



Fiber General Catalog

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



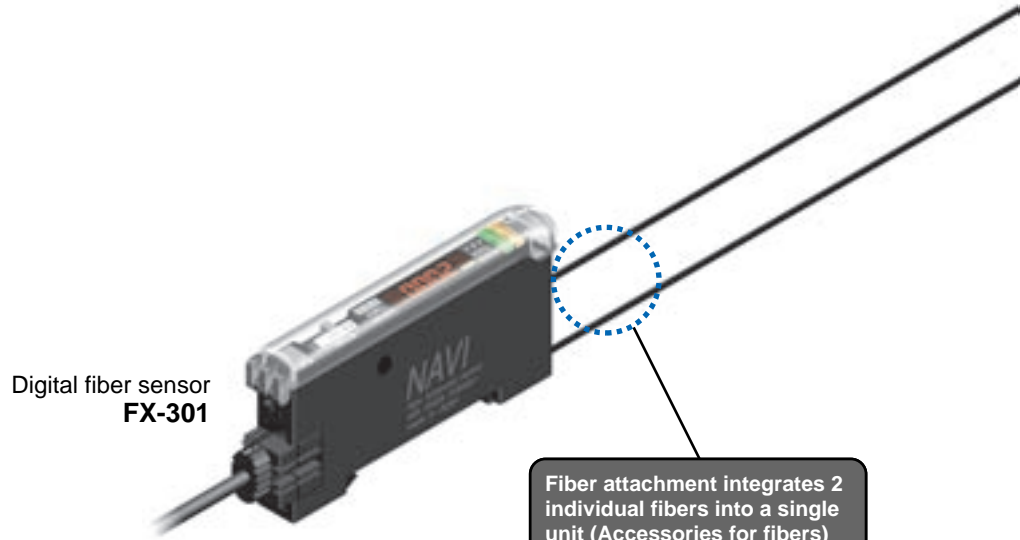
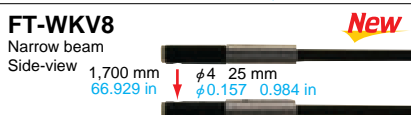
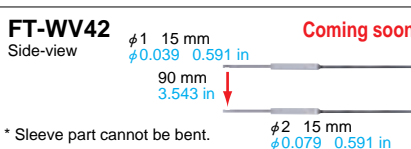
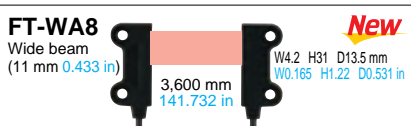
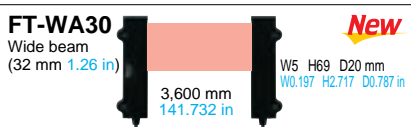
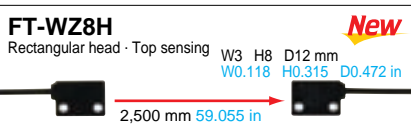
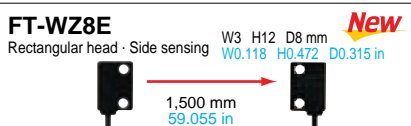
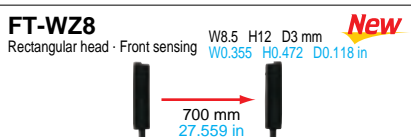
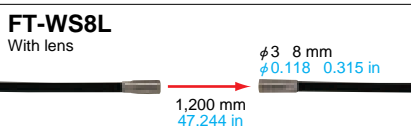
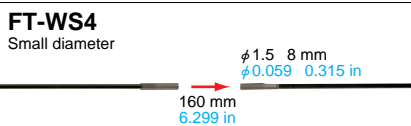
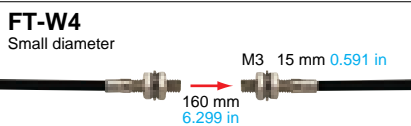
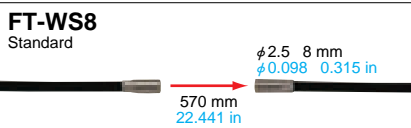
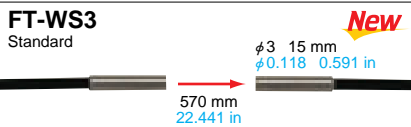
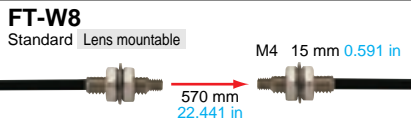
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Now Available – Our Long-awaited, Improved Selection of Sharp Bending Fibers

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

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



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

Newly developed

FX-AT2 (for fixed-length fiber) **FX-AT3** (for $\phi 2.2$ mm $\phi 0.087$ in fiber)

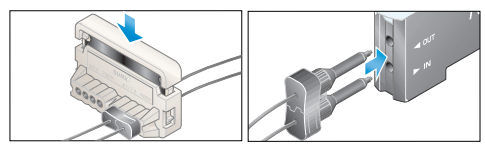
FX-AT4 (for $\phi 1$ mm $\phi 0.039$ in fiber) **FX-AT5** (for $\phi 1.3$ mm $\phi 0.051$ in fiber)

FX-AT6 (for $\phi 1$ mm $\phi 0.039$ in and $\phi 1.3$ mm $\phi 0.051$ in mixed fiber)

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

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

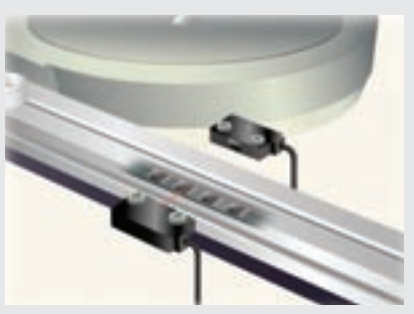
Each fiber (with some exceptions) has a newly developed two-in-one fiber attachment (FX-AT3/AT4/AT5/AT6) which enables two fibers to be cut simultaneously to the same length with the new fiber cutter (FX-CT2). Also, since the fibers can be attached to the amplifier while being fixed in position in the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



New sharp bending fiber applications

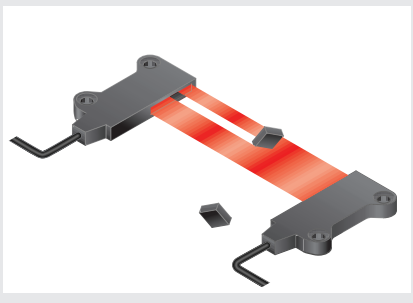
Detecting components from a parts feeder / FT-WZ8E

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

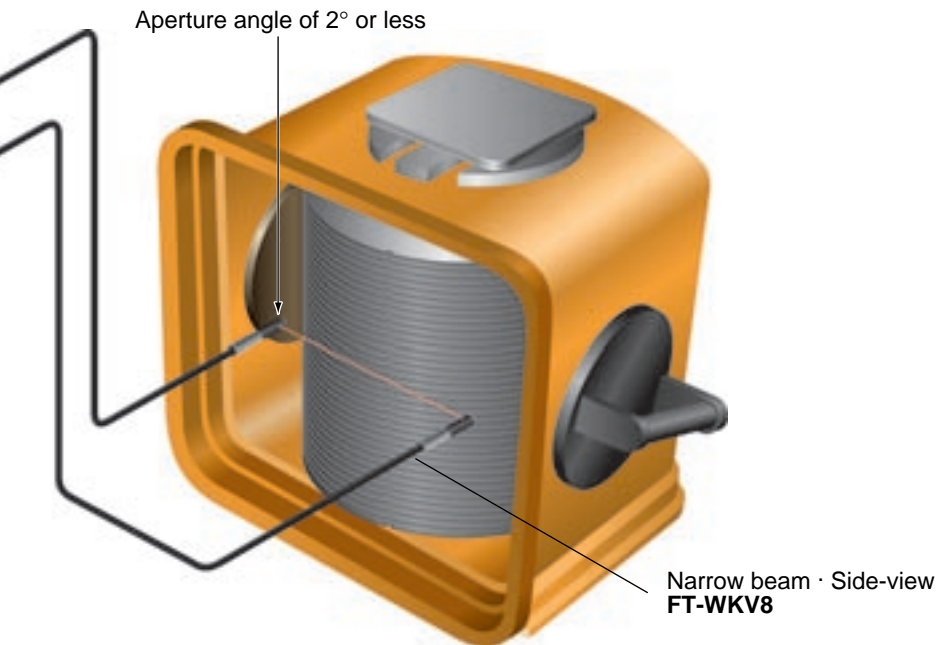


Detecting chip components as they are drop-sorted / FT-WA8

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

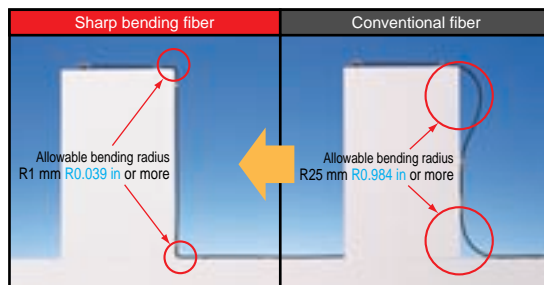
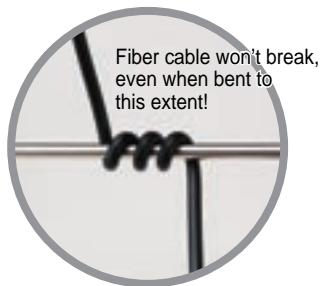


* The sensing ranges indicated above were obtained using LONG mode.



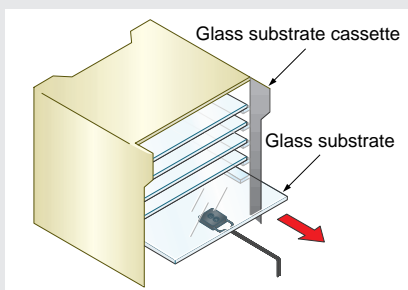
Can be rotated freely in any direction R1 mm R0.039 in or more

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).



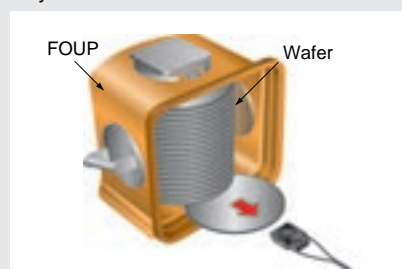
Detecting the presence of a glass substrate within a cassette / FD-WL41

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 1.575 in
φ0.058
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 0.591 in
φ0.118
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 Coaxial Lens mountable
M4 25 mm 0.984 in
65 mm 2.559 in

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

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

FD-WV42 Coming soon
Side-view
φ2 15 mm 0.591 in
φ0.079
15 mm 0.591 in
φ3 15 mm 0.591 in
φ0.118

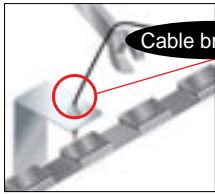
* Sleeve part cannot be bent.

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

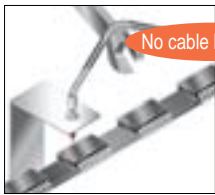
Tough Flexible Fiber / FT-P81X,FD-P81X,FD-G6X

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

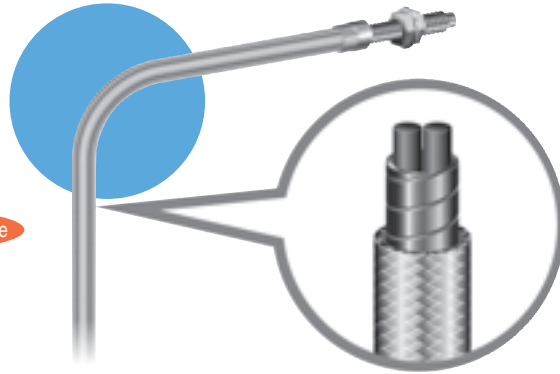
Conventional Fiber



Tough Flexible Fiber



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



Strong stainless steel mesh protects fiber cables from breakage

Tough flexible fiber line-up

FT-P81X

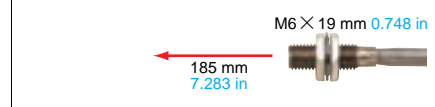
Lens mountable

New



FD-P81X

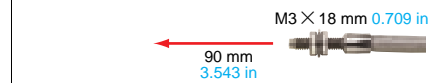
New



FD-G6X

Lens mountable

New

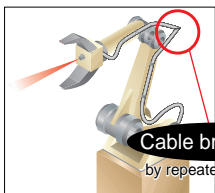


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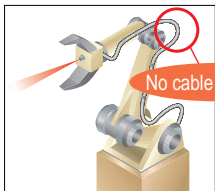
Flexible Fiber / FT-P60,FT-PS1

