



Fiber General Catalog

Meeting the diverse needs of our customers with a wide range of different models and an improved product line-up.



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Now Available – Our Long-awaited, Improved Selection of Sharp Bending Fibers

Additional new products bring our fiber line-up to a total of 24 models, consisting of 13 models of thru-beam fibers and 11 models of reflective fibers.

Product line-up consists of 13 models of sharp bending thru-beam fibers

FT-W8

Standard Lens mountable

M4 15 mm 0.591 in

570 mm
22.441 in

FT-WS3

Standard

φ 3 15 mm
φ 0.118 0.591 in

570 mm
22.441 in

FT-WS8

Standard

φ 2.5 8 mm
φ 0.098 0.315 in

570 mm
22.441 in

FT-W4

Small diameter

M3 15 mm 0.591 in

160 mm
6.299 in

FT-WS4

Small diameter

φ 1.5 8 mm
φ 0.059 0.315 in

160 mm
6.299 in

FT-WS8L

With lens

φ 3 8 mm
φ 0.118 0.315 in

1,200 mm
47.244 in

FT-WZ8

Rectangular head - Front sensing

W8.5 H12 D3 mm
W0.355 H0.472 D0.118 in

700 mm
27.559 in

FT-WZ8E

Rectangular head - Side sensing

W3 H12 D8 mm
W0.118 H0.472 D0.315 in

1,500 mm
59.055 in

FT-WZ8H

Rectangular head - Top sensing

W3 H8 D12 mm
W0.118 H0.315 D0.472 in

2,500 mm
59.055 in

FT-WA30

Wide beam

(32 mm 1.26 in)

W5 H69 D20 mm
W0.197 H2.717 D0.787 in

3,600 mm
141.732 in

FT-WA8

Wide beam

(11 mm 0.433 in)

W4.2 H31 D13.5 mm
W0.165 H1.22 D0.531 in

3,600 mm
141.732 in

FT-WV42

Side-view

φ 1 15 mm
φ 0.039 0.591 in

90 mm
3.543 in

* Sleeve part cannot be bent.

φ 2 15 mm
φ 0.079 0.591 in

FT-WKV8

Narrow beam

Side-view

1,700 mm
66.929 in

φ 4 25 mm
φ 0.157 0.984 in

Digital fiber sensor
FX-301

Fiber attachment integrates 2 individual fibers into a single unit (Accessories for fibers)

FX-AT2
(for fixed-length fiber)

FX-AT3
(for φ 2.2 mm φ 0.087 in fiber)

FX-AT4
(for φ 1 mm φ 0.039 in fiber)

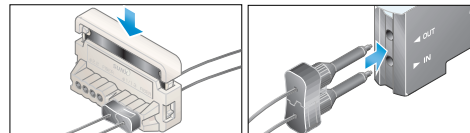
FX-AT5
(for φ 1.3 mm φ 0.051 in fiber)

FX-AT6
(for φ 1 mm φ 0.039 in and φ 1.3 mm φ 0.051 in mixed fiber)

Stable sensing is obtained, as 2 fibers are fixed securely together for usage.

Now 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.



New sharp bending fiber applications

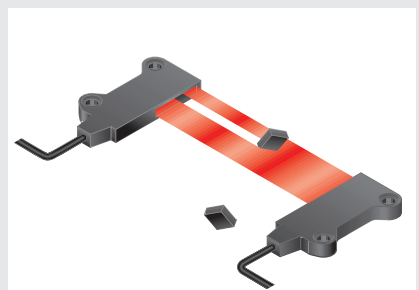
Detecting components from a parts feeder / FT-WZ8E

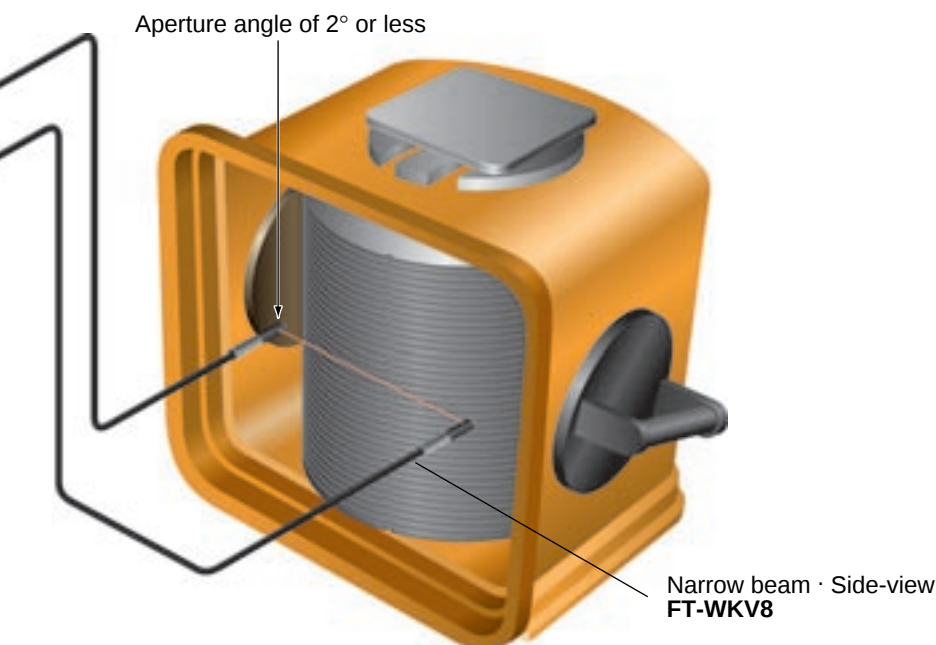
The industry's smallest ultra-thin rectangular fiber head, with dimensions of W3 H12 D8 mm W0.018 H0.472 D0.315 in. Contains a sharp bending fiber cable attachment area, thus saving installation space.



Detecting chip components as they are drop-sorted / FT-WA8

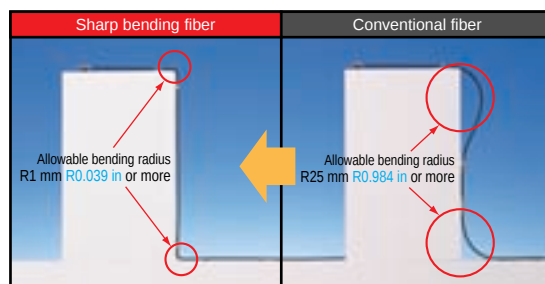
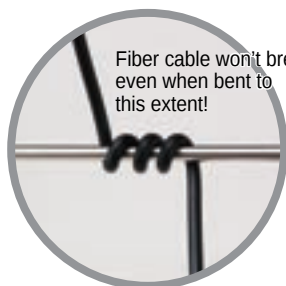
Has a wide 11 mm 0.433 in detection area. Vibrating objects and minute objects passing at high speed, that were previously difficult to detect, can now be easily detected using FT-WA8 in combination with the FX-300 series amplifiers.





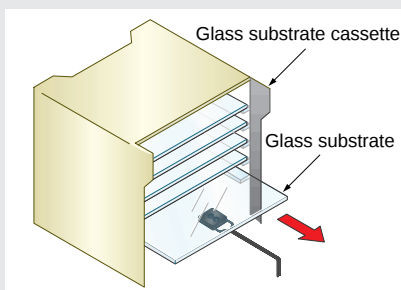
Can be rotated freely in any direction R1 mm **R0.039 in** or more

The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1 mm **R0.039 in** or more (FD-WG4, FD-WSG4 : R2 mm **R0.079 in** or more).



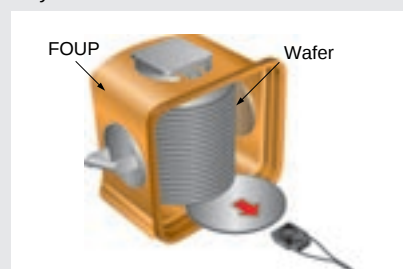
Detecting the presence of a glass substrate within a cassette / FD-WL41

By utilizing its excellent distance-limiting properties, reliable detection of the specific glass substrate located only in the desired position within the cassette, can be guaranteed.

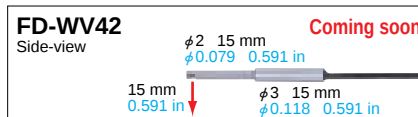
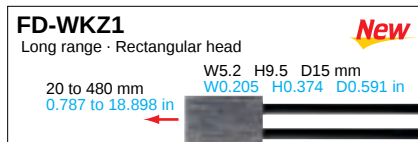
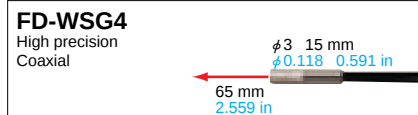
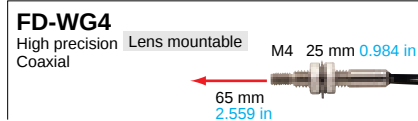
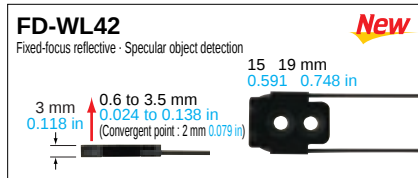
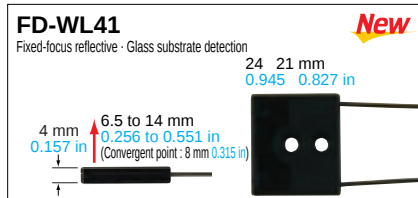
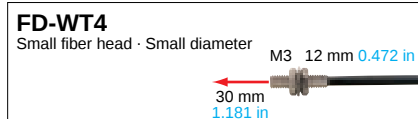
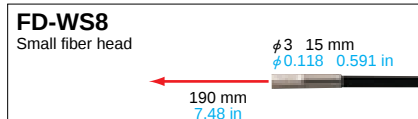
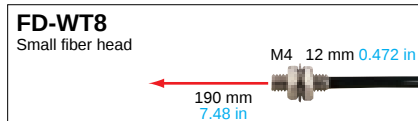
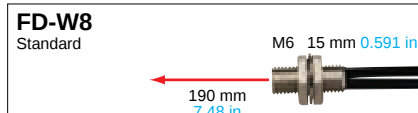


Detecting water taken out from a FOUP / FD-WL42

Due to the distance-limiting properties, detection is unaffected by colors or surface luster, therefore, the upper wafer will not be accidentally detected. Furthermore, **FD-WL42** is the smallest unit in the industry, with a thickness of only 3 mm **0.118 in**.



Product line-up consists of 11 models of sharp bending reflective fibers



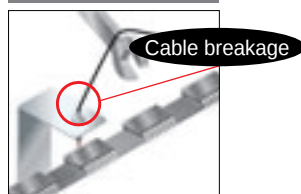
* Sleeve part cannot be bent.

*The sensing ranges indicated above were obtained using LONG mode.

Tough Flexible Fiber / FT-P81X,FD-P81X,FD-G6X

Stainless steel braiding protects the fiber cable and prevents fiber breakage due to snagging. The allowable bending radius is R10 mm **R0.394 in** or greater. The fiber will bend flexibly, without breaking. The installation of troublesome protection tubes for breakage prevention is no longer required.

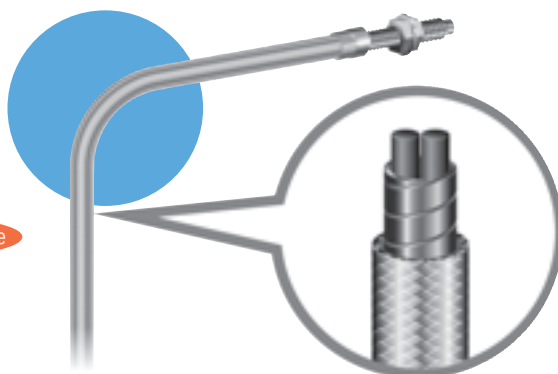
Conventional Fiber



Tough Flexible Fiber



Tough, but bends flexibly!
Allowable bending radius
R10 mm **R0.394 in or greater**



Strong stainless steel mesh
protects fiber cables from breakage

Tough flexible fiber line-up

FT-P81X

Lens mountable

New



FD-P81X

New



FD-G6X

Lens mountable

New

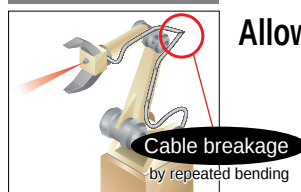


*The sensing ranges indicated above were obtained using LONG mode.

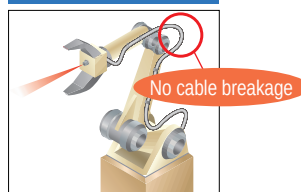
Flexible Fiber / FT-P60,FT-PS1

These fibers are most suitable for usage on moving components due to their high resistance to repeated flexing. Our product line now includes the new **FT-P60** (M4 type, with lens attachment mountable) and **FT-PS1** (ultra-small diameter type, with $\phi 1$ mm **$\phi 0.039$ in**). An allowable bending radius of R4 mm **R0.157 in** or greater has been achieved and the fiber can withstand repeated bending for more than 1 million times (at R10 mm **R0.394 in**).

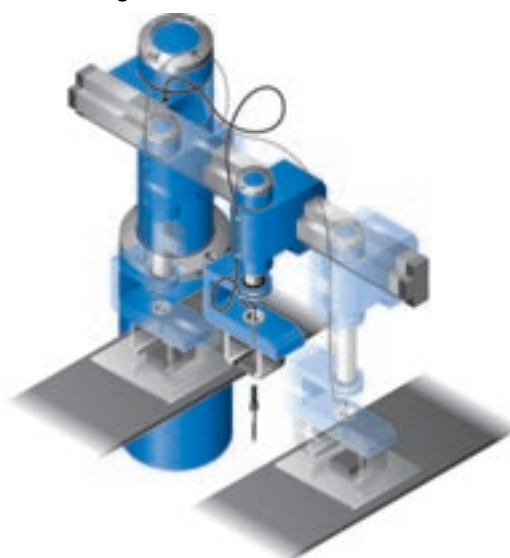
Conventional Fiber



Flexible Fiber



Bending durability 1 million times or more!
Allowable bending radius R4 mm **R0.157 in or more**



Flexible fiber line-up

FT-P60

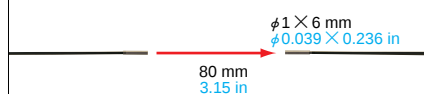
Lens mountable

New

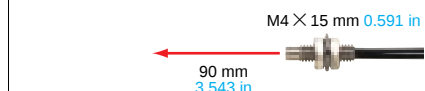


FT-PS1

New



FD-P60



FD-P50



*The sensing ranges indicated above were obtained using LONG mode.

Finest Spot Lens / FX-MR6

High Precision Fiber / FD-EG2,FD-EG3

An ultra-small $\phi 0.1$ mm $\phi 0.004$ in spot size has now been made possible through the integration of our finest spot lens (FX-MR6) with our precision fiber (FD-EG3).



Now available - ultra-small spot size of $\phi 0.1$ mm $\phi 0.004$ in (FX-MR6+FD-EG3)

This precisely focused spot is produced through the use of a new lens design, allowing stable sensing to be achieved, even for minute sensing tasks, such as the detection of ultra-small chip components (0603 chips, etc.).

Small spot applications

Counting connector pins

The optimum combination of lens and fiber can be selected, in accordance with the connector pin size and pin pitch.



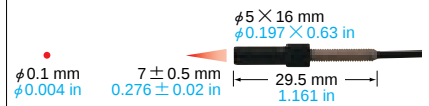
Suction detection for chips

This fiber unit can be used to confirm chip presence, when mounting chips using a flip chip bonder.

