

Digital Fiber Sensor FX-500 SERIES Ver.2

FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

LIGHT CURTAINS / SAFETY COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASUREMENT SENSORS

STATIC ELECTRICITY PREVENTION DEVICES

LASER MARKERS

PLC

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

■ General terms and conditions F-7

■ Sensor selection guide P.3~

Related Information

■ Fiber selection P.5~

■ Glossary of terms P.1455~

■ General precautions P.1458~

Ver.2



* There is no change in Model No. and price due to version upgrade.
* Cover opened state is shown.

panasonic.net/id/pidsx/global


PNP output type available



Timer



Interference prevention



Light intensity monitor



Automatic sensitivity setting



Test input



External sync.

At the industry's leading edge

Improved the operability and visibility of the operation keys

Operation keys (setting switch and MODE key) have been renewed to be easy to operate. Also, the color of the keys has been changed from black to light gray to achieve good visibility in dim light.



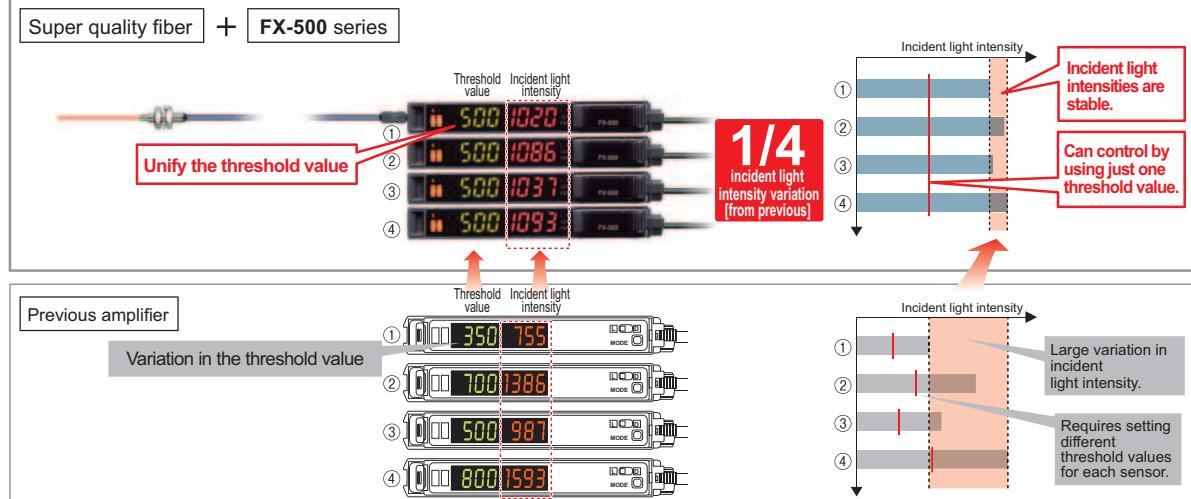
High stability!

When the FX-500 series is used together with our super quality fiber, the incident light intensity variation among units is decreased to only 1/4 of that of conventional models.

By being close to absolute values instead of modified digital values, changes in detection that could not be found in the past can now be monitored.