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

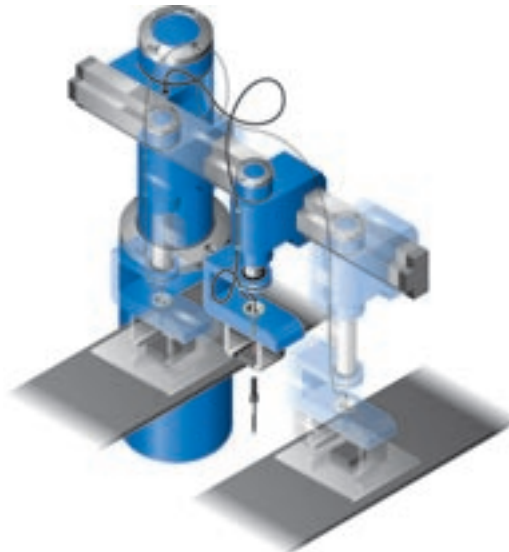
Conventional Fiber



Flexible Fiber



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



Flexible fiber line-up

FT-P60

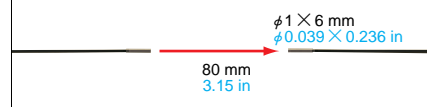
Lens mountable

New



FT-PS1

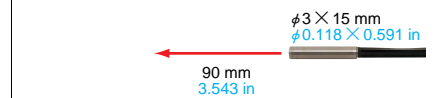
New



FD-P60



FD-P50



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

Finest Spot Lens / FX-MR6 High Precision Fiber / FD-EG2,FD-EG3

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



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

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

Small spot applications

Counting connector pins

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



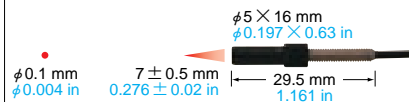
Suction detection for chips

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

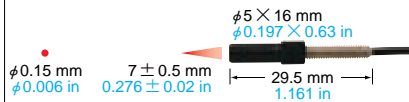


Spot lens & high precision fiber line-up

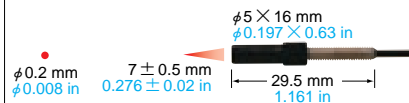
FX-MR6+FD-EG3



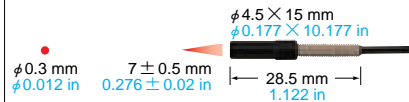
FX-MR6+FD-EG2



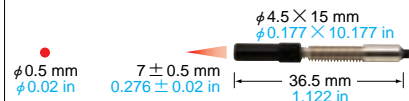
FX-MR6+FD-EG1



FX-MR3+FD-EG1



FX-MR3+FD-G4/WG4



FX-MR2+FD-WG4/G4



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

FX-MR5+FD-WG4/G4

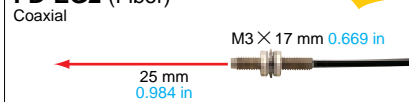


* The spot diameter can be changed by adjusting the length of fiber inserted.

FD-EG3 (Fiber)



FD-EG2 (Fiber)



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

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

Glass substrate detection in high temperature production line

High precision detection

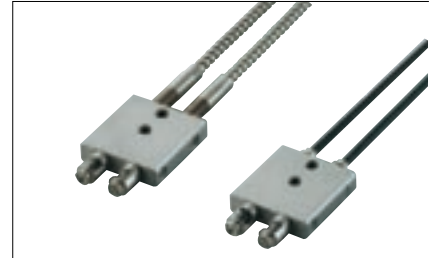
In addition to excellent heat resistance, these fibers have achieved a repeatability of 0.06 mm **0.002 in** for transparent glass substrates.

Extended detection range

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

Thin fiber head

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



Glass substrate detection in high temperature production line



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

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

Seal slit is available

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

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

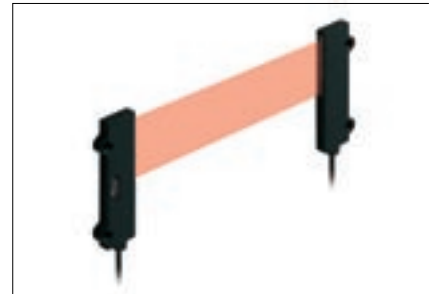
As these fibers incorporate light sources having almost the same collimated beam as lasers, beam interference from peripheral objects is minimal, thus permitting stable detection to be performed in crowded areas.

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

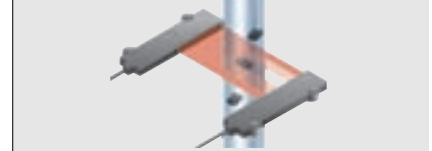
The allowable bending radius for FT-WA30 is R1 mm **R0.039 in** or greater. These fibers can be bent as much as if they were electric wires, thus saving tremendous amounts of space during fiber installation.

Space-saving installation is now possible

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



Detecting dropping objects



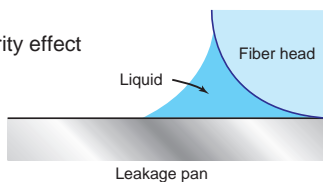
Leak Detection Fiber / FD-F7 SERIES

A new slim fiber ideal for sensing chemical leaks

Reliable detection

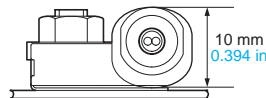
The unique effect of capillarity enables reliable detection of small leaks and viscous liquids.

- Capillarity effect



Compact, space-saving

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



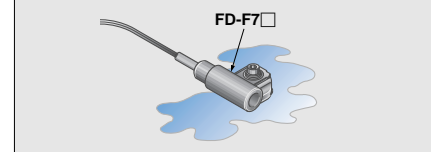
Ideal for chemicals and volatile materials

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

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



Leak detection for use in semiconductor device manufacturing



Liquid Fiber / FT-F9 SERIES

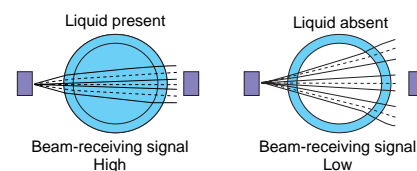
Reliably detect liquid in pipe

Safer fiber type sensor

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

Reliable detection not affected by bubbles or droplets

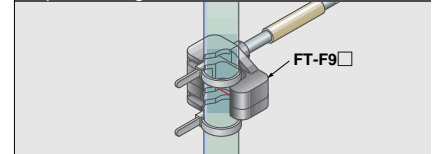
Latest optical fiber techniques have solved problems caused by bubbles, droplets or liquid leakage that arise in conventional pipe-mountable sensors.



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



Liquid sensing



Glass Substrate Alignment & Seating Confirmation Fiber / FD-L43

High accuracy & stable sensing

High accuracy sensing

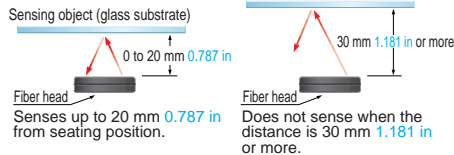
Even with variation among glass substrates, the positioning error is 0.2 mm **0.008 in** or less (at sensing range 5 to 17 mm **0.197 to 0.669 in**).

Single type serving two applications

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

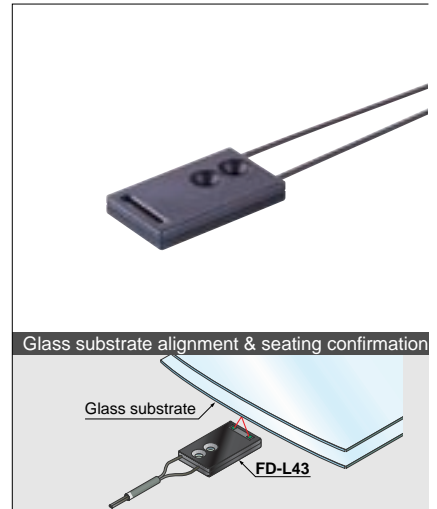
Long-range sensing capability

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



Compact design allows easy, flexible positioning

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

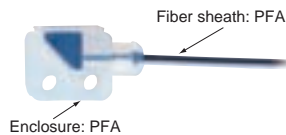


Chemical-resistant Rectangular Head Fiber / FT-Z8Y SERIES

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

Usable with various chemical liquids

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



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

Easy cutting of even PFA protected fiber

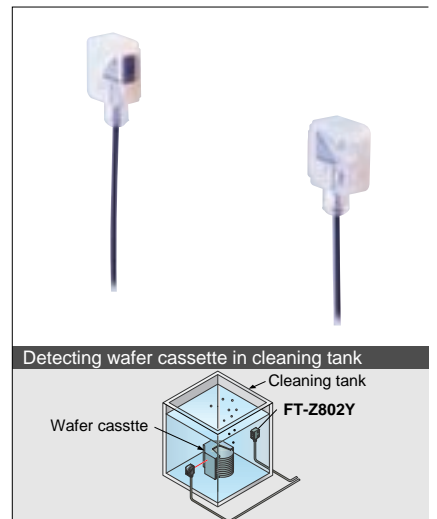
As the diameter of the fiber cable, including the PFA protected portion, is only ϕ 2.2 mm **ϕ 0.087 in**, you can simply cut the fiber cable to a desired length.

Square-shaped head provides easy mounting

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

Excellent explosion-proof structure complying with SEMI S2

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



Flexible Heat-resistant Fiber / FT-H20W SERIES

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

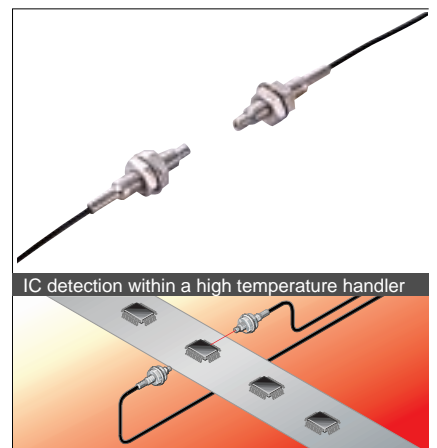
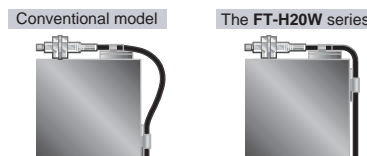
Heat-resistant temperature 200°C (392°F)

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

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

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

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



Rectangular Head Fiber / FT-Z8 SERIES

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

Extremely thin, the smallest size in the industry

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

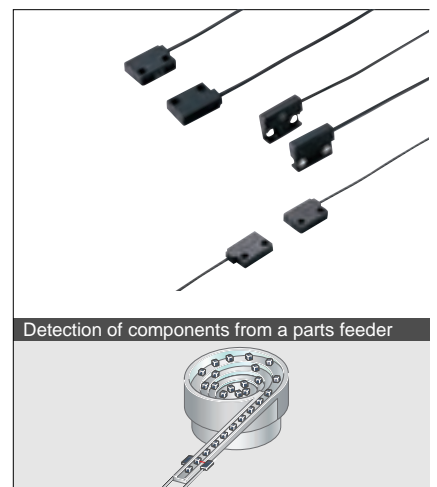
Rectangular fiber head allows for easy installation

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

Utilizes flexible inflection resistant cable

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

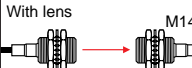
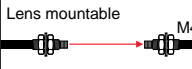

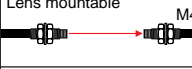
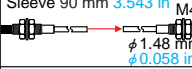
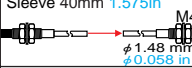
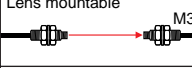


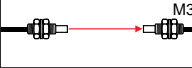
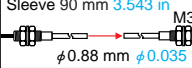
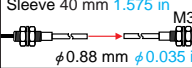

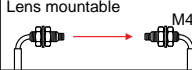
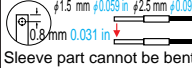
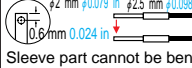
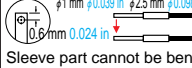
Long sensing range 2,700 mm (106.279 in)



Order Guide

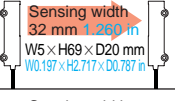
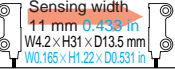
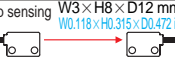
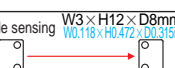
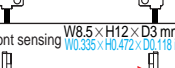



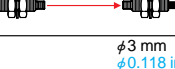
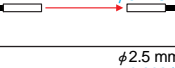


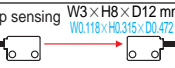
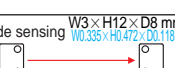
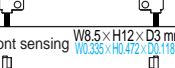
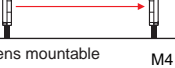



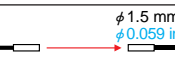
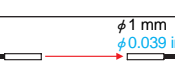
Thru-beam type fiber line-up (one pair set)

