50 mA) (Note 2)<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 2 V or less (Note 3) (at maximum sink current) | <PNP output type><br>PNP open-collector transistor<br>• Maximum source current: 100 mA (2-output type and cable type are 50 mA) (Note 2)<br>• Applied voltage: 30 V DC or less (between output and +V)<br>• Residual voltage: 2 V or less (Note 3) (at maximum source current) | |
| | Output points | 1 point | 2 points | |
| | Output operation | Switchable either Light-ON or Dark-ON by L/D mode | | |
| | Short-circuit protection | Incorporated | | |
| Response time | | H-SP: 25 µs or less, FAST: 60 µs or less, STD: 250 µs or less, LONG: 2 ms or less, U-LG: 4 ms or less, HYPR: 24 ms or less, selectable | | |
| Analog output (Cable type only) | | Output current: 4 to 20 mA approx. [H-SP, FAST STD: At 0 to 4,000 digits, LONG: At 0 to 8,000 digits (Note 4)], Response time: 2 ms or less, Zero point: Within 4 mA ±1 % F.S., Span: Within 16 mA ±5 % F.S., Linearity: Within ±3 % F.S., Load resistance: 0 to 250 Ω | | |
| External input (2-output type only, switchable with Output 2) | | ——— | <NPN output type><br>NPN non-contact input<br>• Signal condition<br>High: +8 V to +V DC or Open<br>Low: 0 to +1.2 V DC (at 0.5 mA source current)<br>• Input impedance: 10 kΩ approx. | <PNP output type><br>PNP non-contact input<br>• Signal condition<br>High: +4 V to +V DC (at 3 mA sink current)<br>Low: 0 to +0.6 V DC or Open<br>• Input impedance: 10 kΩ approx. |
| Possible external input function | | ——— | Emission halt / Teaching (Full-auto, Limit, 2-point) / Logic operation setting / Copy lock / Display adjustment / Data bank load / Data bank save, selectable | |
| Sensitivity setting | | 2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment | | |
| Incident light intensity display range | | H-SP / FAST / STD: 0 to 4,000, LONG: 0 to 8,000, U-LG / HYPR: 0 to 9,999 | | |
| Timer function | | Incorporated with variable OFF-delay / ON-delay /ONE SHOT / ON-delay • OFF-delay / ON-delay • ONE SHOT timer, switchable either effective or ineffective | <Output 1><br>Incorporated with variable OFF-delay / ON-delay /ONE SHOT / ON-delay • OFF-delay / ON-delay • ONE SHOT timer, switchable either effective or ineffective<br><Output 2><br>Incorporated with variable OFF-delay / ON-delay /ONE SHOT timer, switchable either effective or ineffective | |
| | Timer period | Timer range “ms”: 0.5 ms approx., 1 to 9,999 ms approx., 1 ms approx.,<br>Timer range “sec.”: 0.5 s approx., 1 to 32 s approx., 1 s approx.,<br>Timer range “1/10 ms”: 0.05 ms approx., 0.1 to 999.9 ms approx., 0.1 ms approx., each output is set individually | | |
| Light emitting amount selection function | | Incorporated, 3 levels (each level 25 to 100 %) + Auto setting [1 level (25 to 100 %) when using H-SP mode] | | |
| Interference prevention function | | Incorporated (Note 5), selectable either automatic interference prevention or different frequency | | |
| Various settings | | Hysteresis setting / Shift amount setting / Emission power setting / Display turning setting / ECO setting / Data bank loading saving setting / Copying setting / Code setting / Reset setting / Logical calculation setting / Threshold tracking setting, etc. | | |
| Protection | | IP40 (IEC) | | |
| Ambient temperature | | -10 to +55 °C +14 to +131 °F [If 4 to 7 units are mounted in cascade: -10 to +50 °C +14 to +122 °F or if 8 to 16 units (cable type: 8 to 12 units) are mounted in cascade: -10 to +45 °C +14 to +113 °F] (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F | | |
| Emitting element (modulated) | | Red LED (Peak emission wavelength: 643 nm 0.025 mil) | | |
| Material | | Enclosure, Case cover: Polycarbonate, Switch: TPEE | | |
| Cable | | ——— | | 0.15 mm² 6-core cabtyre cable, 2 m 6.562 ft long |
| Cable extension | | ——— | | Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable. (however, supply voltage 12 V DC) |
| Weight | | Net weight: 15 g approx., Gross weight: 70 g approx. | | Net weight: 60 g approx., Gross weight: 100 g approx. |
| Accessory | | **FX-MB1** (Amplifier protection seal): 1 set | | |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) 50 mA max. if 5 or more standard types are connected together. (25 mA in case of 2-output type and cable type)
3) In case of using the quick-connection cable (cable length 5 m 16.404 ft) (optional).
4) If display adjustment was conducted, it is not in this range.
5) Number of sensor heads which is possible to be mounted closely in auto interference prevention function depends on response time as shown in table below.
Number of sensor heads which is possible to be mounted closely in different frequency Interference prevention function is up to 3 units.

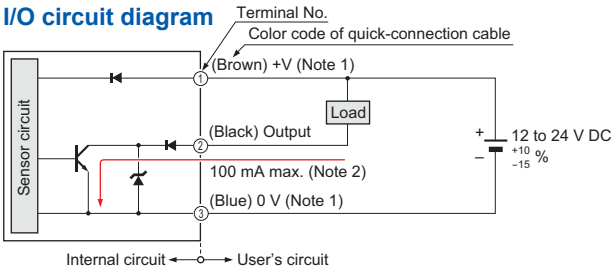
• Number of sensor heads mountable closely (Unit: set)

| Response time | H-SP | FAST | STD | LONG | U-LG | HYPR |
|---|---|---|---|---|---|---|
| IP-1 | 0 | 2 | 4 | 8 | 8 | 12 |

# I/O CIRCUIT AND WIRING DIAGRAMS

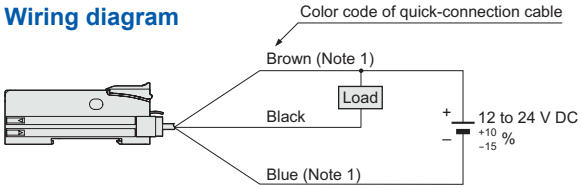
## FX-501 — NPN output type

### I/O circuit diagram



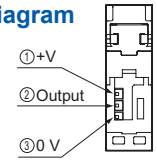

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

### Wiring diagram



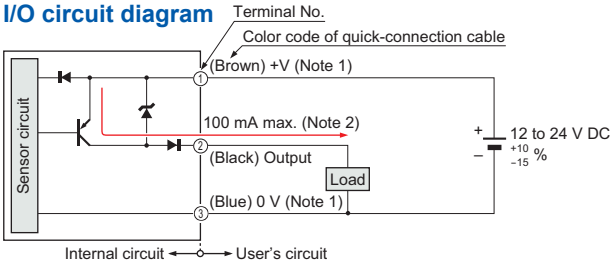

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

### Terminal arragement diagram



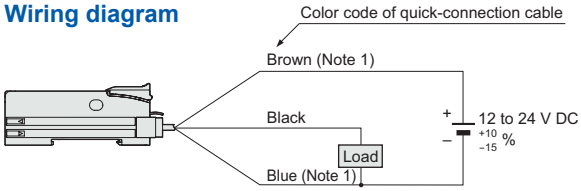

## FX-501P — PNP output type

### I/O circuit diagram



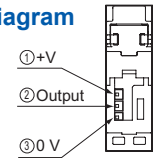

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 50 mA max., if five amplifiers, or more, are connected together.

### Wiring diagram



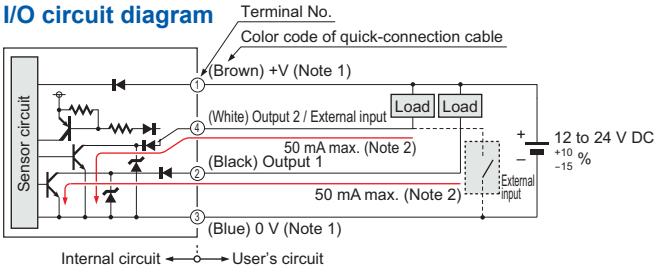

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

### Terminal arragement diagram



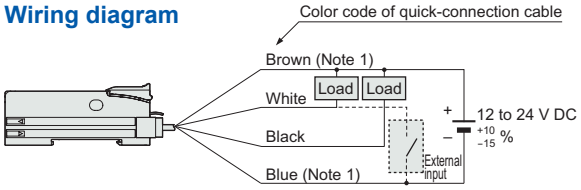

## FX-502 — NPN output type

### I/O circuit diagram



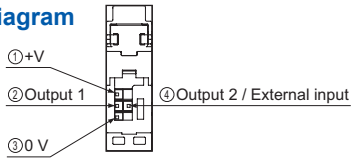

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers, or more, are connected together.

### Wiring diagram



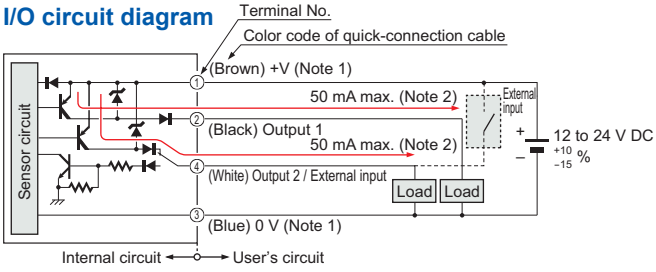

Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

### Terminal arragement diagram



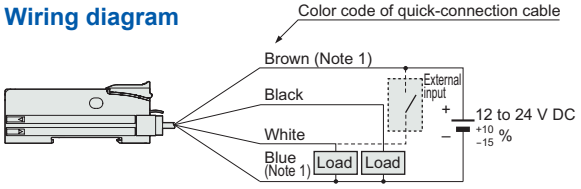

## FX-502P — PNP output type

### I/O circuit diagram



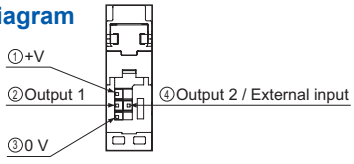

Notes: 1) The quick-connection sub cable does not have +V (brown) and 0 V (blue). The power is supplied from the connector of the main cable.
2) 25 mA max., if five amplifiers, or more, are connected together.

### Wiring diagram




Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

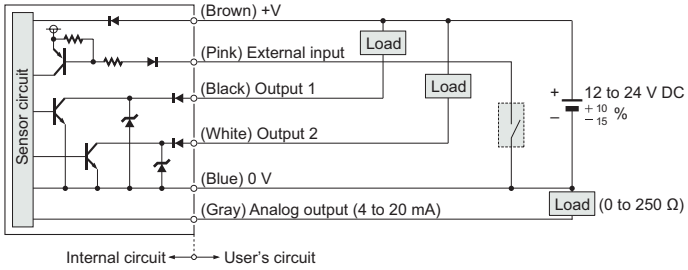
### Terminal arragement diagram



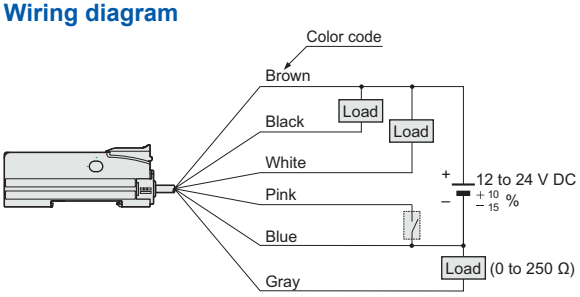
# I/O CIRCUIT AND WIRING DIAGRAMS

## FX-505-C2 — NPN output type

### I/O circuit diagram

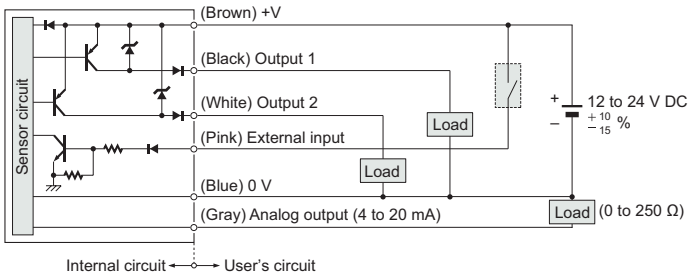



### Wiring diagram

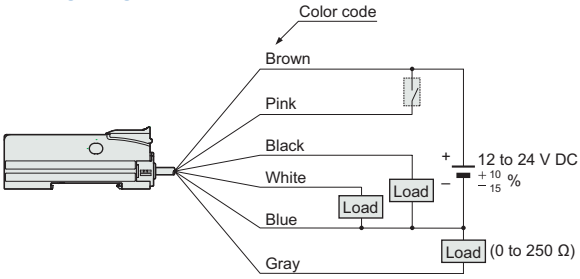



## FX-505P-C2 — PNP output type

### I/O circuit diagram




### Wiring diagram



# PRECAUTIONS FOR PROPER USE

Refer to the “PRO mode operation manual” on our website for details.

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

## Wiring

- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Note that if a voltage exceeding the reted range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- Note that short-circuit of the load or wrong wiring may burn or damage the product.
- Do not run the wires together with high-voltage lines or power lines, or put them in the same raceway.
  This can cause malfunction due to induction.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Make sure to use the quick-connection cable (optional) for the connection of the controller.
  Extension up to total 100 m 328.084 ft is possible with 0.3 $mm^2$ or more, cable.
  However, in order to reduce noise, make the wiring as short as possible.
- Make sure that stress by forcible bending or pulling is not applied to the sensor cable joint and fiber cable.

