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!

CC-Link
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
	FX-501 FX-502	LS-403	DPS-401 DPS-402

Please contact .....

Panasonic Electric Works SUNX Co., Ltd.

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Global Sales & Marketing Division
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Panasonic

No. CE-FIBERGUIDE-7 October, 2011

Specifications are subject to change without notice.

Printed in Japan

Panasonic

Panasonic
ideas for life

Fiber Sensor Guide Book

Fiber Sensor Guide Book

2011.10 | panasonic-electric-works.net/sunx

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GENERAL TERMS AND CONDITIONS

Please read this document carefully with respect to our product warranty policy before using our Panasonic Electric Works SUNX products (“Products”). If you have any questions or comments regarding do’s and don’ts of the Products, please consult your local Panasonic Electric Works SUNX authorized dealer for the correct use and application of the Products.

1. PRODUCT MODIFICATION & DISCONTINUANCE:

Panasonic Electric Works SUNX expressly reserves the right to modify, including the right to discontinue, any of the Products, prior to their order, from time to time without notice.

2. WARRANTIES:

(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.

(2) This warranty extends only to the first purchaser for application, and is not transferable to any person or entity which purchased from such purchaser for application.

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

4. DISCLAIMERS

(1) Panasonic Electric Works SUNX’s sole obligation and liability under this warranty is limited to the repair or replacement, or refund of the purchase price, of a defective Product, at Panasonic Electric Works SUNX’s option.

(2) THE REPAIR, REPLACEMENT, OR REFUND IS THE EXCLUSIVE REMEDY OF THE PURCHASER, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF PROPRIETARY RIGHTS, ARE HEREBY EXPRESSLY DISCLAIMED. IN NO EVENT SHALL PANASONIC ELECTRIC WORKS SUNX AND ITS AFFILIATED ENTITIES BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCTS, OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMANGES RESULTING FROM LOSS OF USE, BUSINESS INTERRUPTION, LOSS OF INFORMATION, LOSS OR INACCURACY OF DATA, LOSS OF PROFITS, LOSS OF SAVINGS, THE COST OF PROCUREMENT OF SUBSTITUTED GOODS, SERVICES OR TECHNOLOGIES, OR FOR ANY MATTER ARISING OUT OF OR IN CONNECTION WITH THE USE OR INABILITY TO USE THE PRODUCTS.

5. CAUTIONS FOR SAFE USE

(1) The applications shown in this catalogue are only suggestions, and it is Purchaser’s sole responsibility to ascertain the fitness and suitability of the Products for any particular application, as well as to abide by Purchaser’s applicable local laws and regulations, if any.

(2) Never use the Products NOT rated or designated as “SAFETY SENSOR” in any application involving risk to life or property. When such a use is made by Purchaser, such Purchaser shall indemnify and hold harmless Panasonic Electric Works SUNX from any liability or damage whatsoever arising out of or in relation to such use.

(3) In incorporating the Products to any equipment, facilities or systems, it is highly recommended to employ fail-safe designs, including but not limited to a redundant design, flame propagation prevention design, and malfunction prevention design so as not to cause any risk of bodily injury, fire accident, or social damage due to any failure of such equipment, facilities or systems.

(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.

Fiber Selection Guide

Choose by model

◆Thru-beam type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FT-140	P.10	P.34
FT-30	P.9	
FT-31	P.10	
FT-31S	P.15	
FT-31W	P.10	
FT-40	P.9	
FT-42	P.10	
FT-42S	P.15	
FT-42W	P.10	
FT-43		
FT-45X		P.35
FT-A11	P.20	
FT-A11W		
FT-A32		
FT-A32W		
FT-AL05		
FT-E13	P.12/P.15	
FT-E23		
FT-F93	P.28	
FT-H13-FM2	P.24	P.36
FT-H20-J20-S		
FT-H20-J30-S		
FT-H20-J50-S		
FT-H20-M1		
FT-H20-VJ50-S		
FT-H20-VJ80-S		
FT-H20W-M1		
FT-H30-M1V-S	P.26	
FT-H35-M2	P.24	
FT-H35-M2S6		
FT-HL80Y	P.23	
FT-KS40	P.19	P.37
FT-KV26		
FT-KV40		
FT-KV40W		
FT-L80Y	P.23	
FT-R40	P.10	
FT-R41W		
FT-R42W		
FT-S11	P.12	
FT-S20	P.9	P.38
FT-S21	P.12	
FT-S21W		
FT-S30	P.9	
FT-S31W	P.12	
FT-S32		
FT-V23	P.15	
FT-V24W		
FT-V25		
FT-V30		
FT-V40	P.12	P.39
FT-V80Y	P.23	
FT-WZ4	P.16	
FT-WZ7		
FT-Z20HBW		
FT-Z30		
FT-Z30E		

Model No.	Page: Sensing range Specifications	Page: Dimensions
FT-Z30EW	P.16	P.39
FT-Z30H		
FT-Z30HW		P.40
FT-Z30W		
FT-Z40HBW		
FT-Z802Y	P.23	

◆Retroreflective type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FR-KZ22E	P.19/P.22	P.41
FR-KZ50E		
FR-KZ50H		
FR-Z50HW		

◆Reflective type

Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-30	P.9	P.42
FD-31	P.11	
FD-31W		
FD-32G	P.11/P.18	
FD-32GX		
FD-40	P.9	
FD-41	P.11	
FD-41S	P.15	
FD-41SW		
FD-41W	P.11	
FD-42G	P.11/P.18	P.43
FD-42GW		
FD-60	P.9	
FD-61	P.11	
FD-61G		
FD-61S	P.15	
FD-61W	P.11	
FD-62		
FD-64X		P.44
FD-A16	P.20	
FD-AL11		
FD-E13	P.13/P.15	
FD-E23		
FD-EG30	P.11/P.18	
FD-EG30S	P.15	P.45
FD-EG31	P.11/P.18	
FD-F4	P.28	
FD-F41		
FD-F41Y		
FD-F71		
FD-F8Y		
FD-FA93		
FD-H13-FM2	P.25	P.46
FD-H18-L31		
FD-H20-21		
FD-H20-M1		

Model No.	Page: Sensing range Specifications	Page: Dimensions
FD-H25-L43	P.25	P.46
FD-H25-L45		
FD-H30-KZ1V-S	P.26	P.47
FD-H30-L32	P.25	
FD-H30-L32V-S	P.26	
FD-H35-20S	P.25	
FD-H35-M2		
FD-H35-M2S6		
FD-HF40Y	P.28	
FD-L10	P.21	P.48
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FD-L12W		
FD-L20H		
FD-L21		
FD-L21W		
FD-L22A		
FD-L23		
FD-L30A		
FD-L31A		
FD-L32H		P.49
FD-R60	P.11	
FD-S21	P.13	
FD-S30	P.9	
FD-S31	P.13	
FD-S32		
FD-S32W		
FD-S33GW		
FD-V30	P.15	P.50
FD-V30W		
FD-V50		
FD-WZ4	P.17	
FD-WZ7		
FD-Z20HBW		
FD-Z40HBW		
FD-Z50HW	P.19	

Fiber Selection Guide

Choose by quality

Super Quality

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

P.8

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.

P.12

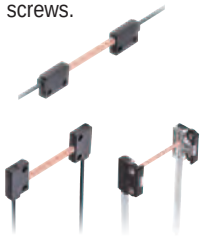
Sleeve

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

P.14

Flat Type

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



P.16

Choose by beam shape

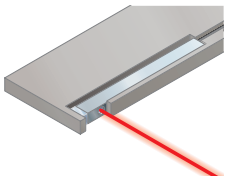
Small Spot

●Senses minute objects using a spot lens.

P.18

Narrow Beam

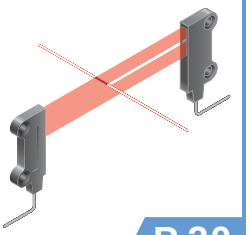
●Not easily affected by surrounding obstacles.