Standard fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Long sensing range	With lens 	<ul style="list-style-type: none"> LONG: 19,500 mm 767.715 in STD: 14,000 mm 551.18 in FAST: 10,000 mm 393.7 in S-D: 3,800 mm 149.606 in 	$\phi 0.4$ mm $\phi 0.016$ in opaque object	• Large lenses on the fiber heads increase the sensing range significantly.	10 m 32.808 ft	R25 mm R0.984 in	FT-FM10L
	With lens $\phi 2.5$ mm $\phi 0.098$ in	<ul style="list-style-type: none"> LONG: 1,600 mm 62.992 in STD: 800 mm 31.496 in FAST: 580 mm 22.835 in S-D: 280 mm 11.024 in 	$\phi 0.02$ mm $\phi 0.001$ in opaque object	• Long sensing range with small fiber heads of $\phi 2.5$ mm $\phi 0.098$ in	2 m 6.562 ft		FT-SFM2L
	Lens mountable 	<ul style="list-style-type: none"> LONG: 1,100 mm 43.307 in STD: 530 mm 20.866 in FAST: 400 mm 15.748 in S-D: 180 mm 7.087 in 	$\phi 0.04$ mm $\phi 0.002$ in opaque object	• Long sensing range	2 m 6.562 ft		FT-B8
		<ul style="list-style-type: none"> LONG: 1,000 mm 39.37 in STD: 480 mm 18.898 in FAST: 360 mm 14.173 in S-D: 168 mm 6.614 in 	$\phi 0.03$ mm $\phi 0.001$ in opaque object	• Low price	2 m 6.562 ft (Note 3)		FT-NB8
Standard	Lens mountable 						FT-FM2
	Sleeve 90 mm 3.543 in 						FT-FM2S
	Sleeve 40 mm 1.575 in 	<ul style="list-style-type: none"> LONG: 780 mm 30.709 in STD: 400 mm 15.748 in FAST: 280 mm 11.024 in S-D: 130 mm 5.118 in 	$\phi 0.03$ mm $\phi 0.001$ in opaque object		2 m 6.562 ft	FT-FM2S4	
	Lens mountable 						FT-T80
							FT-SFM2
			<ul style="list-style-type: none"> LONG: 700 mm 27.559 in STD: 360 mm 14.173 in FAST: 250 mm 9.843 in S-D: 126 mm 4.961 in 	$\phi 0.03$ mm $\phi 0.001$ in opaque object	• Low price	2 m 6.562 ft (Note 3)	FT-N8
							FT-NFM2
	Sleeve 90 mm 3.543 in 	<ul style="list-style-type: none"> LONG: 270 mm 10.63 in STD: 140 mm 5.512 in FAST: 100 mm 3.937 in S-D: 49 mm 1.929 in 	$\phi 0.025$ mm $\phi 0.001$ in opaque object	• Suitable for detection in a congested equipment	2 m 6.562 ft	FT-NFM2S	
	Sleeve 40 mm 1.575 in 	<ul style="list-style-type: none"> LONG: 175 mm 6.89 in STD: 80 mm 3.15 in FAST: 60 mm 2.362 in S-D: 27 mm 1.063 in 				FT-SNFM2	
							FT-SNFM2
Elbow	Lens mountable 	<ul style="list-style-type: none"> LONG: 530 mm 20.866 in STD: 230 mm 9.055 in FAST: 150 mm 9.906 in S-D: 80 mm 3.15 in 	$\phi 0.04$ mm $\phi 0.002$ in opaque object	• The fiber head is bent at a right angle with 5 mm 0.197 in bending radius at the neck.	2 m 6.562 ft	R25 mm R0.984 in	FT-R80
Side-view		<ul style="list-style-type: none"> LONG: 400 mm 15.748 in STD: 200 mm 7.874 in FAST: 140 mm 5.512 in S-D: 70 mm 2.756 in 			2 m 6.562 ft		FT-SFM2SV2
		<ul style="list-style-type: none"> LONG: 390 mm 15.354 in STD: 180 mm 7.087 in FAST: 125 mm 4.921 in S-D: 63 mm 2.48 in 	$\phi 0.02$ mm $\phi 0.001$ in opaque object	• The side-view sensing • Space-saving	1 m 6.562 ft	R25 mm R0.984 in	FT-V22
		<ul style="list-style-type: none"> LONG: 175 mm 6.89 in STD: 80 mm 3.15 in FAST: 60 mm 2.362 in S-D: 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

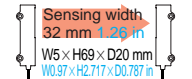

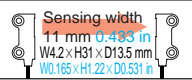
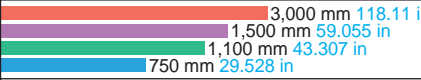
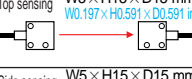

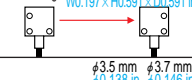

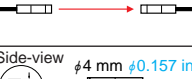
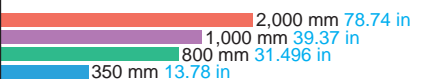
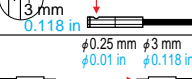


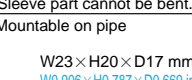
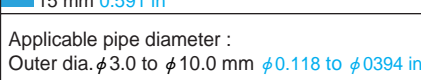
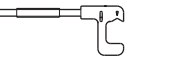
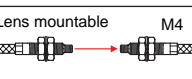

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.
Sharp bending	Wide beam  Sensing width 32 mm 1.260 in W5 x H69 x D20 mm W0.197 x H2.717 x D0.787 in	3,500 mm 137.795 in	φ 0.3 mm	• Sensing width 32 mm 1.26 in wide area • Long sensing range	2 m 6.562 ft	R1 mm R0.039 in	FT-WA30 <i>New</i>
		3,500 mm 137.795 in	φ 0.012 in				
		3,500 mm 137.795 in (Note 3)	opaque object				
	Rectangular head  Sensing width 11 mm 0.433 in W4.2 x H31 x D13.5 mm W0.165 x H1.22 x D0.531 in	3,500 mm 137.795 in	φ 0.25 mm	• Sensing width 11 mm 0.433 in wide area • Long sensing range	2 m 6.562 ft	R1 mm R0.039 in	FT-WA8 <i>New</i>
		1,500 mm 59.055 in	φ 0.01 in				
		1,100 mm 43.307 in	opaque object				
	Rectangular head  Top sensing W3 x H8 x D12 mm W0.118 x H0.315 x D0.472 in	2,500 mm 98.425 in	φ 0.08 mm	• Installs with M2 screws, allowing easy beam axis alignment	2 m 6.562 ft	R1 mm R0.039 in	FT-WZ8H <i>New</i>
		1,200 mm 47.244 in					
		850 mm 33.465 in					
	Rectangular head  Side sensing W3 x H12 x D8 mm W0.118 x H0.472 x D0.315 in	1,500 mm 59.055 in	φ 0.05 mm	• Installs with M2 screws, allowing easy beam axis alignment	2 m 6.562 ft	R1 mm R0.039 in	FT-WZ8E <i>New</i>
		700 mm 27.559 in					
		500 mm 19.685 in					
Rectangular head  Front sensing W8.5 x H12 x D3 mm W0.335 x H0.472 x D0.118 in	700 mm 27.559 in	φ 0.04 mm	• Installs with M2 screws, allowing easy beam axis alignment	2 m 6.562 ft	R1 mm R0.039 in	FT-WZ8 <i>New</i>	
	330 mm 12.992 in						
	240 mm 9.449 in						
Sharp bending	Narrow beam  Side-view φ 4 mm φ 0.157 in φ 3 mm φ 0.118 in	1,700 mm 66.929 in	φ 0.06 mm	• The side-view sensing • Aperture angle 2°	2 m 6.562 ft	R1 mm R0.039 in	FT-WKV8 <i>New</i>
		700 mm 27.559 in					
		600 mm 23.622 in					
	Narrow beam  With lens φ 3 mm φ 0.118 in	1,200 mm 47.244 in	φ 0.02 mm	• Long sensing range with fiber heads of φ 3 mm φ 0.118 in	2 m 6.562 ft	R1 mm R0.039 in	FT-WS8L <i>New</i>
		600 mm 23.622 in					
		420 mm 16.535 in					
	Standard  Lens mountable M4	570 mm 22.441 in	φ 0.03 mm	• Allowable bending radius: R1 mm R0.039 in or more	2 m 6.562 ft	R1 mm R0.039 in	FT-W8 <i>New</i>
		290 mm 11.417 in					
		200 mm 7.874 in					
	Standard  φ 3 mm φ 0.118 in	570 mm 22.441 in	φ 0.05 mm	• Allowable bending radius: R1 mm R0.039 in or more	2 m 6.562 ft	R1 mm R0.039 in	FT-WS3 <i>New</i>
		290 mm 11.417 in					
		200 mm 7.874 in					
Standard  φ 2.5 mm φ 0.098 in	570 mm 22.441 in	φ 0.03 mm	• Allowable bending radius: R1 mm R0.039 in or more	2 m 6.562 ft	R1 mm R0.039 in	FT-WS8 <i>New</i>	
	290 mm 11.417 in						
	200 mm 7.874 in						
Small diameter  M3	160 mm 6.299 in	φ 0.02 mm	• Allowable bending radius: R1 mm R0.039 in or more	2 m 6.562 ft	R1 mm R0.039 in	FT-W4 <i>New</i>	
	80 mm 3.15 in						
	55 mm 2.165 in						
Small diameter  φ 1.5 mm φ 0.059 in	128 mm 5.051 in	φ 0.001 in	• Allowable bending radius: R1 mm R0.039 in or more	2 m 6.562 ft	R1 mm R0.039 in	FT-WS4 <i>New</i>	
	28 mm 1.102 in						
	128 mm 5.051 in						
Flexible	Rectangular head  Top sensing W3 x H8 x D12 mm W0.118 x H0.315 x D0.472 in	2,700 mm 106.299 in	φ 0.03 mm	• 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 <i>New</i>
		1,400 mm 55.118 in					
		1,000 mm 39.37 in					
	Rectangular head  Side sensing W3 x H12 x D8 mm W0.335 x H0.472 x D0.118 in	1,600 mm 62.992 in	φ 0.001 in	• 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-Z8E <i>New</i>
		800 mm 31.496 in					
		600 mm 23.622 in					
	Rectangular head  Front sensing W8.5 x H12 x D3 mm W0.335 x H0.472 x D0.118 in	800 mm 31.496 in	φ 0.001 in	• 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-Z8 <i>New</i>
		400 mm 15.748 in					
		300 mm 11.811 in					
	Standard  Lens mountable (Note 4) M4	650 mm 25.591 in	φ 0.04 mm	• 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 <i>New</i>
		320 mm 12.598 in					
		230 mm 9.055 in					
Standard  Lens mountable M4	400 mm 15.748 in	φ 0.002 in	• Bending durability: 1 million times or more (at R10 mm R0.394 in)	2 m 6.562 ft	R4 mm R0.157 in	FT-P60 <i>New</i>	
	190 mm 7.48 in						
	140 mm 5.512 in						
Small diameter  M3	250 mm 9.843 in	φ 0.02 mm	• 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 <i>New</i>	
	100 mm 3.937 in						
	75 mm 2.953 in						
Small diameter  φ 1.5 mm φ 0.059 in	280 mm 11.024 in	φ 0.001 in	• Bending durability: 1 million times or more (at R4 mm R0.157 in)	1 m 3.281 ft	R4 mm R0.157 in	FT-P2 <i>New</i>	
	120 mm 4.724 in						
	90 mm 3.543 in						
Small diameter  φ 1 mm φ 0.039 in	80 mm 3.15 in	φ 0.001 in	• Bending durability: 1 million times or more (at R10 mm R0.394 in)	500 mm 19.685 in	R4 mm R0.157 in	FT-PS1 <i>New</i>	
	40 mm 1.575 in						
	30 mm 1.181 in						
Small diameter  φ 1 mm φ 0.039 in	17 mm 0.669 in	φ 0.001 in	• Bending durability: 1 million times or more (at R10 mm R0.394 in)	500 mm 19.685 in	R4 mm R0.157 in	FT-PS1 <i>New</i>	
	40 mm 1.575 in						
	30 mm 1.181 in						

- Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
2) The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
3) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long.
4) The sheath of FT-P80 is very soft. In the case of insertion in amplifier, please use an attachment (FX-AT3), then insert the fiber in amplifier vertically.

Order Guide

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

Special use fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length	Allowable bending radius	Model No.
Wide beam	 <p>Sensing width 32 mm 1.26 in W5×H69×D20 mm W0.97×H2.717×D0.787 in</p>	 <p>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)</p>	<p>φ0.3 mm φ0.012 in opaque object</p>	<ul style="list-style-type: none"> Sensing width 32 mm 1.26 in wide area Long sensing range 	<p>Free-cut 2 m 6.562 ft</p>	<p>R10 mm R0.394 in</p>	<p>FT-A30 New</p>
	 <p>Sensing width 11 mm 0.433 in W42×H31×D13.5 mm W0.165×H1.22×D0.531 in</p>	 <p>3,000 mm 118.11 in 1,500 mm 59.055 in 1,100 mm 43.307 in 750 mm 29.528 in</p>	<p>φ0.25 mm φ0.01 in opaque object</p>	<ul style="list-style-type: none"> Sensing width 11 mm 0.433 in wide area Long sensing range 	<p>Free-cut 2 m 6.562 ft</p>	<p>R10 mm R0.394 in</p>	<p>FT-A8</p>
Array	 <p>Top sensing W5×H15×D15 mm W0.197×H0.591×D0.591 in</p>	 <p>650 mm 25.591 in 330 mm 12.992 in 220 mm 8.661 in 115 mm 4.528 in</p>	<p>Horizontal : φ0.025 mm φ0.001 in opaque object Vertical : φ0.45 mm φ0.018 in opaque object</p>	<ul style="list-style-type: none"> Its wide beam meets various needs. 	<p>Free-cut 2 m 6.562 ft</p>	<p>R25 mm R0.984 in</p>	<p>FT-AFM2</p>
	 <p>Side sensing W5×H15×D15 mm W0.197×H0.591×D0.591 in</p>	 <p>590 mm 23.228 in 290 mm 11.417 in 200 mm 7.874 in 100 mm 3.937 in</p>					<p>FT-AFM2E</p>
Narrow beam	 <p>φ3.5 mm φ0.138 in φ3.7 mm φ0.146 in</p>	 <p>2,000 mm 78.74 in 1,000 mm 39.37 in 800 mm 31.496 in 350 mm 13.78 in</p>	<p>φ0.06 mm φ0.002 in opaque object</p>	<ul style="list-style-type: none"> Aperture angle 2° Laser beam equivalent detection 	<p>Free-cut 2 m 6.562 ft</p>	<p>R25 mm R0.984 in</p>	<p>FT-K8</p>
	 <p>Side-view φ4 mm φ0.157 in φ3 mm φ0.118 in</p>	<p>FT-KV8</p>					
Ultra-small diameter	 <p>φ0.25 mm φ0.01 in φ3 mm φ0.118 in</p>	 <p>18 mm 0.709 in 10 mm 0.394 in 8 mm 0.315 in 3 mm 0.118 in</p>	<p>φ0.02 mm φ0.001 in opaque object</p>	<ul style="list-style-type: none"> Ultra-small diameter sleeves, very narrow beam φ0.125 mm φ0.005 in 	<p>500 mm 19.685 in</p>	<p>R5 mm R0.197 in</p>	<p>FT-E12</p>
	 <p>φ0.4 mm φ0.002 in φ3 mm φ0.118 in</p> <p>Sleeve part cannot be bent.</p>	 <p>80 mm 3.15 in 50 mm 1.969 in 36 mm 1.417 in 15 mm 0.591 in</p>					<p>FT-E22</p>
Liquid level sensing	 <p>Mountable on pipe W23×H20×D17 mm W0.906×H0.787×D0.669 in</p>	<p>Applicable pipe diameter : Outer dia. φ3.0 to φ10.0 mm φ0.118 to φ0.394 in</p> <p>[PFA (Fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1.0 mm] 0.012 to 0.039 in</p>	<p>(Liquid)</p>	<ul style="list-style-type: none"> SEMI S2 compliant The shape and thickness of the pipe have no influence 	<p>Free-cut 2 m 6.562 ft</p>	<p>Protective tube R20 mm R0.787 in Fiber R4 mm R0.157 in</p>	<p>FT-F902 (Note 4) FT-F905 (Note 4)</p>
Tough flexible	 <p>Lens mountable M4</p>	 <p>650 mm 25.591 in 320 mm 12.598 in 230 mm 9.055 in 110 mm 4.331 in</p>	<p>φ0.05 mm φ0.002 in opaque object</p>	<ul style="list-style-type: none"> Strong stainless steel mesh protects fiber cables 	<p>1 m 3.281 ft</p>	<p>R10 mm R0.394 in</p>	<p>FT-P81X New</p>

