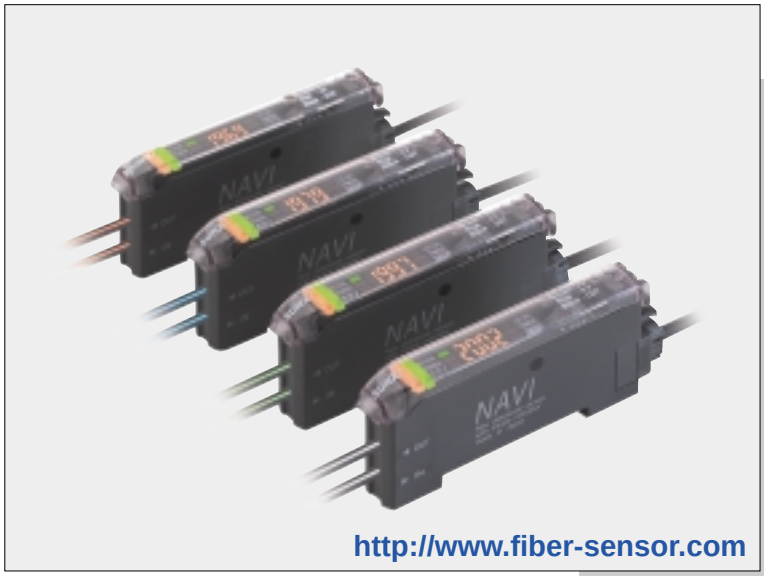
FX-301 SERIES

New

Digital Fiber Sensor

PNP output type available | Timer | Light intensity monitor | Interference prevention | Automatic sensitivity setting



http://www.fiber-sensor.com

Superior performance and advanced user-friendly multi-functionality enables expert usage on the very first day

* Passed the UL 991 Environment Test

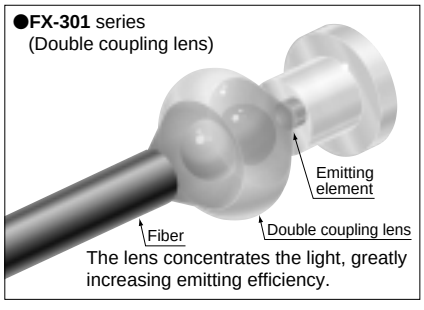
Conforming to EMC Directive

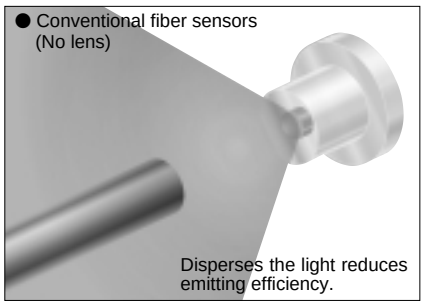
UL Recognition

* UL 61010C-1 compatible, Passed the UL 991 Environment Test based on SEMI S2-0200.
[Category applicable for semiconductor manufacturing: TWW2, Process Equipment]
[Applicable standards: UL 61010C-1]
[Additional test / evaluation standards as per intended use: UL 991, SEMI S2-0200]

Long-range sensing made possible with built-in optical lens

For the first time in the industry, an optical 'double coupling lens' has been incorporated directly into the fiber sensor itself. This lens maximizes the light emission efficiency, resulting in a tremendous improvement in the sensing range. Sensing ranges with small diameter fibers and ultra-small diameter fibers, which have become very popular in recent years due to the miniaturization of chip components, have been increased by 50 % over previous values achieved with other amplifiers.



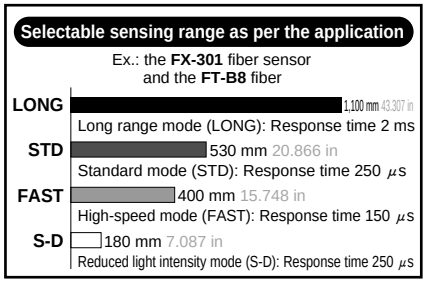


Stable long-term sensing

The newly developed four-chemical emitting element that uses the **FX-301** (red LED type) suppresses changes over long periods of time as much as possible, so that a stable light emitting level is maintained. There is very little element deterioration so that stable and accurate sensing can be maintained over long periods.

Selectable response time

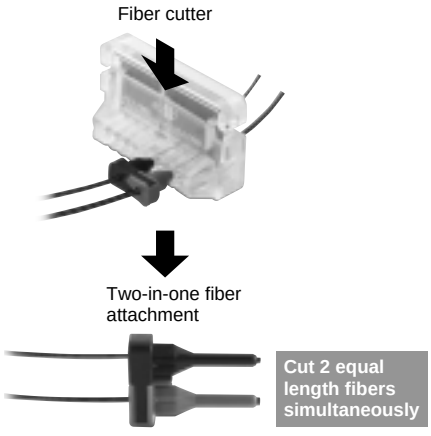
We offer 4 selectable levels to correspond with various applications: the response time 150 μs FAST mode, the LONG mode, perfect for adverse environments, and the S-D mode, especially made for minute detection.



※The S-D mode can be set in the red LED type only.

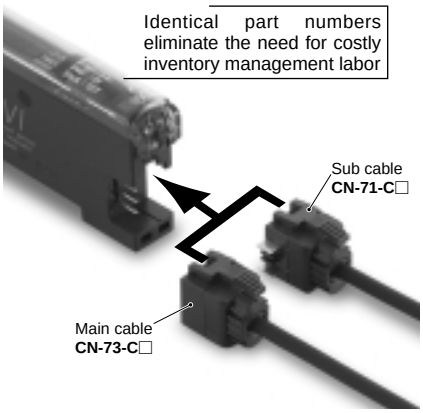
Enhanced worksite-friendly installability

Our new fiber cutter utilizes a specially developed two-in-one fiber attachment that now makes it possible to cut two fibers simultaneously to exactly the same length. Also, since the fibers can be attached to the amplifier while being fixed in position in the two-in-one fiber attachment, sensitivity changes due to variation in the amount of fiber insertion do not occur.



Easy maintenance, as main and sub units are identical

Both main and sub units utilize the same amplifier body. This feature allows for easy mounting in the side-by-side configuration. The main and sub unit functions are distinguished only by the proper use of 3-core main cable and the 1-core sub cable. Moreover, by utilizing the same body for both main and sub units, inventory management and maintenance is simplified.

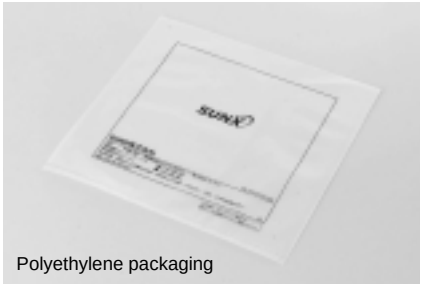


Wiring- and labor-saving design allows side-by-side configuration for up to sixteen units

Up to sixteen amplifiers can be connected in a side-by-side configuration. As the sub cable contains only one output line, a great amount of wiring and space can be saved. Also, special 'sliding' connectors have been provided for all main and sub cables, which can be detached merely by releasing the lock and pulling directly back, without having to slide the amplifier body to the side. Using this connector system, only a minimal amount of space is required for regular maintenance.

Environmentally friendly packaging

With regard to effects on the environment, we only utilize the simplest of packaging methods greatly contributing to the reduction in wastes generated by your worksite.
Also, the bags are made of polyethylene, a substance that doesn't give off polluting gases when burned.


Polyethylene packaging

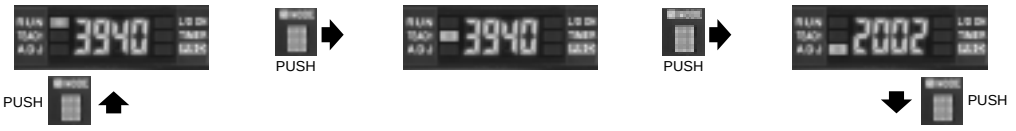
Even beginners can quickly learn how to use the MODE NAVI

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

RUN
This is the sensing mode.
Incident light level is displayed in the digital display.

TEACH
This mode is for setting the threshold value.

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



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

TIMER
This mode permits the choice of using or not using the timer.

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

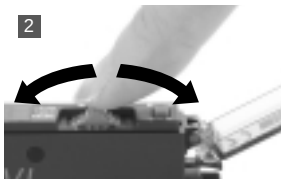
The use of only two switches makes for very simple operations

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

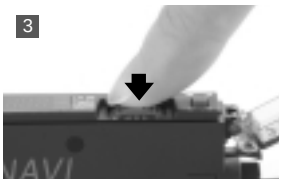
Large MODE key

Pressing the switch selects or cancels the operating mode

Large jog switch



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

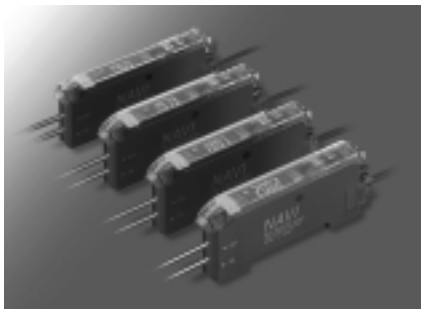


Pressing the switch then confirms the selected setting

FX-301

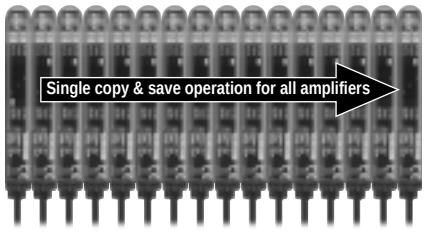
4 types of light sources available

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



Optical communication function lets multiple sensors be adjusted all at once

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



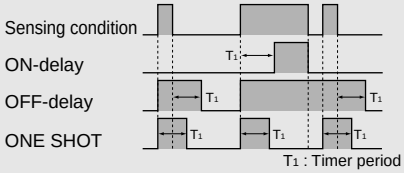
Equipped with each type of timer

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

■ **ON-delay timer**
This function is useful for sensing only objects taking a long time travel.

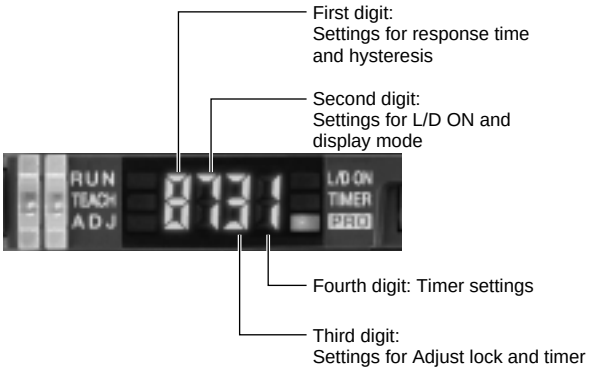
■ **OFF-delay timer**
This function is useful when the connected device has a slow response time.

■ **ONE SHOT timer**
This function is useful when the input specifications of the connected device require a signal of fixed width.



Easy code input setting

Every function can be directly set merely by the input of a four digit code (numbers) from the code table. This convenient feature is easy to set up.
In the event that settings are accidentally changed at the operating site, merely entering the correct code can restore the original settings. This results in easy and quick maintenance.



[Code setting table]

Direct code	First digit		Second digit		Third digit		Fourth digit
	Response time	Hysteresis	L/D ON	Display mode	Adjust lock	Timer	Timer setting
0	STD	H-02 (standard)	L-ON	digit	ON	OFF	OFF
1	STD	H-03 (large)	L-ON	%	ON	OFF-delay	1 ms
2	STD	H-01 (small)	L-ON	Peak hold	ON	ON-delay	3 ms
3	LONG	H-02 (standard)	L-ON	Bottom hold	ON	ONE SHOT	5 ms
4	LONG	H-03 (large)	D-ON	digit	OFF	OFF	10 ms
5	LONG	H-01 (small)	D-ON	%	OFF	OFF-delay	30 ms
6	FAST	H-02 (standard)	D-ON	Peak hold	OFF	ON-delay	50 ms
7	FAST	H-03 (large)	D-ON	Bottom hold	OFF	ONE SHOT	100 ms
8	FAST	H-01 (small)					300 ms
9	S-D	H-02 (standard)					500 ms

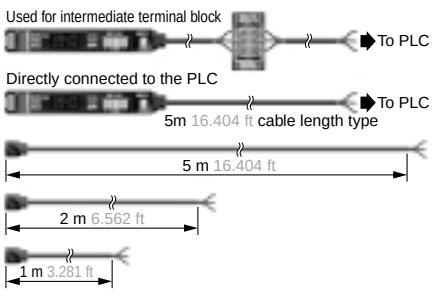
represents a description of the setting in the picture on the left.

Invertible digital display

The digital display can be inverted as per its orientation once mounted onto the amplifier.

Selectable cable length ECO

Made available are 3 lengths, 1 m 3.281 ft, 2 m 6.562 ft, and 5 m 16.404 ft, to suit your application requirements. This helps reduce the waste caused by cutting cables and lightens the installation workload.

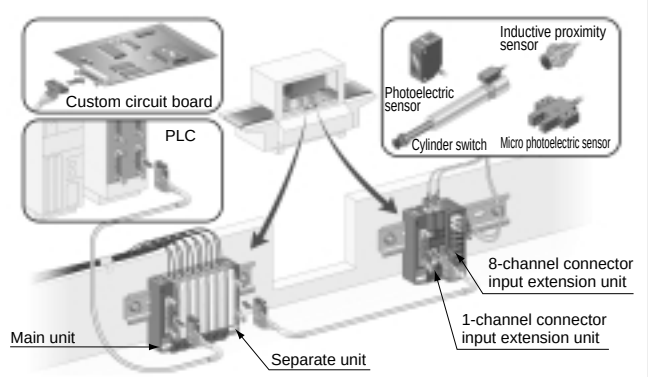


Optional units for greater freedom and control when installing

Sensor-PLC connection system

SC SERIES

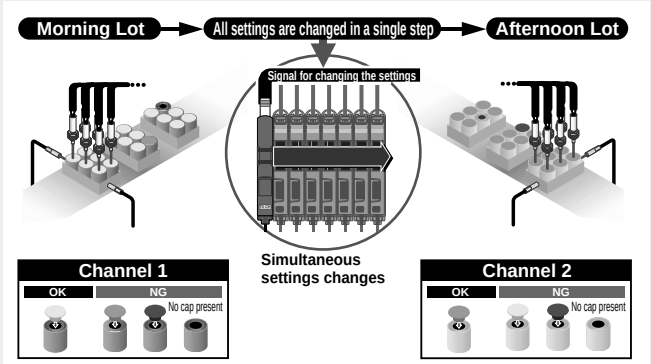
This wire-saving system enables the collective connection of up to 16 I/O devices with an MIL connector. Scattered installation is also possible with the help of a sensor separate unit.
(Refer to p.876 ～ for details)



Bank selection unit

FX-CH SERIES

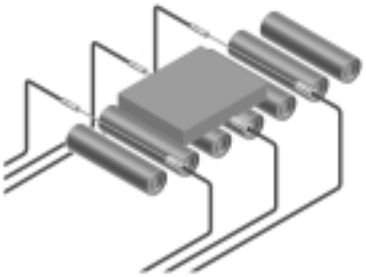
Without directly manipulating the sensor itself, you can simultaneously switch up to 16 fiber sensors' settings using an external emitted signal. (Load and save)
※Also possible with the **FX-301** series' databank function
(Refer to p.144 ～ for details)



APPLICATIONS

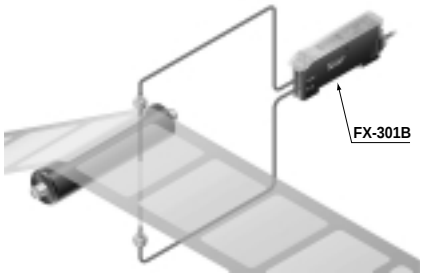
Workpieces detection

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



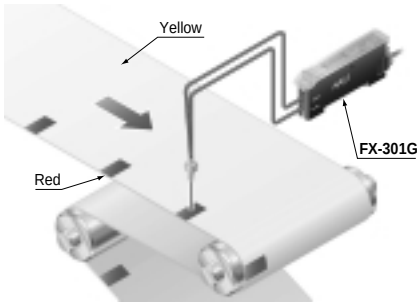
Sensing semi-transparent stickers

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



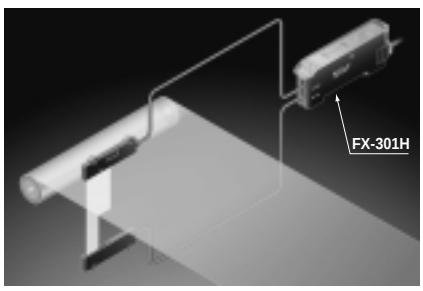
Sensing register marks

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



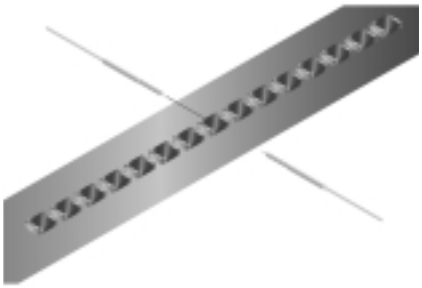
Sensing film meandering

Infrared LED type is ideal for sensing environments with light restrictions, such as places where light-sensitive film is being handled. (The emission peak wavelength: 940 nm 0.037 mil.) It includes full-auto teaching function which allows sensitivity to be set without stopping the workpiece line.



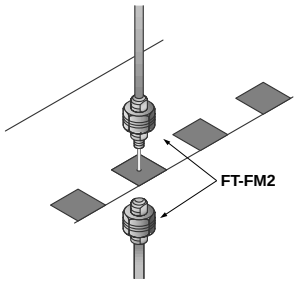
Detecting chip component

Because of low light intensity fluctuations when detecting minute moving objects, decrease the hysteresis in PRO mode and accurate sensing will be possible in high-speed mode. This method is optimal for chip component verification in taping equipment.



Detecting register marks on a transparent sheet

When detecting registration marks on transparent film with a thru-beam type, the S-D (reduced light intensity) mode will enable minute light intensity fluctuation sensing.



FX-301

ORDER GUIDE

Amplifiers

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

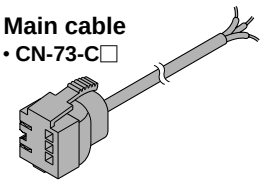
Type		Appearance	Model No.	Emitting element	Output
Digital	NPN output		**FX-301**	Red LED	NPN open-collector transistor
			FX-301B	Blue LED	
			FX-301G	Green LED	
			FX-301H	Infrared LED	
	PNP output		**FX-301P**	Red LED	PNP open-collector transistor
			FX-301BP	Blue LED	
			FX-301GP	Green LED	
			FX-301HP	Infrared LED	

Quick-connection cables

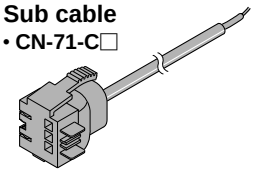
Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable	**CN-73-C1**	Length: 1 m 3.281 ft	0.15 mm² 3-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-73-C2	Length: 2 m 6.562 ft	
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable	**CN-71-C1**	Length: 1 m 3.281 ft	0.15 mm² 1-core cabtyre cable, with connector on one end Cable outer diameter: ϕ3.0 mm ϕ0.118 in
	CN-71-C2	Length: 2 m 6.562 ft	
	CN-71-C5	Length: 5 m 16.404 ft	

Main cable
• **CN-73-C□**

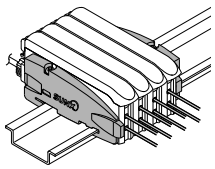


Sub cable
• **CN-71-C□**



End plates

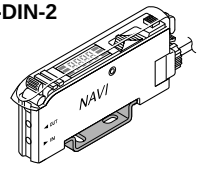
End plates are not supplied with the amplifier. Please order separately when the amplifiers are mounted in cascade.

Appearance	Model No.	Description
	**MS-DIN-E**	When cascading multiple amplifiers, or when it moves depending on the way it is installed on a DIN rail, these end plates ensure that all amplifiers are mounted together in a secure and fully connected manner. Two pcs. per set

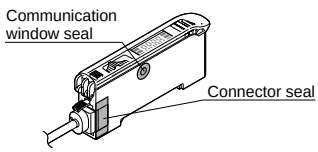
OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	**MS-DIN-2**	Mounting bracket for amplifier
Fiber amplifier protective seal	**FX-MB1**	10 sets of 2 communication window seals and 1 connector seal Communication window seal: It prevents malfunction due to transmission signal from another amplifier, as well as, prevents effect on another amplifier. Connector seal: It prevents contact of any metal, etc., with the pins of the quick-connection cable.

Amplifier mounting bracket
• **MS-DIN-2**

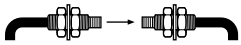


Fiber amplifier protective seal
• **FX-MB1**



LIST OF FIBERS

Standard fibers [Thru-beam type (one pair set)]



Type	Shape of fiber head (mm in)	Sensing range (mm in) (Note 1) ■:LONG ▩:STD ▨:FAST □:S-D				Min. sensing object (under the optimum condition (Note 2))	Fiber cable length ✂: Free-cut	Allowable bending radius	Model No.
		Red LED	Blue LED	Green LED	Infrared LED				
Long sensing range	With lens M14	19,500 767.715 14,000 551.180 10,000 393.700 3,800 149.606	5,400 212.598 2,700 106.299 1,900 74.803 —	2,800 110.236 1,400 55.118 1,000 39.370 —	2,400 94.488 1,200 47.244 900 35.433 (Note 3) —	ϕ0.4 mm ϕ0.016 in opaque object	✂ 10 m 32.808 ft	R25 mm R0.984 in	**FT-FM10L**
Long sensing range	With lens ϕ2.5 ϕ0.098	1,600 62.992 800 31.496 580 22.835 280 11.024	400 15.748 200 7.874 130 5.118 —	200 7.874 100 3.937 65 2.559 —	155 6.102 77 3.031 55 2.165 —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft		**FT-SFM2L**
Long sensing range	Lens mountable M4	1,100 43.307 530 20.866 400 15.748 180 7.087	220 8.661 110 4.331 75 2.953 —	110 4.331 55 2.165 40 1.575 —	100 3.937 50 1.969 30 1.181 —	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft		**FT-B8**
Long sensing range	M4	1,000 39.370 480 18.898 360 14.173 168 6.614	200 7.874 100 3.937 70 2.756 —	100 3.937 50 1.969 35 1.378 —	90 3.543 45 1.772 28 1.102 —	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft (Note 4)		**FT-NB8**
Standard	Lens mountable M4							R25 mm R0.984 in	**FT-FM2**
Standard	Sleeve 90 mm 3.543 in M4 ϕ1.48 ϕ0.058							Fiber R25 mm R0.984 in	**FT-FM2S**
Standard	Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058	780 30.709 400 15.748 280 11.024 130 5.118	150 5.906 75 2.953 40 1.575 —	70 2.756 35 1.378 24 0.945 —	50 1.969 25 0.984 18 0.709 —	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft	Sleeve R10 mm R0.394 in	**FT-FM2S4**
Standard	Lens mountable M3							R25 mm R0.984 in	**FT-T80**
Standard	ϕ2.5 ϕ0.098								**FT-SFM2**
Standard	M4	700 27.559 360 14.173 250 9.843 126 4.961	140 5.512 70 2.756 40 1.575 —	66 2.598 33 1.299 22 0.866 —	45 1.772 22 0.866 17 0.669 —	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft (Note 4)	R25 mm R0.984 in	**FT-N8**
Standard	M3							R25 mm R0.984 in	**FT-NFM2**
Standard	Sleeve 90 mm 3.543 in M3 ϕ0.88 ϕ0.035	270 10.630 140 5.512 100 3.937 49 1.929	50 1.969 25 0.984 16 0.630 —	24 0.945 12 0.472 8 0.315 —	16 0.630 8 0.315 5 0.197 —	ϕ0.025 mm ϕ0.0010 in opaque object	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in	**FT-NFM2S**
Standard	Sleeve 40 mm 1.575 in M3 ϕ0.88 ϕ0.035							Sleeve R10 mm R0.394 in	**FT-NFM2S4**
Standard	ϕ1.5 ϕ0.059							R25 mm R0.984 in	**FT-SNFM2**
Elbow	Lens mountable M4	530 20.866 230 9.055 150 5.906 80 3.150	85 3.346 42 1.654 28 1.102 —	44 1.732 22 0.866 16 0.630 —	32 1.260 16 0.630 12 0.472 —	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FT-R80**
Side-view	ϕ4 ϕ0.157 3 0.118	2,000 78.740 1,000 39.370 800 31.496 350 13.780	400 15.748 200 7.874 130 5.118 —	200 7.874 100 3.937 65 2.559 —	150 5.906 75 2.953 40 1.575 —	ϕ0.05 mm ϕ0.0019 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	***New*** **FT-V10**
Side-view	ϕ1.5 ϕ0.059 0.8 0.031 ϕ2.5 ϕ0.098 Sleeve part cannot be bent.	400 15.748 200 7.874 140 5.512 70 2.756	80 3.150 40 1.575 28 1.102 —	40 1.575 20 0.787 14 0.551 —	30 1.181 15 0.591 12 0.472 —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft		**FT-SFM2SV2**
Side-view	ϕ1 ϕ0.039 0.6 0.024 ϕ2 ϕ0.079 Sleeve part cannot be bent.	390 15.354 180 7.087 125 4.921 63 2.480	50 1.969 25 0.984 16 0.630 —	26 1.024 13 0.512 8 0.315 —	44 1.732 22 0.866 15 0.591 —		1 m 3.281 ft		**FT-V22**
Side-view	ϕ1 ϕ0.039 0.6 0.024 ϕ2.5 ϕ0.098 Sleeve part cannot be bent.	175 6.890 80 3.150 60 2.362 27 1.063	28 1.102 14 0.551 10 0.394 —	14 0.551 7 0.276 5 0.197 —	10 0.394 5 0.197 3 0.118 —		✂ 2 m 6.562 ft		**FT-V41**

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.
2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
3) Sensing range for a 2 m 6.562 ft long fiber. A 10 m 32.808 ft long fiber will cause damping of the beam and cannot be used.
4) The fiber cutter is not supplied as an accessory with **FT-NB8** and **FT-N8**. Please order it separately.

FX-301

LIST OF FIBERS

Sharp bending fibers / Flexible fibers [Thru-beam type (one pair set)]

Type	Shape of fiber head (mm in)	Sensing range (mm in) (Note 1) ■:LONG ■:STD □:FAST □:S-D — Red LED	Blue LED	Green LED	Infrared LED	Min. sensing object (under the optimum condition (Note 2))	Fiber cable length ✂: Free-cut	Allowable bending radius	Model No.
Sharp bending — Wide beam	Wide area sensing, Sensing width 32 mm 1.260 in, W5 × H69 × D20 W0.197 × H2.717 × D0.787	3,500 137.795 3,500 137.795 3,500 137.795 3,500 137.795 (Note 3)	2,400 94.488 1,200 47.244 700 27.559 —	1,200 47.244 600 23.622 350 13.780 —	800 31.496 400 15.748 240 9.449 —	ϕ0.3 mm ϕ0.012 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WA30
Sharp bending — Wide beam	Wide area sensing, Sensing width 11 mm 0.433 in, W4.2 × H31 × D13.5 W0.165 × H1.220 × D0.531	3,500 137.795 1,500 59.055 1,100 43.307 750 29.528	600 23.622 300 11.811 220 8.661 —	300 11.811 150 5.906 110 4.331 —	220 8.661 110 4.331 80 3.150 —	ϕ0.25 mm ϕ0.010 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WA8
Sharp bending — Rectangular head	Easy mounting · Top sensing, W3 × H8 × D12 W0.118 × H0.315 × D0.472	2,500 98.425 1,200 47.244 850 33.465 410 16.142	400 15.748 200 7.874 140 5.512 —	200 7.874 100 3.937 70 2.756 —	180 7.087 90 3.543 65 2.559 —	ϕ0.08 mm ϕ0.003 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WZ8H
Sharp bending — Rectangular head	Easy mounting · Side sensing, W3 × H12 × D8 W0.118 × H0.472 × D0.315	1,500 59.055 700 27.559 500 19.685 210 8.268	240 9.449 120 4.724 80 3.150 —	120 4.724 60 2.362 40 1.575 —	100 3.937 50 1.969 30 1.181 —	ϕ0.05 mm ϕ0.0020 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WZ8E
Sharp bending — Rectangular head	Easy mounting · Front sensing, W8.5 × H12 × D3 W0.335 × H0.472 × D0.118	700 27.559 330 12.992 240 9.449 120 4.724	80 3.150 40 1.575 25 0.984 —	40 1.575 20 0.787 13 0.512 —	36 1.417 18 0.709 12 0.472 —	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WZ8
Sharp bending — Narrow beam	Side-view type with small light dispersion, ϕ4 ϕ0.157, 3, 0.118	1,700 66.929 700 27.559 600 23.622 300 11.811	300 11.811 150 5.906 100 3.937 —	160 6.299 80 3.150 60 2.362 —	150 5.906 75 2.953 45 1.772 —	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WKV8
Sharp bending — Long sensing range	With lens · Long sensing range, ϕ3 ϕ0.118	1,200 47.244 600 23.622 420 16.535 210 8.268	240 9.449 120 4.724 90 3.543 —	120 4.724 60 2.362 40 1.575 —	110 4.331 55 2.165 35 1.378 —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WS8L
Sharp bending — Standard	Lens mountable, M4					ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-W8
Sharp bending — Standard	ϕ3 ϕ0.118	570 22.441 290 11.417 200 7.874 100 3.937	90 3.543 45 1.772 30 1.181 —	56 2.205 28 1.102 20 0.787 —	42 1.654 21 0.827 15 0.591 —	ϕ0.05 mm ϕ0.0020 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WS3
Sharp bending — Standard	ϕ2.5 ϕ0.098					ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WS8
Sharp bending — Small diameter	M3	160 6.299 80 3.150 55 2.165 28 1.102	16 0.630 8 0.315 5 0.197 —	10 0.394 5 0.197 3 0.118 —	8 0.315 4 0.157 2.5 0.098 —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-W4
Sharp bending — Small diameter	ϕ1.5 ϕ0.059								FT-WS4
Sharp bending — Side-view	ϕ1 ϕ0.039, ϕ2 ϕ0.079, 1, 0.039, Sleeve part cannot be bent.	90 3.543 40 1.575 30 1.181 15 0.591	— — — —	— — — —	— — — —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WV42
Flexible — Rectangular head	Easy mounting · Top sensing, W3 × H8 × D12 W0.118 × H0.315 × D0.472	2,700 106.299 1,400 55.118 1,000 39.370 490 19.291	560 22.047 280 11.024 200 7.874 —	200 7.874 100 3.937 65 2.559 —	180 7.087 90 3.543 65 2.559 —	ϕ0.03 mm ϕ0.0012 in opaque object	✂ 2 m 6.562 ft	R4 mm R0.157 in	FT-Z8H
Flexible — Rectangular head	Easy mounting · Side sensing, W3 × H12 × D8 W0.118 × H0.472 × D0.315	1,600 62.992 800 31.496 600 23.622 280 11.024	400 15.748 200 7.874 140 5.512 —	200 7.874 100 3.937 65 2.559 —	140 5.512 70 2.756 50 1.969 —				FT-Z8E
Flexible — Rectangular head	Easy mounting · Front sensing, W8.5 × H12 × D3 W0.335 × H0.472 × D0.118	800 31.496 400 15.748 300 11.811 140 5.512	120 4.724 60 2.362 40 1.575 —	60 2.362 30 1.181 22 0.866 —	46 1.811 23 0.906 16 0.630 —				FT-Z8
Flexible — Standard	Lens mountable, M4	650 25.591 320 12.598 230 9.055 110 4.331	130 5.118 65 2.559 45 1.772 —	70 2.756 35 1.378 25 0.984 —	56 2.205 28 1.102 20 0.787 —	ϕ0.04 mm ϕ0.0016 in opaque object	✂ 2 m 6.562 ft	R4 mm R0.157 in	FT-P80
Flexible — Standard	Lens mountable, M4	400 15.748 190 7.480 140 5.512 80 3.150	50 1.969 25 0.984 18 0.709 —	26 1.024 13 0.512 8 0.315 —	20 0.787 10 0.394 7 0.276 —				New FT-P60
Flexible — Small diameter	M3	250 9.843 100 3.937 75 2.953 35 1.378	32 1.260 16 0.630 12 0.472 —	18 0.709 9 0.354 7 0.276 —	14 0.551 7 0.276 5 0.197 —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R4 mm R0.157 in	FT-P40
Flexible — Small diameter	ϕ1.5 ϕ0.059	280 11.024 120 4.724 90 3.543 42 1.654	36 1.417 18 0.709 14 0.551 —	20 0.787 10 0.394 8 0.315 —	18 0.709 9 0.354 7 0.276 —		1 m 3.281 ft		FT-P2
Flexible — Small diameter	ϕ1 ϕ0.039	80 3.150 40 1.575 30 1.181 17 0.669	14 0.551 7 0.276 4 0.157 —	6 0.236 3 0.118 2 0.079 —	14 0.551 7 0.276 4 0.157 —		500 mm 19.685 in		New FT-PS1

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.
2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
3) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long.

LIST OF FIBERS

Special use fibers [Thru-beam type (one pair set)]

Type		Shape of fiber head (mm in)	Sensing range (mm in) (Note 1) ■:LONG ■:STD ▨:FAST □:S-D				Min. sensing object (under the optimum condition (Note 2))	Fiber cable length ✂: Free-cut	Allowable bending radius	Model No.
			Red LED	Blue LED	Green LED	Infrared LED				
Special use	Wide beam	Sensing width 32 mm 1.260 in W5 × H69 × D20 W0.197 × H2.717 × D0.787	3,500 137.795 3,500 137.795 3,500 137.795 3,500 137.795 (Note 3)	2,400 94.488 1,200 47.244 700 27.559 —	1,200 47.244 600 23.622 350 13.780 —	800 31.496 400 15.748 240 9.449 —	ϕ0.3 mm ϕ0.012 in opaque object	✂ 2 m 6.562 ft	R10 mm R0.394 in	New FT-A30
		Sensing width 11 mm 0.433 in W4.2 × H31 × D13.5 W0.165 × H1.220 × D0.531	3,500 137.795 1,500 59.055 1,100 43.307 750 29.528	600 23.622 300 11.811 220 8.661 —	300 11.811 150 5.906 110 4.331 —	220 8.661 110 4.331 80 3.150 —	ϕ0.25 mm ϕ0.010 in opaque object	✂ 2 m 6.562 ft	R10 mm R0.394 in	FT-A8
	Array	Top sensing W5 × H15 × D15 W0.197 × H0.591 × D0.591	650 25.591 330 12.992 220 8.661 115 4.528	120 4.724 60 2.362 40 1.575 —	60 2.362 30 1.181 20 0.787 —	48 1.890 24 0.945 18 0.709 —	Horizontal: ϕ0.025 mm ϕ0.0010 in opaque object Vertical: ϕ0.45 mm ϕ0.018 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-AFM2
		Side sensing W5 × H15 × D15 W0.197 × H0.591 × D0.591	590 23.228 290 11.417 200 7.874 100 3.937	120 4.724 60 2.362 40 1.575 —	60 2.362 30 1.181 20 0.787 —	48 1.890 24 0.945 18 0.709 —				FT-AFM2E
	Narrow beam	ϕ3.5 ϕ0.138 ϕ3.7 ϕ0.146	2,000 78.740 1,000 39.370 800 31.496 350 13.780	400 15.748 200 7.874 130 5.118 —	200 7.874 100 3.937 65 2.559 —	150 5.906 75 2.953 40 1.575 —	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-K8
		Side-view ϕ4 ϕ0.157 3 0.118								FT-KV8
		Side-view W2 × H1.5 × D20 W0.079 × H0.059 × D0.787 2 0.079	500 19.685 250 9.843 180 7.087 100 3.937	80 3.150 35 1.378 10 0.394 —	— — — —	— — — —	ϕ0.02 mm ϕ0.0008 in opaque object	✂ 2 m 6.562 ft	R10 mm R0.394 in	New FT-KV1
	Ultra-small diameter	Beam diameter: ϕ0.125 mm ϕ0.005 in ϕ0.25 ϕ3 ϕ0.010 ϕ0.118 Sleeve part cannot be bent.	18 0.709 10 0.394 8 0.315 3 0.118	3 0.118 2 0.079 1 0.039 —	1 0.039 — — —	4 0.157 2 0.079 1.5 0.059 —	ϕ0.02 mm ϕ0.0008 in opaque object	500 mm 19.685 in	R5 mm R0.197 in	FT-E12
		Beam diameter: ϕ0.25 mm ϕ0.010 in ϕ0.4 ϕ3 ϕ0.016 ϕ0.118 Sleeve part cannot be bent.	80 3.150 50 1.969 36 1.417 15 0.591	14 0.551 7 0.276 4 0.157 —	6 0.236 3 0.118 2 0.079 —	10 0.394 5 0.197 3 0.118 —		1 m 3.281 ft		FT-E22
	Tough flexible	Lens mountable M4	650 25.591 320 12.598 230 9.055 110 4.331	130 5.118 64 2.520 45 1.772 —	64 2.520 32 1.260 22 0.866 —	130 5.118 64 2.520 45 1.772 —	ϕ0.05 mm ϕ0.0020 in opaque object	1 m 3.281 ft	R10 mm R0.394 in	New FT-P81X

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.