P.19

Wide Beam

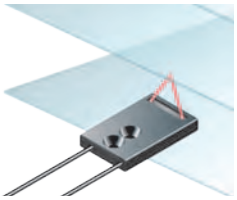
●Senses in the beam band without missing a work.



P.20

Convergent Reflective Type

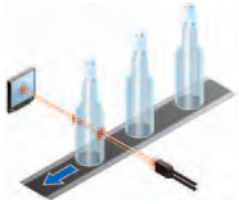
●Senses in the limited range only.



P.21

Retroreflective Type

●Ideal for sensing transparent objects



P.22

Choose by environment/performance

Chemical-resistant

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

P.23

Heat-resistant

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

P.24

Vacuum-resistant

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

P.26

Liquid Leak / Liquid Detection

●Corresponds to various liquid events.

P.28

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

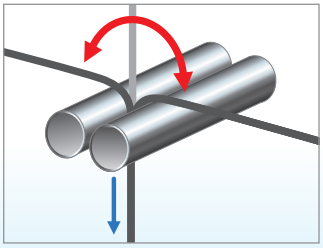
Tough Fiber

Conventional 3 types rolled into 1 !!
New standard fiber

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)

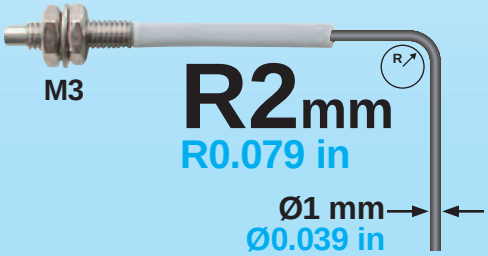
Bending conditions

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

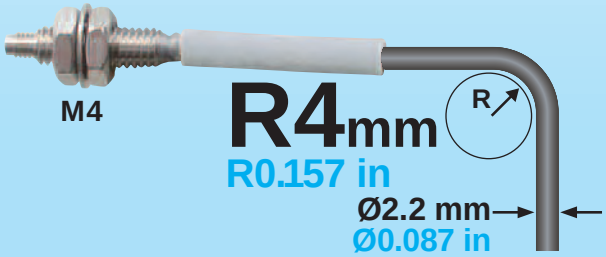
More flexible

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!

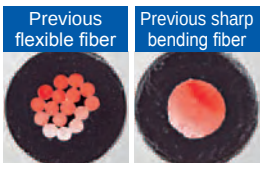
For Buyers

Low Price

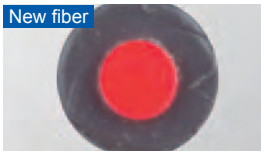
- Cost savings!
- Reduced registration numbers!
- Reduced frequency of maintenance stockpiling and replacement!

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.

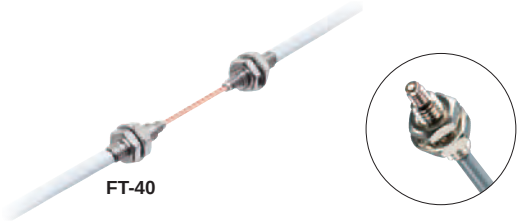


The new standard fiber is composed of a single fiber core, achieving uniform light intensity.

- **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.

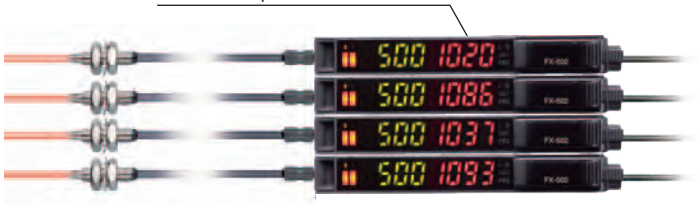


Digital management is simple due to small differences in body.

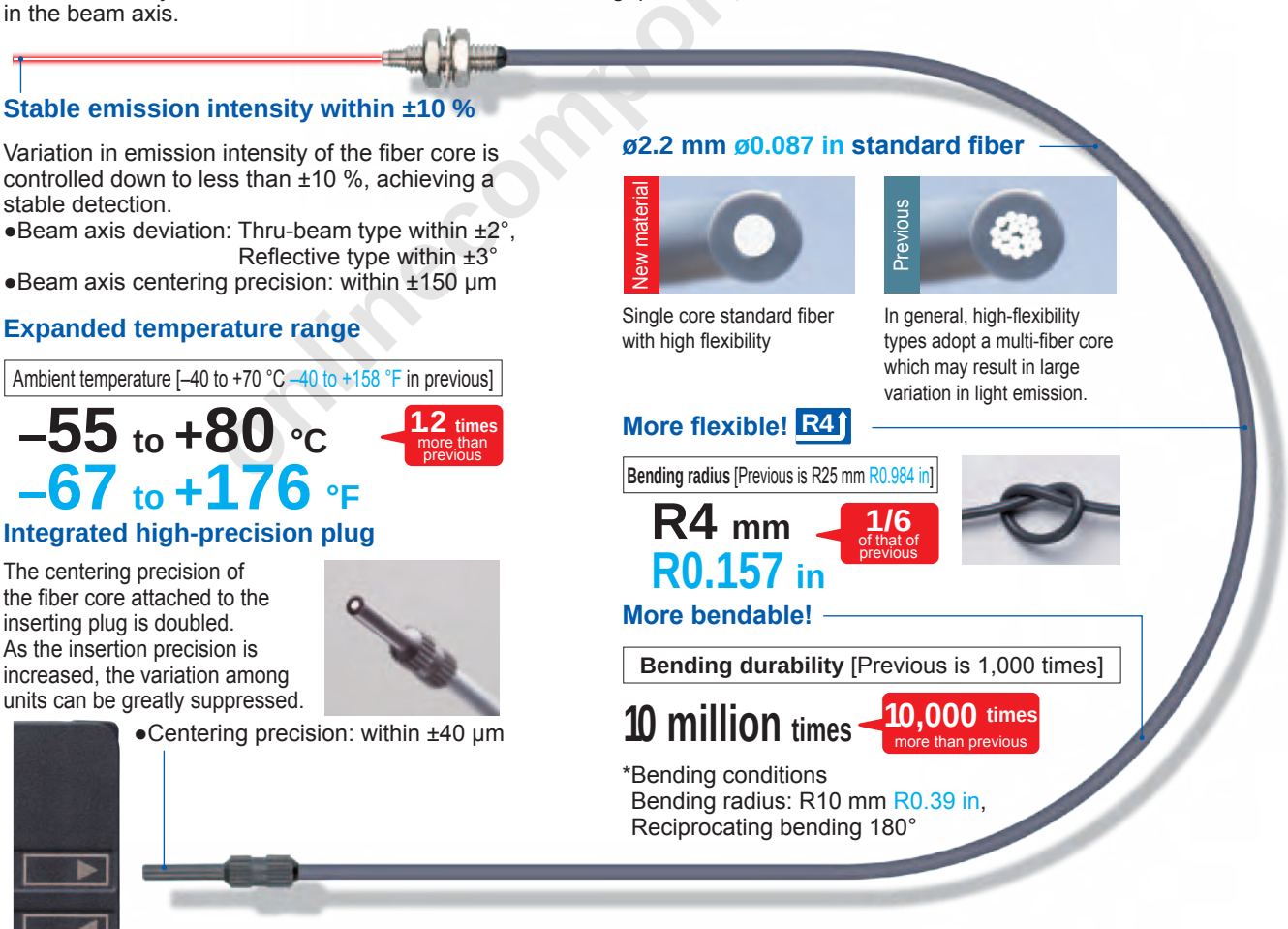
When combined with the **FX-500** series amplifiers, it has up to 4 times improved stability of incident light intensity compared with traditional fibers. Management is simple even when replacing amplifiers because the digital display shows the approximate value.

