SUNX

Fiber General Catalog

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

INDEX

http://www.fiber-sensor.com

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 New
Standard
ϕ3 15 mm ϕ0.118 0.591 in
570 mm 22.441 in

FT-WS8
Standard
ϕ2.5 8 mm ϕ0.098 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
ϕ1.5 8 mm ϕ0.059 0.315 in
160 mm 6.299 in

FT-WS8L
With lens
ϕ3 8 mm ϕ0.118 0.315 in
1,200 mm 47.244 in

FT-WZ8 New
Rectangular head · Front sensing
W8.5 H12 D3 mm W0.355 H0.472 D0.118 in
700 mm 27.559 in

FT-WZ8E New
Rectangular head · Side sensing
W3 H12 D8 mm W0.118 H0.472 D0.315 in
1,500 mm 59.055 in

FT-WZ8H New
Rectangular head · Top sensing
W3 H8 D12 mm W0.118 H0.315 D0.472 in
2,500 mm 59.055 in

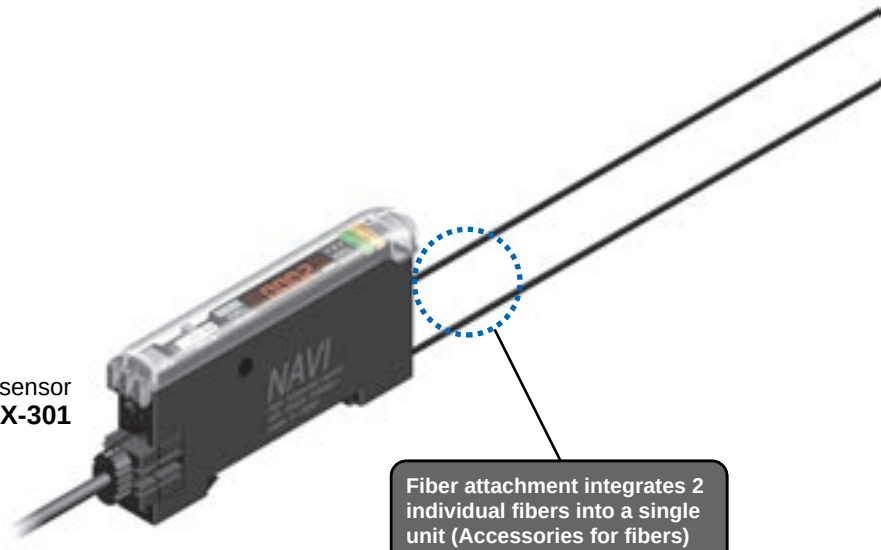
FT-WA30 New
Wide beam (32 mm 1.26 in)
W5 H69 D20 mm W0.197 H2.717 D0.787 in
3,600 mm 141.732 in

FT-WA8 New
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 Coming soon
Side-view
ϕ1 15 mm ϕ0.039 0.591 in
90 mm 3.543 in
ϕ2 15 mm ϕ0.079 0.591 in
* Sleeve part cannot be bent.

FT-WKV8 New
Narrow beam
Side-view
1,700 mm 66.929 in
ϕ4 25 mm ϕ0.157 0.984 in

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

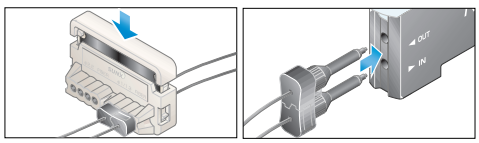


Digital fiber sensor
FX-301

Newly developed

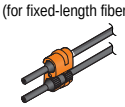
Now it's possible to simultaneously cut two fibers to the same length

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.



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

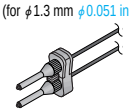
FX-AT2
(for fixed-length fiber)



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)



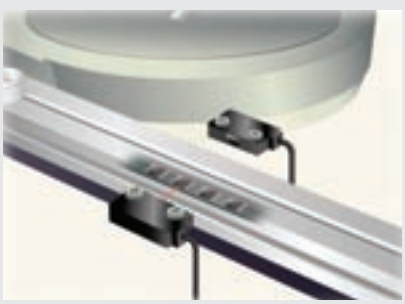
FX-AT6
(for ϕ1 mm ϕ0.039 in and ϕ1.3 mm ϕ0.051 in mixed fiber)

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

New sharp bending fiber applications

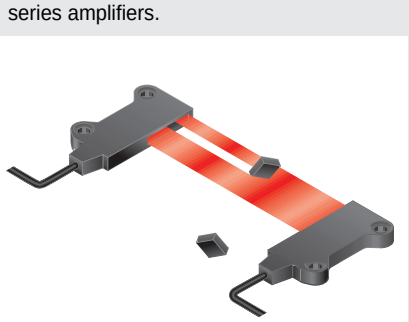
Detecting components from a parts feeder / FT-WZ8E

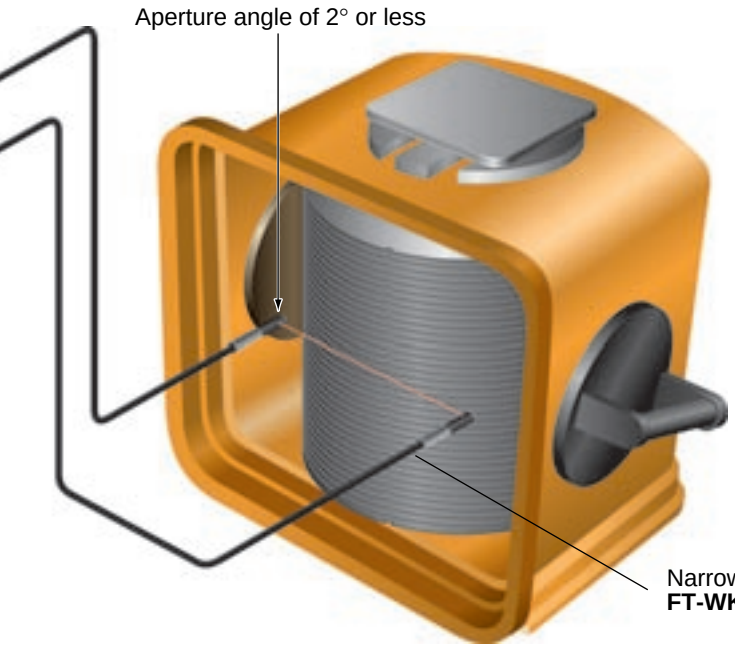
The industry's smallest ultra-thin rectangular fiber head, with dimensions of W3 H12 D8 mm W0.018 H0.472 D0.315 in. Contains a sharp bending fiber cable attachment area, thus saving installation space.



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

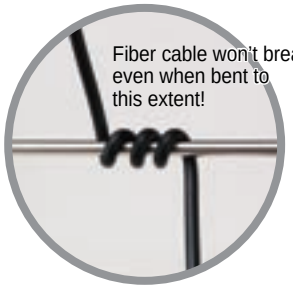
Has a wide 11 mm 0.433 in detection area. Vibrating objects and minute objects passing at high speed, that were previously difficult to detect, can now be easily detected using **FT-WA8** in combination with the **FX-300** series amplifiers.

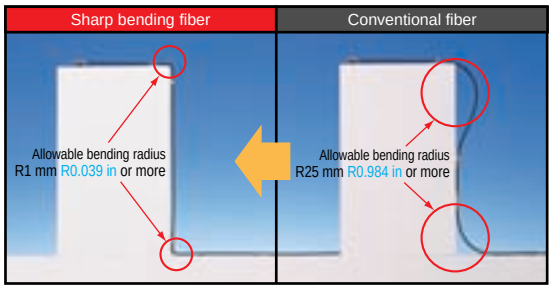




Can be rotated freely in any direction R1 mm R0.039 in or more

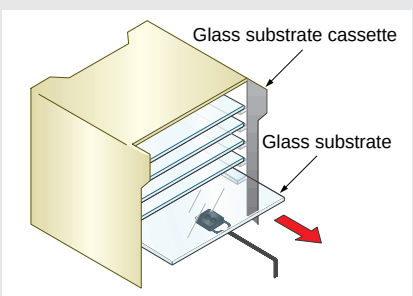
The fiber can be bent sharply, like an electric wire, to avoid space wastage in installation because of its small allowable bending radius of R1 mm R0.039 in or more (**FD-WG4**,**FD-WSG4** : R2 mm R0.079 in or more).





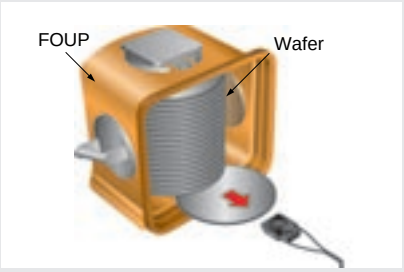
Detecting the presence of a glass substrate within a cassette / FD-WL41

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

FD-W8
Standard
M6 15 mm 0.591 in
190 mm 7.48 in

FD-W44
Small diameter · With sleeve
ϕ1.48 40 mm ϕ0.058 1.575 in
M4 12 mm 0.472 in
30 mm 1.181 in

FD-WT8
Small fiber head
M4 12 mm 0.472 in
190 mm 7.48 in

FD-WS8
Small fiber head
ϕ3 15 mm ϕ0.118 0.591 in
190 mm 7.48 in

FD-WT4
Small fiber head · Small diameter
M3 12 mm 0.472 in
30 mm 1.181 in

FD-WL41 New
Fixed-focus reflective · Glass substrate detection
24 21 mm 0.945 0.827 in
4 mm 0.157 in
6.5 to 14 mm 0.256 to 0.551 in
(Convergent point : 8 mm 0.315 in)

FD-WL42 New
Fixed-focus reflective · Specular object detection
15 19 mm 0.591 0.748 in
3 mm 0.118 in
0.6 to 3.5 mm 0.024 to 0.138 in
(Convergent point : 2 mm 0.079 in)

FD-WG4
High precision Lens mountable
Coaxial
M4 25 mm 0.984 in
65 mm 2.559 in

FD-WSG4
High precision
Coaxial
ϕ3 15 mm ϕ0.118 0.591 in
65 mm 2.559 in

FD-WKZ1 New
Long range · Rectangular head
W5.2 H9.5 D15 mm W0.205 H0.374 D0.591 in
20 to 480 mm 0.787 to 18.898 in

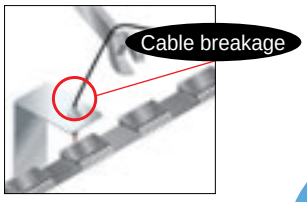
FD-WV42 Coming soon
Side-view
ϕ2 15 mm ϕ0.079 0.591 in
15 mm 0.591 in
ϕ3 15 mm ϕ0.118 0.591 in
* Sleeve part cannot be bent.

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

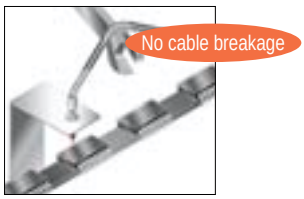
Tough Flexible Fiber / FT-P81X,FD-P81X,FD-G6X

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.

