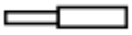
Diffuse-Reflective Fiber Optics

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.

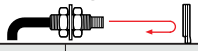
Model Name	Model Pic	Type	Fiber Length (mm)	Bending Radius (mm)	Sensing Range (mm)
Sort		Sort	Sort	Sort	Sort
FD-B8		M6 Threaded Type	2000	25	600
FD-FM2		Coaxial M6 Threaded Type	2000	25	410
FD-G4		Coaxial M4 Threaded Type Lens Mountable	2000	25	150
FD-S80		3mm Cylindrical Type	2000	25	370
FD-SNFM2		2.5mm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

Conforming to EMC Directive | UL Recognition

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

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)

Retroreflective type



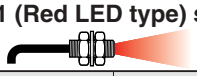
Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Sharp bending / With polarizing filters	W9.5 X H5.2 X D15 W0.374 X H0.205 X D0.591 W30 X H30 X D0.5 W1.181 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	Cannot use Cannot use 100 to 460 3.937 to 18.110	ϕ0.3 mm ϕ0.012 in opaque object	✂ 2 m 6.562 ft	R1 mm R0.039 in	FR-WKZ11
Narrow beam / Top 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	200 7.874 200 7.874 200 7.874	Horizontal: ϕ5.5 mm ϕ0.217 in opaque object Vertical: ϕ0.06 mm ϕ0.0024 in opaque object	✂ 2 m 6.562 ft	R10 mm R0.394 in	FR-KZ21
Narrow beam / Side sensing	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						FR-KZ21E
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	15 to 170 0.591 to 6.693 15 to 80 0.591 to 3.150 15 to 90 0.591 to 3.543	ϕ0.12 mm ϕ0.005 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)

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)

Reflective type



Type	Shape of fiber head (mm in)	Sensing range (mm in)(Note 2, 3) : U-LG : LONG : STDF : STD : FAST : H-SP : S-D	Min. sensing object (Note 4)	Fiber cable length ✂: Free-cut	Bending radius	Model No.
Threaded type / M6	M6	600 23.622 480 18.898 280 11.024 220 8.661	160 6.299 85 3.346 75 2.953	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-B8
Threaded type / M6	Coaxial M6	410 16.142 310 12.205 200 7.874 140 5.512	100 3.937 55 2.165 47 1.850				FD-FM2
Threaded type / M6	Sleeve 90 mm 3.543 in M6 ϕ2.5 ϕ0.098	370 14.567 270 10.630 170 6.693 110 4.331	85 3.346 45 1.772 39 1.535			Fiber R25 mm R0.984 in	FD-FM2S
Threaded type / M6	Sleeve 40 mm 1.575 in M6 ϕ2.5 ϕ0.098					Sleeve R10 mm R0.394 in	FD-FM2S4
Threaded type / M6	M6	250 9.843 190 7.480 110 4.331 90 3.543	60 2.362 25 0.984 32 1.260			R1 mm R0.039 in	FD-W8
Threaded type / M6	M6	300 11.811 220 8.661 130 5.118 100 3.937	70 2.756 30 1.181 35 1.378			R4 mm R0.157 in Flexible	FD-P80
Threaded type / M6	M6 Tough flexible	270 10.630 185 7.283 100 3.937 80 3.150	60 2.362 30 1.181 35 1.378		1 m 3.281 ft	R10 mm R0.394 in	FD-P81X
Threaded type / Elbow	M6	240 9.449 185 7.283 110 4.331 85 3.346	60 2.362 25 0.984 30 1.181	ϕ0.02 mm ϕ0.0008 in gold wire	✂ 2 m 6.562 ft	R25 mm R0.984 in	FD-R80

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)
Thru-beam type	**FT-B8**	160 6.299
	FT-FM2	120 4.724
	FT-NFM2	40 1.575
	FT-E12	2 0.079
	FT-E22	10 0.394

	Fiber model No.	Sensing range (mm in) (Note)
Reflective type	**FD-B8**	60 2.362
	FD-FM2	35 1.378
	FD-NFM2	14 0.551
	FD-E12	1 0.039
	FD-E22	5 0.197

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

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**
FX-301B	LONG	80 3.150	46 1.811	16 0.630	23 0.906	40 1.575	40 1.575	22 0.866	6 0.236	2 0.079	6 0.236	22 0.866
	STD	40 1.575	23 0.906	8 0.315	11 0.433	20 0.787	20 0.787	11 0.433	3 0.118	1 0.039	3 0.118	11 0.433
	FAST	26 1.024	15 0.591	5 0.197	8 0.315	13 0.512	13 0.512	8 0.315	2 0.079	———	2 0.079	6 0.236
FX-301G	LONG	42 1.654	24 0.945	8 0.315	14 0.551	20 0.787	18 0.709	12 0.472	3 0.118	1 0.039	3 0.118	12 0.472
	STD	21 0.827	12 0.472	4 0.157	7 0.276	10 0.394	9 0.354	6 0.236	1.5 0.059	———	1.5 0.059	6 0.236
	FAST	14 0.551	8 0.315	2 0.079	4 0.157	7 0.276	5 0.197	4 0.157	1 0.039	———	1 0.039	4 0.157
FX-301H (Note)	LONG	26 1.024	20 0.787	6 0.236	11 0.433	18 0.709	12 0.472	7 0.276	10 0.394	1 0.039	6 0.236	18 0.709
	STD	13 0.512	10 0.394	3 0.118	5.5 0.217	9 0.354	6 0.236	3.5 0.138	5 0.197	———	3 0.118	9 0.354
	FAST	9 0.354	7 0.276	2 0.079	3 0.118	6 0.236	4 0.157	2 0.079	3 0.118	———	2 0.079	5 0.197