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

12 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

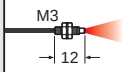
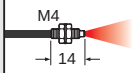
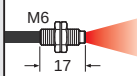
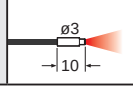
*Bending conditions
Bending radius: R10 mm R0.39 in,
Reciprocating bending 180°

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 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	135 5.315 400 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 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 34.252	ø1				
Cylindrical	ø1.5		Tough NEW FT-S20	R2 Bending durability		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	135 5.315 400 15.748	ø0.5				
	ø3		Tough NEW FT-S30	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	320 12.598 870 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 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984	45 1.772 155 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 HYPR 1,550 61.024	900 35.433 740 29.134 260 10.236 90 3.543	140 5.512 420 16.535				
Cylindrical	ø3		Tough NEW FD-S30			STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984	45 1.772 155 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.

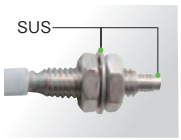
Threaded Type

- 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

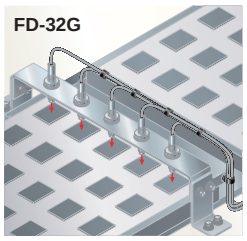
Stainless steel fittings are used for the fiber head of all models. ECO

- 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)

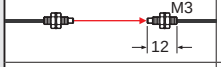
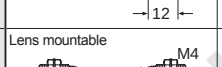
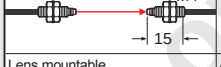
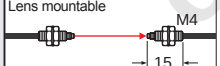
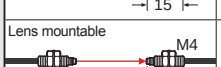
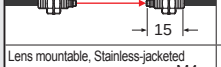
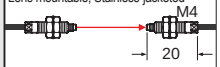
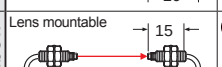
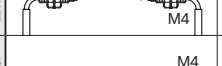
- Makes beam axis adjustment easier
- Improves mounting hole machining accuracy
- Improves sensing accuracy

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	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.
Threaded	M3		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
			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		NEW FT-43	R4 Bending durability		STD 1,400 55.118 HYPR (Note 2) 3,600 141.732	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
			Tough NEW FT-42			STD 1,130 44.488 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	300 11.811 800 31.496	ø1			
			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
			NEW FT-45X	R4	1 m	STD 1,200 47.244 HYPR (Note 2) 1,600 62.992	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		Tough NEW FT-R40	R4 Bending durability	2 m	STD 930 36.614 HYPR (Note 2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299	270 10.630 740 29.134				
	Square head		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
			NEW FT-R42W			STD 2,200 86.614 HYPR (Note 2) 3,600 141.732	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		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.

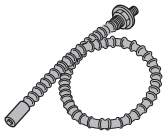
Supports spot lenses and zoom lenses!

Fiber options

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

Lens (For reflective type fiber) ▸P.32

Protective tube ▸P.33
·FTP-□
·FDP-□



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)	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
	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	

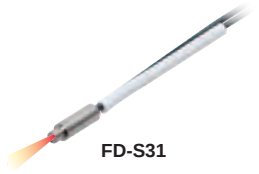
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.
3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

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

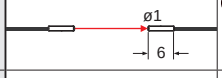
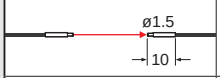
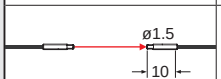
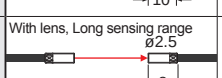
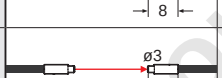
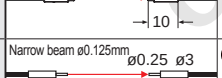
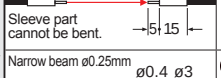
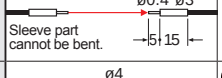
<Thru-beam type> FT-S21/S21W/S31W
<Reflective type> FD-S32/S31

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

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

- 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			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°		
			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		150 µm /±3°		–40 to +60 °C
	ø2·5	 With lens, Long sensing range	NEW FT-S32	R10 Bending durability		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		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	 Narrow beam ø0.125mm Sleeve part cannot be bent.	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	—		–40 to +70 °C
		 Narrow beam ø0.25mm Sleeve part cannot be bent.	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	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Beam axis position/ Inclination of beam axis	Protection	Ambient temp.
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		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°		
		ø3 15	NEW FD-S32W	R1	✂ 2 m	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	—	IP67	–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	—		–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	—	IP40	
	Ultra-small diameter 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.

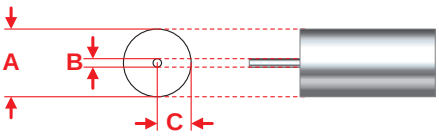
Sleeve

- 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

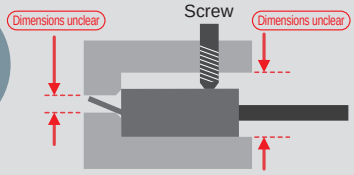
Ultra-small diameter fibers with a compact head ensure precision centering accuracy* to stably detect minute parts.



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

Dimensions UNCLEAR

Previous general fiber

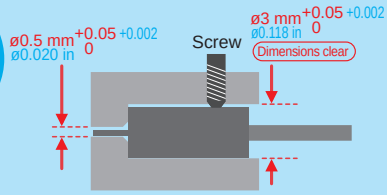


Extra clearance needs to be added when designing and machining the mounting hole due to unclear dimensions.
As a result, mounting variation increases and the beam axis deviates, resulting in a decrease in sensing accuracy or causing the sleeve to bend or break.

Dimensions CLEAR

Ex.) **FT-E13**

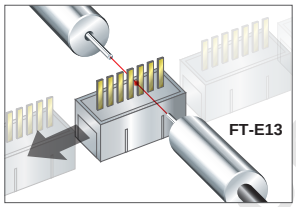
New standard fiber



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.

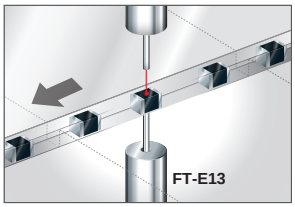
Minute sensing only possible with ultra small fiber

●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

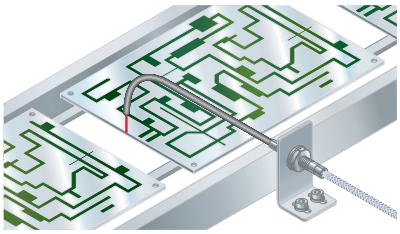


Fiber can be installed with only the ø0.25 mm ø0.010 in sleeve close to the minute section.

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

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

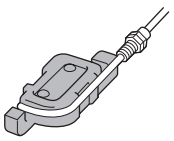
Application



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 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	130 5.118 340 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 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	300 11.811 800 31.496	ø1		
Cylindrical Side-view	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 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	6 0.236 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 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	22 0.866 80 3.150	ø0.25		
	ø2	Sleeve part cannot be bent., ø1, ø2, 20, 15	Tough NEW FT-V23	R4 Bending durability	✂ 2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	160 6.299 400 15.748	ø0.75	IP30	–55 to +80 °C
		Sleeve part cannot be bent., ø1, ø2, 15, 15	Tough NEW FT-V25	R2 Bending durability		STD 240 9.449 HYPR 900 35.433	550 21.654 480 18.898 140 5.512 45 1.772	95 3.740 260 10.236	ø0.5		
		Sleeve part cannot be bent., ø1, ø2, 15, 15	NEW FT-V24W	R1		STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	35 1.378 90 3.543			–40 to +60 °C
	ø2·5	Sleeve part cannot be bent., ø1.5, ø2.5, 20, 15	Tough NEW FT-V30	R4 Bending durability		STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	180 7.087 480 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

