


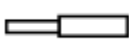
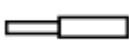




## Diffuse-Reflective Fiber Optics

The FD series of diffuse-reflective fiber optics is a wide-ranging family of sensing heads that are suitable for use in all SUNX fiber amplifiers. Fiber types include standard, high flexibility, special use, and environmentally resistant. Each type is broken down further to include various configurations such as side-view, fixed-focus, ultra-small diameter, high precision, and wide beam.

Model Name	Model Pic	Type	Fiber Length (mm)	Bending Radius (mm)	Sensing Range (mm)
Sort ▲ ▼		Sort ▲ ▼	Sort ▲ ▼	Sort ▲ ▼	Sort ▲ ▼
FD-B8		M6 Threaded Type	2000	25	600
FD-FM2		Coaxial M6 Threaded Type	2000	25	410
FD-G4		Coaxial M4 Threaded Type Lens Mountable	2000	25	150
FD-S80		3mm Cylindrical Type	2000	25	370
FD-SNFM2		2.5mm Cylindrical Type	2000	25	140



FX-305 / FX-301 (Red LED type) sensing range (Note 1)

Retroreflective type



The FX-305 and FX-301 (-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301 (-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3)	Legend	Min. sensing object (Note 4)	Fiber cable length	Bending radius	Model No.
Sharp bending With polarizing filters	W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591 W30 X H40 X D0.5 W1.181 X H1.181 X D0.020	100 to 910 3.937 to 35.827 100 to 730 3.937 to 28.740 100 to 600 3.937 to 23.622 100 to 520 3.937 to 20.472	U-LG, LONG, STDF, STD, FAST, H-SP, S-D	φ 0.3 mm φ 0.012 in opaque object	2 m 6.562 ft	R1 mm R0.039 in	FR-WKZ11
Narrow beam Top sensing Side sensing	W9.5 X H5.2 X D21 W0.374 X H0.205 X D0.827 W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398	200 7.874 200 7.874 200 7.874 200 7.874	FAST, H-SP, S-D	Horizontal: φ 5.5 mm φ 0.217 in opaque object Vertical: φ 0.06 mm φ 0.0024 in opaque object	2 m 6.562 ft	R10 mm R0.394 in	FR-KZ21 FR-KZ21E
	W9.5 X H25 X D5.2 W0.374 X H0.984 X D0.205 W10.6 X H28 X D10.1 W0.417 X H1.102 X D0.398	200 7.874 200 7.874	FAST, H-SP, S-D	φ 0.12 mm φ 0.005 in opaque object	2 m 6.562 ft	R10 mm R0.394 in	FR-KV1
Wafer mapping	W7.5 X H2.2 X D11.2 W0.295 X H0.087 X D0.441 W4 X H2 X D21.5 W0.157 X H0.079 X D0.846	15 to 370 0.591 to 14.567 15 to 330 0.591 to 12.992 15 to 240 0.591 to 9.449 15 to 210 0.591 to 8.268	FAST, H-SP, S-D	φ 0.12 mm φ 0.005 in opaque object	2 m 6.562 ft	R10 mm R0.394 in	FR-KV1

- Notes: 1) Please contact our office for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.  
 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. The sensing range of FR-WKZ11 is specified for the RF-13. The sensing range of FR-KZ21, FR-KZ21E and FR-KV1 is specified for the attached reflector.  
 3) The sensing range of FR-WKZ11 is the possible setting range for the reflector or reflective tape. The fiber can detect an object less than 100 mm 3.937 in away. However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier unit before use. The sensing range of FR-KZ21(E) is the possible setting range for the reflector. However, if setting the fiber to detect objects passing within 0 to 20 mm 0 to 0.787 in from the fiber head, unstable detection may result. The sensing range of FR-KV1 is the possible setting range for the reflector. The fiber can detect an object less than 15 mm 0.591 in away.  
 4) The minimum sensing object size is the value for red LED type. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.