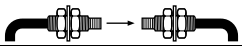
2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

3) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long.

FX-301

LIST OF FIBERS

Environment resistant fibers [Thru-beam type (one pair set)]



Type	Shape of fiber head (mm in)	Sensing range (mm in) (Note 1) ■:LONG ■:STD ▨:FAST □:S-D				Min. sensing object (under the optimum condition (Note 2))	Fiber cable length ✂:Free-cut	Allowable bending radius	Model No.
		Red LED	Blue LED	Green LED	Infrared LED				
Environment resistant – Heat-resistant	350 °C 662 °F Lens mountable	550 21.654 280 11.024 200 7.874 90 3.543	100 3.937 50 1.969 35 1.378 —	50 1.969 25 0.984 18 0.709 —	420 16.535 210 8.268 160 6.299 —	ϕ0.04 mm ϕ0.0016 in opaque object	2 m 6.562 ft	R25 mm R0.984 in	**FT-H35-M2**
	350 °C 662 °F Sleeve 60 mm 2.362 in ϕ2.1 ϕ0.083							Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	**FT-H35-M2S6**
	Allows flexible wiring 200 °C 392 °F Lens mountable	310 12.205 140 5.512 100 3.937 50 1.969	44 1.732 22 0.866 14 0.551 —	22 0.866 11 0.433 7 0.276 —	220 8.661 110 4.331 70 2.756 —	ϕ0.02 mm ϕ0.0008 in opaque object	1 m 3.281 ft	R10 mm R0.394 in	**FT-H20W-M1**
							2 m 6.562 ft		**FT-H20W-M2**
	200 °C 392 °F Lens mountable	550 21.654 280 11.024 200 7.874 90 3.543	100 3.937 50 1.969 35 1.378 —	50 1.969 25 0.984 18 0.709 –	420 16.535 210 8.268 160 6.299 –	ϕ0.04 mm ϕ0.0016 in opaque object	1 m 3.281 ft	R25 mm R0.984 in	**FT-H20-M1**
	130 °C 266 °F Lens mountable	880 34.646 440 17.323 300 11.811 155 6.102	72 2.835 36 1.417 26 1.024 —	32 1.260 16 0.630 10 0.394 —	70 2.756 35 1.378 25 0.984 —	ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft		**FT-H13-FM2**
Chemical-resistant	Easy mounting · Rectangular head SEMI S2 compliant W7 × H15 × D13 W0.276 × H0.591 × D0.512	3,500 137.795 1,500 59.055 1,000 39.370 530 20.866	320 12.598 160 6.299 120 4.724 —	160 6.299 80 3.150 60 2.362 —	320 12.598 160 6.299 120 4.724 —	ϕ4 mm ϕ0.157 in opaque object	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FT-Z802Y**
	ϕ5.5 ϕ0.217	3,500 137.795 1,500 59.055 1,000 39.370 530 20.866	160 6.299 80 3.150 50 1.969 —	160 6.299 80 3.150 50 1.969 —	400 15.748 200 7.874 150 5.906 —	ϕ0.08 mm ϕ0.003 in opaque object	✂ 2 m 6.562 ft (Note 3)	R30 mm R1.181 in	**FT-L8Y**
	Side-view ϕ5.5 ϕ0.217	800 31.496 400 15.748 280 11.024 140 5.512	120 4.724 60 2.362 35 1.378 —	80 3.150 40 1.575 25 0.984 —	75 2.953 38 1.496 24 0.945 —				**FT-V8Y**
Vacuum	Lens mountable	470 18.504 230 9.055 165 6.496 80 3.150	100 3.937 50 1.969 30 1.181 —	46 1.811 23 0.906 16 0.630 —	70 2.756 35 1.378 22 0.866 —	ϕ0.02 mm ϕ0.0008 in opaque object	1 m 3.281 ft	R200 mm R7.874 in	**FT-6V**
		220 8.661 100 3.937 75 2.953 35 1.378	36 1.417 18 0.709 12 0.472 —	18 0.709 9 0.354 6 0.236 —	28 1.102 14 0.551 10 0.394 —			R30 mm R1.181 in	**FT-60V**

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.
2) The minimum sensing object size is the value for red LED type. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
3) The allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.

The vacuum type fiber must be used with the following products as a set.

FT-J6: Fiber at atmospheric side (one pair set) **FV-BR1**: Photo-terminal (one pair set)

Semi-standard fibers (Custom made per order)

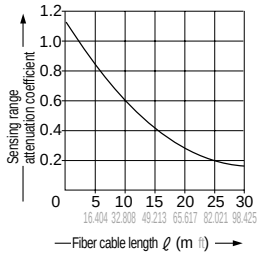
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☆) or the sleeve length (symbol △) from the table below.

Type	Basic model No.	☆ Fiber cable length (Unit: m ft)	△ Sleeve length (Unit: cm in)
Standard threaded head (free-cut)	**FT-FM** ☆	3 9.843, 4 13.123, 5 16.404, 10 32.808, 15 49.213, 20 65.617,25 82.021, 30 98.425	———
With sleeve	**FT-FM** ☆ **-S** △	2 6.562 (Note), 3 9.843, 4 13.123, 5 16.404, 10 32.808, 15 49.213, 20 65.617, 25 82.021, 30 98.425	1 0.394, 2 0.787, 3 1.181, 4 1.575, 5 1.969, 6 2.362, 7 2.756, 8 3.150, 9 3.543, 10 3.937, 11 4.331, 12 4.724
With large diameter lens	**FT-FM** ☆ **L**	20 65.617, 30 98.425	———
Small diameter threaded head with sleeve (free-cut)	**FT-NFM2-S** △	———	1 0.394, 2 0.787, 3 1.181, 4 1.575, 5 1.969, 6 2.362, 7 2.756, 8 3.150, 9 3.543, 10 3.937, 11 4.331, 12 4.724
Wide beam	**FT-WA30-** ☆ **FT-WA8-** ☆ **FT-A30-** ☆ **FT-A8-** ☆	5 16.404	———
200°C 392°F heat-resistant	**FT-H20-M** ☆	2 6.562, 3 9.843	———
350°C 662°F heat-resistant	**FT-H35-M** ☆	3 9.843	———
Chemical-resistant	**FT-Z80** ☆ **Y**	5 16.404, 7 22.966	———

Note: The standard fiber has a 2 m 6.562 ft fiber cable length and a 4 cm 1.575 in or 9 cm 3.543 in sleeve length.

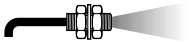
Correlation between sensing range attenuation coefficient and fiber cable length

The longer the fiber cable, the shorter the sensing range.



LIST OF FIBERS

Standard fibers (Reflective type)



Type	Shape of fiber head (mm in)	Sensing range (mm in) (Note 1, 2) ■:LONG ■:STD ▨:FAST □:S-D				Min. sensing object (at the maximum sensitivity (Note 3))	Fiber cable length ✂: Free-cut	Allowable bending radius	Model No.
		Red LED	Blue LED	Green LED	Infrared LED				
Standard (Long sensing range)	M6	480 18.898 220 8.661 160 6.299 75 2.953	80 3.150 40 1.575 26 1.024 —	42 1.654 21 0.827 14 0.551 —	26 1.654 13 0.827 9 0.551 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft		FD-B8
	Coaxial M6	310 12.205 140 5.512 100 3.937 47 1.850	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	90 3.543 45 1.772 30 1.181 —	ϕ0.02 mm ϕ0.0008 in gold wire	500 mm 19.685 in	R25 mm R0.984 in	FD-5
	M6	310 12.205 140 5.512 100 3.937 47 1.850	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	20 0.787 10 0.394 7 0.276 —		✂ 2 m 6.562 ft		FD-FM2
	Sleeve 90 mm 3.543 in M6 ϕ2.5 ϕ0.098	270 10.630 110 4.331 85 3.346 39 1.535	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	20 0.787 10 0.394 7 0.276 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in	FD-FM2S
	Sleeve 40 mm 1.575 in M6 ϕ2.5 ϕ0.098							Sleeve R10 mm R0.394 in	FD-FM2S4
	M4	270 10.630 110 4.331 85 3.346 39 1.535	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	20 0.787 10 0.394 7 0.276 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-T80
	Small diameter M3	90 3.543 45 1.772 35 1.378 16 0.630	16 0.630 8 0.315 5 0.197 —	8 0.315 4 0.157 2 0.079 —	6 0.236 3 0.118 2 0.079 —				FD-T40
	ϕ3 ϕ0.118	270 10.630 110 4.331 85 3.346 39 1.535	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	20 0.787 10 0.394 7 0.276 —				FD-S80
	M6	260 10.236 120 4.724 85 3.346 42 1.654	46 1.811 23 0.906 15 0.591 —	24 0.945 12 0.472 8 0.315 —	20 0.787 10 0.394 7 0.276 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft (Note 4)	R25 mm R0.984 in	FD-N8
	M4	75 2.953 38 1.496 28 1.102 13 0.512	16 0.630 8 0.315 5 0.197 —	8 0.315 4 0.157 2 0.079 —	4 0.157 2 0.079 1.5 0.059 —				FD-N4
	M4	90 3.543 45 1.772 35 1.378 16 0.630	16 0.630 8 0.315 5 0.197 —	8 0.315 4 0.157 2 0.079 —	6 0.236 3 0.118 2 0.079 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-NFM2
	Sleeve 90 mm 3.543 in M4 ϕ1.48 ϕ0.058							Fiber R25 mm R0.984 in	FD-NFM2S
	Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058							Sleeve R10 mm R0.394 in	FD-NFM2S4
	ϕ2.5 ϕ0.098							R25 mm R0.984 in	FD-SNFM2
Elbow	M6	185 7.283 85 3.346 60 2.362 30 1.181	32 1.260 16 0.630 10 0.394 —	16 0.630 8 0.315 5 0.197 —	10 0.472 5 0.197 3 0.118 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-R80
Side-view	ϕ2 ϕ0.079 ϕ5 ϕ0.197 0.8 0.031 Sleeve part cannot be bent.	100 3.937 45 1.772 32 1.260 16 0.630	14 0.551 7 0.276 4 0.157 —	7 0.276 3.5 0.138 — — —	4 0.157 — — — — —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-SFM2SV2
	Small diameter ϕ1.5 ϕ0.059 ϕ3 ϕ0.118 0.7 0.028 Sleeve part cannot be bent.	55 2.165 25 0.984 17 0.669 9 0.354	6 0.236 3 0.118 — — —	3 0.118 — — — — —	— — — — — — —				FD-V41

Notes: 1) The sensing range is specified for white non-glossy paper (**FD-B8**, **FD-5**, **FD-FM2**, **FD-FM2S**, **FD-FM2S4**, **FD-N8**, **FD-T80**, **FD-S80** and **FD-R80**: 400×400 mm 15.748×15.748 in, **FD-T40**, **FD-N4**, **FD-NFM2**, **FD-NFM2S**, **FD-NFM2S4**, **FD-SNFM2**, **FD-SFM2SV2** and **FD-V41**: 200×200 mm 7.874×7.874 in) as the object.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.

3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
Also, note that the corresponding setting distance is different from the rated sensing distance.

4) The fiber cutter is not supplied as an accessory with **FD-N8** and **FD-N4**. Please order it separately.

FX-301

LIST OF FIBERS

Sharp bending fibers / Flexible fibers (Reflective type)

Type	Shape of fiber head (mm in)	Sensing range (mm in) (Note 1, 2) ■:LONG ■:STD ■:FAST □:S-D				Min. sensing object (at the maximum sensitivity (Note 3))	Fiber cable length ✂: Free-cut	Allowable bending radius	Model No.
		Red LED	Blue LED	Green LED	Infrared LED				
Sharp bending / Long sensing range	Long sensing range · Rectangular head W5.2 × H9.5 × D15 mm W0.205 × H0.374 × D0.5911 in	20 to 480 0.787 to 18.898 20 to 230 0.787 to 9.055 20 to 170 0.787 to 6.693 25 to 100 0.984 to 3.937	— — — —	— — — —	— — — —	ϕ0.3 mm ϕ0.012 in copper wire	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FD-WKZ1
Sharp bending / Standard	M6	190 7.480 90 3.543 60 2.362 32 1.260	23 0.906 11 0.433 8 0.315 —	14 0.551 7 0.276 4 0.157 —	11 0.433 5.5 0.217 3 0.118 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R1 mm R0.039 in	FD-W8
Sharp bending / Standard	Sleeve 40 mm 1.575 in M4 ϕ1.48 ϕ0.058	30 1.181 15 0.591 12 0.472 5 0.197	5 0.197 2.5 0.098 1.5 0.059 —	3 0.118 1.5 0.059 1 0.039 —	2 0.079 1 0.039 — —			Fiber R1 mm R0.039 in Sleeve R10 mm R0.394 in	FD-W44
Sharp bending / Standard	M4	190 7.480 90 3.543 60 2.362 32 1.260	23 0.906 11 0.433 8 0.315 —	14 0.551 7 0.276 4 0.157 —	11 0.433 5.5 0.217 3 0.118 —				FD-WT8
Sharp bending / Standard	ϕ3 ϕ0.118							R1 mm R0.039 in	FD-WS8
Sharp bending / Standard	M3	30 1.181 15 0.591 12 0.472 5 0.197	5 0.197 2.5 0.098 1.5 0.059 —	3 0.118 1.5 0.059 1 0.039 —	2 0.079 1 0.039 — —				FD-WT4
Sharp bending / High precision	Small spot for sensing minute objects Coaxial · Lens mountable M4	65 2.559 32 1.260 25 0.984 11 0.433	11 0.433 5 0.197 3 0.118 —	6 0.236 3 0.118 2 0.079 —	5 0.197 2.5 0.098 1.5 0.059 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R2 mm R0.079 in	FD-WG4
Sharp bending / High precision	For sensing minute objects · Coaxial ϕ3 ϕ0.118								FD-WSG4
Sharp bending / Fixed-focus reflective	Glass substrate detection W24 × H21 × D4 W0.945 × H0.827 × D0.157	6.5 to 14 0.256 to 0.551 (Convergent point 8 0.315) 7 to 12 0.276 to 0.472 (Convergent point 8 0.315) 7.5 to 12 0.295 to 0.472 (Convergent point 8 0.315) Cannot use	— — — —	— — — —	— — — —	ϕ1.9 mm ϕ0.075 in metal pipe (gray)	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FD-WL41
Sharp bending / Fixed-focus reflective	Specular object detection W15 × H19 × D3 W0.591 × H0.748 × D0.118	0.6 to 3.5 0.024 to 0.138 (Convergent point 2 0.079) 0.9 to 2.7 0.035 to 0.106 (Convergent point 2 0.079) 1 to 2.5 0.039 to 0.098 (Convergent point 2 0.079) Cannot use	— — — —	— — — —	— — — —	ϕ0.08 mm ϕ0.003 in gold wire			New FD-WL42
Sharp bending / Side-view	ϕ2 ϕ0.079 ϕ3 ϕ0.118 0.039 Sleeve part cannot be bent.	15 0.591 7 0.276 5 0.197 Cannot use	— — — —	— — — —	— — — —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FD-WV42
Flexible / Standard	M6	220 8.661 100 3.937 70 2.756 35 1.378	40 1.575 20 0.787 13 0.512 —	20 0.787 10 0.394 7 0.276 —	18 0.709 9 0.354 6 0.236 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R4 mm R0.157 in	FD-P80
Flexible / Standard	M4	90 3.543 45 1.772 30 1.181 16 0.630	20 0.787 10 0.394 6 0.236 —	10 0.394 5 0.197 3 0.118 —	8 0.315 4 0.157 2.5 0.098 —				FD-P60
Flexible / Standard	ϕ3 ϕ0.118								FD-P50
Flexible / Small diameter	M3	36 1.417 18 0.709 14 0.551 6 0.236	5 0.197 2.5 0.098 1.5 0.059 —	3 0.118 1.5 0.059 1 0.039 —	2 0.079 1 0.039 — —		✂ 2 m 6.562 ft		FD-P40
Flexible / Small diameter	ϕ1.5 ϕ0.059	50 1.969 25 0.984 19 0.748 9 0.354	8 0.315 4 0.157 2.5 0.098 —	4 0.157 2 0.079 1.5 0.059 —	7 0.276 3.5 0.138 2 0.079 —		1 m 3.281 ft		FD-P2

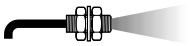
Notes: 1) The sensing range is specified for white non-glossy paper [100 × 100 mm 3.937 × 3.937 in (**FD-WKZ1**, **FD-W8**, **FD-WT8**, **FD-WS8** and **FD-P80**: 400 × 400 mm 15.748 × 15.748 in, **FD-WG4**, **FD-WSG4**, **FD-P60** and **FD-P50**: 200 × 200 mm 7.874 × 7.874 in, **FD-WL41**: glass substrate 100 × 100 × t 2 mm 3.937 × 3.937 × t 0.472 in)] as the object.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.

3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
Also, note that the corresponding setting distance is different from the rated sensing distance. However, with the fixed-focus reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of the sensing object at a distance corresponding to the convergent point.

LIST OF FIBERS

Special use fibers (Reflective type)



Type		Shape of fiber head (mm in)	Sensing range (mm in) (Note 1, 2) :LONG :FAST :STD :S-D — Red LED	Blue LED	Green LED	Infrared LED	Min. sensing object (at the maximum sensitivity (Note 3))	Fiber cable length : Free-cut	Allowable bending radius	Model No.
Special use	Wide beam	W7 × H15 × D30 W0.276 × H0.591 × D1.181	200 7.874 150 5.906 100 3.937 50 1.969	25 0.984 15 0.591 — —	— — — —	— — — —	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-A15** New
	Array	Top sensing W5 × H20 × D20 W0.197 × H0.787 × D0.787	220 8.661 110 4.331 78 3.071 39 1.535	40 1.575 20 0.787 13 0.512 —	18 0.709 9 0.354 5 0.197 —	12 0.472 6 0.236 4 0.157 —	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-AFM2**
		Side sensing W5 × H20 × D20 W0.197 × H0.787 × D0.787								**FD-AFM2E**
	High precision	Coaxial · Lens mountable M4	110 4.331 55 2.165 42 1.654 19 0.748	22 0.866 11 0.433 8 0.315 —	12 0.472 6 0.236 4 0.157 —	7 0.276 3.5 0.138 2 0.079 —	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-G4**
		Coaxial · Lens mountable M3								**FD-G6** New
		Coaxial · Lens mountable M3	38 1.496 18 0.709 14 0.551 6 0.236	6 0.236 3 0.118 2 0.079 —	3 0.118 1.5 0.059 1 0.039 —	10 0.394 5 0.197 3 0.118 —		500 mm 19.685 in		**FD-EG1**
		Coaxial · Lens mountable M3	25 0.984 12 0.472 9 0.354 5 0.197	5 0.197 2 0.079 1 0.039 —	2 0.079 1 0.039 — —	6 0.236 3 0.118 2 0.079 —	ϕ0.04 mm ϕ0.0016 in gold wire		R10 mm R0.394 in	**FD-EG2** New
		Coaxial · Lens mountable M3	15 0.591 8 0.315 5 0.197 3 0.118	2 0.079 1 0.039 — —	1 0.039 — — —	3 0.118 1.5 0.059 1 0.039 —				**FD-EG3** New
	Ultra-small diameter	ϕ1.5 ϕ0.059 ϕ0.5 ϕ0.020 Sleeve part cannot be bent.	11 0.433 6 0.236 4 0.157 1 0.039	2 0.079 1 0.039 — —	1 0.039 — — —	1 0.039 — — —	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3.281 ft	R10 mm R0.394 in	**FD-E12**
		Coaxial ϕ3 ϕ0.118 ϕ0.65 ϕ0.026 Sleeve part cannot be bent.	45 1.772 23 0.906 17 0.669 7 0.276	6 0.236 3 0.118 2 0.079 —	3 0.118 1.5 0.059 1 0.039 —	6 0.236 3 0.118 2 0.079 —			R25 mm R0.984 in	**FD-E22**
		M3 ϕ0.5 ϕ0.020 Sleeve part cannot be bent.	5 0.197 3 0.118 2 0.079 Cannot use	— — — —	— — — —	— — — —		500 mm 19.685 in		**FD-EN500S1**
		Coaxial M3 ϕ0.8 ϕ0.031 Sleeve part cannot be bent.	38 1.496 18 0.709 14 0.551 6 0.236	6 0.236 3 0.118 2 0.079 —	3 0.118 1.5 0.059 1 0.039 —	4 0.157 2 0.079 1.5 0.059 —		1 m 3.281 ft		**FD-ENM1S1**
	Fixed-focus reflective	Glass substrate detection · SEMI S2 compliant W17 × H29 × D3.8 W0.669 × H1.142 × D0.150	0 to 20 0 to 0.787	—	—	—	(LCD glass)	2 m 6.562 ft	R4 R0.157	**FD-L43**
		Glass substrate detection W24 × H21 × D4 W0.945 × H0.827 × D0.157	2.5 to 18 0.098 to 0.709 (Convergent point 8 0.315) 3 to 16 0.118 to 0.630 (Convergent point 8 0.315) 3.5 to 15 0.138 to 0.591 (Convergent point 8 0.315) Cannot use	— — — —	— — — —	— — — —	ϕ0.06 mm ϕ0.0024 in gold wire			**FD-L41**
		Specular object detection · W15 × H19 × D3 W0.591 × H0.748 × D0.118	0.5 to 4 0.020 to 0.157 (Convergent point 2 0.079) 1 to 3.8 0.039 to 0.150 (Convergent point 2 0.079) 1.3 to 3.5 0.051 to 0.138 (Convergent point 2 0.079) Cannot use	— — — —	— — — —	— — — —	ϕ0.03 mm ϕ0.0012 in gold wire		R10 mm R0.394 in	**FD-L42**
		W6 × H18 × D14 W0.236 × H0.709 × D0.551	2.5 to 18 0.098 to 0.709 (Convergent point 6 0.236) 4 to 12 0.157 to 0.472 (Convergent point 6 0.236) 4.5 to 11 0.177 to 0.433 (Convergent point 6 0.236) 4.8 to 9.5 0.189 to 0.374 (Convergent point 6 0.236)	4.5 to 9.5 0.177 to 0.374 5 to 9 0.197 to 0.354 5.5 to 8 0.217 to 0.315 —	5 to 9 0.197 to 0.354 5.5 to 8 0.217 to 0.315 — —	4.5 to 9.5 0.177 to 0.374 — — —	ϕ0.02 mm ϕ0.0008 in gold wire			**FD-L4**
	Liquid level sensing	Contact type ϕ6 ϕ0.236	—				(Liquid)	2 m 6.562 ft (Note 4)	Protective tube R40 mm R1.575 in Fiber R15 mm R0.591 in	**FD-F8Y**
		Mountable on pipe · Standard W25 × H13 × D20 W0.984 × H0.512 × D0.787	Applicable pipe diameter: Outer dia. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PVC, fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in]				(Liquid)	2 m 6.562 ft	R10 mm R0.394 in	**FD-F41**
								5 m 16.404 ft		**FD-F91**
		Mountable on pipe · For PFA, wall thickness 1 mm 0.039 in pipe W25 × H13 × D20 W0.984 × H0.512 × D0.787	Applicable pipe diameter: Outer dia. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]					2 m 6.562 ft		**FD-F4**
								5 m 16.404 ft		**FD-F9**
	Tough flexible	M6	185 7.283 80 3.150 60 2.362 35 1.378	32 1.260 16 0.630 10 0.394 —	16 0.630 8 0.315 5 0.197 —	30 1.181 15 0.591 10 0.394 —	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3.281 ft	R10 mm R0.394 in	**FD-P81X** New
		Small spot for sensing minute objects M3 Coaxial · High precision	90 3.543 45 1.772 35 1.378 20 0.787	22 0.866 11 0.433 6 0.236 —	12 0.472 6 0.236 4 0.157 —	18 0.709 9 0.354 5 0.197 —		1 m 3.281 ft (Note 4)		**FD-G6X** New

Notes: 1) The sensing range is specified for white non-glossy paper [100 × 100 mm 3.937 × 3.937 in (**FD-A15**, **FD-G4**, **FD-G6X**: 200 × 200 mm 7.874 × 7.874 in, **FD-AFM2**, **FD-AFM2E**, **FD-P81X**: 400 × 400 mm 15.748 × 15.748 in, **FD-L43**: glass substrate 76 × 52 × t 1.1 mm 2.992 × 2.047 × t 0.043 in, **FD-L41**: glass substrate 100 × 100 × t 2 mm 3.937 × 3.937 × t 0.079 in)] as the object.

2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.

3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type.
Also, note that the corresponding setting distance is different from the rated sensing distance. However, with the fixed-focus reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of the sensing object at a distance corresponding to the convergent point.

4) Following is the allowable cutting range from the end that the amplifier is inserted **FD-F8Y**: 1,000 mm 39.370 in, **FD-G6X**: 700 mm 27.559 in.

FX-301

LIST OF FIBERS

Environment resistant fibers (Reflective type)

Type		Shape of fiber head (mm in)	Sensing range (mm in) (Note 1, 2) ■:LONG ■:STD ▨:FAST □:S-D				Min. sensing object (at the maximum sensitivity (Note 3))	Fiber cable length ✂:Free-cut	Allowable bending radius	Model No.
			Red LED	Blue LED	Green LED	Infrared LED				
Environment resistant	Heat-resistant	350 °C 662 °F · Coaxial M6	270 10.630 140 5.512 100 3.937 47 1.850	36 1.417 18 0.709 12 0.472 —	20 0.787 10 0.394 7 0.276 —	140 5.512 70 2.756 45 1.772 —	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	**FD-H35-M2**
		350 °C 662 °F · Sleeve 60 mm 2.362 in ϕ2.8 ϕ0.110 in M6							Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	**FD-H35-M2S6**
		200 °C 392 °F · Coaxial M6						1 m 3,281 ft	R25 mm R0.984 in	**FD-H20-M1**
		350 °C 662 °F · Sleeve 90 mm 3.543 in M4 ϕ2.1 ϕ0.083 in	160 6.299 80 3.150 57 2.244 26 1.024	22 0.866 11 0.433 7 0.276 —	12 0.472 6 0.236 4 0.157 —	80 3.150 40 1.575 28 1.102 —	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3,281 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	***New*** **FD-H35-20S**
		200 °C 392 °F · Coaxial M4	270 10.630 140 5.512 100 3.937 47 1.850	36 1.417 18 0.709 12 0.472 —	20 0.787 10 0.394 7 0.276 —	140 5.512 70 2.756 45 1.772 —	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3,281 ft	R25 mm R0.984 in	***New*** **FD-H20-21**
		300 °C 572 °F · Glass substrate detection Fixed-focus reflective type W19 × H27 × D5 W0.748 × H1.063 × D0.197	0 to 15 0 to 0.591 0 to 10 0 to 0.394 1 to 8 0.039 to 0.315 2 to 6 0.079 to 0.236	—	—	—	ϕ0.02 mm ϕ0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	***New*** **FD-H30-L32**
		180 °C 356 °F · Glass substrate detection Fixed-focus reflective type W19 × H27 × D5 W0.748 × H1.063 × D0.197						✂ 2 m 6.562 ft		***New*** **FD-H18-L31**
		130 °C 266 °F M6	310 12.205 140 5.512 100 3.937 47 1.850	20 0.787 11 0.433 7 0.276 —	20 0.787 11 0.433 7 0.276 —	25 0.984 12 0.472 8 0.315 —	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FD-H13-FM2**
	Vacuum	M6	165 6.496 75 2.953 52 2.047 26 1.024	26 1.024 13 0.512 9 0.354 —	14 0.551 7 0.276 4 0.157 —	21 0.827 10 0.394 6 0.236 —	ϕ0.02 mm ϕ0.0008 in gold wire	1 m 3,281 ft	R200 mm R7.874 in	**FD-6V**

Notes: 1) The sensing range is specified for white non-glossy paper [400 × 400 mm 15.748 × 15.748 in (**FD-H30-L32**, **FD-H18-L31**: glass substrate 50 × 50 mm 1.969 × 1.969 in)] as the object.
2) Please take care that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut. In addition, the infrared type is easily affected by humidity, so contact our office if using these sensors in environments with high humidity or where humidity levels can fluctuate.
3) The minimum sensing object size is the value for red LED type at maximum sensitivity. Please contact our office for information on the minimum sensing object size if using amplifiers other than red LED type. Also, note that the corresponding setting distance is different from the rated sensing distance.

The vacuum type fiber must be used with the following products as a set.

FT-J6: Fiber at atmospheric side (one pair set)
FV-BR1: Photo-terminal (one pair set)

Semi-standard fibers (Custom made per order)

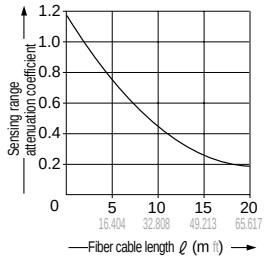
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☆) or the sleeve length (symbol △) from the table below.

Type		Basic model No.	☆ Fiber cable length (Unit: m ft)	△ Sleeve length (Unit: cm in)
Standard threaded head (free-cut)		**FD-FM** ☆	3 9.843, 4 13.123, 5 16.404, 10 32.808, 15 49.213, 20 65.617	———
	With sleeve	**FD-FM** ☆ **-S** △	2 6.562 (Note), 3 9.843, 4 13.123, 5 16.404, 10 32.808, 15 49.213, 20 65.617	1 0.394, 2 0.787, 3 1.181, 4 1.575, 5 1.969, 6 2.362, 7 2.756, 8 3.150, 9 3.543, 10 3.937, 11 4.331, 12 4.724
Small diameter threaded head with sleeve (free-cut)		**FD-NFM2-S** △	———	1 0.394, 2 0.787, 3 1.181, 4 1.575, 5 1.969, 6 2.362, 7 2.756, 8 3.150, 9 3.543, 10 3.937, 11 4.331, 12 4.724
200°C 392°F heat-resistant		**FD-H20-M** ☆	2 6.562, 3 9.843	———
350°C 662°F heat-resistant		**FD-H35-M** ☆	3 9.843	———

Note: The standard fiber has a 2 m 6.562 ft fiber cable length and a 4 cm 1.575 in or 9 cm 3.543 in sleeve length.

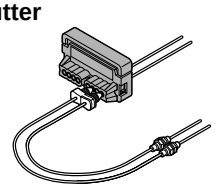
Correlation between sensing range attenuation coefficient and fiber cable length

The longer the fiber cable, the shorter the sensing range.

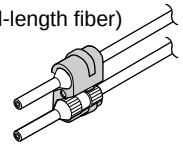


Accessories (attached with fibers)

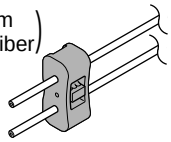
Fiber cutter
• **FX-CT2**



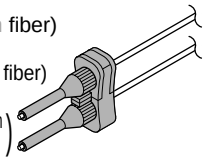
Fiber attachment
• **FX-AT2**
(for fixed-length fiber)



• **FX-AT3**
(for ϕ2.2 mm ϕ0.087 in fiber)



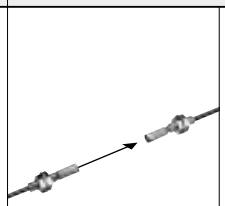
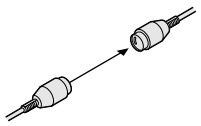
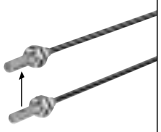
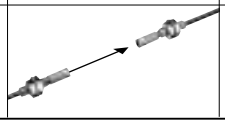
• **FX-AT4**
(for ϕ1 mm ϕ0.039 in fiber)
• **FX-AT5**
(for ϕ1.3 mm ϕ0.051 in fiber)
• **FX-AT6**
(for ϕ1 mm ϕ0.039 in and ϕ1.3 mm ϕ0.051 in mixed fiber)



Notes: 1) Fiber cutter is not supplied as accessory along with **FT-NB8**, **FT-N8**, **FD-N8** and **FD-N4**. Please order it separately.
2) The fiber attachment is not attached with **FT-N8/NB8/P80** and **FD-N8/P80**. The previous **FX-AT10** attachment is attached with **FD-N4**.

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
	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
	Side-view lens	**FX-SV1**		Beam axis is bent by 90 °. • Ambient temperature: −60 to +300 °C −76 to +572 °F
	Expansion lens for vacuum fiber (Note 1)	**FV-LE1**		Sensing range increases by 15 times or more. • Ambient temperature: −40 to +120 °C −40 to +248 °F

Sensing range (mm) [Lens on both sides] (Note 2)

Fiber \ Mode	LONG	STD	FAST	S-D
FT-B8	3,500 (Note 3)	2,500	2,000	1,000
FT-FM2	3,500 (Note 3)	3,500 (Note 3)	2,500	1,300
FT-T80	3,500 (Note 3)	3,500 (Note 3)	2,500	1,300
FT-R80	3,500 (Note 3)	2,300	1,600	800
FT-W8	3,500 (Note 3)	2,900	2,000	1,000
FT-P80	3,500 (Note 3)	3,500 (Note 3)	2,500	1,100
FT-P60	3,500 (Note 3)	3,500 (Note 3)	1,500	900
FT-P81X	3,500 (Note 3)	3,500 (Note 3)	2,500	1,100
FT-H35-M2	3,500 (Note 3)	2,000	1,500	750
FT-H20W-M1	1,600 (Note 3)	1,300	900	500
FT-H20W-M2	2,600	1,300	900	500
FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,100	900

Sensing range (mm) [Lens on both sides] (Note 2)

Fiber \ Mode	LONG	STD	FAST	S-D
FT-B8	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-FM2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-R80	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-W8	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-P80	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-P60	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-P81X	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-H35-M2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)
FT-H20W-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,500
FT-H20W-M2	3,500 (Note 3)	3,500 (Note 3)	3,000	1,500
FT-H20-M1	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)	1,600 (Note 3)
FT-H13-FM2	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)	3,500 (Note 3)

Sensing range (mm) [Lens on both sides] (Note 2)

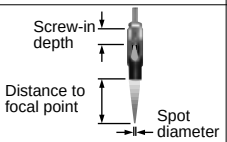
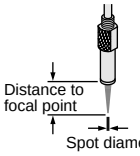
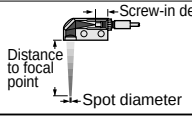
Fiber \ Mode	LONG	STD	FAST	S-D
FT-B8	1,100	530	400	186
FT-FM2	1,200	600	440	210
FT-T80	1,200	600	440	210
FT-W8	900	450	330	160
FT-P80	1,200	600	440	210
FT-P60	650	300	200	130
FT-P81X	1,200	600	440	200
FT-H35-M2	550	280	200	90
FT-H20W-M1	310	140	100	50
FT-H20W-M2	310	140	100	50
FT-H20-M1	550	280	200	90

Sensing range (mm) [Lens on both sides] (Note 2)

Fiber \ Mode	LONG	STD	FAST	S-D
FT-6V	3,500 (Note 3)	2,700	1,800	940
FT-60V	2,800	1,450	1,000	490

Notes: 1) Be careful when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult.
Especially when installing a fiber with many cores (sharp bending fibers and heat-resistant glass fiber) please be sure to use it only after you have adjusted it sufficiently.
2) The sensing ranges are the values for red LED type amplifier. Please contact our office for details on sensing ranges for other types of amplifiers.
3) The fiber cable length practically limits the sensing range to 3.500 mm 137.795 in long (**FT-H20W-M1** and **FT-H20-M1**: 1,600 mm 62.992 in).

Lens (For reflective type fiber)

Designation		Model No.		Description
For reflective type fiber	Pinpoint spot lens	**FX-MR1**		Pinpoint spot of ϕ0.5 mm ϕ0.020 in. Enables detection of minute objects or small marks. • Applicable fibers: **FD-WG4**, **FD-G4** • Distance to focal point: 6±1 mm 0.236 ± 0.039 in • Ambient temperature: −40 to +70 °C −40 to +158 °F
	Zoom lens	**FX-MR2**		The spot diameter is adjustable from ϕ0.7 mm ϕ0.028 in to ϕ2 mm ϕ0.079 in according to how much the fiber is screwed in. • Applicable fibers: **FD-WG4**, **FD-G4** • Ambient temperature: −40 to +70 °C −40 to +158 °F • Accessory: **MS-EX-3** (mounting bracket)
	Finest spot lens	**FX-MR3**		Extremely fine spot of ϕ0.3 mm ϕ0.012 in approx. achieved. • Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**,**FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6** • Ambient temperature: −40 to +70 °C −40 to +158 °F
	Finest spot lens	**FX-MR6**		Extremely fine spot of ϕ0.1 mm ϕ0.004 in approx. achieved. • Applicable fibers: **FD-WG4**, **FD-G4**, **FD-EG1**,**FD-EG2**, **FD-EG3**, **FD-G6X**, **FD-G6** • Ambient temperature: −20 to +60 °C −4 to +140 °F
	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-WG4**, **FD-G4** • Ambient temperature: −40 to +70 °C −40 to +158 °F

Sensing range (Note 1)

Screw-in depth	Distance to focal point	Spot diameter
7 mm	ϕ18.5 mm approx.	ϕ0.7 mm
12 mm	ϕ27 mm approx.	ϕ1.2 mm
14 mm	ϕ43 mm approx.	ϕ2.0 mm

Sensing range (Note 1)

Fiber	Distance to focal point	Spot diameter
FD-EG3	7.5 ± 0.5 mm	ϕ0.15 mm approx.
FD-EG2	7.5 ± 0.5 mm	ϕ0.2 mm approx.
FD-EG1	7.5 ± 0.5 mm	ϕ0.3 mm approx.
FD-WG4/G4/G6X/G6	7.5 ± 0.5 mm	ϕ0.5 mm approx.