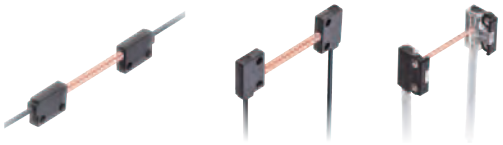
Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	Sensing range (mm in) (Note 1, 2) U-LG LONG FAST H-SP	Sensing range (mm in) (Note 1, 2) FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.
Threaded	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 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	20 0.787 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 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	35 1.378 140 5.512	IP67	–55 to +80 °C
		Sleeve 40 mm, M4, ø1.48, 12	NEW FD-41SW	R1 (Note 3)		STD 80 3.150 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
	M6	Sleeve 40 mm, M6, ø2.5, 15	Tough NEW FD-61S	R4 Bending durability (Note 3)		STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	130 5.118 360 14.173		–55 to +80 °C
Cylindrical Side-view	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	IP40	–40 to +60 °C
	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
	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 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551	25 0.984 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 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079	6 0.236 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 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984	40 1.575 100 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

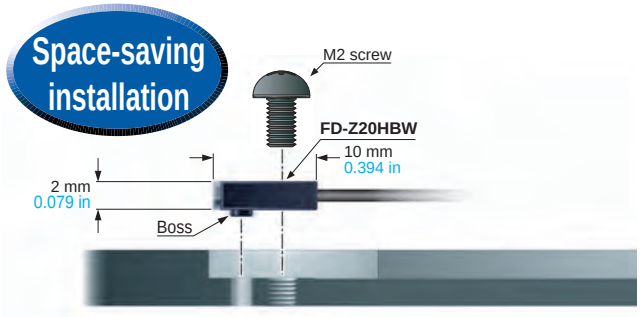
Since it has a thin, rectangular shape, it can be installed in narrow locations. It is also a fiber with good workability and can be mounted directly with screws.



FT-Z30H FT-Z30E FT-Z30

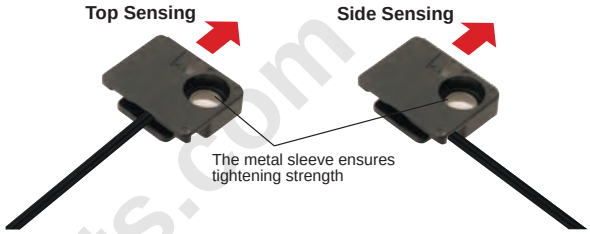
Mounting with M2 or M3 screw

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.



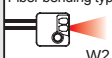
Thru-beam type (one pair set)

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 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,600 102.362 810 31.890	1,400 55.118 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 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134	1,200 47.244 3,200 125.984			
	Side sensing W3 × H12 × D8	NEW FT-Z30EW	R1		STD 3,400 133.858 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803	1,400 55.118 2,600 102.362			
	Front sensing W8.5 × H12 × D3	Tough NEW FT-Z30	R2 Bending durability		STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244 410 16.142	710 27.953 2,300 90.551	ø2		
	Front sensing W8.5 × H12 × D3	NEW FT-Z30W			STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 3,200 125.984 1,000 39.370 280 11.024	540 21.260 1,800 70.866			
With boss	Front sensing W10 × H7 × D2	FT-WZ4		1 m	STD 530 20.866 HYPR (Note 2) 1,600 62.992	1,100 43.307 900 35.433 330 12.992 100 3.937	230 9.055 670 26.378	ø1.5	—	
	Fiber bending type W2 × H10 × D10	NEW FT-Z20HBW	R1		STD 260 10.236 HYPR 1,100 43.307	670 26.378 570 22.441 180 7.087 55 2.165	100 3.937 320 12.598	ø0.5	IP67	
	Front sensing W14 × H7 × D3.5	FT-WZ7		2 m	STD 1,400 55.118 HYPR 3,500 137.795	3,300 129.921 2,300 90.551 890 35.039 290 11.417	330 12.992 1,000 39.370	ø1.5	—	
	Fiber bending type W3.5 × H14 × D11	NEW FT-Z40HBW			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	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.

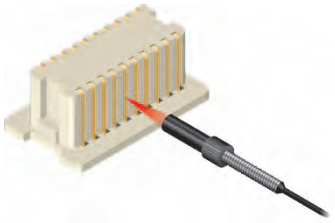
Reflective type

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) 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.
Flat	With boss	Front sensing  W10 × H7 × D2	FD-WZ4	R1	✂ 1 m	STD 2 to 65 0.079 to 2.559 HYPR 1 to 230 0.039 to 9.055	1 to 110 0.039 to 4.331 1 to 85 0.039 to 3.346 3 to 35 0.118 to 1.378 5 to 13 0.197 to 0.512	2 to 20 0.079 to 0.787 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 HYPR 1 to 340 0.039 to 13.386	1 to 210 0.039 to 8.268 1 to 180 0.039 to 7.087 2 to 55 0.079 to 2.165 3 to 15 0.118 to 0.591	2 to 30 0.079 to 1.181 1 to 90 0.039 to 3.543	IP67	
		Front sensing  W14 × H7 × D3.5	FD-WZ7		✂ 2 m	STD 110 4.331 HYPR 430 16.929	230 9.055 180 7.087 1.5 to 65 0.059 to 2.559 3 to 25 0.118 to 0.984	1 to 55 0.039 to 2.165 160 6.299	—	
		Fiber bending type  W3.5 × H14 × D11	NEW FD-Z40HBW			STD 260 10.236 HYPR 760 29.921	540 21.260 470 18.504 1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969	1 to 90 0.039 to 3.543 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.

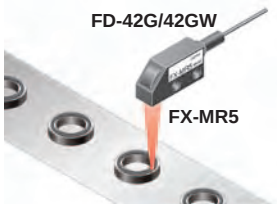
Small Spot

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



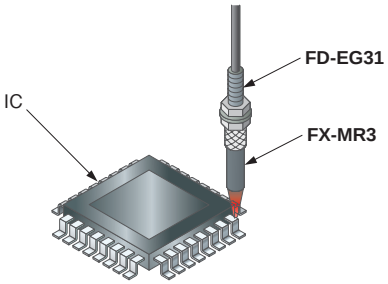
Applications

Packing detection

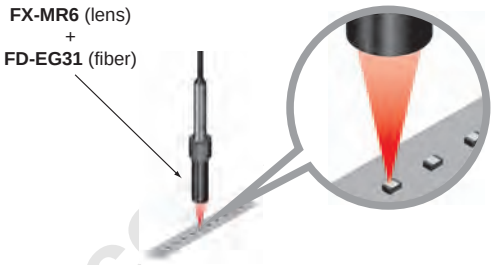


Because it's a side-view type, it can be mounted even in narrow spaces.

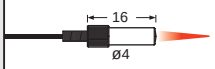
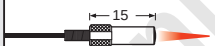
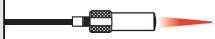
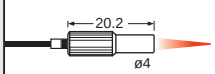
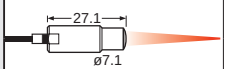
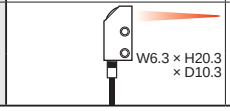
Number of IC pins checking



Discrimination of 0603 chip direction



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

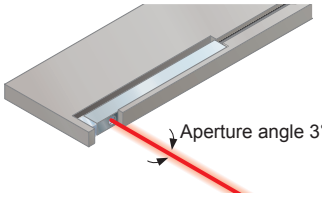
Designation	Shape of head (mm)	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length ✂: Free-cut	Bending radius (mm)	Protection	Ambient temp.
Finest spot lens		ø0.1 ø0.004	7±0.5 0.276±0.020	FX-MR6	–20 to +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		
		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		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		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)		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.