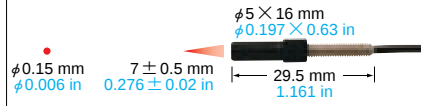


Spot lens & high precision fiber line-up

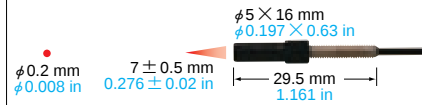
FX-MR6+FD-EG3



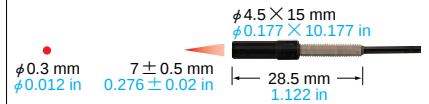
FX-MR6+FD-EG2



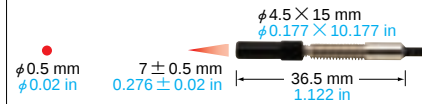
FX-MR6+FD-EG1



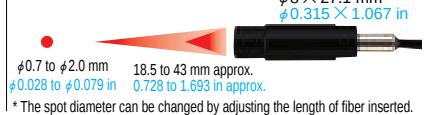
FX-MR3+FD-EG1



FX-MR3+FD-G4/WG4



FX-MR2+FD-WG4/G4



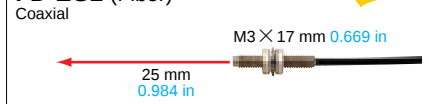
FX-MR5+FD-WG4/G4



FD-EG3 (Fiber)



FD-EG2 (Fiber)



*The sensing ranges indicated above were obtained using LONG mode.

Heat-resistant Fixed-focus Reflective Fiber / **New** FD-H18-L31,FD-H30-L32 SERIES

Glass substrate detection in high temperature production line

High precision detection

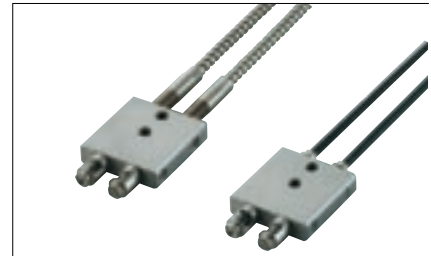
In addition to excellent heat resistance, these fibers have achieved a repeatability of 0.06 mm **0.002 in** for transparent glass substrates.

Extended detection range

Now available with full-range detection capabilities containing no dead zones (in both LONG and STD modes). As well, an extended detection distance of 15 mm **0.591 in** (in LONG mode) has been achieved, even allowing for the detection of warping in glass substrates.

Thin fiber head

In addition to having heat resistance of 180°C **356°F** and 300°C **572°F**, respectively, these new fiber heads are thin - now only 5 mm **0.197 in** thick. Even more space can now be saved during installation.



Glass substrate detection in high temperature production line



Wide Beam Fiber / FT-WA30/A30 **New**

32 mm **1.26 in** New wide-area fiber launched!

Seal slit is available

The using of a seal slit reduces the amount of emitting beam and allows sensing of much smaller objects.

FT-WA30/A30 fiber heads are not susceptible to interference from peripheral objects

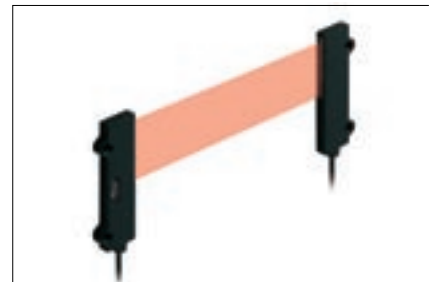
As these fibers incorporate light sources having almost the same collimated beam as lasers, beam interference from peripheral objects is minimal, thus permitting stable detection to be performed in crowded areas.

A bending radius of R1 mm (R0.039 in) has been made possible

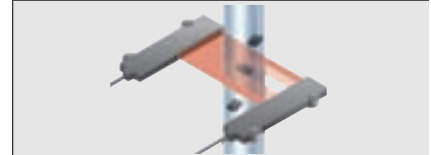
The allowable bending radius for FT-WA30 is R1 mm **R0.039 in** or greater. These fibers can be bent as much as if they were electric wires, thus saving tremendous amounts of space during fiber installation.

Space-saving installation is now possible

FT-WA30/A30 has a depth of 20 mm **0.787 in** allowing for installation on the narrowest production lines.



Detecting dropping objects



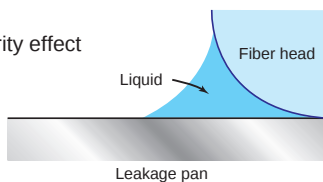
Leak Detection Fiber / FD-F7 SERIES

A new slim fiber ideal for sensing chemical leaks

Reliable detection

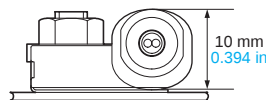
The unique effect of capillarity enables reliable detection of small leaks and viscous liquids.

- Capillarity effect



Compact, space-saving

This slim (10 mm **0.394 in**) side-mounting fiber is especially good for use in confined spaces.



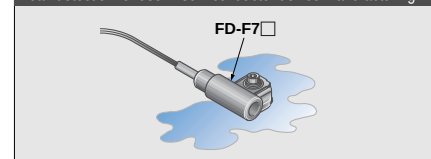
Ideal for chemicals and volatile materials

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

Note: Dedicated amplifier **FX-301-F** must be used with the **FD-F7** series.



Leak detection for use in semiconductor device manufacturing



Liquid Fiber / FT-F9 SERIES

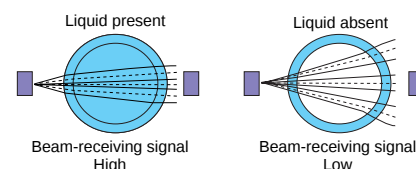
Reliably detect liquid in pipe

Safer fiber type sensor

In response to the demand for higher safety standards throughout the world, including SEMI S2, safer sensing can be achieved by placing the amplifier for this fiber sensor away from dangerous locations, such as locations with volatile chemicals, where electrical circuits increase the risk of fire or explosion.

Reliable detection not affected by bubbles or droplets

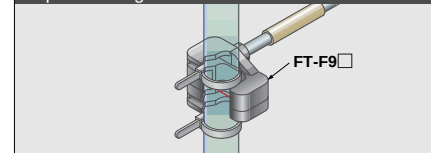
Latest optical fiber techniques have solved problems caused by bubbles, droplets or liquid leakage that arise in conventional pipe-mountable sensors.



Note: Dedicated amplifier **FX-301-F** must be used with the **FT-F9** series.



Liquid sensing



Glass Substrate Alignment & Seating Confirmation Fiber / FD-L43

High accuracy & stable sensing

High accuracy sensing

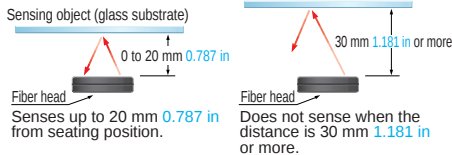
Even with variation among glass substrates, the positioning error is 0.2 mm **0.008 in** or less (at sensing range 5 to 17 mm **0.197 to 0.669 in**).

Single type serving two applications

As the fiber can sense an object located even at 0 mm, it can be used for sensing, as well as alignment checking of the glass substrate (at sensing range 5 to 17 mm **0.197 to 0.669 in**).

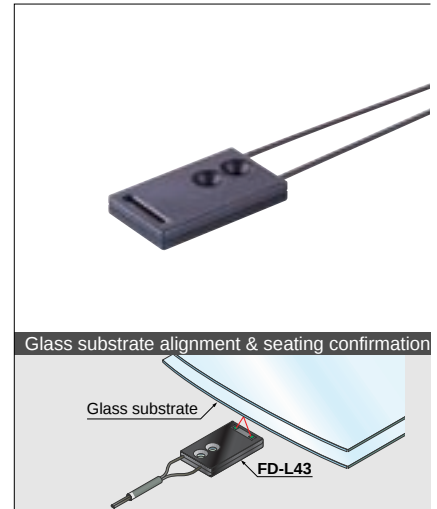
Long-range sensing capability

The sensing range is as long as 0 to 20 mm **0.787 in**. In addition, the fiber will not detect a glass substrate 30 mm **1.181 in** or more away achieving outstanding detecting characteristics for limited distance.



Compact design allows easy, flexible positioning

Compact size of W17×H29×D3.8 mm **W0.669×H1.142×D0.15 in**. The outer diameter of the fiber cable is ϕ 1.3 mm **ϕ 0.118 in**, enabling the fiber to be routed with R4 mm **R0.157 in** bending radius.

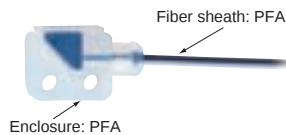


Chemical-resistant Rectangular Head Fiber / FT-Z8Y SERIES

Chemical-resistant square-shaped head with no light-beam misalignment

Usable with various chemical liquids

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



Thru-beam type side-view with 3,500 mm **137.795 in** long sensing range

Easy cutting of even PFA protected fiber

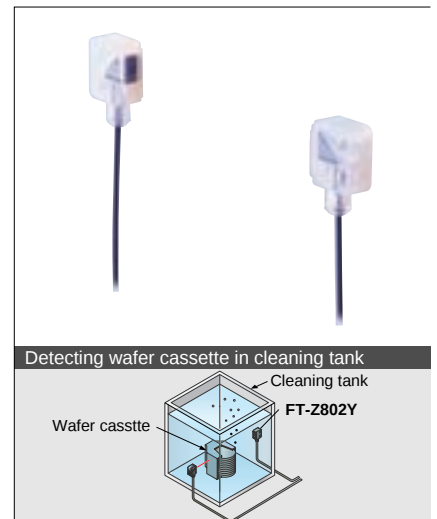
As the diameter of the fiber cable, including the PFA protected portion, is only ϕ 2.2 mm **ϕ 0.087 in**, you can simply cut the fiber cable to a desired length.

Square-shaped head provides easy mounting

The square-shaped head offers both easy installation and easy light-beam alignment. The head measures W7×H15×D13 mm **W0.276×H0.591×D0.512 in**, and can be mounted with M3 screws at two locations.

Excellent explosion-proof structure complying with SEMI S2

Since the fiber does not have any electrical circuit in the sensing part, it offers an excellent explosion-proof structure.



Flexible Heat-resistant Fiber / FT-H20W SERIES

A bending radius of R10 mm **R0.394 in** is possible even in high temperature environments

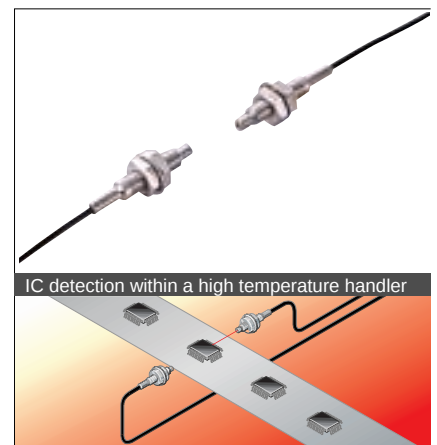
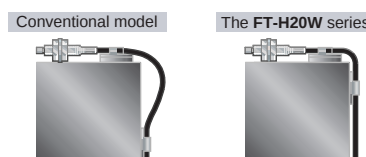
Heat-resistant temperature 200°C (392°F)

Withstands temperature up to 200°C **392°F**. Sensing is now possible in high temperature environments, such as detecting the presence of ICs in a high temperature handler.

Fiber cable types of 1 m (3.281 ft) and 2 m (6.562 ft) lengths are available

Bending radius R10 mm (R0.394 in) for space saving

By utilizing a PTFE exterior coating, bends of R10 mm **R0.394 in** are possible, even in high temperature environments. Cabling can be laid out freely, thus saving space.



Rectangular Head Fiber / FT-Z8 SERIES

Smallest in the industry
Easy, space-saving screw type installation

Extremely thin, the smallest size in the industry

The smallest super thin type rectangular head fiber in the industry with dimensions of W3×H12×D8 mm **W0.118×H0.472×D0.315 in** (side sensing type).

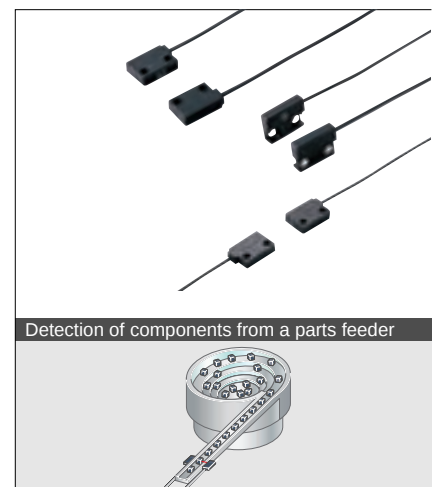
Rectangular fiber head allows for easy installation

It can be installed with only two M2 screws, allowing easy light beam axis alignment.

Utilizes flexible inflection resistant cable

Minimum permissible bending radius of R4 mm **R0.157 in**. The fiber can withstand repeated bending 1 million times or more (at R10 mm **R0.394 in**).

Long sensing range 2,700 mm (106.279 in)



Order Guide

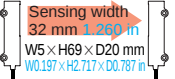
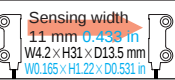
Thru-beam type fiber line-up (one pair set)

Standard fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length ✂ : Free-cut	Allowable bending radius	Model No.
Long sensing range	With lens 	M14 LONG STD FAST S-D 19,500 mm 767.715 in 14,000 mm 551.18 in 10,000 mm 393.7 in 3,800 mm 149.606 in	φ0.4 mm φ0.016 in opaque object	• Large lenses on the fiber heads increase the sensing range significantly.	✂ 10 m 32.808 ft	R25 mm R0.984 in	FT-FM10L
	With lens φ2.5 mm φ0.098 in 	1,600 mm 62.992 in 800 mm 31.496 in 580 mm 22.835 in 280 mm 11.024 in	φ0.02 mm φ0.001 in opaque object	• Long sensing range with small fiber heads of φ2.5 mm φ0.098 in	✂ 2 m 6.562 ft		FT-SFM2L
	Lens mountable 	M4 1,100 mm 43.307 in 530 mm 20.866 in 400 mm 15.748 in 180 mm 7.087 in	φ0.04 mm φ0.002 in opaque object	• Long sensing range	✂ 2 m 6.562 ft		FT-B8
		M4 1,000 mm 39.37 in 480 mm 18.898 in 360 mm 14.173 in 168 mm 6.614 in	φ0.03 mm φ0.001 in opaque object	• Low price	✂ 2 m 6.562 ft (Note 3)		FT-NB8
	Lens mountable 	M4				R25 mm R0.984 in	FT-FM2
	Sleeve 90 mm 3.543 in 	M4 φ1.48 mm φ0.058 in		• Free-cut type		Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FT-FM2S
	Sleeve 40 mm 1.575 in 	M4 φ1.48 mm φ0.058 in	780 mm 30.709 in 400 mm 15.748 in 280 mm 11.024 in 130 mm 5.118 in	φ0.03 mm φ0.001 in opaque object	✂ 2 m 6.562 ft		FT-FM2S4
	Lens mountable 	M3 φ2.5 mm φ0.098 in		• Long sensing range with miniature fiber heads		R25 mm R0.984 in	FT-T80
		M4		• Free-cut type			FT-SFM2
		M4 700 mm 27.559 in 360 mm 14.173 in 250 mm 9.843 in 126 mm 4.961 in	φ0.03 mm φ0.001 in opaque object	• Low price	✂ 2 m 6.562 ft (Note 3)	R25 mm R0.984 in	FT-N8
		M3				R25 mm R0.984 in	FT-NFM2
	Sleeve 90 mm 3.543 in 	M3 φ0.88 mm φ0.035 in	270 mm 10.63 in 140 mm 5.512 in 100 mm 3.937 in 49 mm 1.929 in	φ0.025 mm φ0.001 in opaque object	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FT-NFM2S
Standard	Sleeve 40 mm 1.575 in 	M3 φ0.88 mm φ0.035 in		• Suitable for detection in a congested equipment			FT-NFM2S4
		M3 φ1.5 mm φ0.059 in				R25 mm R0.984 in	FT-SNFM2
	Elbow 	M4 530 mm 20.866 in 230 mm 9.055 in 150 mm 9.906 in 80 mm 3.15 in	φ0.04 mm φ0.002 in opaque object	• The fiber head is bent at a right angle with 5 mm 0.197 in bending radius at the neck.	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-R80
	Side-view 	φ1.5 mm φ0.059 in φ2.5 mm φ0.098 in φ0.8 mm 0.031 in Sleeve part cannot be bent.	400 mm 15.748 in 200 mm 7.874 in 140 mm 5.512 in 70 mm 2.756 in		✂ 2 m 6.562 ft		FT-SFM2SV2
		φ2 mm φ0.079 in φ2.5 mm φ0.098 in φ0.6 mm 0.024 in Sleeve part cannot be bent.	390 mm 15.354 in 180 mm 7.087 in 125 mm 4.921 in 63 mm 2.48 in	φ0.02 mm φ0.001 in opaque object	✂ 1 m 6.562 ft	R25 mm R0.984 in	FT-V22
		φ1 mm φ0.039 in φ2.5 mm φ0.098 in φ0.6 mm 0.024 in Sleeve part cannot be bent.	175 mm 6.89 in 80 mm 3.15 in 60 mm 2.362 in 27 mm 1.063 in	• The side-view sensing • Space-saving	✂ 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.
2) 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) Fiber cutter is not supplied as accessory along with FT-NB8 and FT-N8. Please order it separately.