Sensing range (Note 1)

Fiber	Distance to focal point	Spot diameter
FD-EG3	7 ± 0.5 mm	ϕ0.1 mm approx.
FD-EG2	7 ± 0.5 mm	ϕ0.15 mm approx.
FD-EG1	7 ± 0.5 mm	ϕ0.2 mm approx.
FD-WG4/G4/G6X/G6	7 ± 0.5 mm	ϕ0.4 mm approx.

Sensing range (Note 1)

Screw-in depth	Distance to focal point	Spot diameter
8 mm	13 mm approx.	ϕ0.5 mm
10 mm	15 mm approx.	ϕ0.8 mm
14 mm	30 mm approx.	ϕ3.0 mm

Note: The sensing ranges are the values when used in combination with red LED type amplifier. Please contact our office for details on sensing distances for other types of amplifier.

FX-301

FIBER OPTIONS

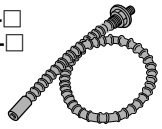
Others

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-B8** **FT-FM2** **FT-FM2S** **FT-FM2S4** **FT-P80**	**FT-P60** **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-T80** **FT-NFM2** **FT-NFM2S** **FT-NFM2S4**	**FT-P40** **FD-T40** **FD-P40**	
	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-B8** **FD-FM2** **FD-FM2S** **FD-FM2S4** **FD-P80**	**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-T80** **FD-N4** **FD-NFM2** **FD-NFM2S** **FD-NFM2S4**		
	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				
Fiber cutter	**FX-CT1**	The free-cut type fiber can be easily cut. (Accessory for **FT/FD-P80** only)				
	FX-CT2	The free-cut type fiber can be easily cut. (Accessory for the free-cut type fiber. Not attached with the **FT-N8/NB8/P80** and **FD-N8/N4/P80**)				
Attachment for fixed-length fiber	**FX-AT2**	This is the attachment for the fixed length fiber. (Accessory)				
Attachment for ϕ2.2 mm ϕ0.087 in fiber	**FX-AT3**	This is the attachment for the ϕ2.2 mm ϕ0.087 in fiber. (Accessory. Does not attach with the **FT-N8/NB8/P80** or the **FD-N8/P80**.) (Note 3)				
Attachment for ϕ1 mm ϕ0.039 in fiber	**FX-AT4**	This is the attachment for the ϕ1 mm ϕ0.039 in fiber (Accessory. Does not attach with the **FD-N4**.) (Note 3)				
Attachment for ϕ1.3 mm ϕ0.051 in fiber	**FX-AT5**	This is the attachment for the ϕ1.3 mm ϕ0.051 in fiber (Accessory)				
Attachment for ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber	**FX-AT6**	This is the attachment for the ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber. (Accessory)				

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) Refer to p.332～ for details of the universal sensor mounting stand.
3) The conventional **FX-AT10** fiber attachment is attached with the **FD-N4**.

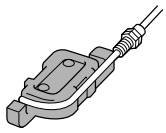
Protective tube

• **FTP-□**
• **FDP-□**



Fiber bender

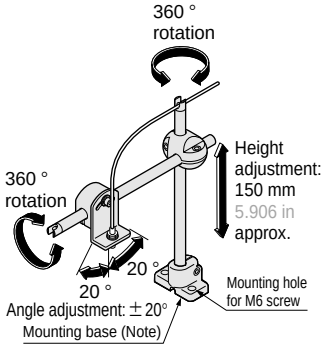
• **FB-1**



Universal sensor mounting stand

• **MS-AJ1-F**
• **MS-AJ2-F**

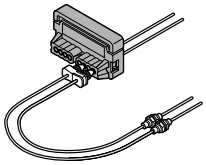
Using the arm which enables adjustment in the horizontal direction, sensing can also be done from above an assembly line.



Note: The above figure is **MS-AJ1-F**. The mounting base of **MS-AJ2-F** has a different shape.

Fiber cutter

• **FX-CT2**

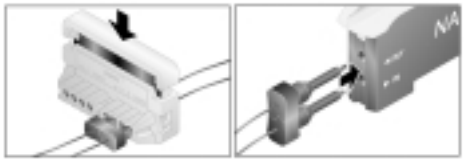


• **FX-CT1**

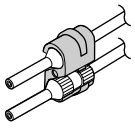
Fiber attachment

It's possible to simultaneously cut two fibers to the same length

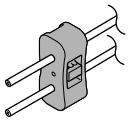
Each fiber (with some exceptions) has a newly developed two-in-one fiber attachment (**FX-AT3/AT4/AT5/AT6**) which enables two fibers to be cut simultaneously to the same length with the new fiber cutter (**FX-CT2**). Also, since the fibers can be attached to the amplifier while being fixed in position in the two-in-one fiber attachment, sensitivity changes resulting from variation in the amount of fiber insertion do not occur.



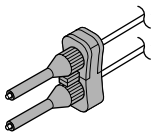
FX-AT2



FX-AT3



FX-AT4/AT5/AT6



SPECIFICATIONS

Amplifiers

Item \ Type	NPN output				PNP output			
	Red LED	Blue LED	Green LED	Infrared LED	Red LED	Blue LED	Green LED	Infrared LED
Model No.	**FX-301**	**FX-301B**	**FX-301G**	**FX-301H**	**FX-301P**	**FX-301BP**	**FX-301GP**	**FX-301HP**
Supply voltage	12 to 24 V DC ± 10 % Ripple P-P 10 % or less							
Power consumption	<Red LED / Infrared LED type> Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)				<Blue LED / Green LED type> Normal operation: 720 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 430 mW or less (Current consumption 18 mA or less at 24 V supply voltage)			
Output	NPN open-collector transistor • Maximum sink current:100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) sink current.				PNP open-collector transistor • Maximum source current: 100 mA (50 mA, if five, or more, amplifiers are connected in cascade.) • Applied voltage: 30 V DC or less (between output and + V) • Residual voltage: 1.5 V or less (at 100 mA (at 50 mA, if five, or more, amplifiers are connected in cascade) source current.			
Utilization category	DC-12 or DC-13							
Output operation	Selectable either Light-ON or Dark-ON, with jog switch							
Short-circuit protection	Incorporated							
Response time	150 μs or less (FAST), 250 μs or less [STD / S-D (Red LED type only)], 2 ms or less (LONG) selectable with jog switch							
Sensitivity setting	2-level teaching / Limit teaching / Manual adjustment / Full auto-teaching (excluding red LED type)							
Operation indicator	Orange LED (lights up when the output is ON)							
Stability indicator	Green LED (lights up under stable light received condition or stable dark condition)							
MODE indicator	RUN: Green LED, TEACH · ADJ · L/D ON · TIMER · PRO: Yellow LED							
Digital display	4 digit red LED display							
Fine sensitivity adjustment function	Incorporated							
Timer function	Incorporated with variable ON-delay / OFF-delay / ONE SHOT timer, switchable either effective or ineffective. (timer period: 0.5 to 500 ms approx.)							
Automatic interference prevention function	Incorporated (Up to four sets of fiber heads can be mounted close together) (Note 1)							
Environmental resistance: Pollution degree	3 (Industrial environment)							
Environmental resistance: Ambient temperature	− 10 to + 55 °C + 14 to + 131 °F (If 4 to 7 units are connected in cascade: − 10 to + 50 °C + 14 to + 122 °F, if 8 to 16 units are connected in cascade: − 10 to + 45 °C + 14 to + 113 °F) (No dew condensation or icing allowed), Storage: − 20 to + 70 °C − 4 to + 158 °F							
Environmental resistance: Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH							
Environmental resistance: Ambient illuminance	Sunlight: 10,000 ℓx at the light-receiving face, Incandescent light: 3,000 ℓx at the light-receiving face							
Environmental resistance: EMC	Red LED type: EN 50081-2, EN 50082-2, EN 60947-5-2 Blue / green / infrared LED type: EN 60947-5-2							
Environmental resistance: Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 2)							
Environmental resistance: Insulation resistance	20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 2)							
Environmental resistance: Vibration resistance	10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each							
Environmental resistance: Shock resistance	98 m/s² acceleration (10 G approx.) in X, Y and Z directions for five times each							
Emitting element (modulated)	Red LED	Blue LED	Green LED	Infrared LED	Red LED	Blue LED	Green LED	Infrared LED
Material	Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Switch: Acrylic							
Connecting method	Connector (Note 3)							
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable.							
Weight	25 g approx.							

Notes: 1) When the power supply is switched on, the emission timing are automatically set for interference prevention.
2) The voltage withstandability and the insulation resistance values given in the above table are for the amplifier only.
3) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft), **CN-73-C2** (cable length 2 m 6.562 ft), **CN-73-C5** (cable length 5 m 16.404 ft)
Sub cable (1-core): **CN-71-C1** (cable length 1 m 3.281 ft), **CN-71-C2** (cable length 2 m 6.562 ft), **CN-71-C5** (cable length 5 m 16.404 ft)

FX-301

SPECIFICATIONS

Fibers

Item \ Type		Standard	Flexible
Allowable bending radius		R25 mm R0.984 in or more [Sleeve of a head with sleeve:R10 mm R0.394 in or more (Note 1)]	R4 mm R0.157 in or more
Bending durability		———	1 million times or more (at R10 mm R0.394 in, **FT-P40/P2** and **FD-P40/P2**: at R4 mm R0.157 in)
Ambient temperature		−40 to +70 °C −40 to +158 °F (**FT-SFM2SV2**: −20 to +70 °C −4 to +158 °F **FT-V22**, **FD-SFM2SV2**: −20 to +60 °C −4 to +140 °F **FT-V41**, **FD-V41**, **FT-V10**: −40 to +60 °C −40 to +140 °F)	−40 to +70 °C −40 to +158 °F (**FT-Z8□**, **FT-P60**, **FT-PS1**, **FD-P60**, **FD-P50**: −40 to +60 °C −40 to +140 °F)
Ambient humidity		35 to 85%RH (No dew condensation or icing allowed)	
Material	Fiber core	Acrylic	
	Sheath	Polyethylene (**FT-V22**: Polyolefin)	Vinyl chloride (**FT-PS1**: Polyethylene, **FD-P2**: Vinyl chloride and Polyurethane)
	Fiber head	Brass (Nickel plated) (**FT-SFM2L/T80/SFM2/SNFM2/SFM2SV2/V22/V41**, **FD-T80/T40/S80/SNFM2/SFM2SV2/V41** and Sleeve: Stainless steel (SUS) **FT-FM10L**: ABS, Lens of **FT-FM10L/SFM2L/V10**: Acrylic **FT-V10**: Stainless steel (SUS) and Polycarbonate)	Stainless steel (SUS) (**FT/FD-P80**, **FT-P60**: Brass (Nickel plated) Case of **FT-Z8□**: Polycarbonate Lens of **FT-Z8H/Z8E**, Front film of **FT-Z8**: Polyester)
Accessories (Note 2)		All fibers (except for **FT-NB8/N8** and **FD-N8/N4**): 1 fiber attachment set Free-cut type fibers (except for **FT-NB8/N8** and **FD-N8/N4**): **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)	All fibers: 1 fiber attachment set. (except for **FT-P80** and **FD-P80**) Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. (**FT/FD-P80**: **FX-CT1** 1 pc.) Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.), **FT-Z8□**: 1 set of mounting screw

Notes: 1) Sleeve part of side-view fiber cannot be bent.
2) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

Item \ Type		Sharp bending
Allowable bending radius		R1 mm R0.039 in or more (**FD-WG4/WSG4**: R2 mm R0.079 in or more, Sleeve of **FD-W44**: R10 mm R0.394 in or more)
Ambient temperature		−40 to +60 °C −40 to +140 °F (**FT-WA30/WA8/WKV8**: −40 to +55 °C −40 to +131 °F)
Ambient humidity		35 to 85 %RH (No dew condensation or icing allowed)
Material	Fiber core	Acrylic
	Sheath	Polyethylene
	Fiber head	Stainless steel (SUS) (including sleeve) (**FT-W8/W4**, **FD-W8/W44/WG4**: Brass (Nickel plated) Case of **FT-WA30/WA8/WZ8□**, Lens of **FT-WS8L** and Resin part of **FT-WKV8**: Polycarbonate, Lens of **FT-WA30**: Norbornene resin Lens of **FT-WA8**: Polyolefin, Lens of **FT-WZ8H/WZ8E**, Reflector of **FT-WZ8E** and Prism of **FT-WKV8**: Acrylic, Reflector of **FT-WZ8**: Polycarbonate, **FD-WL41**: Heat-resistant ABS, Front film of **FD-WL41**: Polyester, **FD-WL42**: Aluminum (Black ALMITE), Lens of **FD-WKZ1**: Optical lens)
Accessories (Note)		All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. Threaded fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.) **FT-WA30**: 0.5 × 32 mm 0.020 × 1.260 in seal type slit mask 2 pcs. **FT-WA8**: 0.5 × 12 mm 0.020 × 0.472 in seal type slit mask 2 pcs. and 1 × 12 mm 0.039 × 0.472 in seal type slit mask 2 pcs. **FT-WZ8□**: 1 set of mounting screw **FD-WKZ1**: mounting bracket 1 pc.

Note: The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

Item \ Type		Special use			
		Wide beam	Array	Narrow beam	High precision
Allowable bending radius		**FT-A30/A8**: R10 mm R0.394 in or more **FD-A15**: R25 mm R0.984 in or more	R25 mm R0.984 in or more	R25 mm R0.984 in or more (**FT-KV1**: R10 mm R0.394 in or more)	**FD-EG2/EG3**: R10 mm R0.394 in or more **FD-G4/G6/EG1**: R25 mm R0.984 in or more
Ambient temperature		**FT-A30**, **FD-A15**: −40 to +60 °C −40 to +140 °F **FT-A8**: −40 to +70 °C −40 to +158 °F	−40 to +70 °C −40 to +158 °F	−40 to +60 °C −40 to +140 °F	−20 to +60°C −4 to +140 °F (**FD-G4**: −40 to +70 °C −40 to +158 °F **FD-G6**: −40 to +60 °C −40 to +140 °F)
Ambient humidity		35 to 85 %RH (No dew condensation or icing allowed)			
Material	Fiber core	Acrylic			
	Sheath	Polyethylene			Polyolefin (**FD-G4/G6**: Polyethylene)
	Fiber head	Polycarbonate (Lens of **FT-A30**, **FD-A15**: Norbornene resin Lens of **FT-A8**: Polyolefin)	Brass (Nickel plated)	Stainless steel (SUS), Polycarbonate (Lens: Norbornene resin Lens of **FT-KV1**: Polycarbonate, Prism of **FT-KV8**: Acrylic)	Brass (Nickel plated) [**FD-G6**: Stainless steel (SUS)]
Accessories (Note)		All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. **FT-A30**: 0.5 × 32 mm 0.020 × 1.260 in seal type slit mask 2 pcs. **FT-A8**: 0.5 × 12 mm 0.020 × 0.472 in seal type slit mask 2 pcs. and 1 × 12 mm 0.039 × 0.472 in seal type slit mask 2 pcs.	All fibers: 1 fiber attachment set Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. and toothed lock washer 1 pc.		

Note: The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

SPECIFICATIONS

Fibers

Item \ Type		Special use		
		Ultra-small diameter	Fixed-focus reflective	Tough flexible
Allowable bending radius		**FT-E12/E22**: R5 mm R0.197 in or more (Note 1) **FD-E12**: R10 mm R0.394 in or more (Note 1) **FD-E22/EN500S1/ENM1S1**: R25 mm R0.984 in or more (Note 1)	R10 mm R0.394 in or more (**FD-L43**: R4 mm R0.157 in or more)	R10 mm R0.394 in or more
Ambient temperature		**FT-E12/E22, FD-E22**: −40 to +70 °C −40 to +158 °F **FD-E12**: −40 to +60 °C −40 to +140 °F **FD-EN500S1/ENM1S1**: −20 to +60 °C −4 to +140 °F	**FD-L43**: 0 to +70 °C +32 to +158 °F **FD-L41/L42**: −40 to +60 °C −40 to +140 °F **FD-L4**: −40 to +70 °C −40 to +158 °F	−40 to +60 °C −40 to +140 °F (**FD-P81X**: −40 to +70 °C −40 to +158 °F)
Ambient humidity		35 to 85 %RH (No dew condensation or icing allowed)		
Material	Fiber core	Acrylic		
	Sheath	Polyolefin	Polyethylene (**FD-L42**: Vinyl chloride)	Polyethylene [**FT-P81X**: Vinyl chloride, Protective tube: Stainless steel (SUS)]
	Fiber head	Brass (Nickel plated) [Sleeve: Stainless steel (SUS)]	**FD-L43/L41**: Heat-resistant ABS **FD-L4**: ABS **FD-L42**: Aluminum (Black ALMITE) (Lens of **FD-L43/L4**: Acrylic Front film of **FD-L41**: Polyester)	**FT-P81X**, **FD-P81X**: Brass (Nickel plated) **FD-G6X**: Stainless steel (SUS)
Accessories (Note 2)		All fibers: 1 fiber attachment set Threaded head fibers: Nuts 2 pcs. and toothed lock washer 1 pc.	All fibers: 1 fiber attachment set and **FX-CT2** (fiber cutter) 1 pc. **FD-L4**: M2.6 (length 12 mm 0.472 in) screws with washers 2 pcs. and nuts 2 pcs.	All fibers: 1 fiber attachment set , nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.) **FD-G6X**: **FX-CT2** (fiber cutter) 1 pc.

Notes: 1) Sleeve part cannot be bent.
2) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

Item \ Type / Model No.		Special use Liquid level sensing	
		FD-F8Y	**FD-F4□/F9□**
Allowable bending radius		Protective tube: R40 mm R1.575 in or more Fiber: R15 mm R0.591 in or more	R10 mm R0.394 in or more
Ambient temperature		−40 to +125 °C −40 to +257 °F (Note 1)	−40 to +100 °C −40 to +212 °F (Note 1)
Ambient humidity		35 to 85 %RH (No dew condensation or icing allowed)	
Material	Fiber core	Polycarbonate	
	Sheath	Polypropylene (Protective tube: Fluorine resin)	Polyethylene
	Fiber head		Polyetherimide (Lens: Polycarbonate)
Accessories (Note 2)		1 fiber attachment set **FX-CT2** (fiber cutter) 1 pc.	1 fiber attachment set, **FX-CT2** (fiber cutter) 1pc. Tying bands 4 pcs., anti-slip tubes 2 pcs.

Notes: 1) With the liquid sensing fiber, make sure that the temperature of the liquid is also within the ambient temperature range.
2) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

Item \ Type		Environment resistant						
		Heat-resistant					Chemical-resistant	Vacuum
		350 °C 662 °F type	300°C 572°F type	200°C 392°F type	180°C 356°F type	130°C 266°F type		
Allowable bending radius		R25 mm R0.984 in or more (**FT-H20W-□**: R10 mm R0.394 in or more, Sleeve of a head with sleeve: R10 mm R0.394 in or more)					R30 mm R1.181 in or more (**FT-Z802Y**: R25 mm R0.984 in or more)	R200 mm R7.874 in or more (**FT-60V**: R30 mm R1.181 in or more)
Ambient temperature		−60 to +350 °C −76 to +662 °F (Note 1, 2)	−60 to +300 °C −76 to +572 °F (Note 1, 2, 3)	−60 to +200 °C −76 to +392 °F (Note 2)	−60 to +180 °C −76 to +356 °F (Note 2, 4)	−60 to +130 °C −76 to +266 °F	−40 to +115 °C −40 to +239 °F (**FT-Z802Y**: 0 to +60 °C +14 to +140 °F)	−40 to +120 °C −40 to +248 °F
Ambient humidity		35 to 85 %RH (No dew condensation or icing allowed)						
Material	Fiber core	Multi-component glass (Note 3)			Silicone	Acrylic		Quartz glass (Note 3)
	Sheath	Stainless steel (SUS)	Silicone (Inside stainless steel (SUS) spiral tube **FD-H20-21**: Stainless steel (sus) **FT-H20W-□**: Fluorine resin)		Fluorine resin		Protective tube: Fluorine resin Sheath: Polypropylene (Sheath of **FT-Z802Y**: Fluorine resin)	Fluorine resin
	Fiber head		Brass (Nickel plated) **FD-H20-21**: Stainless steel (sus)		Stainless steel (SUS)	Brass (Nickel plated)		Aluminum
Accessories (Note 5)		**FT-H20W-□**, **FD-H18-L31** and **FT-H13-FM2**: 1 fiber attachment set Free-cut type fibers: **FX-CT2** (fiber cutter) 1 pc. Threaded head fibers: Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)					1 fiber attachment set **FX-CT2** (fiber cutter) 1 pc.	Nuts 2 pcs. (thru-beam type: 4 pcs.) and toothed lock washer 1 pc. (thru-beam type: 2 pcs.)

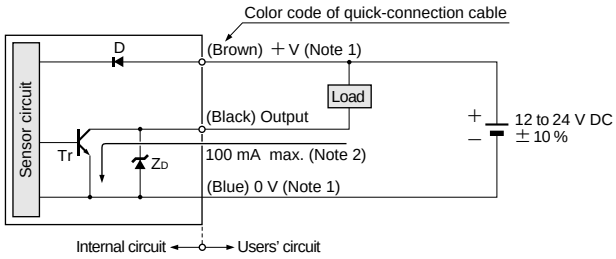
Notes: 1) If the fiber is used below −30 °C −22 °F, its maximum resistable temperature drops to +200° C +392 °F. If the side-view lens **FX-SV1** is put on the fiber head, the allowable maximum temperature drops to +300 °C +572 °F. (The ambient temperature range of **FX-SV1** is from −60 to +300 °C −76 to +572 °F.)
2) The ambient temperature of heat-resistant 350 °C 662 °F type, 300 °C 572 °F type, 200 °C 392 °F type and 180 °C 356 °F type fibers are the value in dry condition. In humid environment, the ambient temperature differs. (For a high humidity of 85 %RH, the ambient temperature is 0 to +40 °C +14 to 104 °F.)
3) If the fiber material is quartz glass or multi-component glass, keep it away from vibration or impact.
4) The normal temperature for continuous usage or storage should be −60 to +150 °C −76 to +302 °F.
5) The five types of attached fiber attachments (**FX-AT2/AT3/AT4/AT5/AT6**) described in this catalog are for use only with the **FX-301/302/303/311** series. Refer to p.76 for details '**FIBER OPTIONS**'. Fiber attachment accessories are also supplied along with conventional amplifiers. Please contact our office for more details on these accessories.

FX-301

I/O CIRCUIT AND WIRING DIAGRAMS

NPN output type

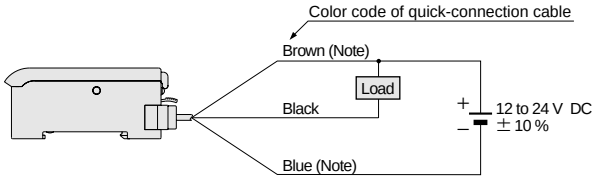
I/O circuit diagram



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

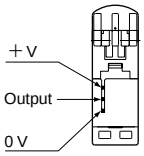
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : NPN output transistor

Wiring diagram



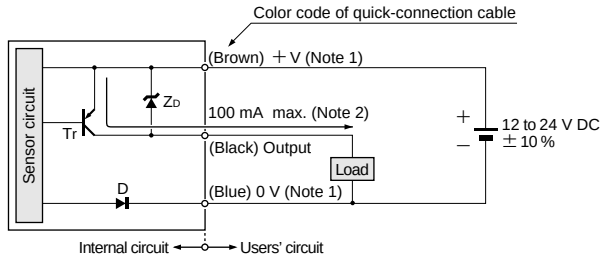
Note: The quick-connection sub cable does not have brown lead wire and blue lead wire.

Terminal arrangement diagram



PNP output type

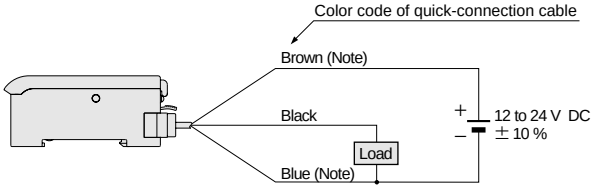
I/O circuit diagram



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

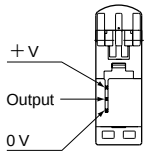
Symbols ... D : Reverse supply polarity protection diode
ZD: Surge absorption zener diode
Tr : PNP output transistor

Wiring diagram



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

Terminal arrangement diagram

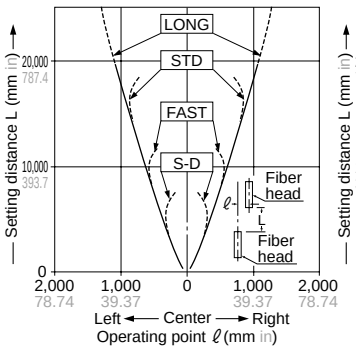


SENSING CHARACTERISTICS (TYPICAL)

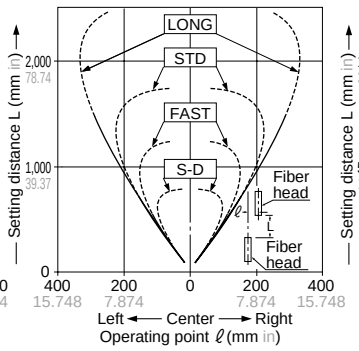
The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

Parallel deviation

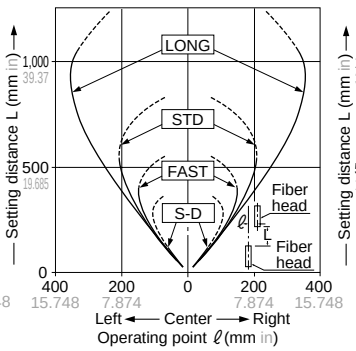
FT-FM10L Thru-beam type



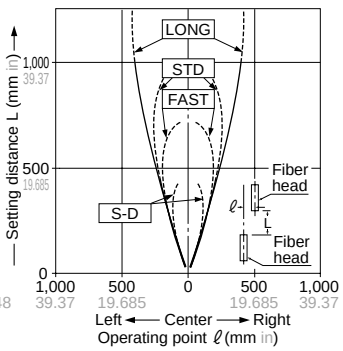
FT-SFM2L Thru-beam type



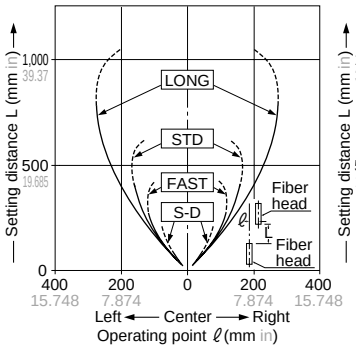
FT-B8 Thru-beam type



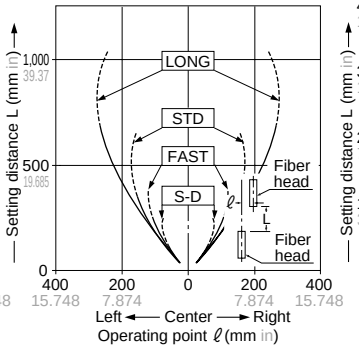
FT-NB8 Thru-beam type



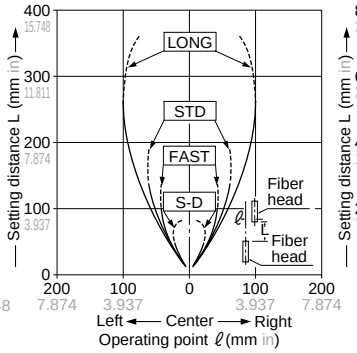
FT-FM2 FT-FM2S FT-FM2S4 FT-T80 FT-SFM2 Thru-beam type



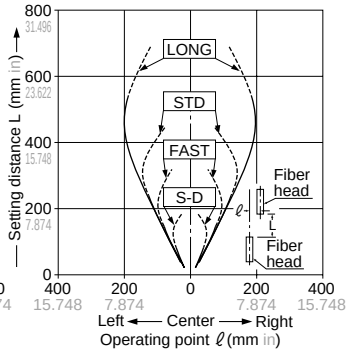
FT-N8 Thru-beam type



FT-NFM2 FT-NFM2S FT-NFM2S4 FT-SNFM2 Thru-beam type

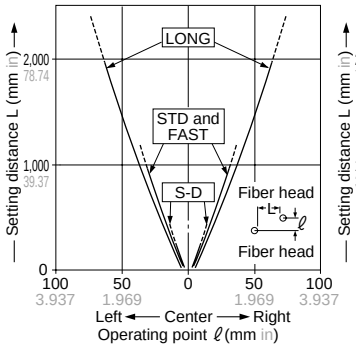


FT-R80 Thru-beam type

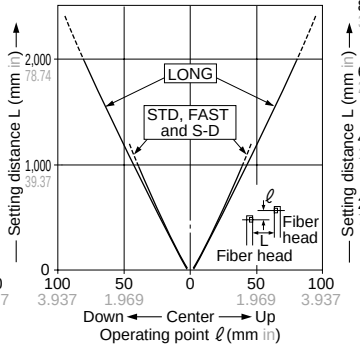


FT-V10 Thru-beam type

Horizontal direction

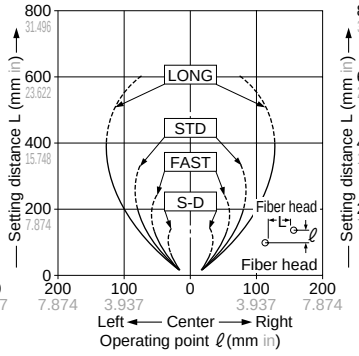


Vertical direction

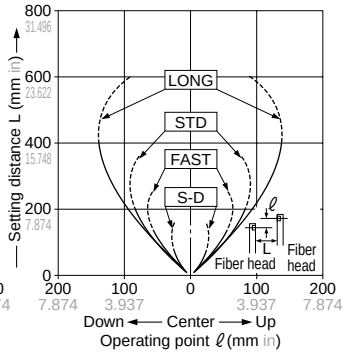


FT-SFM2SV2 Thru-beam type

Horizontal direction

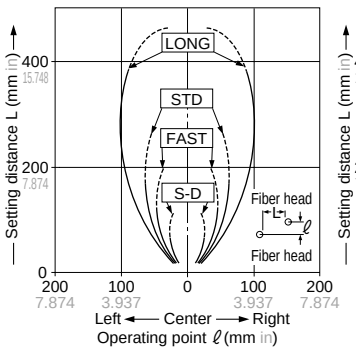


Vertical direction

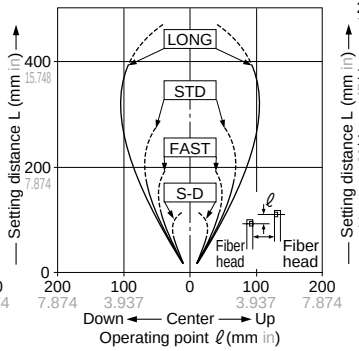


FT-V22 Thru-beam type

Horizontal direction

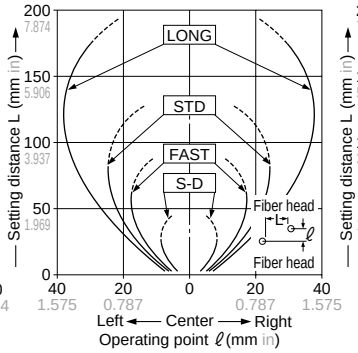


Vertical direction

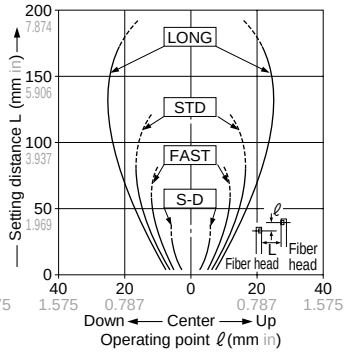


FT-V41 Thru-beam type

Horizontal direction



Vertical direction



FX-301

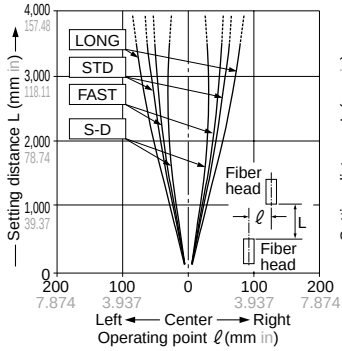
SENSING CHARACTERISTICS (TYPICAL)

The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

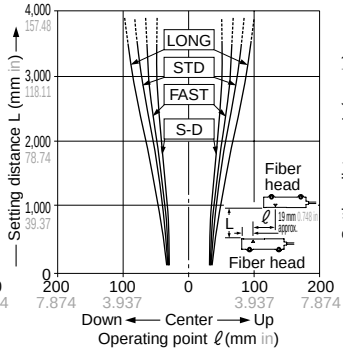
Parallel deviation

FT-WA30 FT-A30 — Thru-beam type

Horizontal direction

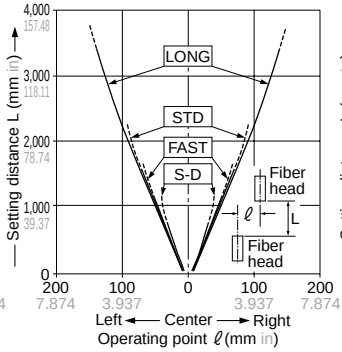


Vertical direction

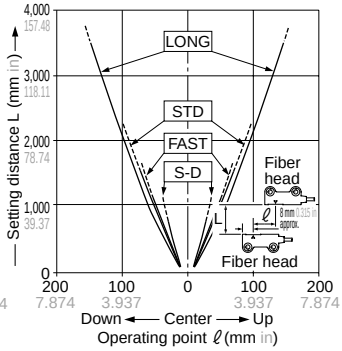


FT-WA8 FT-A8 — Thru-beam type

Horizontal direction

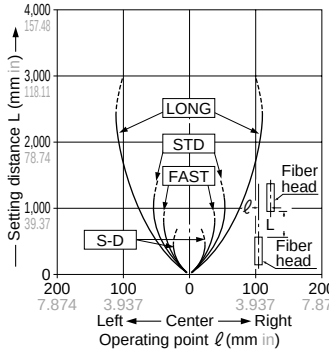


Vertical direction

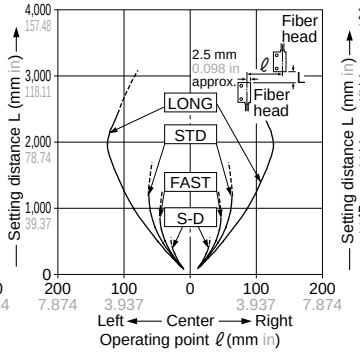


FT-WZ8H — Thru-beam type

Horizontal direction

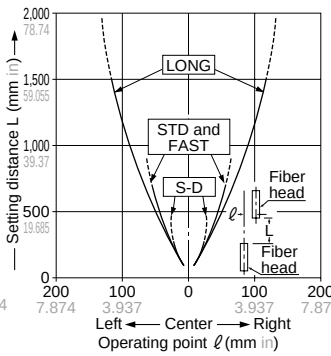


Vertical direction

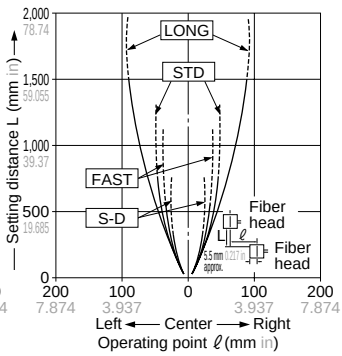


FZ-WZ8E — Thru-beam type

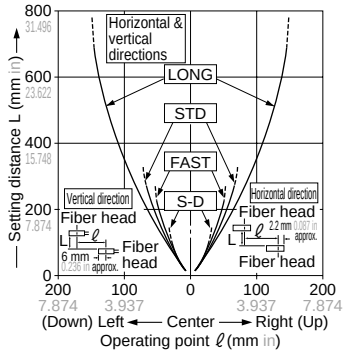
Horizontal direction



Vertical direction

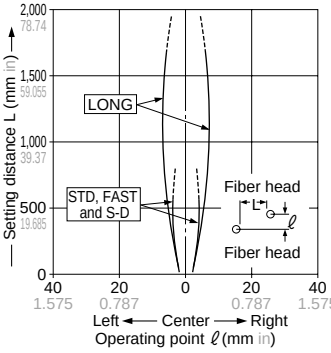


FT-WZ8 — Thru-beam type

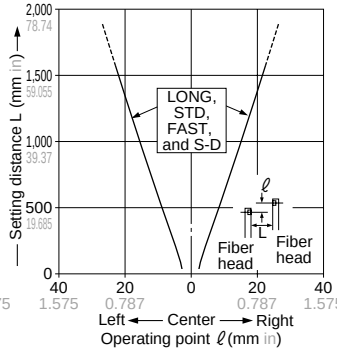


FT-WKV8 — Thru-beam type

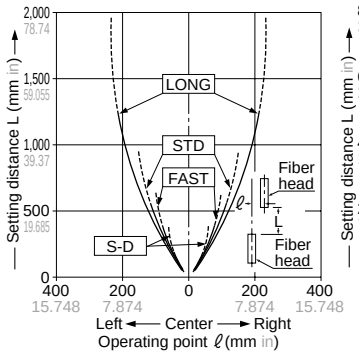
Horizontal direction



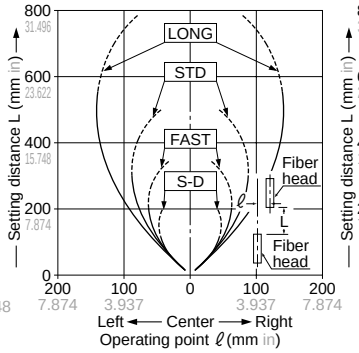
Vertical direction



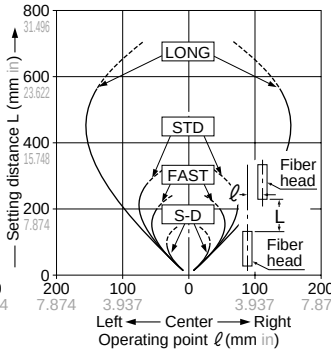
FT-WS8L — Thru-beam type



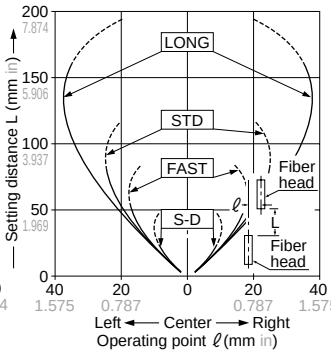
FT-W8 FT-WS8 — Thru-beam type



FT-WS3 — Thru-beam type



FT-W4 FT-WS4 — Thru-beam type



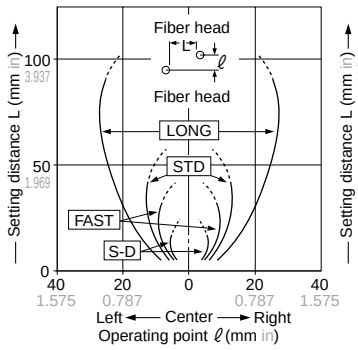
SENSING CHARACTERISTICS (TYPICAL)