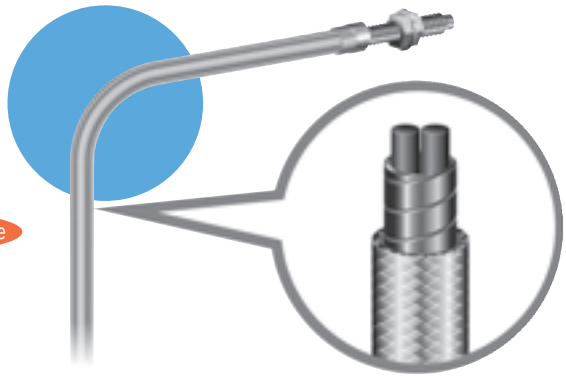
Conventional Fiber



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 New
Lens mountable

FD-P81X New

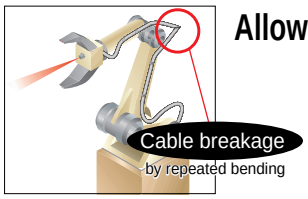
FD-G6X New
Lens mountable

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

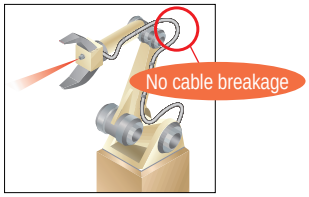
Flexible Fiber / FT-P60,FT-PS1

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 ϕ1 mm ϕ0.039 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).

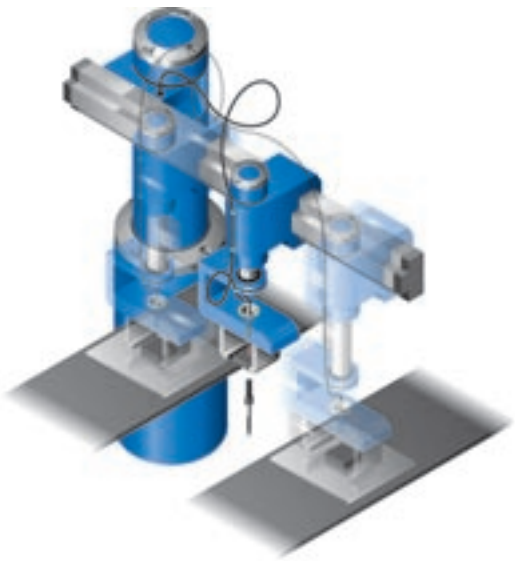
Conventional Fiber



Flexible Fiber

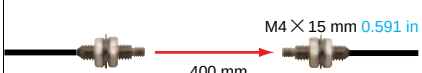


Bending durability 1 million times or more!
Allowable bending radius R4 mm R0.157 in or more



Flexible fiber line-up

FT-P60 New
Lens mountable



FT-PS1 New

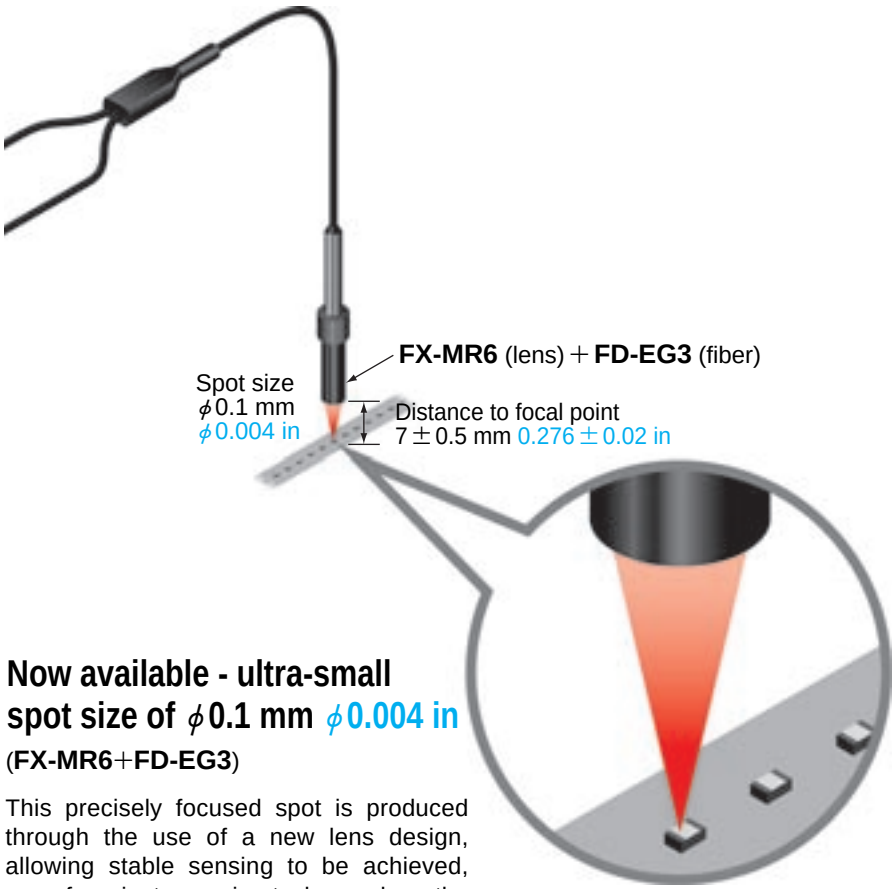
FD-P60

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 ϕ0.1 mm ϕ0.004 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 ϕ0.1 mm ϕ0.004 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

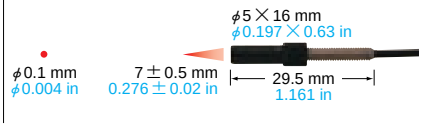
The optimum combination of lens and fiber can be selected, in accordance with the connector pin size and pin pitch.

Suction detection for chips

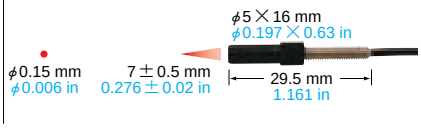
This fiber unit can be used to confirm chip presence, when mounting chips using a flip chip bonder.

Spot lens & high precision fiber line-up

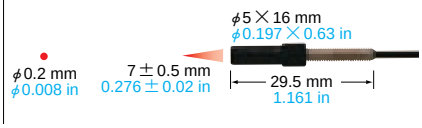
FX-MR6+FD-EG3



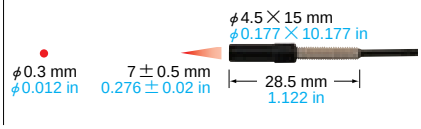
FX-MR6+FD-EG2



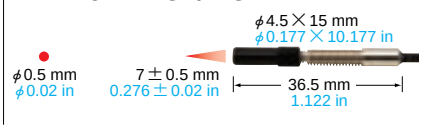
FX-MR6+FD-EG1



FX-MR3+FD-EG1



FX-MR3+FD-G4/WG4



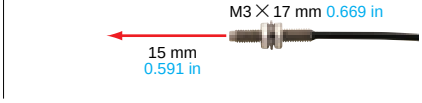
FX-MR2+FD-WG4/G4

* The spot diameter can be changed by adjusting the length of fiber inserted.

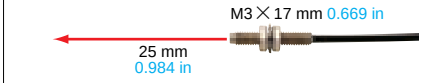
FX-MR5+FD-WG4/G4

* The spot diameter can be changed by adjusting the length of fiber inserted.

FD-EG3 (Fiber) New
Coaxial



FD-EG2 (Fiber) New
Coaxial



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

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

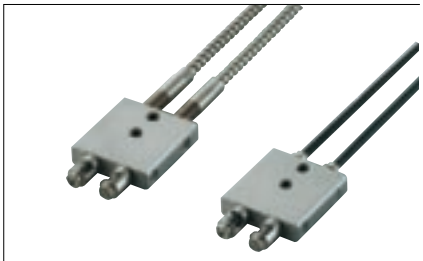
New

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

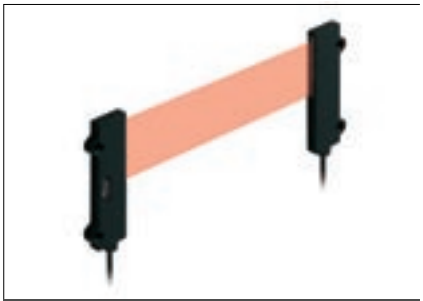
32 mm 1.26 in New wide-area fiber launched!

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

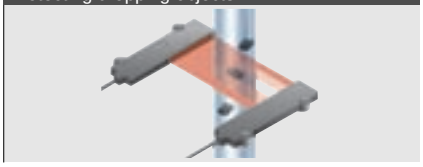
FT-WA30/A30 fiber heads are not susceptible to interference from peripheral objects
As these fibers incorporate light sources having almost the same collimated beam as lasers, beam interference from peripheral objects is minimal, thus permitting stable detection to be performed in crowded areas.

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

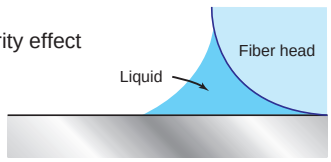


Leak Detection Fiber / FD-F7 SERIES

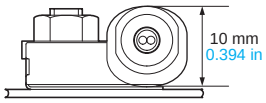
A new slim fiber ideal for sensing chemical leaks

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

• Capillarity effect



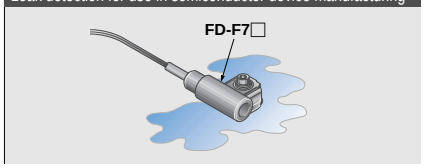
Compact, space-saving
This slim (10 mm 0.394 in) side-mounting fiber is especially good for use in confined spaces.



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

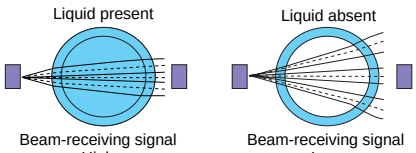


Liquid Fiber / FT-F9 SERIES

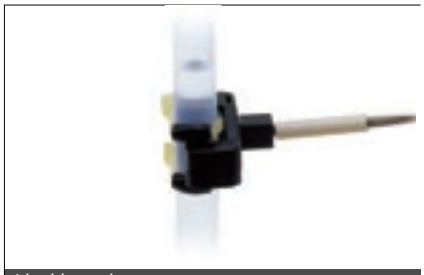
Reliably detect liquid in pipe

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.

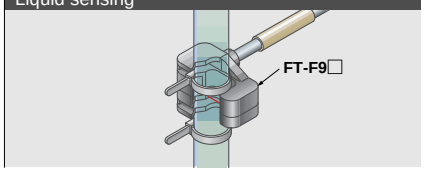
Reliable detection not affected by bubbles or droplets
Latest optical fiber techniques have solved problems caused by bubbles, droplets or liquid leakage that arise in conventional pipe-mountable sensors.



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



Liquid sensing



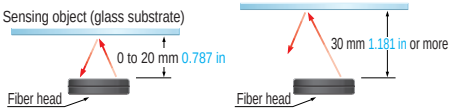
Glass Substrate Alignment & Seating Confirmation Fiber / FD-L43

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).

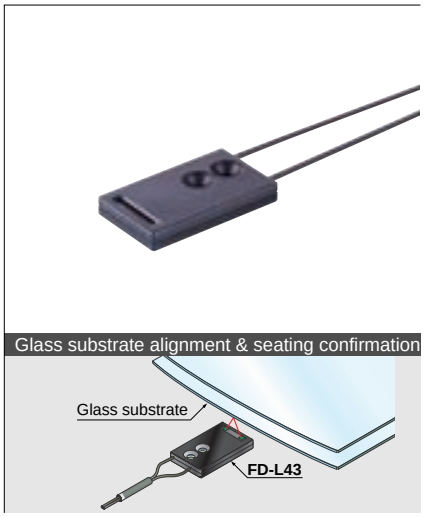
Long-range sensing capability
The sensing range is as long as 0 to 20 mm 0.787 in. In addition, the fiber will not detect a glass substrate 30 mm 1.181 in or more away achieving outstanding detecting characteristics for limited distance.