Sharp bending fibers / Flexible fibers

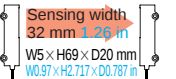
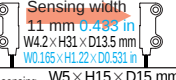
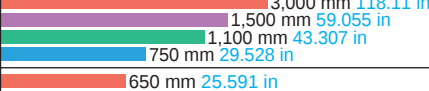
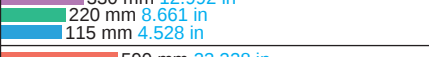
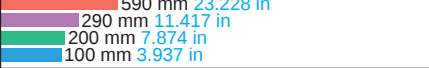
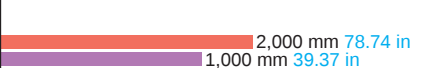
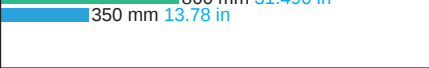
Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Sharp bending	Wide beam	 Sensing width 32 mm 1.260 in W5 × H69 × D20 mm W0.197 × H2.717 × D0.787 in	3,500 mm 137.795 in 3,500 mm 137.795 in 3,500 mm 137.795 in 3,500 mm 137.795 in (Note 3)	φ 0.3 mm φ 0.012 in opaque object	• Sensing width 32 mm 1.26 in wide area • Long sensing range	 2 m 6.562 ft	 R1 mm R0.039 in New FT-WA30
		 Sensing width 11 mm 0.433 in W4.2 × H31 × D13.5 mm W0.165 × H1.22 × D0.531 in	3,500 mm 137.795 in 1,500 mm 59.055 in 1,100 mm 43.307 in 750 mm 29.528 in	φ 0.25 mm φ 0.01 in opaque object	• Sensing width 11 mm 0.433 in wide area • Long sensing range	 2 m 6.562 ft	 R1 mm R0.039 in New FT-WA8
		Top sensing W3 × H8 × D12 mm W0.118 × H0.315 × D0.472 in	2,500 mm 98.425 in 1,200 mm 47.244 in 850 mm 33.465 in 410 mm 16.142 in	φ 0.08 mm φ 0.003 in opaque object	• Installs with M2 screws, allowing easy beam axis alignment	 2 m 6.562 ft	 R1 mm R0.039 in New FT-WZ8H
	Rectangular head	Side sensing W3 × H12 × D8 mm W0.118 × H0.472 × D0.315 in	1,500 mm 59.055 in 700 mm 27.559 in 500 mm 19.685 in 210 mm 8.268 in	φ 0.05 mm φ 0.002 in opaque object			 R1 mm R0.039 in New FT-WZ8E
		Front sensing W8.5 × H12 × D3 mm W0.335 × H0.472 × D0.118 in	700 mm 27.559 in 330 mm 12.992 in 240 mm 9.449 in 120 mm 4.724 in	φ 0.04 mm φ 0.002 in opaque object			 R1 mm R0.039 in New FT-WZ8
	Narrow beam	Side-view φ 4 mm φ 0.157 in 3 mm 0.118 in	1,700 mm 66.929 in 700 mm 27.559 in 600 mm 23.622 in 300 mm 11.417 in	φ 0.06 mm φ 0.002 in opaque object	• The side-view sensing • Aperture angle 2°	 2 m 6.562 ft	 R1 mm R0.039 in New FT-WKV8
		With lens φ 3 mm φ 0.118 in	1,200 mm 47.244 in 600 mm 23.622 in 420 mm 16.535 in 210 mm 8.268 in	φ 0.02 mm φ 0.001 in opaque object	• Long sensing range with fiber heads of φ 3 mm φ 0.118 in	 2 m 6.562 ft	 R1 mm R0.039 in FT-WS8L
		Lens mountable M4	570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	φ 0.03 mm φ 0.001 in opaque object	• Allowable bending radius: R1 mm R0.039 in or more	 2 m 6.562 ft	FT-W8
	Standard	φ 3 mm φ 0.118 in	570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	φ 0.05 mm φ 0.002 in opaque object			 R1 mm R0.039 in New FT-WS3
		φ 2.5 mm φ 0.098 in	570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	φ 0.03 mm φ 0.001 in opaque object			FT-WS8
	Small diameter	M3	160 mm 6.299 in 80 mm 3.15 in 55 mm 2.165 in 28 mm 1.102 in	φ 0.02 mm φ 0.001 in opaque object		 2 m 6.562 ft	FT-W4
		φ 1.5 mm φ 0.059 in					FT-WS4
Flexible	Rectangular head	Top sensing W3 × H8 × D12 mm W0.118 × H0.315 × D0.472 in	2,700 mm 106.299 in 1,400 mm 55.118 in 1,000 mm 39.37 in 490 mm 19.291 in	φ 0.03 mm φ 0.001 in opaque object	• Installs with M2 screws, allowing easy beam axis alignment • Bending durability: 1 million times or more (at R10 mm R0.394 in)	 2 m 6.562 ft	FT-Z8H
		Side sensing W3 × H12 × D8 mm W0.335 × H0.472 × D0.118 in	1,600 mm 62.992 in 800 mm 31.496 in 600 mm 23.622 in 280 mm 11.024 in				 R4 mm R0.157 in FT-Z8E
		Front sensing W8.5 × H12 × D3 mm W0.335 × H0.472 × D0.118 in	800 mm 31.496 in 400 mm 15.748 in 300 mm 11.811 in 140 mm 5.512 in				FT-Z8
	Standard	Lens mountable M4	650 mm 25.591 in 320 mm 12.598 in 230 mm 9.055 in 110 mm 4.331 in	φ 0.04 mm φ 0.002 in opaque object	• Bending durability: 1 million times or more (at R10 mm R0.394 in)	 2 m 6.562 ft	FT-P80
		Lens mountable M4	400 mm 15.748 in 190 mm 7.48 in 140 mm 5.512 in 80 mm 3.15 in				 R4 mm R0.157 in New FT-P60
	Small diameter	M3	250 mm 9.843 in 100 mm 3.937 in 75 mm 2.953 in 35 mm 1.378 in	φ 0.02 mm φ 0.001 in opaque object	• Bending durability: 1 million times or more (at R4 mm R0.157 in)	 2 m 6.562 ft	FT-P40
		φ 1.5 mm φ 0.059 in	280 mm 11.024 in 120 mm 4.724 in 90 mm 3.543 in 42 mm 1.654 in				 R4 mm R0.157 in FT-P2
		φ 1 mm φ 0.039 in	80 mm 3.15 in 40 mm 1.575 in 30 mm 1.181 in 17 mm 0.669 in				 R1 mm R0.039 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.
2) 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.
4) The sheath of **FT-P80** is very soft. In the case of insertion in amplifier, please use an attachment (**FX-AT3**), then insert the fiber in amplifier vertically.

Order Guide

Thru-beam type fiber line-up (one pair set)

Special use fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Special use	Wide beam	 Sensing width 32 mm 1.26 in W5 x H69 x D20 mm W0.97 x H2.717 x D0.787 in	 3,500 mm 137.795 in 3,500 mm 137.795 in 3,500 mm 137.795 in (Note 3)	• Sensing width 32 mm 1.26 in wide area • Long sensing range	2 m 6.562 ft	R10 mm R0.394 in	FT-A30 New
		 Sensing width 11 mm 0.433 in W42 x H31 x D13.5 mm W0.165 x H1.22 x D0.531 in	 3,000 mm 118.11 in 1,500 mm 59.055 in 1,100 mm 43.307 in 750 mm 29.528 in	• Sensing width 11 mm 0.433 in wide area • Long sensing range	2 m 6.562 ft	R10 mm R0.394 in	FT-A8
	Array	Top sensing W5 x H15 x D15 mm W0.197 x H0.591 x D0.591 in	 650 mm 25.591 in 330 mm 12.992 in 220 mm 8.661 in 115 mm 4.528 in	• Its wide beam meets various needs.	2 m 6.562 ft	R25 mm R0.984 in	FT-AFM2
		Side sensing W5 x H15 x D15 mm W0.197 x H0.591 x D0.591 in	 590 mm 23.228 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in				FT-AFM2E
	Narrow beam	 φ3.5 mm φ0.138 in φ3.7 mm φ0.146 in	 2,000 mm 78.74 in 1,000 mm 39.37 in 800 mm 31.496 in 350 mm 13.78 in	• Aperture angle 2° • Laser beam equivalent detection	2 m 6.562 ft	R25 mm R0.984 in	FT-K8
		Side-view φ4 mm φ0.157 in φ3 mm φ0.118 in		• Aperture angle 2° • Side-view type			FT-KV8
	Ultra-small diameter	 φ0.25 mm φ0.01 in φ3 mm φ0.118 in	 18 mm 0.709 in 10 mm 0.394 in 8 mm 0.315 in 3 mm 0.118 in	• Ultra-small diameter sleeves, very narrow beam φ0.125 mm φ0.005 in	500 mm 19.685 in	R5 mm R0.197 in	FT-E12
		Sleeve part cannot be bent. φ0.4 mm φ0.016 in φ3 mm φ0.118 in	 80 mm 3.15 in 50 mm 1.969 in 36 mm 1.417 in 15 mm 0.591 in	• Ultra-small diameter sleeves, very narrow beam φ0.25 mm φ0.01 in	1 m 3.281 ft		FT-E22
	Liquid level sensing	Mountable on pipe W23 x H20 x D17 mm W0.906 x H0.787 x D0.669 in	Applicable pipe diameter : Outer dia. φ3.0 to φ10.0 mm φ0.118 to φ0.394 in [PFA (Fluorine resin) or equivalently trans- parent pipe, wall thickness 0.3 to 1.0 mm 0.012 to 0.039 in]	(Liquid)	2 m 6.562 ft	Protective tube R20 mm R0.787 in Fiber R4 mm R0.157 in	FT-F902 (Note 4)
		Lens mountable M4	 650 mm 25.591 in 320 mm 12.598 in 230 mm 9.055 in 110 mm 4.331 in	• Strong stainless steel mesh protects fiber cables	1 m 3.281 ft	R10 mm R0.394 in	FT-P81X New

- 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.
2) 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.
4) Dedicated amplifier **FX-301-F** must be used with **FT-F902** and **FT-F905**.

Environment resistant fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Heat-resistant	Lens mountable	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	φ 0.04 mm φ 0.002 in opaque object	• Heat-resistant temp. : 350°C 662°F • Cold-resistant temp. : -60°C -76°F	2 m 6.562 ft	R25 mm R0.984 in	FT-H35-M2
	Sleeve 60 mm 2.362 in φ 2.1 mm φ 0.083 in					Fiber R25 mm Sleeve R10 mm	FT-H35-M2S6
	Lens mountable	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 50 mm 1.969 in	φ 0.02 mm φ 0.001 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : -60°C -76°F	1 m 3.281 ft 2 m 6.562 ft	R10 mm R0.394 in	FT-H20W-M1 FT-H20W-M2
	Lens mountable	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	φ 0.04 mm φ 0.002 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : -60°C -76°F	1 m 3.281 ft	R25 mm	FT-H20-M1
	Lens mountable	880 mm 34.646 in 440 mm 17.323 in 300 mm 11.811 in 155 mm 6.102 in	φ 0.06 mm φ 0.002 in opaque object	• Heat-resistant temp. : 130°C 266°F • Cold-resistant temp. : -60°C -76°F	2 m 6.562 ft	R0.984 in	FT-H13-FM2
	Rectangular head SEMI S2 compliant W7×H15×D13 mm W0.276×H0.591×D0.512 in	3,500 mm 137.795 in 1,500 mm 59.055 in 1,000 mm 39.37 in 530 mm 20.866 in	φ 4 mm φ 0.157 in opaque object	• Rectangular head with no beam misalignment	2 m 6.562 ft 5 m 16.404 ft 7 m 22.966 ft	R25 mm R0.984 in	FT-Z802Y FT-Z805Y FT-Z807Y
	φ 5.5 mm φ 0.217 in	3,500 mm 137.795 in 1,500 mm 59.055 in 1,000 mm 39.37 in 530 mm 20.866 in	φ 0.08 mm φ 0.003 in opaque object	• Heat-resistant specification (115°C 239°F) • Long sensing range with lens	2 m 6.562 ft	R30 mm R1.181 in	FT-L8Y FT-V8Y
	φ 5.5 mm φ 0.217 in	800 mm 31.496 in 400 mm 15.748 in 280 mm 11.024 in 140 mm 5.512 in		• Heat-resistant specification (115°C 239°F) • Side-view type			
	Lens mountable	470 mm 18.504 in 230 mm 9.055 in 165 mm 6.496 in 80 mm 3.15 in	φ 0.02 mm φ 0.001 in opaque object	• Heat-resistant temp. : 120°C 248°F	1 m 3.281 ft	R200 mm R7.874 in R30 mm R1.181 in	FT-6V FT-60V
		220 mm 8.661 in 100 mm 3.937 in 75 mm 2.953 in 35 mm 1.378 in					

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.

2) 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.

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-order made)

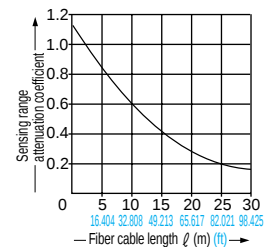
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☒) or the sleeve length (symbol ☐) from the table below.

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 3.15, 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 3.15, 9 3.543, 10 3.937, 11 4.331, 12 4.724
200°C heat-resistant	FT-H20-M ☒	2 6.562, 3 9.843	—
350°C heat-resistant	FT-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

Longer the fiber cable, shorter is the sensing range.



Order Guide

Reflective type fiber line-up

Standard fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length ✂ : Free-cut	Allowable bending radius	Model No.
Standard	Long sensing range M6	LONG STD FAST S-D 480 mm 18.898 in 220 mm 8.661 in 160 mm 6.299 in 75 mm 2.953 in	φ0.02 mm φ0.001 in gold wire	• Long sensing range	✂ 2 m 6.562 ft		FD-B8
	Coaxial M6	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 47 mm 1.85 in	φ0.02 mm φ0.001 in gold wire	• As fiber cutting is not required, sensing range will not be reduced.	✂ 500 mm 19.685 in	R25 mm R0.984 in	FD-5
	Sleeve 90 mm 3.543 in M6 φ2.5 mm φ0.098 in	270 mm 10.63 in 110 mm 4.331 in 85 mm 3.346 in 39 mm 1.535 in	φ0.02 mm φ0.001 in gold wire	• Free-cut type	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FD-FM2S
	Sleeve 40 mm 1.575 in M6 φ2.5 mm φ0.098 in	85 mm 3.346 in 39 mm 1.535 in					FD-FM2S4
	M4	270 mm 10.63 in 110 mm 4.331 in 85 mm 3.346 in 39 mm 1.535 in	φ0.02 mm φ0.001 in gold wire		✂ 2 m 6.562 ft		FD-T80
	Small diameter M3	90 mm 3.543 in 45 mm 1.772 in 35 mm 1.378 in 16 mm 0.63 in	φ0.02 mm φ0.001 in gold wire	• Long sensing range with miniature fiber head	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-T40
	φ3 mm φ0.118 in	270 mm 10.63 in 110 mm 4.331 in 85 mm 3.346 in 39 mm 1.535 in					FD-S80
	M6	260 mm 10.236 in 120 mm 4.724 in 85 mm 3.346 in 42 mm 1.654 in	φ0.02 mm φ0.001 in gold wire	• Low price	✂ 2 m 6.562 ft (Note 4)	R25 mm R0.984 in	FD-N8
	M4	75 mm 2.953 in 38 mm 1.496 in 28 mm 1.102 in 13 mm 0.512 in					FD-N4
	M4						FD-NFM2
	Sleeve 90 mm 3.543 in M4 φ1.48 mm φ0.058 in	90 mm 3.543 in 45 mm 1.772 in 35 mm 1.378 in 16 mm 0.63 in	φ0.02 mm φ0.001 in gold wire	• Suitable for detection in a congested equipment	✂ 2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FD-NFM2S
	Sleeve 40 mm 1.575 in M4 φ1.48 mm φ0.058 in	35 mm 1.378 in 16 mm 0.63 in					FD-NFM2S4
	φ2.5 mm φ0.098 in						FD-SNFM2
	Elbow M6	185 mm 7.283 in 85 mm 3.346 in 60 mm 2.362 in 30 mm 1.181 in	φ0.02 mm φ0.001 in gold wire	• The fiber head is bent at a right angle with 5mm bending radius at the neck.	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-R80
	Side-view φ5 mm φ0.197 in φ2 mm φ0.079 in φ0.9 mm 0.031 in	100 mm 3.937 in 45 mm 1.772 in 32 mm 1.26 in 16 mm 0.63 in	φ0.02 mm φ0.001 in gold wire	• The side-view sensing • Space-saving	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-SFM2SV2
	Small diameter φ1.5 mm φ0.059 in φ3 mm φ0.118 in φ0.7 mm 0.028 in	55 mm 2.165 in 25 mm 0.984 in 17 mm 0.669 in 9 mm 0.354 in					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.

3) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance.

4) Fiber cutter is not supplied as accessory along with FD-N8 and FD-N4. Please order it separately.

Sharp bending fibers / Flexible fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	LONG STD FAST S-D	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.	
Sharp bending	Long sensing range  W5.2 H9.5 D15 mm W0.205 H0.374 D0.591 in	20 to 480 mm 0.787 to 18.898 in 20 to 230 mm 0.787 to 9.055 in 20 to 170 mm 0.787 to 6.693 in 25 to 100 mm 0.984 to 3.937 in		ϕ 0.3 mm ϕ 0.012 in copper wire	- Narrow-view - Long sensing range	2 m 6.562 ft	R1 mm R0.039 in	New FD-WKZ1	
	Standard	M6 	190 mm 7.48 in 90 mm 3.543 in 60 mm 2.362 in 32 mm 1.26 in		ϕ 0.02 mm ϕ 0.001 in gold wire	Allowable bending radius: R1 mm R0.039 in or more (Sleeve part of FD-W44: R10 mm R0.394 in or more)	2 m 6.562 ft	R1 mm R0.039 in	FD-W8
		Sleeve 40 mm M4 1.575 in ϕ 1.48 mm ϕ 0.058 in 	30 mm 1.181 in 15 mm 0.591 in 12 mm 0.472 in 5 mm 0.197 in	Fiber R1 mm Sleeve R10 mm				FD-W44	
		M4 	190 mm 7.48 in 90 mm 3.543 in 60 mm 2.362 in 32 mm 1.26 in	R1 mm R0.039 in				FD-WT8	
		ϕ 3 mm ϕ 0.118 in 	190 mm 7.48 in 90 mm 3.543 in 60 mm 2.362 in 32 mm 1.26 in	R1 mm R0.039 in				FD-WS8	
		M3 	30 mm 1.181 in 15 mm 0.591 in 12 mm 0.472 in 5 mm 0.197 in					FD-WT4	
	Hing precision	Coaxial Lens mountable M4 	65 mm 2.559 in 32 mm 1.26 in 25 mm 0.984 in 11 mm 0.433 in		ϕ 0.02 mm ϕ 0.001 in gold wire	Precise position sensing	2 m 6.562 ft	R2 mm R0.079 in	FD-WG4
		Coaxial ϕ 3 mm ϕ 0.118 in 	65 mm 2.559 in 32 mm 1.26 in 25 mm 0.984 in 11 mm 0.433 in					FD-WSG4	
	Fixed-focus reflective	Glass substrate detection W24 H21 D4 mm W0.945 H0.827 	6.5 to 14 mm 0.256 to 0.551 in (Convergent point 8 mm 0.315 in) 7 to 12 mm 0.276 to 0.472 in (Convergent point 8 mm 0.315 in) 7.5 to 12 mm 0.295 to 0.472 in (Convergent point 8 mm 0.315 in) Cannot use		ϕ 1.9 mm ϕ 0.0751 in Metal pipe (gray)	- Just 4 mm 0.157 in thick - Glass substrate is reliably detected.	2 m 6.562 ft	R1 mm R0.039 in	New FD-WL41
		Specular object detection W15 H19 D3 mm W0.591 H0.748 	0.6 to 3.5 mm 0.024 to 0.138 in (Convergent point 2 mm 0.079 in) 0.9 to 2.7 mm 0.035 to 0.106 in (Convergent point 2 mm 0.079 in) 1.0 to 2.5 mm 0.039 to 0.098 in (Convergent point 2 mm 0.079 in) Cannot use	ϕ 0.08 mm ϕ 0.003 in gold wire	- Just 3 mm 0.118 in thick - Wafer is reliably detected.	New FD-WL42			
Flexible	Standard	M6  (Note 4)	220 mm 8.661 in 100 mm 3.937 in 70 mm 2.756 in 35 mm 1.378 in	ϕ 0.02 mm ϕ 0.001 in gold wire	Bending durability: 1 million times or more (at R10 mm R0.394 in)	2 m 6.562 ft	R4 mm R0.157 in	FD-P80	
		M4 	90 mm 3.543 in 45 mm 1.772 in 30 mm 1.181 in 16 mm 0.63 in					FD-P60	
		ϕ 3 mm ϕ 0.118 in 						FD-P50	
	Small diameter	M3 	36 mm 1.417 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in	ϕ 0.02 mm ϕ 0.001 in gold wire	Bending durability: 1 million times or more (at R4 mm R0.157 in)	1 m 3.281 ft		FD-P40	
		ϕ 1.5 mm ϕ 0.059 in 	50 mm 1.969 in 25 mm 0.984 in 19 mm 0.748 in 9 mm 0.354 in				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 t2 mm 3.937 3.937 t0.472 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.
- 3) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance. However, in the case of fixed-focus reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of sensing object at a distance of convergent point.
- 4) The sheath of FD-P80 is very soft. In the case of insertion in amplifier, please use an attachment (FX-AT3), then insert the fiber in amplifier vertically.

Order Guide

Reflective type fiber line-up

Special use fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Special use	Array	Top sensing W5 H20 D20 mm W0.197 H0.787 D0.787 in	220 mm 8.661 in 110 mm 4.331 in	• Its wide beam meets various needs.	2 m 6.562 ft	R25 mm R0.984 in	FD-AFM2
		Side sensing W5 H20 D20 mm W0.197 H0.787 D0.787 in	78 mm 3.071 in 39 mm 1.535 in				FD-AFM2E
	High precision	Coaxial Lens mountable M4	110 mm 4.331 in 55 mm 2.165 in 42 mm 1.654 in 19 mm 0.748 in	• Precise position sensing	2 m 6.562 ft	R25 mm R0.984 in	FD-G4
		Coaxial Lens mountable M3	38 mm 1.496 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in				FD-EG1
		Coaxial Lens mountable M3	25 mm 0.984 in 12 mm 0.472 in 9 mm 0.354 in 5 mm 0.197 in	• Combination with FX-MR6 lens gives an extremely small spot diameter of $\phi 0.2$ mm $\phi 0.008$ in approx.	500 mm 19.685 in	R10 mm R0.394 in	FD-EG2 New
		Coaxial Lens mountable M3	15 mm 0.591 in 8 mm 0.315 in 5 mm 0.197 in 3 mm 0.118 in				FD-EG3 New
	Ultra-small diameter	$\phi 1.5$ mm $\phi 0.059$ in $\phi 0.5$ mm $\phi 0.02$ in	11 mm 0.433 in 6 mm 0.236 in 4 mm 0.157 in 1 mm 0.039 in	• Easy fine adjustment of the installation position. • Precise position sensing with coaxial fiber • Suitable for detection in a congested equipment	1 m 3.281 ft	R10 mm R0.394 in	FD-E12
		Coaxial $\phi 3$ mm $\phi 0.118$ in $\phi 0.65$ mm $\phi 0.026$ in	45 mm 1.772 in 23 mm 0.906 in 17 mm 0.669 in 7 mm 0.276 in				FD-E22
		M3 $\phi 0.5$ mm $\phi 0.02$ in	5 mm 0.197 in 3 mm 0.118 in 2 mm 0.079 in				FD-EN500S1
		Coaxial M3 $\phi 0.8$ mm $\phi 0.031$ in	38 mm 1.496 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in		1 m 3.281 ft		FD-ENM1S1
		Glass substrate detection SEMI S2 compliant W17 H29 D3.8 mm W0.669 H1.142 D0.15 in	0 to 20 mm 0 to 0.787 in			R4 mm R0.157 in	FD-L43
		Glass substrate detection W24 H21 D4 mm W0.945 H0.827 D0.157 in	2.5 to 18 mm 0.098 to 0.709 in (Convergent point 8 mm 0.315 in) 3 to 16 mm 0.118 to 0.63 in (Convergent point 8 mm 0.315 in) 3.5 to 15 mm 0.138 to 0.591 in (Convergent point 8 mm 0.315 in) Cannot use		2 m 6.562 ft	R10 mm R0.394 in	FD-L41
	Fixed-focus reflective	Specular object detection W15 H19 D3 mm W0.591 H0.748 D0.118 in	0.5 to 4 mm 0.02 to 0.157 in (Convergent point 2 mm 0.079 in) 1 to 3.8 mm 0.039 to 0.15 in (Convergent point 2 mm 0.079 in) 1.3 to 3.5 mm 0.051 to 0.138 in (Convergent point 2 mm 0.079 in) Cannot use				FD-L42
		W6 H18 D14 mm W0.236 H0.709 D0.551 in	2.5 to 18 mm 0.098 to 0.709 in (Convergent point 6 mm 0.236 in) 4 to 12 mm 0.157 to 0.472 in (Convergent point 6 mm 0.236 in) 4.5 to 11 mm 0.177 to 0.433 in (Convergent point 6 mm 0.236 in) 4.8 to 9.5 mm 0.189 to 0.374 in (Convergent point 6 mm 0.236 in)				FD-L4
	Liquid leak detection	SEMI S2 compliant W20 H30 D10 mm W0.787 H1.181 D0.394 in		(Liquid)		5 m 16.404 ft (Protective tube: 3 m 9.843 ft) 7 m 22.966 ft (Protective tube: 5 m 16.404 ft)	FD-F705
		Contact type $\phi 5$ mm $\phi 0.197$ in $\phi 6$ mm $\phi 0.236$ in		(Liquid)			FD-F707
	Liquid level sensing	Mountable on pipe Standard W25 H13 D20 mm W0.984 H0.512 D0.787 in	Applicable pipe diameter : Outer dia. $\phi 6$ to $\phi 26$ mm $\phi 0.236$ to $\phi 1.024$ in transparent pipe [PVC, fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm]	(Liquid)	2 m 6.562 ft		FD-F41
		Mountable on pipe for 1 mm 0.039 in thick PFA pipe W25 H13 D20 mm W0.984 H0.512 D0.787 in	Applicable pipe diameter : Outer dia. $\phi 6$ to $\phi 26$ mm $\phi 0.236$ to $\phi 1.024$ in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]		5 m 16.404 ft	R10 mm R0.394 in	FD-F91
					2 m 6.562 ft		FD-F4
					5 m 16.404 ft		FD-F9
	Tough flexible	M6	185 mm 7.283 in 80 mm 3.15 in 60 mm 2.362 in 35 mm 1.378 in	• Strong stainless steel mesh protects fiber cables	1 m 3.281 ft		FD-P81X New
		Coaxial Lens mountable M3	90 mm 3.543 in 45 mm 1.772 in 35 mm 1.378 in 20 mm 0.787 in		1 m 3.281 ft	R10 mm R0.394 in	FD-G6X New

Notes: 1) The sensing range is specified for white non-glossy paper [100 100 mm 3.937 3.937 in (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 t1.1 mm 2.992 2.047 t0.043 in, FD-L41: glass substrate 100 100 t2 mm 3.937 3.937 t0.472 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.
3) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance. However, in the case of fixed-focus reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of sensing object at a distance of convergent point.

Environment resistant fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Environment resistant	Coaxial M6			• Heat-resistant temp.: 350°C 662°F	2 m 6.562 ft	R25 mm R0.984 in	FD-H35-M2
	Sleeve 60 mm 2.362 in M6 φ2.8 mm φ0.11 in	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 47 mm 1.85 in	φ0.02 mm φ0.001 in gold wire	• Cold-resistant temp.: 60°C 76°F		Fiber R25 mm Sleeve R10 mm	FD-H35-M2S6
	Coaxial M6			• Heat-resistant temp.: 200°C 392°F • Cold-resistant temp.: 60°C 76°F	1 m 3.281 ft	R25 mm R0.984 in	FD-H20-M1
	Fixed-focus reflective W19 H27 D5 mm W0.748 H1.063 D0.197 in	0 to 15 mm 0 to 0.591 in 0 to 10 mm 0 to 0.394 in 1 to 8 mm 0.039 to 0.315 in 2 to 6 mm 0.079 to 0.236 in	φ0.02 mm φ0.001 in gold wire	• Heat-resistant temp.: 300°C 572°F • Cold-resistant temp.: 60°C 76°F	2 m 6.562 ft	R25 mm	FD-H30-L32 New
	Fixed-focus reflective W19 H27 D5 mm W0.748 H1.063 D0.197 in			• Heat-resistant temp.: 180°C 356°F • Cold-resistant temp.: 60°C 76°F	2 m 6.562 ft	R0.984 in	FD-H18-L31 New
	M6	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 47 mm 1.85 in	φ0.02 mm φ0.001 in gold wire	• Heat-resistant temp.: 130°C 266°F • Cold-resistant temp.: 60°C 76°F	2 m 6.562 ft	R25 mm R0.984 in	FD-H13-FM2
	Vacuum M6	165 mm 6.496 in 75 mm 2.953 in 52 mm 2.047 in 26 mm 1.024 in	φ0.02 mm φ0.001 in gold wire	• Usable in vacuum chamber • Heat-resistant temp.: 130°C 266°F	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.
3) The minimum sensing object is specified for maximum sensitivity. 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-order made)

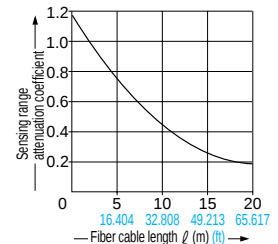
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☒) or the sleeve length (symbol ☐) from the table below.

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 3.15, 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 3.15, 9 3.543, 10 3.937, 11 4.331, 12 4.724
200 °C heat-resistant	FD-H20-M ☒	2 6.562, 3 9.843	—
350 °C 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

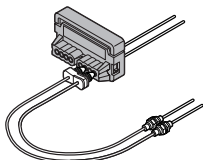
Longer the fiber cable, shorter is the sensing range.



Accessories (attached with fibers)

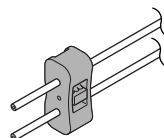
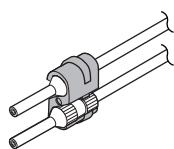
Fiber cutter

- FX-CT2

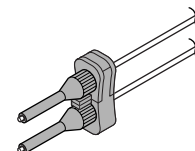


Fiber attachment

- FX-AT2 (for fixed-length fiber)
- FX-AT3 (for φ2.2 mm φ0.087 in fiber)



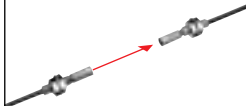
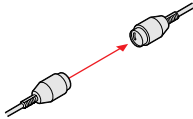
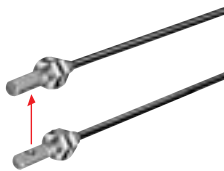
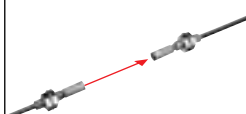
- FX-AT4 (for φ1 mm φ0.039 in fiber)
- FX-AT5 (for φ1.3 mm φ0.051 in fiber)
- FX-AT6 (for φ1 mm φ0.039 in and φ1.3 mm φ0.051 in mixed fiber)



Note: Fiber cutter is not supplied as accessory along with FT-NB8, FT-N8, FD-N8 and FD-N4. Please order it separately.