The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

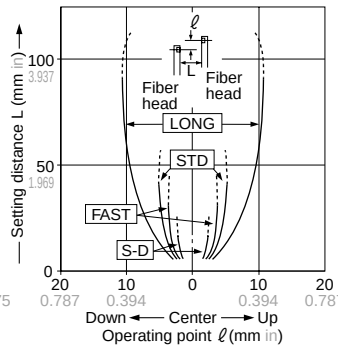
Parallel deviation

FT-WV42 Thru-beam type

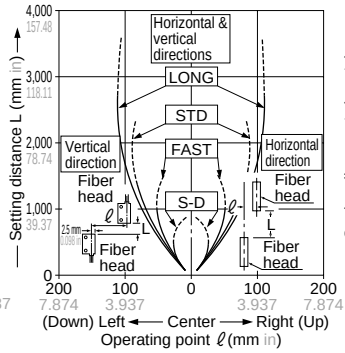
Horizontal direction



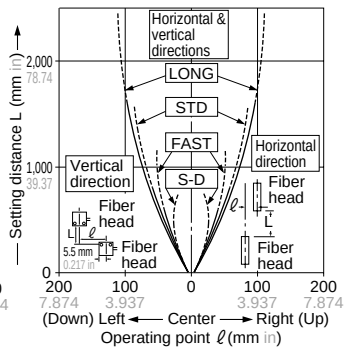
Vertical direction



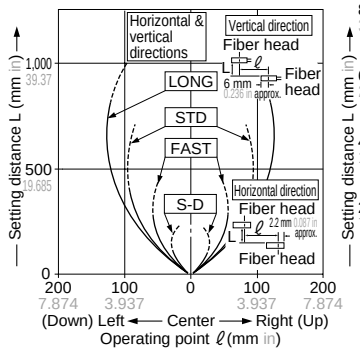
FT-Z8H Thru-beam type



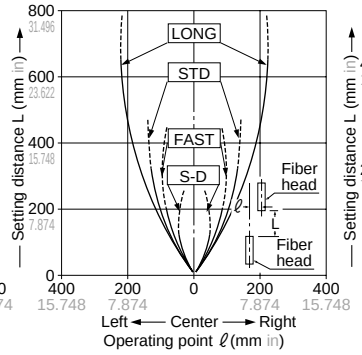
FT-Z8E Thru-beam type



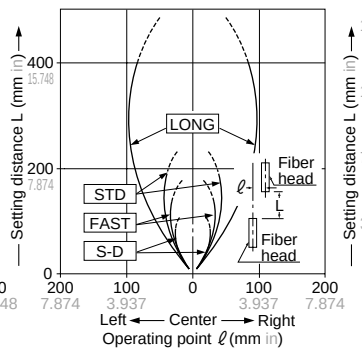
FT-Z8 Thru-beam type



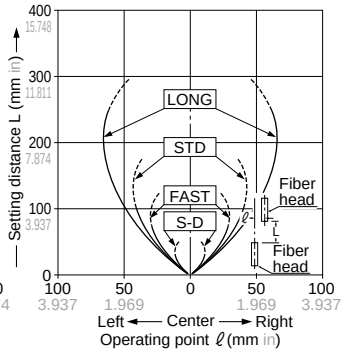
FT-P80 Thru-beam type



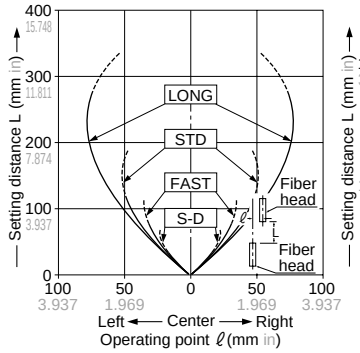
FT-P60 Thru-beam type



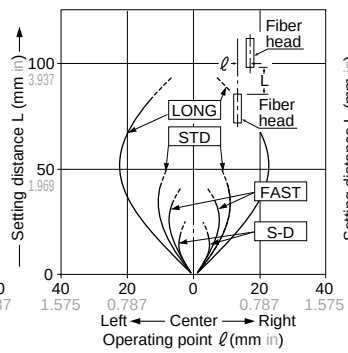
FT-P40 Thru-beam type



FT-P2 Thru-beam type

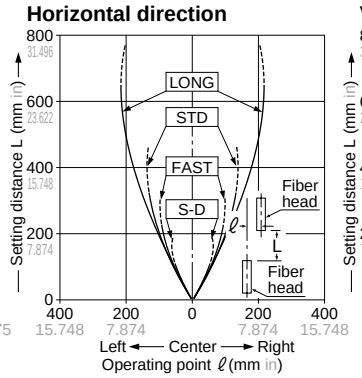


FT-PS1 Thru-beam type

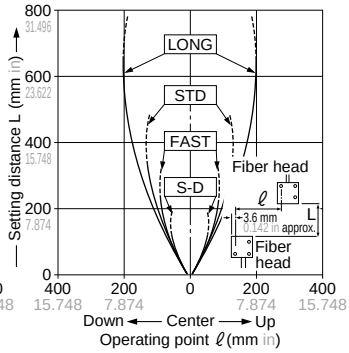


FT-AFM2 Thru-beam type

Horizontal direction

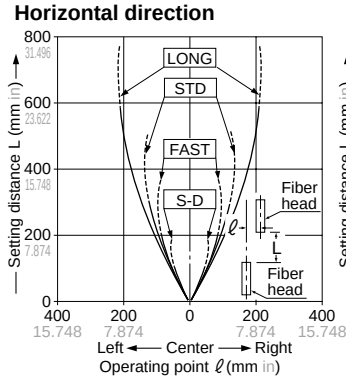


Vertical direction

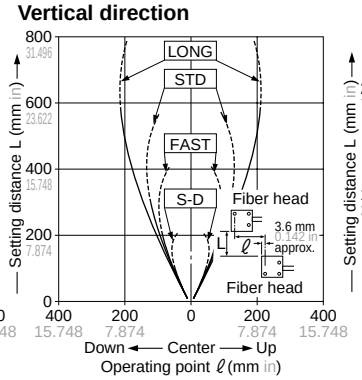


FT-AFM2E Thru-beam type

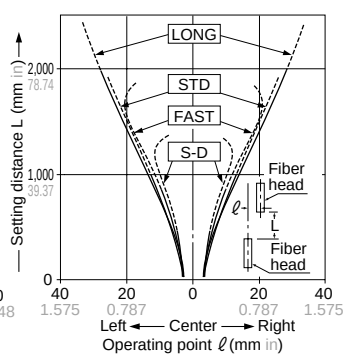
Horizontal direction



Vertical direction



FT-K8 Thru-beam type



FX-301

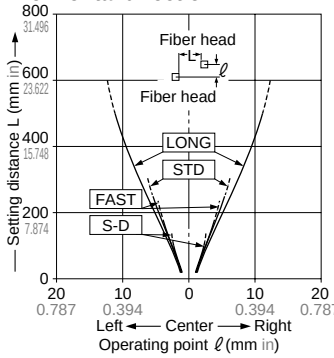
SENSING CHARACTERISTICS (TYPICAL)

The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

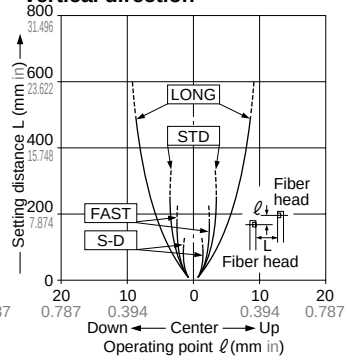
Parallel deviation

FT-KV1 Thru-beam type

Horizontal direction

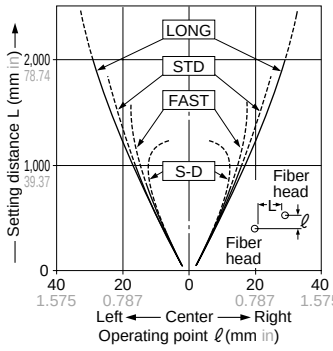


Vertical direction

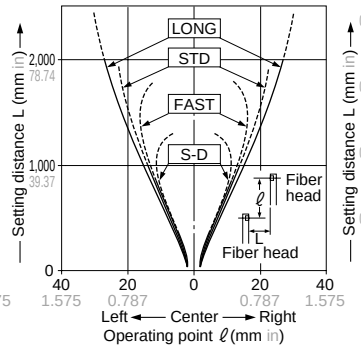


FT-KV8 Thru-beam type

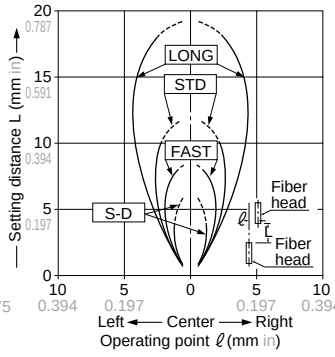
Horizontal direction



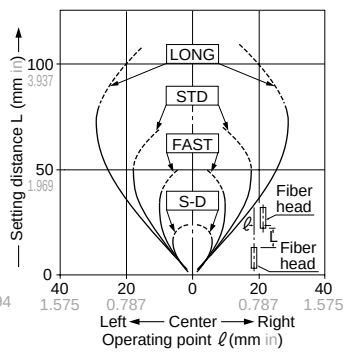
Vertical direction



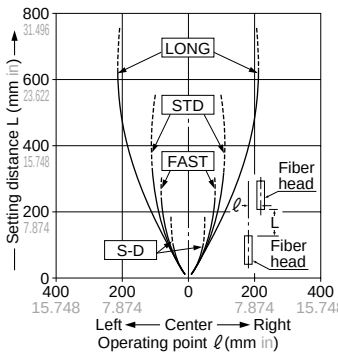
FT-E12 Thru-beam type



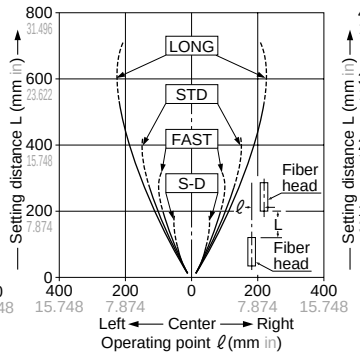
FT-E22 Thru-beam type



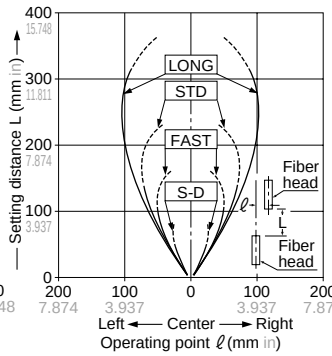
FT-P81X Thru-beam type



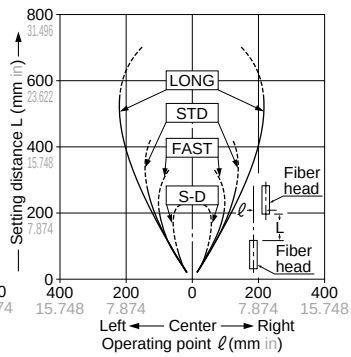
FT-H35-M2 FT-H35-M2S6 Thru-beam type



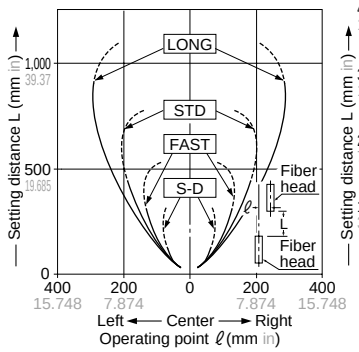
FT-H20W-M1 FT-H20W-M2 Thru-beam type



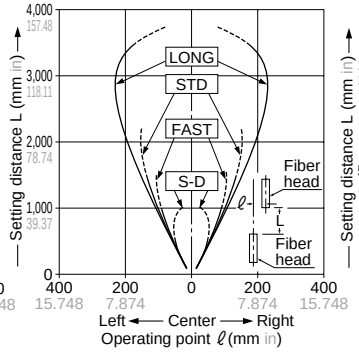
FT-H20-M1 Thru-beam type



FT-H13-FM2 Thru-beam type

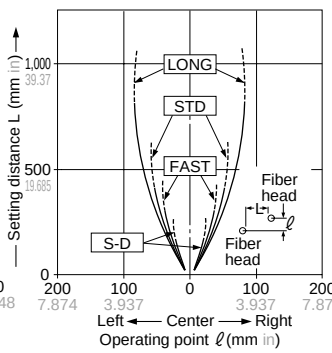


FT-L8Y Thru-beam type

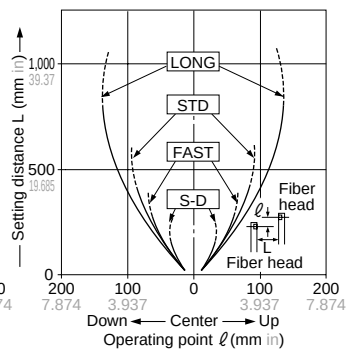


FT-V8Y Thru-beam type

Horizontal direction



Vertical direction

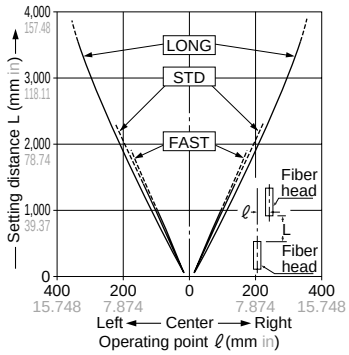


SENSING CHARACTERISTICS (TYPICAL)

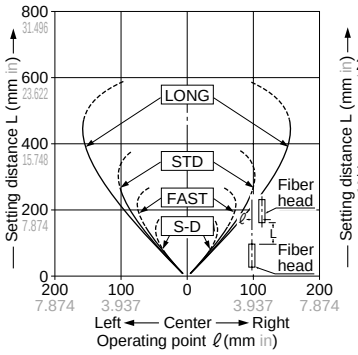
The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

Parallel deviation

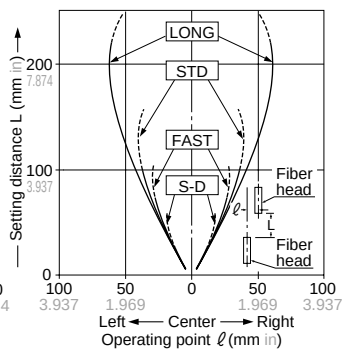
FT-Z802Y Thru-beam type



FT-6V Thru-beam type

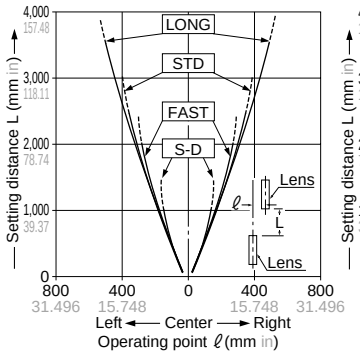


FT-60V Thru-beam type

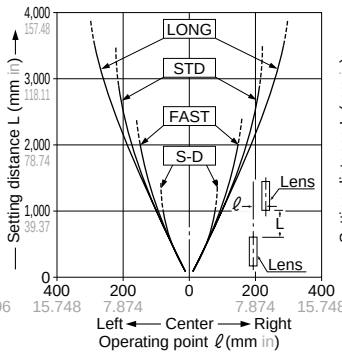


Parallel deviation with FX-LE1 (expansion lens) applied on both sides

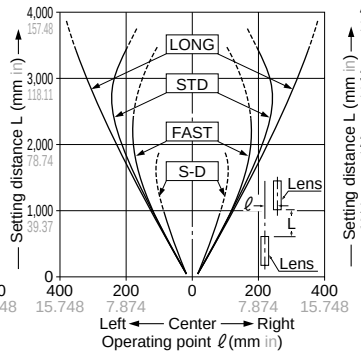
FT-B8 Thru-beam type



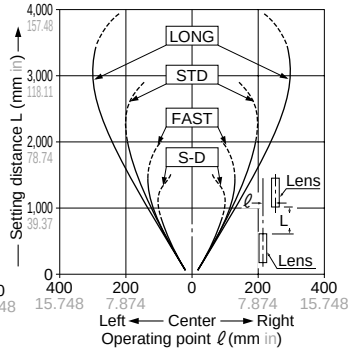
FT-W8 Thru-beam type



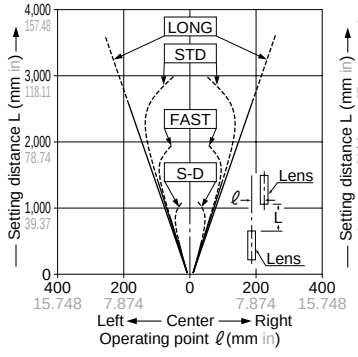
FT-P80 Thru-beam type



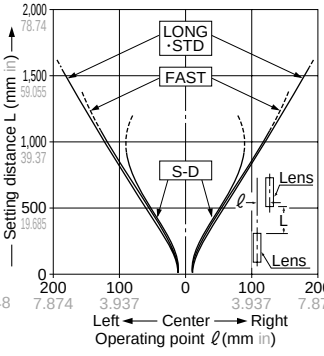
FT-H35-M2 Thru-beam type



FT-H20W-M2 Thru-beam type

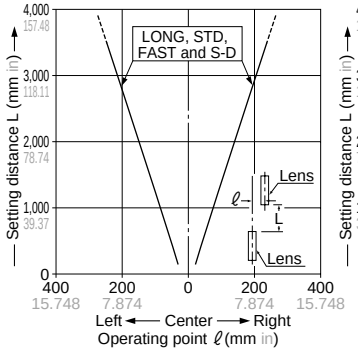


FT-H20-M1 Thru-beam type

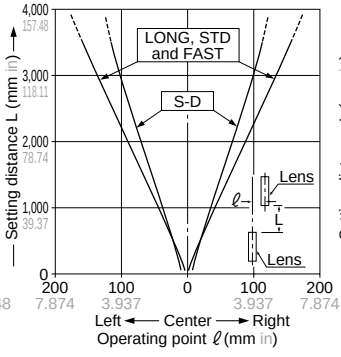


Parallel deviation with FX-LE2 (super-expansion lens) applied on both sides

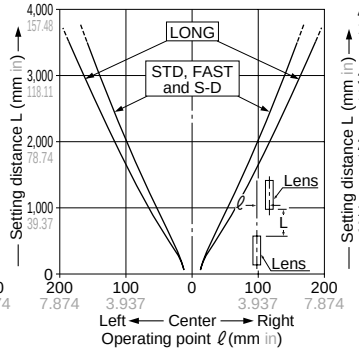
FT-B8 Thru-beam type



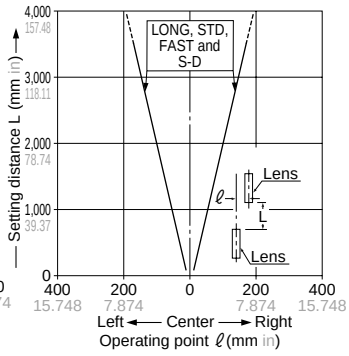
FT-W8 Thru-beam type



FT-P80 Thru-beam type



FT-H35-M2 Thru-beam type



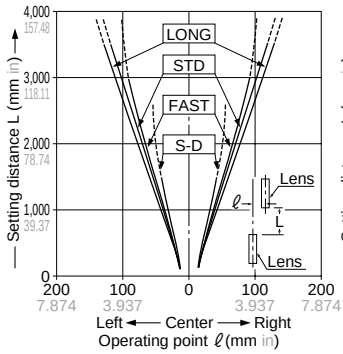
FX-301

SENSING CHARACTERISTICS (TYPICAL)

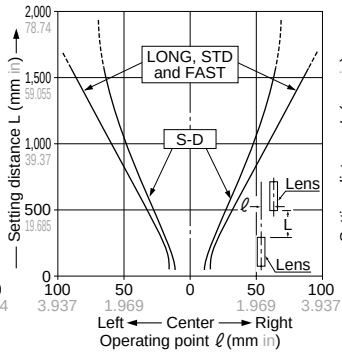
The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

Parallel deviation with FX-LE2 (super-expansion lens) applied on both sides

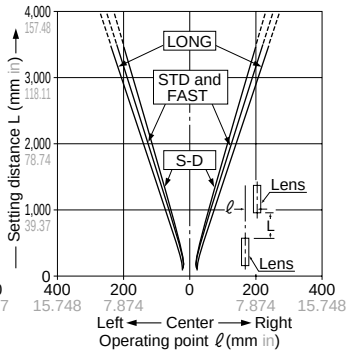
FT-H20W-M2 Thru-beam type



FT-H20-M1 Thru-beam type



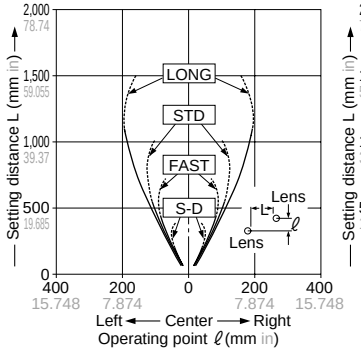
FT-H13-FM2 Thru-beam type



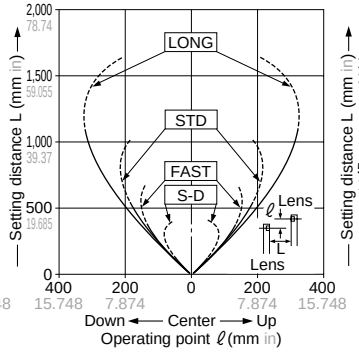
Parallel deviation with FX-SV1 (side-view lens) applied on both sides

FT-B8 Thru-beam type

Horizontal direction

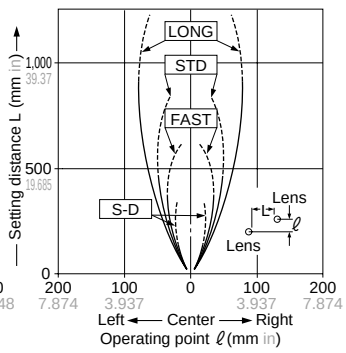


Vertical direction

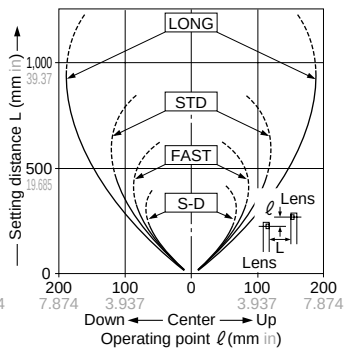


FT-W8 Thru-beam type

Horizontal direction

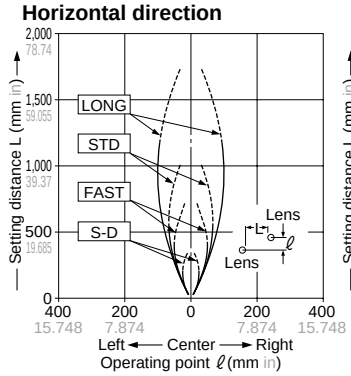


Vertical direction

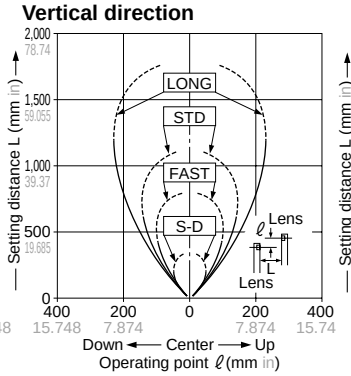


FT-P80 Thru-beam type

Horizontal direction

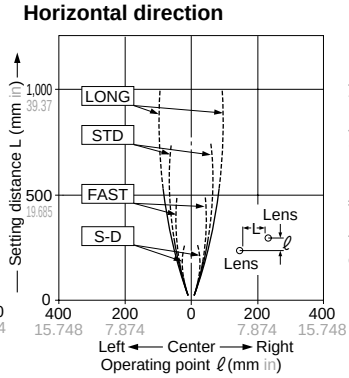


Vertical direction

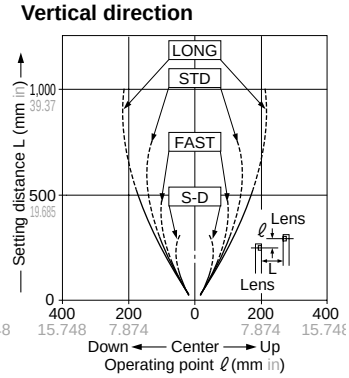


FT-H35-M2 Thru-beam type

Horizontal direction

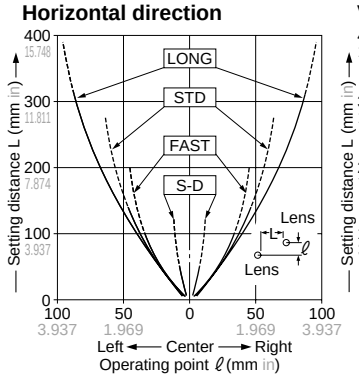


Vertical direction

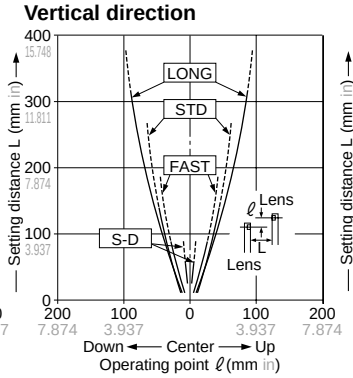


FT-H20W-M2 Thru-beam type

Horizontal direction

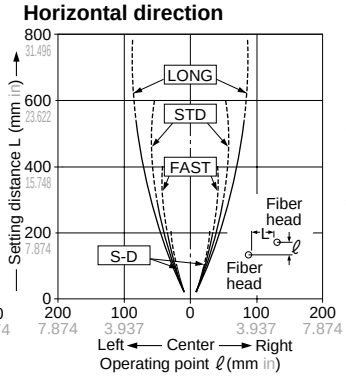


Vertical direction

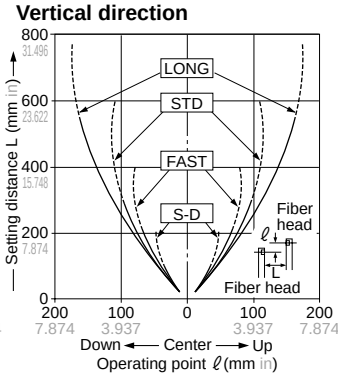


FT-H20-M1 Thru-beam type

Horizontal direction



Vertical direction

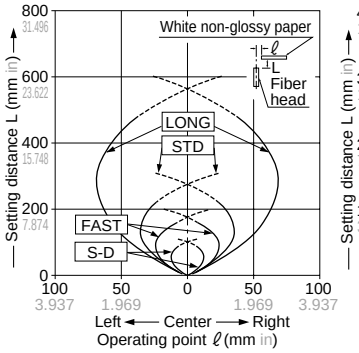


SENSING CHARACTERISTICS (TYPICAL)

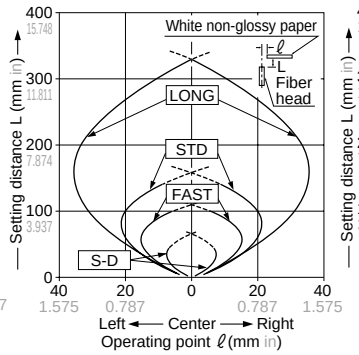
The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

Sensing fields

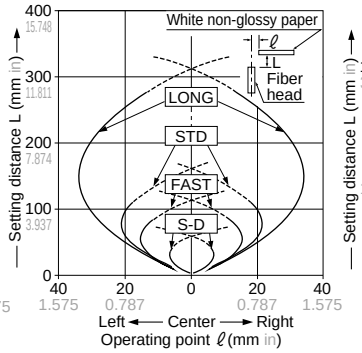
FD-B8 Reflective type



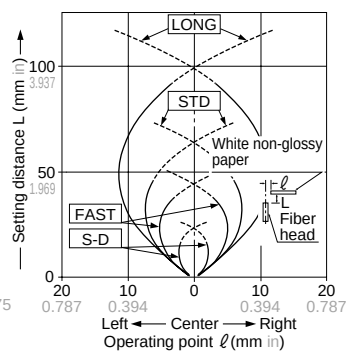
FD-5 FD-FM2 Reflective type



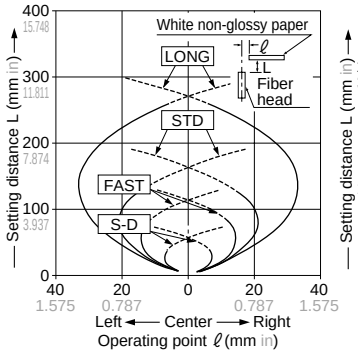
FD-T80 FD-S80 FD-FM2S FD-FM2S4 Reflective type



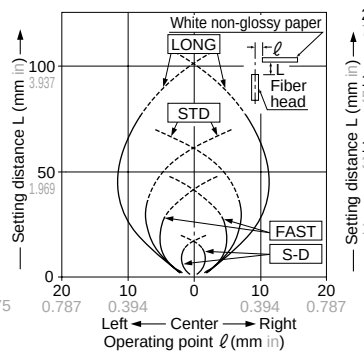
FD-T40 FD-NFM2 FD-NFM2S FD-NFM2S4 FD-SNFM2 Reflective type



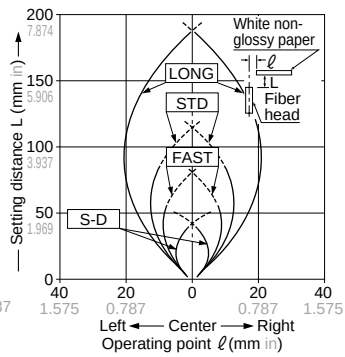
FD-N8 Reflective type



FD-N4 Reflective type

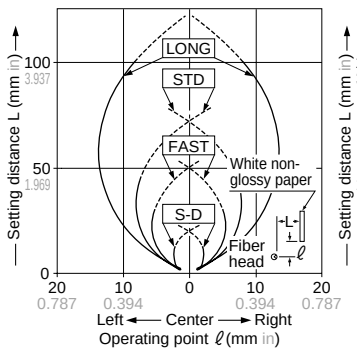


FD-R80 Reflective type

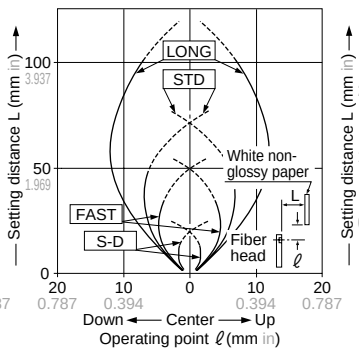


FD-SFM2SV2 Reflective type

Horizontal direction

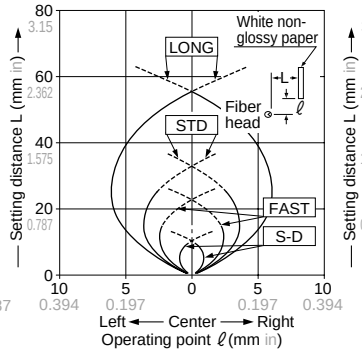


Vertical direction

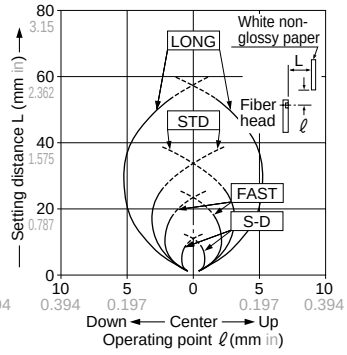


FD-V41 Reflective type

Horizontal direction

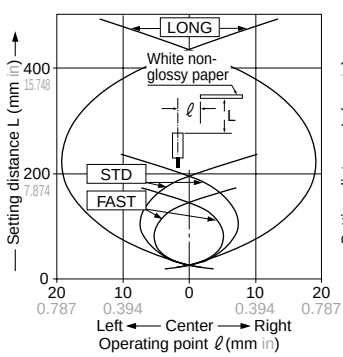


Vertical direction

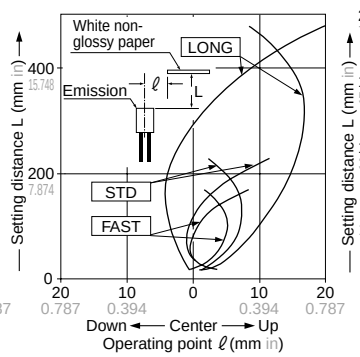


FD-WKZ1 Reflective type

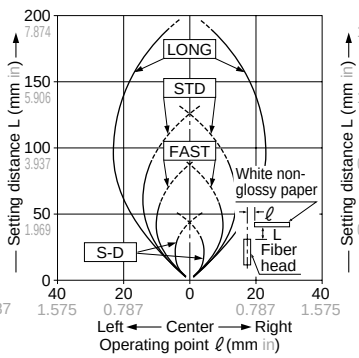
Horizontal direction



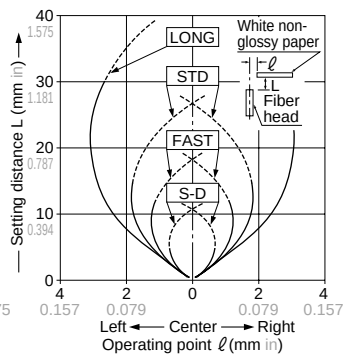
Vertical direction



FD-W8 FD-WT8 FD-WS8 Reflective type



FD-W44 FD-WT4 Reflective type



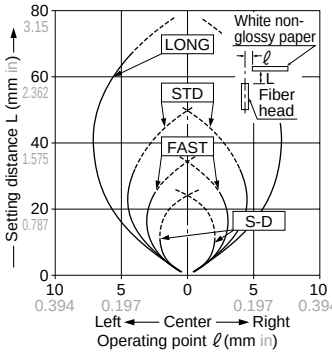
FX-301

SENSING CHARACTERISTICS (TYPICAL)