- Notes: 1) Please take care that the sensing range of the free-cut type fiber may be reduced by 20% max. depending upon how the fiber is cut.
 2) The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
 3) The fiber cable length practically limits the sensing range to 3,500 mm 137.795 in long.
 4) Dedicated amplifier FX-301-F must be used with FT-F902 and FT-F905.

Environment resistant fibers

Type	Shape of fiber head	Sensing range (Note 1)	Min. sensing object (under the optimum condition (Note 2))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.	
Environment resistant	Heat-resistant	Lens mountable 	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	ϕ 0.04 mm ϕ 0.002 in opaque object	• Heat-resistant temp. : 350°C 662°F • Cold-resistant temp. : -60°C -76°F	2 m 6.562 ft	R25 mm R0.984 in	FT-H35-M2
		Sleeve 60 mm 2.362 in ϕ 2.1 mm ϕ 0.083 in	Fiber R25 mm Sleeve R10 mm				FT-H35-M2S6	
	Heat-resistant	Lens mountable 		310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 50 mm 1.969 in	ϕ 0.02 mm ϕ 0.001 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : -60°C -76°F	1 m 3.281 ft	R10 mm R0.394 in
		Lens mountable 	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	2 m 6.562 ft			FT-H20W-M2	
	Heat-resistant	Lens mountable 	550 mm 21.654 in 280 mm 11.024 in 200 mm 7.874 in 90 mm 3.549 in	ϕ 0.04 mm ϕ 0.002 in opaque object	• Heat-resistant temp. : 200°C 392°F • Cold-resistant temp. : -60°C -76°F	1 m 3.281 ft	R25 mm	FT-H20-M1
		Lens mountable 	880 mm 34.646 in 440 mm 17.323 in 300 mm 11.811 in 155 mm 6.102 in			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		ϕ 4 mm ϕ 0.157 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
		Chemical-resistant	Rectangular head ϕ 5.5 mm ϕ 0.217 in		ϕ 0.08 mm ϕ 0.003 in opaque object	• Heat-resistant specification (115°C 239°F) • Long sensing range with lens • Heat-resistant specification (115°C 239°F) • Side-view type	2 m 6.562 ft	R30 mm R1.181 in
Rectangular head ϕ 5.5 mm ϕ 0.217 in							800 mm 31.496 in 400 mm 15.748 in 280 mm 11.024 in 140 mm 5.512 in	FT-V8Y
Vacuum	Lens mountable 	470 mm 18.504 in 230 mm 9.055 in 165 mm 6.496 in 80 mm 3.15 in	ϕ 0.02 mm ϕ 0.001 in opaque object	• Heat-resistant temp. : 120°C 248°F	1 m 3.281 ft	R200 mm R7.874 in	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)

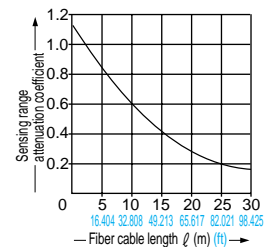
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol \boxtimes) or the sleeve length (symbol \boxtriangle) from the table below.

Type	Basic model No.	\boxtimes Fiber cable length (Unit: m ft)	\boxtriangle Sleeve length (Unit: cm in)
Standard threaded head (free-cut)	FT-FM \boxtimes	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 \boxtimes -S \boxtriangle	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 \boxtimes L	20 65.617, 30 98.425	—
Small diameter threaded head with sleeve (free-cut)	FT-NFM2-S \boxtriangle	—	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 \boxtimes	2 6.562, 3 9.843	—
350°C heat-resistant	FT-H35-M \boxtimes	3 9.843	—

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

Correlation between sensing range attenuation coefficient and fiber cable length

Longer the fiber cable, shorter is the sensing range.



Order Guide

Reflective type fiber line-up

Standard fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.	
Standard	Long sensing range M6	<ul style="list-style-type: none"> LONG: 480 mm 18.898 in STD: 220 mm 8.661 in FAST: 160 mm 6.299 in S-D: 75 mm 2.953 in 	φ0.02 mm φ0.001 in gold wire	• Long sensing range	2 m 6.562 ft		FD-B8	
	Coaxial M6	<ul style="list-style-type: none"> LONG: 310 mm 12.205 in STD: 140 mm 5.512 in FAST: 100 mm 3.937 in S-D: 47 mm 1.85 in 	φ0.02 mm φ0.001 in gold wire	• As fiber cutting is not required, sensing range will not be reduced.	500 mm 19.685 in	R25 mm R0.984 in	FD-5	
	Sleeve 90 mm 3.543 in M6 φ2.5 mm φ0.098 in	<ul style="list-style-type: none"> LONG: 270 mm 10.63 in STD: 110 mm 4.331 in FAST: 85 mm 3.346 in S-D: 39 mm 1.535 in 	φ0.02 mm φ0.001 in gold wire	• Free-cut type	2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FD-FM2S	
	Sleeve 40 mm 1.575 in M6 φ2.5 mm φ0.098 in	<ul style="list-style-type: none"> LONG: 270 mm 10.63 in STD: 110 mm 4.331 in FAST: 85 mm 3.346 in S-D: 39 mm 1.535 in 	φ0.02 mm φ0.001 in gold wire				FD-FM2S4	
	M4	<ul style="list-style-type: none"> LONG: 270 mm 10.63 in STD: 110 mm 4.331 in FAST: 85 mm 3.346 in S-D: 39 mm 1.535 in 	φ0.02 mm φ0.001 in gold wire				FD-T80	
	Small diameter M3	<ul style="list-style-type: none"> LONG: 90 mm 3.543 in STD: 45 mm 1.772 in FAST: 35 mm 1.378 in S-D: 16 mm 0.63 in 	φ0.02 mm φ0.001 in gold wire	• Long sensing range with miniature fiber head	2 m 6.562 ft	R25 mm R0.984 in	FD-T40	
	φ3 mm φ0.118 in	<ul style="list-style-type: none"> LONG: 270 mm 10.63 in STD: 110 mm 4.331 in FAST: 85 mm 3.346 in S-D: 39 mm 1.535 in 	φ0.02 mm φ0.001 in gold wire				FD-S80	
	M6	<ul style="list-style-type: none"> LONG: 260 mm 10.236 in STD: 120 mm 4.724 in FAST: 85 mm 3.346 in S-D: 42 mm 1.654 in 	φ0.02 mm φ0.001 in gold wire	• Low price	2 m 6.562 ft (Note 4)	R25 mm R0.984 in	FD-N8	
	M4	<ul style="list-style-type: none"> LONG: 75 mm 2.953 in STD: 38 mm 1.496 in FAST: 28 mm 1.102 in S-D: 13 mm 0.512 in 	φ0.02 mm φ0.001 in gold wire				FD-N4	
	M4	<ul style="list-style-type: none"> LONG: 260 mm 10.236 in STD: 120 mm 4.724 in FAST: 85 mm 3.346 in S-D: 42 mm 1.654 in 	φ0.02 mm φ0.001 in gold wire				FD-NFM2	
	Sleeve 90 mm 3.543 in M4 φ1.48 mm φ0.058 in	<ul style="list-style-type: none"> LONG: 90 mm 3.543 in STD: 45 mm 1.772 in FAST: 35 mm 1.378 in S-D: 16 mm 0.63 in 	φ0.02 mm φ0.001 in gold wire	• Suitable for detection in a congested equipment	2 m 6.562 ft	Fiber R25 mm R0.984 in Sleeve R10 mm R0.394 in	FD-NFM2S	
	Sleeve 40 mm 1.575 in M4 φ1.48 mm φ0.058 in	<ul style="list-style-type: none"> LONG: 90 mm 3.543 in STD: 45 mm 1.772 in FAST: 35 mm 1.378 in S-D: 16 mm 0.63 in 	φ0.02 mm φ0.001 in gold wire				FD-NFM2S4	
	φ2.5 mm φ0.098 in	<ul style="list-style-type: none"> LONG: 260 mm 10.236 in STD: 120 mm 4.724 in FAST: 85 mm 3.346 in S-D: 42 mm 1.654 in 	φ0.02 mm φ0.001 in gold wire				FD-SNFM2	
	Elbow M6	<ul style="list-style-type: none"> LONG: 185 mm 7.283 in STD: 85 mm 3.346 in FAST: 60 mm 2.362 in S-D: 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 φ2 mm φ0.197 in φ0.079 in Sleeve part cannot be bent.	<ul style="list-style-type: none"> LONG: 100 mm 3.937 in STD: 45 mm 1.772 in FAST: 32 mm 1.26 in S-D: 16 mm 0.63 in 	φ0.02 mm φ0.001 in gold wire	• The side-view sensing	2 m 6.562 ft	R25 mm R0.984 in	FD-SFM2SV2
		Small diameter φ3 mm φ1.5 mm φ0.118 in φ0.059 in Sleeve part cannot be bent.	<ul style="list-style-type: none"> LONG: 55 mm 2.165 in STD: 25 mm 0.984 in FAST: 17 mm 0.669 in S-D: 9 mm 0.354 in 	φ0.02 mm φ0.001 in gold wire	• Space-saving			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)	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	<ul style="list-style-type: none"> ■ : LONG ■ : STD ■ : FAST ■ : S-D <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> φ0.3 mm φ0.012 in copper wire 	<ul style="list-style-type: none"> • Narrow-view • Long sensing range 	<ul style="list-style-type: none"> 2 m 6.562 ft 	<ul style="list-style-type: none"> R1 mm R0.039 in 	<ul style="list-style-type: none"> New FD-WKZ1 		
	Standard	M6	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Allowable bending radius: R1 mm R0.039 in or more • Sleeve part of FD-W44: R10 mm R0.394 in or more 	<ul style="list-style-type: none"> 2 m 6.562 ft 	<ul style="list-style-type: none"> R1 mm R0.039 in 	FD-W8	
		Sleeve 40 mm M4 1.575 in φ1.48 mm φ0.058 in	<ul style="list-style-type: none"> 30 mm 1.181 in 15 mm 0.591 in 12 mm 0.472 in 5 mm 0.197 in 				<ul style="list-style-type: none"> Fiber R1 mm Sleeve R10 mm 	FD-W44	
		M4	<ul style="list-style-type: none"> 190 mm 7.48 in 90 mm 3.543 in 60 mm 2.362 in 32 mm 1.26 in 				FD-WT8		
		φ3 mm φ0.118 in	<ul style="list-style-type: none"> R1 mm R0.039 in 				FD-WS8		
		M3	<ul style="list-style-type: none"> 30 mm 1.181 in 15 mm 0.591 in 12 mm 0.472 in 5 mm 0.197 in 				FD-WT4		
	Hing precision	Coaxial Lens mountable M4	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Precise position sensing 	<ul style="list-style-type: none"> 2 m 6.562 ft 	<ul style="list-style-type: none"> R2 mm R0.079 in 	FD-WG4	
		Coaxial φ3 mm φ0.118 in	<ul style="list-style-type: none"> 11 mm 0.433 in 				FD-WSG4		
	Fixed-focus reflective	Glass substrate detection W24 H21 D4 mm W0.945 H0.827 in	<ul style="list-style-type: none"> 6.5 to 14 mm 0.256 to 0.551 in (Convergent point 8 mm 0.315 in) 7 to 12 mm 0.276 to 0.472 in (Convergent point 8 mm 0.315 in) 7.5 to 12 mm 0.295 to 0.472 in (Convergent point 8 mm 0.315 in) Cannot use 	φ1.9 mm φ0.0751 in φ0.003 in gold wire	<ul style="list-style-type: none"> • Just 4 mm 0.157 in thick • Glass substrate is reliably detected. 	<ul style="list-style-type: none"> 2 m 6.562 ft 	<ul style="list-style-type: none"> R1 mm R0.039 in 	<ul style="list-style-type: none"> New FD-WL41 	
		Specular object detection W15 H19 D3 mm W0.591 H0.748 in	<ul style="list-style-type: none"> 0.6 to 3.5 mm 0.024 to 0.138 in (Convergent point 2 mm 0.079 in) 0.9 to 2.7 mm 0.035 to 0.106 in (Convergent point 2 mm 0.079 in) 1.0 to 2.5 mm 0.039 to 0.098 in (Convergent point 2 mm 0.079 in) Cannot use 				<ul style="list-style-type: none"> • Just 3 mm 0.118 in thick • Wafer is reliably detected. 	<ul style="list-style-type: none"> New FD-WL42 	
	Flexible	Standard	M6 (Note 4)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 2 m 6.562 ft 	<ul style="list-style-type: none"> R4 mm R0.157 in 	<ul style="list-style-type: none"> • Bending durability: 1 million times or more (at R10 mm R0.394 in) 	FD-P80
			M4	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 30 mm 1.181 in 16 mm 0.63 in 				FD-P50	
		Small diameter	M3	<ul style="list-style-type: none"> 36 mm 1.417 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in 				FD-P40	
φ1.5 mm φ0.059 in			<ul style="list-style-type: none"> 50 mm 1.969 in 25 mm 0.984 in 19 mm 0.748 in 9 mm 0.354 in 	<ul style="list-style-type: none"> • Bending durability: 1 million times or more (at R4 mm R0.157 in) 				<ul style="list-style-type: none"> 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)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.		
Array	Top sensing W5 H20 D20 mm W0.197 H0.787 D0.787 in	220 mm 8.661 in 110 mm 4.331 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	78 mm 3.071 in 39 mm 1.535 in					FD-AFM2E		
High precision	Coaxial Lens mountable M4	110 mm 4.331 in 55 mm 2.165 in 42 mm 1.654 in 19 mm 0.748 in	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					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					FD-EG2 New		
	Coaxial Lens mountable M3	15 mm 0.591 in 8 mm 0.315 in 5 mm 0.197 in 3 mm 0.118 in					FD-EG3 New		
Ultra-small diameter	φ1.5 mm φ0.059 in φ0.5 mm φ0.02 in	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		
	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					FD-E22		
	Coaxial φ3 mm φ0.118 in φ0.65 mm φ0.026 in	5 mm 0.197 in 3 mm 0.118 in 2 mm 0.079 in					500 mm 19.685 in	R25 mm R0.984 in	FD-EN500S1
	Sleeve part cannot be bent.	Cannot use							
	M3 φ0.5 mm φ0.02 in	38 mm 1.496 in 18 mm 0.709 in 14 mm 0.551 in 6 mm 0.236 in					1 m 3.281 ft	FD-ENM1S1	
	Coaxial M3 φ0.8 mm φ0.031 in	Cannot use							
Sleeve part cannot be bent.									
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 8 mm 0.315 in) 3.5 to 15 mm 0.138 to 0.591 in (Convergent point 8 mm 0.315 in) Cannot use	φ0.06 mm φ0.002 in gold wire	• Just 4 mm 0.157 in thick • Glass substrate is reliably detected.			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 2 mm 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		
	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		
Liquid level sensing	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	R10 mm R0.394 in	FD-F41		
	Mountable on pipe for 1 mm 0.039 in thick PFA pipe W25 H13 D20 mm W0.984 H0.512 D0.787 in	Applicable pipe diameter : Outer dia. 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]			5 m 16.404 ft		FD-F91		
					2 m 6.562 ft		FD-F4		
					5 m 16.404 ft		FD-F9		
Tough flexible	M6	185 mm 7.283 in 80 mm 3.15 in 60 mm 2.362 in 35 mm 1.378 in	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	FD-P81X New		
	Coaxial Lens mountable M3	90 mm 3.543 in 45 mm 1.772 in 35 mm 1.378 in 20 mm 0.787 in			1 m 3.281 ft		FD-G6X New		