Order Guide

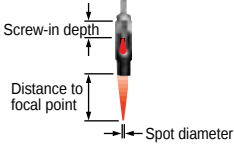
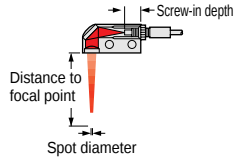
Lens (For thru-beam type fiber)

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	Sensing range (mm)[Lens on both sides] <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>FAST</th><th>S-D</th></tr><tr><td>FT-B8</td><td>3,500 (Note 2)</td><td>2,500</td><td>2,000</td><td>1,000</td></tr><tr><td>FT-FM2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>2,500</td><td>1,300</td></tr><tr><td>FT-T80</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>2,500</td><td>1,300</td></tr><tr><td>FT-R80</td><td>3,500 (Note 2)</td><td>2,300</td><td>1,600</td><td>800</td></tr><tr><td>FT-W8</td><td>3,500 (Note 2)</td><td>2,900 (Note 2)</td><td>2,000</td><td>1,000</td></tr><tr><td>FT-P80</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>2,500</td><td>1,100</td></tr><tr><td>FT-P60</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>1,500</td><td>900</td></tr><tr><td>FT-P81X</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>2,500</td><td>1,100</td></tr><tr><td>FT-H35-M2</td><td>3,500 (Note 2)</td><td>2,000</td><td>1,500</td><td>750</td></tr><tr><td>FT-H20W-M1</td><td>1,600 (Note 2)</td><td>1,300</td><td>900</td><td>500</td></tr><tr><td>FT-H20W-M2</td><td>2,600</td><td>1,300</td><td>900</td><td>500</td></tr><tr><td>FT-H20-M1</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td><td>1,100</td><td>900</td></tr></table>	Fiber \ Mode	LONG	STD	FAST	S-D	FT-B8	3,500 (Note 2)	2,500	2,000	1,000	FT-FM2	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	FT-T80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	FT-R80	3,500 (Note 2)	2,300	1,600	800	FT-W8	3,500 (Note 2)	2,900 (Note 2)	2,000	1,000	FT-P80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100	FT-P60	3,500 (Note 2)	3,500 (Note 2)	1,500	900	FT-P81X	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100	FT-H35-M2	3,500 (Note 2)	2,000	1,500	750	FT-H20W-M1	1,600 (Note 2)	1,300	900	500	FT-H20W-M2	2,600	1,300	900	500	FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,100	900
	Fiber \ Mode	LONG	STD	FAST	S-D																																																																	
	FT-B8	3,500 (Note 2)	2,500	2,000	1,000																																																																	
	FT-FM2	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300																																																																	
FT-T80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300																																																																		
FT-R80	3,500 (Note 2)	2,300	1,600	800																																																																		
FT-W8	3,500 (Note 2)	2,900 (Note 2)	2,000	1,000																																																																		
FT-P80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100																																																																		
FT-P60	3,500 (Note 2)	3,500 (Note 2)	1,500	900																																																																		
FT-P81X	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100																																																																		
FT-H35-M2	3,500 (Note 2)	2,000	1,500	750																																																																		
FT-H20W-M1	1,600 (Note 2)	1,300	900	500																																																																		
FT-H20W-M2	2,600	1,300	900	500																																																																		
FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,100	900																																																																		
	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	Sensing range (mm)[Lens on both sides] <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>FAST</th><th>S-D</th></tr><tr><td>FT-B8</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-FM2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-R80</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-W8</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-P80</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-P60</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-P81X</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-H20W-M1</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td><td>1,500</td></tr><tr><td>FT-H20W-M2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,000</td><td>1,500</td></tr><tr><td>FT-H20-M1</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td><td>1,600 (Note 2)</td></tr><tr><td>FT-H13-FM2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr></table>	Fiber \ Mode	LONG	STD	FAST	S-D	FT-B8	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-R80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-W8	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-P80	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-P60	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-P81X	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-H35-M2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	FT-H20W-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,500	FT-H20W-M2	3,500 (Note 2)	3,500 (Note 2)	3,000	1,500	FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	FT-H13-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)
Fiber \ Mode	LONG	STD	FAST	S-D																																																																		
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FT-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)																																																																		
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FT-P81X	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)																																																																		
FT-H35-M2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)																																																																		
FT-H20W-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,500																																																																		
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FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)	1,600 (Note 2)																																																																		
FT-H13-FM2	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)	3,500 (Note 2)																																																																		
	Side-view lens	FX-SV1		Beam axis is bent by 90°. Ambient temperature: 60 to 300 C 76 to 662 F	Sensing range (mm)[Lens on both sides] <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>FAST</th><th>S-D</th></tr><tr><td>FT-B8</td><td>1,100</td><td>530</td><td>400</td><td>186</td></tr><tr><td>FT-FM2</td><td>1,200</td><td>600</td><td>440</td><td>210</td></tr><tr><td>FT-T80</td><td>1,200</td><td>600</td><td>440</td><td>210</td></tr><tr><td>FT-W8</td><td>900</td><td>450</td><td>330</td><td>160</td></tr><tr><td>FT-P80</td><td>1,200</td><td>600</td><td>440</td><td>210</td></tr><tr><td>FT-P60</td><td>650</td><td>300</td><td>200</td><td>130</td></tr><tr><td>FT-P81X</td><td>1,200</td><td>600</td><td>440</td><td>200</td></tr><tr><td>FT-H35-M2</td><td>550</td><td>280</td><td>200</td><td>90</td></tr><tr><td>FT-H20W-M1</td><td>310</td><td>140</td><td>100</td><td>50</td></tr><tr><td>FT-H20W-M2</td><td>310</td><td>140</td><td>100</td><td>50</td></tr><tr><td>FT-H20-M1</td><td>550</td><td>280</td><td>200</td><td>90</td></tr></table>	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					
Fiber \ Mode	LONG	STD	FAST	S-D																																																																		
FT-B8	1,100	530	400	186																																																																		
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FT-H20-M1	550	280	200	90																																																																		
	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] <table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>FAST</th><th>S-D</th></tr><tr><td>FT-6V</td><td>3,500 (Note 2)</td><td>2,700</td><td>1,800</td><td>940</td></tr><tr><td>FT-60V</td><td>2,800</td><td>1,450</td><td>1,000</td><td>490</td></tr></table>	Fiber \ Mode	LONG	STD	FAST	S-D	FT-6V	3,500 (Note 2)	2,700	1,800	940	FT-60V	2,800	1,450	1,000	490																																																		
Fiber \ Mode	LONG	STD	FAST	S-D																																																																		
FT-6V	3,500 (Note 2)	2,700	1,800	940																																																																		
FT-60V	2,800	1,450	1,000	490																																																																		

Note: 1) When the thru-beam type fiber is used equipping with the expansion lens, since beam envelope becomes narrow, be careful in the case of installation. Especially, in the case of using the fiber of the many cores (sharp bending fibers and heat-resistant glass fiber) please use it after sufficiently adjusting.
2) 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)

For reflective type fiber

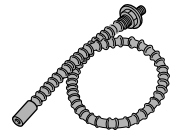
Designation	Model No.	Description																	
Pinpoint spot lens	FX-MR1		Pinpoint spot of $\phi 0.5$ mm $\phi 0.02$ in. Enables detection of minute objects or small marks. - Applicable fibers: FD-WG4, FD-G4 - Ambient temperature: 40 to 70 C 40 to 158 F - Distance to focal point: 6 1 mm 0.236 0.039 mm																
Zoom lens	FX-MR2		The spot diameter is adjustable from $\phi 0.7$ $\phi 0.028$ to $\phi 2$ mm $\phi 0.079$ 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) <table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>7 mm</td><td>18.5 mm approx.</td><td>$\phi 0.7$ mm</td></tr><tr><td>12 mm</td><td>27 mm approx.</td><td>$\phi 1.2$ mm</td></tr><tr><td>14 mm</td><td>43 mm approx.</td><td>$\phi 2.0$ mm</td></tr></table>		Screw-in depth	Distance to focal point	Spot diameter	7 mm	18.5 mm approx.	$\phi 0.7$ mm	12 mm	27 mm approx.	$\phi 1.2$ mm	14 mm	43 mm approx.	$\phi 2.0$ mm			
Screw-in depth	Distance to focal point	Spot diameter																	
7 mm	18.5 mm approx.	$\phi 0.7$ mm																	
12 mm	27 mm approx.	$\phi 1.2$ mm																	
14 mm	43 mm approx.	$\phi 2.0$ mm																	
Finest spot lens	FX-MR3		Extremely fine spot of $\phi 0.3$ mm $\phi 0.012$ in achieved. - Applicable fibersFD-WG4, FD-G4 FD-EG1, FD-EG2, FD-EG3, FD-G6X, - Ambient temperature: 40 to 70 C 40 to 158 F <table><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG3</td><td>7.5 0.5 mm</td><td>$\phi 0.15$ mm approx.</td></tr><tr><td>FD-EG2</td><td>7.5 0.5 mm</td><td>$\phi 0.2$ mm approx.</td></tr><tr><td>FD-EG1</td><td>7.5 0.5 mm</td><td>$\phi 0.3$ mm approx.</td></tr><tr><td>FD-WG4/G4/G6X</td><td>7.5 0.5 mm</td><td>$\phi 0.5$ mm approx.</td></tr></table>		Fiber	Distance to focal point	Spot diameter	FD-EG3	7.5 0.5 mm	$\phi 0.15$ mm approx.	FD-EG2	7.5 0.5 mm	$\phi 0.2$ mm approx.	FD-EG1	7.5 0.5 mm	$\phi 0.3$ mm approx.	FD-WG4/G4/G6X	7.5 0.5 mm	$\phi 0.5$ mm approx.
Fiber	Distance to focal point	Spot diameter																	
FD-EG3	7.5 0.5 mm	$\phi 0.15$ mm approx.																	
FD-EG2	7.5 0.5 mm	$\phi 0.2$ mm approx.																	
FD-EG1	7.5 0.5 mm	$\phi 0.3$ mm approx.																	
FD-WG4/G4/G6X	7.5 0.5 mm	$\phi 0.5$ mm approx.																	
Finest spot lens	FX-MR6		Extremely fine spot of $\phi 0.1$ mm $\phi 0.004$ in achieved. - Applicable fibersFD-WG4, FD-G4 FD-EG1, FD-EG2, FD-EG3, FD-G6X, - Ambient temperature: 20 to 60 C 4 to 140 F <table><tr><th>Fiber</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-EG3</td><td>7 0.5 mm</td><td>$\phi 0.1$ mm approx.</td></tr><tr><td>FD-EG2</td><td>7 0.5 mm</td><td>$\phi 0.15$ mm approx.</td></tr><tr><td>FD-EG1</td><td>7 0.5 mm</td><td>$\phi 0.2$ mm approx.</td></tr><tr><td>FD-WG4/G4/G6X</td><td>7 0.5 mm</td><td>$\phi 0.4$ mm approx.</td></tr></table>		Fiber	Distance to focal point	Spot diameter	FD-EG3	7 0.5 mm	$\phi 0.1$ mm approx.	FD-EG2	7 0.5 mm	$\phi 0.15$ mm approx.	FD-EG1	7 0.5 mm	$\phi 0.2$ mm approx.	FD-WG4/G4/G6X	7 0.5 mm	$\phi 0.4$ mm approx.
Fiber	Distance to focal point	Spot diameter																	
FD-EG3	7 0.5 mm	$\phi 0.1$ mm approx.																	
FD-EG2	7 0.5 mm	$\phi 0.15$ mm approx.																	
FD-EG1	7 0.5 mm	$\phi 0.2$ mm approx.																	
FD-WG4/G4/G6X	7 0.5 mm	$\phi 0.4$ mm approx.																	
Zoom lens (Side-view type)	FX-MR5		FX-MR2 is converted into a side-view type and can be mounted in a very small space. - Applicable fibers: FD-WG4, FD-G4 - Ambient temperature: 40 to 70 C 40 to 158 F <table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm</td><td>13 mm approx.</td><td>$\phi 0.5$ mm</td></tr><tr><td>10 mm</td><td>15 mm approx.</td><td>$\phi 0.8$ mm</td></tr><tr><td>14 mm</td><td>30 mm approx.</td><td>$\phi 3.0$ mm</td></tr></table>		Screw-in depth	Distance to focal point	Spot diameter	8 mm	13 mm approx.	$\phi 0.5$ mm	10 mm	15 mm approx.	$\phi 0.8$ mm	14 mm	30 mm approx.	$\phi 3.0$ mm			
Screw-in depth	Distance to focal point	Spot diameter																	
8 mm	13 mm approx.	$\phi 0.5$ mm																	
10 mm	15 mm approx.	$\phi 0.8$ mm																	
14 mm	30 mm approx.	$\phi 3.0$ mm																	

Others

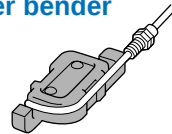
Designation	Model No.	Description				
Protective tube (For thru-beam type fiber)	FTP-500 (0.5 m 1.64 ft)	For M4 thread	Applicable fibers	FT-B8 FT-NB8 FT-FM2 FT-FM2S FT-FM2S4	FT-N8 FT-P80 FT-P60 FT-H13-FM2	The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.
	FTP-1000 (1 m 3.281 ft)					
	FTP-1500 (1.5 m 4.921 ft)					
	FTP-N500 (0.5 m 1.64 ft)	For M3 thread		FT-T80 FT-NFM2S 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 1.64 ft)	For M6 thread	Applicable fibers	FD-B8 FD-FM2 FD-FM2S FD-FM2S4 FD-N8	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 1.64 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-AJ-F	Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fibers)				

Notes: 1) Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.
2) Refer to the **MS-AJ** series catalog or sensor general catalog for the universal sensor mounting stand.

Protective tube

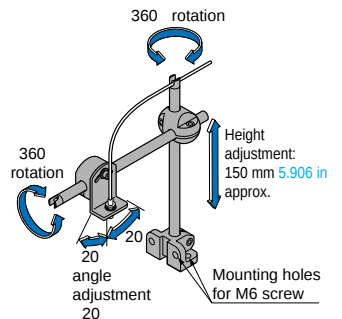


Fiber bender



Universal sensor mounting stand

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



Fiber Specifications

Standard / Flexible / Sharp bending / Special use Fibers

Type		Standard	Flexible
Item			
Allowable bending radius		R25 mm R0.984 in or more [Sleeve part of a head with sleeve: R10 mm 0.394 in or more (Note 1)]	R4 mm or more
Bending durability		—	1 million times or more (at R10 mm, FT-P40/P2 , FD-P40/P2 : at R4 mm)
Ambient temperature		-40 to $+70^{\circ}\text{C}$ -40 to $+158^{\circ}\text{F}$ FT-SFM2SV2 : -20 to $+70^{\circ}\text{C}$ -4 to $+158^{\circ}\text{F}$ FT-V22 , FD-SFM2SV2 : -20 to $+60^{\circ}\text{C}$ -4 to $+140^{\circ}\text{F}$ FT-V41 , FD-V41 : -40 to $+60^{\circ}\text{C}$ -40 to $+140^{\circ}\text{F}$	-40 to $+70^{\circ}\text{C}$ -40 to $+158^{\circ}\text{F}$ FT-Z8□ , FT-P60 , FT-PS1 , FD-P60 , FD-P50 : -40 to $+60^{\circ}\text{C}$ -4 to $+140^{\circ}\text{F}$
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, Polyurethane)
	Fiber head	Brass (Nickel plated) FT-SFM2L/T80/SFM2/SNFM2/SFM2SV2/V22/V41 , FD-T80/T40/S80/SNFM2/SFM2SV2/V41 , Sleeve: SUS, FT-FM10L : ABS, Lens of FT-FM10L/SFM2L : Acrylic	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 , FD-N8/N4): 1 set of fiber attachment Free-cut type fibers (except for FT-NB8/N8 , FD-N8/N4): 1 No. of FX-CT2 (Fiber cutter) Threaded head fibers: 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.)	All fibers: 1 set of fiber attachment Free-cut type fibers: 1 No. of FX-CT2 (Fiber cutter) Threaded head fibers: 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.), FT-Z8□ : 1 set of mounting screw

Notes 1) Sleeve part of side-view type cannot be bent.

2) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Type		Sharp bending
Item		
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 $+60^{\circ}\text{C}$ -40 to $+140^{\circ}\text{F}$ (FT-WA30/WA8/WKV8 : -40 to $+55^{\circ}\text{C}$ -40 to $+131^{\circ}\text{F}$)
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 part) FT-W8/W4 , FD-W8/W44/WG4 : Brass (Nickel plated) Case of FT-WA30/WA8/WZ8□ , Lens of FT-WS8L , Resin of FT-WKV8 : Polycarbonate, Lens of FT-WA30 : Norbornene resin Lens of FT-WA8 : Polyolefin, Lens of FT-WZ8H/WZ8E , Reflector of FT-WZ8E , Prism of FT-WKV8 : Acrylic, Reflector of FT-WZ8 : Polycarbonate, FD-WL41 : Heat-resistant ABS, FD-WL42 : Aluminum (Aluminized in black), Lens of FD-WKZ1 : Optical lens, Front film of FD-WL41 : Polyester
Accessories (Note 1)		All fibers: 1 set of fiber attachment and 1 No. of FX-CT2 (Fiber cutter) Threaded fibers: 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.) FT-WA30 : 2 Nos. of 0.5×32 mm 0.02×1.26 in seal type slit mask FT-WA8 : 2 Nos. of 0.5×12 mm 0.02×0.472 in seal type slit mask and 2 Nos. of 1×12 mm 0.039×0.472 in seal type slit mask FT-WZ8□ : 1 set of mounting screw FD-WKZ1 : 1 No. of mounting bracket

Notes 1) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Type		Special use			
Item		Wide beam	Array	Narrow beam	High precision
Allowable bending radius		R10 mm R0.394 in or more	R25 mm R0.984 in or more	R25 mm R0.984 in or more	FD-EG2/EG3 : R10 mm R0.394 in or more FD-G4/EG1 : R25 mm R0.984 in or more
Ambient temperature		FT-A30 : -40 to $+60^{\circ}\text{C}$ -40 to $+140^{\circ}\text{F}$ FT-A8 : -40 to $+70^{\circ}\text{C}$ -40 to $+158^{\circ}\text{F}$	-40 to $+70^{\circ}\text{C}$ -40 to $+158^{\circ}\text{F}$	-40 to $+60^{\circ}\text{C}$ -40 to $+140^{\circ}\text{F}$	-20 to $+60^{\circ}\text{C}$ -4 to $+140^{\circ}\text{F}$ FD-G4 : -40 to $+70^{\circ}\text{C}$ -40 to $+158^{\circ}\text{F}$
Ambient humidity		35 to 85%RH (No dew condensation or icing allowed)			
Material	Fiber core	Acrylic			
	Sheath	Polyethylene			Polyolefin (FD-G4 : Polyethylene)
	Fiber head	Polycarbonate (Lens of FT-A30 : Norbornene resin) Lens of FT-A8 : Polyolefin	Brass (Nickel plated)	Stainless steel (SUS), Polycarbonate (Lens: Norbornene resin) Prism of FT-KV8 : Acrylic	Brass (Nickel plated)
Accessories (Note 1)		All fibers: 1 set of fiber attachment and 1 No. of FX-CT2 (Fiber cutter) FT-A30 : 2 Nos. of 0.5×32 mm 0.02×1.26 in seal type slit mask FT-A8 : 2 Nos. of 0.5×12 mm 0.02×0.472 in seal type slit mask and 2 Nos. of 1×12 mm 0.039×0.472 in seal type slit mask	All fibers: 1 set of fiber attachment Free-cut type fibers: 1 No. of FX-CT2 (Fiber cutter) Threaded head fibers: 2 Nos. of nuts and 1 No. of toothed lock washer		

Notes 1) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Special use / Environment resistant Fibers

Type		Special use		
		Ultra-small diameter	Fixed-focus reflective	Tough flexible
Item	Model No.			
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 +170°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 +14 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
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 set of fiber attachment Threaded head fibers: 2 Nos. of nuts and 1 No. of toothed lock washer	All fibers: 1 set of fiber attachment and 1 No. of FX-CT2 (Fiber cutter) FD-L4: 2 Nos. of M2.6 (length 12 mm 0.472 in) screws with washers and 2 Nos. of nuts	All fibers: 1 set of fiber attachment, 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.) FD-G6X: 1 No. of FX-CT2 (Fiber cutter)

Notes 1) Sleeve part cannot be bent.

2) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Type		Special use			
		Leak detection	Liquid level sensing		
Item	Model No.	FD-F7□	FT-F9□	FD-F8Y	FD-F4□/F9□
Allowable bending radius		Protective tube: R20 mm R0.0787 in or more Fiber: R4 mm R0.157 mm or more		Protective tube: R40 mm R1.575 in or more Fiber: R15 mm R0.591 in or more	R10 mm R0.394 in or more
Bending durability		Fiber: 1 million times or more (at R4 mm R0.157 in)			
Ambient temperature		-20 to +60°C -4 to +140°F (Note 1)		-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	Acrylic		Polycarbonate	
	Sheath	Vinyl chloride (Protective tube: Fluorine resin)		Polypropylene (Protective tube: Fluorine resin)	Polyethylene
	Fiber head	Exterior: Fluorine resin Interior: Heat-resistant ABS, Acrylic, Brass	Case: Heat-resistant ABS Lens: Acrylic		Polyetherimide (Lens: Polycarbonate)
Accessories (Note2)		1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 1 No. of PFA mounting bracket, 1 No. of PVC mounting bracket	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 2 Nos. of tying bands and 2 Nos. of anti-slip tubes	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter)	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 4 Nos. of tying bands and 2 Nos. of anti-slip tubes

Notes 1) With the liquid sensing fiber, make sure that the temperature of the liquid is also within the ambient temperature range.

2) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Type		Environment resistant					
		Heat resistant				Chemical-resistant	Vacuum
Item	Model No.	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)				R30 mm R1.181 in or more (FT-Z8□Y: 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) (Note 2)	-60 to +300°C -76 to +572°F (Note 1) (Note 2) (Note 3)	-60 to +200°C -76 to +392°F (Note 2)	-60 to +180°C -76 to +356°F (Note 2) (Note 4)	-60 to +130°C -76 to +266°F (FT-Z8□Y: 0 to +60°C +14 to +140°F)	-40 to +120°C -40 to +248°C
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 FT-H20W-□: Fluorine resin	Fluorine resin		Fluorine resin
	Fiber head			Brass (Nickel plated)	Stainless steel (SUS)	Brass (Nickel plated)	Aluminum
Accessories (Note5)		FT-H20W-□, FD-H18-L31, FT-H13-FM2: 1 set of fiber attachment Free-cut type fibers: 1 No. of FX-CT2 (Fiber cutter) Threaded head fibers: 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.)				1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter)	2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.)

Notes 1) If the fiber is used under -30°C **-22°F**, its resistable maximum temperature drops to +200°C **+392°F**. If the side-view lens **FX-SV1** is put on the fiber head, the allowable maximum temperature comes down 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 and 200°C **392°F** type fiber is 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**.)

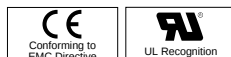
3) If the fiber material is quartz glass or multi-component glass, keep it away from vibration or impact.

4) Please give continuous using temperature and continuous storage temperature as -60 to +150°C **-76 to +302°F**.

5) The fiber attachment accessories described in this catalog are for use only with the **FX-300** series. Fiber attachment accessories are also supplied as accessory along with conventional amplifiers. Please contact our office for more details on these accessories.

Digital Fiber Sensor / FX-301

Refer to the **FX-301** catalog for more details.



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



MODE NAVI
New Advanced sensor with Visible Indicator

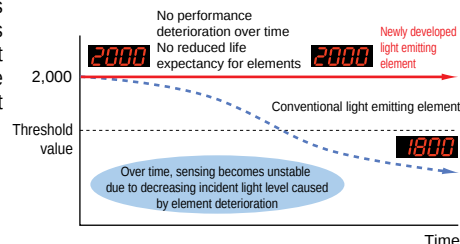
Type	NPN output	PNP output
Model No.	FX-301	FX-301P
Sensing range	Thru-beam type (FT-B8): 1,100 mm 43.307 in (LONG), 530 mm 20.866 in (STD) 400 mm 15.748 in (FAST), 180 mm 7.087 in (S-D) Reflective type (FD-B8): 480 mm 18.898 in (LONG), 220 mm 8.661 in (STD) 160 mm 6.299 in (FAST), 75 mm 2.953 in (S-D)	
Supply voltage	12 to 24 V DC $\pm$ 10%	
Output	NPN open-collector transistor	PNP open-collector transistor
Output operation	Selectable either Light-ON or Dark-ON, with jog switch	
Response time	150 μ s or less (FAST), 250 μ s or less (STD / S-D), 2 ms or less (LONG) selectable with jog switch	
Digital display	4 digit red LED display	
Sensitivity setting	2-level teaching / Limit teaching / Manual adjustment	
Automatic interference prevention function	Incorporated (Up to 4 sets of fiber heads can be mounted closely.)	
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)	
Emitting element	Red LED (modulated)	
Dimensions	W10 × H30.5 × D64.5 mm W0.394 × H1.201 × D2.575 in	

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

Main cable (3-core): **CN-73-C1** (cable length 1 m **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**)

Specially developed light emitting element extends life expectancy – no need to ever adjust incident light level

The levels of incident light produced by the light-emitting element (LEDs) utilized in conventional fiber sensor, tend to eventually decrease due to the effects of temperature and time. However, **FX-301** incorporates our newly developed 'four-chemical LED', which eliminates such LED performance deterioration. This new element results in stable incident light levels that can be maintained almost indefinitely.

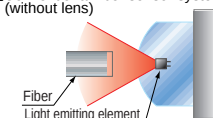


Newly developed

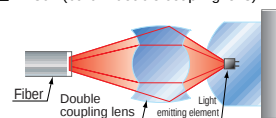
Long-range sensing made possible with built-in optical lens

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.

■ Conventional fiber sensor system (without lens)
 Low efficiency due to the diffusion and loss of emitted light.



■ **FX-301** (built-in double coupling lens)
 The light emission efficiency is increased tremendously, as light is now collected and focused into the fiber by the lens.



Easy operation with MODE NAVI

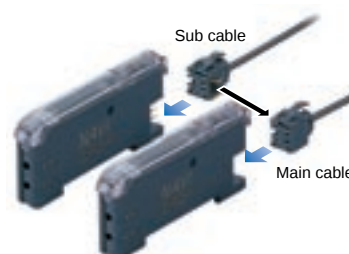
MODE NAVI uses six indicators to display the amplifier's basic operations. The current operating mode can be confirmed at a glance, so even a first time user can easily operate the amplifier without becoming confused.



MODE NAVI (MODE indicators)

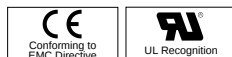
Easy maintenance, as main and sub units are identical

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

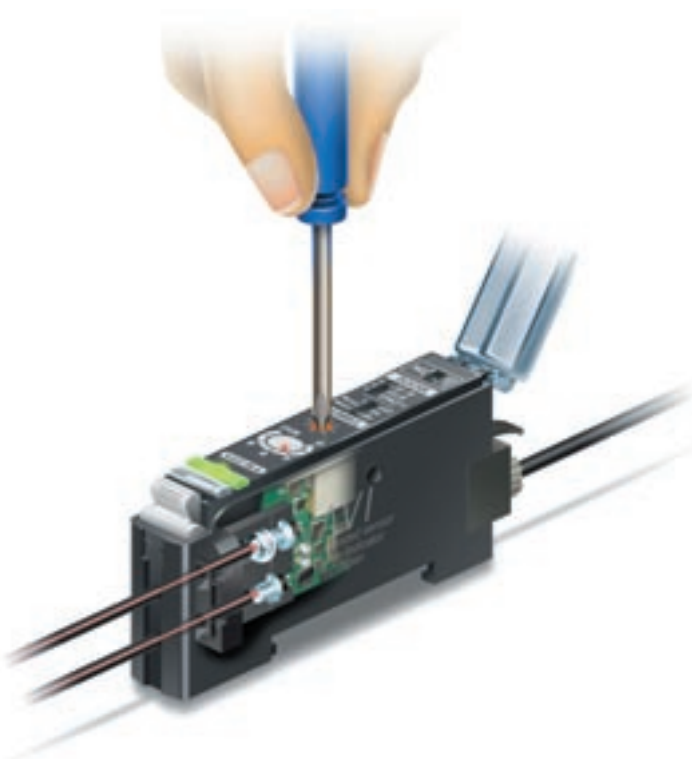


Manually Set Fiber Sensor / FX-311

Refer to the **FX-311** catalog for more details.



Sensing New Frontiers Highly sensitive manual tuning made easy.



12-turn potentiometer with visible indicator

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

Indicator

12-turn potentiometer



Easy operation by using a convenient, hand-turned adjusting knob of cover

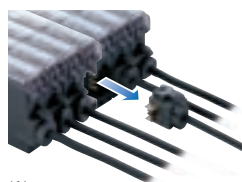
An optional hand-turned knob attached cover (**FX-AJ1**) is available, which makes a screwdriver unnecessary. You can adjust sensitivity on site at any time quickly and easily.



Side-by-side connection with FX-301 is also possible for wide-saving and quick installation

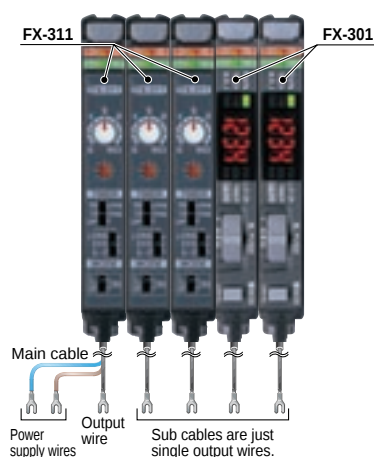
Each sub cable is a single output wire, reducing wiring and simplifying installation. Quick-connection cables are the same type as used on **FX-301**, facilitating side-by-side connection. Further, the connectors are slide type, allowing removal without shifting amplifier positions. This eliminates the need to provide extra maintenance space around the amplifiers.

Sliding connectors are easy to insert and remove



※NOTE

Note that settings other than the interference prevention function cannot be transmitted between this product and digital fiber sensor **FX-301(P)** / **302(P)**. Therefore, if both models of amplifiers are mounted in cascade, make sure to mount identical models together.



Type	NPN output	PNP output
Model No.	FX-311	FX-311P
Sensing range	Thru-beam type (FT-B8): 1,100 mm 43.307 in (LONG), 530 mm 20.866 in (STD), 180 mm 7.087 in (S-D) Reflective type (FD-B8): 480 mm 18.898 in (LONG), 220 mm 8.661 in (STD), 75 mm 2.953 in (S-D)	
Supply voltage	12 to 24 V DC $\pm$ 10%	
Output	NPN open-collector transistor	PNP open-collector transistor
Output operation	Selectable either Light-ON or Dark-ON, with selection switch	
Response time	250 μ s or less (STD / S-D), 2 ms or less (LONG) selectable with selection switch	
Timer function	Incorporated with OFF-delay timer, selectable either effective (10ms or 40ms approx.) or ineffective	
Automatic interference prevention function	Incorporated (Up to 4 sets of fiber heads can be mounted closely.)	
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 131°F)	
Emitting element	Red LED (modulated)	
Dimensions	W10 $\times$ H30.5 $\times$ D64.5 mm W0.394 $\times$ H1.201 $\times$ D2.575 in	

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

Main cable (3-core): **CN-73-C1** (cable length 1 m **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**)

Rapid flashing 'Assist Function' eases adjustment for optimum sensitivity

FX-311 has a convenient built-in 'assist function' which indicates the optimum sensitivity position by flashing rapidly when optimum sensitivity is reached. This enables easy and reliable sensitivity adjustment, which is convenient for a narrow sensing range requiring fine tuning.