The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

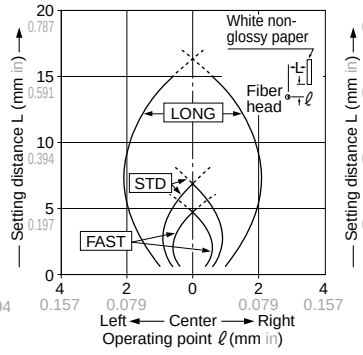
Sensing fields

FD-WG4 FD-WSG4 Reflective type

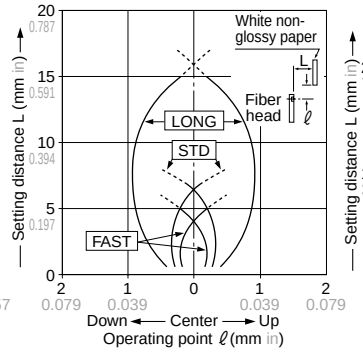


FD-WV42 Reflective type

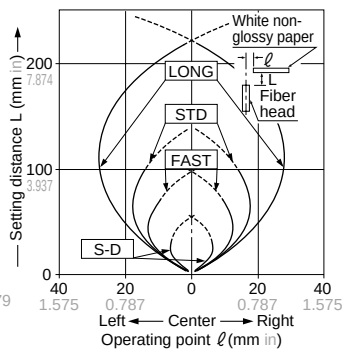
Horizontal direction



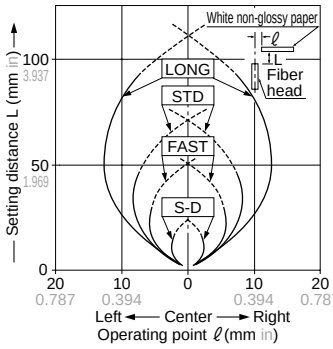
Vertical direction



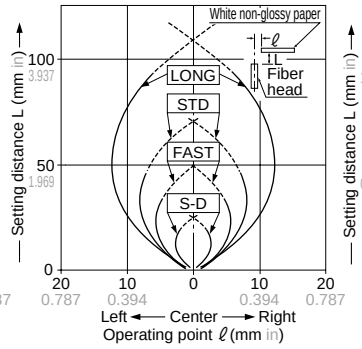
FD-P80 Reflective type



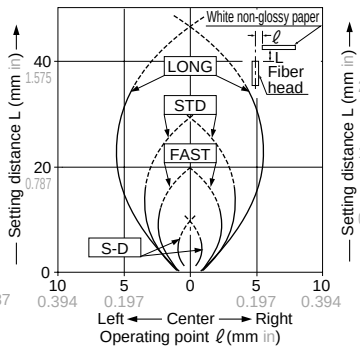
FD-P60 Reflective type



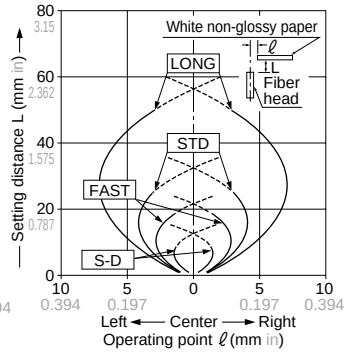
FD-P50 Reflective type



FD-P40 Reflective type

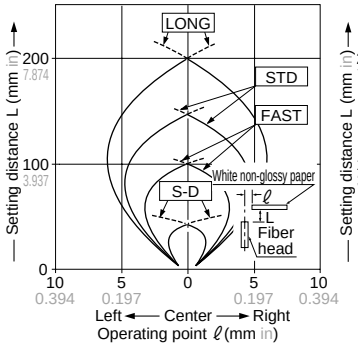


FD-P2 Reflective type

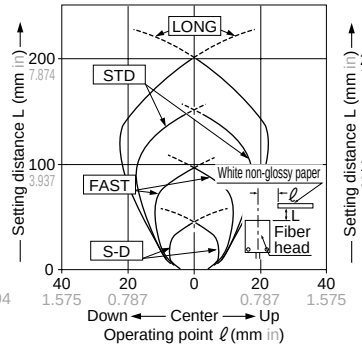


FD-A15 Reflective type

Horizontal direction

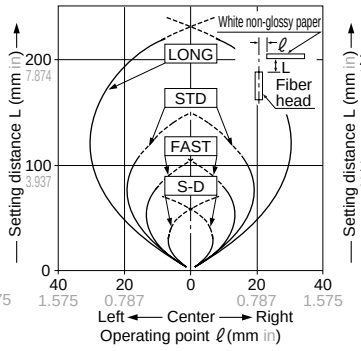


Vertical direction

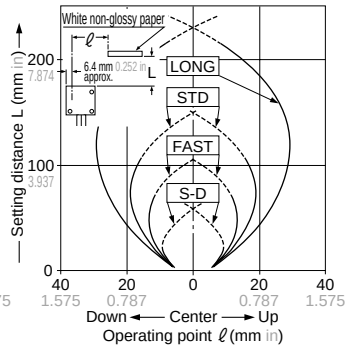


FD-AFM2 FD-AFM2E Reflective type

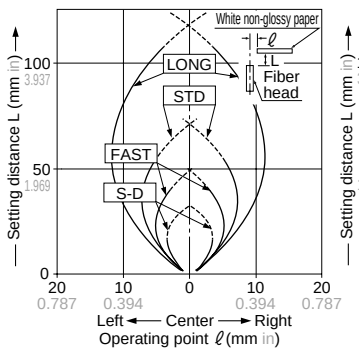
Horizontal direction



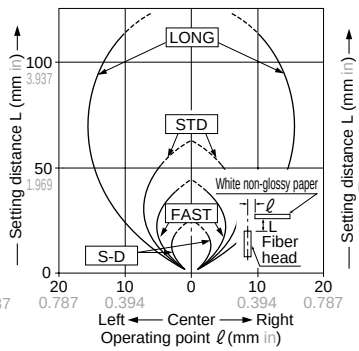
Vertical direction



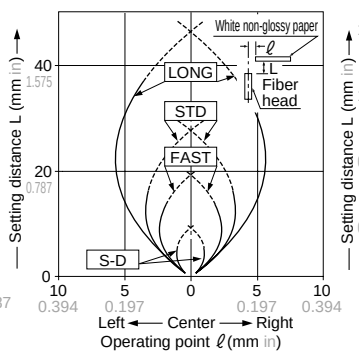
FD-G4 Reflective type



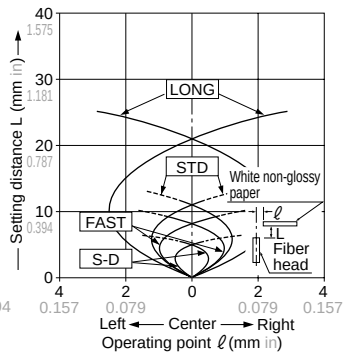
FD-G6 Reflective type



FD-EG1 Reflective type



FD-EG2 Reflective type

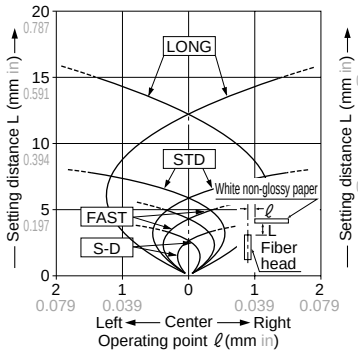


SENSING CHARACTERISTICS (TYPICAL)

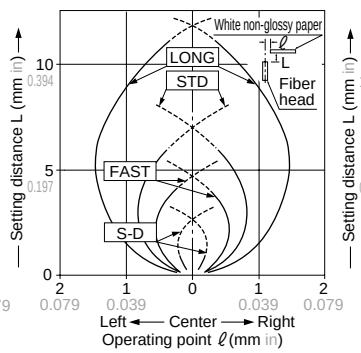
The following sensing characteristics pertain to the red LED type. Please contact our office for the sensing characteristics pertaining corresponding to types other than the red LED or to types not mentioned here.

Sensing fields

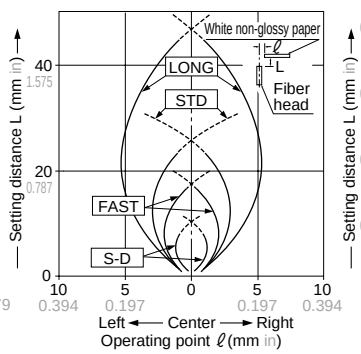
FD-EG3 Reflective type



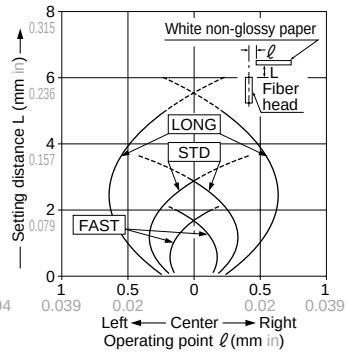
FD-E12 Reflective type



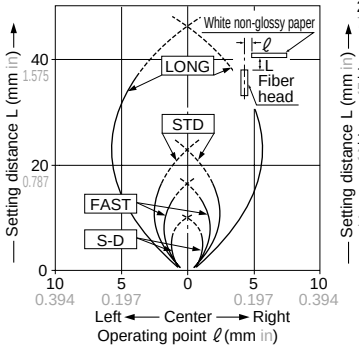
FD-E22 Reflective type



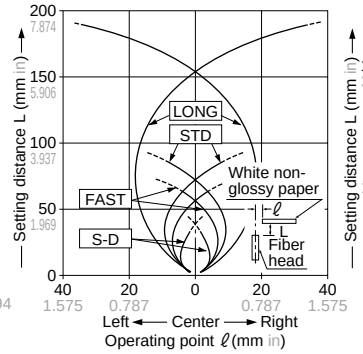
FD-EN500S1 Reflective type



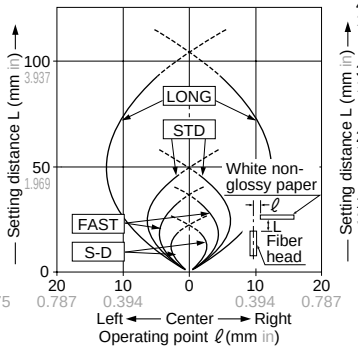
FD-ENM1S1 Reflective type



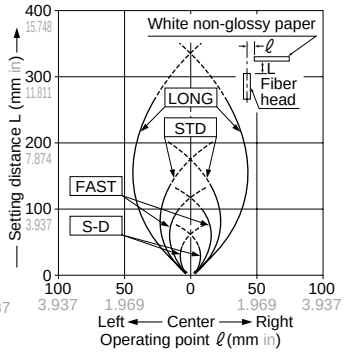
FD-P81X Reflective type



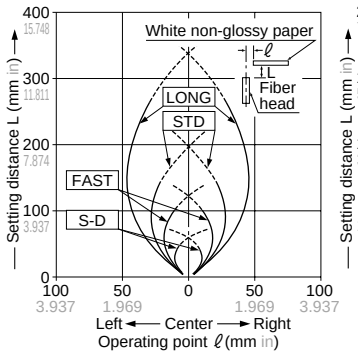
FD-G6X Reflective type



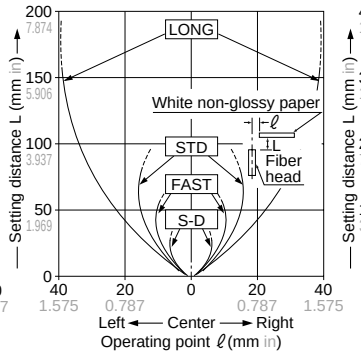
FD-H35-M2
FD-H35-M2S6 Reflective type



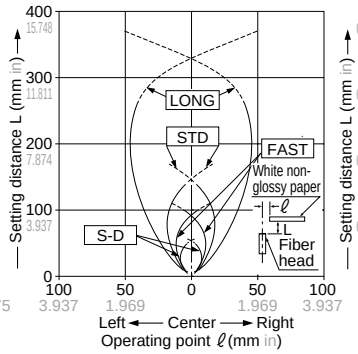
FD-H20-M1 Reflective type



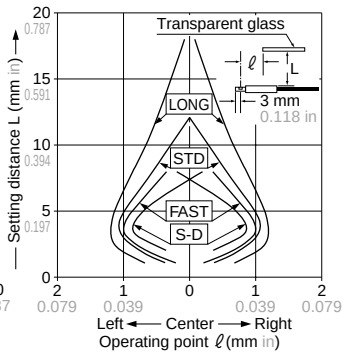
FD-H35-20S Reflective type



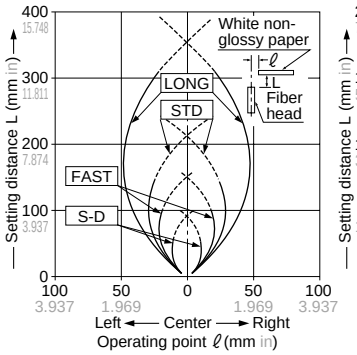
FD-H20-21 Reflective type



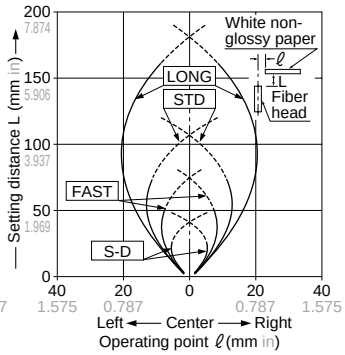
FD-H30-L32
FD-H18-L31 Reflective type



FD-H13-FM2 Reflective type



FD-6V Reflective type



FX-301

PRECAUTIONS FOR PROPER USE

Refer to p.1135〜 for general precautions, and to the 'PRO Mode Operation Guide' or 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for details pertaining to operating instructions for the amplifier.

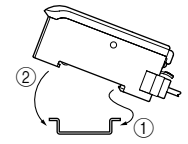
Amplifier

This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Mounting

How to mount the amplifier

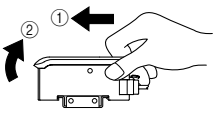
① Fit the rear part of the amplifier on a 35 mm 1.378 in width DIN rail.
② Press down the front part of the mounting section of the amplifier on the 35 mm 1.378 in width DIN rail.



35 mm 1.378 in width DIN rail

How to remove the amplifier

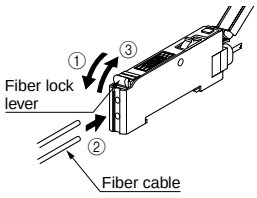
① Push the amplifier forward.
② Lift up the front part of the amplifier to remove it.



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

How to connect the fiber cables

① Snap the fiber lock lever down.
② Insert fiber cables slowly into the inlets until they stop. (Note 1)
③ Return the fiber lock lever to the original position, till it stops.



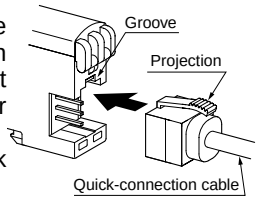
Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
2) With the coaxial reflective type fiber, such as, **FD-G4** or **FD-FM2**, insert the single-core fiber cable into the beam-emitting inlet and the multi-core fiber cable into the beam-receiving inlet. If they are inserted in reverse, the sensing accuracy will deteriorate.

Connection

• Make sure that the power supply is off while connecting or disconnecting the quick-connection cable.

Connection method

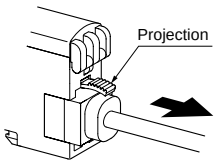
① Holding the connector of the quick-connection cable, align its projection with the groove at the top portion of the amplifier connector.
② Insert the connector till a click is felt.



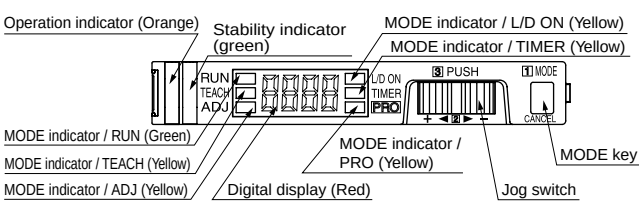
Disconnection method

① Pressing the projection at the top of the quick-connection cable connector, pull out the connector.

Note: Take care that it the connector is pulled out without pressing the projection, the projection may break. Do not use a quick-connection cable whose projection has broken.
Further, do not pull by holding the cable, as this can cause a cable-break.



Part description

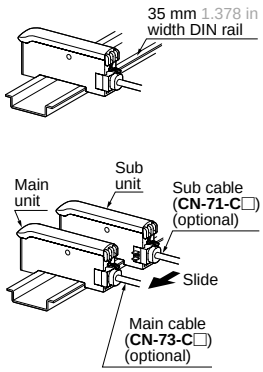


Cascading amplifiers

- Make sure that the power supply is off while cascading or removing the amplifier.
- Make sure to check the allowable ambient temperature, as it depends on the number of amplifiers connected in cascade.
- In case two, or more, amplifiers are connected in cascade, make sure to mount them on a DIN rail.
- When connecting in cascade, mount the amplifiers close to each other, fitting them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- When the amplifiers move on the DIN rail depending on the attaching condition, fitting them between the optional end plates (**MS-DIN-E**) mounted at the two ends.
- Up to maximum 15 amplifiers can be added (total 16 amplifiers connected in cascade.)
- When connecting more than two amplifiers in cascade, use the sub cable (**CN-71-C**□) as the quick-connection cable for the second amplifier onwards.
- Between the **FX-301B**(**P**)**/G**(**P**)**/H**(**P**) and the **FX-301**(**P**), the setting status copy function via communication signal cannot be used. If coupling these, please arrange identical models one at a time.

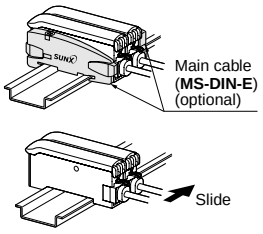
Cascading method

① Mount the amplifiers, one by one, on the 35 mm1.378 in width DIN rail.
(For details, refer to '**Mounting**'.)
② Slide the sub units next to the main unit, and connect the quick-connection cables.
③ Mount the optional end plates (**MS-DIN-E**) at both the ends to hold the amplifiers between their flat sides.
④ Tighten the screws to fix the end plates (**MS-DIN-E**).



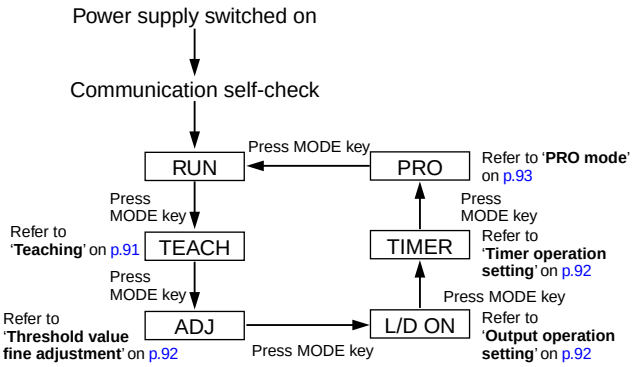
Dismantling

① Loosen the screws of the end plates (**MS-DIN-E**).
② Remove the end plates (**MS-DIN-E**).
③ Slide the sub units and remove them one by one.
(For details, refer to '**Mounting**'.)



Operation procedure

- When the power supply is switched on, communication self-check is carried out and normal condition is displayed [MODE indicator / RUN (green) lights up and the digital display shows incident light intensity].
- When MODE key is pressed, the mode changes as per the diagram below.



When jog switch is pressed, the setting is confirmed.
When MODE key is pressed for 2 sec., or more, the sensor returns to the RUN mode.
Cancellation is possible by pressing MODE key during setting.

PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions, and to the 'PRO Mode Operation Guide' or 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for details pertaining to operating instructions for the amplifier.

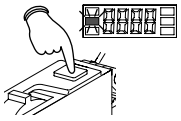
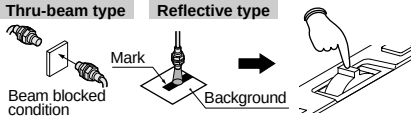
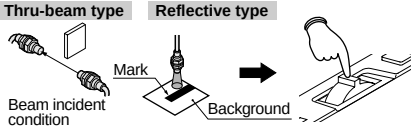
Amplifier

Teaching

• The threshold values can be set by 2-level teaching, limit teaching or full-auto teaching, when the MODE indicator / TEACH (yellow) lights up.

In case of 2-level teaching

• This is the method of setting the threshold value by teaching two levels, corresponding to the object present and object absent conditions. Normally, setting is done by this method.

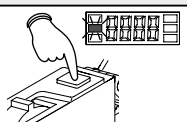
Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	Press jog switch in the object present condition. If the teaching is accepted, the read incident light intensity blinks in the digital display. **Thru-beam type** **Reflective type** 	567
③	MODE indicator / TEACH (yellow) blinks. Press jog switch in the object absent condition. **Thru-beam type** **Reflective type** 	1234
④	If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed. • In case stable sensing is possible: ' Good ' is displayed. Stability indicator (green) blinks. • In case stable sensing is not possible: ' HArd ' blinks. Stability indicator (green) is off.	Good HArd
⑤	The threshold value is displayed.	900
⑥	' - - - - ' blinks in the digital display.	- - - -
⑦	The incident light intensity appears in the digital display and the setting is complete.	1234

Note: Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

In case of full auto-teaching

FX-301B(P)/G(P)/H(P) only

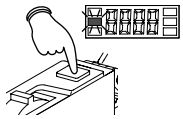
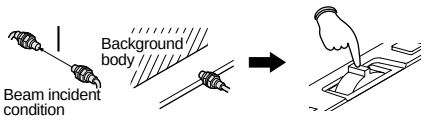
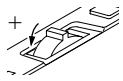
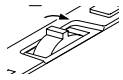
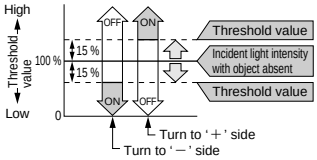
• Full auto-teaching is used when it is desired to set the threshold value without stopping the assembly line, with the object in the moving condition.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	Press the jog switch continuously for 0.5 sec. or more with the object moving on the assembly line. (The incident light intensity is displayed during sampling.)	1234
③	' Auto ' is displayed on the digital display. Release the jog switch when the object has passed.	Auto
④	If the teaching is accepted, the read incident light intensity blinks in the digital display and the threshold value is set at the mid-value between the incident light intensities in the object present and the object absent conditions. After this, the judgment on the stability of sensing is displayed. • In case stable sensing is possible: ' Good ' is displayed. Stability indicator (green) blinks. • In case stable sensing is not possible: ' HArd ' blinks. Stability indicator (green) is off.	Good HArd
⑤	The threshold value is displayed.	900
⑥	' - - - - ' blinks in the digital display.	- - - -
⑦	The incident light intensity appears in the digital display and the setting is complete.	1234

Notes: 1) The threshold value's shift amount can be selected in PRO mode. Refer to the 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for more details pertaining to setting instructions. (Increments of 5 % between –45 and 45 % for setting possible. 0 % default.)
2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

In case of limit teaching

• This is the method of setting the threshold value by teaching only the object absent condition (stable incident light condition). This is used for detection in the presence of a background body or for detection of small objects.

Step	Description	Display
①	Set the fiber within the sensing range. Press MODE key to light up MODE indicator / TEACH (yellow). 	1234
②	Press jog switch in the object absent condition. If the teaching is accepted, the read incident light intensity blinks in the display. **Thru-beam type** **Reflective type** 	1234
③	MODE indicator / TEACH (yellow) blinks. Turn jog switch to the '+' side or '−' side.	1234
④	If jog switch is turned to the '+' side, ' ' scrolls (twice) the display from right to left, and the threshold level is shifted to a value approx. 15 % higher (lower sensitivity) than that set at ②. (Note 1)  This is used in case of reflective type fibers. If jog switch is turned to the '−' side, ' ' scrolls (twice) the display from left to right, and the threshold level is shifted to a value approx. 15 % lower (higher sensitivity) than that set at ②. (Note 1)  This is used in case of thru-beam type fibers. 	
⑤	After this, the judgment on whether the setting shift amount can be shifted or not is displayed. • In case shifting is possible: ' Good ' blinks. • In case shifting is not possible: ' HArd ' blinks.	Good HArd
⑥	The threshold value is displayed.	1420
⑦	' - - - - ' blinks in the digital display.	- - - -
⑧	The incident light intensity appears in the digital display and the setting is complete.	1234

Notes: 1) The approx. 15% amount of shift is the initial value. The amount of shift can be changed in the PRO mode from approx. 5 to 80 % (5 % step). Refer to the 'Fiber Sensor Guide Book' or 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for more details pertaining to setting instructions.
2) Do not move or bend the fiber cable after the sensitivity setting. Detection may become unstable.

Please refer to p.624 for setting of threshold value when used in combination with liquid level sensing fiber **FD-F8Y** and to p.618 for setting of threshold value when used in combination with pipe-mountable liquid level sensing fiber **FD-F4□**, **FD-F9□**.

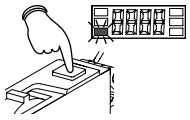
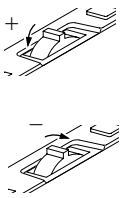
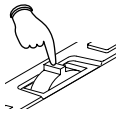
FX-301

PRECAUTIONS FOR PROPER USE

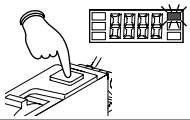
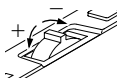
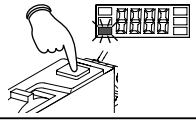
Refer to p.1135～ for general precautions, and to the 'PRO Mode Operation Guide' or 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for details pertaining to operating instructions for the amplifier.

Amplifier

Threshold value fine adjustment

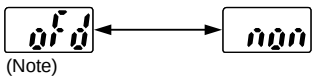
Step	Description	Display
①	Press MODE key to light up MODE indicator / ADJ (yellow). 	———
②	In case the threshold value is to be increased (sensitivity to be reduced), turn the jog switch to the '＋' side to increase the threshold value slowly. If the jog switch is turned continuously to the '＋' side, the threshold value increases rapidly. In case the threshold value is to be decreased (sensitivity to be increased), turn the jog switch to the '－' side to decrease the threshold value slowly. If the jog switch is turned continuously to the '－' side, the threshold value decreases rapidly. 	1234 → 1235 or 1234 → 1233
②	When jog switch is pressed, the threshold value is confirmed. 	———

Output operation setting

Step	Description	Display
①	Press MODE key to light up MODE indicator / L/D ON (yellow). 	L-on Displays present setting
②	If the jog switch is turn to the '＋' or '－' direction, the output operation setting will change. 	Light state L-on ↕ D-on Dark state
③	When jog switch is pressed, the threshold value is confirmed. 	D-on Displays selected setting

Timer operation setting

- The setting for whether the timer is used or not can be done when MODE indicator / TIMER (yellow) lights up.
- 10 ms OFF-delay (initial value) timer is automatically set when the timer is set to be used.
- Further, an OFF-delay (initial value) which is useful when the response of the connected device is slow, etc., an ON-delay which is useful to detect only objects taking a long time to travel, and ONE SHOT, which is useful when the input specifications of the connected device require a signal of a fixed width, are possible with the **FX-301** series. Refer to the 'Fiber Sensor Guide Book' or 'SUNX fiber sensor home page' (http://www fiber-sensor.com) for the setting method of the OFF-delay, ON-delay and ONE SHOT timer intervals.



(Note)

Note: The OFF-delay timer interval set in the PRO mode is displayed. Refer to the 'Fiber Sensor Guide Book' or 'SUNX fiber sensor home page' (http://www fiber-sensor.com) for more details.

Key-lock function

- With the **FX-301B(P)/G(P)/H(P)**, if jog switch and MODE key are pressed for more than 3 sec. at the same time in 'RUN' mode condition, the key operations are locked, and only the threshold value confirmation function or the adjust function (valid only when the adjust lock function is canceled) is valid.
  To cancel the lock function, press both the keys for more than 3 sec. once again.

Wiring

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

Others

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- This sensor is suitable for indoor use only.
- Avoid dust, dirt, and steam.
- Take care that the product does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- This sensor cannot be used in an environment containing inflammable or explosive gasses.
- Never disassemble or modify the sensor.

PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions, and to the 'PRO Mode Operation Guide' or 'SUNX fiber sensor home page' (http://www.fiber-sensor.com) for details pertaining to operating instructions for the amplifier.

Amplifier

PRO mode

- Refer to the 'Fiber Sensor Guide Book' for more details pertaining to the PRO mode settings and procedures.

- The above can also be download from 'SUNX fiber sensor homepage' (http://www.fiber-sensor.com)
- PRO settings can be done when MODE indicator / PRO (yellow) lights up.

Table for PRO mode settings

NAVI mode

RUN Run
This indicates normal sensing operation.

PRO Pro
Allows various detailed settings to be configured, such as optical communications, save / load and other settings.

TIMER Timer
Configures operation of the timer.

L/D ON L-ON / D-ON
Sets output operation either Light-ON, or Dark-ON.

ADJ Adjust
Allows fine adjustment of the 'threshold value'.

TEACH Teaching
The 'threshold value' for the **FX-301(P)** can be set by utilizing either '2-level teaching' or 'limit teaching', and the 'threshold value' for the **FX301B(P)/G(P)/H(P)** can be set using these and also a third mode called 'full-auto teaching'.

PRO mode

PRO1
- SPEd Response time change — Switches among response times.
- dELY Timer setting — Configures timer operation and timer period.
- HYS Hysteresis — Allows the selection of hysteresis level.
- SHFt Shift — Shifts the 'threshold value' by a certain percentage increment during 'limit teaching' or 'full-auto teaching'.
- Stb Stability — Permits selection of stability indicator response levels for changes in the range for lighting up.

PRO2
- diSP Digital display setting — Allows selection of different content to be viewed in the digital display.
- turn Digital display inversion — Flips and reverses the viewing orientation of the digital display.
- Eco ECO mode setting — Sets the digital display to turn off automatically.

PRO3
- chLd Data bank load — Loads configuration setting from the data bank.
- chSA Data bank save — Saves configuration setting into the data bank.

PRO4
- CoPY Copy — Using optical communications, configuration settings from the main unit are copied to connected sub units, in a single step.
- chLd Remote data bank load — Using optical communications, configuration settings can be loaded from data banks, in a single step.
- chSA Remote data bank save — Using optical communications, configuration settings can be saved into data banks, in a single step.
- C.Lc Transmission change to permit / not to permit — Allows all communication changes to be disabled during the execution of single-step copy, load and save operations using optical communications. *Available only in **FX-301B(P)/G(P)/H(P)**.
- tESt Test — Verifies whether optical communications have been properly established.

PRO5
- CodE Coding — Allows basic configuration information to be set in a single step, by inputting a 4-digit code.
- 0AdJ Zero adjust — Forces the numerical value for incident light intensity to '0', on the digital display.
- A.Lc Adjust lock — Allows fine adjustment of the 'threshold value' to be directly performed during RUN mode.
- rSEt Reset — All settings, except for data bank information, revert to factory settings.

FX-301

PRECAUTIONS FOR PROPER USE

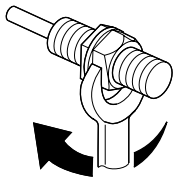
Refer to p.1135～ for general precautions.

Fiber

Mounting

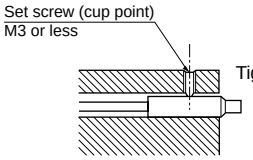
• The tightening torque must not exceed the values given below.

Mounting with a nut (threaded head type)



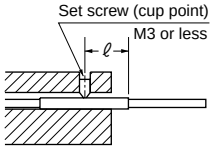
	Tightening torque
M3	0.39 N·m
M4	0.58 N·m (350 °C 662 °F heat-resistant fiber and **FT-H20W-M**□: 0.98 N·m, **FD-H35-20S**: 0.58 N·m)
M5 M6	0.98 N·m (350 °C 662 °F heat-resistant fiber: 1.96 N·m)
M14	1.47 N·m

Mounting with a set screw

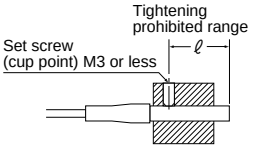


Tightening torque: 0.29 N·m or less
(**FT-SFM2L**: 0.19 N·m
FT-H20W-M□: 0.49 N·m)

• Fibers for which the tightening section has been specified should be fixed at ℓ mm from the tightening section tip. (However, for **FT-K8**, **FT-KV8**, **FT-WKV8** and **FT-V10** 'ℓ' indicates the range over which tightening cannot be done.)



<FT-K8, FT-KV8, FT-WKV8, FT-V10>

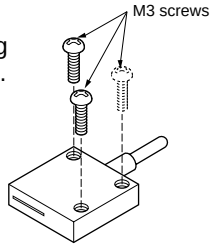


	ℓ (mm in)	Tightening torque
FT-PS1	3 0.118	0.1 N·m
FD-E12	4 0.157 (Note 1)	0.29 N·m
FT-V22 **FT-41, FD-V41** **FT-SFM2SV2**	10 0.394	0.19 N·m
FD-EG1	10 0.394	0.29 N·m
FT-WV42 **FD-WV42**	15 0.591	0.29 N·m
FD-SFM2SV2	7 0.276	0.34 N·m
FT-KV8, FT-WKV8 **FT-V10**	13 0.512	0.3 N·m
FT-K8	12 0.472	

Notes 1): Excluding the sleeve.
2): When installing, make sure to use screws smaller than the fiber diameter.

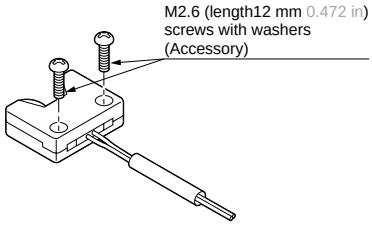
Mounting array fiber

• Using M3 screws, the tightening torque should be 0.58 N·m or less.



Mounting FD-L4

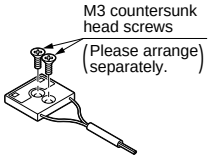
• Using M2.6 (length 12 mm 0.472 in) screws with washers (accessory), the tightening torque should be 0.3 N·m or less.



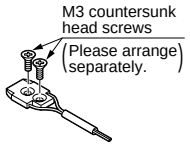
Mounting FD-WL41 / FD-L41 and FD-WL42 / FD-L42

• Using M3 countersunk head screws, the tightening torque should be 0.3 N·m or less.

<FD-WL41 / FD-L41>

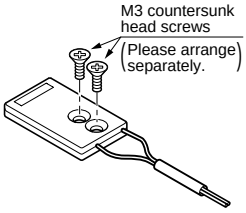


<FD-WL42 / FD-L42>



Mounting FD-L43

• Using M3 countersunk head screws, the tightening torque should be 0.3 N·m or less.



PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions.

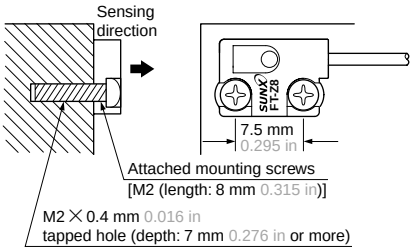
Fiber

Mounting FT-Z8□ and FT-WZ8□

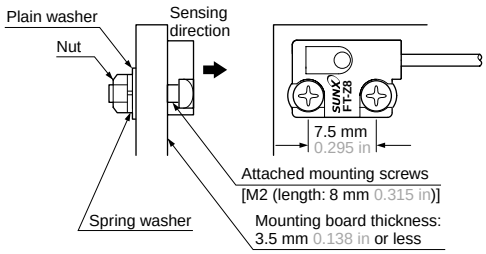
- Mount the fiber head by using the enclosed set of screws. The tightening torque should be 0.15 N·m or less
- If the fiber head is mounted in places subject to vibrations or shocks, use a screw-locking adhesive, etc.
- Mount each fiber head as given below.

<FT-Z8 / FT-WZ8 (Front sensing type)>

In case of tapping the mounting section

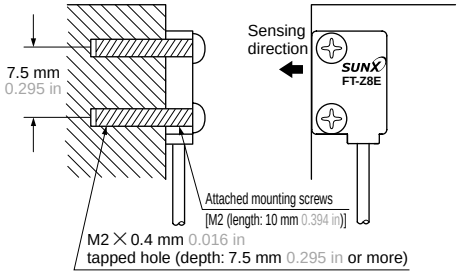


In case of using attached screw and nut

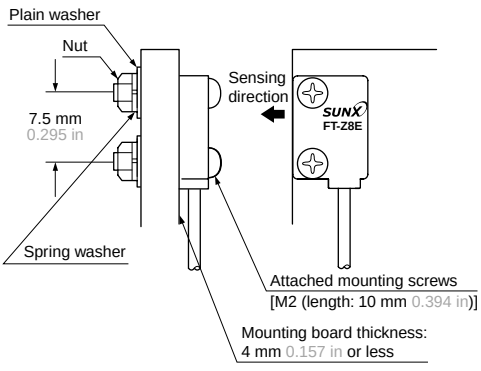


<FT-Z8E / FT-WZ8E (Side sensing type)>

In case of tapping the mounting section

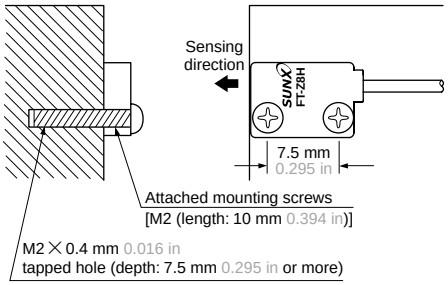


In case of using attached screw and nut

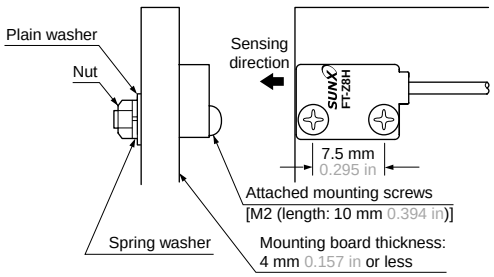


<FT-Z8H / FT-WZ8H (Top sensing type)>

In case of tapping the mounting section

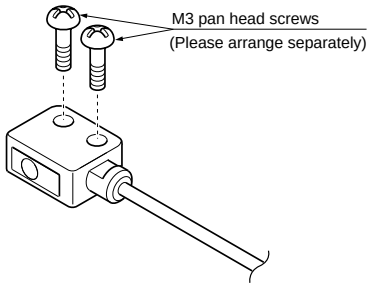


In case of using attached screw and nut



Mounting FT-Z802Y

- Using M3 pan head screws, the tightening torque should be 0.3 N·m or less.