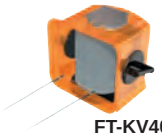
Narrow Beam

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



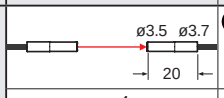
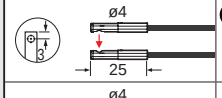
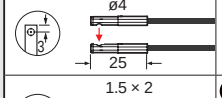
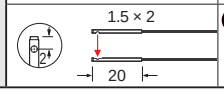
Applications


FR-KZ50H

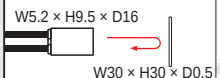
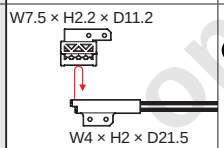
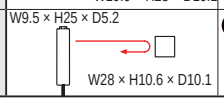

FT-KV40


FR-KZ22E

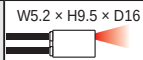
Thru-beam type (one pair set)

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 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	2,200 86.614 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 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	2,200 86.614 3,600 141.732 (Note 2)	ø2.5	±0.8°	IP30	
	 ø4 25	NEW FT-KV40W	R1		STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,100 122.047 940 37.008					
	 1.5 × 2 20	Tough NEW FT-KV26	R2 Bending durability		STD 710 27.953 HYPR 2,500 98.425	1,600 62.992 1,200 47.244 440 17.323 160 6.299	135 5.315 560 22.047	ø1	X±1° 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 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	100 to 550 3.937 to 21.654 100 to 830 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 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	15 to 200 0.591 to 7.874 15 to 360 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 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874 20 to 350 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

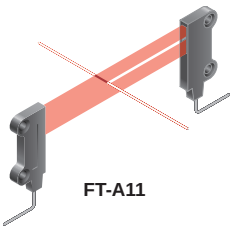
Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1) FX-500 series	Sensing range (mm in) (Note 1) U-LG LONG FAST H-SP	Sensing range (mm in) (Note 1) FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.
Long range	 W5.2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

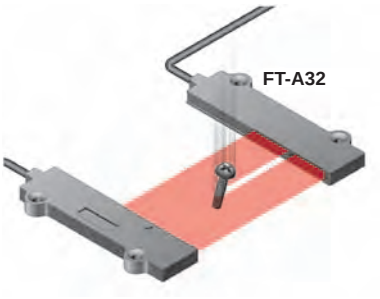
Wide Beam

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

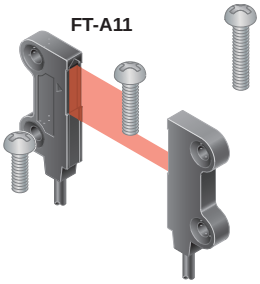

FT-A11

Applications

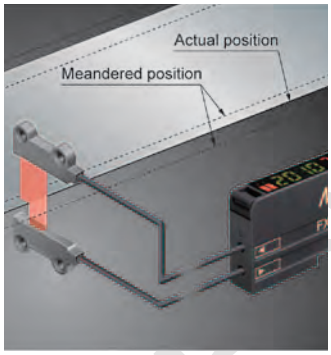
Sensing tiny moving objects



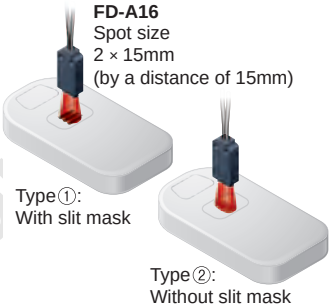
Inspecting screw height



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 W5 × H69 × D20	Tough NEW FT-A32	R2 Bending durability	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,100 82.677	3,600 141.732 (Note 2) 3,600 141.732 (Note 2)	3.2 × 32	IP40	–40 to +60 °C
Wide beam	Allows flexible wiring Sensing width 32mm W5 × H69 × D20	NEW FT-A32W	R1	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,000 118.110				–40 to +55 °C
Wide beam	Sensing width 11mm W4.2 × H31 × D13.5	Tough NEW FT-A11	R2 Bending durability	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,100 43.307	1,900 74.803 3,600 141.732 (Note 2)	2.2 × 11		–40 to +70 °C
Wide beam	Allows flexible wiring Sensing width 11mm W4.2 × H31 × D13.5	NEW FT-A11W	R1	2 m	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,300 51.181	1,700 66.929 3,400 133.858			–40 to +55 °C
Array	Sensing width 5.5mm W5 × H15 × D15	Tough NEW FT-AL05	R2 Bending durability	2 m	STD 860 33.858 HYPR 2,300 90.551	1,550 61.024 1,500 59.055 500 19.685 170 6.693	250 9.843 660 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.

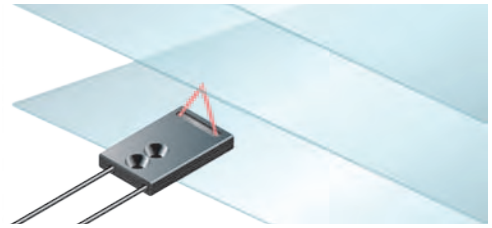
Reflective type

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 FD-A16	R4 Bending durability	2 m	STD 200 7.874 HYPR Cannot use	200 7.874 200 7.874 140 5.512 75 2.953	120 4.724 240 9.449	IP40	–40 to +60 °C
Array	W5 × H20 × D20	Tough NEW FD-AL11	R2 Bending durability		STD 320 12.598 HYPR 670 26.378	530 20.866 510 20.079 180 7.087 50 1.969	100 3.937 285 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.

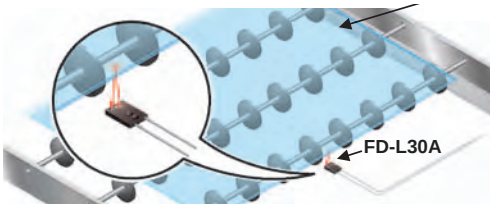
Convergent Reflective Type



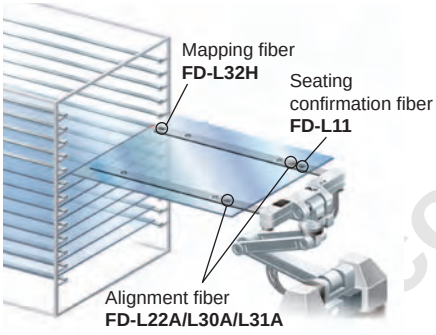
It is a fiber in which the sensing distance is limited to a specific range so it is not easily affected by the background. It is effective when work has accumulated or when the background is near.

Applications

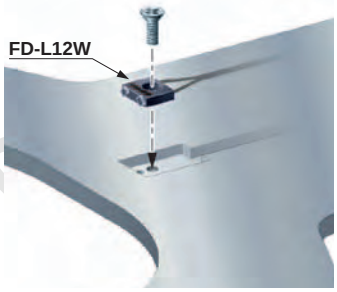
Detecting glass substrate



Substrate conveyors



Mounting in handring arms



Reflective type

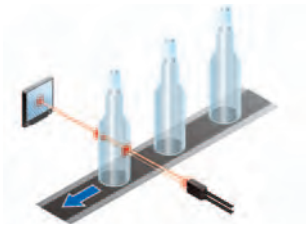
Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Sensing range (mm in) (Note 1, 2) FX-500 series	U-LG LONG FAST H-SP	FX-101 (Upper value) FX-102 (Lower value)	Protection	Ambient temp.
Glass substrate detection	Mapping W25 × H7.3 × D30	NEW FD-L32H	R4 Bending durability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

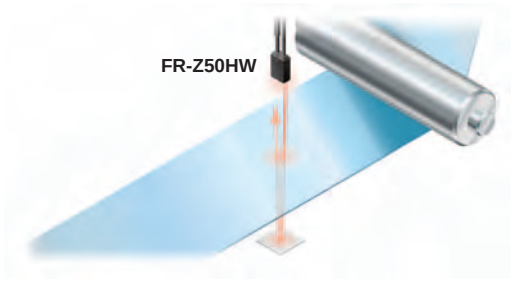
Retroreflective Type

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.