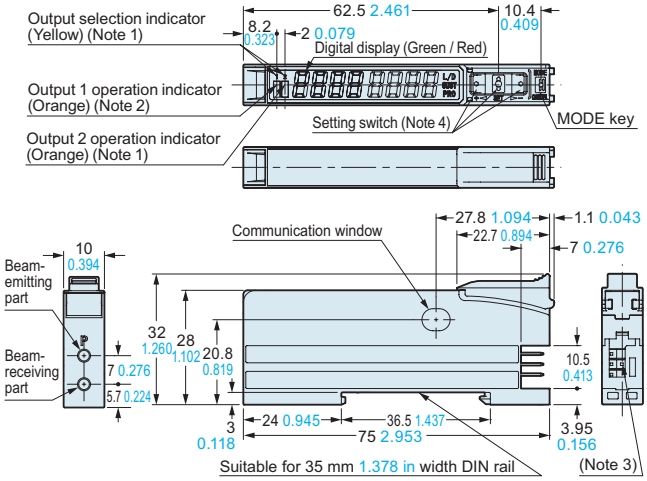
## Others

- Our products have been developed / produced for industrial use only.
- The specification may not be satisfied in a strong magnetic field.
- The ultra long distance (U-LG, HYPR) mode is more likely to be affected by extraneous noise since the sensitivity of that is higher than the other modes. Make sure to check the environment before use.
- Do not use during the initial transient time (H-SP, FAST, STD: 0.5 sec., LONG, U-LG, HYPR: 1 sec.) after the power supply is switched ON.
- These sensors are only for indoor use.
- Avoid dust, dirt, and steam.
- Make sure that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
- This product cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify this product.
- This product adopts EEPROM. Settings cannot be done 100 thousand times or more because of the EEPROM's lifetime.

# DIMENSIONS (Unit: mm in)

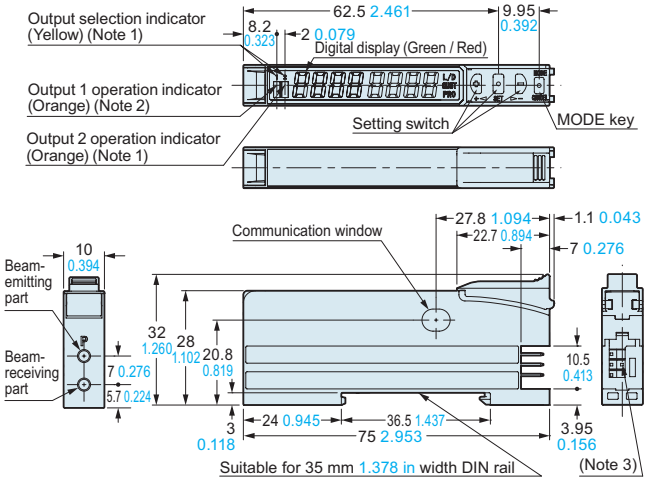
The CAD data in the dimensions can be downloaded from our website.

## FX-501(P) FX-502(P) — Amplifier



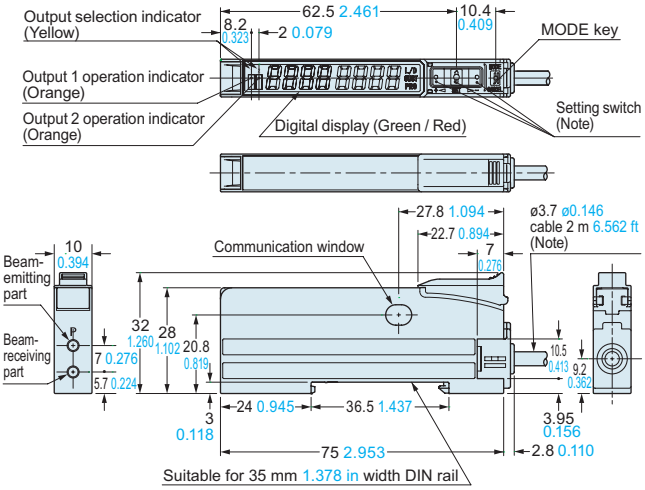

Notes: 1) **FX-502(P)** only
2) **FX-501(P)**: Operation indicator
3) **FX-501(P)**: 3-pin, **FX-502(P)**: 4-pin
4) The shape of setting switch will be changed from production at the end of November, 2011. Please see drawing below.

### After the modification



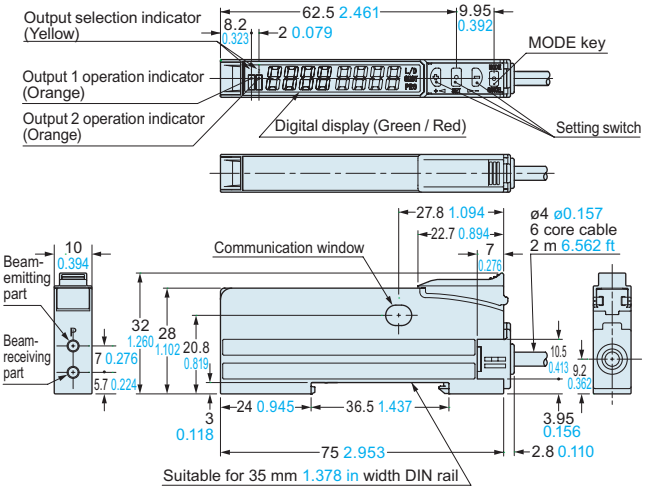

Notes: 1) **FX-502(P)** only
2) **FX-501(P)**: Operation indicator
3) **FX-501(P)**: 3-pin, **FX-502(P)**: 4-pin

## FX-505-C2 FX-505P-C2 — Amplifier




Note: The shape of setting switch and cable will be changed from production at the end of November, 2011. Please see drawing below.

### After the modification



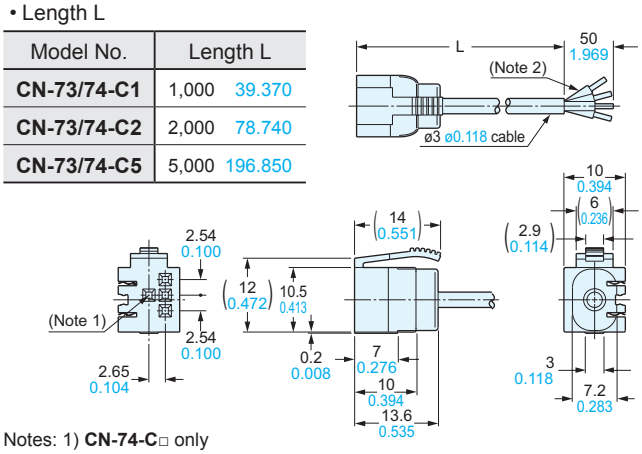
# DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

## CN-73-C□ CN-74-C□ Main cable (Optional)

• Length L

| Model No. | Length L |
|---|---|
| CN-73/74-C1 | 1,000 39.370 |
| CN-73/74-C2 | 2,000 78.740 |
| CN-73/74-C5 | 5,000 196.850 |

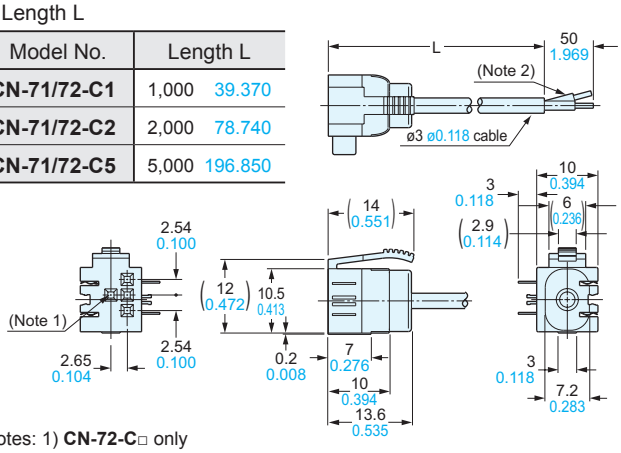



Notes: 1) **CN-74-C□** only
2) **CN-73-C□**: 3-core

## CN-71-C□ CN-72-C□ Sub cable (Optional)

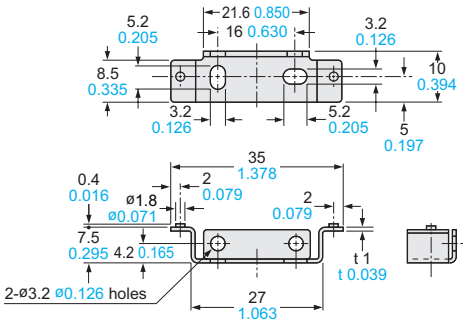
• Length L

| Model No. | Length L |
|---|---|
| CN-71/72-C1 | 1,000 39.370 |
| CN-71/72-C2 | 2,000 78.740 |
| CN-71/72-C5 | 5,000 196.850 |



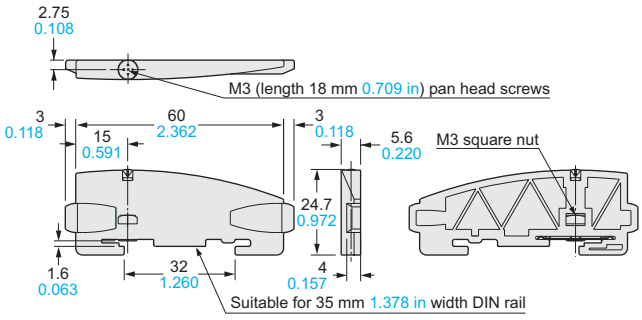

Notes: 1) **CN-72-C□** only
2) **CN-71-C□**: 1-core

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




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

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




Material: Polycarbonate

Digital Fiber Sensor

# FX-100 SERIES

## Taking fiber sensors to the next level

Conforming to EMC Directive

Listing

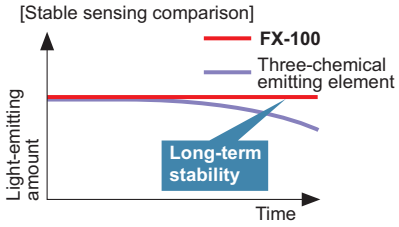
**FX-100** series has been modificated from July 2011 production. The color of enclosure has been changed from white to dark gray and the protection cover has been attached.

### Saving-space with a width of 9 mm 0.354 in

Very slim at only 9 mm 0.354 in. This is much thinner than existing fiber sensors. Even if the difference is small when only using one unit, when using many units this makes a very large difference.


### Improved stability over both long terms

Utilizes the standard Panasonic Electric Works SUNX digital fiber sensor element “Four-chemical emitting element” for light emission. The light emission is guaranteed to be stable over long periods of time.

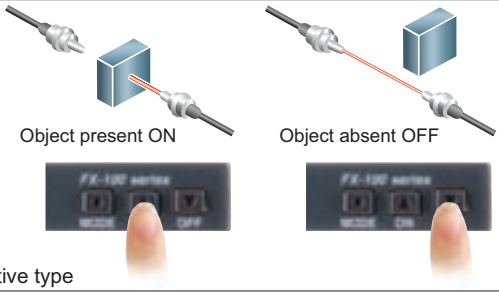



### Teaching using ON / OFF buttons SET mode

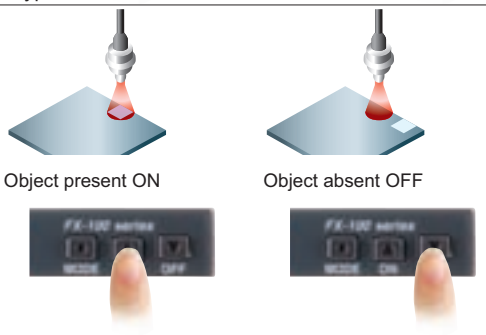
Simply press the ON button when an object is present and OFF when it is not.

**<Setting example>**

Thru-beam type / Retroreflective type



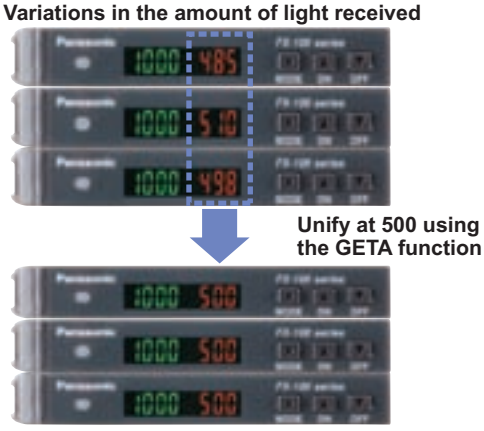

Reflective type




### Resolves variation in incident light intensity display GETA function PRO mode

Even when performing the same sensing operation, there may be variances in the digital values of the fiber amp.
Given value can be corrected with the GETA function, so the apparent variation can be eliminated.

**Variations in the amount of light received**



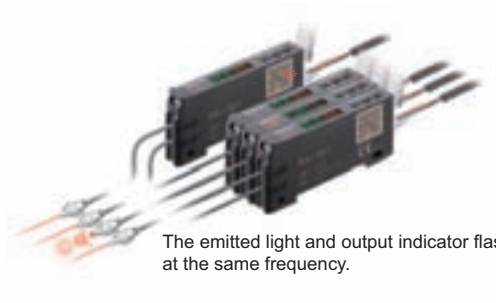
## Stable detection by attenuation function SET mode

If the light receiving level becomes saturated when sensing over short distances or when sensing transparent objects or minute objects, the light emitting amount can be reduced so that stable sensing can be provided without needing to change the response time.
Light reduction: 3 levels plus an automatic mode


## Interference prevention function SET mode

(**FX-101**□: Interference prevention for up to 3 units
**FX-102**□: Interference prevention for up to 4 units)

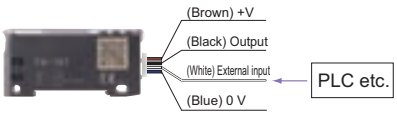
The emission frequencies can be set separately for each unit in order to avoid interference. The emitted light flashes while setting is in progress, so that you can see at a glance which fiber sensor is currently being set.