Mounting FD-WKZ1

<If not using the attached mounting brackets>

- Use M3 or less set screws (cup point), and affix the head within 15 mm 0.591 in from the tip of the fiber head. Do not exceed a torque of 0.3 N·m when tightening.

<If using the attached mounting brackets>

- The head can be affixed even without using the set screws.
- If using the set screws, use M3 set screws (cup point) to affix and do not exceed a torque of 0.05 N·m when tightening.

Mounting FD-A15

- Using M3 screws, the tightening torque should be 0.3 N·m or less.

Mounting FD-H30-L32 / FD-H18-L31

- Using M3 screws, the tightening torque should be 3 N·m or less.

FX-301

PRECAUTIONS FOR PROPER USE

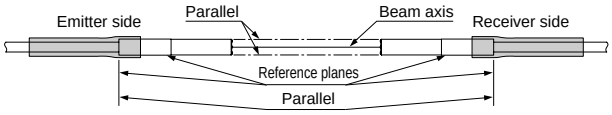
Refer to p.1135～ for general precautions.

Fiber

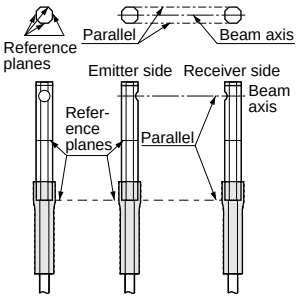
Narrow beam type fiber mounting

- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting. At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the emitting and receiving fibers so that they are parallel.

<FT-K8>

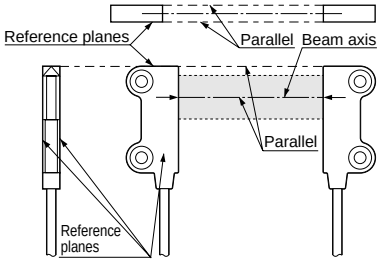


<FT-KV8 / FT-WKV8>

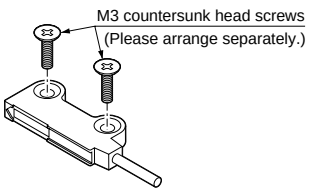


Thru-beam type wide beam fiber mounting

- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting. At the time of installation, determine a reference plane, as shown in the figure below, and taking sufficient care against beam misalignment or tilt, install the beam-emitting and receiving fibers so that they are parallel.



- Install the fiber using M3 countersunk head screws. The tightening torque should be 0.3 N·m or less. Further, when using the fiber at places having intense vibrations, use a screw-locking adhesive, etc.



- If mineral oil or solvent containing mineral oil component adheres to the sensing surface, the lens may be deformed. Take sufficient care to handle them.

Method of fixing fiber cable

- If fixing the fiber cable in position, make sure that it is set in a manner as shown below, so that no load is applied on the fiber. (Excluding **FT-H35-M2**, **FT-H35-M2S6**, **FD-H35-M2** and **FD-H35-M2S6**)

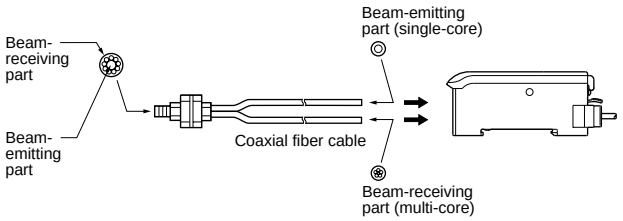
Connection with reflective coaxial type fiber

- With reflective coaxial type fiber, insert the center fiber cable (single-core) into the beam-emitting inlet and the outer fiber cable (multi-core) into the beam-receiving inlet.

FD-H35-M2 or **FD-H20-M1** is marked 'P' on the beam-emitting fiber cable and 'D' on the beam-receiving fiber cable.

FD-WG4, **FD-WSG4** and **FD-G4**, **FD-G6**, **FD-G6X** are composed of beam-emitting and beam-receiving fiber cables that are different in diameter.

FD-G500, **FD-EG1**, **FD-EG2**, **FD-EG3**, **FD-E22**, **FD-H20-21** and **FD-ENM1S1** are marked P on the beam-emitting fiber cable.

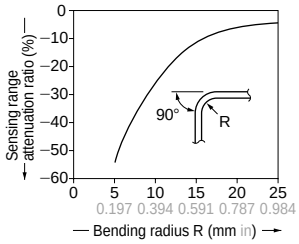


Notes: 1) In case the fiber cables are not inserted to a position where they stop, the sensing range reduces.
2) Before connecting fiber cables to the amplifier, mount the fiber attachments on their ends.

Fiber cable bending radius

- If the fiber cable is bent at a smaller bending radius than allowable bending radius, the sensing range decreases due to beam attenuation.

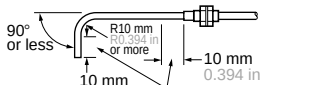
For a allowable bending radius of 25 mm (0.984 in)



Note: Please note that the 350 °C 662 °F heat-resistant fibers, vacuum-resistant and chemical-resistant fibers cannot bend less than the allowable bending radius.

How to bend sleeve

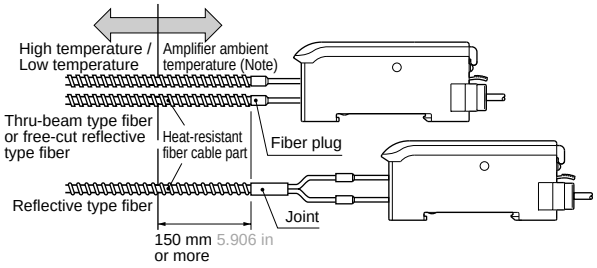
- The bending radius must be R10 mm R0.394 in or more. Please bend gradually using the fiber bender (**FB-1**) or a round bar of ϕ20 mm ϕ0.787 in or more.



Note: Do not bend the sleeve of side-view type, narrow beam type, narrow-view type and ultra-small diameter type fiber.

Use of heat-resistant type fiber

- Use by keeping 150 mm 5.906 in, or more, of the heat-resistant fiber cable part at normal temperature.



- Protect the amplifier from heat radiation or hot air.
- With the 350 °C 662 °F heat-resistant type fiber, the surface of the fiber head or the spiral may be discolored by heat. However, this does not affect its performance.

PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions.

Fiber

Fiber attachments (FX-AT□)

Product outline

• When the beam-emitting and beam-receiving fiber cables are inserted into the fiber sensor amplifier (**FX-301/302/303/311** series etc.), the enclosed fiber attachment (**FX-AT2/AT3/AT4/AT5/AT6**) facilitates insertion of the fiber cables and reduces the possibility of incorrect fiber cable insertion.

Cautions

• Take care that **FX-AT2**, **FX-AT3**, **FX-AT4**, **FX-AT5** and **FX-AT6** cannot be used with fiber sensor amplifiers having a pitch, between the beam-emitting and the beam-receiving fiber cables, other than 7 mm 0.276 in. In case of fiber sensor amplifiers having a pitch other than 7 mm 0.276 in, please use attachments **FX-AT10** or **FX-AT13**. (accessory)

Component description

<FX-AT2>
Attachment for fixed-length fiber: orange

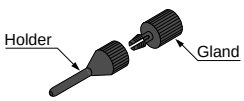
<FX-AT3>
Attachment for ϕ2.2 mm ϕ0.087 in fiber: clear orange

<FX-AT4>
Attachment for ϕ1 mm ϕ0.039 in fiber: black

<FX-AT5>
Attachment for ϕ1.3 mm ϕ0.051 in fiber: gray

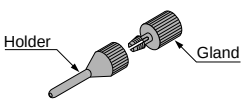
<FX-AT6>
Attachment for ϕ1 mm / ϕ1.3 mm ϕ0.039 in / ϕ0.051 in mixed fiber
(for ϕ1 mm ϕ0.039 in fiber: black,
for ϕ1.3 mm ϕ0.051 in fiber: gray)

<FX-AT10>
Attachment for ϕ1 mm ϕ0.039 in fiber: black



This is enclosed by **FX-AT4**.

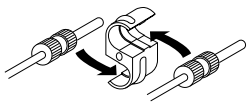
<FX-AT13>
Attachment for ϕ1.3 mm ϕ0.051 in fiber: gray



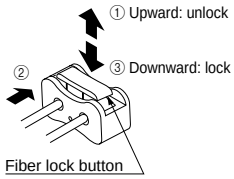
This is enclosed by **FX-AT5**.

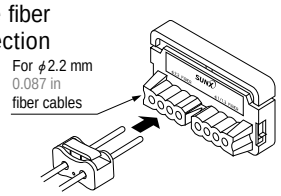
Mounting

<FX-AT2>
① Mount the plug part of the fiber cables in **FX-AT2**, as shown in the figure below. (The resin plug has a groove to hold it in place.)
② Connect the fiber cables, in condition ①, to the fiber sensor amplifier.



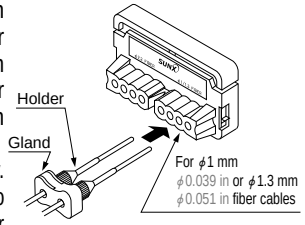
<FX-AT3>
① Confirm that the fiber lock button of **FX-AT3** is in unlock side.
② Insert the fiber cables one by one, in condition ①.
③ After inserting, press down the fiber lock button. The fiber cables are fixed at the desired position. (In order to unlock the fiber cables, press the fiber lock button towards unlock direction from the opposite side.)
④ Insert the fiber cables into the holes for ϕ2.2 mm ϕ0.087 in fiber cables of the fiber cutter (**FX-CT2**) from the direction shown in the figure right.





⑤ Cut both fiber cables simultaneously. (At this time, place the attachment without any gap against the fiber cutter. The fiber cables will be cut at a position approx. 10.5 mm 0.413 in from the tip of the fiber cable.)
⑥ After cutting, connect the fiber cables to the fiber sensor amplifier immediately.

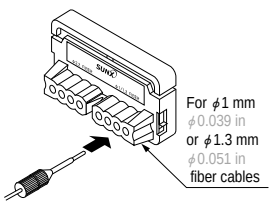
<FX-AT4, FX-AT5, FX-AT6>
① Mount the holders on the gland lightly.
Notes: 1) If both long holders and short holders are enclosed with the fiber, use the short holders.
2) In case of **FX-AT6**, match the colors of the holders and the gland. The black color is for ϕ1.0 mm ϕ0.039 in fiber cable and the gray color is for ϕ1.3 mm ϕ0.051 in fiber cable.
② Insert the fiber cables into the holders, in condition ①.
③ Tighten the holders to fix the fiber cables at the desired length.
④ Insert the fiber cables, in condition ③, into the holes for ϕ1.0 mm ϕ0.039 in or ϕ1.3 mm ϕ0.051 in fiber cables of the fiber cutter (**FX-CT2**) from direction shown in the figure right.



⑤ Cut both fiber cables simultaneously. (At this time, insert the attachment to a position at which it stops. The fiber cables will be cut at a position approx. 0.5 mm 0.020 in from the holder.)
⑥ After cutting, insert the fiber cables to the fiber sensor amplifier immediately.

<FX-AT10, FX-AT13>
① Thread the fiber cable through the gland and holder separately, and screw the gland into the holder clockwise.

② Insert the fiber cables one by one into the holes for ϕ1.0 mm ϕ0.039 in or ϕ1.3 mm ϕ0.051 in fiber cable of the fiber cutter (**FX-CT2**) from the direction shown in the figure right. (At this time, insert the attachment to a position at which it stops. The fibers will be cut at a position approx. 0.5 mm 0.020 in from the holder.)



FX-301

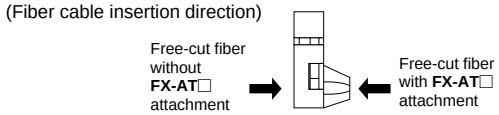
PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions.

Fiber

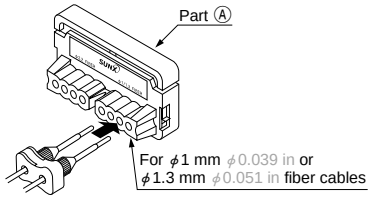
Fiber cutter (FX-CT2)

• To cut the fiber cables, insert them from the direction shown below.



How to use fiber cutter (FX-CT2)

① Slide part Ⓐ of the fiber cutter fully upward till it stops.
② Insert the fiber cables, mounted in the attachment, till they stop.
(Take care that there are separate fiber insertion cable holes for ϕ2.2 mm ϕ0.087 in and ϕ1.0 mm ϕ0.039 in or ϕ1.3 mm ϕ0.051 in fiber cables.)
③ Slide part Ⓐ of the fiber cutter down to cut the fibers.



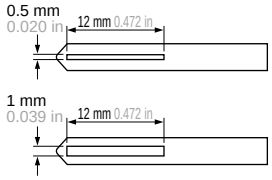
Notes: 1) The fiber cables should be cut in one stroke.
2) Once a fiber cable is cut off at a hole, do not use the hole again. If used, it degrades the cut surface quality and the detectability may deteriorate.
3) The blade cannot be replaced. Please purchase an additional fiber cutter, if required.
4) Note that the sensing range may be reduced by up to 20 % depending on the cut condition. Hence, decide the setting distance by taking sufficient margin.

Seal type slit mask for FT-WA30/A30, FT-WA8/A8

• Two types of slit masks are enclosed. (one type for **FT-A30** and **FT-WA30**) Apply the enclosed slit mask when detecting small objects or as measures not to saturate the emitted light amount for short-range sensing.
However, the sensing range is reduced when the slit mask is mounted.
As the slit mask is seal type, stick it by aligning the projection of the slit mask with the upper portion of the fiber head, as shown in the figure below.

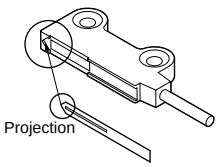
Slit masks

<FT-A8, FT-WA8>



<FT-A30, FT-WA30>

Mounting

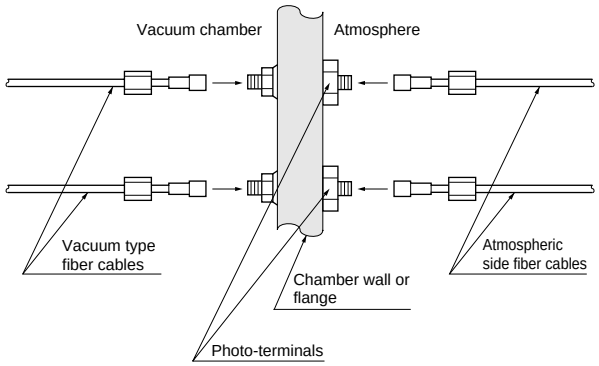


Sensing range when mounting slit mask [with FX-301(P)]

FT-WA30/A30: 2,500 mm 98.425 in (LONG) / 1,000 mm 39.370 in (STD) / 600 mm 23.622 in (FAST) / 200 mm 7.874 in (S-D)
FT-WA8/A8: 400 mm 15.748 in (LONG) / 200 mm 7.874 in (STD) / 140 mm 5.512 in (FAST) / 70 mm 2.756 in (S-D) (0.5 × 12 mm 0.020 × 0.472 in slit mask)
FT-WA8/A8: 800 mm 31.496 in (LONG) / 400 mm 15.748 in (STD) / 280 mm 11.024 in (FAST) / 140 mm 5.512 in (S-D) (1 × 12 mm 0.039 × 0.472 in slit mask)

Vacuum type fiber

Configuration

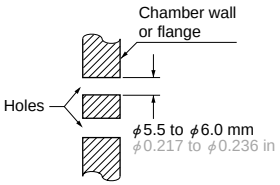


Leakage: 1.33 × 10^{-10} Pa·m^3/sec. [He] or less

Mounting

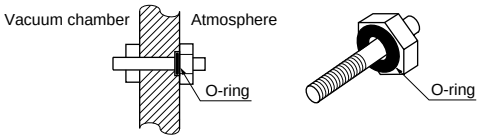
① Make two holes on the vacuum tank wall (chamber wall or flange).

Note: The hole diameter must be from ϕ5.5 to ϕ6.0 mm ϕ0.217 to ϕ0.236 in.



② Mount the **FV-BR1** photo-terminal on the vacuum tank wall.

Notes: 1) The attached O-ring must be mounted.
2) The O-ring must be used at the atmospheric side.
3) The tightening torque should be 0.58 N·m or less.



③ Mount the **FT-J6** atmospheric side fibers on the atmospheric side of the **FV-BR1** photo-terminals.

Notes: 1) The fixing nuts must be tightened securely. If not, the sensing range may decrease.
2) The tightening torque should be 0.58 N·m or less.

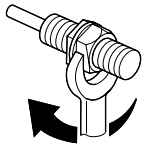
④ Mount the vacuum type fibers on the vacuum side of the **FV-BR1** photo-terminals.

Notes: 1) The fixings rings of the vacuum type fibers must be tightened securely. If not, the sensing range may decrease.
2) The tightening torque should be 0.58 N·m or less.

⑤ Fix the fiber head of the vacuum type fiber.

Note: The maximum tightening torque should be as given below.

	Tightening torque
M2.6	0.29 N·m
M4 M6	0.58 N·m



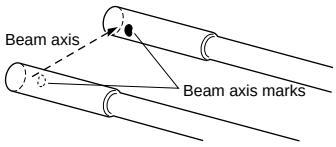
PRECAUTIONS FOR PROPER USE

Refer to p.1135～ for general precautions.

Fiber

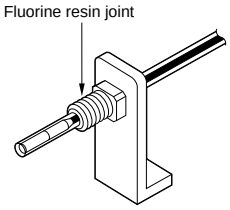
FT-L8Y/V8Y chemical-resistant type fiber

- Do not use it in the following chemicals:
  Dissolved alkali metals (Natrium, Potassium or Lithium), Fluorine gas (F_2), ClF_3, OF_2 (including gaseous state).
- The beam axis mark is indicated on the side-view fiber. Perform the beam alignment with the beam axis marks, on the receiver and the emitter, facing each other.

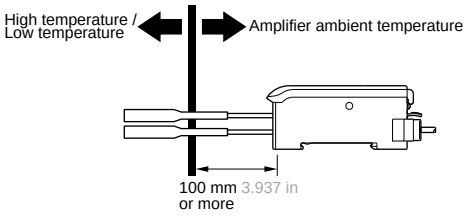


Mounting

- Use a commercial Fluorine resin joint to mount the fiber.
- The bending radius of the protective jacket should be R30 mm 1.181 in or more. It will be damaged under the value.
- The bending radius of the bear fiber should be R25 mm R0.984 in or more. The sensing range will be shortened under the value.



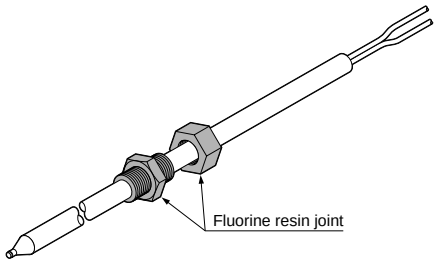
- Do not subject the fiber under tension.
- Although the chemical-resistant type fiber is rated for use up to ＋115 °C ＋239 °F, place 100 mm 3.937 in or more of the fiber in the normal temperature area to protect the amplifier.



FD-F8Y liquid level sensing fiber

Mounting

- Use a commercially available fluorine resin joint, etc., to install **FD-F8Y**.



Cautions

- Take care that unclear liquid may not be sensed stably.
- Take care that the tube may stretch by maximum 2 % of the total length if it is used at a high temperature.
- Do not scratch the fiber jacket while cutting the fluorine resin tube.

FX-301

PRECAUTIONS FOR PROPER USE

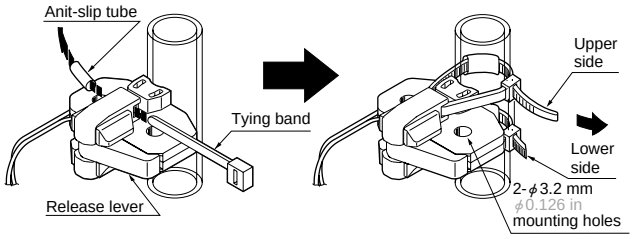
Refer to p.1135～ for general precautions.

Fiber

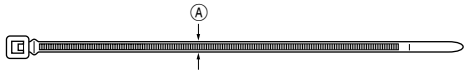
FD-F4□ and FD-F9□ liquid level sensing fiber

Mounting

- Mount the fiber head on a pipe with the attached tying bands and anti-slip tubes as shown in the figure below.
  Make sure that the release lever is retracted (position as in the fig.) before mounting.
  Fasten two tying bands, as shown, and cut off the excess portions.



- If other tying bands are to be used, the dimension Ⓐ shown in the figure below should be 2.5 mm 0.098 in or less.

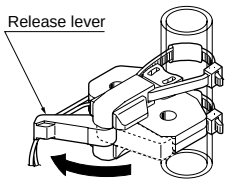


- In case of mounting using the two mounting holes, use M3 screws, plain washers, and spring washers.
  The tightening torque should be 0.5 N·m or less.
  (Please arrange the M3 screws, plain washers, and spring washers separately.)

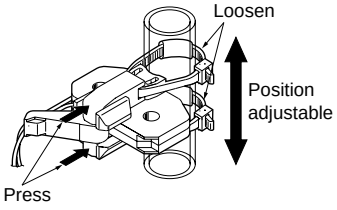
- In case of mounting on the pipe with tying bands, the fiber position can be easily adjusted.

Adjustment

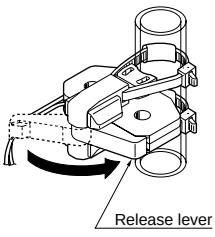
① Unlock the release lever (in the direction of the arrow).



② Press the movable center holders forward to loosen the tying bands and adjust the position.



③ Lock the release lever to its original place.



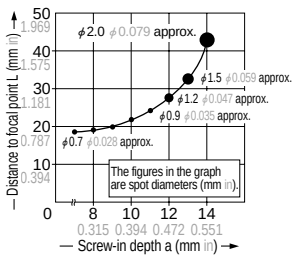
Notes: 1) Whenever the mounting position is changed, adjust the sensitivity again.
2) The lever mechanism must be used only to adjust the position, and not for tightening the tying bands. If tying bands are tightened while the lever is open, and then the lever is locked, the fiber may be damaged.

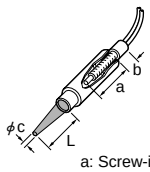
Cautions

- Liquid in a pipe which is not transparent cannot be sensed correctly.
- Unclear or viscous liquid may not be sensed.
- Fit the fiber head to the pipe securely, otherwise the operation may be erroneous.
- Take care that no dew condenses on the pipe's sensing surface or the pipe's inside wall and no bubble attaches on the pipe's inside wall, since it can affect the operation.
- Neither the **FD-F4**□ or the **FD-F9**□ is waterproof or chemical-resistant. Installation should be avoided at any place where it could come in direct contact with water or chemicals.
- Do not apply excessive tensile force to the fiber cable.

Cautions for FX-MR2 zoom lens usage

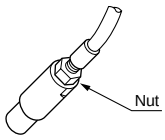
- The spot diameter and the sensing range are adjustable by the screw-in depth as follows.



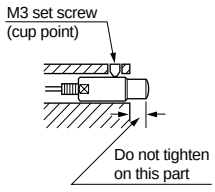


a: Screw-in depth
b: 25 – a
L: Distance to focal point
ϕc: Spot diameter

- After **FX-MR2** is set on the fiber head at the desired depth, tighten the attached nut securely.

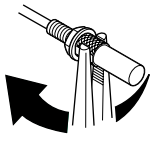


- To mount **FX-MR2** with a set screw, use a M3 set screw (cup point). The tightening torque should be 0.29 N·m or less.



Caution for FX-MR3, FX-MR6 finest spot lens usage

- Screw **FX-MR3, FX-MR6** on the fiber head until the fiber is fully inserted.
  The tightening torque should be 0.29 N·m or less.



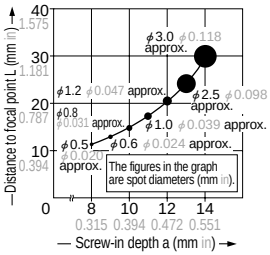
PRECAUTIONS FOR PROPER USE

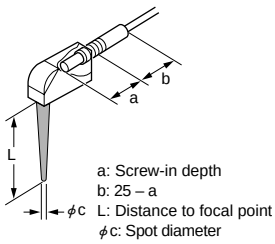
Refer to p.1135～ for general precautions.

Fiber

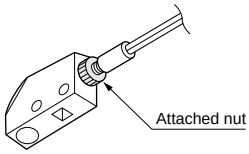
Cautions for FX-MR5 side-view zoom lens usage

- The spot diameter and the sensing range are adjustable by the screw-in depth as follows.





- After **FX-MR5** is set on the fiber head at the desired depth, tighten the attached nut **NT-FX-MR5** securely.



- The tightening torque should be 0.5 N·m or less when tightening **FX-MR5** with a screw.

Fitting protective tube

- The threaded head free-cut fiber can be fitted with a protective tube.

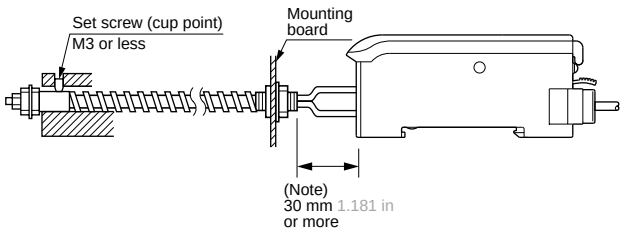
Fitting

① Insert the fiber cable into the protective tube from the sleeve side.

② Turn the fiber head to screw it on the inner thread of the sleeve.

Mounting

- The maximum tightening torque should be as given below.



<Sleeve part>
Tightening torque:
0.58 N·m or less

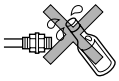
<Threaded part>
Tightening torque:
0.58 N·m or less

Note: The fiber cable must be longer than the protective tube by 30 mm 1.181 in or more to connect it to the amplifier. Make sure to measure the length required before cutting.

Others

- Do not use the fiber at places having intense vibrations, as this can cause malfunction.
- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.

- Do not expose the fiber cable to any organic solvents. (Excluding chemical-resistant type fiber)



- Do not use the fiber head in places where it may come in direct contact with water. A water drop on the fiber head deteriorates the sensing.
- Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.
- Do not apply excessive tensile force to the fiber cable.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.

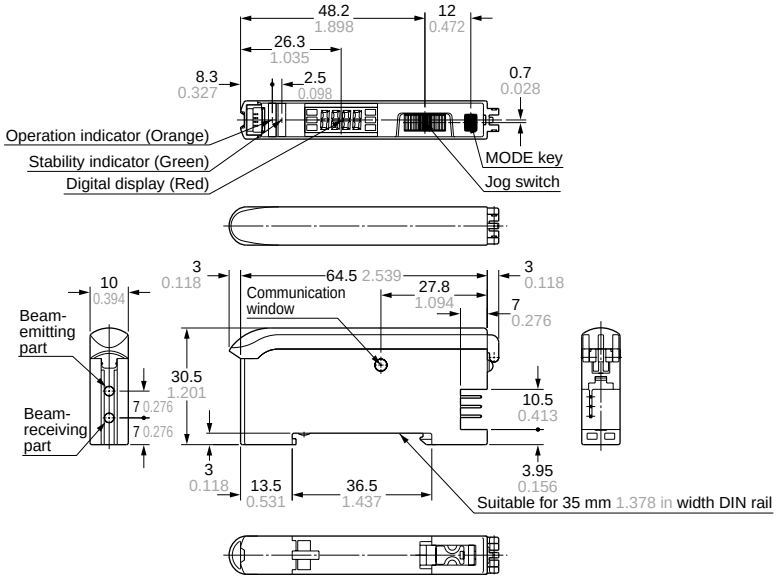
- Since the sensing portion of the wide beam or narrow beam fiber is concave shaped, take care that dust or dirt does not collect on it.
  In case it does collect, wipe it with a dry soft cloth.

FX-301

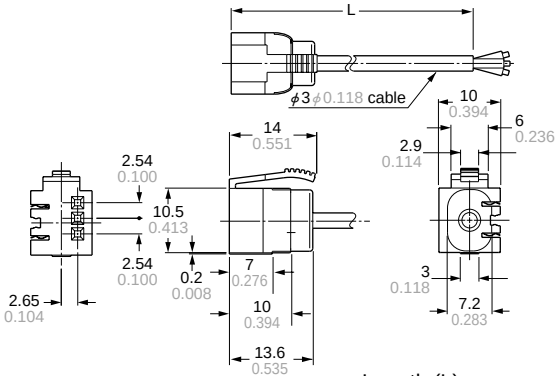
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

FX-301□ FX-301□P Amplifier



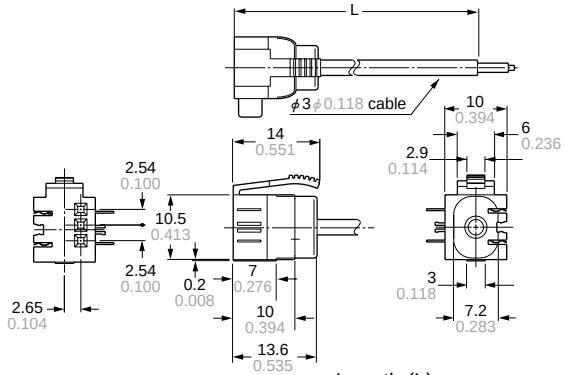
CN-73-C1 CN-73-C2 CN-73-C5 Main cable (Optional)



• Length (L)

Model No.	Length (mm in)
CN-73-C1	1,000 39.370
CN-73-C2	2,000 78.740
CN-73-C5	5,000 196.850

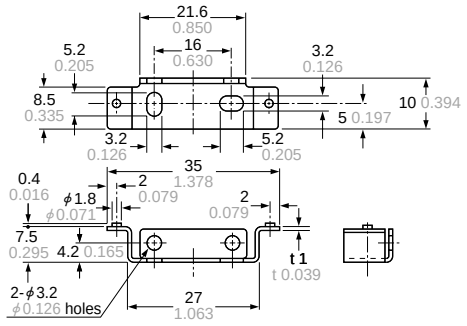
CN-71-C1 CN-71-C2 CN-71-C5 Sub cable (Optional)



• Length (L)

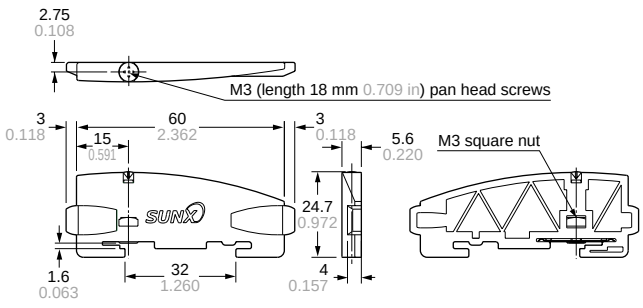
Model No.	Length (mm in)
CN-71-C1	1,000 39.370
CN-71-C2	2,000 78.740
CN-71-C5	5,000 196.850

MS-DIN-2 Amplifier mounting bracket (Optional)



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

MS-DIN-E End plate (Optional)

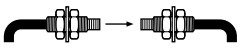


Material: Polycarbonate

DIMENSIONS (Unit: mm in)

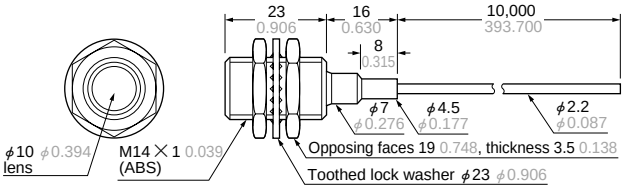
The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

Thru-beam type fibers



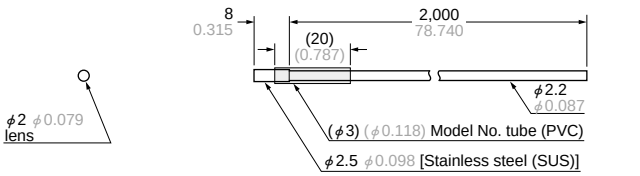
FT-FM10L

Free-cut — With FX-AT3



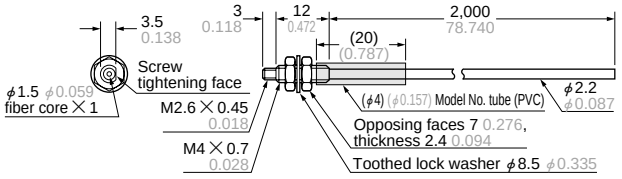
FT-SFM2L

Free-cut — With FX-AT3



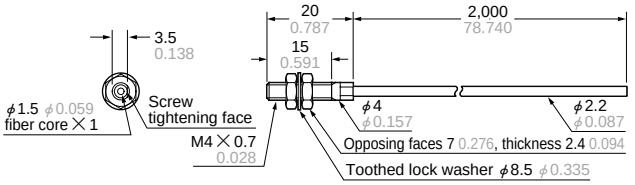
FT-B8

Free-cut — With FX-AT3



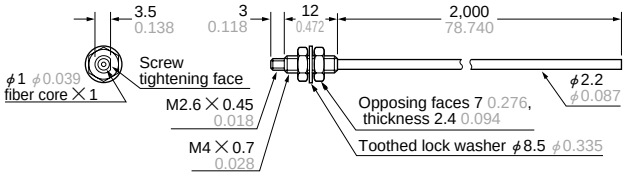
FT-NB8

Free-cut



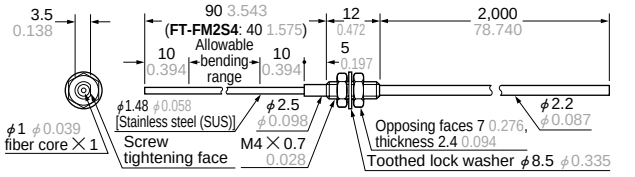
FT-FM2

Free-cut — With FX-AT3



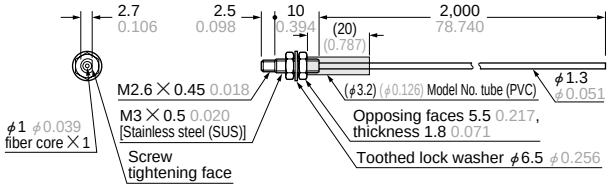
FT-FM2S FT-FM2S4

Free-cut — With FX-AT3



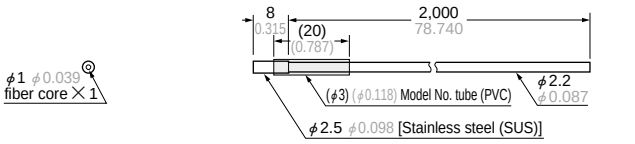
FT-T80

Free-cut — With FX-AT5



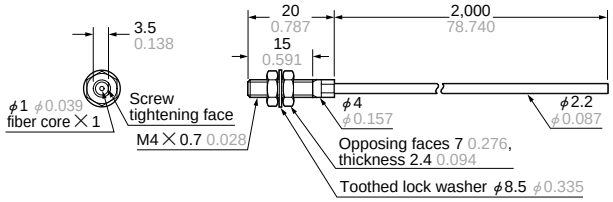
FT-SFM2

Free-cut — With FX-AT3



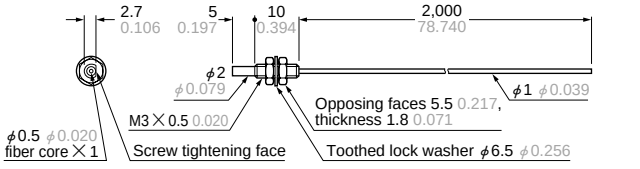
FT-N8

Free-cut



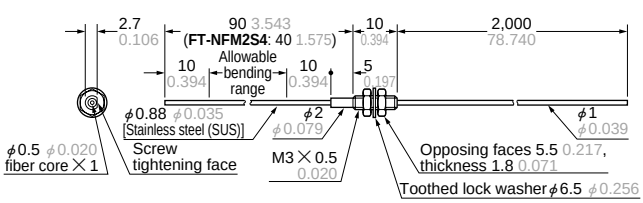
FT-NFM2

Free-cut — With FX-AT4



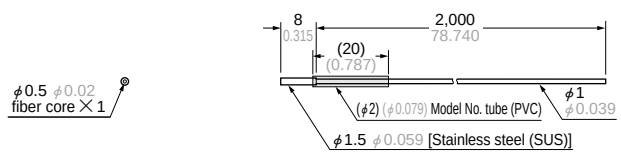
FT-NFM2S FT-NFM2S4

Free-cut — With FX-AT4



FT-SNFM2

Free-cut — With FX-AT4



FX-301

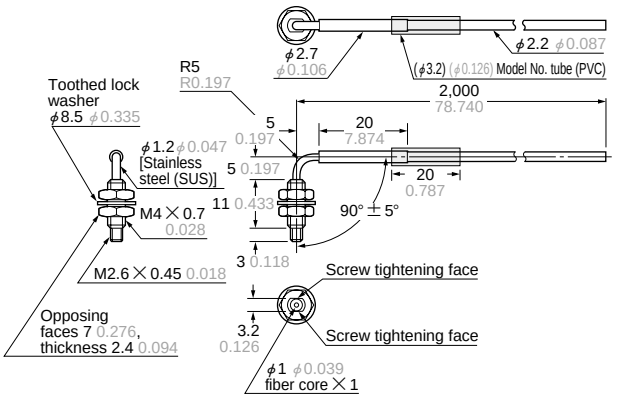
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