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)

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

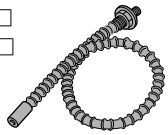
Others

Designation	Model No.	Description			
Protective tube (For thru-beam type fiber)	**FTP-500** (0.5 m 1.640 ft)	For M4 thread	Applicable fibers	**FT-B8 FT-P80 FT-FM2 FT-P60 FT-FM2S FT-FM2S4 FT-H13-FM2**	The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.
	FTP-1000 (1 m 3.281 ft)				
	FTP-1500 (1.5 m 4.921 ft)				
	FTP-N500 (0.5 m 1.640 ft)	For M3 thread		**FT-T80 FT-P40 FT-NFM2 FD-T40 FT-NFM2S FD-P40 FT-NFM2S4**	
	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-H13-FM2 FD-FM2S FD-FM2S4**	
	FDP-1000 (1 m 3.281 ft)				
	FDP-1500 (1.5 m 4.921 ft)				
	FDP-N500 (0.5 m 1.640 ft)	For M4 thread		**FD-T80 FD-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. Accessory. **FX-CT1** is attached with the **FT-P80** or the **FD-P80**. The **FX-CT2** is provided with fibers other than this.			
	FX-CT1				
Attachment for fixed-length fiber	**FX-AT2**	This is the attachment for the fixed length fiber. (Accessory)			
Attachment for ϕ2.2 mm ϕ0.087 in fiber	**FX-AT3**	This is the attachment for the ϕ2.2 mm ϕ0.087 in fiber. (Accessory. Does not attach with the **FT-P80** or the **FD-P80**.)			
Attachment for ϕ1 mm ϕ0.039 in fiber	**FX-AT4**	This is the attachment for the ϕ1 mm ϕ0.039 in fiber. (Accessory)			
Attachment for ϕ1.3 mm ϕ0.051 in fiber	**FX-AT5**	This is the attachment for the ϕ1.3 mm ϕ0.051 in fiber. (Accessory)			
Attachment for ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber	**FX-AT6**	This is the attachment for the ϕ1 mm ϕ0.039 in / ϕ1.3 mm ϕ0.051 in mixed fiber. (Accessory)			

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

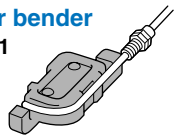
Protective tube

• **FTP-□**
• **FDP-□**



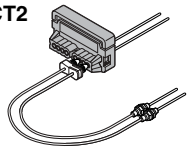
Fiber bender

• **FB-1**

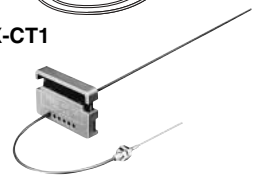


Fiber cutter

• **FX-CT2**



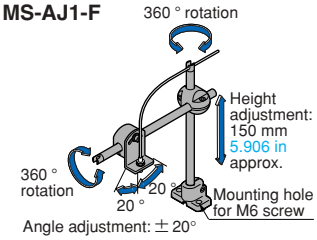
• **FX-CT1**



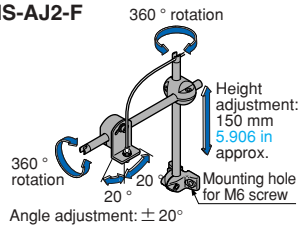
Universal sensor mounting stand

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

• **MS-AJ1-F**



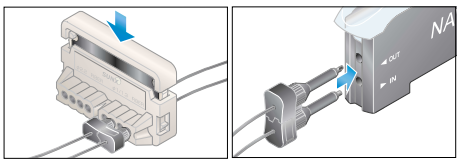
• **MS-AJ2-F**



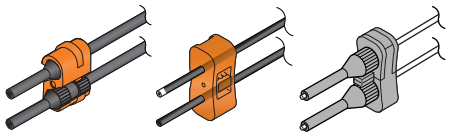
Fiber attachment

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

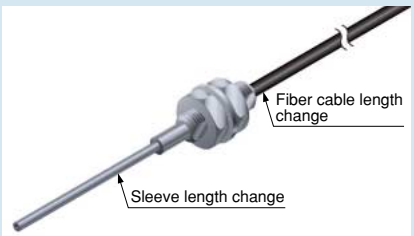
Each fiber (with some exceptions) has a newly developed two-in-one fiber attachment (**FX-AT3/AT4/AT5/AT6**) which enables two fibers to be cut simultaneously to the same length with the new fiber cutter (**FX-CT2**). Also, since the fibers can be attached to the amplifier while being fixed in position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



FX-AT2 **FX-AT3** **FX-AT4/AT5/AT6**



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.