Senses up to 20 mm 0.787 in from seating position.

Does not sense when the distance is 30 mm 1.181 in or more.

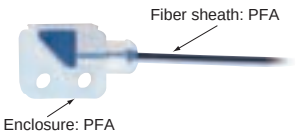
Compact design allows easy, flexible positioning
Compact size of W17×H29×D3.8 mm W0.669×H1.142×D0.15 in. The outer diameter of the fiber cable is ϕ1.3 mm ϕ0.118 in, enabling the fiber to be routed with R4 mm R0.157 in bending radius.



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.

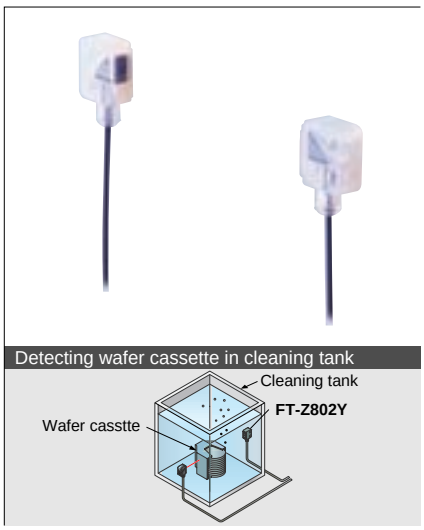


Thru-beam type side-view with 3,500 mm 137.795 in long sensing range

Easy cutting of even PFA protected fiber
As the diameter of the fiber cable, including the PFA protected portion, is only ϕ2.2 mm ϕ0.087 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.



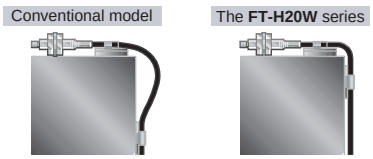
Flexible Heat-resistant Fiber / FT-H20W SERIES

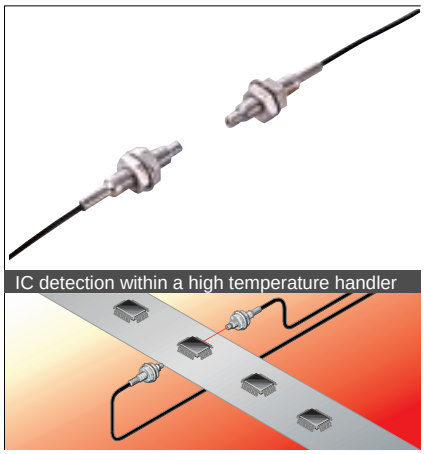
A bending radius of R10 mm R0.394 in is possible even in high temperature environments

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

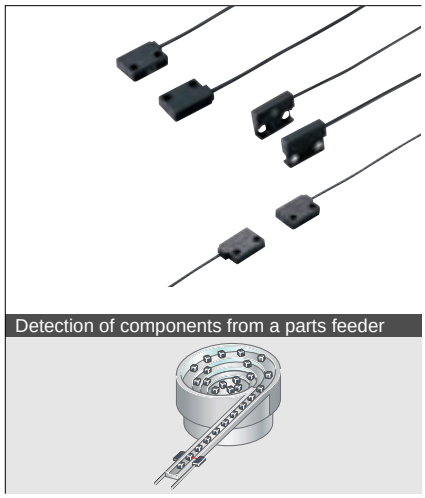
Smallest in the industry Easy, space-saving screw type installation

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

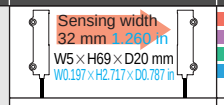
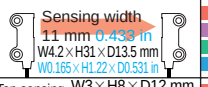
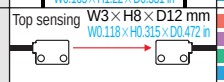
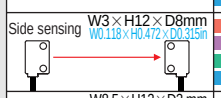
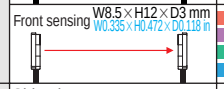
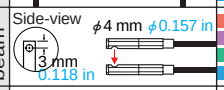
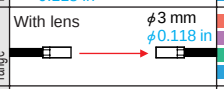
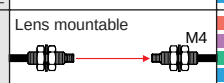
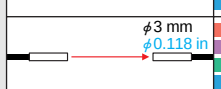
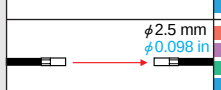
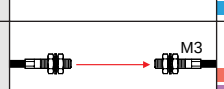
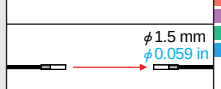
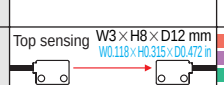
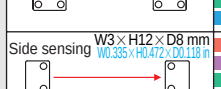
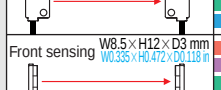
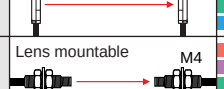
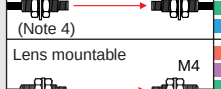
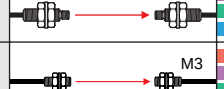
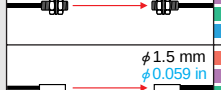
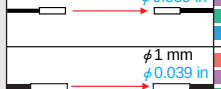
Thru-beam type fiber line-up (one pair set)

Standard fibers

Type	Shape of fiber head	Sensing range (Note 1) (: LONG, : STD, : FAST, : S-D)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length (✂ : Free-cut)	Allowable bending radius	Model No.
Standard – Long sensing range	With lens, M14	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
Standard – Long sensing range	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
Standard – Long sensing range	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
Standard – Long sensing range	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
Standard	Lens mountable, M4	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	• Free-cut type	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-FM2
Standard	Sleeve 90 mm 3.543 in, M4, ϕ1.48 mm ϕ0.058 in					Fiber R25 mm R0.984 in	FT-FM2S
Standard	Sleeve 40mm 1.575in, M4, ϕ1.48 mm ϕ0.058 in					Sleeve R10 mm R0.394 in	FT-FM2S4
Standard	Lens mountable, M3			• Long sensing range with miniature fiber heads		R25 mm R0.984 in	FT-T80
Standard	ϕ2.5 mm ϕ0.098 in			• Free-cut type			FT-SFM2
Standard	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
Standard	M3	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	• Suitable for detection in a congested equipment	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-NFM2
Standard	Sleeve 90 mm 3.543 in, M3, ϕ0.88 mm ϕ0.035 in					Fiber R25 mm R0.984 in	FT-NFM2S
Standard	Sleeve 40 mm 1.575 in, M3, ϕ0.88 mm ϕ0.035 in					Sleeve R10 mm R0.394 in	FT-NFM2S4
Standard	ϕ1.5 mm ϕ0.059 in					R25 mm R0.984 in	FT-SNFM2
Standard – Elbow	Lens mountable, 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
Standard – Side-view	ϕ1.5 mm ϕ0.059 in, ϕ2.5 mm ϕ0.098 in, 0.8 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	ϕ0.02 mm ϕ0.001 in opaque object	• The side-view sensing • Space-saving	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-SFM2SV2
Standard – Side-view	ϕ2 mm ϕ0.079 in, ϕ2.5 mm ϕ0.098 in, 0.6 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			1 m 6.562 ft		FT-V22
Standard – Side-view	ϕ1 mm ϕ0.039 in, ϕ2.5 mm ϕ0.098 in, 0.6 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			✂ 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) : LONG : STD : FAST : S-D	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length ✂ : Free-cut	Allowable bending radius	Model No.
Sharp bending	Wide beam		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)	ϕ0.3 mm ϕ0.012 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
			3,500 mm 137.795 in 1,500 mm 59.055 in 1100 mm 43.307 in 750 mm 29.528 in	ϕ0.25 mm ϕ0.01 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
	Rectangular head		2,500 mm 98.425 in 1,200 mm 47.244 in 850 mm 33.465 in 410 mm 16.142 in	ϕ0.08 mm ϕ0.003 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
			1,500 mm 59.055 in 700 mm 27.559 in 500 mm 19.685 in 210 mm 8.268 in	ϕ0.05 mm ϕ0.002 in opaque object				New FT-WZ8E
			700 mm 27.559 in 330 mm 12.992 in 240 mm 9.449 in 120 mm 4.724 in	ϕ0.04 mm ϕ0.002 in opaque object				New FT-WZ8
	Narrow beam		1,700 mm 66.929 in 700 mm 27.559 in 600 mm 23.622 in 300 mm 11.417 in	ϕ0.06 mm ϕ0.002 in opaque object	• The side-view sensing • Aperture angle 2°	✂ 2 m 6.562 ft	R1 mm R0.039 in	New FT-WKV8
	Long sensing range		1,200 mm 47.244 in 600 mm 23.622 in 420 mm 16.535 in 210 mm 8.268 in	ϕ0.02 mm ϕ0.001 in opaque object	• Long sensing range with fiber heads of ϕ3 mm ϕ0.118 in	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-WS8L
	Standard		570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	ϕ0.03 mm ϕ0.001 in opaque object	• Allowable bending radius: R1 mm R0.039 in or more	✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-W8
			570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	ϕ0.05 mm ϕ0.002 in opaque object				New FT-WS3
			570 mm 22.441 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in	ϕ0.03 mm ϕ0.001 in opaque object				FT-WS8
	Small diameter		160 mm 6.299 in 80 mm 3.15 in 55 mm 2.165 in 28 mm 1.102 in	ϕ0.02 mm ϕ0.001 in opaque object		✂ 2 m 6.562 ft	R1 mm R0.039 in	FT-W4
								FT-WS4
Flexible	Rectangular head		2,700 mm 106.299 in 1,400 mm 55.118 in 1,000 mm 39.37 in 490 mm 19.291 in	ϕ0.03 mm ϕ0.001 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	R4 mm R0.157 in	FT-Z8H
			1,600 mm 62.992 in 800 mm 31.496 in 600 mm 23.622 in 280 mm 11.024 in					FT-Z8E
			800 mm 31.496 in 400 mm 15.748 in 300 mm 11.811 in 140 mm 5.512 in					FT-Z8
	Standard		650 mm 25.591 in 320 mm 12.598 in 230 mm 9.055 in 110 mm 4.331 in	ϕ0.04 mm ϕ0.002 in opaque object	• Bending durability: 1 million times or more (at R10 mm R0.394 in)	✂ 2 m 6.562 ft	R4 mm R0.157 in	FT-P80
			400 mm 15.748 in 190 mm 7.48 in 140 mm 5.512 in 80 mm 3.15 in					New FT-P60
	Small diameter		250 mm 9.843 in 100 mm 3.937 in 75 mm 2.953 in 35 mm 1.378 in	ϕ0.02 mm ϕ0.001 in opaque object	• Bending durability: 1 million times or more (at R4 mm R0.157 in)	✂ 2 m 6.562 ft	R4 mm R0.157 in	FT-P40
			280 mm 11.024 in 120 mm 4.724 in 90 mm 3.543 in 42 mm 1.654 in			1 m 3.281 ft		FT-P2
			80 mm 3.15 in 40 mm 1.575 in 30 mm 1.181 in 17 mm 0.669 in		• Bending durability: 1 million times or more (at R10 mm R0.394 in)	500 mm 19.685 in		New FT-PS1