Thru-beam type fibers

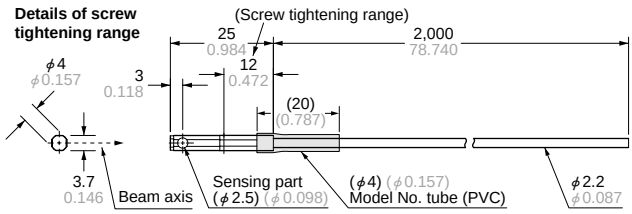
FT-R80

Free-cut — With FX-AT3



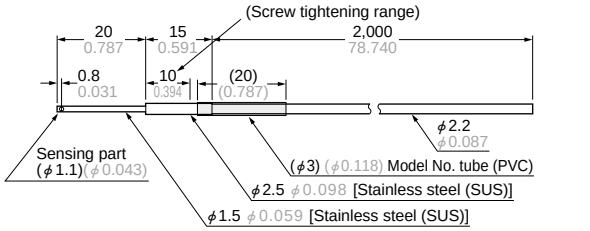
FT-V10

Free-cut — With FX-AT3



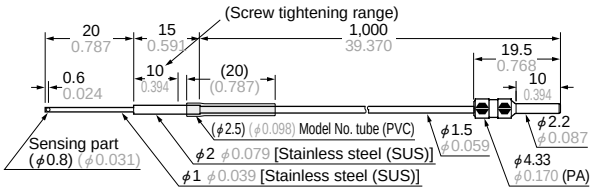
FT-SFM2SV2

Free-cut — With FX-AT3



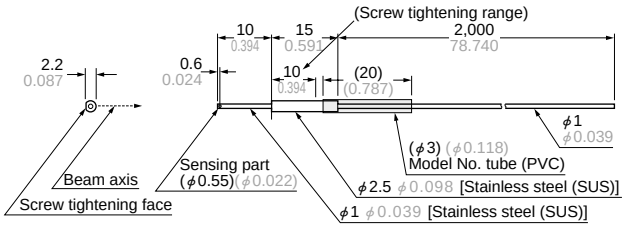
FT-V22

With FX-AT2



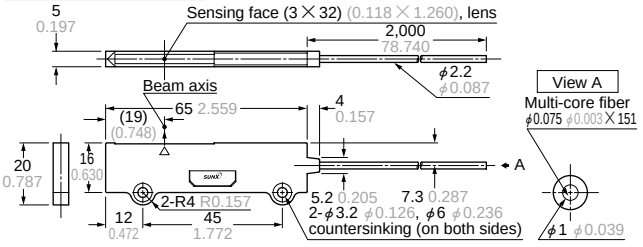
FT-V41

Free-cut — With FX-AT4



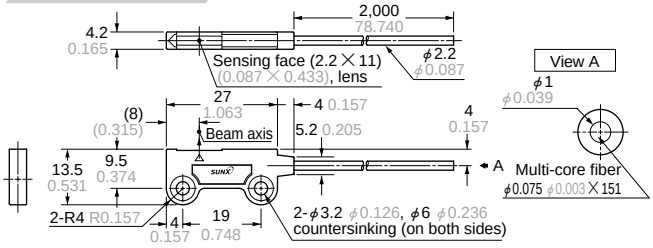
FT-WA30

Free-cut — With FX-AT3



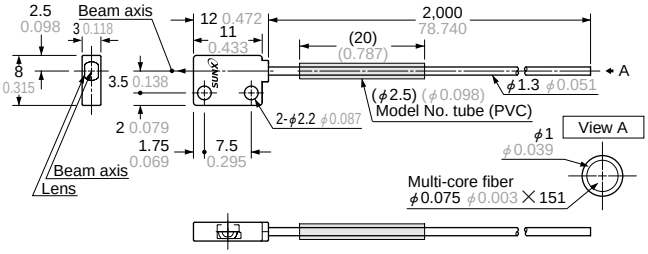
FT-WA8

Free-cut — With FX-AT3



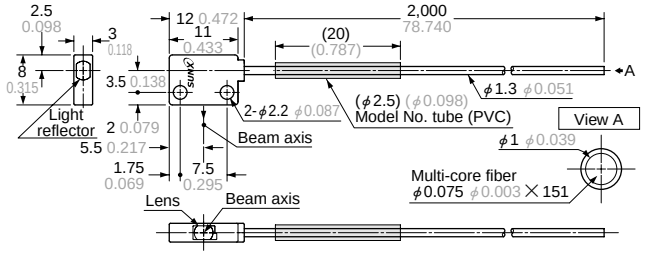
FT-WZ8H

Free-cut — With FX-AT5



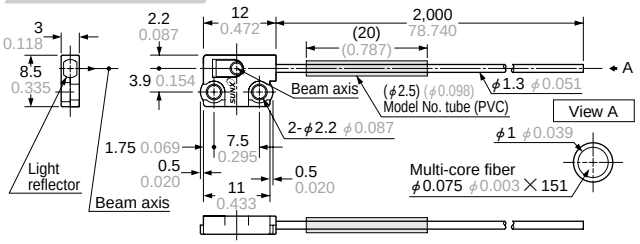
FT-WZ8E

Free-cut — With FX-AT5



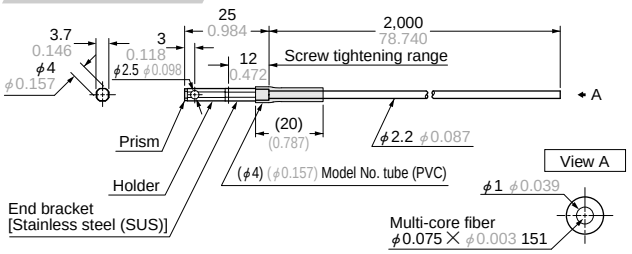
FT-WZ8

Free-cut — With FX-AT5



FT-WKV8

Free-cut — With FX-AT3

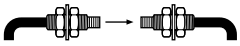


Note: The emiter and receiver are symmetric.

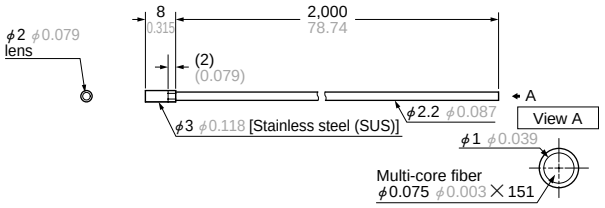
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

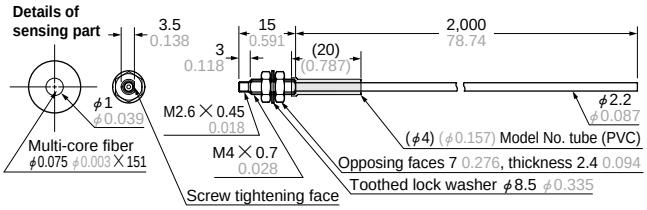
Thru-beam type fibers



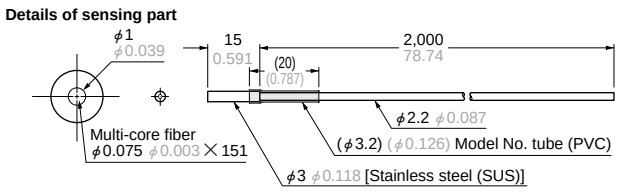
FT-WS8L — Free-cut — With FX-AT3



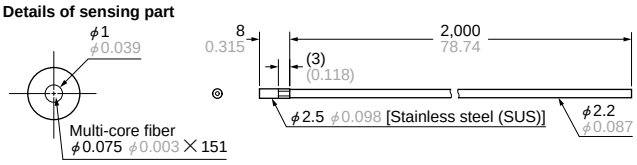
FT-W8 — Free-cut — With FX-AT3



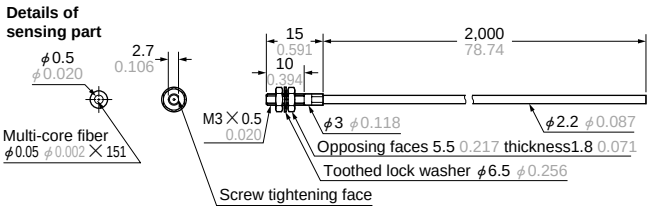
FT-WS3 — Free-cut — With FX-AT3



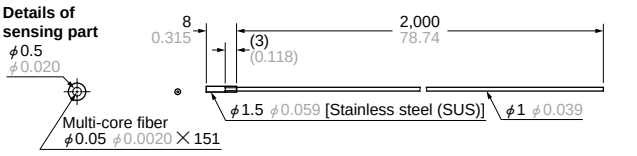
FT-WS8 — Free-cut — With FX-AT3



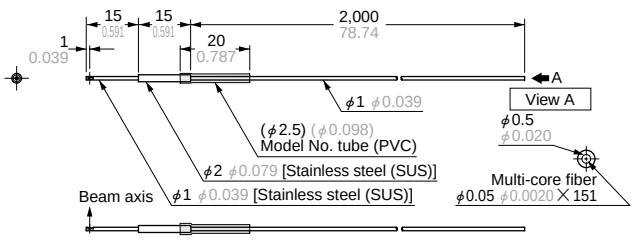
FT-W4 — Free-cut — With FX-AT3



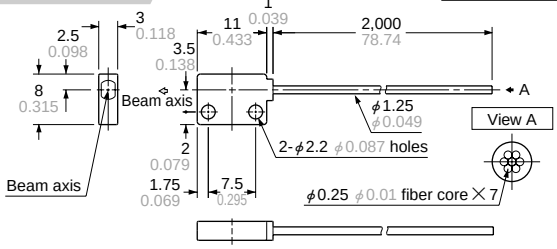
FT-WS4 — Free-cut — With FX-AT4



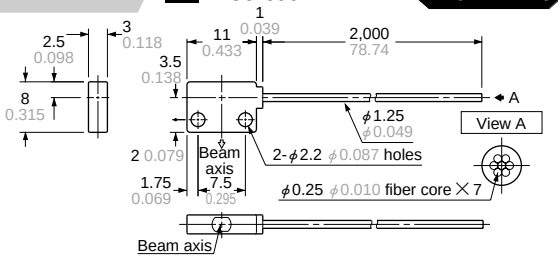
FT-WV42 — Free-cut — With FX-AT4



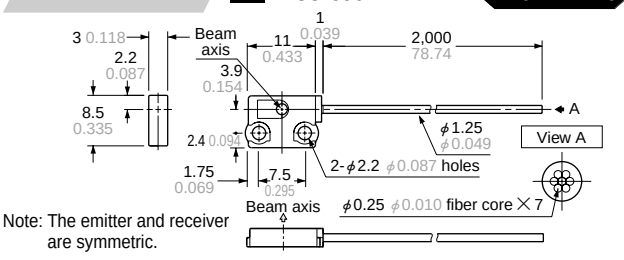
FT-Z8H — Free-cut — With FX-AT5



FT-Z8E — Free-cut — With FX-AT5

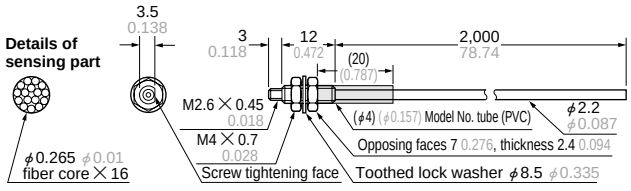


FT-Z8 — Free-cut — With FX-AT5

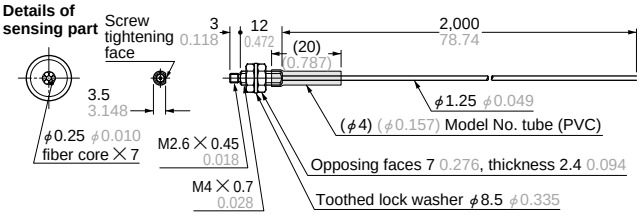


Note: The emitter and receiver are symmetric.

FT-P80 — Free-cut



FT-P60 — Free-cut — With FX-AT5

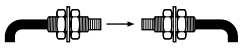


FX-301

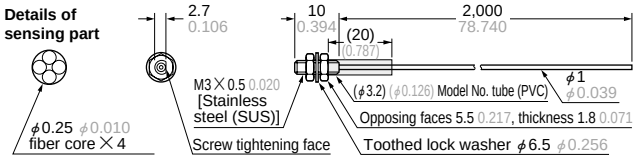
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

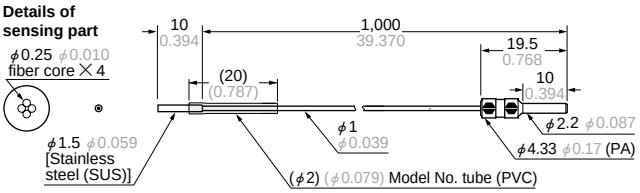
Thru-beam type fibers



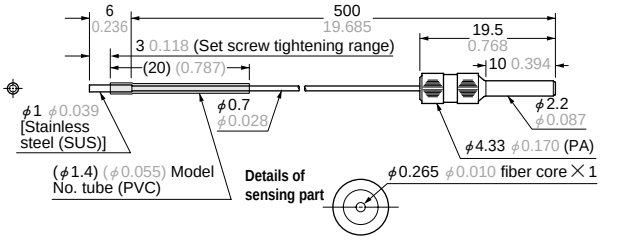
FT-P40 — Free-cut — With FX-AT4



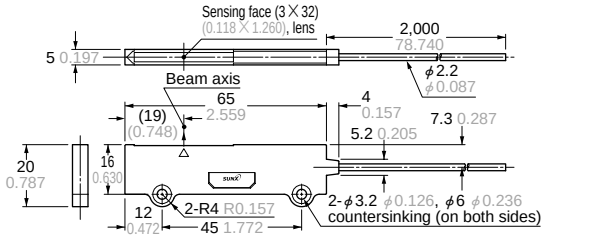
FT-P2 — With FX-AT2



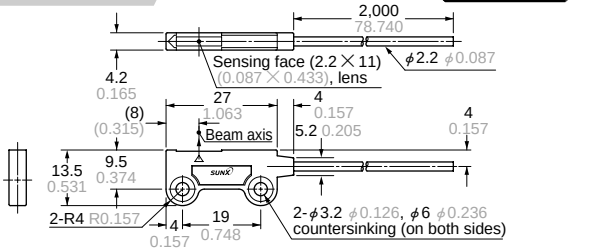
FT-PS1 — With FX-AT2



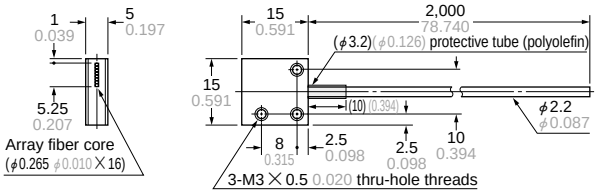
FT-A30 — Free-cut — With FX-AT3



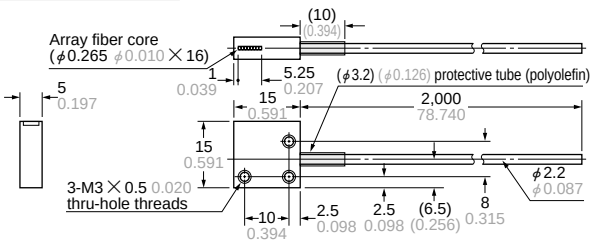
FT-A8 — Free-cut — With FX-AT3



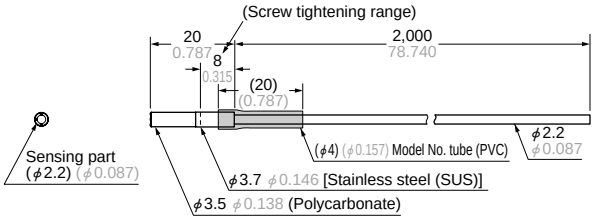
FT-AFM2 — Free-cut — With FX-AT3



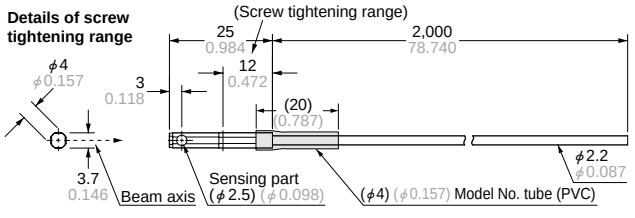
FT-AFM2E — Free-cut — With FX-AT3



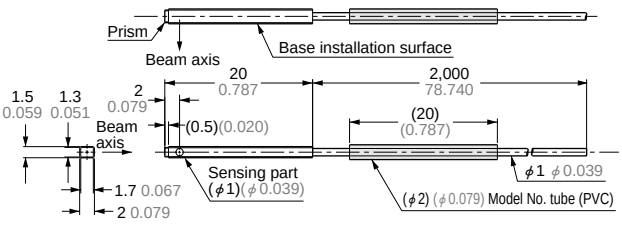
FT-K8 — Free-cut — With FX-AT3



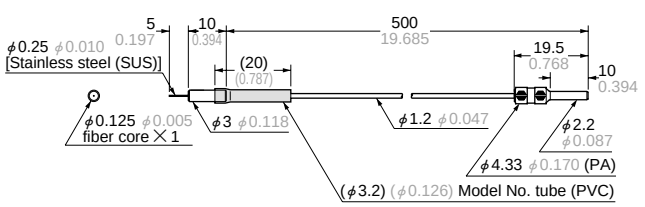
FT-KV8 — Free-cut — With FX-AT3



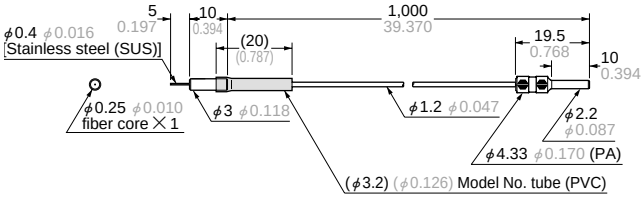
FT-KV1 — Free-cut — With FX-AT4



FT-E12 — With FX-AT2



FT-E22 — With FX-AT2



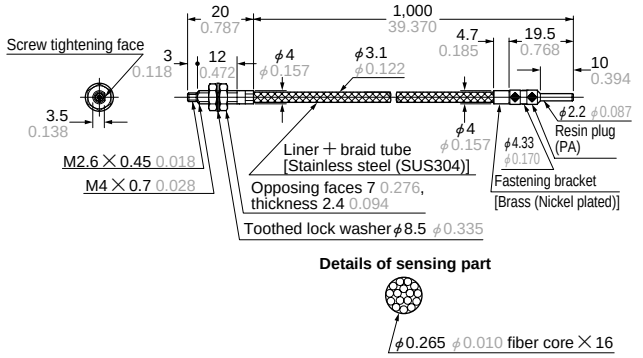
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

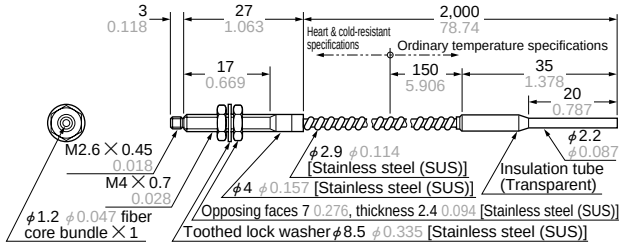
Thru-beam type fibers

FT-P81X

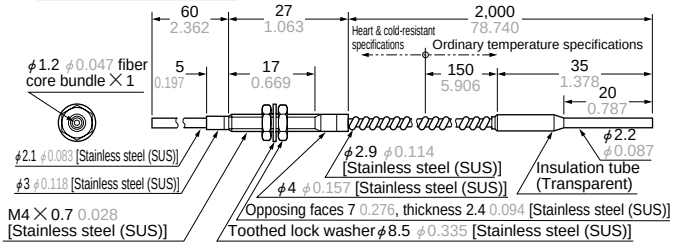
With FX-AT2



FT-H35-M2

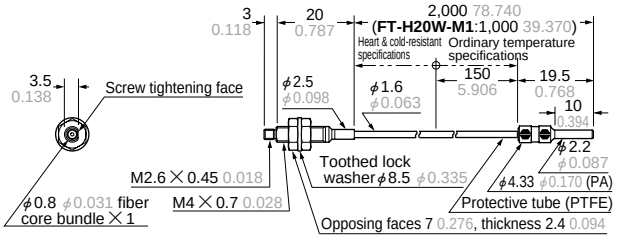


FT-H35-M2S6

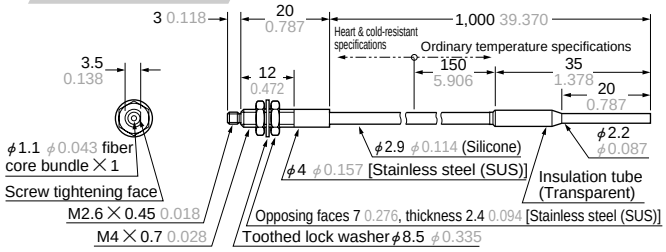


FT-H20W-M1 FT-H20W-M2

With FX-AT2



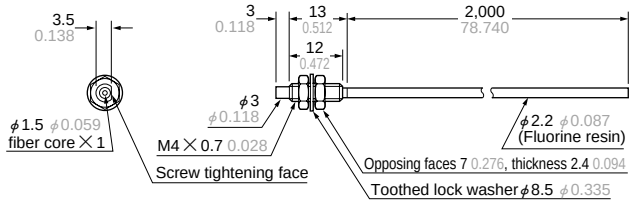
FT-H20-M1



FT-H13-FM2

Free-cut

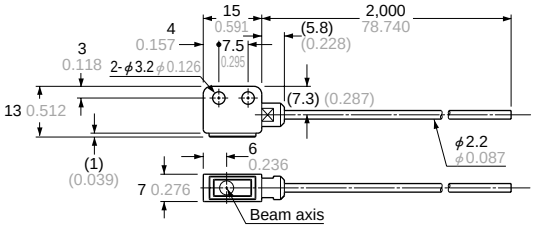
With FX-AT3



FT-Z802Y

Free-cut

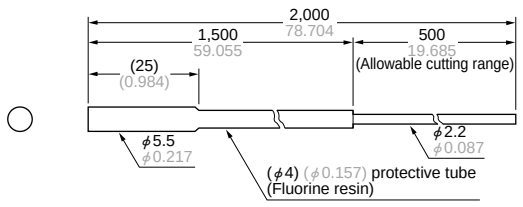
With FX-AT3



FT-L8Y

Free-cut

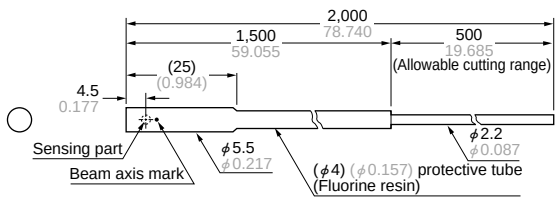
With FX-AT3



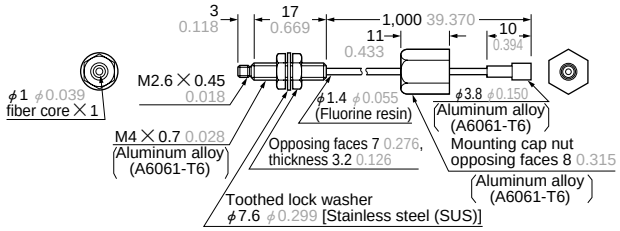
FT-V8Y

Free-cut

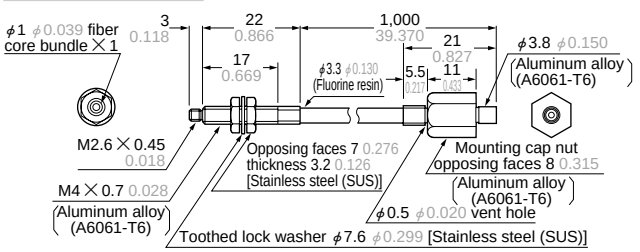
With FX-AT3



FT-6V



FT-60V



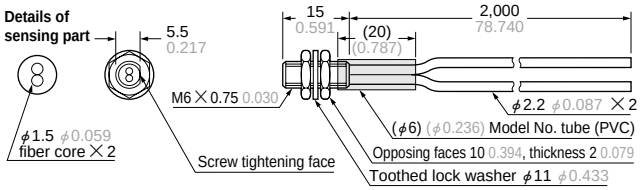
FX-301

DIMENSIONS (Unit: mm in)

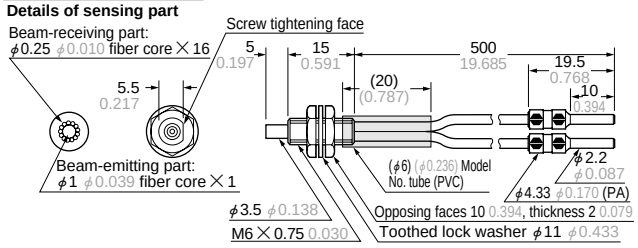
The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

Reflective type fibers

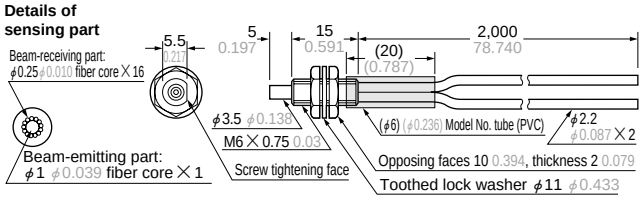
FD-B8 — Free-cut — With FX-AT3



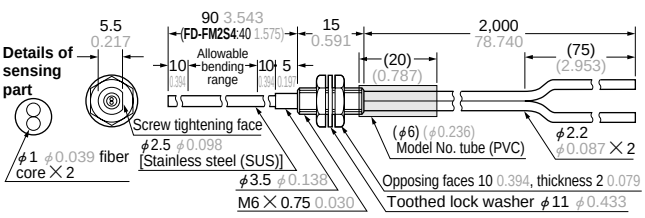
FD-5 — With FX-AT2



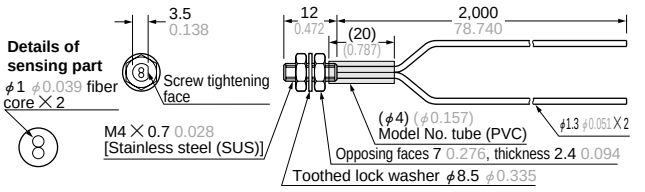
FD-FM2 — Free-cut — With FX-AT3



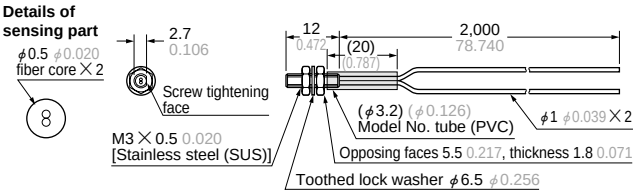
FD-FM2S FD-FM2S4 — Free-cut — With FX-AT3



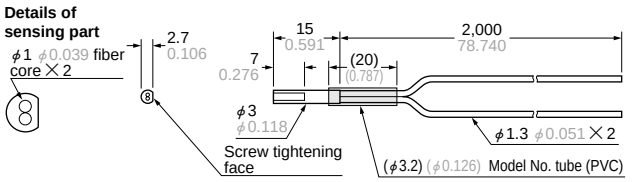
FD-T80 — Free-cut — With FX-AT5



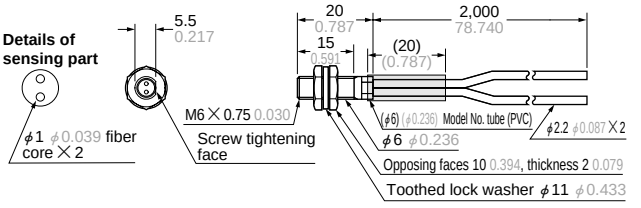
FD-T40 — Free-cut — With FX-AT4



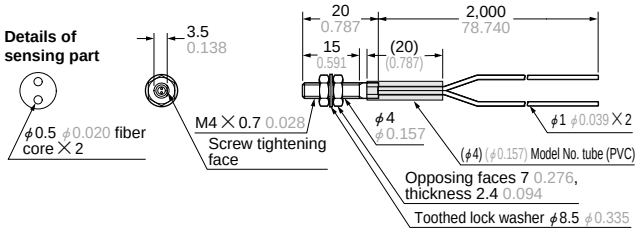
FD-S80 — Free-cut — With FX-AT5



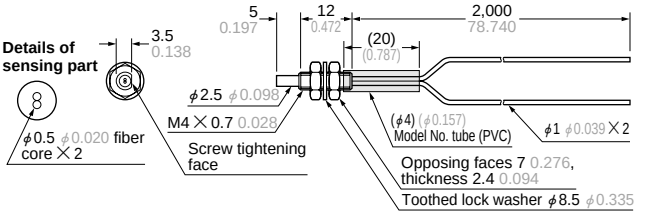
FD-N8 — Free-cut



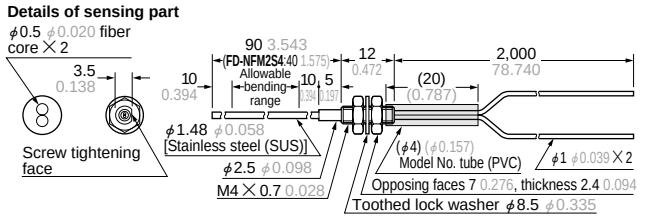
FD-N4 — Free-cut — With FX-AT10



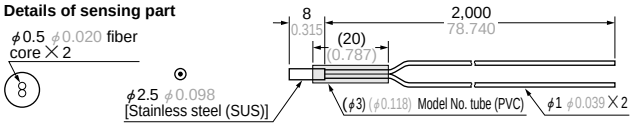
FD-NFM2 — Free-cut — With FX-AT4



FD-NFM2S FD-NFM2S4 — Free-cut — With FX-AT4



FD-SNFM2 — Free-cut — With FX-AT4



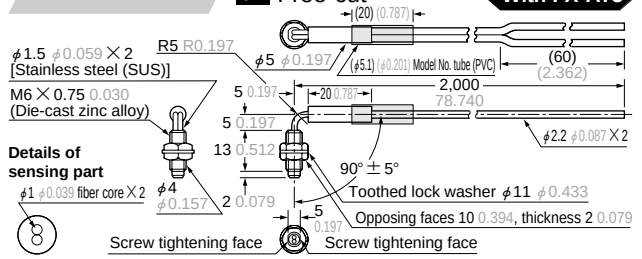
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

Reflective type fibers

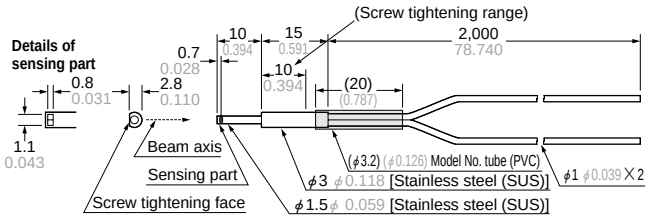
FD-R80

Free-cut — With FX-AT3



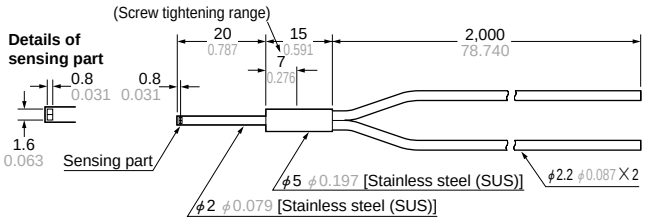
FD-V41

Free-cut — With FX-AT4



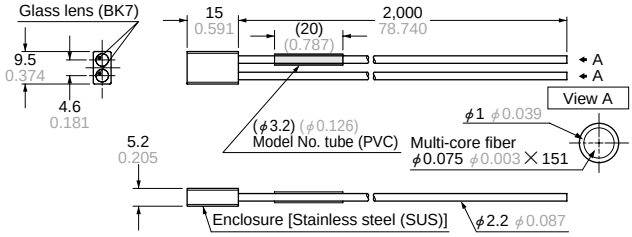
FD-SFM2SV2

Free-cut — With FX-AT3



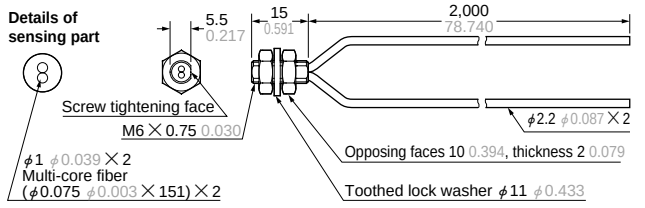
FD-WKZ1

Free-cut — With FX-AT3



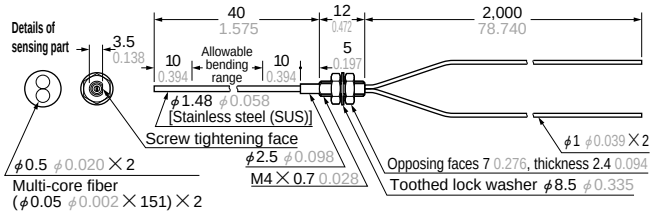
FD-W8

Free-cut — With FX-AT3



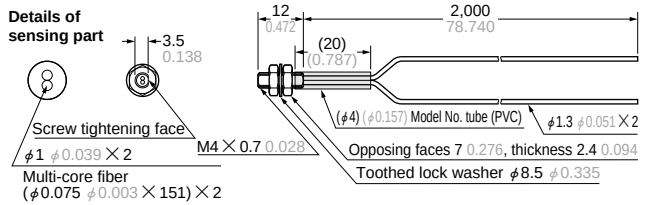
FD-W44

Free-cut — With FX-AT4



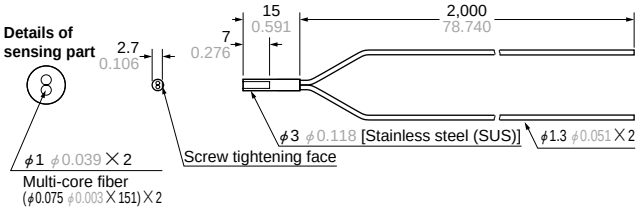
FD-WT8

Free-cut — With FX-AT5



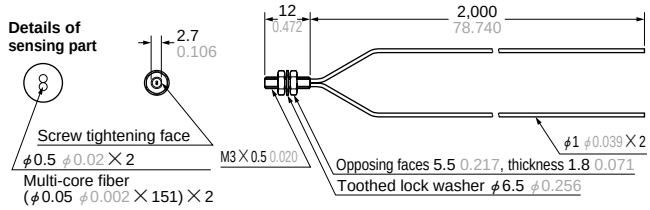
FD-WS8

Free-cut — With FX-AT5



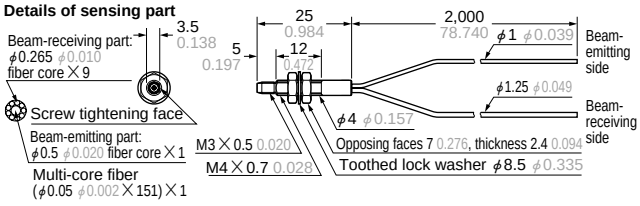
FD-WT4

Free-cut — With FX-AT4



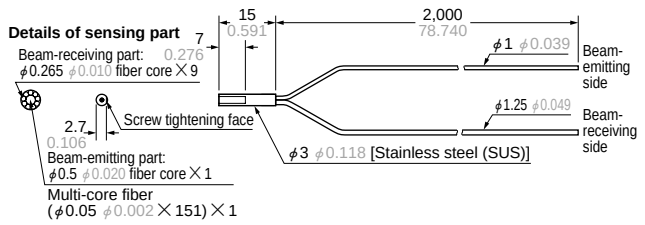
FD-WG4

Free-cut — With FX-AT6



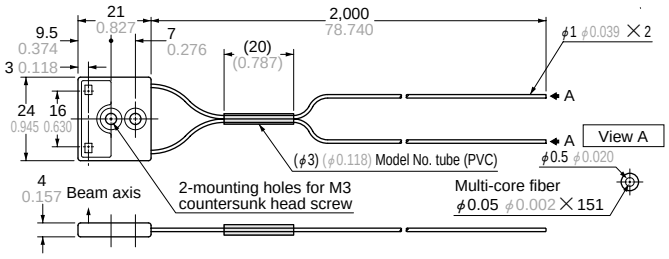
FD-WSG4

Free-cut — With FX-AT6



FD-WL41

Free-cut — With FX-AT4

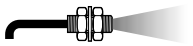


FX-301

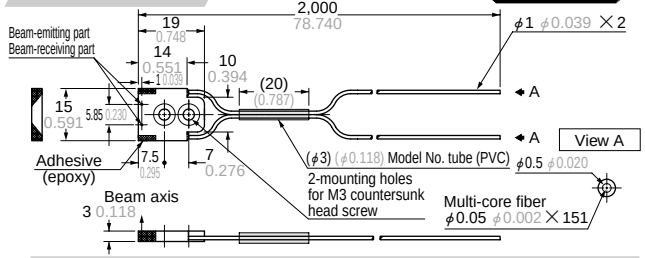
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