Notes: 1) The sensing range is specified for white non-glossy paper [100 100 mm 3.937 3.937 in (FD-G4, FD-G6X: 200 200 mm 7.874 7.874 in, FD-AFM2, FD-AFM2E, FD-P81X: 400 400 mm 15.748 15.748 in, FD-L43: glass substrate 76 52 t1.1 mm 2.992 2.047 t0.043 in, FD-L41: glass substrate 100 100 12 mm 3.937 3.937 t0.472 in)] as the object.

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

3) The minimum sensing object is specified for maximum sensitivity. Also, note that the corresponding setting distance is different from the rated sensing distance. However, in the case of fixed-focus reflective type, when the sensitivity is at MAX., it is only possible to detect the minimum size of sensing object at a distance of convergent point.

Environment resistant fibers

Type	Shape of fiber head	Sensing range (Note 1, 2)	Min. sensing object (at the maximum sensitivity (Note 3))	Features	Fiber cable length Free-cut	Allowable bending radius	Model No.			
Environment resistant	Heat-resistant	Coaxial M6		φ 0.02 mm φ 0.001 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	FD-H35-M2			
		Sleeve 60 mm 2.362 in M6 φ 2.8 mm φ 0.11 in	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 47 mm 1.85 in			φ 0.02 mm φ 0.001 in gold wire	2 m 6.562 ft	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
	Vacuum	Fixed-focus reflective W19 H27 D5 mm W0.748 H1.063 D0.197 in	0 to 15 mm 0 to 0.591 in 0 to 10 mm 0 to 0.394 in 1 to 8 mm 0.039 to 0.315 in 2 to 6 mm 0.079 to 0.236 in	φ 0.02 mm φ 0.001 in gold wire	• Heat-resistant temp.: 300°C 572°F • Cold-resistant temp.: 60°C 76°F	2 m 6.562 ft	R25 mm	FD-H30-L32 New		
		Fixed-focus reflective W19 H27 D5 mm W0.748 H1.063 D0.197 in					• Heat-resistant temp.: 180°C 356°F • Cold-resistant temp.: 60°C 76°F	2 m 6.562 ft	R0.984 in	FD-H18-L31 New
		M6	310 mm 12.205 in 140 mm 5.512 in 100 mm 3.937 in 47 mm 1.85 in						φ 0.02 mm φ 0.001 in gold wire	2 m 6.562 ft
		M6	165 mm 6.496 in 75 mm 2.933 in 52 mm 2.047 in 26 mm 1.024 in				φ 0.02 mm φ 0.001 in gold wire	1 m 3.281 ft		

- 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)

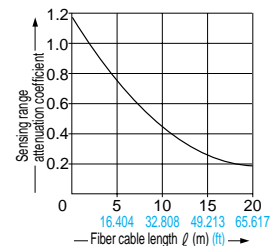
The fiber cable length or sleeve length of the standard fibers can be modified at your request. Select the fiber cable length (symbol ☒) or the sleeve length (symbol ☐) from the table below.

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	10.394, 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 ☐	—	10.394, 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

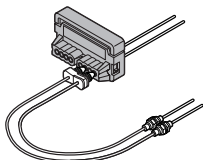
Longer the fiber cable, shorter is the sensing range.



Accessories (attached with fibers)

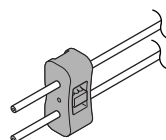
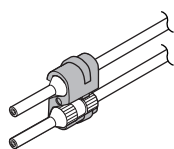
Fiber cutter

- FX-CT2

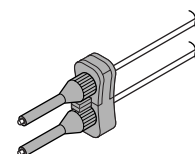


Fiber attachment

- FX-AT2 (for fixed-length fiber)
- FX-AT3 (for φ 2.2 mm φ 0.087 in fiber)



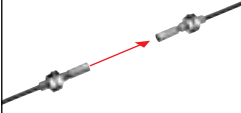
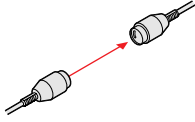
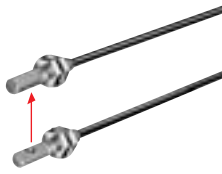
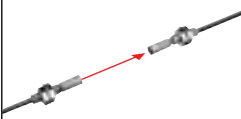
- FX-AT4 (for φ 1 mm φ 0.039 in fiber)
- FX-AT5 (for φ 1.3 mm φ 0.051 in fiber)
- FX-AT6 (for φ 1 mm φ 0.039 in and φ 1.3 mm φ 0.051 in mixed fiber)



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


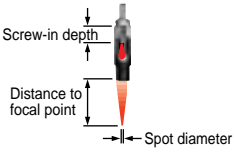

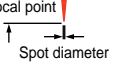
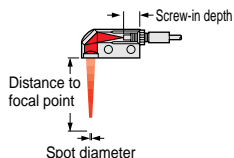
Order Guide

Lens (For thru-beam type fiber)

Designation	Model No.	Description																																																																		
For thru-beam type fiber	Expansion lens (Note 1)	FX-LE1	 <p>Increases the sensing range by 5 times or more.</p> <ul style="list-style-type: none"> Ambient temperature: 60 to 350 C 76 to 662 F 																																																																	
	Super-expansion lens (Note 1)	FX-LE2	 <p>Tremendously increases the sensing range with large diameter lenses.</p> <ul style="list-style-type: none"> Ambient temperature: 60 to 350 C 76 to 662 F 																																																																	
	Side-view lens	FX-SV1	 <p>Beam axis is bent by 90°.</p> <ul style="list-style-type: none"> Ambient temperature: 60 to 300 C 76 to 662 F 																																																																	
	Expansion lens for vacuum fiber (Note 1)	FV-LE1	 <p>Sensing range increases by 15 times or more.</p> <ul style="list-style-type: none"> Ambient temperature: 40 to 120 C 40 to 248 F 																																																																	
<p>Sensing range (mm)[Lens on both sides]</p> <table border="1"> <thead> <tr> <th>Fiber \ Mode</th> <th>LONG</th> <th>STD</th> <th>FAST</th> <th>S-D</th> </tr> </thead> <tbody> <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> </tbody> </table>				Fiber \ Mode	LONG	STD	FAST	S-D	FT-B8	3,500 (Note 2)	2,500	2,000	1,000	FT-FM2	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	FT-T80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,300	FT-R80	3,500 (Note 2)	2,300	1,600	800	FT-W8	3,500 (Note 2)	2,900 (Note 2)	2,000	1,000	FT-P80	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100	FT-P60	3,500 (Note 2)	3,500 (Note 2)	1,500	900	FT-P81X	3,500 (Note 2)	3,500 (Note 2)	2,500	1,100	FT-H35-M2	3,500 (Note 2)	2,000	1,500	750	FT-H20W-M1	1,600 (Note 2)	1,300	900	500	FT-H20W-M2	2,600	1,300	900	500	FT-H20-M1	1,600 (Note 2)	1,600 (Note 2)	1,100	900
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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).

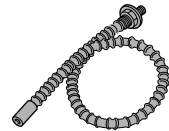
Lens (For reflective type fiber)