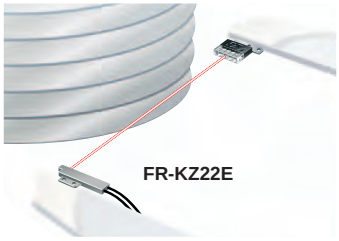


Applications

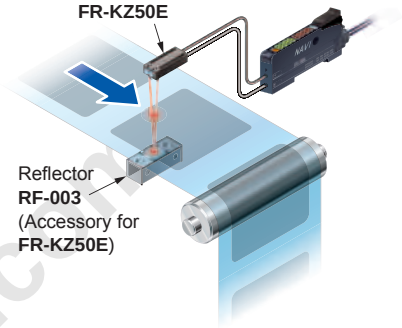
Detecting transparent film



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 W30 × H30 × D0.5	NEW FR-Z50HW	R1	✂ 2 m	STD 100 to 990 3.937 to 38.976 HYPR 100 to 1,900 3.937 to 74.803	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	100 to 550 3.937 to 21.654 100 to 830 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	✂ 2 m	STD 15 to 310 0.591 to 12.205 HYPR 15 to 570 0.591 to 22.441	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	15 to 200 0.591 to 7.874 15 to 360 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		✂ 2 m	STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874 20 to 350 0.787 to 13.780	IP30	–40 to +60 °C
Narrow beam Side sensing	W9.5 × H25 × D5.2 W28 × H10.6 × D10.1	Tough NEW FR-KZ50E		✂ 2 m	STD 20 to 300 0.787 to 11.811 HYPR 20 to 1,000 0.787 to 39.370	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 200 0.787 to 7.874 20 to 350 0.787 to 13.780	IP30	–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 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 3.937 to 748.030	100 to 8,000 3.937 to 314.960	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118	100 to 2,400 3.937 to 94.488	100 to 5,000 3.937 to 196.850
RF-220	100 to 8,000 3.937 to 314.960	100 to 4,700 3.937 to 185.039	100 to 3,500 3.937 to 137.795	100 to 3,000 3.937 to 118.110	100 to 1,800 3.937 to 70.866	100 to 830 3.937 to 32.677	100 to 1,300 3.937 to 51.181	100 to 2,600 3.937 to 102.362
RF-210	100 to 5,500 3.937 to 216.535	100 to 2,700 3.937 to 106.299	100 to 2,400 3.937 to 94.488	100 to 1,500 3.937 to 59.055	100 to 1,200 3.937 to 47.244	100 to 530 3.937 to 20.866	100 to 980 3.937 to 38.583	100 to 1,300 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

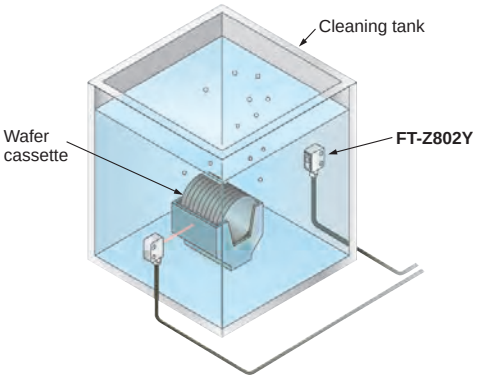
Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

Chemical-resistant

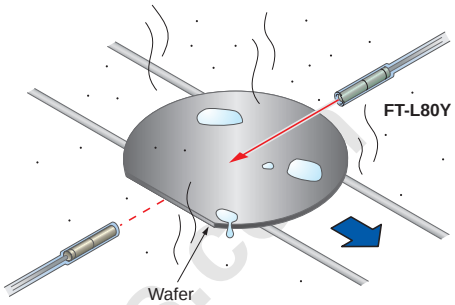
With the case and fiber sheath made of PFA, the fiber can be used with various types of chemical liquids.

Applications

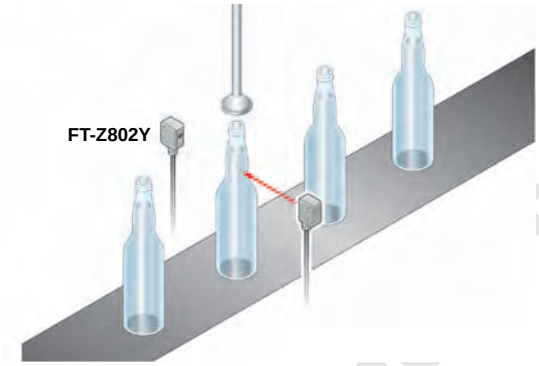
Detecting wafer cassette in cleaning tank



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 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,900 74.803 470 18.504	520 20.472 3,100 122.047	ø3.7	IP67	0 to +60 °C
	Heat-resistant 115 °C ø5.5 (25)	FT-HL80Y	R30	✂ 2 m (Note 3)	STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,300 90.551 740 29.134	990 38.976 2,340 92.126		IP67g	–40 to +115 °C
	ø5.5 (25)	FT-L80Y			STD (Note 2) 3,600 141.732 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,800 110.236 920 36.220	1,100 43.307 2,600 102.362			–40 to +70 °C
	Side-view ø5.5 (25)	FT-V80Y			STD 1,300 51.181 HYPR (Note 2) 3,600 141.732	2,800 110.236 2,200 86.614 800 31.496 240 9.449	340 13.386 800 31.496	ø2.8		

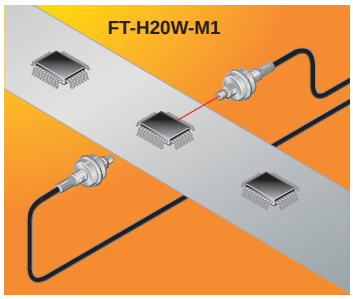
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.

Heat-resistant

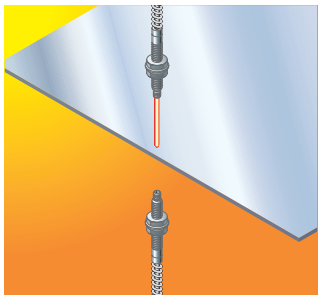
- It can be used under environments of -60 to +350 °C -76 to +662 °F.
- A wide joint type for workability is also prepared.

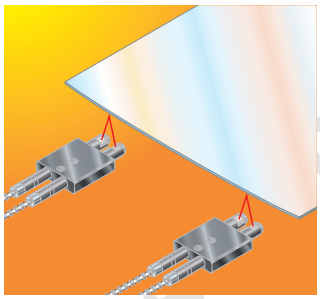
Applications

IC detection within a high temperature handler

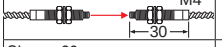
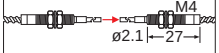
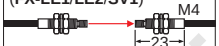
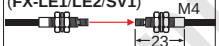
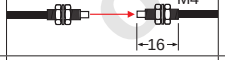
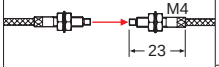
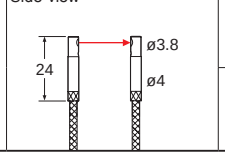


Detecting glass substrates



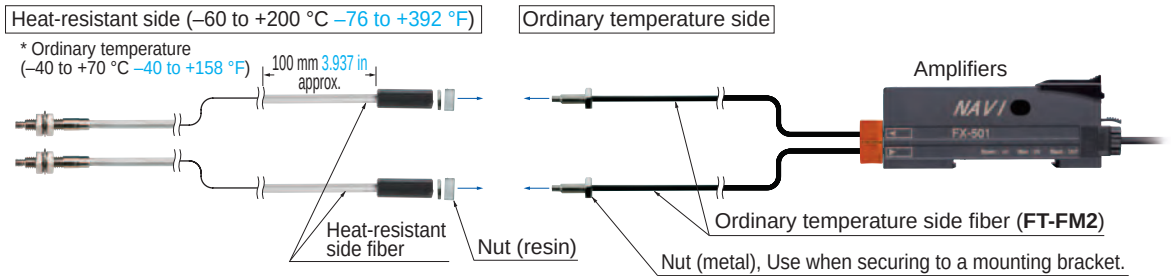


Thru-beam type (one pair set)