The emitted light and output indicator flash at the same frequency.

## Multi-function external input PRO mode

Settings such as emission halt, limit / auto teaching, 2-point teaching and ECO settings can be carried out via external input. Also, the threshold value can be memorized.

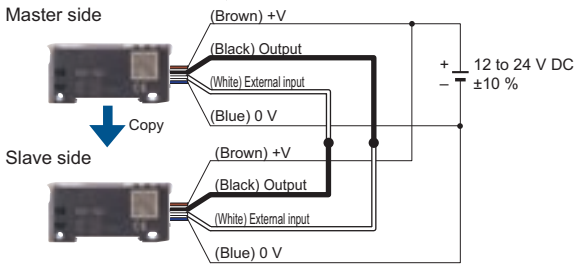



**External input lines are equipped as standard**

## Setting copy function to reduce man-hours and human error PRO mode

By cable wiring, the master sensor settings can be copied along with data transmissions. By synchronizing the settings on all the devices, trouble from setting errors can be prevented.

**<Wiring inset coping>** Color of lead wire of attached connector cable




**Copiable setting**

Threshold value, output operation setting, timer operation setting, timer period setting, light-emitting amount selection setting (attenuation function), shift setting, ECO setting, digital display inversion setting, and threshold value margin setting (alert function)

*The copy unit **SC-SU1** which can copy settings in one touch is available. (optional)

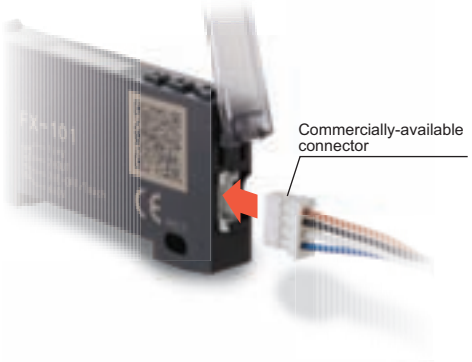
## Electricity consumption saving possibilities ECO

After setting, if about 20 seconds go by without any key operations taking place the digital display will turn off and energy consumption is kept under 600 mW. (When illuminated it is under 720 mW)

## Commercially-available connectors are used so that lead time and spare part numbers can both be reduced

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

**Commercially-available press-fit connectors are used, so that the processing costs for connection cables can be greatly reduced.**



# ORDER GUIDE

## Amplifiers

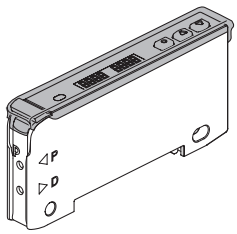
| Type | | Appearance | Model No. | Emitting element | Output |
|---|---|---|---|---|---|
| Standard type | M8 plug-in connector type |  | **FX-101** (Note 2) | Red LED | NPN open-collector transistor |
| | | | **FX-101-Z** (Note 3) | | NPN open-collector transistor |
| | | | **FX-101P** (Note 2) | | PNP open-collector transistor |
| | | | **FX-101P-Z** (Note 3) | | PNP open-collector transistor |
| | Cable set (Note 1) | | **FX-101-CC2** | | NPN open-collector transistor |
| | | | **FX-101P-CC2** | | PNP open-collector collector transistor |
| Long sensing range type | M8 plug-in connector type | | **FX-102** (Note 2) | | NPN open-collector transistor |
| | | | **FX-102-Z** (Note 3) | | NPN open-collector transistor |
| | | | **FX-102P** (Note 2) | | PNP open-collector transistor |
| | M8 plug-in connector type | | **FX-102P-Z** (Note 3) | | PNP open-collector transistor |
| | Cable set (Note 1) | | **FX-102-CC2** | | NPN open-collector transistor |
| | | | **FX-102P-CC2** | | PNP open-collector transistor |

Notes: 1) The connector attached cable **CN-14A-C2** is supplied with the amplifier.
2) Make sure to use the optional connector attached cable **CN-14A(-R)-C□** or the connector **CN-14A**, or a connector manufactured by J.S.T. Mfg. Co., Ltd. (contact: SPHD-001T-P0.5, housing: PAP-04V-S)
3) Make sure to use the optional M8 connector attached cable **CN-24A-C□**.

### Accessory

• **CN-14A-C2**
(Connector attached cable 2 m 6.562 ft)
* Only include cable set type

• **FC-FX-1** (Protection cover)
* It have been attached from the production at July, 2011.



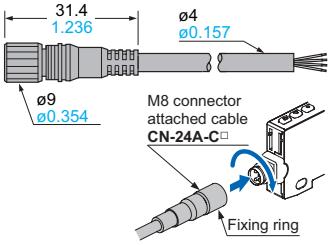
# OPTIONS

| Designation | Model No. | Description | |
|---|---|---|---|
| Connector attached cable | **CN-14A-C1** | 1 m 3.281 ft | 0.2 mm² 4-core cabtyre cable with connector on one end<br>Cable outer diameter: ø3.7 mm ø0.146 in |
| | **CN-14A-C2** (Note 1) | 2 m 6.562 ft | |
| | **CN-14A-C3** | 3 m 9.843 ft | |
| | **CN-14A-C5** | 5 m 16.404 ft | |
| Connector attached cable (Flexible type) | **CN-14A-R-C1** | 1 m 3.281 ft | |
| | **CN-14A-R-C2** | 2 m 6.562 ft | |
| | **CN-14A-R-C3** | 3 m 9.843 ft | |
| | **CN-14A-R-C5** | 5 m 16.404 ft | |
| M8 connector attached cable | **CN-24A-C2** | 2 m 6.562 ft | For M8 plug-in connector type<br>The connector on one end<br>Cable outer diameter: ø4 mm ø0.157 in |
| | **CN-24A-C5** | 5 m 16.404 ft | |
| Connector | **CN-14A** | Set of 10 housings and 40 contacts | |
| Amplifier mounting bracket | **MS-DIN-4** | Mounting bracket for amplifier | |
| End plates | **MS-DIN-E**<br>Two pcs. per set | When it moves depending on the way it is installed on a DIN rail, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner. | |
| Copy unit | **SC-SU1** | Copy the controller settings to other controllers. | |

Note: The connector attached cable **CN-14A-C2** is supplied with the cable set type **FX-10□-CC2**.

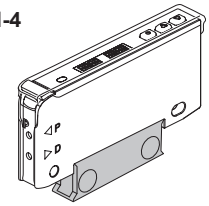
### M8 connector attached cable

• **CN-24A-C□**



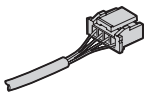

### Amplifier mounting bracket

• **MS-DIN-4**



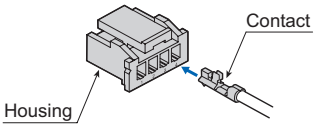
### Connector attached cable

• **CN-14A(-R)-C□**



### Connector

• **CN-14A**




### Recommended connector

Contact: SPHD-001T-P0.5, Housing: PAP-04V-S (Manufactured by J.S.T. Mfg. Co., Ltd.)
Note: Contact the manufacturer for details of the recommended products.

### Recommended crimping tool

Model No.: YC-610R (Manufactured by J.S.T. Mfg. Co., Ltd.)
Note: Contact the manufacturer for details of the recommended products.

## SPECIFICATIONS

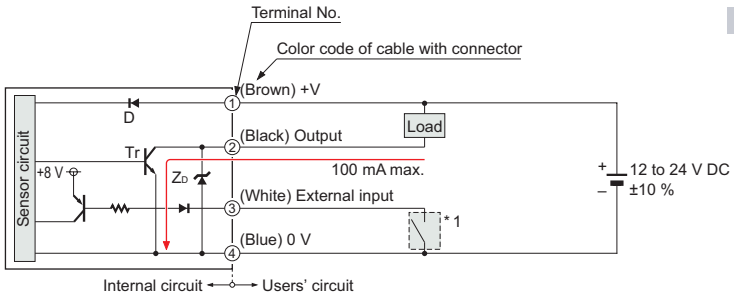
| Item \ Type | | Standard type | | Long sensing range type | |
|---|---|---|---|---|---|
| | | | Cable set | | Cable set |
| Model No. | NPN output | **FX-101**(**-Z**) (Note 5) | **FX-101-CC2** | **FX-102**(**-Z**) (Note 5) | **FX-102-CC2** |
| | PNP output | **FX-101P**(**-Z**) (Note 5) | **FX-101P-CC2** | **FX-102P**(**-Z**) (Note 5) | **FX-102P-CC2** |
| Supply voltage | | 12 to 24 V DC ±10 % Ripple P-P 10 % or less | | | |
| Power consumption | | Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage)<br>ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage) | | | |
| Output | | <NPN output type><br>NPN open-collector transistor<br>• Maximum sink current: 100 mA<br>• Applied voltage: 30 V DC or less (between output and 0 V)<br>• Residual voltage: 1.5 V or less (at 100 mA sink current) | | <PNP output type><br>PNP open-collector transistor<br>• Maximum source current: 100 mA<br>• Applied voltage: 30 V DC or less (between output and +V)<br>• Residual voltage: 1.5 V or less (at 100 mA source current) | |
| | Output operation | Selectable either Light-ON or Dark-ON, at SET mode | | | |
| | Short-circuit protection | Incorporated | | | |
| External input | | <NPN output type><br>NPN non-contact input<br>• Signal condition<br>High: +8 V to +V DC or Open<br>Low: 0 to +2 V DC<br>(Source current 0.5 mA or less)<br>• Input impedance: 10 kΩ approx. | | <PNP output type><br>PNP non-contact input<br>• Signal condition<br>High: +4 V to +V DC<br>(Sink current 0.5 to 3 mA)<br>Low: 0 to +0.6 V DC or Open<br>• Input impedance: 10 kΩ approx. | |
| Response time | | Emission frequency 0: 250 µs or less (factory default setting)<br>Emission frequency 1: 450 µs or less<br>Emission frequency 2: 500 µs or less<br>Emission frequency 3: 600 µs or less | | Emission frequency 1: 2.5 ms or less (factory default setting)<br>Emission frequency 2: 2.8 ms or less<br>Emission frequency 3: 3.2 ms or less<br>Emission frequency 4: 5.0 ms or less | |
| Sensitivity setting | | 2-point teaching / Limit teaching / Full-auto teaching | | | |
| Operation indicator | | Orange LED (lights up when the output is ON) | | | |
| Digital display | | 4 digits (green) + 4 digits (red) LCD display | | | |
| Fine sensitivity adjustment function | | Incorporated | | | |
| Timer function | | ON-delay / OFF-delay timer, switchable either effective or ineffective<br>[Timer period: 1 ms, 5 ms, 10 ms, 20 ms, 40 ms, 50 ms, 100 ms, 500 ms, 1,000 ms] | | | |
| Attenuation function | | 3–level + Auto setting | | | |
| Interference prevention function | | Incorporated<br>Emission frequency selection method (Note 2)<br>(Functions at emission frequency 1, 2 or 3) | | Incorporated<br>Emission frequency selection method (Note 2)<br>(Functions at emission frequency 1, 2, 3 or 4) | |
| Environmental resistance | Ambient temperature | –10 to +55 °C +14 to +131 °F (If 4 to 7 units are mounted close together: –10 to +50 °C +14 to +122 °F, if 8 to 16 units are mounted close together: –10 to +45 °C +14 to +113 °F) (No dew condensation or icing allowed), Storage: –20 to +70 °C –4 to +158 °F | | | |
| | Ambient humidity | 35 to 85 % RH, Storage: 35 to 85 % RH | | | |
| | Ambient illuminance | Incandescent light: 3,000 ℓx at the light-receiving face | | | |
| | Voltage withstandability | 1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 3) | | | |
| | Insulation resistance | 20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 3) | | | |
| | Vibration resistance | 10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each | | | |
| | Shock resistance | 98 m/s$^2$ acceleration (10 G approx.) in X, Y and Z directions for five times each | | | |
| Emitting element (modulated) | | Red LED (Peak emission wavelength: 632 nm 0.025 mil) | | | |
| Material | | Enclosure: Polycarbonate, Key switch: Polycarbonate, Fiber lock lever: PBT | | | |
| Connecting method | | Connector (Note 4) | | | |
| Cable length | | Total length up to 100 m 328.084 ft is possible with 0.3 mm$^2$, or more, cable. | | | |
| Weight | | Net weight: 15 g approx.<br>Gross weight: 35 g approx. | Net weight: 15 g approx.<br>Gross weight: 75 g approx. | Net weight: 15 g approx.<br>Gross weight: 35 g approx. | Net weight: 15 g approx.<br>Gross weight: 75 g approx. |
| Accessory | | **FC-FX-1**<br>(Protection cover): 1 pc. (Note 6) | **FC-FX-1**<br>(Protection cover): 1 pc. (Note 6)<br>**CN-14A-C2**<br>(Connector attached cable, 2 m 6.562 ft long): 1 pc. | **FC-FX-1**<br>(Protection cover): 1 pc. (Note 6) | **FC-FX-1**<br>(Protection cover): 1 pc. (Note 6)<br>**CN-14A-C2**<br>(Connector attached cable, 2 m 6.562 ft long): 1 pc. |

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2) When using the interference prevention function, set the emission frequencies for the amplifiers to be covered by the interference prevention function to different frequency values.
However, the interference prevention function does not operate at emission frequency 0 (factory default setting) for the **FX-101**(**P**)(**-Z**) / **FX-101**(**P**)**-CC2**.
3) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.
4) Connector attached cable **CN-14A-C2** is not attached to the models that have no "**-CC2**" at the end of the model Nos.
Make sure to use the optional connector attached cable **CN-14A**(**-R**)**-C**□ or the connector **CN-14A**, or a connector manufactured by J.S.T. Mfg., Ltd. (contact: SPHD-001T-P0.5, housing: PAP-04V-S).
5) Model Nos. having the suffix "**-Z**" are M8 plug-in connector type. Make sure to use the optional M8 attached connector cable **CN-24A-C**□.
6) Protection cover **FC-FX-1** has been attached from the production at July, 2011.