Innovative feature

High-functional Digital Fiber Sensor / FX-302

Building upon our existing multi-functionality and usability, **FX-302** further extends the state-of-the-art by incorporating a Window Comparator Mode

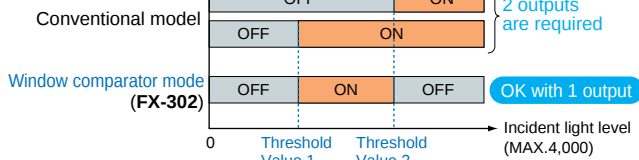


Arithmetic processing is no longer required Incorporates a convenient single-output window comparator mode

New
concept

In addition to standard ON / OFF operation, **FX-302** comes fully equipped with a window comparator mode, which sets maximum and minimum threshold values and controls the incident light level through ON / OFF operation within this range. With its single output, only one wire is required, making PLC processing unnecessary.

In the L-ON state



Teaching Methods

There are 3 types of teaching methods:
1-level teaching / 2-level teaching / 3-level teaching.

1-level Teaching

This function allows the unit to perform 1-level teaching (object 'A'). If an arbitrary shift value has been selected, then threshold values are set at 2 positions.

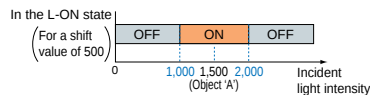
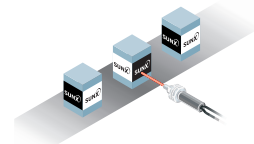
Identifying the orientation of the object

[When only object 'A' must be detected]

Performing 1-level teaching only for object 'A'

NG Object 'A' NG Object 'B'

No object present (0) OK (1,500) (3,000)



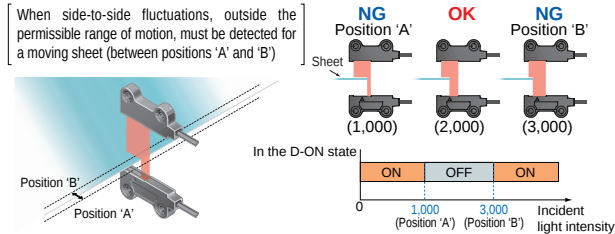
2-level Teaching

If teaching is performed for 2 positions (positions 'A' and 'B'), then the threshold values will be set for these 2 positions.

Sensing side-to-side fluctuations in sheet motion

[When side-to-side fluctuations, outside the permissible range of motion, must be detected for a moving sheet (between positions 'A' and 'B')]

Performing 2-level teaching for positions 'A' and 'B'



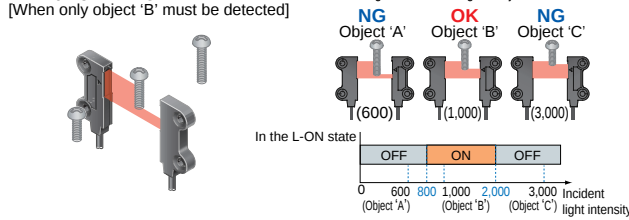
3-level Teaching

If 3-level teaching is performed for 3 positions (objects 'A', 'B' and 'C'), then the threshold values will be set in-between objects 'A' & 'B', and objects 'B' & 'C'.

Identifying the length of a screw

[When only object 'B' must be detected]

Performing 3-level teaching on objects 'A', 'B' and 'C'



Communications setting change function can be locked

Once optical communications has been used for the single-step copy of settings, or for the single-step read-out / saving of databank data, then new data cannot be overwritten into fiber sensors with locked settings.

This function is useful when all data must be read-out in a single step, at the time that sensing objects are about to be rearranged, or when the existing settings of synchronized fiber sensors must be maintained.



Overwriting will be prevented when fiber sensor amplifier settings have been locked.

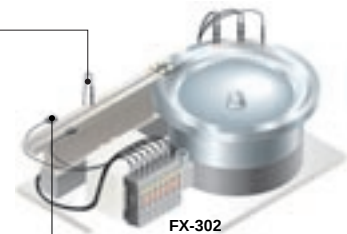
Lower total cost, as PLC and timer are not required Incorporates an ON-delay / OFF-delay timer and an ON-delay / ONE SHOT timer

In addition to the 3 timer modes incorporated in **FX-301** (ON-delay, OFF-delay and ONE SHOT), **FX-302** also adds an ON-delay / OFF-delay timer and an ON-delay / ONE SHOT timer. Timer operations that were previously controlled by the PLC and timer can now be controlled by the fiber sensor unit itself, resulting in space savings and a lower cost.

Application example for the ON-delay / OFF-delay timer and the ON-delay / ONE-SHOT timer

Utilization of high pressure air for chip sorting after identification of top and bottom surfaces

Only chips with the bottom surface facing upward will be detected. These chips, once detected, will be blown to the side with a jet of air. The ON-delay function cancels the detection signals of the electrodes. By detecting the distance between the fiber head and the air outlet, and the rate of vibration, either the ON-delay / OFF-delay timer, or the ON-delay / ONE-SHOT timer will be set.



Application example for the ON-delay / OFF-delay timer

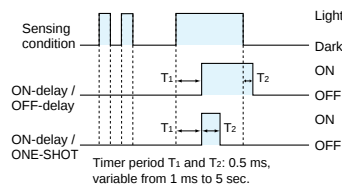
Detecting chip congestion status on a straight transport feeder

The ON-delay function is used to output a signal containing the chip congestion status, in order to determine whether the feeder is too crowded with chips. This signal controls the rate of vibration at the ball feeder area. The OFF-delay function keeps the vibration of the ball feeder area stopped, until chip congestion decreases and chips are again transported smoothly.



Time Chart

In the L-ON state



Timer period	Settings Changing Unit
0.5 ms, 1 ms to 30 ms	1 ms
30 ms to 100 ms	5 ms
100 ms to 500 ms	10 ms
500 ms to 1 sec.	50 ms
1 sec. to 5 sec.	0.5 sec.

Up to 8 fiber heads can be installed closely together

The optical communications feature allows up to 8 fiber heads to be installed closely together, without causing mutual interference.

(However, when connecting **FX-301/311** units, a maximum of 4 units can be installed without mutual interference.)

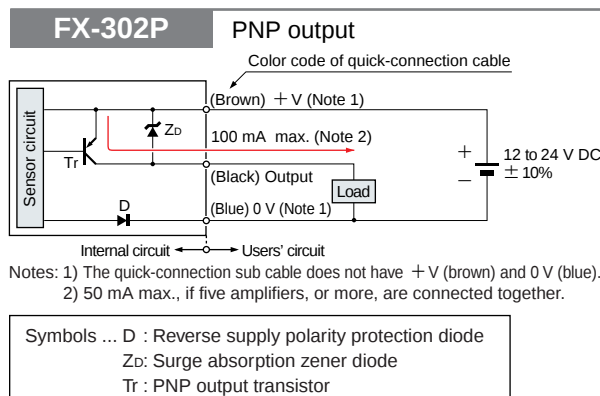
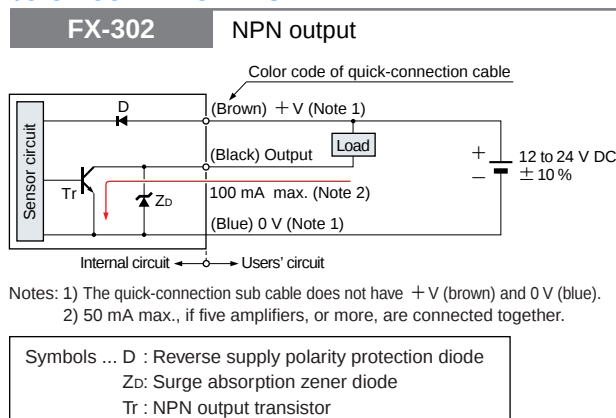


SPECIFICATIONS

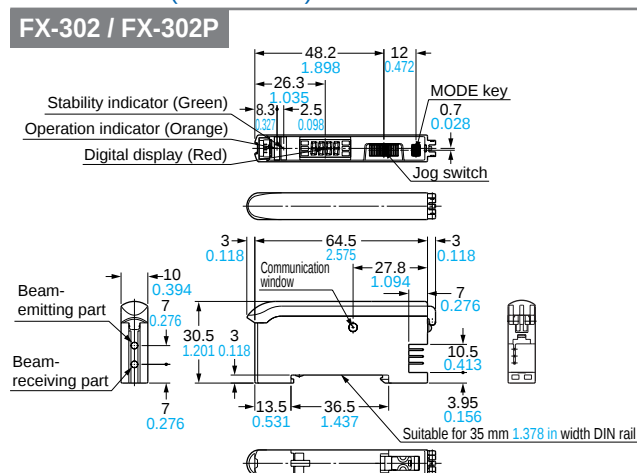
Type	NPN output		PNP output	
Model No.	FX-302		FX-302P	
Supply voltage	12 to 24 V DC $\pm$ 10 %		Ripple P-P 10 % or less	
Power consumption	Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)			
Output	NPN open-collector transistor • Maximum sink current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) sink current]		PNP open-collector transistor • Maximum source current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and + V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) source current]	
Output operation	Selectable either Light-ON or Dark-ON, with jog switch			
Short-circuit protection	Incorporated			
Response time	300 μ s or less (FAST), 500 μ s or less (STD / S-D), 4 ms or less (LONG) selectable with jog switch			
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			
Sensitivity setting	Normal mode: 2-level teaching / Limit teaching / Manual adjustment Window comparator mode: Teaching (1-level / 2-level / 3-level) / Manual adjustment			
Fine sensitivity adjustment function	Incorporated			
Timer function	Incorporated with variable ON-delay, OFF-delay, ONE-SHOT, ON-delay / OFF-delay, ON-delay / ONE-SHOT timer, switchable either effective or ineffective (timer period. 0.5 ms to 5 sec. approx.)			
Automatic interference prevention function	Incorporated (Up to 8 sets of fiber heads can be mounted closely.)			
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			
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH			
Emitting element	Red LED (modulated)			
Material	Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Switch: Acrylic			
Connecting method	Connector connection (Note 4)			
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm ² 0.012 in ² , or more, cable.			
Weight	20 g 0.705 oz approx.			

- Notes: 1) 50 mA, if five, or more, amplifiers are connected in cascade.
 2) When connecting FX-301 (P) digital fiber sensors and FX-311 (P) manually set fiber sensors, a maximum of 4 units can be installed without mutual interference.
 3) When the power supply is switched on, the emission timing are automatically set for interference prevention.
 4) 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)

I/O CIRCUIT DIAGRAMS



DIMENSIONS (Unit : mm in)



Digital Fiber Sensor **For leak detection fiber / liquid fiber only**

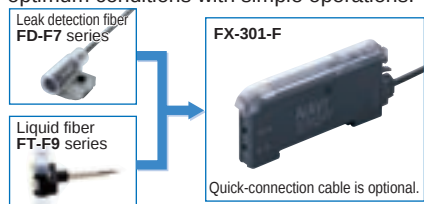
FX-301-F

Refer to the **FX-301-F** catalog for more details.

Optimum settings can be realized with simple operations.

Use only with leak detection or liquid fiber

FX-301-F is designed for use with only leak detection fiber, the **FD-F7** series or liquid fiber, the **FT-F9** series. You can set the optimum conditions with simple operations.



Flashing function incorporated

When the leak detection fiber is connected (F7 mode), if a leak is detected, you will recognize which fiber detects the leak at one sight because the emitter will start flashing.

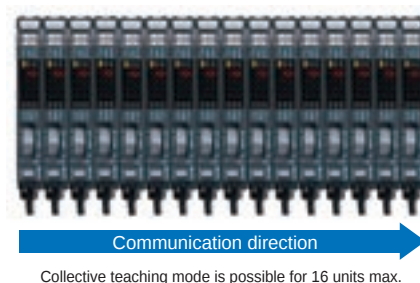
Easy to operate with individual / collective teaching mode

Individual teaching mode (TEACH)

After you select the **FD-F7** series or the **FT-F9** series by the jog switch, the optimum threshold level is automatically set by just pressing the jog switch.

Collective teaching mode (ALL)

You can set the optimum sensitivity for all cascaded units in one step by the optical communications function. Further, since the settings are also copied to all the units, cumbersome setting operation is considerably reduced.



Supply voltage: 12 to 24 V DC $\pm 10\%$
 Output: NPN open-collector transistor (NPN output type) or PNP open-collector transistor (PNP output type)

Bank Selection Unit / FX-CH SERIES



Settings for up to 16 fiber sensors can be changed at once by means of external signals

Settings can be changed by external signals

The settings for fiber sensors with bank functions can be changed using switch or PLC signals.

Both loading and saving can be performed

It is possible to perform both load (read-out settings) and save (save settings) operations by designating the bank channel.

Settings for 16 fiber sensors can be changed at once

Settings for up to 16 FX-301 and FX-302 sensors connected in series can be changed at once. This makes it much easier to reset sensors after tooling changes.

Suitable for a wide range of applications

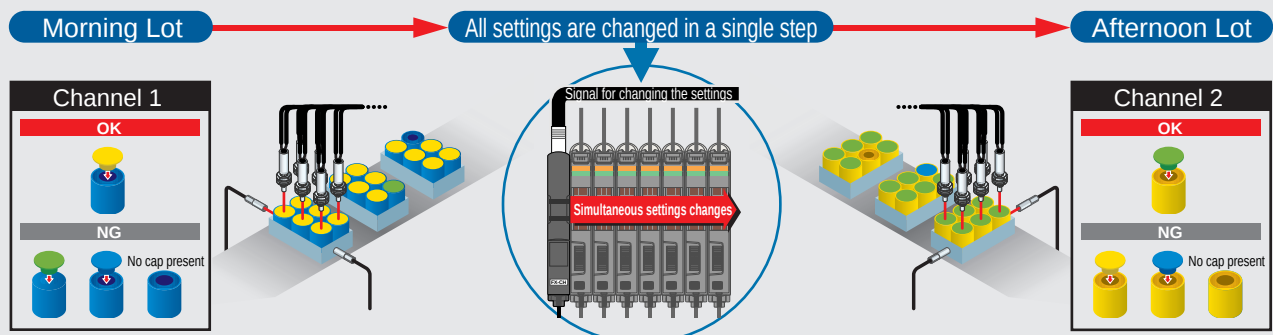
Bank settings include response times, threshold values, output operation settings, timer settings, hysteresis, stability, digital display settings (incident light intensity / percentage / peak hold / bottom hold), digital display inversion and ECO mode. These can all be changed at once using external signals to correspond to a variety of different applications.



Application Example

In production lines containing target objects that vary in color, from lot to lot, as shown by the figures below, the fiber sensor settings must be changed in accordance with the characteristics of the target objects. However, it can be very troublesome to change sensor settings for each different arrangement or type of work. Making these changes to settings takes time and requires extra care, in order to avoid possible malfunctions.

The FX-CH series allows preset bank settings to be changed, all in a single step, by utilizing an external signal, without having to handle individual sensors.



ORDER GUIDE

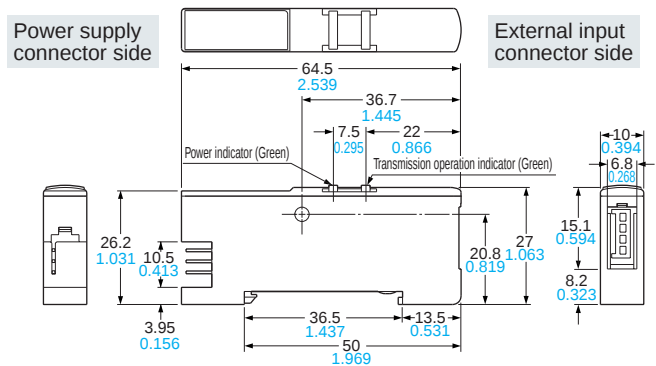
Designation		Model No.	Description	
Bank selection unit		FX-CH	NPN input type	This unit allows the bank channel settings for up to 16 fiber sensors (of both FX-301 and FX-302) to be changed, all in a single step, through the use of an external signal.
		FX-CH-P	PNP input type	
4-pin type male snap connector		SL-CP1 (White)	For 0.08 to 0.2 mm ² Wire diameter: φ0.7 to φ1.2 mm φ0.028 to φ0.047 in	This male snap connector is used to connect the channel changing input to the bank selection unit. The bank selection unit includes one SL-CP1 .
		SL-CP2 (Black)	For 0.3 mm ² Wire diameter: φ1.1 to φ1.6 mm φ0.043 to φ0.063 in	
		SL-CP3 (Greenish blue)	For 0.5 mm ² Wire diameter: φ1.7 to φ2.5 mm φ0.067 to φ0.098 in	
Quick-connection cable	Main cable	CN-73-C1	Length: 1 m 3.281 ft	This one-touch cable is utilized when connecting the FX-300 series fiber sensor and the FX-CH series bank selection unit together in the side-by-side configuration. 0.15 mm ² 3-core cabtyre cable, with connector on one end Cable outer diameter: φ3 mm φ0.12 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	This one-touch cable is utilized when connecting the FX-300 series fiber sensor and the FX-CH series bank selection unit together in the side-by-side configuration. 0.15 mm ² 1-core cabtyre cable, with connector on one end Cable outer diameter: φ 3 mm φ0.12 in
		CN-71-C2	Length: 2 m 6.562 ft	
		CN-71-C5	Length: 5 m 16.404 ft	
End plates		MS-DIN-E	After the FX-CH series and the fiber sensors have been attached to the DIN rail, all of these devices must be secured firmly together by placing end plates at each of the ends and sandwiching the FX-CH series and the fiber sensors in-between. Ensure that these end plates are used for this purpose.	