Designation	Model No.	Description															
For reflective type fiber	Pinpoint spot lens FX-MR1		Pinpoint spot of $\phi 0.5$ mm $\phi 0.02$ in. Enables detection of minute objects or small marks. <ul style="list-style-type: none"> Applicable fibers: FD-WG4, FD-G4 Ambient temperature: 40 to 70 C 40 to 158 F Distance to focal point: 6 1 mm 0.236 0.039 mm 														
	Zoom lens FX-MR2		The spot diameter is adjustable from $\phi 0.7$ to $\phi 2$ mm $\phi 0.079$ in according to how much the fiber is screwed in. <ul style="list-style-type: none"> Applicable fibers: FD-WG4, FD-G4 Ambient temperature: 40 to 70 C 40 to 158 F Accessory: MS-EX-3 (mounting bracket) <table border="1"> <thead> <tr> <th>Screw-in depth</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>7 mm</td> <td>18.5 mm approx.</td> <td>$\phi 0.7$ mm</td> </tr> <tr> <td>12 mm</td> <td>27 mm approx.</td> <td>$\phi 1.2$ mm</td> </tr> <tr> <td>14 mm</td> <td>43 mm approx.</td> <td>$\phi 2.0$ mm</td> </tr> </tbody> </table>	Screw-in depth	Distance to focal point	Spot diameter	7 mm	18.5 mm approx.	$\phi 0.7$ mm	12 mm	27 mm approx.	$\phi 1.2$ mm	14 mm	43 mm approx.	$\phi 2.0$ mm		
	Screw-in depth	Distance to focal point	Spot diameter														
	7 mm	18.5 mm approx.	$\phi 0.7$ mm														
	12 mm	27 mm approx.	$\phi 1.2$ mm														
14 mm	43 mm approx.	$\phi 2.0$ mm															
Finest spot lens FX-MR3		Extremely fine spot of $\phi 0.3$ mm $\phi 0.012$ in achieved. <ul style="list-style-type: none"> Applicable fibers: FD-WG4, FD-G4, FD-EG1, FD-EG2, FD-EG3, FD-G6X, Ambient temperature: 40 to 70 C 40 to 158 F <table border="1"> <thead> <tr> <th>Fiber</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>FD-EG3</td> <td>7.5 0.5 mm</td> <td>$\phi 0.15$ mm approx.</td> </tr> <tr> <td>FD-EG2</td> <td>7.5 0.5 mm</td> <td>$\phi 0.2$ mm approx.</td> </tr> <tr> <td>FD-EG1</td> <td>7.5 0.5 mm</td> <td>$\phi 0.3$ mm approx.</td> </tr> <tr> <td>FD-WG4/G4/G6X</td> <td>7.5 0.5 mm</td> <td>$\phi 0.5$ mm approx.</td> </tr> </tbody> </table>	Fiber	Distance to focal point	Spot diameter	FD-EG3	7.5 0.5 mm	$\phi 0.15$ mm approx.	FD-EG2	7.5 0.5 mm	$\phi 0.2$ mm approx.	FD-EG1	7.5 0.5 mm	$\phi 0.3$ mm approx.	FD-WG4/G4/G6X	7.5 0.5 mm	$\phi 0.5$ mm approx.
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FD-EG3	7.5 0.5 mm	$\phi 0.15$ mm approx.															
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FD-EG1	7.5 0.5 mm	$\phi 0.3$ mm approx.															
FD-WG4/G4/G6X	7.5 0.5 mm	$\phi 0.5$ mm approx.															
Finest spot lens FX-MR6		Extremely fine spot of $\phi 0.1$ mm $\phi 0.004$ in achieved. <ul style="list-style-type: none"> Applicable fibers: FD-WG4, FD-G4, FD-EG1, FD-EG2, FD-EG3, FD-G6X, Ambient temperature: 20 to 60 C 4 to 140 F <table border="1"> <thead> <tr> <th>Fiber</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>FD-EG3</td> <td>7 0.5 mm</td> <td>$\phi 0.1$ mm approx.</td> </tr> <tr> <td>FD-EG2</td> <td>7 0.5 mm</td> <td>$\phi 0.15$ mm approx.</td> </tr> <tr> <td>FD-EG1</td> <td>7 0.5 mm</td> <td>$\phi 0.2$ mm approx.</td> </tr> <tr> <td>FD-WG4/G4/G6X</td> <td>7 0.5 mm</td> <td>$\phi 0.4$ mm approx.</td> </tr> </tbody> </table>	Fiber	Distance to focal point	Spot diameter	FD-EG3	7 0.5 mm	$\phi 0.1$ mm approx.	FD-EG2	7 0.5 mm	$\phi 0.15$ mm approx.	FD-EG1	7 0.5 mm	$\phi 0.2$ mm approx.	FD-WG4/G4/G6X	7 0.5 mm	$\phi 0.4$ mm approx.
Fiber	Distance to focal point	Spot diameter															
FD-EG3	7 0.5 mm	$\phi 0.1$ mm approx.															
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FD-EG1	7 0.5 mm	$\phi 0.2$ mm approx.															
FD-WG4/G4/G6X	7 0.5 mm	$\phi 0.4$ mm approx.															
Zoom lens (Side-view type) FX-MR5		FX-MR2 is converted into a side-view type and can be mounted in a very small space. <ul style="list-style-type: none"> Applicable fibers: FD-WG4, FD-G4 Ambient temperature: 40 to 70 C 40 to 158 F <table border="1"> <thead> <tr> <th>Screw-in depth</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>8 mm</td> <td>13 mm approx.</td> <td>$\phi 0.5$ mm</td> </tr> <tr> <td>10 mm</td> <td>15 mm approx.</td> <td>$\phi 0.8$ mm</td> </tr> <tr> <td>14 mm</td> <td>30 mm approx.</td> <td>$\phi 3.0$ mm</td> </tr> </tbody> </table>	Screw-in depth	Distance to focal point	Spot diameter	8 mm	13 mm approx.	$\phi 0.5$ mm	10 mm	15 mm approx.	$\phi 0.8$ mm	14 mm	30 mm approx.	$\phi 3.0$ mm			
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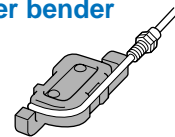
Others

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

Protective tube

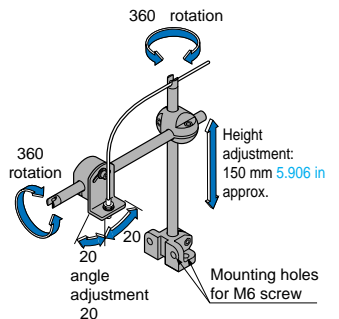


Fiber bender



Universal sensor mounting stand

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



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.

Fiber Specifications

Standard / Flexible / Sharp bending / Special use Fibers

Type		Standard	Flexible
Item			
Allowable bending radius		R25 mm R0.984 in or more (Sleeve part of a head with sleeve: R10 mm 0.394 in or more (Note 1))	R4 mm or more
Bending durability		—————	1 million times or more (at R10 mm, FT-P40/P2 , FD-P40/P2 : at R4 mm)
Ambient temperature		-40 to +70°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 mounting screw	

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

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

Type		Sharp bending	
Item			
Allowable bending radius		R1 mm R0.039 in or more (FD-WG4/WG4 : 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.

Type		Special use			
Item		Wide beam	Array	Narrow beam	High precision
Allowable bending radius		R10 mm R0.394 in or more	R25 mm R0.984 in or more	R25 mm R0.984 in or more	FD-EG2/EG3 : R10 mm R0.394 in or more FD-G4/EG1 : R25 mm R0.984 in or more
Ambient temperature		FT-A30 : -40 to +60°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

Type		Special use		
		Ultra-small diameter	Fixed-focus reflective	Tough flexible
Item	Model No.			
Allowable bending radius	FT-E12/E22: R5 mm R0.197 in or more (Note 1) FD-E12: R10 mm R0.394 in or more (Note 1) FD-E22/EN500S1/ENM1S1: R25 mm R0.984 in or more (Note 1)	R10 mm R0.394 in or more (FD-L43: R4 mm R0.157 in or more)		R10 mm R0.394 in or more
Ambient temperature	FT-E12/E22, FD-E22: -40 to +70°C -40 to +170°F FD-E12: -40 to +60°C -40 to +140°F FD-EN500S1/ENM1S1: -20 to +60°C -4 to +140°F	FD-L43: 0 to +70°C +14 to +158°F FD-L41/L42: -40 to +60°C -40 to +140°F FD-L4: -40 to +70°C -40 to +158°F	-40 to +60°C -40 to +140°F (FD-P81X: -40 to +70°C -40 to	
Ambient humidity	35 to 85%RH (No dew condensation or icing allowed)			
Material	Fiber core	Acrylic		
	Sheath	Polyolefin	Polyethylene (FD-L42: Vinyl chloride)	Polyethylene [FT-P81X: Vinyl chloride, Protective tube: Stainless steel (SUS)]
	Fiber head	Brass (Nickel plated) [Sleeve: Stainless steel (SUS)]	FD-L43/L41: Heat-resistant ABS FD-L4: ABS FD-L42: Aluminum (Black ALMITE) (Lens of FD-L43/L4: Acrylic Front film of FD-L41: Polyester)	FT-P81X, FD-P81X: Brass (Nickel plated) FD-G6X: Stainless steel (SUS)
Accessories (Note 2)	All fibers: 1 set of fiber attachment Threaded head fibers: 2 Nos. of nuts and 1 No. of toothed lock washer	All fibers: 1 set of fiber attachment and 1 No. of FX-CT2 (Fiber cutter) FD-L4: 2 Nos. of M2.6 (length 12 mm 0.472 in) screws with washers and 2 Nos. of nuts	All fibers: 1 set of fiber attachment, 2 Nos. of nuts (thru-beam type: 4 Nos.) and 1 No. of toothed lock washer (thru-beam type: 2 Nos.) FD-G6X: 1 No. of FX-CT2 (Fiber cutter)	

Notes 1) Sleeve part cannot be bent.

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

Type		Special use			
		Leak detection	Liquid level sensing		
Item	Model No.	FD-F7□	FT-F9□	FD-F8Y	FD-F4□/F9□
Allowable bending radius		Protective tube: R20 mm R0.0787 in or more Fiber: R4 mm R0.157 mm or more	Protective tube: R40 mm R1.575 in or more Fiber: R15 mm R0.591 in or more		R10 mm R0.394 in or more
Bending durability		Fiber: 1 million times or more (at R4 mm R0.157 in)			
Ambient temperature		-20 to +60°C -4 to +140°F (Note 1)		-40 to +125°C -40 to +257°F (Note 1)	-40 to +100°C -40 to +212°F (Note 1)
Ambient humidity		35 to 85%RH (No dew condensation or icing allowed)			
Material	Fiber core	Acrylic		Polycarbonate	
	Sheath	Vinyl chloride (Protective tube: Fluorine resin)		Polypropylene (Protective tube: Fluorine resin)	Polyethylene
	Fiber head	Exterior: Fluorine resin Interior: Heat-resistant ABS, Acrylic, Brass	Case: Heat-resistant ABS Lens: Acrylic	Polyetherimide (Lens: Polycarbonate)	
Accessories (Note2)	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 1 No. of PFA mounting bracket, 1 No. of PVC mounting bracket	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 2 Nos. of tying bands and 2 Nos. of anti-slip tubes	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter)	1 set of fiber attachment 1 No. of FX-CT2 (Fiber cutter) 4 Nos. of tying bands and 2 Nos. of anti-slip tubes	

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

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

Type		Environment resistant						
		Heat resistant				Chemical-resistant	Vacuum	
Item	Model No.	350°C 662°F type	300°C 572°F type	200°C 392°F type	180°C 356°F type	130°C 266°F type		
Allowable bending radius		R25 mm R0.984 in or more (FT-H20W-□: R10 mm R0.394 in or more)				R30 mm R1.181 in or more (FT-Z8□Y: R25 mm R0.984 in or more)	R200 mm R7.874 in or more (FT-60V: R30 mm R1.181 in or more)	
Ambient temperature		-60 to +350°C -76 to +662°F (Note 1) (Note 2)	-60 to +300°C -76 to +572°F (Note 1) (Note 2) (Note 3)	-60 to +200°C -76 to +392°F (Note 2)	-60 to +180°C -76 to +356°F (Note 2) (Note 4)	-60 to +130°C -76 to +266°F	-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		Quartz 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.



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	

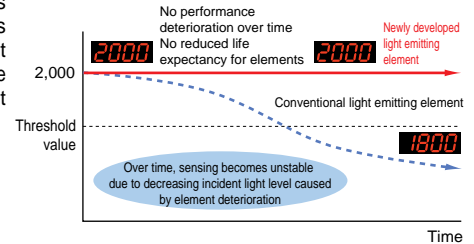
Note: The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below

- 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.

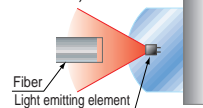


Long-range sensing made possible with built-in optical lens

Innovative feature

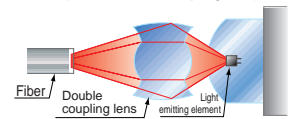
For the first time in the industry, an optical 'double coupling lens' has been incorporated directly into the fiber sensor itself. This lens maximizes the light emission efficiency, resulting in a tremendous improvement in the sensing range. Sensing ranges with small diameter fibers and ultra-small diameter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

Conventional fiber sensor system (without lens)



Low efficiency due to the diffusion and loss of emitted light.

FX-301 (built-in double coupling lens)



The light emission efficiency is increased tremendously, as light is now collected and focused into the fiber by the lens.

Easy operation with MODE NAVI

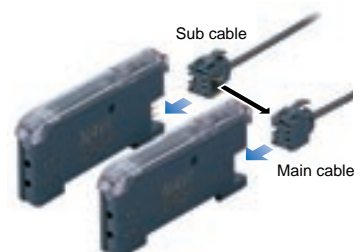
MODE NAVI uses six indicators to display the amplifier's basic operations. The current operating mode can be confirmed at a glance, so even a first time user can easily operate the amplifier without becoming confused.



MODE NAVI (MODE indicators)

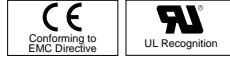
Easy maintenance, as main and sub units are identical

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



Manually Set Fiber Sensor / FX-311

Refer to the FX-311 catalog for more details.



Sensing New Frontiers Highly sensitive manual tuning made easy.



12-turn potentiometer with visible indicator

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

Indicator
12-turn potentiometer



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

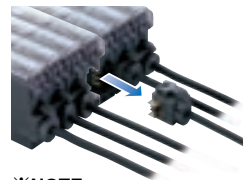
An optional hand-turned knob attached cover (FX-AJ1) is available, which makes a screwdriver unnecessary. You can adjust sensitivity on site at any time quickly and easily.