FX-305 / FX-301 (Red LED type) sensing range (Note 1)

Reflective type



The FX-305 and FX-301 (-HS) have different sensing modes.  
 FX-305: H-SP, FAST, STD, STDF, LONG, U-LG (no S-D mode)  
 FX-301 (-HS): S-D, H-SP, FAST, STD, LONG (no STDF or U-LG mode)

Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3)	Legend	Min. sensing object (Note 4)	Fiber cable length	Bending radius	Model No.	
Threaded type M6	M6	600 23.622 480 18.898 280 11.024 220 8.661	FAST, H-SP, S-D	φ 0.02 mm φ 0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in	FD-B8	
	Coaxial M6	410 16.142 310 12.205 200 7.874 140 5.512	FAST, H-SP, S-D				FD-FM2	
	Sleeve 90 mm 3.543 in M6 φ 2.5 φ 0.098	370 14.567 270 10.630	FAST, H-SP, S-D			FD-FM2S		
	Sleeve 40 mm 1.575 in M6 φ 2.5 φ 0.098	170 6.693 110 4.331	FAST, H-SP, S-D			FD-FM2S4		
	M6	250 9.843 190 7.480 110 4.331 90 3.543	FAST, H-SP, S-D			R1 mm R0.039 in	FD-W8	
	M6	300 11.811 220 8.661 130 5.118 100 3.937	FAST, H-SP, S-D			R4 mm R0.157 in Flexible	FD-P80	
	M6	270 10.630 185 7.283 100 3.937 80 3.150	FAST, H-SP, S-D			1 m 3.281 ft	R10 mm R0.394 in	FD-P81X
	Elbow M6	240 9.449 185 7.283 110 4.331 85 3.346	FAST, H-SP, S-D			φ 0.02 mm φ 0.0008 in gold wire	2 m 6.562 ft	R25 mm R0.984 in

- Notes: 1) Refer to p.27 for the sensing ranges for the FX-301-HS in H-SP mode and for the FX-301B/G/H.  
 2) The sensing range is specified for white non-glossy paper [400 × 400 mm 15.748 × 15.748 in] as the object.  
 3) 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.  
 4) The minimum sensing object size is the value for red LED type at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.

## LIST OF SENSING RANGE FOR FX-301(P)-HS · FX-301B/G/H

### Sensing range for ultra high-speed type FX-301(P)-HS in H-SP mode (35 μs)(Typical model)

	Fiber model No.	Sensing range (mm in) (Note)		Fiber model No.	Sensing range (mm in) (Note)
Thru-beam type	<b>FT-B8</b>	160 <b>6.299</b>	Reflective type	<b>FD-B8</b>	60 <b>2.362</b>
	<b>FT-FM2</b>	120 <b>4.724</b>		<b>FD-FM2</b>	35 <b>1.378</b>
	<b>FT-NFM2</b>	40 <b>1.575</b>		<b>FD-NFM2</b>	14 <b>0.551</b>
	<b>FT-E12</b>	2 <b>0.079</b>		<b>FD-E12</b>	1 <b>0.039</b>
	<b>FT-E22</b>	10 <b>0.394</b>		<b>FD-E22</b>	5 <b>0.197</b>

Note: The sensing ranges are in H-SP mode. The sensing ranges in FAST, STD, S-D and LONG modes are the same as for the **FX-301**. (Refer to p.18~)

### Sensing range for FX-301B/G/H (Typical model)

(mm in)