SPECIFICATIONS

Type	NPN input	PNP input
Model No.	FX-CH	FX-CH-P
Supply voltage	12 to 24 V DC ± 10 % Ripple P-P10 % or less	
Current consumption	25 mA or less	
Bank selection input	Low: 0 to 2 V DC (Source current: 0.5 mA (Input impedance: 10 kΩ approx.) High: 5 V to +V DC or open	High: 4 V to +V DC (Sink current: 0.5 to 3 mA (Input impedance: 10 kΩ approx.) Low: 0 to 0.6 V DC or open
Power indicator	Green LED (Lights up when the power is ON)	
Transmission operation indicator	Green LED (Lights up when loaded, blinks → lights up when saved)	
Ambient temperature	−10 to +55°C +14 to 131°F (No dew condensation or icing allowed), Storage: −20 to +70°C −4 to +158°F	
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH	
Material	Enclosure: Heat-resistant ABS	
Weight	20 g 0.705 oz approx.	
Accessory	SL-CP1 (Male snap connector): 1 No.	

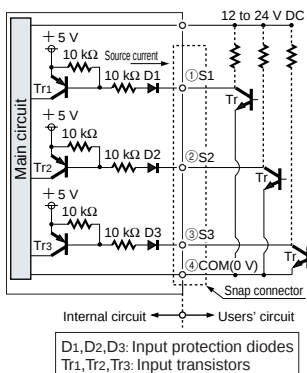
DIMENSIONS (Unit : mm in)

FX-CH / FX-CH-P

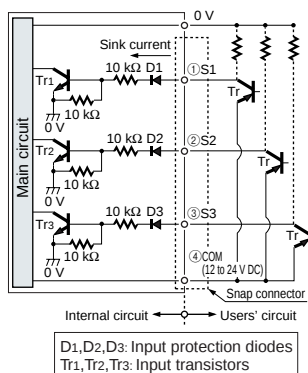


I/O CIRCUIT DIAGRAMS

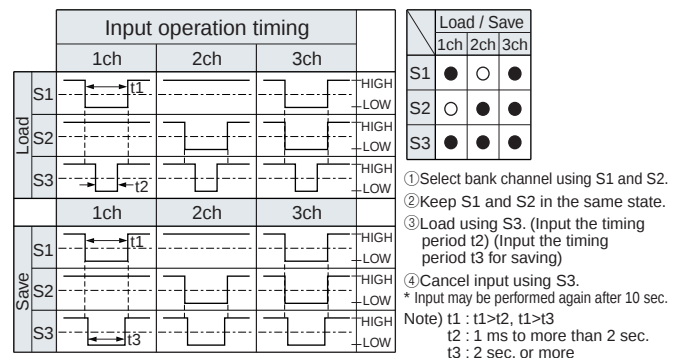
FX-CH



FX-CH-P



OPERATION TIMING CHART



Notes: 1) The above diagram is for **FX-CH** (NPN input).
 For **FX-CH-P** (PNP input), HIGH and LOW are reversed.

Sensor-PLC Connection System / SC SERIES



Up to 16 I/O devices can be connected at once using MIL connectors

Up to 16 I/O devices can be connected at once

Devices such as fiber sensors and amplifiers built-in compact sensors that are used in concentrated groups can be connected together efficiently using MIL connectors.

Separated installation possible

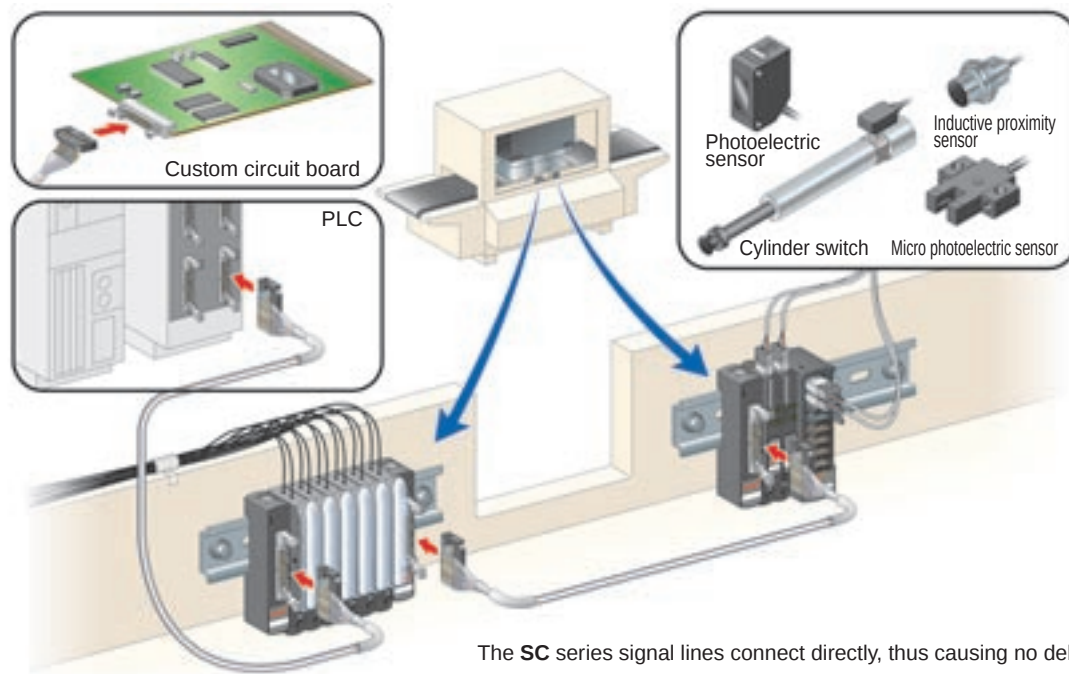
Separate unit **SC-MIL-S** is available for connecting sensors at a distance from each other using MIL connectors. This makes it possible to finely tune the sensor layout to suit the setting-up location.

Freely expandable as required

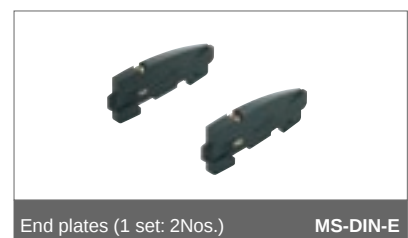
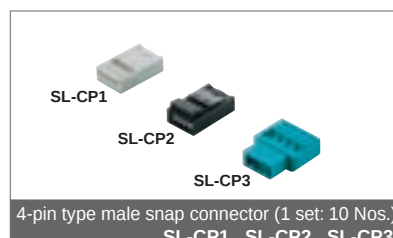
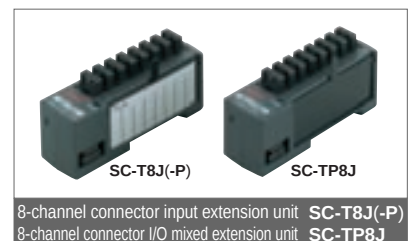
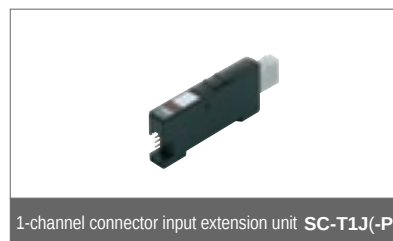
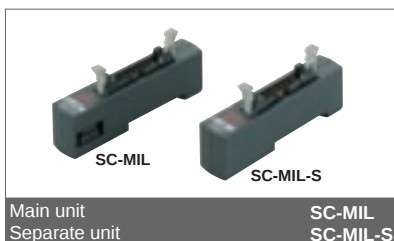
The abbreviated wiring system is economical and lets you expand the system by any amount required from one up to 16 channels.

Compatible with a variety of input and output devices

In addition to NPN open collector and PNP open collector output sensors and switches, input from other devices such as DC 2-wire sensors is also possible. Output to many different types of device is also available.



The **SC** series signal lines connect directly, thus causing no delay in response.



Designation	Model No.	Description
Main unit	SC-MIL	The MIL connector allows up to 16 input / output device connections to a PLC or custom circuit board, in a single step.
Separate unit	SC-MIL-S	Distributed installations are possible through the use of a main unit and MIL connectors.
1-channel connector input extension unit	SC-T1J	For NPN output devices
	SC-T1J-P	For PNP output devices
8-channel connector input extension unit	SC-T8J	For NPN output devices
	SC-T8J-P	For PNP output devices
8-channel connector I/O mixed extension unit	SC-TP8J	Allows the connection of a variety of input and output devices. This unit does not contain input / output signal indicators.
Non-line connector	CN-70	This one-touch connector is used to connect the main unit to the following devices: The FX-300 series fiber sensors, the FX-CH series bank selection unit and the 1-channel connector input extension unit.
4-pin type male snap connector (1 set: 10 Nos.)	SL-CP1 (White)	For 0.08 to 0.2 mm ² Wire diameter: φ0.7 to φ1.2 mm φ0.028 to 0.047 mm
	SL-CP2 (Black)	For 0.3 mm ² Wire diameter: φ1.1 to φ1.6 mm φ0.043 to 0.063 mm
	SL-CP3 (Greenish blue)	For 0.5 mm ² Wire diameter: φ1.7 to φ2.5 mm φ0.067 to 0.098 mm
End plates (1 set: 2 Nos.)	MS-DIN-E	After the SC series units have been attached to the DIN rail, all these devices must be secured firmly together by placing end plates at each of the ends and sandwiching the devices in-between. Ensure that these end plates are used for this purpose.

Designation	Model No.	Description
Index seals (1 set: 10 sheets.)	SC-MA1	An identifier for each connector should be marked on each seal, then the seals should be applied to the number plates attached to both the 8-channel connector input unit and the 8-channel connector input / output unit.
Connector end caps (1 set: 8 Nos.)	SC-PK	Connector end caps are utilized to protect the unconnected ends of connectors, for both the 8-channel connector input unit and the 8-channel connector input / output unit.

I/O CIRCUIT DIAGRAMS

SC-T1J / SC-T8J

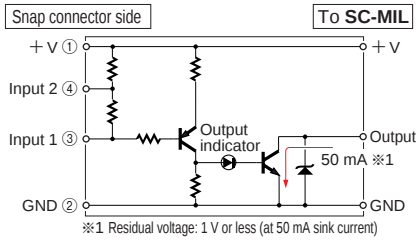
Male snap connector pin position

Pin No.	SC-T1J(-P) SC-T8J(-P)	SC-TP8J
1	+V	+V
2	GND	GND
3	Input 1	Input
4	※Input 2 (Not connected)	

※ For DC 2-wire type input device
[SC-T1J(-P) only]

Conditions

Leak current :
1 mA or less (when the power is OFF)
Offset voltage :
3 V or less (when the power is ON)
The product of which the load current range contains 5 to 8 mA.



※1 Residual voltage: 1 V or less (at 50 mA sink current)

SC-T1J-P / SC-T8J-P

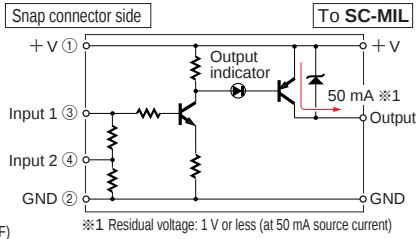
Male snap connector pin position

Pin No.	SC-T1J(-P) SC-T8J(-P)	SC-TP8J
1	+V	+V
2	GND	GND
3	Input 1	Input
4	※Input 2 (Not connected)	

※ For DC 2-wire type input device
[SC-T1J(-P) only]

Conditions

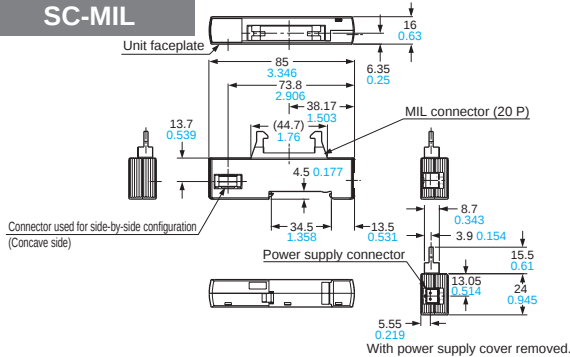
Leak current :
1 mA or less (when the power is OFF)
Offset voltage :
3 V or less (when the power is ON)
The product of which the load current range contains 5 to 8 mA.



※1 Residual voltage: 1 V or less (at 50 mA source current)

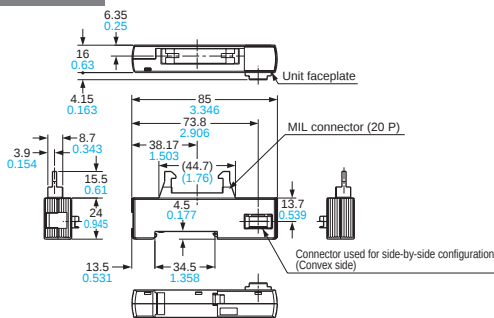
DIMENSIONS (Unit : mm in)

SC-MIL



With power supply cover removed.

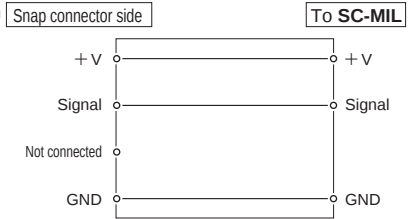
SC-MIL-S



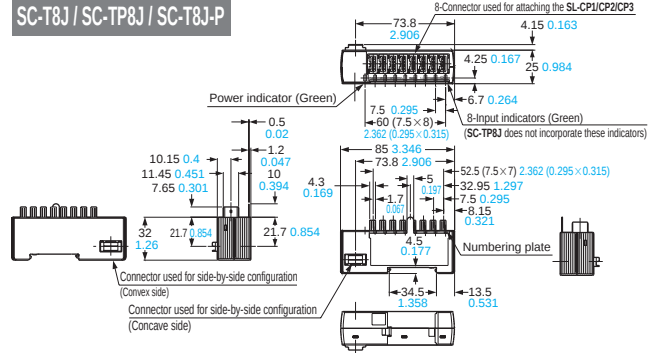
SC-TP8J

Male snap connector pin position

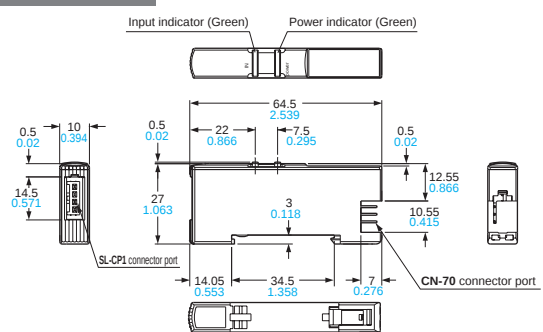
Pin No.	SC-TP8J
1	+V
2	GND
3	Signal
4	Not connected



SC-T8J / SC-TP8J / SC-T8J-P



SC-T1J / SC-T1J-P



All information is subject to change without prior notice.



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