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
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) : LONG : STD : FAST : S-D	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×H69×D20 mm W0.97×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)	ϕ0.3 mm ϕ0.012 in opaque object	• Sensing width 32 mm 1.26 in wide area • Long sensing range	2 m 6.562 ft	R10 mm R0.394 in	New FT-A30
Special use – Wide beam	Sensing width 11 mm 0.433 in W4.2×H31×D13.5 mm W0.165×H1.22×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	ϕ0.25 mm ϕ0.01 in opaque object	• Sensing width 11 mm 0.433 in wide area • Long sensing range	2 m 6.562 ft	R10 mm R0.394 in	FT-A8
Special use – Array	Top sensing W5×H15×D15 mm W0.197×H0.591×D0.591 in	650 mm 25.591 in 330 mm 12.992 in 220 mm 8.661 in 115 mm 4.528 in	Horizonal : ϕ0.025 mm ϕ0.001 in opaque object Vertical : ϕ0.45 mm ϕ0.018 in opaque object	• Its wide beam meets various needs.	2 m 6.562 ft	R25 mm R0.984 in	FT-AFM2
Special use – Array	Side sensing W5×H15×D15 mm W0.197×H0.591×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
Special use – 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	ϕ0.06 mm ϕ0.002 in opaque object	• Aperture angle 2° • Laser beam equivalent detection	2 m 6.562 ft	R25 mm R0.984 in	FT-K8
Special use – Narrow beam	Side-view ϕ4 mm ϕ0.157 in 3 mm 0.118 in			• Aperture angle 2° • Side-view type			FT-KV8
Special use – Ultra-small diameter	ϕ0.25 mm ϕ0.01 in ϕ3 mm ϕ0.118 in Sleeve part cannot be bent.	18 mm 0.709 in 10 mm 0.394 in 8 mm 0.315 in 3 mm 0.118 in	ϕ0.02 mm ϕ0.001 in opaque object	• 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
Special use – Ultra-small diameter	ϕ0.4 mm ϕ0.002 in ϕ3 mm ϕ0.118 in Sleeve part cannot be bent.	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
Special use – Liquid level sensing	Mountable on pipe W23×H20×D17 mm W0.906×H0.787×D0.669 in	Applicable pipe diameter : Outer dia. ϕ3.0 to ϕ10.0 mm ϕ0.118 to ϕ0394 in PFA (Fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1.0 mm 0.012 to 0.039 in	(Liquid)	• SEMI S2 compliant • The shape and thickness of the pipe have no influence	2 m 6.562 ft	Protective tube R20 mm R0.787 in	FT-F902 (Note 4)
Special use – Liquid level sensing						Fiber R4 mm R0.157 in	FT-F905 (Note 4)
Special use – Tough flexible	Lens mountable M4	650 mm 25.591 in 320 mm 12.598 in 230 mm 9.055 in 110 mm 4.331 in	ϕ0.05 mm ϕ0.002 in opaque object	• Strong stainless steel mesh protects fiber cables	1 m 3.281 ft	R10 mm R0.394 in	New FT-P81X

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
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) : LONG : STD : FAST : S-D	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length ✂ : Free-cut	Allowable bending radius	Model No.
Environment resistant — Heat-resistant	Lens mountable M4	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	ϕ0.04 mm ϕ0.002 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, M4, ϕ2.1 mm ϕ0.083 in					Fiber R25 mm Sleeve R10 mm	FT-H35-M2S6
	Lens mountable M4	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 50 mm 1.969 in	ϕ0.02 mm ϕ0.001 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : −60°C −76°F	1 m 3.281 ft	R10 mm R0.394 in	FT-H20W-M1
					2 m 6.562 ft		FT-H20W-M2
	Lens mountable M4	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	ϕ0.04 mm ϕ0.002 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : −60°C −76°F	1 m 3.281 ft	R25 mm R0.984 in	FT-H20-M1
	Lens mountable M4	880 mm 34.646 in 440 mm 17.323 in 300 mm 11.811 in 155 mm 6.102 in	ϕ0.06 mm ϕ0.002 in opaque object	• Heat-resistant temp. : 130°C 266°F • Cold-resistant temp. : −60°C −76°F	✂ 2 m 6.562 ft		FT-H13-FM2
Chemical-resistant	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	ϕ4 mm ϕ0.157 in opaque object	• Rectangular head with no beam misalignment	✂ 2 m 6.562 ft	R25 mm R0.984 in	FT-Z802Y
					✂ 5 m 16.404 ft		FT-Z805Y
					✂ 7 m 22.966 ft		FT-Z807Y
	ϕ5.5 mm ϕ0.217 in	3,500 mm 137.795 in 1,500 mm 59.055 in 1,000 mm 39.37 in 530 mm 20.866 in	ϕ0.08 mm ϕ0.003 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
	ϕ5.5 mm ϕ0.217 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			FT-V8Y
Vacuum	Lens mountable M4	470 mm 18.504 in 230 mm 9.055 in 165 mm 6.496 in 80 mm 3.15 in	ϕ0.02 mm ϕ0.001 in opaque object	• Heat-resistant temp. : 120°C 248°F	1 m 3.281 ft	R200 mm R7.874 in	FT-6V
		220 mm 8.661 in 100 mm 3.937 in 75 mm 2.953 in 35 mm 1.378 in				R30 mm R1.181 in	FT-60V

Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
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)

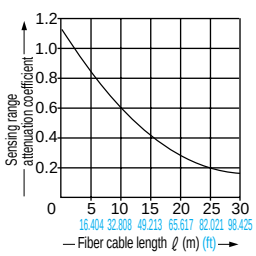
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☆) or the sleeve length (symbol △) from the table below.

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) (: 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.
Standard / Long sensing range	M6	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	R25 mm R0.984 in	**FD-B8**
Standard	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**
Standard	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	• Free-cut type	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FD-FM2**
Standard	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	**FD-FM2S**
Standard	Sleeve 40 mm 1.575 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	Sleeve R10 mm R0.394 in	**FD-FM2S4**
Standard	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	• Long sensing range with miniature fiber head	✂ 2 m 6.562 ft	R25 mm R0.984 in	**FD-T80**
Standard	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**
Standard	ϕ3 mm ϕ0.118 in	270 mm 00 in 110 mm 00 in 85 mm 00 in 39 mm 00 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-S80**
Standard	M6	260 mm 10.63 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**
Standard	M4	75 mm 2.953 in 38 mm 1.496 in 28 mm 1.102 in 13 mm 0.512 in	ϕ0.02 mm ϕ0.001 in gold wire	• Low price	✂ 2 m 6.562 ft (Note 4)	R25 mm R0.984 in	**FD-N4**
Standard	M4	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	R25 mm R0.984 in	**FD-NFM2**
Standard	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	**FD-NFM2S**
Standard	Sleeve 40 mm 1.575 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	Sleeve R10 mm R0.394 in	**FD-NFM2S4**
Standard	ϕ2.5 mm ϕ0.098 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	R25 mm R0.984 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 0.8 mm 0.031 in Sleeve part cannot be bent.	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**
Side-view	Small diameter ϕ1.5 mm ϕ0.059 in ϕ3mm ϕ0.118 in 0.7 mm 0.028 in Sleeve part cannot be bent.	55 mm 2.165 in 25 mm 0.984 in 17 mm 0.669 in 9 mm 0.354 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-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	Rectangular head 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	ϕ0.3 mm ϕ0.012 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	ϕ0.02 mm ϕ0.001 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 1.575 in M4 ϕ1.48 mm ϕ0.058 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
		ϕ3 mm ϕ0.118 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
	Hihg 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	ϕ0.02 mm ϕ0.001 in gold wire	• Precise position sensing	✂ 2 m 6.562 ft	R2 mm R0.079 in	FD-WG4
		Coaxial ϕ3 mm ϕ0.118 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) D0.1 mm Cannot use	ϕ1.9 mm ϕ0.0751 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) D0.1 mm Cannot use	ϕ0.08 mm ϕ0.003 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	ϕ0.02 mm ϕ0.001 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
		ϕ3 mm ϕ0.118 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		• Bending durability: 1 million times or more (at R4 mm R0.157 in)			FD-P40
		ϕ1.5 mm ϕ0.059 in	50 mm 1.969 in 25 mm 0.984 in 19 mm 0.748 in 9 mm 0.354 in			1 m 3.281 ft		FD-P2

Notes: 1) The sensing range is specified for white non-glossy paper [100 100 mm 3.937 3.937 in (**FD-WKZ1**, **FD-W8**, **FD-WT8**, **FD-WS8** and **FD-P80**: 400 400 mm 15.748 15.748 in, **FD-WG4**, **FD-WSG4**, **FD-P60** and **FD-P50**: 200 200 mm 7.874 7.874 in, **FD-WL41**: glass substrate 100 100 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) (: 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.
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 78 mm 3.071 in 39 mm 1.535 in	ϕ0.02 mm ϕ0.001 in gold wire	• 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						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	ϕ0.02 mm ϕ0.001 in gold wire	• 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		• Combination with **FX-MR6** lens gives an extremely small spot diameter of ϕ0.2 mm ϕ0.008 in approx.	500 mm 19.685 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	ϕ0.04 mm ϕ0.002 in gold wire	• Combination with **FX-MR6** lens gives an extremely small spot diameter of ϕ0.15 mm ϕ0.006 in approx.		R10 mm R0.394 in	New FD-EG2
		Coaxial Lens mountable M3	15 mm 0.591 in 8 mm 0.315 in 5 mm 0.197 in 3 mm 0.118 in		• Combination with **FX-MR6** lens gives an extremely small spot diameter of ϕ0.1 mm ϕ0.004 in approx.			New FD-EG3
	Ultra-small diameter	ϕ1.5 mm ϕ0.059 in ϕ0.5 mm ϕ0.02 in Sleeve part cannot be bent.	11 mm 0.433 in 6 mm 0.236 in 4 mm 0.157 in 1 mm 0.039 in	ϕ0.02 mm ϕ0.001 in gold wire	• Easy fine adjustment of the installation position.	1 m 3.281 ft	R10 mm R0.394 in	FD-E12
		Coaxial ϕ3 mm ϕ0.118 in ϕ0.65 mm ϕ0.026 in Sleeve part cannot be bent.	45 mm 1.772 in 23 mm 0.906 in 17 mm 0.669 in 7 mm 0.276 in		• Precise position sensing with coaxial fiber		R25 mm R0.984 in	FD-E22
		M3 ϕ0.5 mm ϕ0.02 in Sleeve part cannot be bent.	5 mm 0.197 in 3 mm 0.118 in 2 mm 0.079 in Cannot use		• Suitable for detection in a congested equipment	500 mm 19.685 in		FD-EN500S1
		Coaxial M3 ϕ0.8 mm ϕ0.031 in Sleeve part cannot be bent.	38 mm 1.496 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in		• Precise position sensing with coaxial fiber	1 m 3.281 ft		FD-ENM1S1
	Fixed-focus reflective	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	LCD glass	• Just 3.8 mm 0.15 in thick • Glass substrate is reliably detected.	✂ 2 m 6.562 ft	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 8mm 0.315 in) 3.5 to 15 mm 0.138 to 0.591 in (Convergent point 8 mm 0.315 in) Cannot use	ϕ0.06 mm ϕ0.002 in gold wire	• Just 4 mm 0.157 in thick • Glass substrate is reliably detected.		R10 mm R0.394 in	FD-L41
		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 2mm 0.079 in) Cannot use	ϕ0.03 mm ϕ0.001 in gold wire	• Just 3 mm 0.118 in thick • Wafer is reliably detected.			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)	ϕ0.02 mm ϕ0.001 in gold wire	• Detection is not affected by object color.			FD-L4
	Liquid leak detection	SEMI S2 compliant W20 H30 D10 mm W0.787 H1.181 D0.394 in	—	(Liquid)	• Small leaks and viscous liquids are reliably detected.	✂ 5 m 16.404 ft (Protective tube: 3 m 9.843 ft) ✂ 7 m 22.966 ft (Protective tube: 5 m 16.404 ft)	Protective tube R20 mm Fiber R4 mm	FD-F705 FD-F707
	Liquid level sensing	Contact type ϕ5 mm ϕ0.197 in ϕ6 mm ϕ0.236 in	—	(Liquid)	• Reduces malfunction due to liquid drop at the tip.	✂ 2 m 6.562 ft	Protective tube R40 mm Fiber R15 mm	FD-F8Y
		Mountable on pipe Standard W25 H13 D20 mm W0.984 H0.512 D0.787 in	Applicable pipe diameter : Outer dia. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PVC, fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm]	(Liquid)	• Liquid level is reliably detected from outside the pipe.	✂ 2 m 6.562 ft ✂ 5 m 16.404 ft	R10 mm R0.394 in	FD-F41 FD-F91
		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. ϕ6 to ϕ26 mm ϕ0.236 to ϕ1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in]			✂ 2 m 6.562 ft ✂ 5 m 16.404 ft		FD-F4 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	ϕ0.02 mm ϕ0.001 in gold wire	• Strong stainless steel mesh protects fiber cables	1 m 3.281 ft	R10 mm R0.394 in	New FD-P81X
		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		New FD-G6X