		Thru-beam type										
		FT-B8	FT-FM2	FT-NFM2	FT-V10	FT-W8	FT-Z8	FT-P80	FT-A30	FT-A8	FT-E12	FT-E22
<b>FX-301B</b>	LONG	220 <b>8.661</b>	150 <b>5.906</b>	50 <b>1.969</b>	400 <b>15.748</b>	90 <b>3.543</b>	120 <b>4.724</b>	130 <b>5.118</b>	2,400 <b>94.488</b>	600 <b>23.622</b>	3 <b>0.118</b>	14 <b>0.551</b>
	STD	110 <b>4.331</b>	75 <b>2.953</b>	25 <b>0.984</b>	200 <b>7.874</b>	45 <b>1.772</b>	60 <b>2.362</b>	65 <b>2.559</b>	1,200 <b>47.244</b>	300 <b>11.811</b>	2 <b>0.079</b>	7 <b>0.276</b>
	FAST	75 <b>2.953</b>	40 <b>1.575</b>	16 <b>0.630</b>	130 <b>5.118</b>	30 <b>1.181</b>	40 <b>1.575</b>	45 <b>1.772</b>	700 <b>27.559</b>	220 <b>8.661</b>	1 <b>0.039</b>	4 <b>0.157</b>
<b>FX-301G</b>	LONG	110 <b>4.331</b>	70 <b>2.756</b>	24 <b>0.945</b>	200 <b>7.874</b>	56 <b>2.205</b>	60 <b>2.362</b>	70 <b>2.756</b>	1,200 <b>47.244</b>	300 <b>11.811</b>	1 <b>0.039</b>	6 <b>0.236</b>
	STD	55 <b>2.165</b>	35 <b>1.378</b>	12 <b>0.472</b>	100 <b>3.937</b>	28 <b>1.102</b>	30 <b>1.181</b>	35 <b>1.378</b>	600 <b>23.622</b>	150 <b>5.906</b>	—	3 <b>0.118</b>
	FAST	40 <b>1.575</b>	24 <b>0.945</b>	8 <b>0.315</b>	65 <b>2.559</b>	20 <b>0.787</b>	22 <b>0.866</b>	25 <b>0.984</b>	350 <b>13.780</b>	110 <b>4.331</b>	—	2 <b>0.079</b>
<b>FX-301H</b> (Note)	LONG	100 <b>3.937</b>	50 <b>1.969</b>	16 <b>0.630</b>	150 <b>5.906</b>	42 <b>1.654</b>	46 <b>1.811</b>	56 <b>2.205</b>	800 <b>31.496</b>	220 <b>8.661</b>	4 <b>0.157</b>	10 <b>0.394</b>
	STD	50 <b>1.969</b>	25 <b>0.984</b>	8 <b>0.315</b>	75 <b>2.953</b>	21 <b>0.827</b>	23 <b>0.906</b>	28 <b>1.102</b>	400 <b>15.748</b>	110 <b>4.331</b>	2 <b>0.079</b>	5 <b>0.197</b>
	FAST	30 <b>1.181</b>	18 <b>0.709</b>	5 <b>0.197</b>	40 <b>1.575</b>	15 <b>0.591</b>	16 <b>0.630</b>	20 <b>0.787</b>	240 <b>9.449</b>	80 <b>3.150</b>	1.5 <b>0.059</b>	3 <b>0.118</b>

Note: Infrared types are easily affected by humidity, so if using them in environments with high humidity or where the humidity fluctuates, please contact our office.

(mm in)

		Reflective type										
		FD-B8	FD-FM2	FD-NFM2	FD-W8	FD-P80	FD-AFM2	FD-G4	FD-EG1	FD-E12	FD-E22	FD-G6X
<b>FX-301B</b>	LONG	80 <b>3.150</b>	46 <b>1.811</b>	16 <b>0.630</b>	23 <b>0.906</b>	40 <b>1.575</b>	40 <b>1.575</b>	22 <b>0.866</b>	6 <b>0.236</b>	2 <b>0.079</b>	6 <b>0.236</b>	22 <b>0.866</b>
	STD	40 <b>1.575</b>	23 <b>0.906</b>	8 <b>0.315</b>	11 <b>0.433</b>	20 <b>0.787</b>	20 <b>0.787</b>	11 <b>0.433</b>	3 <b>0.118</b>	1 <b>0.039</b>	3 <b>0.118</b>	11 <b>0.433</b>
	FAST	26 <b>1.024</b>	15 <b>0.591</b>	5 <b>0.197</b>	8 <b>0.315</b>	13 <b>0.512</b>	13 <b>0.512</b>	8 <b>0.315</b>	2 <b>0.079</b>	—	2 <b>0.079</b>	6 <b>0.236</b>
<b>FX-301G</b>	LONG	42 <b>1.654</b>	24 <b>0.945</b>	8 <b>0.315</b>	14 <b>0.551</b>	20 <b>0.787</b>	18 <b>0.709</b>	12 <b>0.472</b>	3 <b>0.118</b>	1 <b>0.039</b>	3 <b>0.118</b>	12 <b>0.472</b>
	STD	21 <b>0.827</b>	12 <b>0.472</b>	4 <b>0.157</b>	7 <b>0.276</b>	10 <b>0.394</b>	9 <b>0.354</b>	6 <b>0.236</b>	1.5 <b>0.059</b>	—	1.5 <b>0.059</b>	6 <b>0.236</b>
	FAST	14 <b>0.551</b>	8 <b>0.315</b>	2 <b>0.079</b>	4 <b>0.157</b>	7 <b>0.276</b>	5 <b>0.197</b>	4 <b>0.157</b>	1 <b>0.039</b>	—	1 <b>0.039</b>	4 <b>0.157</b>
<b>FX-301H</b> (Note)	LONG	26 <b>1.024</b>	20 <b>0.787</b>	6 <b>0.236</b>	11 <b>0.433</b>	18 <b>0.709</b>	12 <b>0.472</b>	7 <b>0.276</b>	10 <b>0.394</b>	1 <b>0.039</b>	6 <b>0.236</b>	18 <b>0.709</b>
	STD	13 <b>0.512</b>	10 <b>0.394</b>	3 <b>0.118</b>	5.5 <b>0.217</b>	9 <b>0.354</b>	6 <b>0.236</b>	3.5 <b>0.138</b>	5 <b>0.197</b>	—	3 <b>0.118</b>	9 <b>0.354</b>
	FAST	9 <b>0.354</b>	7 <b>0.276</b>	2 <b>0.079</b>	3 <b>0.118</b>	6 <b>0.236</b>	4 <b>0.157</b>	2 <b>0.079</b>	3 <b>0.118</b>	—	2 <b>0.079</b>	5 <b>0.197</b>