# I/O CIRCUIT AND WIRING DIAGRAMS

## FX-10□(-Z/-CC2) — NPN output type

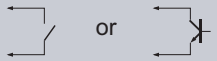
### I/O circuit diagram




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

* 1

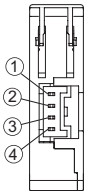
Non-voltage contact or NPN open-collector transistor




High (+8 V to +V DC, or open): Ineffective
Low [0 to +2 V DC (source current 0.5 mA or less)]: Effective

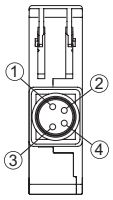
### Terminal arrangement diagram

#### Connector type




| Terminal No. | Function |
|---|---|
| ① | +V |
| ② | Output |
| ③ | External input |
| ④ | 0 V |

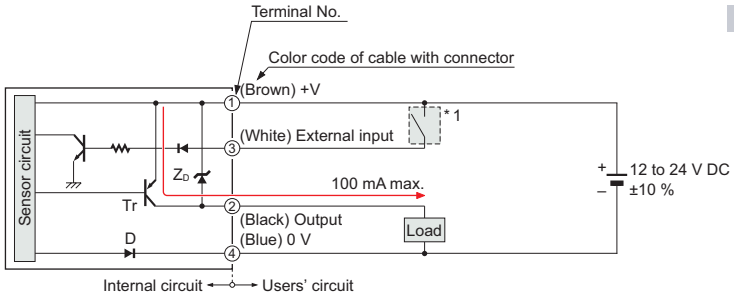
#### M8 plug-in connector type




| Terminal No. | Function |
|---|---|
| ① | +V |
| ② | Output |
| ③ | External input |
| ④ | 0 V |

## FX-10□P(-Z/-CC2) — PNP output type

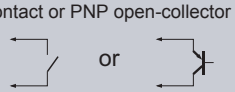
### I/O circuit diagram




Symbols … D : Reverse supply polarity protection diode
$Z_D$: Surge absorption zener diode
Tr : PNP output transistor

* 1

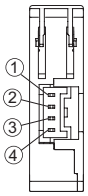
Non-voltage contact or PNP open-collector transistor




High [ +4 V to +V DC (sink current 0.5 to 3 mA)]: Effective
Low (0 to +0.6 V DC, or open): Ineffective

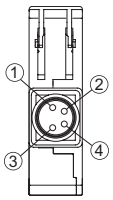
### Terminal arrangement diagram

#### Connector type




| Terminal No. | Function |
|---|---|
| ① | +V |
| ② | Output |
| ③ | External input |
| ④ | 0 V |

#### M8 plug-in connector type




| Terminal No. | Function |
|---|---|
| ① | +V |
| ② | Output |
| ③ | External input |
| ④ | 0 V |

# PRECAUTIONS FOR PROPER USE

Refer to the “Operation Guide” on our website for details pertaining to operating instructions for the amplifier.

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

## Using in combination with the FX-300 / FX-410 series

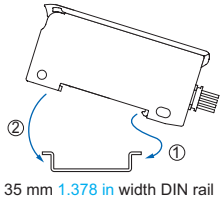
- The **FX-100** series does not use the horizontal connectors that are used with the **FX-300** / **FX-410** series. Please note that horizontal connection cannot be performed using a connector attached cable. In addition, the optical communication function is not equipped on the **FX-100** series, so it is unable to perform interference prevention for use with the **FX-300** / **FX-410** series.
  If using the **FX-100** series together with the **FX-300** / **FX-410** series side-by-side, please set the same models together in groups.

## Mounting

**<When using a DIN rail>**

**How to mount the amplifier**

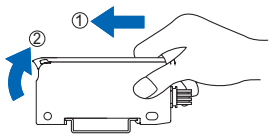
① Fit the rear part of the mounting section of the amplifier on a 35 mm 1.378 in width DIN rail.
② Press down the rear part of the mounting section of the unit on the 35 mm 1.378 in width DIN rail and fit the front part of the mounting section to the DIN rail.



35 mm 1.378 in width DIN rail

**How to remove the amplifier**

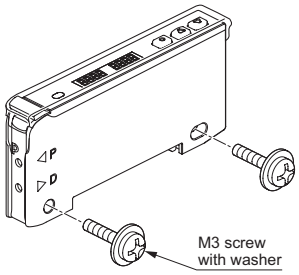
① Push the amplifier forward.
② Lift up the front part of the amplifier to remove it.




Note: Take care that if the front part is lifted without pushing the amplifier forward, the hook on the rear portion of the mounting section is likely to break.

**<When using screws with washers>**

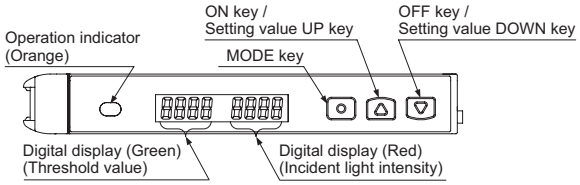
- Use M3 screws with washers for mounting. The tightening torque should be 0.5 N·m or less.




## Wiring

- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Note that if a voltage exceeding the reted range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- Note that short-circuit of the load or wrong wiring may burn or damage the product.
- Do not run the wires together with high-voltage lines or power lines, or put them in the same raceway. This can cause malfunction due to induction.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Make sure to use the quick-connection cable (optional) for the connection of the controller.
  Extension up to total 100 m 328.084 ft is possible with 0.3 mm² or more, cable. However, in order to reduce noise, make the wiring as short as possible.

## Part description




## Setting mode

- Setting mode appears after the MODE key is pressed for 2 sec. in RUN mode.

| Setting item | Factory setting | Description |
|---|---|---|
| Teaching mode | tAch | Threshold value can be set in 2-point teaching, limit teaching, or full-auto teaching. |
| Output operation setting | L.d d.on [Dark-ON] | Light-ON or Dark-ON can be set. |
| Timer operation setting | dELY non [Without timer] | Without timer, ON delay timer, or OFF delay timer can be set. |
| Timer setting | ond 10 [ON-delay timer: 10 ms] oFd 10 [OFF-delay timer: 10 ms] | In case of setting ON-delay timer or OFF-delay timer in the timer operation setting mode, timer can be set. When timer is not set, this mode is not displayed. |
| Emission amount setting | PctL MAX Level 3 | Setting for reduced intensity of emission amount is possible when the incident light intensity is saturated. |
| Emission frequency setting | **FX-101□** FrEQ F- 0 [0 (Response time: 250 µs or less)] **FX-102□** FrEQ F-01 [1 (Response time: 2.5 ms or less)] | In case of using the fiber heads in parallel, interference can be prevented by setting different emission frequency. However, when emission frequency 0 is set, interference cannot be prevented. Response time corresponds to emission frequency. |

# PRECAUTIONS FOR PROPER USE

Refer to the "Operation Guide" on our website for details pertaining to operating instructions for the amplifier.

## PRO mode

• PRO mode appears after the MODE key is pressed for 4 sec. in RUN mode.

| Setting item | Factory setting | Description |
|---|---|---|
| Shift setting | SHFt 15P [Shift amount 15 %] | Shift amount can be selected from 0 to 80 % in the limit teaching. Select 0 % when it is desired to set the present incident light intensity as a threshold value. |
| External input setting | inPt E-oF [Emission halt] | External input can be selected from emission halt, limit teaching [+], limit teaching [-], full-auto teaching, ECO (Note 1), 2-point teaching or emission amount test. When setting the incident light intensity test "tESt", output turns ON / OFF every 100ms when the rate of incident light intensity and threshold value is less than half of the set shift amount (for example, when the rate of incident light intensity and threshold value is within ±10 % for 20 % of shift amount) at external input. |
| Threshold value-storing setting mode (Note 2) | b-uP oFF [OFF] | Threshold value set at the limit teaching, full-auto teaching or 2-point teaching by external input is stored. When selecting Auto in the emission amount setting mode, the set emission amount level is also stored. |
| Threshold value follow-up cycle setting (Note 3) | CYCL oFF [OFF] | When incident light intensity exceeds threshold value, this mode can change the threshold value with each set cycle depending on variations of the incident light intensity. The follow-up shift amount is same as the one set in the shift setting mode. However, the threshold value is not stored. |
| GETA function setting (Note 4, 5) | GEtA oFF [OFF] | Variations can be reduced by correcting the present incident light intensity in each amplifier to a target value. Target value to offset incident light intensity can be selected from 0 to 2,000 by 100 unit each. For example, if the target value is set to 2,000 when the incident light intensity is 1,500, the incident light intensity becomes 2,000. |
| ECO setting | Eco oFF [OFF] | It is possible to light up / turn off the digital display. When ECO setting mode is ON, the display turns off in 20 sec. approx. in RUN mode. To light up the display again, press any key for 2 sec. or more. |
| Digital display inversion setting | turn oFF [OFF] | Digital display can be inverted. |
| Threshold value margin setting | ALrt oFF [OFF] | Margin for threshold value to the present incident light intensity can be checked. When there is no margin, it is possible to make the digital display blink.<br>oFF : Set to "OFF": does not function<br>GrEn : Green blinks.<br>rEd : Red blinks.<br>ALt : Red and green blink.<br>In-t : When conducting limit teaching or 2-point teaching by external input, in case the rate of reference incident light intensity and threshold value after teaching is 200% or more, or in case it is less than half of the shift amount, output turns ON / OFF every 100 ms. (Note 6) |
| Setting copy | CoPY no [NO] | The settings of the master side amplifier can be copied to the slave side amplifier. For details, refer to "**Setting copy function**". |
| Reset | rSEt no [NO] | Returns to default settings (factory settings.) |

Notes: 1) When ECO is selected at the external input setting mode, key operation on the main body is invalid during external input.
2) This mode is not indicated unless any of " LtcP ", " Ltc- ", " Auto " or " 2-Pt " is set at the external input setting mode.
3) If the incident light intensity becomes "300" or less, the follow-up operation stops. In that condition, threshold value [digital display (green)] blinks. This function can be used when thru-beam type or retroreflective type fiber is applied to this product. If reflective type fiber is applied, the function cannot be used depending on use conditions.
4) If MODE key is pressed in RUN mode when GETA function is used, the incident light intensity before setting GETA function is displayed on the red digital display for 2 sec. approx.
5) When GETA function is used in saturation of incident light intensity (4,000 or more,) " HArd " is indicated on the red digital display. Correction value is up to 4,000.
6) This mode does not operate unless any of " LtcP ", " Ltc- " or " 2-Pt " is set at the external input setting mode.

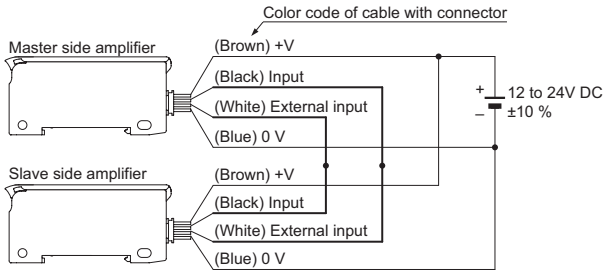
## Setting copy function

• This can copy the settings of the master side amplifier to the slave side amplifier.

- Be sure to use the setting copy function between the identical models (Between **FX-101**□ models or **FX-102**□ models).
  This function cannot be used between different models.
- Only one sensor can be connected on slave side with a master side sensor for the setting copy function.
- Threshold value, output operation setting, timer operation setting, timer setting, light-emitting amount setting, shift setting, external input setting, threshold value margin setting, ECO setting, digital display inversion setting, and threshold value margin setting can be copied.

**<Setting procedures>**

① Set the setting copy mode of the master side amplifier to "Copy sending ON", and press the MODE key so that " CoPY rEdY " is shown on the digital display and the sensor is in copy ready state. For the setting method, refer to "Operation guide".
② Turn off the master side amplifier.
③ Connect the master side amplifier with the slave side amplifier as shown below.




④ Turn on the master side amplifier and the slave side amplifier at the same time. (Note)
⑤ " CoPY " is shown on the green digital display of the master side amplifier and 4-digit code is shown on the red digital display of it, then the copying starts. During copy communication, " CoPY " is shown on the green digital display of the slave side amplifier, and the ongoing copy communication indicator (" I "→" II "→" III "→ " IIII "→" IIIII "→" IIIIII "→" IIIIIII "→"IIIIIII") is displayed on the red digital display.
⑥ When the copying is completed, " Good " is shown on the green digital display of the slave side amplifier, while the 4-digit code (the same code as the master side amplifier) is shown on the red digital display of it.
⑦ Turn off the power of the master side amplifier and the slave side amplifier and disconnect the wire.

* If copying the settings to another amplifier repeatedly, follow the steps ③ to ⑦.

Note: Take care that if the power is not turned on at the same time, the setting contents may not be copied.

**<To cancel the setting copy mode of the master side amplifier>**

① While the slave side amplifier is disconnected, turn on the power of the master side amplifier.
② Press the MODE key for 2 sec. approx.

# PRECAUTIONS FOR PROPER USE

Refer to the “Operation Guide” on our website for details pertaining to operating instructions for the amplifier.