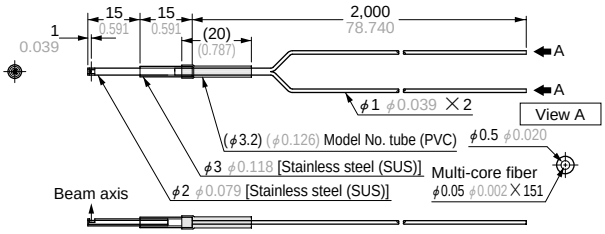
Reflective type fibers



FD-WL42 — Free-cut — With FX-AT4

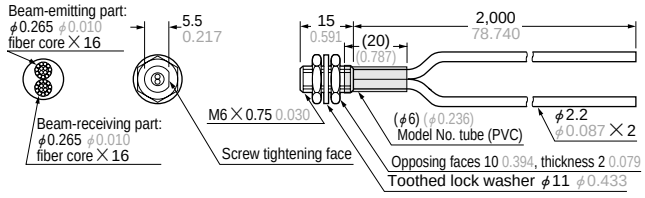


FD-WV42 — Free-cut — With FX-AT4



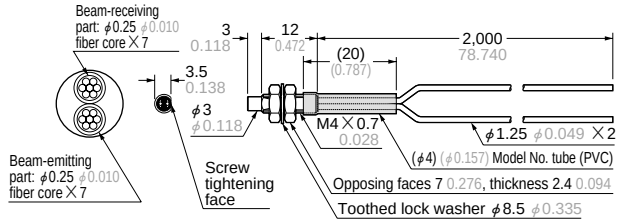
FD-P80 — Free-cut

Details of sensing part



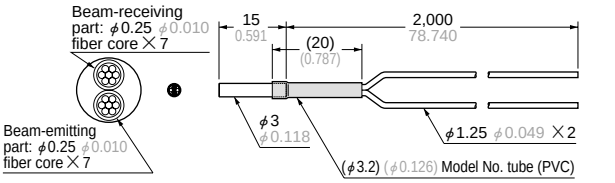
FD-P60 — Free-cut — With FX-AT5

Details of sensing part



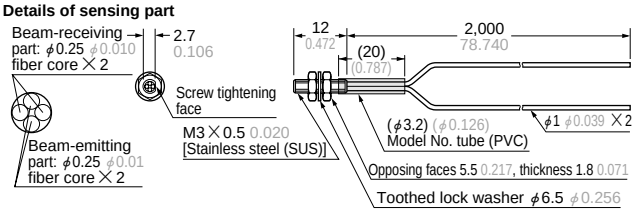
FD-P50 — Free-cut — With FX-AT5

Details of sensing part



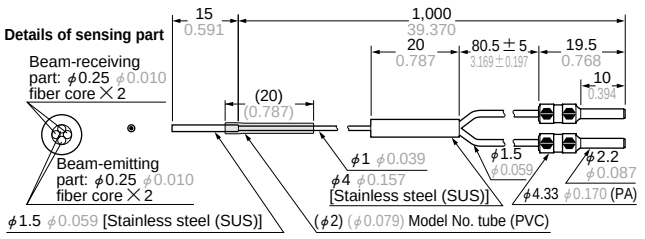
FD-P40 — Free-cut — With FX-AT4

Details of sensing part

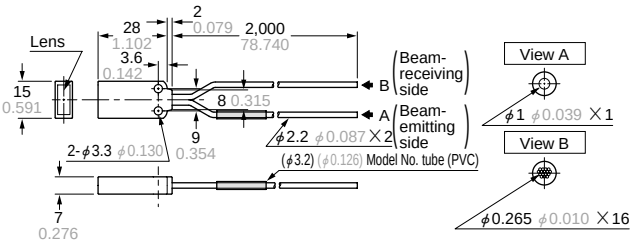


FD-P2 — With FX-AT2

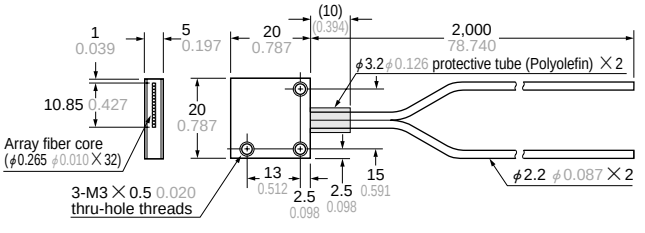
Details of sensing part



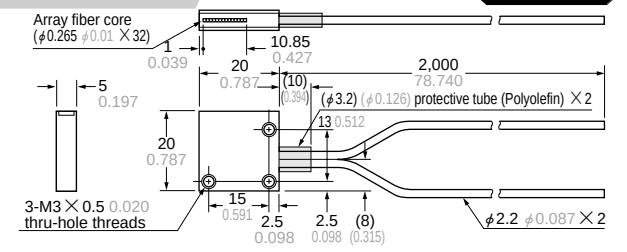
FD-A15 — Free-cut — With FX-AT3



FD-AFM2 — Free-cut — With FX-AT3

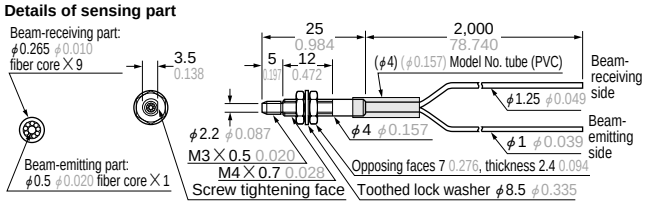


FD-AFM2E — Free-cut — With FX-AT3



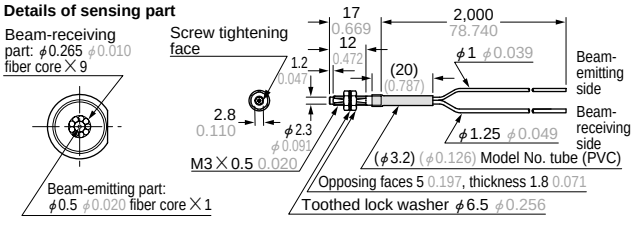
FD-G4 — Free-cut — With FX-AT6

Details of sensing part



FD-G6 — Free-cut — With FX-AT6

Details of sensing part



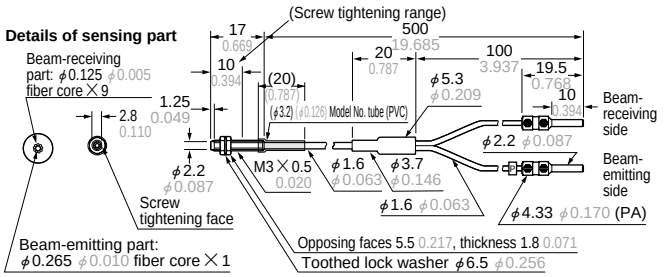
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

Reflective type fibers

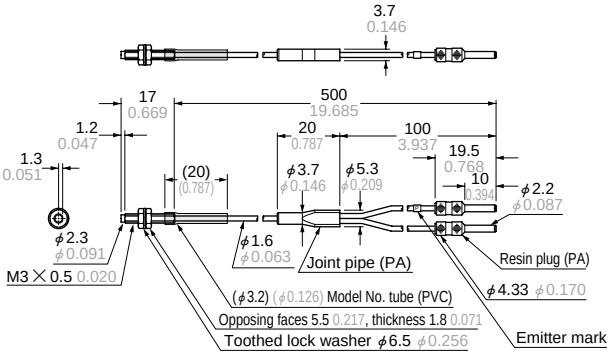
FD-EG1

With FX-AT2

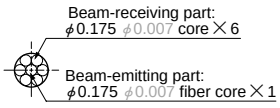


FD-EG2

With FX-AT2

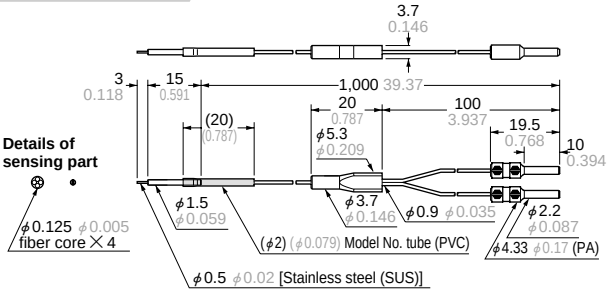


Details of sensing part



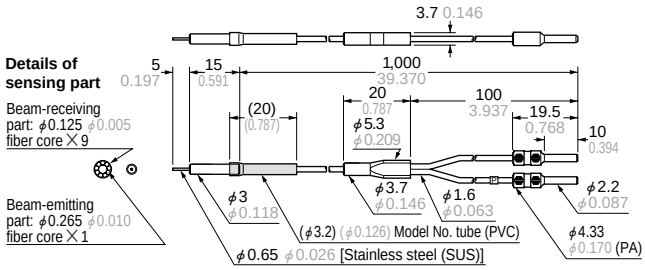
FD-E12

With FX-AT2



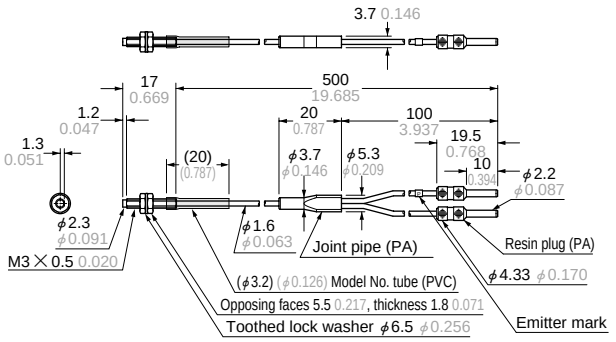
FD-E22

With FX-AT2

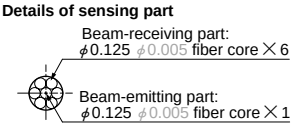


FD-EG3

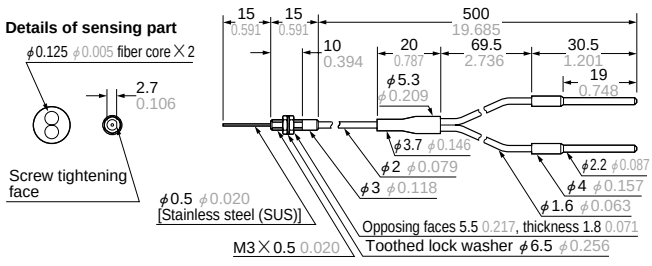
With FX-AT2



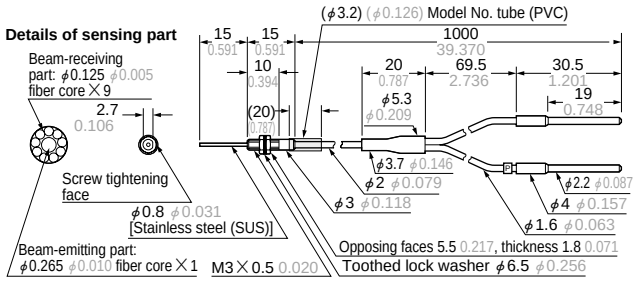
Details of sensing part



FD-EN500S1



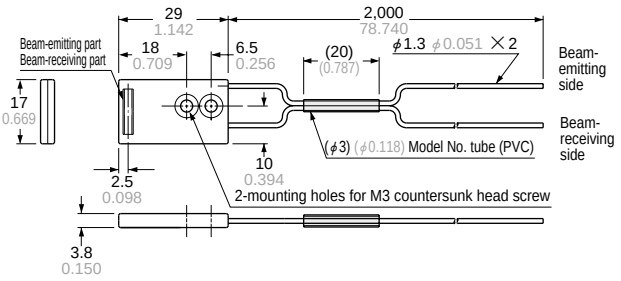
FD-ENM1S1



FD-L43

Free-cut

With FX-AT5

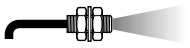


FX-301

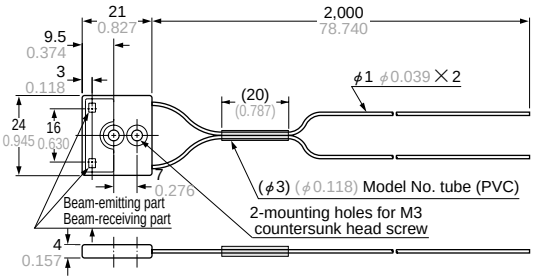
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

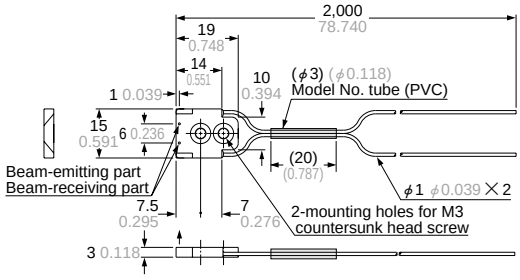
Reflective type fibers



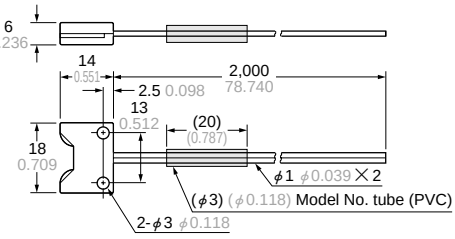
FD-L41 — Free-cut — With FX-AT4



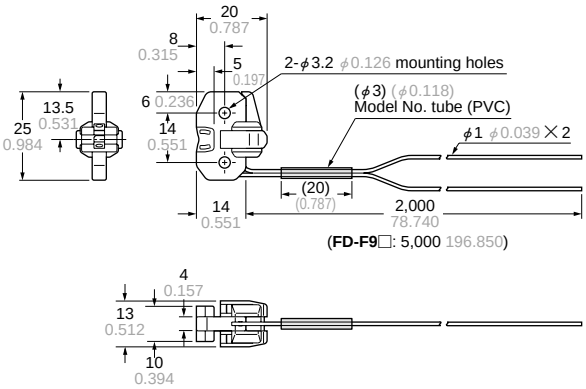
FD-L42 — Free-cut — With FX-AT4



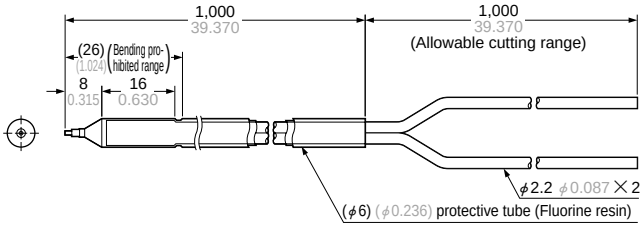
FD-L4 — Free-cut — With FX-AT4



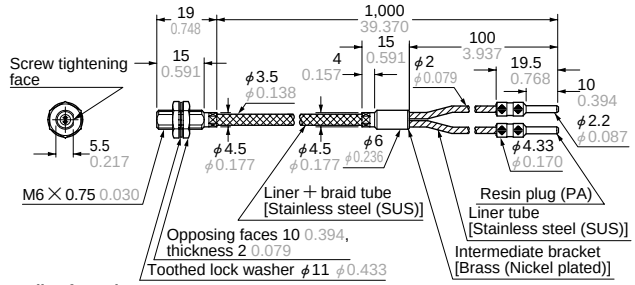
FD-F41 FD-F91 FD-F4 FD-F9 — Free-cut — With FX-AT4



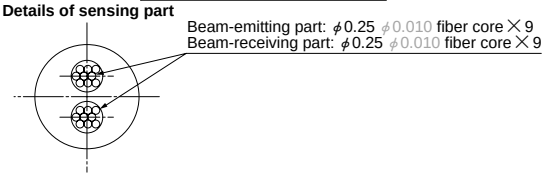
FD-F8Y — Free-cut — With FX-AT3



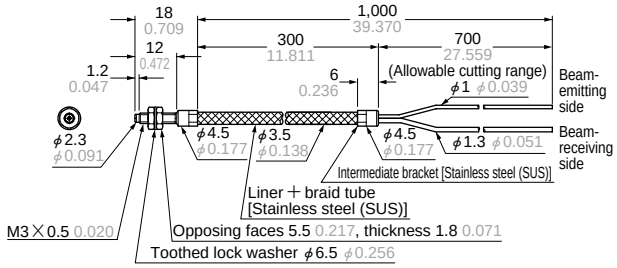
FD-P81X — With FX-AT2



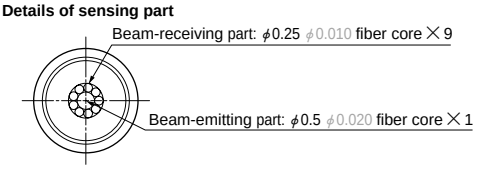
Details of sensing part



FD-G6X — Free-cut — With FX-AT6



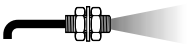
Details of sensing part



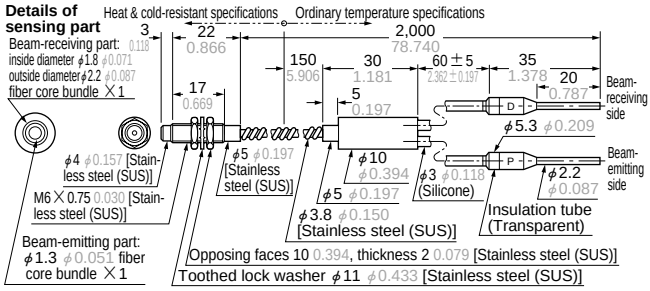
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

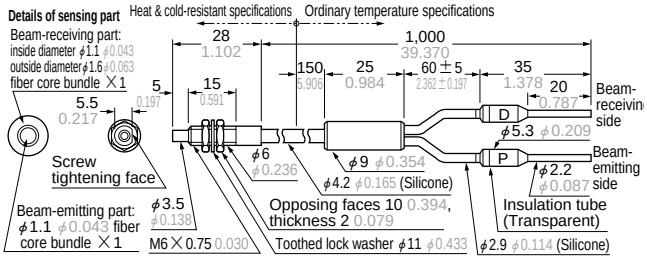
Reflective type fibers



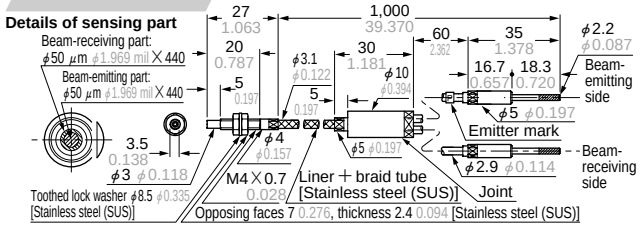
FD-H35-M2



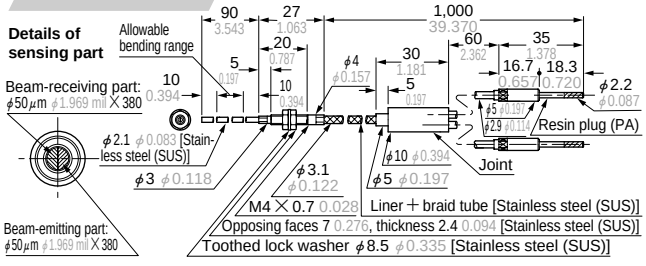
FD-H20-M1



FD-H20-21



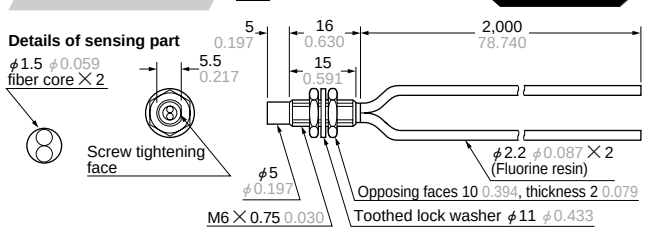
FD-H35-20S



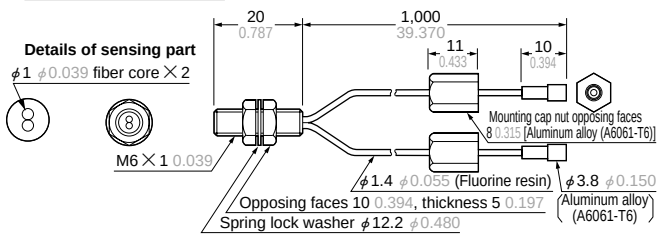
FD-H13-FM2

Free-cut

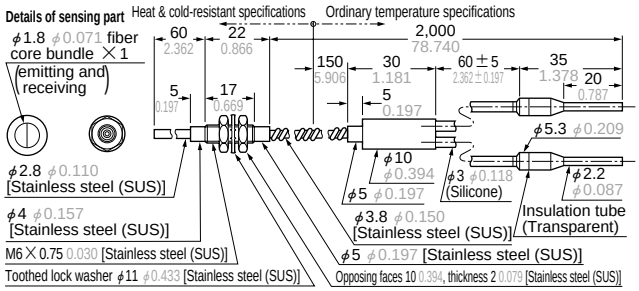
With FX-AT3



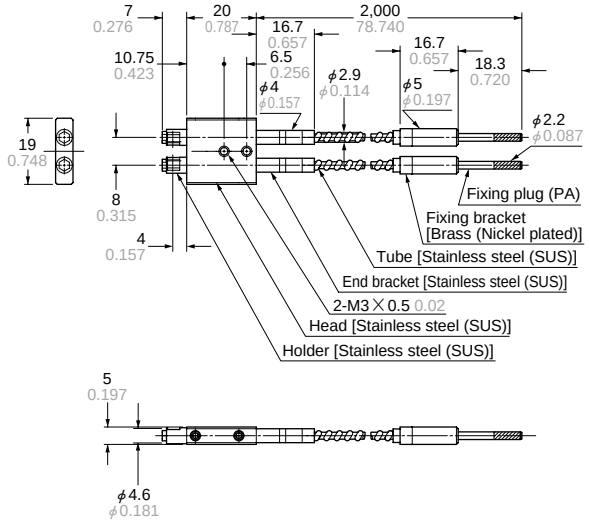
FD-6V



FD-H35-M2S6



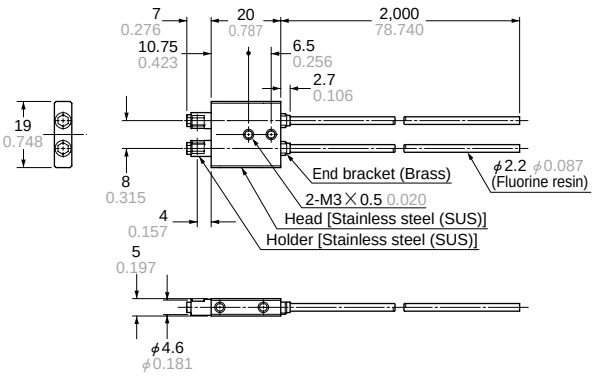
FD-H30-L32



FD-H18-L31

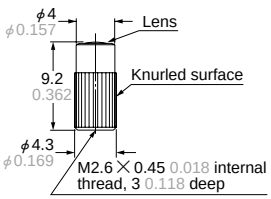
Free-cut

With FX-AT3



FX-LE1

Expansion lens (Optional)



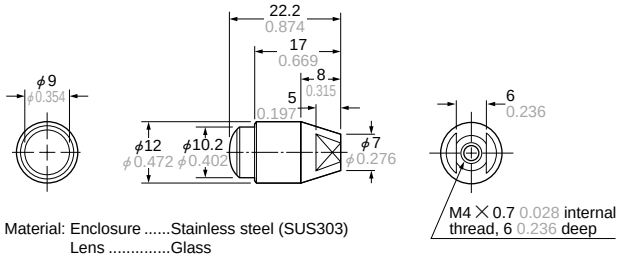
Material: Enclosure .....Brass (Nickel plated)
Lens .....Glass

FX-301

DIMENSIONS (Unit: mm in)

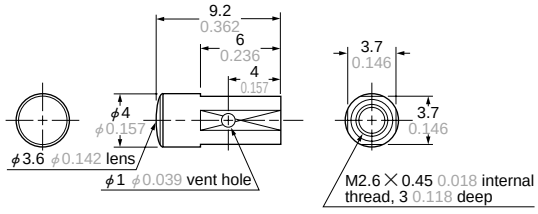
The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

FX-LE2 Super-expansion lens (Optional)



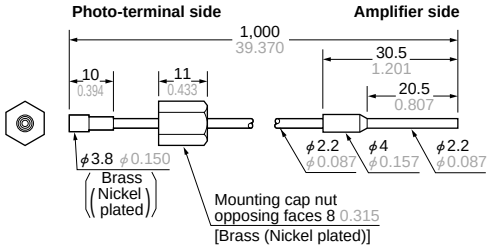
Material: Enclosure .....Stainless steel (SUS303)
Lens .....Glass

FV-LE1 Expansion lens (For vacuum type fiber · Optional)

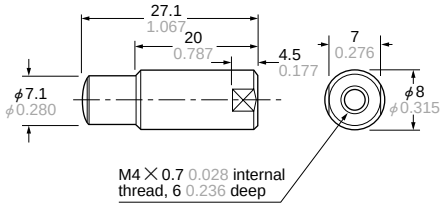


Material: Enclosure .....Aluminum alloy (A6061-T6)
Lens BK-7

FT-J6 Fiber at atmospheric side (For vacuum type fiber · Optional)

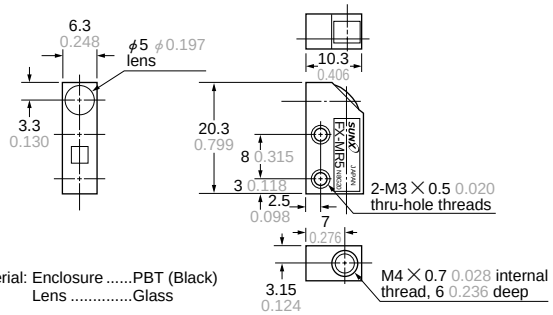


FX-MR2 Zoom lens (Optional)



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

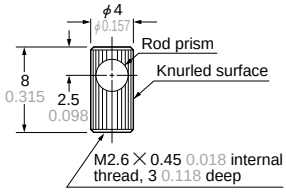
FX-MR5 Zoom lens (Optional)



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

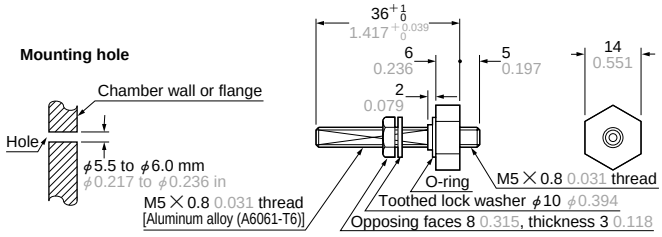
NT-FX-MR5 (exclusive nut) is attached.

FX-SV1 Side-view lens (Optional)

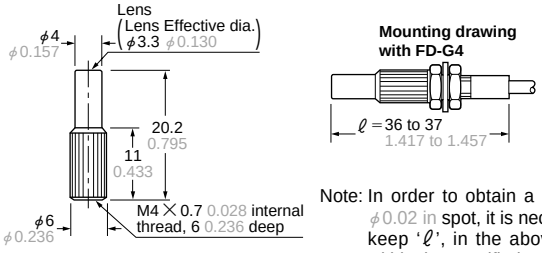


Material: Enclosure .....Brass (Nickel plated)
Lens .....Glass

FV-BR1 Photo-terminal (For vacuum type fiber · Optional)



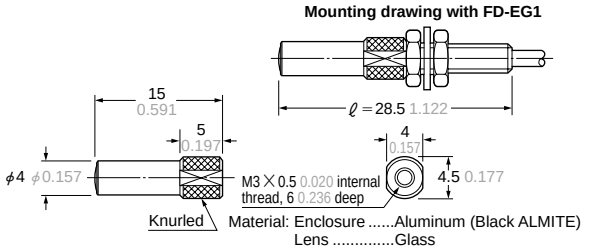
FX-MR1 Pinpoint spot lens (Optional)



Note: In order to obtain a ϕ0.5 mm ϕ0.02 in spot, it is necessary to keep 'ℓ', in the above figure, within the specified range.

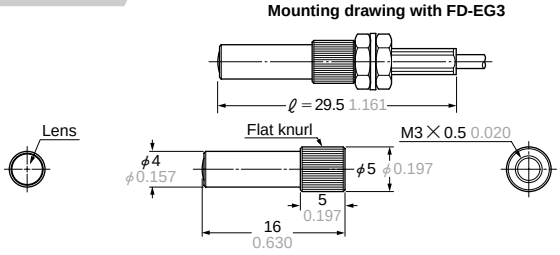
Material: Enclosure .....Aluminum (Black ALMITE)
Lens .....Glass

FX-MR3 Finest spot lens (Optional)



Notes: 1) In order to obtain a ϕ0.3 mm ϕ0.012 in spot, it is necessary for 'ℓ', in the above figure, to be 28.5 mm 1.122 in.
2) When inserting the fiber, insert it fully till it stops.

FX-MR6 Finest spot lens (Optional)



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

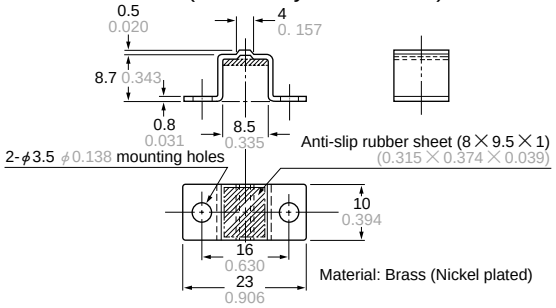
Notes: 1) In order to obtain a ϕ0.1 mm ϕ0.004 in spot, it is necessary for 'ℓ', in the above figure, to be 29.5 mm 1.161 in.
2) When inserting the fiber, insert it fully till it stops.

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX fiber sensor website: http://www.fiber-sensor.com/

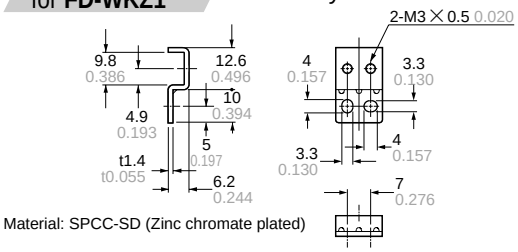
MS-EX-3

Mounting bracket for **FX-MR2**
(Accessory for **FX-MR2**)



Mounting bracket for FD-WKZ1

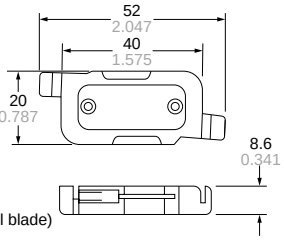
Accessory for **FD-WKZ1**



Material: SPCC-SD (Zinc chromate plated)

FB-1

Fiber bender (Optional)



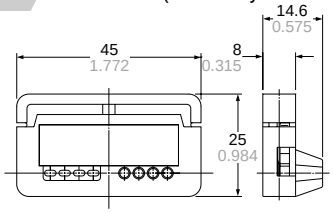
Material: PP (Containing steel blade)

FX-CT2

Fiber cutter (Accessory for free-cut type fiber)

FX-CT2 is not attached with the **FT-NB8/N8/P80** or the **FD-N8/N4/P80**

A conventional **FX-CT1** fiber cutter is attached with the **FT-P80** and the **FD-P80**.

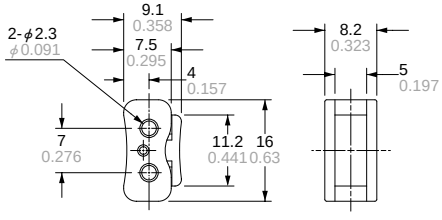


Material: ABS

FX-AT3

Attachment for ϕ2.2 mm ϕ0.087 in fiber (Accessory)

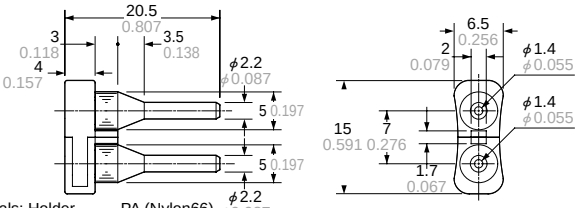
FX-AT3 is not attached with the **FT-NB8/N8/P80**, **FD-N8/P80**



Material: Polycarbonate

FX-AT5

Attachment for ϕ1.3 mm ϕ0.051 in fiber
(Accessory for ϕ1.3 mm ϕ0.051 in fiber)

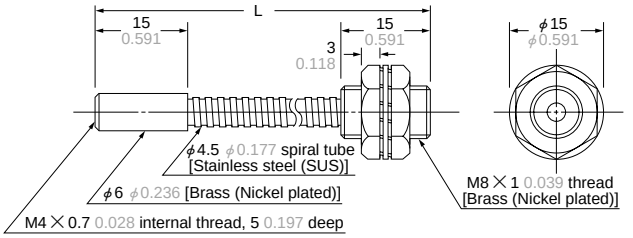


Materials: Holder.....PA (Nylon66)
Ground .....POM

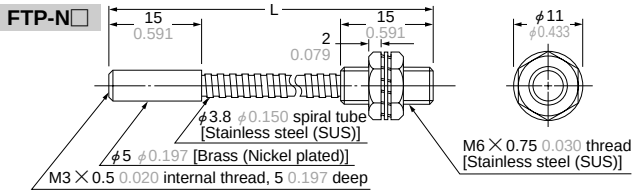
FTP-□ FDP-□

Protective tube (Optional)

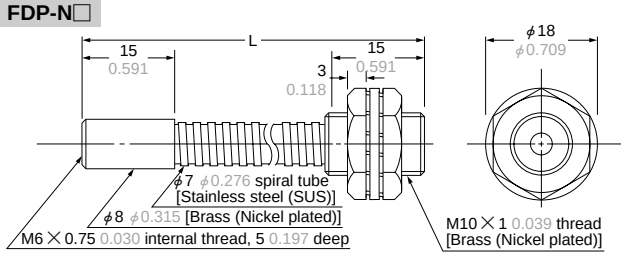
FTP-□, FDP-N□



FTP-N□



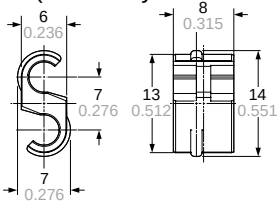
FDP-N□



Model No.	Length L (mm in)
FTP-500, **FTP-N500**, **FDP-N500**, **FDP-500**	500^{+10}_{0} $19.685^{+0.394}_{0}$
FTP-1000, **FTP-N1000**, **FDP-N1000**, **FDP-1000**	$1{,}000^{+10}_{0}$ $39.37^{+0.394}_{0}$
FTP-1500, **FTP-N1500**, **FDP-N1500**, **FDP-1500**	$1{,}500^{+10}_{0}$ $59.055^{+0.394}_{0}$

FX-AT2

Attachment for fixed-length fiber
(Accessory for fixed-length fiber)

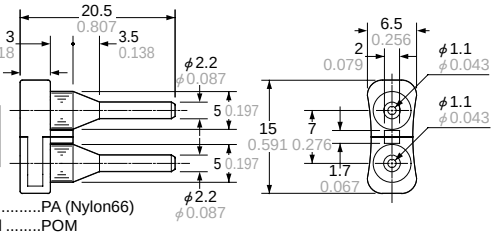


Material: POM

FX-AT4

Attachment for ϕ1 mm ϕ0.039 in fiber
(Accessory for ϕ1 mm ϕ0.039 in fiber)

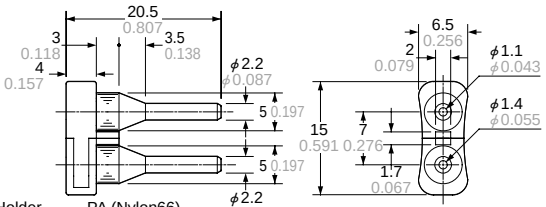
FX-AT4 is not attached with the **FD-N4**



Materials: Holder.....PA (Nylon66)
Ground .....POM

FX-AT6

Attachment for ϕ1 mm / ϕ1.3 mm ϕ0.039 in / ϕ0.051 in mixed fiber
(Accessory for ϕ1 mm / ϕ1.3 mm ϕ0.039 in / ϕ0.051 in fiber)



Materials: Holder.....PA (Nylon66)
Ground .....POM