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

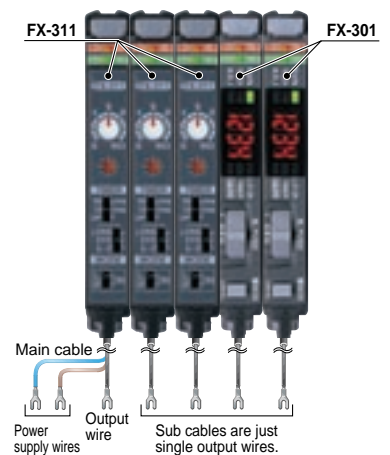
Each sub cable is a single output wire, reducing wiring and simplifying installation. Quick-connection cables are the same type as used on FX-301, facilitating side-by-side connection. Further, the connectors are slide type, allowing removal without shifting amplifier positions. This eliminates the need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

Sliding connectors are easy to insert and remove



※NOTE

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



Type	NPN output	PNP output
Model No.	FX-311	FX-311P
Sensing range	Thru-beam type (FT-B8): 1,100 mm 43.307 in (LONG), 530 mm 20.866 in (STD), 180 mm 7.087 in (S-D) Reflective type (FD-B8): 480 mm 18.898 in (LONG), 220 mm 8.661 in (STD), 75 mm 2.953 in (S-D)	
Supply voltage	12 to 24 V DC ± 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)

Rapid flashing 'Assist Function' eases adjustment for optimum sensitivity

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

Innovative feature

High-functional Digital Fiber Sensor / FX-302

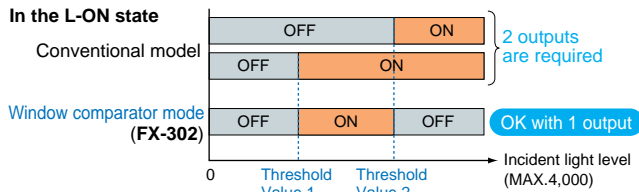
Building upon our existing multi-functionality and usability, **FX-302** further extends the state-of-the-art by incorporating a Window Comparator Mode



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

New concept

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



New concept

Teaching Methods

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

1-level Teaching

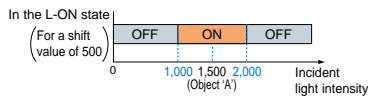
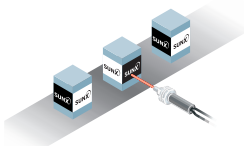
This function allows the unit to perform 1-level teaching (object 'A'). If an arbitrary shift value has been selected, then threshold values are set at 2 positions.

Identifying the orientation of the object

Performing 1-level teaching only for object 'A'

NG Object 'A' NG Object 'B'

No object present (0) OK Object 'A' (1,500) OK Object 'B' (3,000)

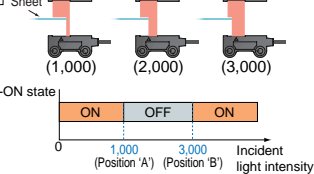
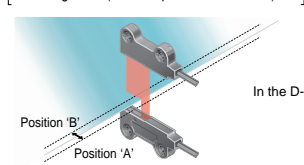


2-level Teaching

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

Sensing side-to-side fluctuations in sheet motion

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

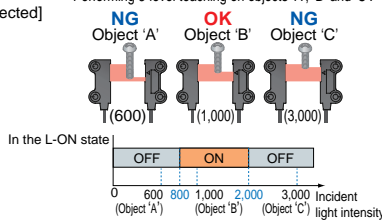
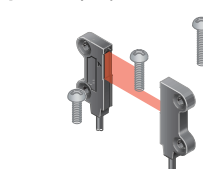


3-level Teaching

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

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



Communications setting change function can be locked

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

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



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

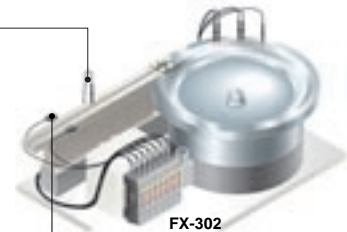
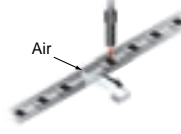
Lower total cost, as PLC and timer are not required Incorporates an ON-delay / OFF-delay timer and an ON-delay / ONE SHOT timer

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

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

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

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



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

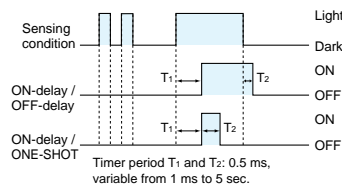
Detecting chip congestion status on a straight transport feeder

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



Time Chart

In the L-ON state



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

Up to 8 fiber heads can be installed closely together

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

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

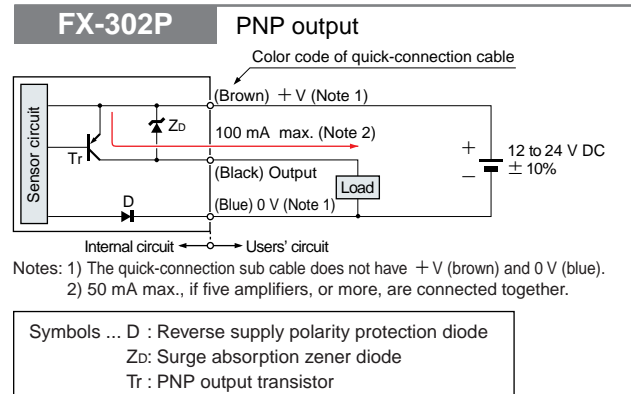
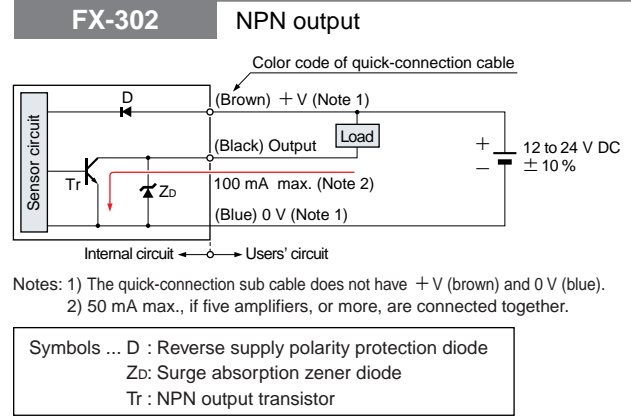


SPECIFICATIONS

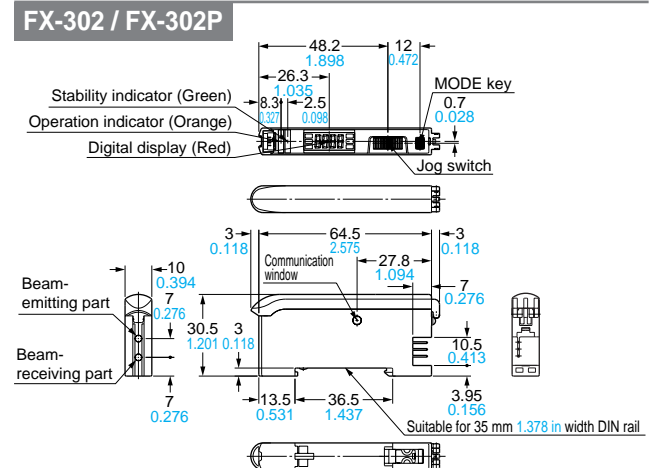
Type	NPN output	PNP output
Model No.	FX-302	FX-302P
Supply voltage	12 to 24 V DC $\pm 10\%$ Ripple P-P 10% or less	
Power consumption	Normal operation: 960 mW or less (Current consumption 40 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)	
Output	NPN open-collector transistor • Maximum sink current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) sink current]	PNP open-collector transistor • Maximum source current: 100 mA (Note 1) • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less [at 100 mA (Note 1) source current]
Output operation	Selectable either Light-ON or Dark-ON, with jog switch	
Short-circuit protection	Incorporated	
Response time	300 μ s or less (FAST), 500 μ s or less (STD / S-D), 4 ms or less (LONG) selectable with jog switch	
Operation indicator	Orange LED (lights up when the output is ON)	
Stability indicator	Green LED (lights up under stable light received condition or stable dark condition)	
MODE indicator	RUN: Green LED, TEACH • ADJ • L / D ON • TIMER • PRO: Yellow LED	
Digital display	4 digit red LED display	
Sensitivity setting	Normal mode: 2-level teaching / Limit teaching / Manual adjustment Window comparator mode: Teaching (1-level / 2-level / 3-level) / Manual adjustment	
Fine sensitivity adjustment function	Incorporated	
Timer function	Incorporated with variable ON-delay, OFF-delay, ONE-SHOT, ON-delay / OFF-delay, ON-delay / ONE-SHOT timer, switchable either effective or ineffective (timer period. 0.5 ms to 5 sec. approx.)	
Automatic interference prevention function	Incorporated (Up to 8 sets of fiber heads can be mounted closely.)	
Ambient temperature	- 10 to + 55°C + 14 to 131°F (If 4 to 7 units are connected in cascade: - 10 to + 50°C + 14 to 122°F, if 8 to 16 units are connected in cascade: - 10 to + 45°C + 14 to 113°F) (No dew condensation or icing allowed) Storage: - 20 to + 70°C - 4 to + 158°F	
Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH	
Emitting element	Red LED (modulated)	
Material	Enclosure: Heat-resistant ABS, Case cover: Polycarbonate, Switch: Acrylic	
Connecting method	Connector connection (Note 4)	
Cable extension	Extension up to total 100 m 328.084 ft is possible with 0.3 mm ² 0.012 in ² , or more, cable.	
Weight	20 g 0.705 oz approx.	

- Notes: 1) 50 mA, if five, or more, amplifiers are connected in cascade.
2) When connecting FX-301 (P) digital fiber sensors and FX-311 (P) manually set fiber sensors, a maximum of 4 units can be installed without mutual interference.
3) When the power supply is switched on, the emission timing are automatically set for interference prevention.
4) The cable for amplifier connection is not supplied as an accessory. Make sure to use the optional quick-connection cable given below.
- Main cable (3-core): CN-73-C1 (cable length 1 m 3.281 ft)
CN-73-C2 (cable length 2 m 6.562 ft)
CN-73-C5 (cable length 5 m 16.404 ft)
- Sub cable (1-core): CN-71-C1 (cable length 1 m 3.281 ft)
CN-71-C2 (cable length 2 m 6.562 ft)
CN-71-C5 (cable length 5 m 16.404 ft)

I/O CIRCUIT DIAGRAMS



DIMENSIONS (Unit : mm in)



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

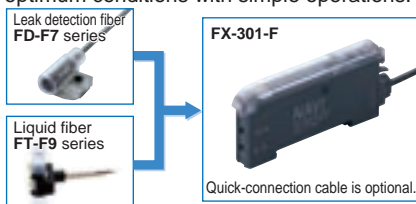
FX-301-F

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

Optimum settings can be realized with simple operations.

Use only with leak detection or liquid fiber

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



Flashing function incorporated

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

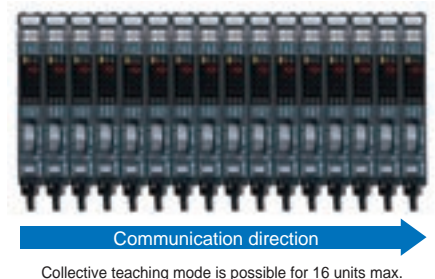
Easy to operate with individual / collective teaching mode

Individual teaching mode (TEACH)

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

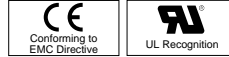
Collective teaching mode (ALL)

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



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

Bank Selection Unit / FX-CH SERIES



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

Settings can be changed by external signals

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

Both loading and saving can be performed

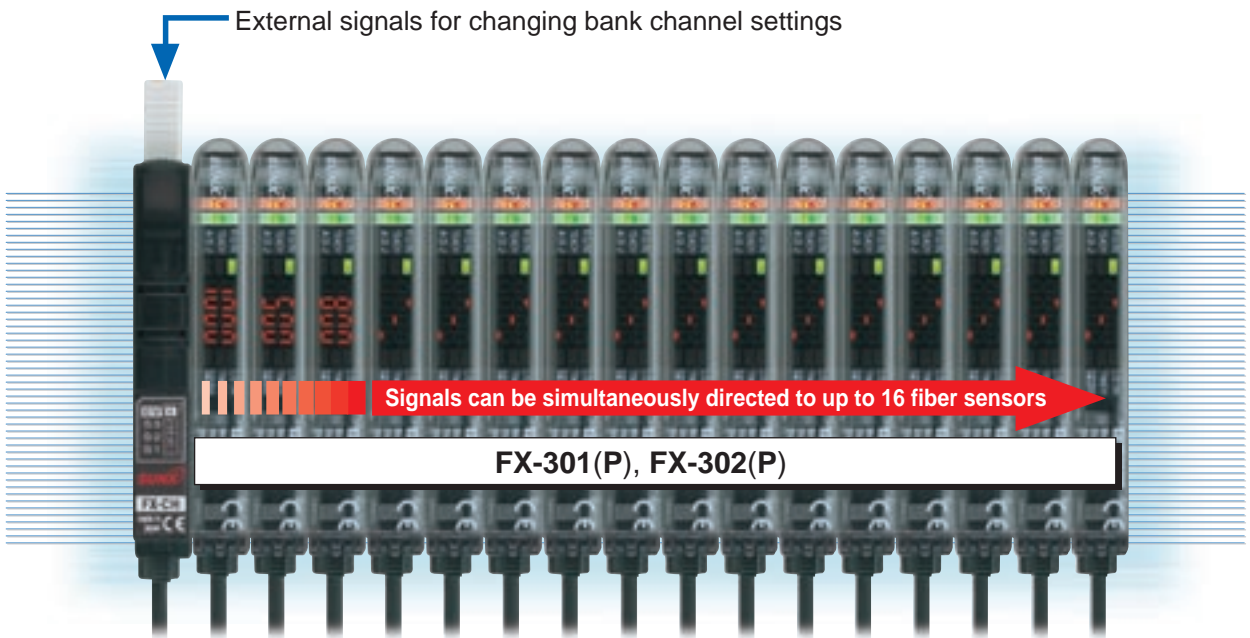
It is possible to perform both load (read-out settings) and save (save settings) operations by designating the bank channel.