## Others

- Our products have been developed / produced for industrial use only.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that the product is not directly exposed to fluorescent lamp from a rapid-starter lamp, a high frequency lighting device or sunlight etc., as it may affect the sensing performance.
- This product is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in contact with oil, grease, organic solvents, such as thinner, etc., strong acid or alkaline.
- This product cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify this product.
- EEPROM is adopted to this product. It is not possible to conduct teaching 100 thousand times or more, because of the EEPROM’s lifetime.

## Quick setting function

- The quick setting function makes it possible to set the content of the SET Mode (output operation, timer operation, amount of light emitted, and frequency of light emitted) simply by selecting a setting number.
- While in the RUN Mode, pressing and holding both the ON key (▲) and OFF key (▼) simultaneously for 2 seconds will switch to the quick setting function.

**<Table of quick setting numbers>**

| No. | Output operation | Timer | Emission amount setting |
|---|---|---|---|
| -00- | D-ON | non | Level 3 (OFF) |
| -01- | D-ON | non | Level 2 (ON) |
| -02- | D-ON | ofd 10 ms | Level 3 (OFF) |
| -03- | D-ON | ofd 10 ms | Level 2 (ON) |
| -04- | D-ON | ofd 40 ms | Level 3 (OFF) |
| -05- | D-ON | ofd 40 ms | Level 2 (ON) |
| -06- | D-ON | ond 10 ms | Level 3 (OFF) |
| -07- | D-ON | ond 10 ms | Level 2 (ON) |
| -08- | D-ON | ond 40 ms | Level 3 (OFF) |
| -09- | D-ON | ond 40 ms | Level 2 (ON) |
| -10- | L-ON | ond 40 ms | Level 2 (ON) |
| -11- | L-ON | ond 40 ms | Level 3 (OFF) |
| -12- | L-ON | ond 10 ms | Level 2 (ON) |
| -13- | L-ON | ond 10 ms | Level 3 (OFF) |
| -14- | L-ON | ofd 40 ms | Level 2 (ON) |
| -15- | L-ON | ofd 40 ms | Level 3 (OFF) |
| -16- | L-ON | ofd 10 ms | Level 2 (ON) |
| -17- | L-ON | ofd 10 ms | Level 3 (OFF) |
| -18- | L-ON | non | Level 2 (ON) |
| -19- | L-ON | non | Level 3 (OFF) |

## Code setting function

- The code setting function makes it possible to set the output operation, timer operation, amount of light emitted, frequency of light emitted, ECO setting, external input, and amount of shift by selecting a code of one’s choice.
- While in the RUN Mode, pressing and holding both the ON key (▲) and OFF key (▼) simultaneously for 4 seconds will switch to the code setting function.

**<Code table>**

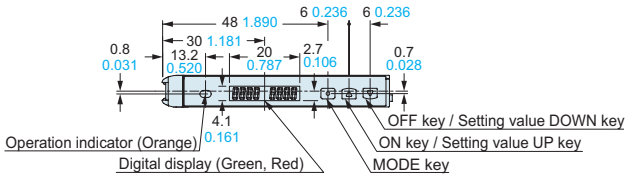

| Code | 1st digit | | 2nd digit | | | 3rd digit | | 4th digit |
|---|---|---|---|---|---|---|---|---|
| | Output operation | Timer (Note 1) | Emission amount setting | Emission frequency FX-101□ | Emission frequency FX-102□ | ECO | External input | Shift (Note 1) |
| 0 | D-ON | non | Level 3 (OFF) | 0 | 1 | OFF | Emission halt | 5 % |
| 1 | | ond 10 ms | | 1 | 2 | | Limit teaching [+] | 10 % |
| 2 | | ond 40 ms | | 2 | 3 | | Limit teaching [-] | 15 % |
| 3 | | ofd 10 ms | | 3 | 4 | | Full-auto teaching | 20 % |
| 4 | | ofd 40 ms | Level 2 (ON) | 0 | 1 | | ECO | 25 % |
| 5 | L-ON | non | | 1 | 2 | ON | Emission halt | 30 % |
| 6 | | ond 10 ms | | 2 | 3 | | Limit teaching [+] | 35 % |
| 7 | | ond 40 ms | | 3 | 4 | | Limit teaching [-] | 40 % |
| 8 | | ofd 10 ms | Level 1 | 0 | 1 | | Full-auto teaching | 45 % |
| 9 | | ofd 40 ms | | 1 | 2 | | ECO | 50 % |
| A | | | | 2 | 3 | OFF | 2-point teaching | |
| b | | | | 3 | 4 | | Incident light intensity test | |
| c | | | Auto | 0 | 1 | ON | 2-point teaching | |
| d | | | | 1 | 2 | | Incident light intensity test | |
| E | | | | 2 | 3 | | | |
| F | | | | 3 | 4 | | | |

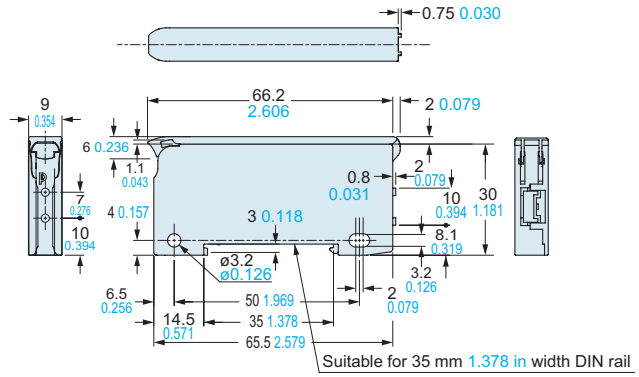
Notes: 1) When the present setting is out of the code setting range, “-” is shown. When “-” is selected, the set content of the digit is not changed.
2) The factory setting is “ 0002 ”.

# DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

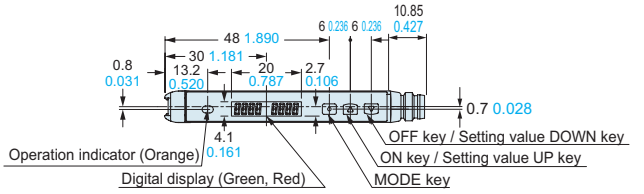
## FX-101□ FX-102□ Amplifier

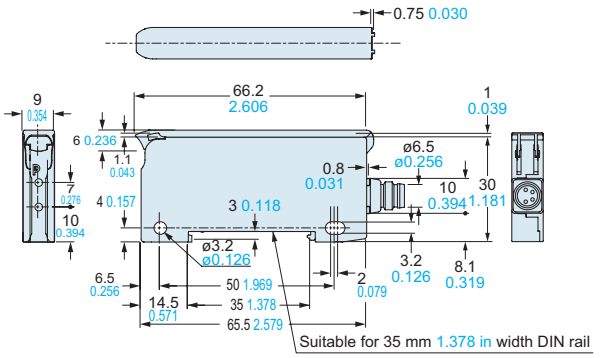



Note: The protection cover has been attached from the production at July, 2011.

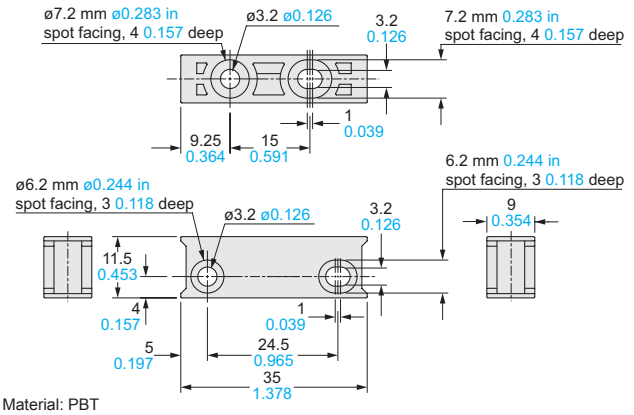
## FX-101(P)-Z FX-102(P)-Z Amplifier



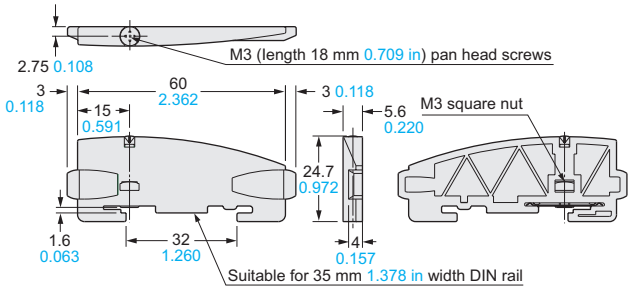

Note: The protection cover has been attached from the production at July, 2011.

## MS-DIN-4 Amplifier mounting bracket (Optional)



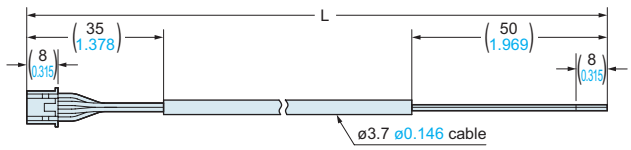

Material: PBT

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




Material: Polycarbonate

## CN-14A-C□ CN-14A-R-C□ Connector attached cable (Optional)




**CN-14A-C2** is attached **FX-101(P)-CC2** / **FX-102(P)-CC2**

• Length L

| Model No. | Length L |
|---|---|
| **CN-14A(-R)-C1** | 1,000 39.370 |
| **CN-14A(-R)-C2** | 2,000 78.740 |
| **CN-14A(-R)-C3** | 3,000 118.110 |
| **CN-14A(-R)-C5** | 5,000 196.850 |

MEMO

# INDEX

# INDEX



## M

# INDEX

## R



## S

MEMO

# Earlier Models Comparison Table

## Advantages of switching to recommended replacements

- The quality of many models has been improved by shortening their bending radii and achieving better bending performance.
- The number of part numbers has been reduced, letting you reduce the part numbers to keep track of and service parts to keep on hand.
- We have reduced our environmental impact further by making fiber end bracket out of stainless steel and plastic, which contain no RoHS substances.

## Subjected models

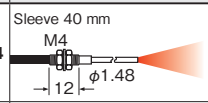
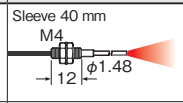
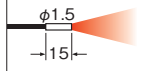
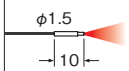
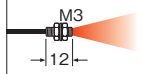
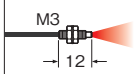
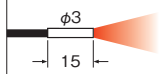
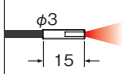
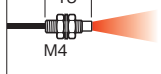
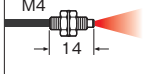
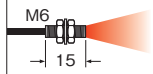
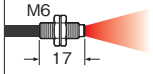
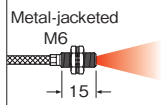
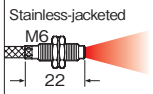
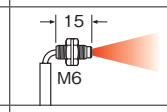
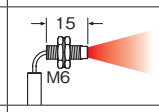
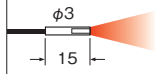
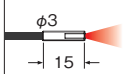
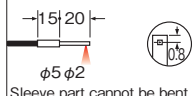
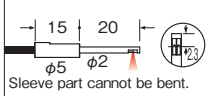
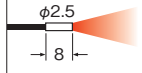
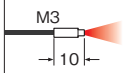
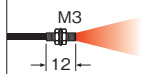
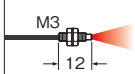
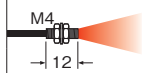
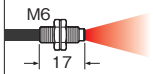
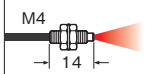
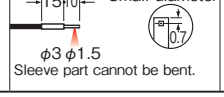
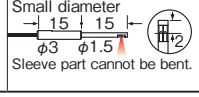
Discontinued models Stopping taking order date : 31 Mar., 2012

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reflective type | FD-A15 | W7×H15×D30 | R25 | – | 200 7.874 | Tough FD-A16 | W7×H15×D30 | R4 | ○ | 200 7.874 | |
| | FD-AFM2 | Top sensing W5×H20×D20 | R25 | – | 280 11.024 | Tough FD-AL11 | W5×H20×D20 | R2 | ○ | 320 12.598 | ・Cable lead out orientation changed<br>・Metal case material (brass) ⇒ Changed to plastic (PPS) |
| | FD-AFM2E | Side sensing W5×H20×D20 | R25 | – | 280 11.024 | Tough FD-AL11 | W5×H20×D20 | R2 | ○ | 320 12.598 | ・Cable lead out orientation changed<br>・Metal casing material (brass) ⇒ Changed to plastic (PPS) |
| | FD-B8 | M6, 15 | R25 | – | 490 19.291 | FD-62 | M6, 17 | R4 | ○ | 520 20.472 | ・End bracket total length for the M6 part only: 15 mm ⇒ Changed to 17 mm (M6 part/15 mm + ø4.5 area/2 mm ) |
| | FD-E12 | ϕ1.5 ϕ0.5, 15 3, Sleeve part cannot be bent. | R10 | – | 12 0.472 | FD-E13 | ϕ1.5 ϕ0.48, 15 3, Sleeve part cannot be bent. | R4 | – | 12 0.472 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration |
| | FD-E22 | Coaxia ϕ3 ϕ0.65, 15 5, Sleeve part cannot be bent. | R25 | – | 55 2.165 | FD-E23 | ϕ3 ϕ0.65, 15 5, Sleeve part cannot be bent. | R4 | – | 55 2.165 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration |
| | FD-EG1 | High precision・Coaxial Lens mountable (FX-MR3, FX-MR6) M3, 17 | R25 | – | 40 1.575 | FD-EG30 | Coaxial, Lens mountable M3, 16 | R4 | – | 48 1.890 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting / receiving configuration<br>・End bracket total length 17 mm ⇒ Changed to 16 mm |
| | FD-EG2 | High precision・Coaxial Lens mountable (FX-MR3, FX-MR6) Light emitting fiber element ϕ0.175 M3, 17 | R10 | – | 24 0.945 | FD-EG31 | Coaxial, Lens mountable M3, 16 | R4 | – | 20 0.787 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration<br>・End bracket total length 17 mm ⇒ Changed to 16 mm<br>・Protective tube outside diameter ø1.6 ⇒ Changed to ø1.2 |
| | FD-EG3 | High precision・Coaxial Lens mountable (FX-MR3, FX-MR6) Light emitting fiber element ϕ0.125 M3, 17 | R10 | – | 20 0.787 | FD-EG31 | Coaxial, Lens mountable M3, 16 | R4 | – | 20 0.787 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration<br>・End bracket total length 17 mm ⇒ Changed to 16 mm<br>・Protective tube outside diameter ø1.6 ⇒ Changed to ø1.2 |
| | FD-EN500S1 | M3 ϕ0.5, 15 15, Sleeve part cannot be bent. | R25 | – | – | FD-EG30S | Sleeve 15 mm M3 ϕ0.8, 15, Sleeve part cannot be bent. | R4 | – | 50 1.969 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting /receiving configuration<br>・Sleeve size ø0.5 ⇒ Changed to ø0.8 |
| | FD-ENM1S1 | Coaxial M3 ϕ0.8, 15 15, Sleeve part cannot be bent. | R25 | – | 50 1.969 | FD-EG30S | Sleeve 15 mm M3 ϕ0.8, 15, Sleeve part cannot be bent. | R4 | – | 50 1.969 | ・Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration |
| | FD-F705 | SEMI S2 compliant W20×H30×D10 | R4 (Protective tube R20) | ○ | Liquid leak detection | Tough FD-F71 | SEMI S2 compliant W20×H30×D10 | R4 (Protective tube R20) | ○ | Liquid leak detection | |
| | FD-FA90 | Mountable on pipe・Array fiber W6.5×H28.3×D17 | R10 | – | Liquid detection | Tough FD-FA93 | Array fiber W6.5×H28.3×D17 | R4 | ○ | Liquid detection | |

# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reflective type | **FD-FM2** | Coaxial<br>M6<br>20 | R25 | — | 420<br>16.535 | **Tough FD-61** | M6<br>17 | R4 | ○ | 450<br>17.717 | ・End bracket total length of 20 mm for the (M6 part/15 mm + ø3.5 area/5 mm) ⇒ Changed to 17 mm (M6 part/15 mm + ø4.5 area/2 mm)<br>・Coaxial cable used for wiring ⇒ Changed to parallel type |
| | **FD-FM2S** | Sleeve 90 mm<br>M6<br>20 ϕ2.5 | R25 (Sleeve R10) | — | 380<br>14.961 | **Tough FD-61G** | Coaxial<br>M6<br>17 | R4 | ○ | 420<br>16.535 | ・End bracket total length of 20 mm for the (M6 part/15 mm + ø3.5 area/5 mm) ⇒ Changed to 17 mm (M6 part/15 mm + ø4.5 area/2 mm) |
| | **FD-FM2S4** | Sleeve 40 mm<br>M6<br>20 ϕ2.5 | R25 (Sleeve R10) | — | 380<br>14.961 | **Tough FD-61S** | Sleeve 40 mm<br>M6<br>20 ϕ2.5 | R4 (Sleeve R10) | ○ | 420<br>16.535 | ・The sleeve length 90 mm type supports semi-custom products. |
| | **FD-G4** | Minute objects can be detected due to the small spot beam.<br>Coaxial・Lens mountable (**FX-MR1/MR2/MR3/MR5/MR6**)<br>M4<br>25 | R25 | — | 140<br>5.512 | **Tough FD-61S** | Sleeve 40 mm<br>M6<br>20 ϕ2.5 | R4 (Sleeve R10) | ○ | 420<br>16.535 | |
| | **FD-G6** | Lens mountable (**FX-MR3**, **FX-MR6**)<br>Coaxial<br>M3<br>17 | R25 | — | 140<br>5.512 | **Tough FD-42G** | Coaxial・Lens mountable<br>M4<br>25 | R2 | ○ | 200<br>7.874 | |
| | **FD-G6X** | Metal-jacketed<br>Lens mountable (**FX-MR3**, **FX-MR6**)<br>Coaxial<br>M3<br>18 | R25 | — | 170<br>6.693 | **Tough FD-32G** | Coaxial・Lens mountable<br>M3<br>17 | R2 | ○ | 200<br>7.874 | |
| | **FD-L4** | W6×H18×D14 | R25 | — | 15.5<br>0.610 | **Tough FD-32GX** | Coaxial・Lens mountable<br>Stainless-jacketed<br>M3<br>18 | R2 | — | 200<br>7.874 | ・Stainless steel mesh jacket covering the stainless steel spiral tube used as a protective cover for the fiber ⇒Changed to plastic (polyolefin) |
| | **FD-L41** | Glass substrate detection<br>W24×H21×D4 | R10 | — | 1.5 to 16<br>0.059 to 0.630 | **Tough FD-L20H** | W6×H18×D14 | R2 | ○ | 23<br>0.906 | |
| | **FD-L43** | Glass substrate detection・Alignment<br>W17×H29×D3.8 | R4 | — | 0 to 24<br>0 to 0.945 | **Tough FD-L21** | W24×H21×D4 | R2 | ○ | 1.5 to 16<br>0.059 to 0.630 | |
| | **FD-L44** | Glass substrate detection・Seating confirmation<br>W12×H19×D3 | R10 | — | 0 to 9.5<br>0 to 0.374 | **Tough FD-L22A** | Alignment<br>W17×H29×D3.8 | R2 | ○ | 0 to 24<br>0 to 0.945 | |
| | **FD-L44S** | Glass substrate detection・Seating confirmation<br>W12×H19×D3 | R10 | — | 0 to 5<br>0 to 0.197 | **Tough FD-L11** | Seating confirmation<br>W12×H19×D3 | R4 | ○ | 0 to 9.5<br>0 to 0.374 | |
| | **FD-L45** | Glass substrate detection・Alignment<br>W20×H29×D3.8 | R4 | — | 0 to 40<br>0 to 1.575 | **Tough FD-L10** | Seating confirmation<br>W12×H19×D3 | R4 | ○ | 0 to 5<br>0 to 0.197 | |
| | **FD-L45A** | Glass substrate detection・Alignment<br>W23.5×H29×D4.5 | R25 | — | 4 to 44<br>0.157 to 1.732 | **Tough FD-L30A** | Alignment<br>W20×H29×D3.8 | R4 | ○ | 0 to 43<br>0 to 1.693 | |
| | **FD-L46** | Glass substrate detection・Mapping<br>W25×H7.3×D30 | R25 | — | 1 to 56<br>0.039 to 2.205 | **Tough FD-L31A** | Alignment<br>W23.5×H29×D4.5 | R4 | ○ | 4 to 33<br>0.157 to 1.299 | ・Previous no flexing distance specifications ⇒ Specification wording changed to state flexing ±2 degrees (Reference: Discontinued model ±2 degrees specification is 10 mm to 32 mm) |
| | **FD-L47** | Glass substrate detection・Seating confirmation<br>W18×H29×D3.8 | R4 | — | 0 to 29<br>0 to 1.142 | **Tough FD-L32H** | Mapping<br>W25×H7.3×D30 | R4 | ○ | 0 to 56<br>0 to 2.205 | |
| | **FD-NFM2** | M4<br>17 | R25 | — | 120<br>4.724 | **Tough FD-L23** | Seating confirmation<br>W18×H29×D3.8 | R2 | ○ | 0 to 29<br>0 to 1.142 | |
| | **FD-NFM2S** | Sleeve 90 mm<br>M4<br>12 ϕ1.48 | R25 (Sleeve R10) | — | 120<br>4.724 | **Tough FD-41** | M4<br>14 | R2 | ○ | 125<br>4.921 | ・End bracket total length of 17 mm for the (M4 part/12 mm + ø2.5 area/5 mm) ⇒ Changed to 14 mm (M4 part/12 mm +ø2.5 area/2 mm) |
| | | | | | | **Tough FD-41S** | Sleeve 40 mm<br>M4<br>12 ϕ1.48 | R2 (Sleeve R10) | ○ | 125<br>4.921 | ・The sleeve length 90 mm type supports semi-custom products. |

# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reflective type | **FD-NFM2S4** |   | R25 (Sleeve R10) | — | 120<br>4.724 | **Tough FD-41S** |   | R2 (Sleeve R10) | ○ | 125<br>4.921 | |
| | **FD-P2** |   | R4 | ○ | 80<br>3.150 | **Tough FD-S21** |   | R2 | ○ | 80<br>3.150 | ·Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration<br>·End bracket total length 15 mm ⇒ Changed to 10 mm<br>·PVC outer covering material for fiber ⇒ Changed to PE |
| | **FD-P40** |   | R4 | ○ | 45<br>1.772 | **Tough FD-31** |   | R2 | ○ | 125<br>4.921 | ·End bracket shape is 12 mm for the M3 part only ⇒ Changed to a total length of 12 mm (M3 part/10 mm + ø2 area/2 mm )<br>·PVC outer covering material for fiber ⇒ Changed to PE |
| | **FD-P50** |   | R4 | ○ | 120<br>4.724 | **Tough FD-S32** |   | R4 | ○ | 420<br>16.535 | ·PVC outer covering material for fiber ⇒ Changed to PE |
| | **FD-P60** |   | R4 | ○ | 120<br>4.724 | **Tough FD-41** |   | R2 | ○ | 125<br>4.921 | ·End bracket total length of 15 mm for the (M4 part/12 mm + ø3 area/3 mm) ⇒ Changed to 14 mm (M4 part/12 mm + ø2.5 area/2 mm)<br>·PVC outer covering material for fiber ⇒ Changed to PE |
| | **FD-P80** |   | R4 | ○ | 280<br>11.024 | **Tough FD-61** |   | R4 | ○ | 450<br>17.717 | ·End bracket total length of 15 mm for the M6 part only ⇒ Changed to 17 mm (M6 part/15 mm + ø4.5 area/2 mm)<br>·PVC outer covering material for fiber ⇒ Changed to PE |
| | **FD-P81X** |   | R10 | — | 270<br>10.630 | **FD-64X** |   | R4 | — | 280<br>11.024 | ·End bracket total length of 19 mm for the (M6 part/15 mm + crimped area/4 mm) ⇒ Changed to 22 mm (ø4.5 area/2 mm + M6 part/15 mm + crimped area/5 mm)<br>·Split amplifier insertion section configuration ⇒ Changed to integrated light emitting/receiving configuration<br>·Stainless steel mesh jacket covering the stainless steel spiral tube used as a protective cover for the fiber ⇒ Changed to plastic (polyolefin) |
| | **FD-R80** |   | R25 | — | 220<br>8.661 | **Tough FD-R60** |   | R4 | ○ | 290<br>11.417 | |
| | **FD-S80** |   | R25 | — | 380<br>14.961 | **Tough FD-S32** |   | R4 | ○ | 420<br>16.535 | |
| | **FD-SFM2SV2** |   | R25 | — | 120<br>4.724 | **Tough FD-V50** |   | R4 | ○ | 120<br>4.724 | ·From sleeve end to optical axis center position is 0.8 mm ⇒ Changed to 2.3 mm<br>·A D-shaped surface that makes it easy to align with the optical axis has been added |
| | **FD-SNFM2** |   | R25 | — | 120<br>4.724 | **Tough FD-S31** |   | R2 | ○ | 125<br>4.921 | ·End bracket shape is 8 mm for the ø2.5 part only ⇒ Changed to 10 mm (ø3 part/ 8 mm + ø2 area/2 mm) |
| | **FD-T40** |   | R25 | — | 120<br>4.724 | **Tough FD-31** |   | R2 | ○ | 125<br>4.921 | ·End bracket shape is 12 mm for the M3 part only ⇒ Changed to a total length of 12 mm (M3 part /10 mm + ø2 area/2 mm) |
| | **FD-T80** |   | R25 | — | 380<br>14.961 | **Tough FD-61** |   | R4 | ○ | 450<br>17.717 | ·End bracket shape is 12 mm for the M4 part only ⇒ Changed to a total length of 17 mm (M6 part/15 mm + ø4.5 area/2 mm)<br>·Fiber cable outside diameter ø1.3 ⇒ Changed to ø2.2 |
| | | | | | | **Tough FD-41** |   | R2 | ○ | 125<br>4.921 | ·End bracket total length is 12 mm for the M4 part only ⇒ Changed to 14 mm (M4 part/12 mm + ø2.5 area/2 mm)<br>·Fiber cable outside diameter ø1.3 ⇒ Changed to ø1 |
| | **FD-V41** |   | R25 | — | 65<br>2.559 | **Tough FD-V30** |   | R2 | ○ | 65<br>2.559 | ·From sleeve end to optical axis center position is 0.7 mm ⇒ Changed to 2 mm<br>·End sleeve length of 10 mm ⇒ Changed to 15 mm |