Note: Infrared types are easily affected by humidity, so if using them in environments with high humidity or where the humidity fluctuates, please contact our office.

### Sensing range when using in combination with FR-WKZ11 reflector (optional)

The sensing ranges are the values for **FX-305** / **FX-301** infrared types.

(mm in)

<b>RF-230</b>	100 to 3,200 <b>3.937 to 125.984</b> (LONG), 100 to 2,000 <b>3.937 to 78.740</b> (STD), 100 to 1,600 <b>3.937 to 62.992</b> (FAST), 100 to 1,000 <b>3.937 to 39.370</b> (S-D)
<b>RF-220</b>	100 to 2,400 <b>3.937 to 94.488</b> (LONG), 100 to 1,300 <b>3.937 to 51.181</b> (STD), 100 to 1,000 <b>3.937 to 39.370</b> (FAST), 100 to 600 <b>3.937 to 23.622</b> (S-D)
<b>RF-210</b>	100 to 1,100 <b>3.937 to 43.307</b> (LONG), 100 to 700 <b>3.937 to 27.559</b> (STD), 100 to 550 <b>3.937 to 21.654</b> (FAST), 100 to 300 <b>3.937 to 11.811</b> (S-D)

Note: The sensing range indicates the allowable setting range for the reflector. The fiber head can detect objects at distances of 100 mm **3.937 in** or less.

However, note that if there are any white or highly-reflective surfaces near the fiber head, reflected incident light may affect the fiber head. If this occurs, adjust the threshold value of the amplifier before use.