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) (: 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.
Environment resistant	Heat-resistant	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	• Heat-resistant temp. : 350°C 662°F • Cold-resistant temp. : 60°C 76°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					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-foucus 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 R0.984 in	New **FD-H30-L32**
		Fixed-foucus 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		New **FD-H18-L31**
		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 2.593 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)

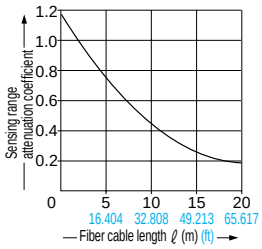
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☆) or the sleeve length (symbol △) from the table below.

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.

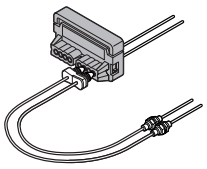
• Correlation between sensing range attenuation coefficient and fiber cable length

Longer the fiber cable, shorter is the sensing range.

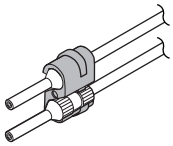


Accessories (attached with fibers)

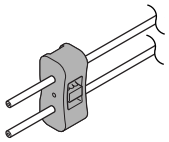
Fiber cutter
• **FX-CT2**



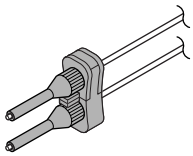
Fiber attachment
• **FX-AT2** (for fixed-length fiber)



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



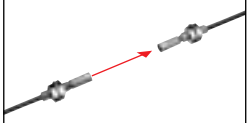
• **FX-AT4** (for ϕ1 mm ϕ0.039 in fiber)
• **FX-AT5** (for ϕ1.3 mm ϕ0.051 in fiber)
• **FX-AT6** (for ϕ1 mm ϕ0.039 in and ϕ1.3 mm ϕ0.051 in mixed fiber)

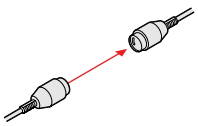


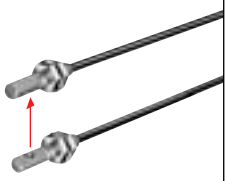
Note: Fiber cutter is not supplied as accessory along with **FT-NB8**, **FT-N8**, **FD-N8** and **FD-N4**. Please order it separately.

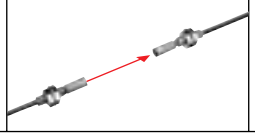
Order Guide

Lens (For thru-beam type fiber)

<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">For thru-beam type fiber</td><td>Expansion lens
(Note 1)</td><td>FX-LE1</td><td>  </td><td>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></td></tr>
<tr><td>Super-expansion lens
(Note 1)</td><td>FX-LE2</td><td>  </td><td>Tremendously increases the sensing range with large diameter lenses.
• Ambient temperature: 60 to 350 C
76 to 662 F

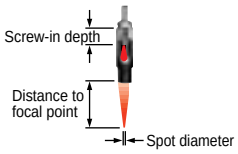
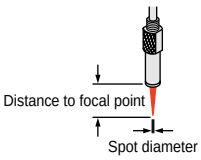
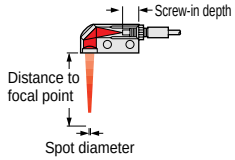
Sensing range (mm)[Lens on both sides]<table><tr><th>Fiber \ Mode</th><th>LONG</th><th>STD</th><th>FAST</th><th>S-D</th></tr><tr><td>FT-B8</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</td></tr><tr><td>FT-FM2</td><td>3,500 (Note 2)</td><td>3,500 (Note 2)</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></td></tr>
<tr><td>Side-view lens</td><td>FX-SV1</td><td>  </td><td>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></td></tr>
<tr><td>Expansion lens for vacuum fiber
(Note 1)</td><td>FV-LE1</td><td>  </td><td>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></td></tr>
</table>

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)

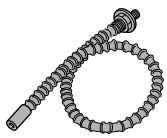
<table>
<tr><th colspan="2">Designation</th><th>Model No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">For reflective type fiber</td><td>Pinpoint spot lens</td><td>FX-MR1</td><td>  </td><td colspan="2">Pinpoint spot of ϕ0.5 mm ϕ0.02 in. Enables detection of minute objects or small marks.
• 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</td></tr>
<tr><td>Zoom lens</td><td>FX-MR2</td><td>  </td><td>The spot diameter is adjustable from ϕ0.7 ϕ0.028 to ϕ2 mm ϕ0.079 in according to how much the fiber is screwed in.
• Applicable fibers: FD-WG4, FD-G4
• Ambient temperature: 40 to 70 C 40 to 158 F
• Accessory: MS-EX-3 (mounting bracket)</td><td><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>ϕ0.7 mm</td></tr><tr><td>12 mm</td><td>27 mm approx.</td><td>ϕ1.2 mm</td></tr><tr><td>14 mm</td><td>43 mm approx.</td><td>ϕ2.0 mm</td></tr></table></td></tr>
<tr><td>Finest spot lens</td><td>FX-MR3</td><td rowspan="2">  </td><td>Extremely fine spot of ϕ0.3 mm ϕ0.012 in achieved.
• Applicable fibers FD-WG4, FD-G4
FD-EG1, FD-EG2,
FD-EG3, FD-G6X,
• Ambient temperature: 40 to 70 C 40 to 158 F</td><td><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>ϕ0.15 mm approx.</td></tr><tr><td>FD-EG2</td><td>7.5 0.5 mm</td><td>ϕ0.2 mm approx.</td></tr><tr><td>FD-EG1</td><td>7.5 0.5 mm</td><td>ϕ0.3 mm approx.</td></tr><tr><td>FD-WG4/G4/G6X</td><td>7.5 0.5 mm</td><td>ϕ0.5 mm approx.</td></tr></table></td></tr>
<tr><td>Finest spot lens</td><td>FX-MR6</td><td>Extremely fine spot of ϕ0.1 mm ϕ0.004 in achieved.
• Applicable fibers FD-WG4, FD-G4
FD-EG1, FD-EG2,
FD-EG3, FD-G6X,
• Ambient temperature: 20 to 60 C 4 to 140 F</td><td><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>ϕ0.1 mm approx.</td></tr><tr><td>FD-EG2</td><td>7 0.5 mm</td><td>ϕ0.15 mm approx.</td></tr><tr><td>FD-EG1</td><td>7 0.5 mm</td><td>ϕ0.2 mm approx.</td></tr><tr><td>FD-WG4/G4/G6X</td><td>7 0.5 mm</td><td>ϕ0.4 mm approx.</td></tr></table></td></tr>
<tr><td>Zoom lens (Side-view type)</td><td>FX-MR5</td><td>  </td><td>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</td><td><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>ϕ 0.5 mm</td></tr><tr><td>10 mm</td><td>15 mm approx.</td><td>ϕ 0.8 mm</td></tr><tr><td>14 mm</td><td>30 mm approx.</td><td>ϕ 3.0 mm</td></tr></table></td></tr>
</table>

Others

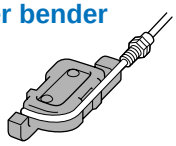
<table>
<tr><th>Designation</th><th>Model No.</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">Protective tube (For thru-beam type fiber</td><td>FTP-500 (0.5 m 1.64 ft)</td><td rowspan="3">For M4 thread</td><td rowspan="10">Applicable fibers</td><td rowspan="3">FT-B8 FT-N8
FT-NB8 FT-P80
FT-FM2 FT-P60
FT-FM2S FT-H13-FM2
FT-FM2S4</td><td rowspan="10">The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.</td></tr>
<tr><td>FTP-1000 (1 m 3.281 ft)</td></tr>
<tr><td>FTP-1500 (1.5 m 4.921 ft)</td></tr>
<tr><td>FTP-N500 (0.5 m 1.64 ft)</td><td rowspan="2">For M3 thread</td><td rowspan="2">FT-T80 FT-P40
FT-NFM2 FD-T40
FT-NFM2S FD-P40
FT-NFM2S4</td></tr>
<tr><td>FTP-N1000 (1 m 3.281 ft)</td></tr>
<tr><td rowspan="5">Protective tube (For reflective type fiber</td><td>FTP-N1500 (1.5 m 4.921 ft)</td><td rowspan="2">For M6 thread</td><td rowspan="2">FD-B8 FD-P80
FD-FM2 FD-H13-FM2
FD-FM2S
FD-FM2S4
FD-N8</td></tr>
<tr><td>FDP-500 (0.5 m 1.64 ft)</td></tr>
<tr><td>FDP-1000 (1 m 3.281 ft)</td><td rowspan="3">For M4 thread</td><td rowspan="3">FD-T80
FD-N4
FD-NFM2
FD-NFM2S
FD-NFM2S4</td></tr>
<tr><td>FDP-1500 (1.5 m 4.921 ft)</td></tr>
<tr><td>FDP-N500 (0.5 m 1.64 ft)</td></tr>
<tr><td>Fiber bender</td><td>FB-1</td><td colspan="4">The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note 1)</td></tr>
<tr><td>Universal sensor mounting stand (Note 2)</td><td>MS-AJ-F</td><td colspan="4">Mounting stand assembly for fiber
(For M3, M4 or M6 threaded head fibers)</td></tr>
</table>

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

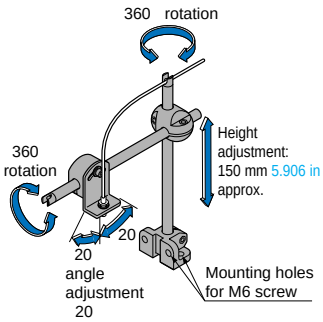


Fiber bender



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

Item \ Type		Standard	Flexible
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°C −40 to +158°F (**FT-SFM2SV2**: −20 to +70°C −4 to +158°F **FT-V22**, **FD-SFM2SV2**: −20 to +60°C −4 to +140°F **FT-V41**, **FD-V41**: −40 to +60°C −40 to +140°F)	−40 to +70°C −40 to +158°F (**FT-Z8□**, **FT-P60**, **FT-PS1**, **FD-P60**, **FD-P50**: −40 to +60°C −4 to +140°F)
Ambient humidity		35 to 85%RH (No dew condensation or icing allowed)	
Material	Fiber core	Acrylic	
	Sheath	Polyethylene (**FT-V22**: Polyolefin)	Vinyl chloride (**FT-PS1**: Polyethylene, **FD-P2**: Vinyl chloride, 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 mouhting 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.