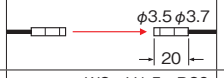
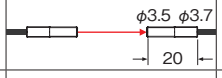
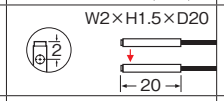
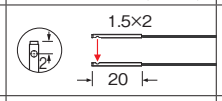
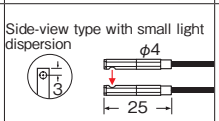
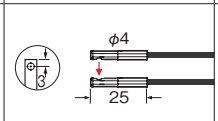
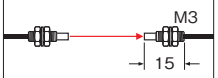
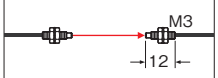
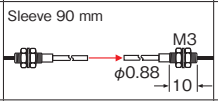
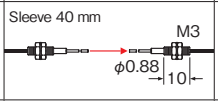
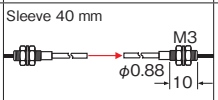
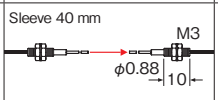
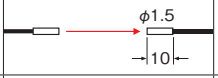
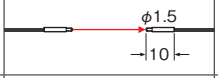
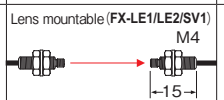
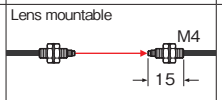
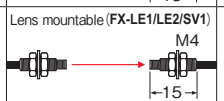
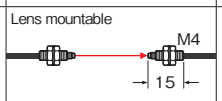
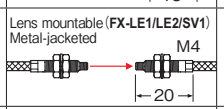
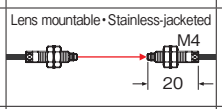
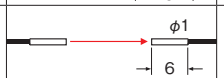
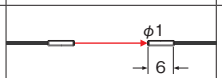
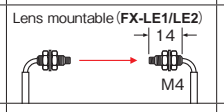
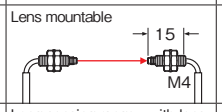
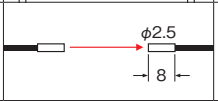
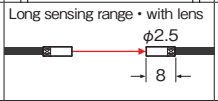
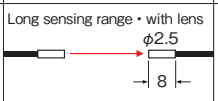
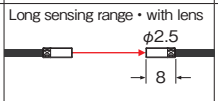
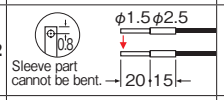
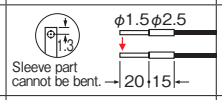
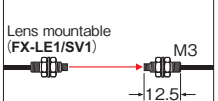
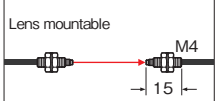
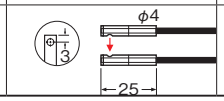
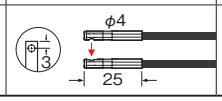
# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reflective type | **FD-W44** | Sleeve 40 mm, M4, ϕ1.48, 12 | R1 (Sleeve R10) | — | 80 3.150 | **Tough FD-41S** | Sleeve 40 mm, M4, ϕ1.48, 12 | R2 (Sleeve R10) | ○ | 125 4.921 | |
| | | | | | | **FD-41SW** | Sleeve 40 mm, M4, ϕ1.48, 12 | R1 (Sleeve R10) | — | 80 3.150 | |
| | **FD-W8** | M6, 15 | R1 | — | 250 9.843 | **Tough FD-61** | M6, 17 | R4 | ○ | 450 17.717 | ·End bracket total length is 15 mm for the M6 part only ⇒ Changed to 17 mm (M6 part/ 15 mm + ø4.5 area/2 mm) |
| | | | | | | **FD-61W** | M6, 17 | R1 | — | 270 10.630 | ·End bracket total length is 15 mm for the M6 part only ⇒ Changed to 17 mm (M6 part/ 15 mm + ø4.5 area/2 mm) |
| | **FD-WG4** | Minute objects can be detected due to the small spot beam. Coaxial • Lens mountable (**FX-MR1/MR2/MR3/MR5/MR6**), M4, 25 | R2 | — | 150 5.906 | **Tough FD-42G** | Coaxial • Lens mountable, M4, 25 | R2 | ○ | 200 7.874 | |
| | | | | | | **FD-42GW** | Coaxial • Lens mountable, M4, 25 | R1 | — | 150 5.906 | |
| | **FD-WKZ1** | Long sensing range • Rectangular head, W5.2×H9.5×D15 | R1 | — | 20 to 490 0.787 to 19.291 | **FD-Z50HW** | W5.2×H9.5×D15 | R1 | — | 10 to 650 0.394 to 25.591 | ·Stainless steel unit casing material ⇒ Changed to plastic (PC) |
| | **FD-WL41** | Glass substrate detection, W24×H21×D4 | R1 | — | 2.5 to 14 0.098 to 0.551 | **Tough FD-L21** | W24×H21×D4 | R2 | ○ | 1.5 to 16 0.059 to 0.630 | |
| | | | | | | **FD-L21W** | W24×H21×D4 | R1 | — | 3 to 14 0.118 to 0.551 | |
| | **FD-WL48** | W7.2×H7.5×D2 | R1 | — | 7.5 0.295 | **FD-L12W** | W7.2×H7.5×D2 | R1 | — | 8 0.315 | |
| | **FD-WS8** | ϕ3, 15 | R1 | — | 250 9.843 | **Tough FD-S32** | ϕ3, 15 | R4 | ○ | 420 16.535 | |
| | | | | | | **FD-S32W** | ϕ3, 15 | R1 | — | 270 10.630 | |
| | **FD-WSG4** | Coaxial, ϕ3, 15 | R2 | — | 150 5.906 | **FD-S33GW** | Coaxial, ϕ3, 15 | R1 | — | 150 5.906 | |
| | **FD-WT4** | M3, 12 | R1 | — | 80 3.150 | **Tough FD-31** | M3, 12 | R2 | ○ | 125 4.921 | ·End bracket total length is 12 mm for the M3 part only ⇒ Changed to 12 mm (M3 part/ 10 mm + ø2 area /2 mm) |
| | | | | | | **FD-31W** | M3, 12 | R1 | — | 80 3.150 | ·End bracket total length is 12 mm for the M3 part only ⇒ Changed to 12 mm (M3 part/ 10 mm + ø2 area/ 2 mm) |
| | **FD-WT8** | M4, 14 | R1 | — | 250 9.843 | **Tough FD-41** | M4, 14 | R2 | ○ | 125 4.921 | ·End bracket total length is 12 mm for the M4 part only ⇒ Changed to 14 mm (M4 part/12 mm + ø3 area/ 2 mm) |
| | | | | | | **FD-41W** | M4, 14 | R1 | — | 270 10.630 | ·End bracket total length is 12 mm for the M4 part only ⇒ Changed to 14 mm (M4 part/12 mm + ø3 area/ 2 mm) |
| | **FD-WV42** | 15 15, ϕ3 ϕ2, Sleeve part cannot be bent. | R1 | — | 16 0.630 | **Tough FD-V30** | Small diameter, 15 15, ϕ3 ϕ1.5, 2, Sleeve part cannot be bent. | R2 | ○ | 65 2.559 | ·From sleeve end to optical axis center position is 1 mm ⇒ Changed to 2 mm ·End sleeve thickness of ø2 ⇒ Changed to ø1.5 ·A D-shaped surface that makes it easy to align with the optical axis has been added |
| | | | | | | **FD-V30W** | 15 15, ϕ3 ϕ1.5, 2, Sleeve part cannot be bent. | R1 | — | 20 0.787 | ·From sleeve end to optical axis center position is 1 mm ⇒ Changed to 2 mm ·End sleeve thickness of ø2 ⇒ Changed to ø1.5 ·A D-shaped surface that makes it easy to align with the optical axis has been added |

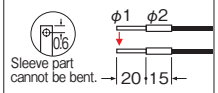
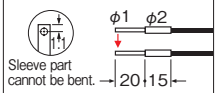
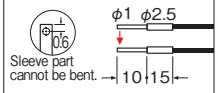
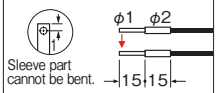
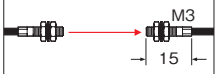
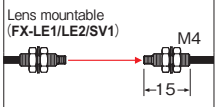
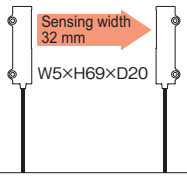
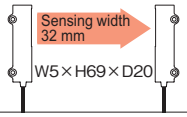
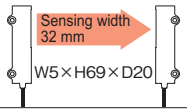
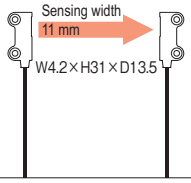
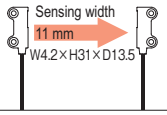
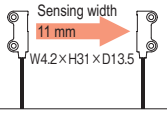
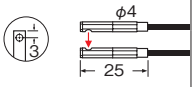
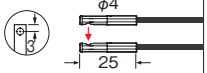
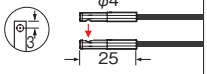
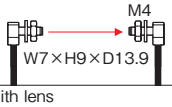
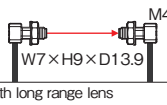
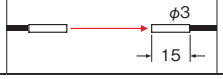
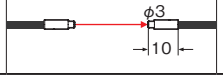
# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reflective type | FD-WZ4HB | Fiber bending type W2×H10×D10 | R1 | – | 2.5 to 65 0.098 to 2.559 | FD-Z20HBW | Fiber bending type W2×H10×D10 | R1 | – | 2 to 85 0.079 to 3.346 | |
| | FD-WZ7HB | Fiber bending type W3.5×H14×D11 | R1 | – | 1 to 150 0.039 to 5.906 | FD-Z40HBW | Fiber bending type W3.5×H14×D11 | R1 | – | 260 10.236 | |
| Retroreflective type | FR-KV1 | W7.5×H2.2×D11.2 W4×H2×D21.5 | R10 | – | 20 to 310 0.787 to 12.205 | Tough FR-KZ22E | W7.5×H2.2×D11.2 W4×H2×D21.5 | R2 | ○ | 15 to 310 0.591 to 12.205 | ・Unit side installation screw positions have been moved back 1 mm from the front edge |
| | FR-KZ21 | W9.5×H5.2×D21 W10.6×H28×D10.1 | R10 | – | 20 to 200 0.787 to 7.874 | Tough FR-KZ50H | W9.5×H5.2×D21 W10.6×H28×D10.1 | R2 | ○ | 20 to 300 0.787 to 11.811 | |
| | FR-KZ21E | W9.5×H25×D5.2 W10.6×H28×D10.1 | R10 | – | 20 to 200 0.787 to 7.874 | Tough FR-KZ50E | W9.5×H25×D5.2 W28×H10.6×D10.1 | R2 | ○ | 20 to 300 0.787 to 11.811 | |
| | FR-WKZ11 | W9.5×H5.2×D15 W30×H30×D0.5 | R1 | – | 100 to 990 3.937 to 38.976 | FR-Z50HW | W5.2×H9.5×D16 W30×H30×D0.5 | R1 | ○ | 100 to 990 3.937 to 38.976 | |
| Thru-beam type | FT-A30 | Wide area sensing Sensing width 32 mm W5×H69×D20 | R10 | – | 3600 141.732 | Tough FT-A32 | Sensing width 32 mm W5×H69×D20 | R2 | ○ | 3600 141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3<br>・Optical cable diameter of 3 × 32 ⇒ Changed to 3.2 × 32 |
| | FT-A8 | Wide area sensing Sensing width 11 mm W4.2×H31×D13.5 | R10 | – | 3600 141.732 | Tough FT-A11 | Sensing width 11 mm W4.2×H31×D13.5 | R2 | ○ | 3600 141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3 |
| | FT-AFM2 | Top sensing W5×H15×D15 | R25 | – | 860 33.858 | Tough FT-AL05 | Sensing width 5.5 mm W5×H15×D15 | R2 | ○ | 860 33.858 | ・Cable lead out orientation changed<br>・Metal casing material (brass) ⇒ Changed to plastic (PPS) |
| | FT-AFM2E | Side sensing W5×H15×D15 | R25 | – | 860 33.858 | Tough FT-AL05 | Sensing width 5.5 mm W5×H15×D15 | R2 | ○ | 860 33.858 | ・Cable lead out direction changed<br>・Metal casing material (brass) ⇒ Changed to plastic (PPS) |
| | FT-B8 | Lens mountable (FX-LE1/LE2/SV1) M4 15 | R25 | – | 1250 49.213 | FT-43 | Lens mountable M4 15 | R4 | ○ | 1400 55.118 | |
| | FT-E12 | Beam dia. ϕ0.125 mm ϕ0.25 ϕ3 Sleeve part cannot be bent. | R5 | – | – | Tough FT-E13 | Beam dia. ϕ0.125 mm ϕ0.25 ϕ3 5 15 Sleeve part cannot be bent. | R2 | ○ | 15 0.591 | ・Fiber length 500 mm /set length type ⇒ Changed to fiber length 1 m/free cut type<br>・Fiber cable outside diameter ø1.2 ⇒ Changed to ø1<br>・End bracket length of 10 mm ⇒ Changed to 15 mm |
| | FT-E22 | Beam dia. ϕ0.25 mm ϕ0.4 ϕ3 5 10 Sleeve part cannot be bent. | R5 | – | – | Tough FT-E23 | Beam dia. ϕ0.25 mm ϕ0.4 ϕ3 5 15 Sleeve part cannot be bent. | R2 | ○ | 75 2.953 | ・Set length type ⇒ Changed to free cut type<br>・Fiber cable outside diameter ø1.2 ⇒ Changed to ø1<br>・End bracket length of 10 mm ⇒ Changed to 15 mm |
| | FT-F902 | Mountable on pipe SEMI S2 compliant W23×H20×D17 | R4 (Protective tube R20) | ○ | Liquid detection | Tough FT-F93 | SEMI S2 compliant W23×H20×D17 | R2 (Protective tube R20) | ○ | Liquid detection | |
| | FT-FM10L | With lens M14 23 | R25 | – | 19600 771.654 | Tough FT-140 | With long range lens M14 40 | R4 | ○ | 19600 771.654 | |
| | FT-FM2 | Lens mountable (FX-LE1/LE2/SV1) M4 15 | R25 | – | 1100 43.307 | Tough FT-42 | Lens mountable M4 15 | R4 | ○ | 1130 44.488 | |
| | FT-FM2S | Sleeve 90 mm M4 ϕ1.48 12 | R25 (Sleeve R10) | – | 1100 43.307 | Tough FT-42S | Sleeve 40 mm M4 ϕ1.48 12 | R4 (Sleeve R10) | ○ | 1130 44.488 | ・The sleeve length 90 mm type supports semi-custom products. |
| | FT-FM2S4 | Sleeve 40 mm M4 ϕ1.48 12 | R25 (Sleeve R10) | – | 1100 43.307 | Tough FT-42S | Sleeve 40 mm M4 ϕ1.48 12 | R4 (Sleeve R10) | ○ | 1130 44.488 | |

# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thru-beam type | FT-K8 |   | R25 | – | 3600 141.732 | Tough FT-KS40 |   | R2 | ○ | 3600 141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1 |
| | FT-KV1 |   | R10 | – | 540 21.260 | Tough FT-KV26 |   | R2 | ○ | 710 27.953 | |
| | FT-KV8 |   | R25 | – | 3600 141.732 | Tough FT-KV40 |   | R2 | ○ | 3600 141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1<br>・Metal end material (stainless steel) ⇒ Changed to plastic (LCP), set screw fastening specifications ⇒ Changed to **MS-FD-3** fastener specifications |
| | FT-NFM2 |   | R25 | – | 310 12.205 | Tough FT-31 |   | R2 | ○ | 315 12.402 | ・End bracket total length of 15 mm for the (M3 part/10 mm + ø2 area/5 mm ⇒ Changed to 12 mm (M3 part/10 mm + ø2 area/2 mm) |
| | FT-NFM2S |   | R25 (Sleeve R10) | – | 310 12.205 | Tough FT-31S |   | R2 (Sleeve R10) | ○ | 315 12.402 | ・The sleeve length 90 mm type supports semi-custom products. |
| | FT-NFM2S4 |   | R25 (Sleeve R10) | – | 310 12.205 | Tough FT-31S |   | R2 (Sleeve R10) | ○ | 315 12.402 | |
| | FT-P2 |   | R4 | ○ | 330 12.992 | Tough FT-S21 |   | R2 | ○ | 315 12.402 | ・Fiber length 1 m/Set length type ⇒ Changed to fiber length 2 m/free cut type<br>・Fiber exterior cover material of PVC ⇒ Changed to PE |
| | FT-P40 |   | R4 | ○ | 160 6.299 | Tough FT-31 |   | R2 | ○ | 315 12.402 | ・End bracket total length of 10 mm for the M3 part ⇒ Changed to 12 mm (M3 part/10 mm + ø2 area/2 mm)<br>・Fiber exterior cover material of PVC ⇒ Changed to PE |
| | FT-P60 |   | R4 | ○ | 350 13.780 | Tough FT-42 |   | R4 | ○ | 1130 44.488 | ・Fiber exterior cover material of PVC ⇒ Changed to PE<br>・Fiber cable outside diameter ø1.25 ⇒ Changed to ø2.2 |
| | FT-P80 |   | R4 | ○ | 810 31.890 | Tough FT-42 |   | R4 | ○ | 1130 44.488 | ・Fiber exterior cover material of PVC ⇒ Changed to PE |
| | FT-P81X |   | R10 | – | 880 34.646 | FT-45X |   | R4 | – | 1200 47.244 | ・Stainless steel mesh jacket covering the stainless steel spiral tube used as a protective cover for the fiber ⇒ Changed to plastic (polyolefin) |
| | FT-PS1 |   | R4 | ○ | 90 3.543 | Tough FT-S11 |   | R2 | ○ | 90 3.543 | |
| | FT-R80 |   | R25 | – | 780 30.709 | Tough FT-R40 |   | R4 | ○ | 930 36.614 | ・End bracket total length of 14 mm for the (M2.6 part/3 mm + M4 part/11 mm) ⇒ Changed to 15 mm (M2.6 part/3 mm + M4 part/12 mm) |
| | FT-SFM2 |   | R25 | – | 1100 43.307 | FT-S32 |   | R10 | ○ | 3100 122.047 | ・Optical cable diameter of ø1 ⇒ Changed to ø2.2 |
| | FT-SFM2L |   | R25 | – | 2600 102.362 | FT-S32 |   | R10 | ○ | 3100 122.047 | |
| | FT-SFM2SV2 |   | R25 | – | 570 22.441 | Tough FT-V30 |   | R4 | ○ | 680 26.772 | ・From sleeve end to optical axis center position is 0.8 ⇒ Changed to 1.3 mm<br>・D-shaped surface that makes it easy to align with the optical axis has been added |
| | FT-SNFM2 |   | R25 | – | 310 12.205 | Tough FT-S21 |   | R2 | ○ | 315 12.402 | ・End bracket total length of ø1.5 /8 mm ⇒ Changed to 12 mm (ø1 area/2 mm + ø1.5/8 mm) |
| | FT-T80 |   | R25 | – | 1100 43.307 | Tough FT-42 |   | R4 | ○ | 1130 44.488 | ・End bracket total length of 12.5 mm for the (M2.6 part/2.5 mm + M3 part/10 mm) ⇒ Changed to 15 mm (M2.6 part /3 mm + M4 part/12 mm)<br>・Fiber cable outside diameter ø1.3 ⇒ Changed to ø2.2 |
| | FT-V10 |   | R25 | – | 3500 137.795 | Tough FT-V40 |   | R4 | ○ | 3500 137.795 | |

# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thru-beam type | **FT-V22** |  | R25 | – | 300<br>11.811 | **FT-V23** (Tough) |  | R4 | ○ | 450<br>17.717 | ・Fiber length 1 m/Set length type ⇒ Changed to fiber length 2 m/free cut type<br>・From sleeve end to optical axis center position is 0.6 ⇒ Changed to 1.1 mm<br>・D-shaped surface that makes it easy to align with the optical axis has been added |
| | **FT-V41** |  | R25 | – | 200<br>7.874 | **FT-V25** (Tough) |  | R2 | ○ | 240<br>9.449 | ・End bracket outside diameter of ø2.5 ⇒ Changed to ø2<br>・From sleeve end to optical axis center position is 0.6 ⇒ Changed to 1 mm |
| | **FT-W4** |  | R1 | – | 250<br>9.843 | **FT-31** (Tough) |  | R2 | ○ | 315<br>12.402 | ・End bracket total length of 15 mm for the (M3 part/10 mm + crimped area/5 mm) ⇒ Changed to 12 mm (ø2 area/2 mm + M3 part/10 mm)<br>・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1 |
| | | | | | | **FT-31W** |  | R1 | – | 260<br>10.236 | ・End bracket total length of 15 mm for the (M3 part/10 mm + crimped area/5 mm) ⇒ Changed to 12 mm (ø2 area/2 mm + M3 part/10 mm)<br>・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1 |
| | **FT-W8** |  | R10 | – | 790<br>31.102 | **FT-42** (Tough) |  | R4 | ○ | 1130<br>44.488 | |
| | | | | | | **FT-42W** |  | R1 | – | 800<br>31.496 | |
| | **FT-WA30** |  | R1 | – | 3600<br>141.732 | **FT-A32** (Tough) |  | R2 | ○ | 3600<br>141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3<br>・Optical cable diameter of 3 × 32 ⇒ Changed to 3.2 × 32 |
| | | | | | | **FT-A32W** |  | R1 | – | 3600<br>141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3<br>・Optical cable diameter of 3 × 32 ⇒ Changed to 3.2 × 32 |
| | **FT-WA8** |  | R1 | – | 3600<br>141.732 | **FT-A11** (Tough) |  | R2 | ○ | 3600<br>141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3 |
| | | | | | | **FT-A11W** |  | R1 | – | 3600<br>141.732 | Fiber cable outside diameter ø2.2 ⇒ Changed to ø1.3 |
| | **FT-WKV8** |  | R1 | – | 3600<br>141.732 | **FT-KV40** (Tough) |  | R2 | ○ | 3600<br>141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1<br>・Metal end material (stainless steel) ⇒ Changed to plastic (LCP), set screw fastening specifications ⇒ Changed to **MS-FD-3** fastener specifications |
| | | | | | | **FT-KV40W** |  | R1 | – | 3600<br>141.732 | ・Fiber cable outside diameter ø2.2 ⇒ Changed to ø1<br>・Metal end material (stainless steel) ⇒ Changed to plastic (LCP), set screw fastening specifications ⇒ Changed to **MS-FD-3** fastener specifications |
| | **FT-WR80** |  | R1 | – | 660<br>25.984 | **FT-R41W** |  | R1 | – | 800<br>31.496 | |
| | **FT-WR80L** |  | R1 | – | 2200<br>86.614 | **FT-R42W** |  | R1 | – | 2200<br>86.614 | |
| | **FT-WS3** |  | R1 | – | 790<br>31.102 | **FT-S31W** |  | R1 | – | 800<br>31.496 | ・End bracket total length of 15 mm ⇒ Changed to 10 mm |

# Earlier Models Comparison Table

| Type | Discontinued models: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Recommended replacements: Model No. | Shape of fiber head (mm) | Bending radius (mm) | Bending durability | Sensing range FX-500 STD (mm in) | Main points of difference from discontinued models |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thru-beam type | FT-WS4 | ϕ1.5, 8 | R1 | — | 250 9.843 | Tough FT-S21 | ϕ1.5, 10 | R2 | ○ | 315 12.402 | ・End bracket shape of ø1.5/8 mm ⇒ Changed to 10 mm (ø1 part/2 mm + ø1.5 part/8 mm) |
| | FT-WS8 | ϕ2.5, 8 | R1 | — | 790 31.102 | FT-S21W | ϕ1.5, 10 | R1 | — | 260 10.236 | ・End bracket shape of ø1.5/8 mm ⇒ Changed to 10 mm (ø1 part/2 mm + ø1.5 part/8 mm) |
| | FT-WS8L | Long sensing range • with lens, ϕ3, 8 | R1 | — | 3300 129.921 | FT-S31W | ϕ3, 10 | R1 | — | 800 31.496 | ・End bracket shape of ø2.5/8 mm ⇒ Changed to 10 mm (ø2 part/2 mm + ø3 part/8 mm) |
| | FT-WV42 | ϕ1 ϕ2, 15 15, Sleeve part cannot be bent. | R1 | — | 100 3.937 | FT-S32 | Long sensing range • with lens, ϕ2.5, 8 | R10 | ○ | 3100 122.047 | ・End bracket shape of ø3 ⇒ Changed to ø2.5<br>・Bending radius of 1 mm ⇒ Changed to 10 mm |
| | FT-WZ4HB | Fiber bending type W2×H10×D10 | R1 | — | 210 8.268 | Tough FT-V25 | Sleeve part cannot be bent., ϕ1 ϕ2, 15 15 | R2 | ○ | 240 9.449 | ・D-shaped surface that makes it easy to align with the optical axis has been added |
| | FT-WZ7HB | Fiber bending type W3.5×H14×D11 | R1 | — | 790 31.102 | FT-V24W | Sleeve part cannot be bent., ϕ1 ϕ2, 15 15 | R1 | — | 110 4.331 | ・D-shaped surface that makes it easy to align with the optical axis has been added |
| | FT-WZ8 | Top sensing W8.5×H12×D3 | R1 | — | 1300 51.181 | FT-Z20HBW | Fiber bending type W2×H10×D10 | R1 | — | 260 10.236 | |
| | FT-WZ8E | Side sensing W3×H12×D8 | R1 | — | 3400 133.858 | FT-Z40HBW | Fiber bending type W3.5×H14×D11 | R1 | — | 800 31.496 | |
| | FT-WZ8H | Top sensing W3×H8×D12 | R1 | — | 3300 129.921 | Tough FT-Z30 | Top sensing W8.5×H12×D3 | R2 | ○ | 2100 82.677 | ・Black casing color ⇒ Changed to translucent, protective seal eliminated |
| | FT-Z8 | Top sensing W8.5×H12×D3 | R4 | ○ | 1200 47.244 | FT-Z30W | Top sensing W8.5×H12×D3 | R1 | — | 1500 59.055 | ・Black casing color ⇒ Changed to translucent, protective seal eliminated |
| | FT-Z8E | Side sensing W3×H12×D8 | R4 | ○ | 2000 78.740 | Tough FT-Z30E | Side sensing W3×H12×D8 | R2 | ○ | 3500 137.795 | |
| | FT-Z8H | Top sensing W3×H8×D12 | R4 | ○ | 2100 82.677 | FT-Z30EW | Side sensing W3×H12×D8 | R1 | — | 3400 133.858 | |
| | | | | | | Tough FT-Z30H | Top sensing W3×H8×D12 | R2 | ○ | 3500 137.795 | |
| | | | | | | FT-Z30HW | Top sensing W3×H8×D12 | R1 | — | 3500 137.795 | |
| | | | | | | Tough FT-Z30 | Top sensing W8.5×H12×D3 | R2 | ○ | 2100 82.677 | ・Black casing color ⇒ Changed to translucent, protective seal eliminated |
| | | | | | | Tough FT-Z30E | Side sensing W3×H12×D8 | R2 | ○ | 3500 137.795 | |
| | | | | | | Tough FT-Z30H | Top sensing W3×H8×D12 | R2 | ○ | 3500 137.795 | |

MEMO

New Product

# Communication Unit for Open Network

## SC-GU3 SERIES

## The digital sensor can be connected directly to the 3 types of open network!

Other types of analog input sensors can also be connected!

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**SC-GU3-01**

DeviceNet
**SC-GU3-02**

EtherCAT
**SC-GU3-03**

On sale soon

Scattered digital sensors can be centrally managed and set through an open network.

| Applicable Digital Sensor | Digital Fiber Sensor | Digital Laser Sensor | Digital Pressure Sensor |
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Please contact .....


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