## FIBER OPTIONS

### Others

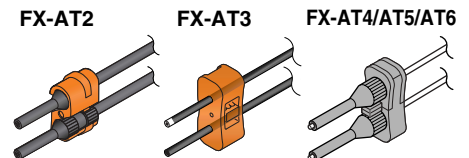
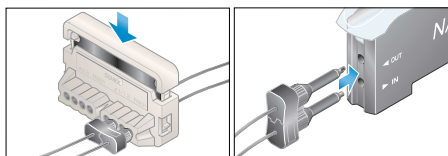
Designation	Model No.	Description		
Protective tube (For thru-beam) type fiber	FTP-500 (0.5 m 1.640 ft)	For M4 thread	Applicable fibers  The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.	
	FTP-1000 (1 m 3.281 ft)			
	FTP-1500 (1.5 m 4.921 ft)			
	FTP-N500 (0.5 m 1.640 ft)	For M3 thread		
	FTP-N1000 (1 m 3.281 ft)			
	FTP-N1500 (1.5 m 4.921 ft)			
Protective tube (For reflective) type fiber	FDP-500 (0.5 m 1.640 ft)	For M6 thread	FD-B8    FD-P80 FD-FM2    FT-P60 FT-FM2S    FT-FM2S4 FT-H13-FM2	
	FDP-1000 (1 m 3.281 ft)		For M4 thread	FT-T80    FT-P40 FT-NFM2    FD-T40 FT-NFM2S    FD-P40 FT-NFM2S4
	FDP-1500 (1.5 m 4.921 ft)			FD-B8    FD-P80 FD-FM2    FT-H13-FM2 FD-FM2S FD-FM2S4
	FDP-N500 (0.5 m 1.640 ft)	For M4 thread		FD-T80 FD-NFM2 FD-NFM2S FD-NFM2S4
	FDP-N1000 (1 m 3.281 ft)			
	FDP-N1500 (1.5 m 4.921 ft)			
Fiber bender	FB-1	The fiber bender bends the sleeve part of the fiber head at the proper radius. (Note)		
Universal sensor mounting stand	MS-AJ1-F	Horizontal mounting type	Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fiber)	
	MS-AJ2-F	Vertical mounting type		
Fiber cutter	FX-CT2	The free-cut type fiber can be easily cut.		
	FX-CT1	Accessory. FX-CT1 is attached with the FT-P80 or the FD-P80. The FX-CT2 is provided with fibers other than this.		
Attachment for fixed-length fiber	FX-AT2	This is the attachment for the fixed length fiber. (Accessory)		
Attachment for $\phi 2.2$ mm $\phi 0.087$ in fiber	FX-AT3	This is the attachment for the $\phi 2.2$ mm $\phi 0.087$ in fiber. (Accessory. Does not attach with the FT-P80 or the FD-P80.)		
Attachment for $\phi 1$ mm $\phi 0.039$ in fiber	FX-AT4	This is the attachment for the $\phi 1$ mm $\phi 0.039$ in fiber. (Accessory)		
Attachment for $\phi 1.3$ mm $\phi 0.051$ in fiber	FX-AT5	This is the attachment for the $\phi 1.3$ mm $\phi 0.051$ in fiber. (Accessory)		
Attachment for $\phi 1$ mm $\phi 0.039$ in / $\phi 1.3$ mm $\phi 0.051$ in mixed fiber	FX-AT6	This is the attachment for the $\phi 1$ mm $\phi 0.039$ in / $\phi 1.3$ mm $\phi 0.051$ in mixed fiber. (Accessory)		

Note: Do not bend the sleeve part of any side-view type fiber or ultra-small diameter head type fiber.

### Fiber attachment

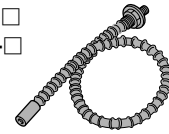
It's possible to simultaneously cut two fibers to the same length

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



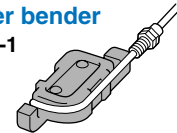
### Protective tube

- FTP-□
- FDP-□



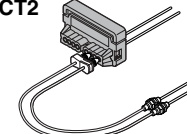
### Fiber bender

- FB-1

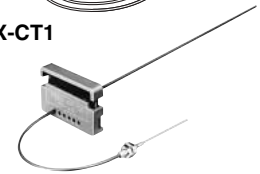


### Fiber cutter

- FX-CT2



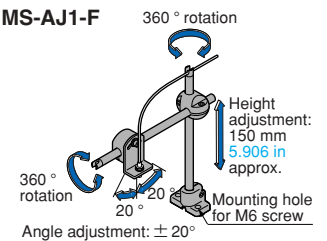
- FX-CT1



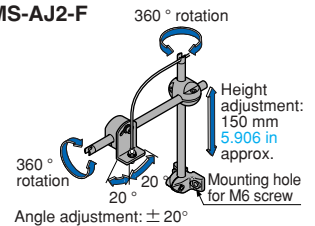
### Universal sensor mounting stand

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

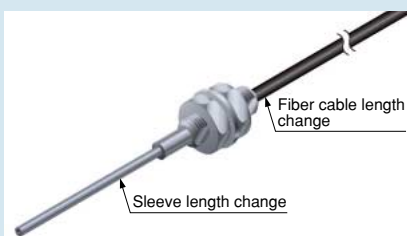
- MS-AJ1-F



- MS-AJ2-F



### Guide to interchanging fiber length and sleeve length



Custom-ordered products are available with different fiber lengths and sleeve lengths in order to respond quickly to different requirements.

#### Custom-ordered product (Typical)

- Fiber length can be set up to 30 m 98.425 ft in units of 1 m 3.281 ft ..... FT-B8, FT-AFM2 etc.
- Sleeve length can be set up to 12 cm 4.724 in units of 1 cm 0.394 in ..... FT-FM2S4, FD-NFM2S4 etc.

Please contact us.