Item \ Type		Sharp bending
Allowable bending radius		R1 mm R0.039 in or more (**FD-WG4/WSG4**: R2 mm R0.079 in or more, Sleeve of **FD-W44**: R10 mm R0.394 in or more)
Ambient temperature		−40 to +60 °C −40 to +140 °F (**FT-WA30/WA8/WKV8**: −40 to +55 °C −40 to +131 °F)
Ambient humidity		35 to 85%RH (No dew condensation or icing allowed)
Material	Fiber core	Acrylic
	Sheath	Polyethylene
	Fiber head	Stainless steel (SUS) (including sleeve 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.

Item \ Type		Special use			
		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°C −40 to +140°F **FT-A8**: −40 to +70°C −40 to +158°F	−40 to +70°C −40 to +158°F	−40 to +60°C −40 to +140°F	−20 to +60°C −4 to +140°F (**FD-G4:** −40 to +70°C −40 to +158°F)
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

Item \ Type		Special use		
		Ultra-small diameter	Fixed-focus reflective	Tough flexible
Allowable bending radius		**FT-E12/E22**: R5 mm R0.197 in or more (Note 1) **FD-E12**: R10 mm R0.394 in or more (Note 1) **FD-E22/EN500S1/ENM1S1**: R25 mm R0.984 in or more (Note 1)	R10 mm R0.394 in or more (**FD-L43**: R4 mm R0.157 in or more)	R10 mm R0.394 in or more
Ambient temperature		**FT-E12/E22**, **FD-E22**: −40 to +70°C −40 to +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.

Item / Model No. \ Type		Special use			
		Leak detection	Liquid level sensing		
		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.

Item \ Type		Environment resistant							
		Heat resistant					Chemical-resistant	Vacuum	
		350°C 662°F type	300°C 572°F type	200°C 392°F type	180°C 356°F type	130°C 266°F type			
Allowable bending radius		R25 mm R0.984 in or more (**FT-H20W-□**: R10 mm R0.394 in or more)					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	−40 to +115°C −40 to +239°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		Quarts glass (Note 3)	
	Sheath	Stainless steel (SUS)	Silicone [Inside stainless steel (SUS) spiral tube **FT-H20W-□**: Fluorine resin		Fluorine resin		Protective tube: Fluorine resin Sheath: Polypropylene (Sheath of **FT-Z8□Y**: 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.

Conforming to EMC Directive

UL Recognition

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 ± 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 μs or less (FAST), 250 μs 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

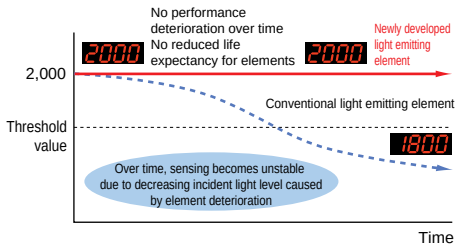
Main cable (3-core): **CN-73-C1** (cable length 1 m 3.281 ft)
CN-73-C2 (cable length 2 m 6.562 ft)
CN-73-C5 (cable length 5 m 16.404 ft)

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)

Newly developed

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.

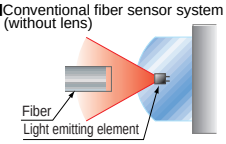


Innovative feature

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

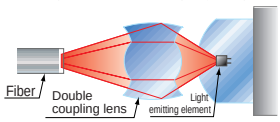
For the first time in the industry, an optical 'double coupling lens' has been incorporated directly into the fiber sensor itself. This lens maximizes the light emission efficiency, resulting in a tremendous improvement in the sensing range. Sensing ranges with small diameter fibers and ultra-small diameter 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.

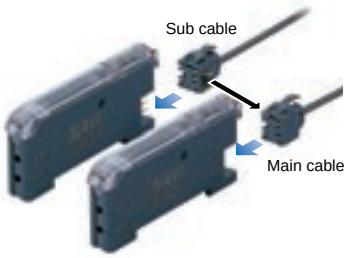
Easy operation with MODE NAVI

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.



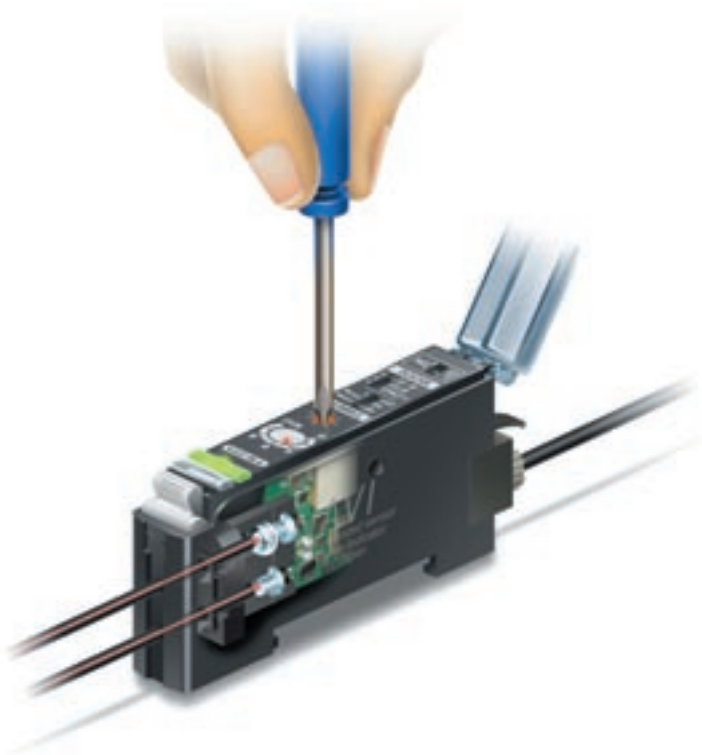
Manually Set Fiber Sensor / FX-311

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

Conforming to EMC Directive

UL Recognition

Sensing New Frontiers
Highly sensitive manual tuning made easy.



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 ± 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 μs 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 × H30.5 × D64.5 mm W0.394 × H1.201 × D2.575 in	

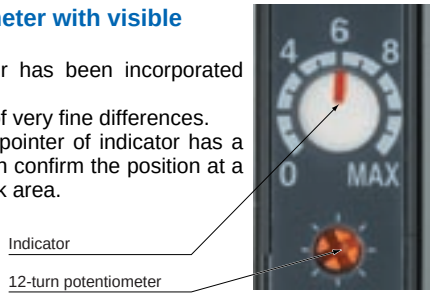
Note: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below

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)

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.



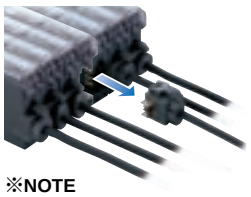
Easy operation by using a convenient, hand-turned adjusting knob of cover

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.

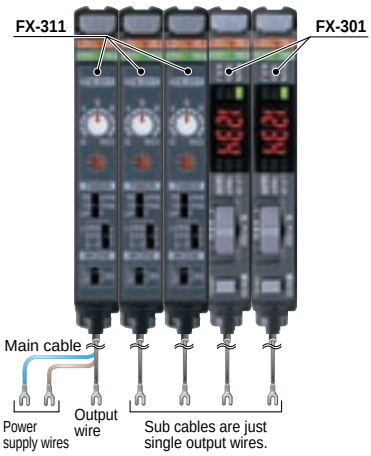
Sliding connectors are easy to insert and remove



※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.



Rapid flashing 'Assist Function' eases adjustment for optimum sensitivity

Innovative feature

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.

High-functional Digital Fiber Sensor / FX-302

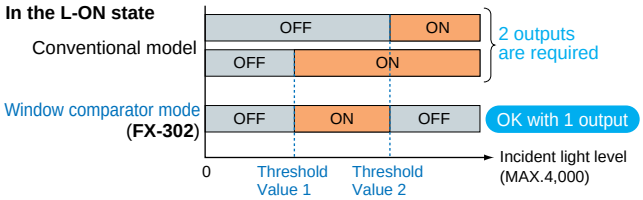
Building upon our existing multi-functionality and usability, **FX-302** further extends the state-of-the-art by incorporating a Window Comparator Mode

Conforming to EMC Directive | UL Recognition

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.

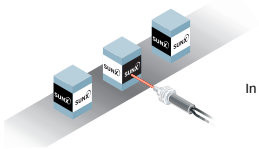


Teaching Methods There are 3 types of teaching methods: 1-level teaching / 2-level teaching / 3-level teaching.

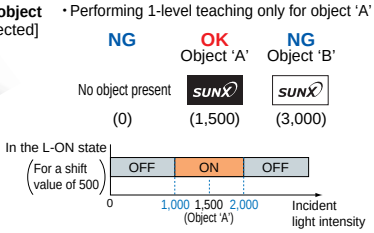
1-level Teaching

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]



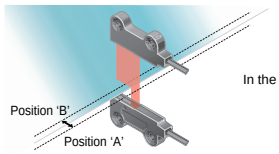
• Performing 1-level teaching only for object 'A'



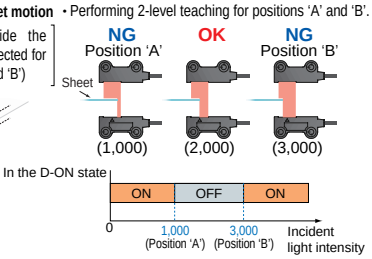
2-level Teaching

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')



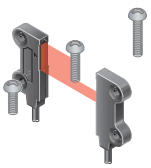
• Performing 2-level teaching for positions 'A' and 'B'.



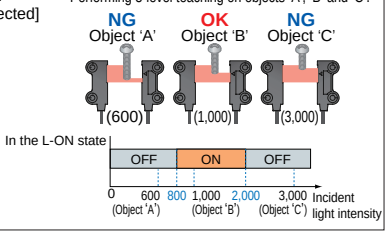
3-level Teaching

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]



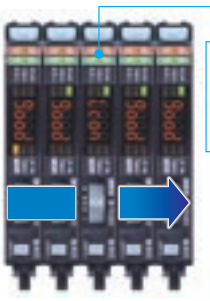
• Performing 3-level teaching on objects 'A', 'B' and 'C'.



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

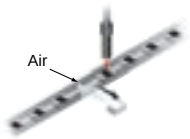
New concept

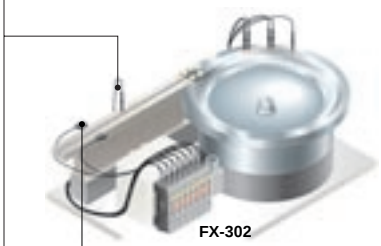
In addition to the 3 timer modes incorporated in **FX-301** (ON-delay, OFF-delay and ONE SHOT), **FX-302** also adds an ON-delay / OFF-delay timer and an ON-delay / ONE SHOT timer. Timer operations that were previously controlled by the PLC and timer can now be controlled by the fiber sensor unit itself,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



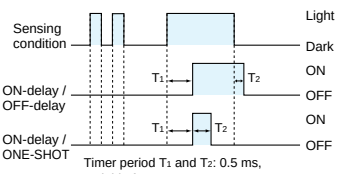


Application example for the ON-delay / OFF-delay timer

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 T_1 and T_2: 0.5 ms, variable from 1 ms to 5 sec.

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.