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) 	FT-H35-M2	R25	2 m	STD 430 16.929 HYPR 1,200 47.244	880 34.646 670 26.378 250 9.843 80 3.150	170 6.693 490 19.291	ø1.2	–60 to +350 °C
		Sleeve 60 mm 	FT-H35-M2S6	Fiber R25 Sleeve R10						
	200 °C	Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) 	FT-H20W-M1	R10	1 m	STD 470 18.504 HYPR (Note 2) 1,600 62.992	1,000 39.370 840 33.071 300 11.811 90 3.543	100 3.937 300 11.811	ø0.8	–60 to +200 °C
		Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-M1	R25		STD 540 21.260 HYPR (Note 2) 1,600 62.992	1,300 51.181 960 37.795 330 12.992 110 4.331	210 8.268 540 21.260	ø1.2	
	130 °C	Lens mountable (FX-LE2 only) 	FT-H13-FM2		✂ 2 m	STD 700 27.559 HYPR 3,300 129.921	1,900 74.803 1,300 51.181 410 16.142 140 5.512	250 9.843 700 27.559	ø1.5	–60 to +130 °C
Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 200 mm (Note 3)	STD 470 18.504 HYPR 1,600 62.992	1,000 39.370 790 31.102 300 11.811 90 3.543	135 5.315 420 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 	FT-H20-VJ50-S (Note 5)			STD 600 23.622 HYPR 2,100 82.677	1,300 51.181 980 38.583 390 15.354 120 4.724	150 5.906 500 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 HYPR 720 28.346	540 21.260 460 18.110 150 5.906 45 1.772	75 2.953 280 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 HYPR 840 33.071	550 21.654 440 17.323 140 5.512 45 1.772	85 3.346 200 7.874	
		200 °C	Coaxial M6, 28	**FD-H20-M1**			STD 330 12.992 HYPR 840 33.071	550 21.654 500 19.685 200 7.874 55 2.165	120 4.724 300 11.811	–60 to +200 °C
			Coaxial M4, 27	**FD-H20-21**			STD 230 9.055 HYPR 770 30.315	500 19.685 380 14.961 130 5.118 45 1.772	90 3.543 280 11.024	
		130 °C	M6, 21	**FD-H13-FM2**		✂ 2 m	STD 350 13.780 HYPR 880 34.646	640 25.197 600 23.622 200 7.874 65 2.559	100 3.937 280 11.024	–60 to +130 °C
	Glass substrate detection convergent reflective	300 °C	W19 × H27 × D5	**FD-H30-L32**	R25	2 m	STD 17 0.669 HYPR 40 1.575	30 1.181 25 0.984 12 0.472 1.5 to 6 0.059 to 0.236	2 to 9 0.079 to 0.354 0 to 17 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 HYPR 1 to 31 0.039 to 1.220	1 to 30 0.039 to 1.181 1 to 28 0.039 to 1.102 1.5 to 24 0.059 to 0.945 2 to 18 0.079 to 0.709	4 to 16 0.157 to 0.630 4 to 23 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 HYPR 4 to 43.5 0.157 to 1.713	4 to 43 0.157 to 1.693 4.5 to 43 0.177 to 1.693 5 to 40 0.197 to 1.575 6.5 to 34 0.256 to 1.339	7 to 35 0.276 to 1.378 7 to 38 0.276 to 1.496	
		180 °C	W19 × H27 × D5	**FD-H18-L31**		✂ 2 m	STD 16 0.630 HYPR 60 2.362	32 1.260 24 0.945 13 0.512 2 to 6.5 0.079 to 0.256	0 to 10 0 to 0.394 0 to 25 0 to 0.984	–60 to +180 °C

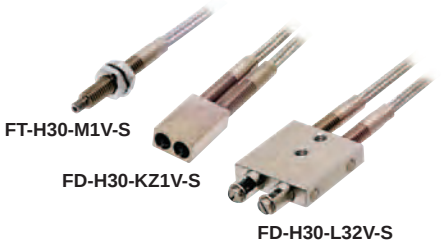
Notes: 1) The sensing range of reflective type is the value for white non-glossy paper (50 × 50 mm 1.969 × 1.969 in glass substrate for **FD-H30-L32**, **FD-H18-L31**, transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in for **FD-H25-L43** and **FD-H25-L45**).
2) Note that the sensing range 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~

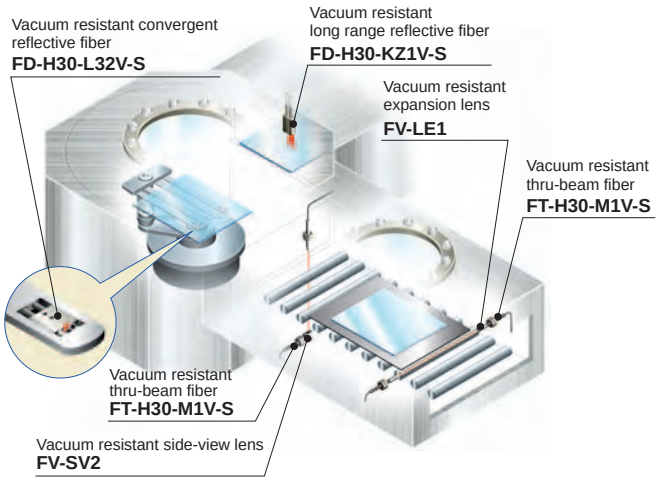
Vacuum-resistant

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



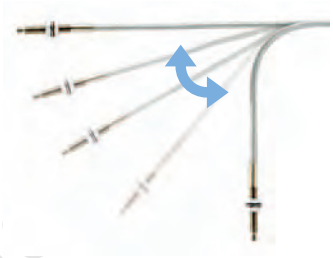
Applications

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 Lens mountable (**FV-LE1/SV2**) M4 ← 30 →	**FT-H30-M1V-S** (Note)	R18	1 m	STD 270 10.630 HYPR 1,000 39.370	590 23.228 470 18.504 160 6.299 55 2.165	110 4.331 280 11.024	ø1.2	–30 to +300 °C

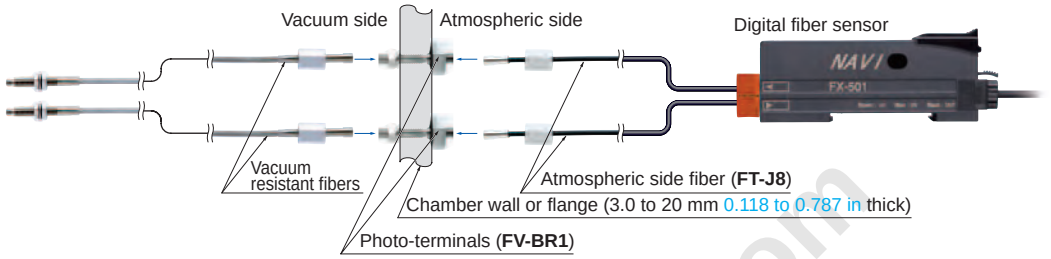
Note: Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).

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 W9.5 × H5.2 × D15	**FD-H30-KZ1V-S** (Note 1)	R18	1 m	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386 15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772	25 to 80 0.984 to 3.150 10 to 220 0.394 to 8.661	–30 to +300 °C
	Convergent reflective	300 °C, Glass substrate detection W19 × H5 × D27	**FD-H30-L32V-S** (Note 1)		3 m	STD 8 0.315 HYPR 18 0.709	12 0.472 10 0.394 5.5 0.217 1.5 to 3 0.059 to 0.118	2.5 to 6.5 0.098 to 0.256 0 to 11 0 to 0.433	

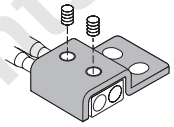
Notes: 1) Sold as a set comprising vacuum type fiber + photo-terminal (**FV-BR1**) + fiber at atmospheric side (**FT-J8**).
2) The sensing range of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

Set contents



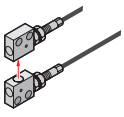
Model No. when ordering individual parts from repair parts

- 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)

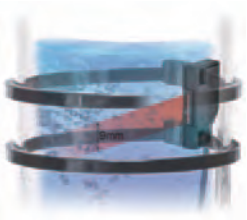
Designation		Model No.		Description
For thru-beam type fiber	Vacuum resistant expansion lens (Note 1)	**FV-LE1**		Increases the sensing range 4 times or more. • Ambient temperature: –60 to +350 °C –76 to +662 °F (Note 3) • Beam axis dia: ø3.6 mm ø0.142 in Sensing range (mm in) [Lens on both sides] (Note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

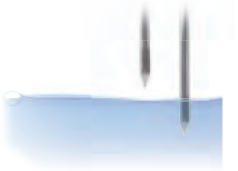
Liquid Leak / Liquid Detection



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

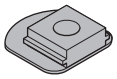
Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Description: FX-500 series (STD mode)	Description: FX-101 FX-102	Protection	Ambient temp.
Contact type	Liquid level sensing	Heat resistant 125 °C Fluorine resin coating ø6	FD-F8Y	Protective tube R40 Fiber R15	✂ 2 m (Note 1)	ø6 mm ø0.236 in Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable) Liquid surface not contacted: Beam received, 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 Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, 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 Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, 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 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] 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] 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] 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] 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.