Settings for 16 fiber sensors can be changed at once

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

Suitable for a wide range of applications

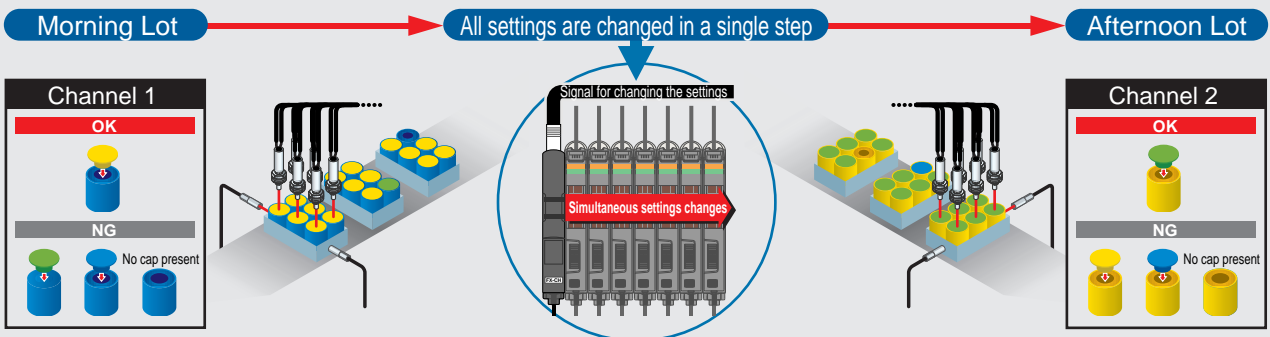
Bank settings include response times, threshold values, output operation settings, timer settings, hysteresis, stability, digital display settings (incident light intensity / percentage / peak hold / bottom hold), digital display inversion and ECO mode. These can all be changed at once using external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



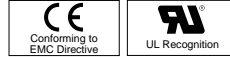
Application Example

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

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



Sensor-PLC Connection System / SC SERIES



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

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

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

Separated installation possible

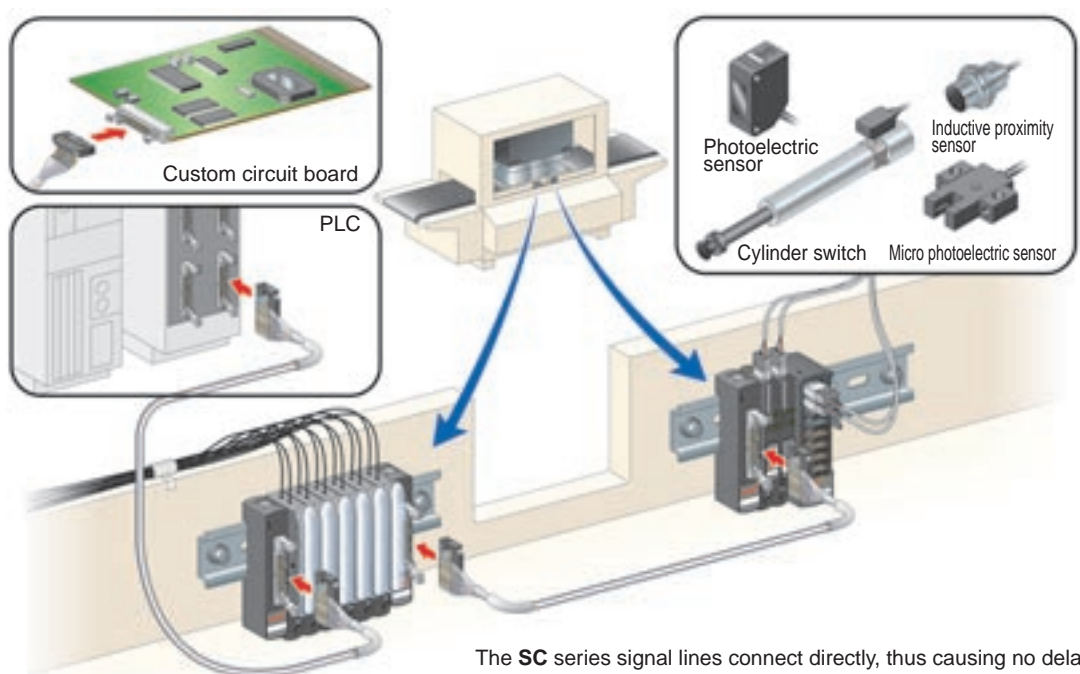
Separate unit **SC-MIL-S** is available for connecting sensors at a distance from each other using MIL connectors. This makes it possible to finely tune the sensor layout to suit the setting-up location.

Freely expandable as required

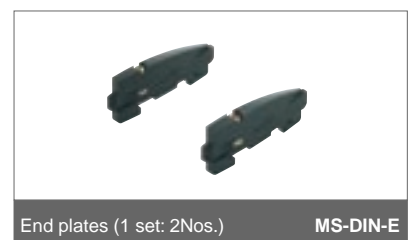
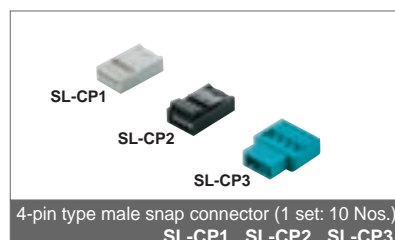
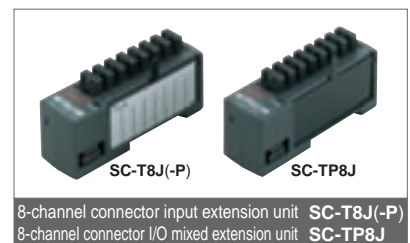
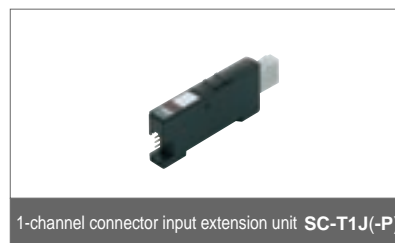
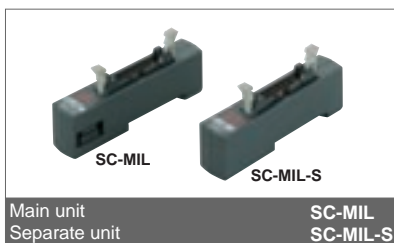
The abbreviated wiring system is economical and lets you expand the system by any amount required from one up to 16 channels.

Compatible with a variety of input and output devices

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



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



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
	SC-T1J-P	For PNP output devices
8-channel connector input extension unit	SC-T8J	For NPN output devices
	SC-T8J-P	For PNP output devices
8-channel connector I/O mixed extension unit	SC-TP8J	Allows the connection of a variety of input and output devices. This unit does not contain input / output signal indicators.
Non-line connector	CN-70	This one-touch connector is used to connect the main unit to the following devices: The FX-300 series fiber sensors, the FX-CH series bank selection unit and the 1-channel connector input extension unit.
4-pin type male snap connector (1 set: 10 Nos.)	SL-CP1 (White)	For 0.08 to 0.2 mm ² Wire diameter: $\phi 0.7$ to $\phi 1.2$ mm $\phi 0.028$ to 0.047 mm
	SL-CP2 (Black)	For 0.3 mm ² Wire diameter: $\phi 1.1$ to $\phi 1.6$ mm $\phi 0.043$ to 0.063 mm
	SL-CP3 (Greenish blue)	For 0.5 mm ² Wire diameter: $\phi 1.7$ to $\phi 2.5$ mm $\phi 0.067$ 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.

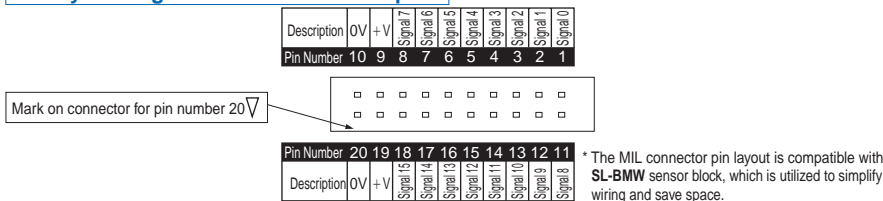
SPECIFICATIONS

Sensor unit

Type	Main unit	Separate unit
Model No.	SC-MIL	SC-MIL-S
Supply voltage	12 to 24 V DC $\pm 10\%$ (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 $\pm 10\%$.
 When connecting the **FX-300** series, set the power voltage to 12 to 24 V DC $\pm 10\%$, 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



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 $\pm 10\%$				5 to 24 V DC $\pm 10\%$ (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, 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.	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.

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
Manually set fiber sensors	FX-302P	For PNP output devices
	FX-311	For NPN output devices
Digital fiber sensors for leak detection fiber / liquid fiber	FX-311P	For PNP output devices
	FX-301-F	For NPN output devices
Bank selection unit	FX-301-F	For PNP output devices
	FX-CH	For NPN output devices
	FX-CH-P	For PNP output devices

I/O CIRCUIT DIAGRAMS

SC-T1J / SC-T8J

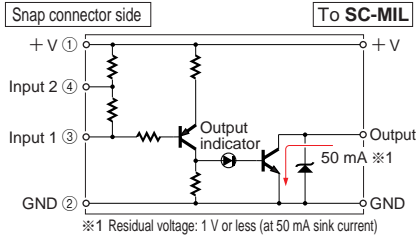
Male snap connector pin position

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

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

Conditions

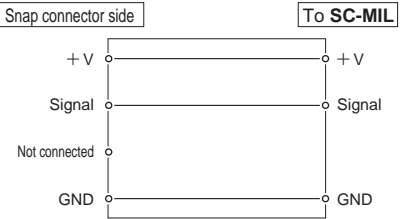
- Leak current : 1 mA or less (when the power is OFF)
- Offset voltage : 3 V or less (when the power is ON)
- The product of which the load current range contains 5 to 8 mA.



SC-TP8J

Male snap connector pin position

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



SC-T1J-P / SC-T8J-P

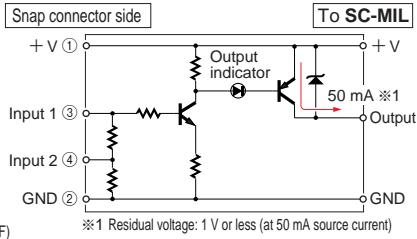
Male snap connector pin position

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

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

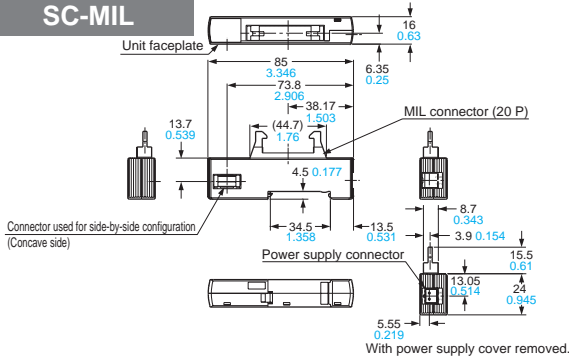
Conditions

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

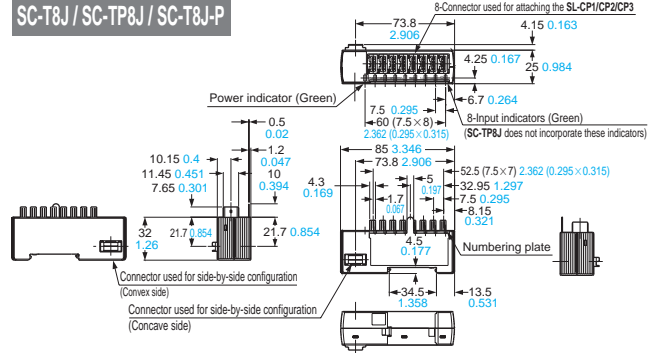


DIMENSIONS (Unit : mm in)

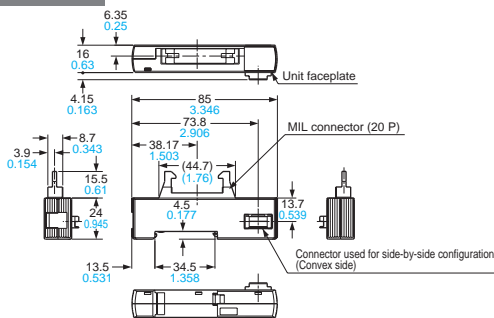
SC-MIL



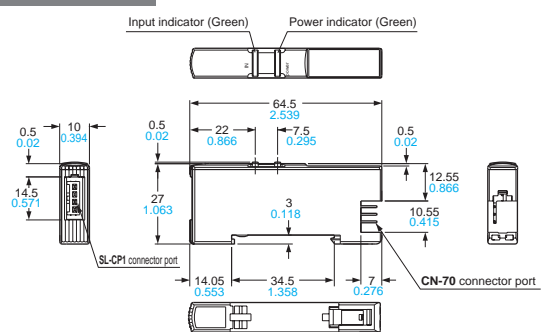
SC-T8J / SC-TP8J / SC-T8J-P



SC-MIL-S



SC-T1J / SC-T1J-P



All information is subject to change without prior notice.



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