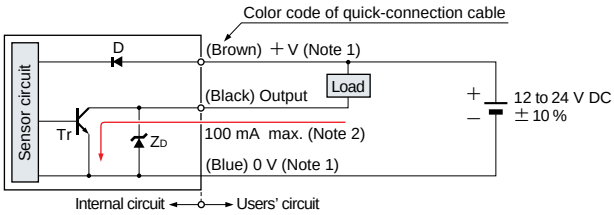
SPECIFICATIONS

Type	NPN output	PNP output
Model No.	**FX-302**	**FX-302P**
Supply voltage	12 to 24 V DC ± 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 μs or less (FAST), 500 μs 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 sensivity 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 connectedin 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 mm² 0.012 in², 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

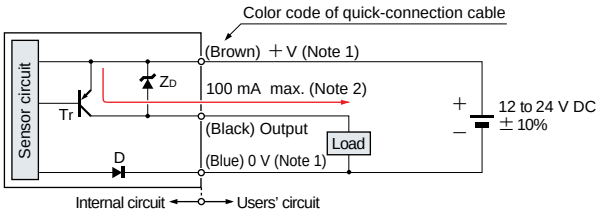
FX-302 NPN output



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

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

FX-302P PNP output

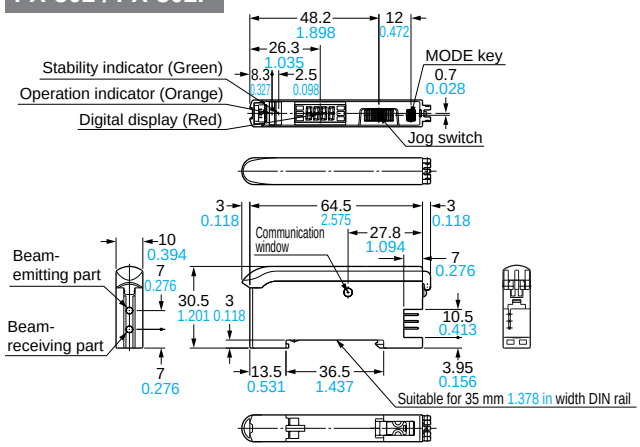


Notes: 1) The quick-connection sub cable does not have + V (brown) and 0 V (blue).
2) 50 mA max., if five amplifiers, or more, are connected together.

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

DIMENSIONS (Unit : mm in)

FX-302 / FX-302P



Digital Fiber Sensor For leak detection fiber / liquid fiber only

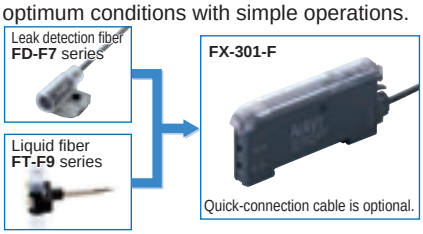
FX-301-F

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.

Communication direction

Collective teaching mode is possible for 16 units max.

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

Bank Selection Unit / FX-CH SERIES

Conforming to EMC Directive

UL Recognition

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

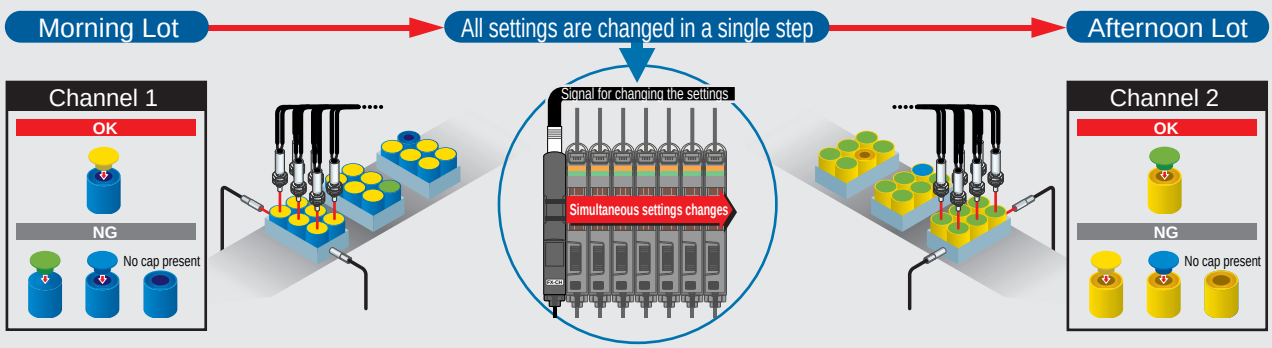
Settings for up to 16 **FX-301** and **FX-302** sensors connected in series can be changed at once. This makes it much easier to reset sensors after tooling changes.

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

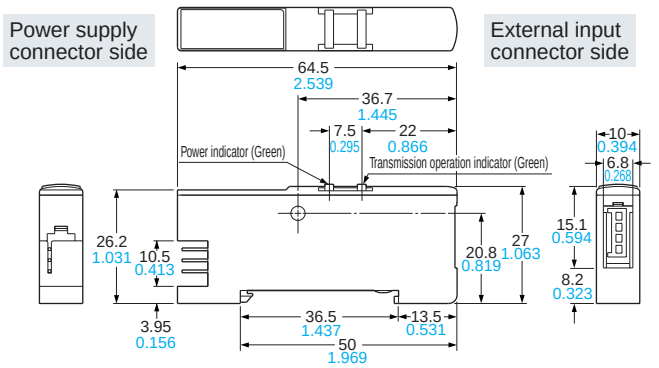
Designation		Model No.	Description	
Bank selection unit		**FX-CH**	NPN input type	This unit allows the bank channel settings for up to 16 fiber sensors (of both **FX-301** and **FX-302**) to be changed, all in a single step, through the use of an external signal.
		FX-CH-P	PNP input type	
4-pin type male snap connector		**SL-CP1** (White)	For 0.08 to 0.2 mm² 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 mm² Wire diameter: ϕ1.1 to ϕ1.6 mm ϕ0.043 to ϕ0.063 in	
		SL-CP3 (Greenish blue)	For 0.5 mm² 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 mm² 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 mm² 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.	

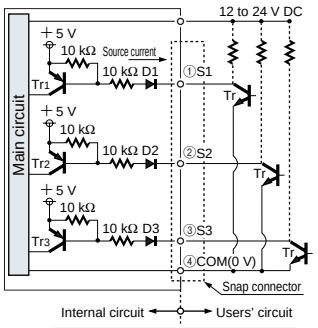
DIMENSIONS (Unit : mm in)

FX-CH / FX-CH-P



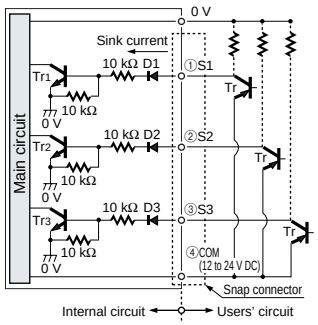
I/O CIRCUIT DIAGRAMS

FX-CH



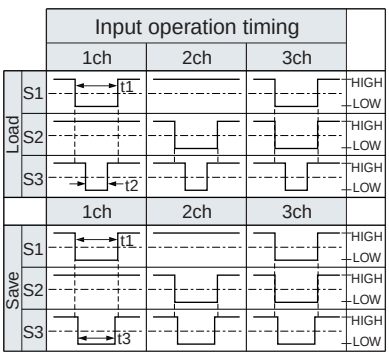
D1,D2,D3: Input protection diodes
Tr1,Tr2,Tr3: Input transistors

FX-CH-P



D1,D2,D3: Input protection diodes
Tr1,Tr2,Tr3: Input transistors

OPERATION TIMING CHART



	Load / Save		
	1ch	2ch	3ch
S1	●	○	●
S2	○	●	●
S3	●	●	●

①Select bank channel using S1 and S2.
②Keep S1 and S2 in the same state.
③Load using S3. (Input the timing period t2) (Input the timing period t3 for saving)
④Cancel input using S3.
* Input may be performed again after 10 sec.

Note) t1 : t1>t2, t1>t3
t2 : 1 ms to more than 2 sec.
t3 : 2 sec. or more

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

Conforming to EMC Directive

UL Recognition

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

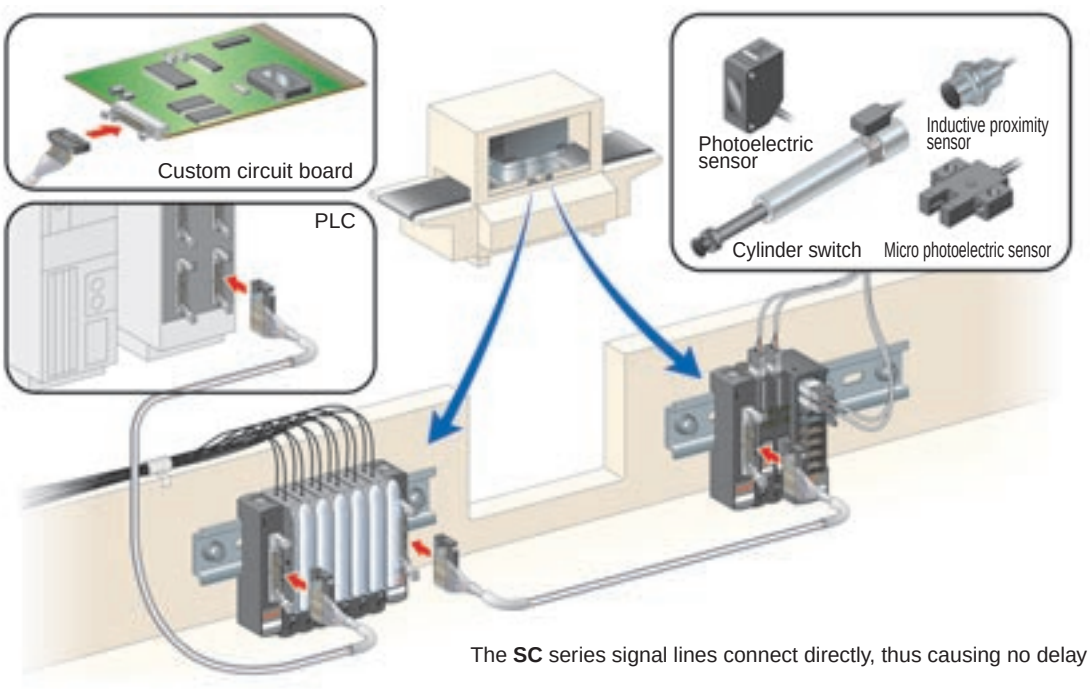
Separate unit **SC-MIL-S** is available for connecting sensors at a distance from each other using MIL connectors. This makes it possible to finely tune the sensor layout to suit the setting-up location.

Freely expandable as required

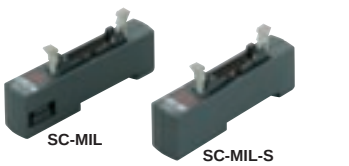
The abbreviated wiring system is economical and lets you expand the system by any amount required from one up to 16 channels.

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.

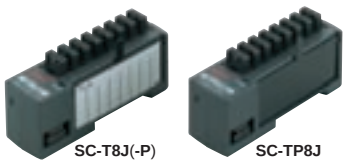


The **SC** series signal lines connect directly, thus causing no delay in response.