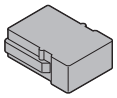
Tough : It is a fiber which possesses both unbreakable (bending radius: R10 mm, reciprocating bending: 180°) and bendable (bending radius: R4 mm or less) features.

Accessories

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



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



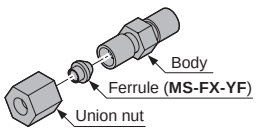
Fiber options

Designation	Model No.	Description		
Liquid inflow prevention joint (Note)	**MS-FX-01Y**	Applicable fibers	**FD-HF40Y** **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.

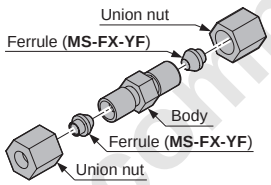
Liquid inflow prevention joint

• **MS-FX-01Y**



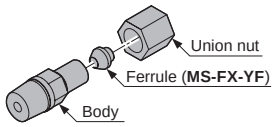
Protective tube extension joint

• **MS-FX-02Y**



Fiber mounting joint

• **MS-FX-03Y**



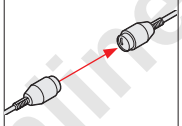
Fiber options

Lens (For thru-beam type fiber)

Designation		Model No.	Description
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)

Designation		Model No.	Description
For thru-beam type fiber	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)

For thru-beam type fiber

Side-view lens — FX-SV1

Beam axis is bent by 90°.
• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)
• Beam dia: ø2.8 mm ø0.110 in
Sensing range (mm in) [Lens on both sides]

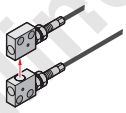
Fiber \ Amplifier / Mode	FX-500 series HYPR	U-LG	LONG	STD	FAST	H-SP	FX-101□	FX-102□
FT-43	3,600 141.732 (Note 2)	3,400 133.858	2,600 102.362	1,700 66.929	970 38.189	310 12.205	510 20.079	1,400 55.118
FT-42	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	1,150 45.276	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

Sensing range increases by 4 times or more.
• Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 4)
• Beam dia: ø3.6 mm ø0.142 in
Sensing range (mm in) [Lens on both sides] (Note 3)

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



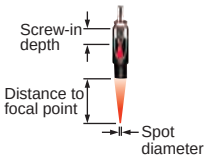
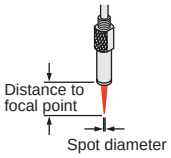
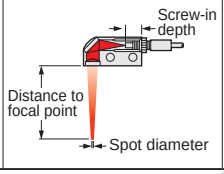
Beam axis is bent by 90°.
• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 4)
• Beam dia: ø3.7 mm ø0.146 in
Sensing range (mm in) [Lens on both sides] (Note 3)

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. • Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in • Applicable fibers: **FD-42G**, **FD-42GW** • 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. • Applicable fibers: **FD-42G**, **FD-42GW** • Ambient temperature:-40 to +70 °C -40 to +158 °F (Note) • Accessory: **MS-EX3** (mounting bracket) **Sensing range** Screw-in depth / Distance to focal point / Spot diameter 7 mm / 18.5 mm approx. / ø0.7 mm 12 mm / 27 mm approx. / ø1.2 mm 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. • Applicable fibers: **FD-EG31**, **FD-EG30**, **FD-42G**, **FD-42GW**, **FD-32G**, **FD-32GX** • Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) **Sensing range** FD-EG31 / 7.5 ± 0.5 mm / ø0.15 mm approx. FD-EG30 / 7.5 ± 0.5 mm / ø0.3 mm approx. 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. • Applicable fibers: **FD-EG31**, **FD-EG30**, **FD-42G**, **FD-42GW**, **FD-32G**, **FD-32GX** • Ambient temperature: -20 to +60 °C -4 to +140 °F (Note) **Sensing range** FD-EG31 / 7 ± 0.5 mm / ø0.1 mm approx. FD-EG30 / 7 ± 0.5 mm / ø0.2 mm approx. 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. • Applicable fibers: **FD-42G**, **FD-42GW** • Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) **Sensing range** Screw-in depth / Distance to focal point / Spot diameter 8 mm / 13 mm approx. / ø0.5 mm 10 mm / 15 mm approx. / ø0.8 mm 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**

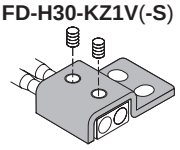
Model No. when ordering vacuum-resistant fibers individually as replacement parts

• 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



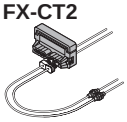
Accessories (attached with fibers)

• **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**

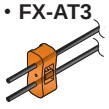

• **RF-13**


• **FX-CT1**

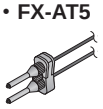

• **FX-CT2**


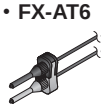
• **FX-CT3**

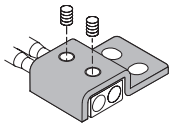

• **FX-AT2**


• **FX-AT3**


• **FX-AT4**


• **FX-AT5**


• **FX-AT6**


• **MS-FD-2**


Fiber options

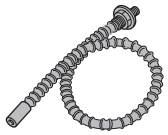
Others

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.

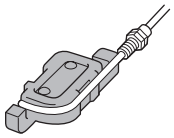
Protective tube

- **FTP-□**
- **FDP-□**



Fiber bender

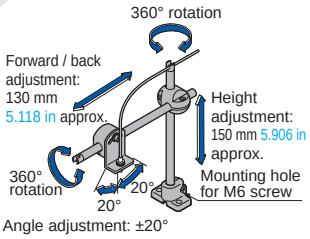
- **FB-1**



Universal sensor mounting stand

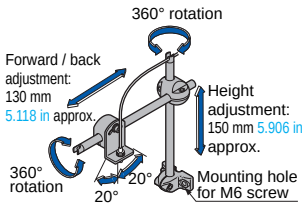
Using the arm which enables adjustment in the horizontal direction, sensing can also be done from above an assembly line.

- **MS-AJ1-F**



Angle adjustment: ±20°

- **MS-AJ2-F**



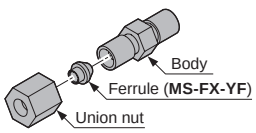
Angle adjustment: ±20°

Single core holder

- **FX-AT15A**

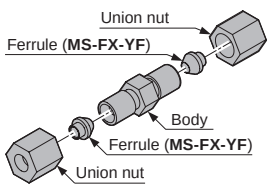
Liquid inflow prevention joint

- **MS-FX-01Y**



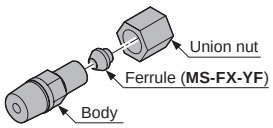
Protective tube extension joint

- **MS-FX-02Y**



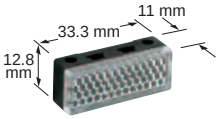
Fiber mounting joint

- **MS-FX-03Y**



Reflector

- **RF-210**



- **RF-220**

- **RF-230**