Main unit **SC-MIL**
Separate unit **SC-MIL-S**

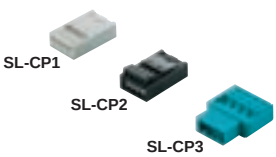
1-channel connector input extension unit **SC-T1J(-P)**



8-channel connector input extension unit **SC-T8J(-P)**
8-channel connector I/O mixed extension unit **SC-TP8J**

W27.5 × H19.6 × D14.1 mm
W1.083 × H0.772 × D0.555 in

Non-line connector **CN-70**



4-pin type male snap connector (1 set: 10 Nos.)
SL-CP1 SL-CP2 SL-CP3

End plates (1 set: 2Nos.) **MS-DIN-E**

ORDER GUIDE

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	Allows the connection of input devices, such as sensors or switches. Incorporates a power indicator and an input signal indicators (1 ch).
	SC-T1J-P	For PNP output devices	
8-channel connector input extension unit	**SC-T8J**	For NPN output devices	Allows the connection of input devices, such as sensors or switches. Incorporates a power indicator and input signal indicators (8 ch).
	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 mm² Wire diameter: ϕ0.7 to ϕ1.2 mm ϕ0.028 to 0.047 mm	Male snap connectors are utilized to connect input / output devices to both the 1-channel and the 8-channel connector input units, as well as to the 8-channel connector combined input / output unit. The 1-channel connector input extension unit includes one **SL-CP1**.
	SL-CP2 (Black)	For 0.3 mm² Wire diameter: ϕ1.1 to ϕ1.6 mm ϕ0.043 to 0.063 mm	
	SL-CP3 (Greenish blue)	For 0.5 mm² 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.	

OPTIONS

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.

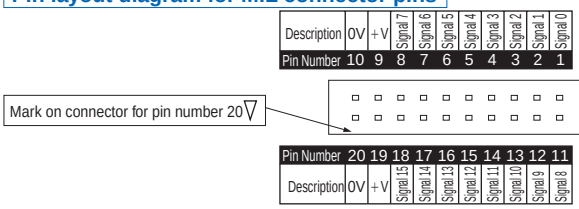
SPECIFICATIONS

Sensor unit

Type	Main unit	Separate unit
Model No.	**SC-MIL**	**SC-MIL-S**
Supply voltage	12 to 24 V DC ±10% (Note 1)	Depends on the supply voltage from **SC-MIL**
Allowable through current	2 A or less (Note 2)	1 A or less (Note 3)
Signal channel No.	Connectable up to 16 channels (Note 4)	
Max. distance between units	10 m or less (the distance between **SC-MIL** and PLC and that between **SC-MIL** and **SC-MIL-S** put together) (Note 5)	
Ambient temperature	−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	
Material	Enclosure: Heat-resistant ABS	
Weight	25 g 0.882 oz approx.	20 g 0.705 oz approx.
Accessory	Connector protection seal: 1 No.	

Notes: 1) In combination with **SC-TP8J**, the unit can be also used with a power supply of 5 to 24 V DC ±10%.
When connecting the **FX-300** series, set the power voltage to 12 to 24 V DC ±10%, ripple to P-P 10% or less.
2) Same as maximum permissible current consumption of all units connected to **SC-MIL**. When either the permissible current amount of power supply unit or the permissible current amount of cable to be connected is 2 A or less, adjust the current to the smallest value.
3) Same as maximum permissible current consumption of all units connected to **SC-MIL**, or permissible current amount of general cable with MIL connector. When the permissible current amount of cable with MIL connector to connect is 1 A or less, adjust it to the specification.
4) The signal of up to 16th point (counting from unit adjacent to **SC-MIL**), of all unit connected to **SC-MIL**, is transferred, however, the signal thereafter is not transferred. Note that **SC-MIL-S** does not occupy any signal point.
5) The value is given for case when the **FX-300** series is connected.

Pin layout diagram for MIL connector pins



* The MIL connector pin layout is compatible with **SL-BMW** sensor block, which is utilized to simplify wiring and save space.

Non-line connector

Type	Non-line connector
Model No.	**CN-70**
Applicable unit	Refer to the list of 'Applicable unit of non-line connector'
Supply voltage	Depends on the supply voltage from **SC-MIL** (Note)
Supply current for units	100 mA or less
Signal channel No.	1 channel
Ambient temperature	−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
Material	Enclosure: ABS
Weight	4 g 0.141 oz approx.

Note: In case the **FX-300** series is connected in cascade, the supply voltage should be 12 to 24 V DC +10% ripple P-P10% or less.

Applicable unit of non-line connector

Designation	Model No.	Description
1-channel input extension units	**SC-T1J**	For NPN output devices
	SC-T1J-P	For PNP output devices
Digital fiber sensors	**FX-301**	For NPN output devices
	FX-301P	For PNP output devices
	FX-302	For NPN output devices
	FX-302P	For PNP output devices
Manually set fiber sensors	**FX-311**	For NPN output devices
	FX-311P	For PNP output devices
Digital fiber sensors for leak detection fiber / liquid fiber	**FX-301-F**	For NPN output devices
	FX-301P-F	For PNP output devices
Bank selection unit	**FX-CH**	For NPN output devices
	FX-CH-P	For PNP output devices

Connector extension units

Type	Connector input extension unit				Connector I/O mixed extension unit
	For NPN output devices		For PNP output devices		
	1 channel	8 channels	1 channel	8 channels	8 channels
Model No.	**SC-T1J**	**SC-T8J**	**SC-T1J-P**	**SC-T8J-P**	**SC-TP8J**
Supply voltage	12 to 24 V DC ±10 %				5 to 24 V DC ±10 % (Note 1)
Current consumption (Note 2)	20 mA or less (when all indicators light up)	60 mA or less (when all indicators light up)	20 mA or less (when all indicators light up)	60 mA or less (when all indicators light up)	7 mA or less
Signal channel No.	1 input	8 inputs (Note 3)	1 input	8 inputs (Note 3)	8 inputs / outputs (Note 4)
Connectable device	NPN open-collector, or DC 2-wire output type sensor, or switch etc.	NPN open-collector output sensor or switch etc. (Note 5)	PNP open-collector, or DC 2-wire output type sensor, or switch etc.	PNP open-collector output sensor or switch etc. (Note 5)	Commercial I/O device
Supply current for units (Note 6)	100 mA or less	800 mA or less (At a total of 8 channels)	100 mA or less	800 mA or less (At a total of 8 channels)	
Power indicator	Green LED (Lights up when the power is ON)				
Input indicator	Green LED [**SC-T8J**(**-P**): 8 Nos.] (Lights up when each channel input is ON)				———
Ambient temperature	−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				
Material	Enclosure: Heat-resistant ABS, Frame: Polycarbonate	Enclosure: Heat-resistant ABS	Enclosure: Heat-resistant ABS, Frame: Polycarbonate	Enclosure: Heat-resistant ABS	
Weight	10 g 0.353 oz approx.	40 g 1.411 oz approx.	10 g 0.353 oz approx.	40 g 1.411 oz approx.	40 g 1.411 oz approx.
Accessories	**SL-CP1** (Male snap connector): 1 No.	Index seal: 1 No.	**SL-CP1** (Male snap connector): 1 No.	Index seal: 1 No.	

Notes:1) It depends on the power supply from **SC-MIL**.
2) The current consumption and input current of input unit connected are not included.
3) The signal for 8 channels is occupied regardless of number of input units connected.
4) The signal for 8 channels is occupied regardless of number of I/O units connected.
5) DC 2-wire type sensor and switch etc. cannot be connected.
6) Set the maximum current passing through input / output line, to 50 mA or less.

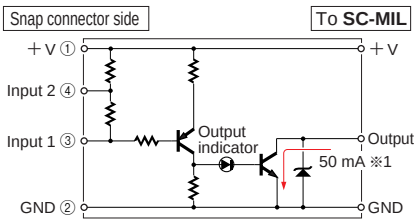
I/O CIRCUIT DIAGRAMS

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]



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

Conditions

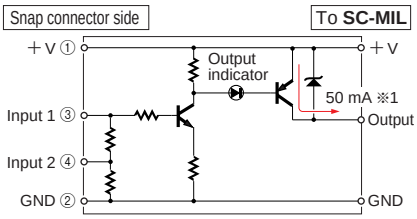
Leak current :
1 mA or less (when the power is OFF)
Offset voltage :
3 V or less (when the power is ON)
The product of which the load current range contains 5 to 8 mA.

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]



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

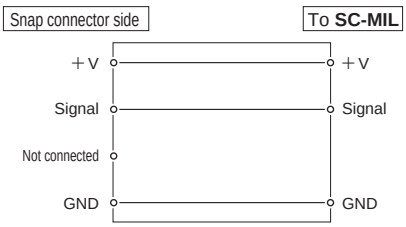
Conditions

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.

SC-TP8J

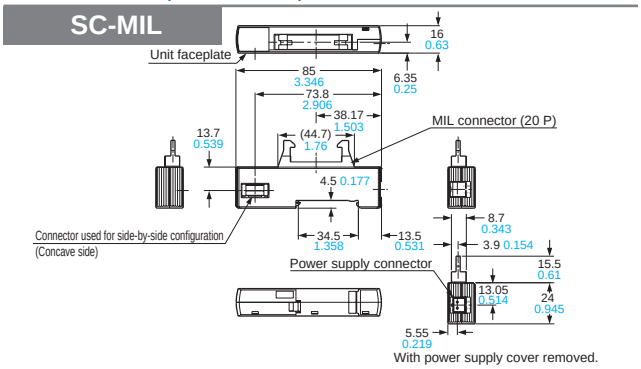
Male snap connector pin position

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

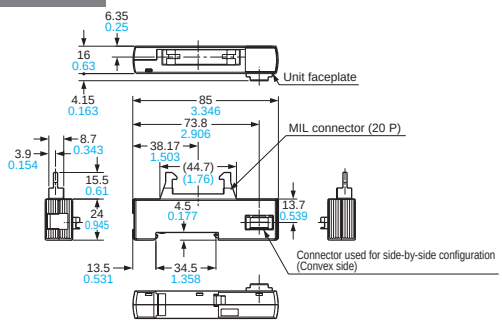


DIMENSIONS (Unit : mm in)

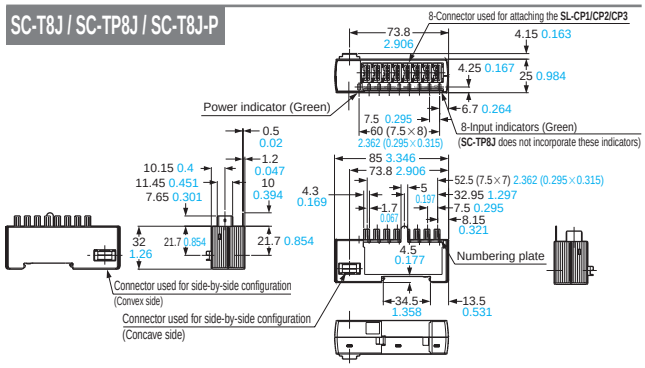
SC-MIL



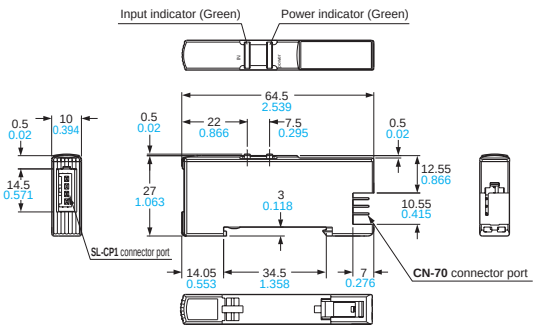
SC-MIL-S



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



SC-T1J / SC-T1J-P



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