Selection Guide
Fibers
Fiber Amplifiers

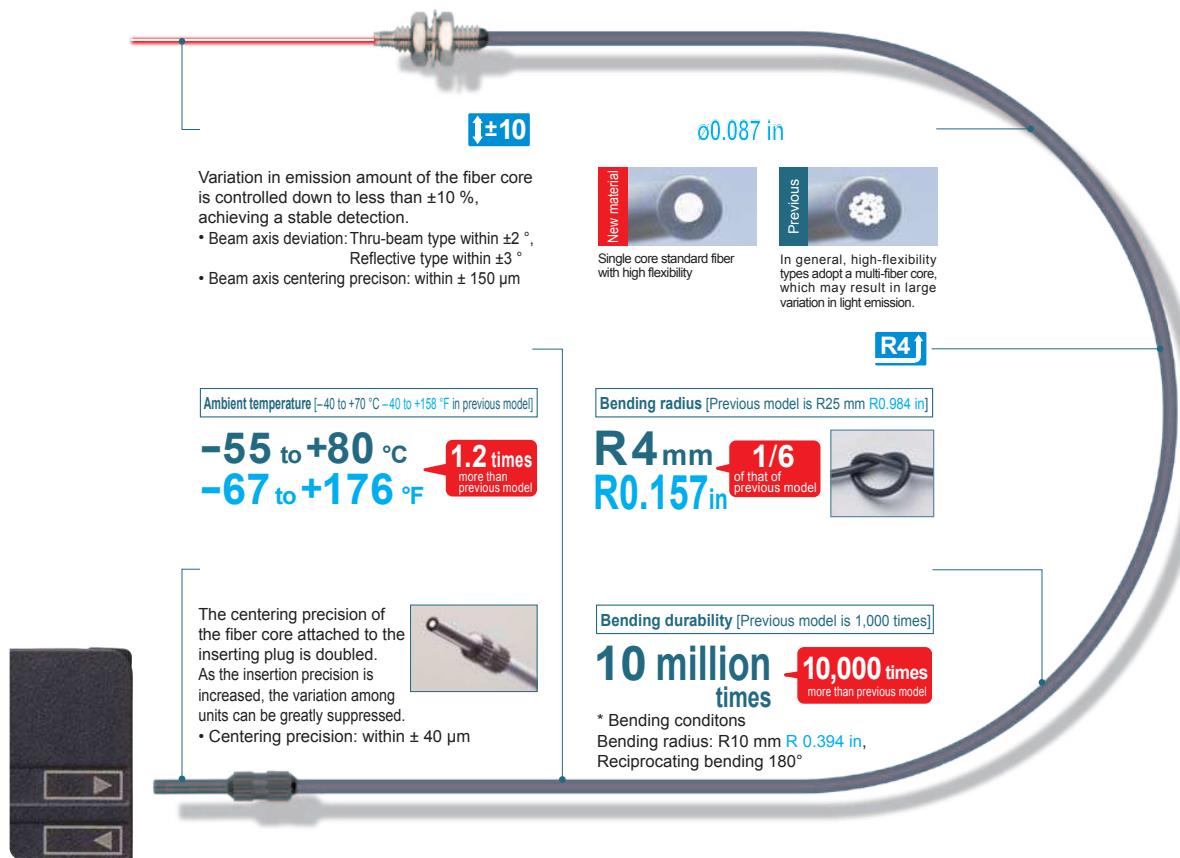
FX-500
FX-100
FX-300
FX-410
FX-311
FX-301-F7/ FX-301-F



A quality that surpassed that of standard fibers!

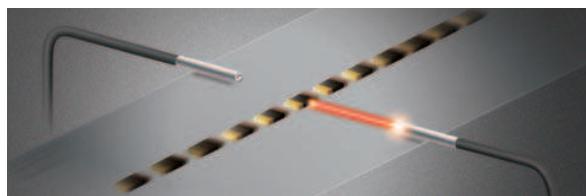
New fibers developed using a new manufacturing method adopted by our own factory along with a persistent quality control system.

The basic performance of a standard fiber is greatly enhanced!



Max. 25 μs response time

FX-500 with its high response time contributes to improve productivity.

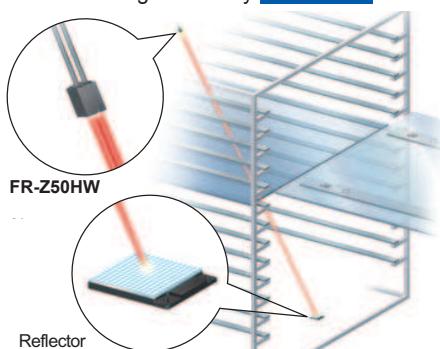


Performing minute object detection when using a small diameter fiber is now possible with a high response time and longer sensing range.

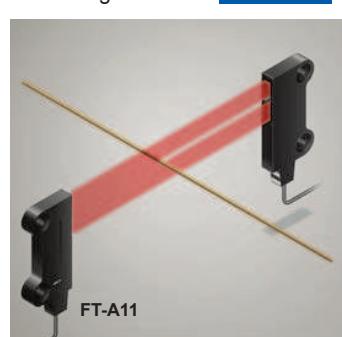
So accurate! Sharp detection with suppressed hysteresis

FX-500 with its accurate detection catches fractional differences in light intensity, achieving high precision and solving low-hysteresis applications.

- Long range detection of small objects with small difference in light intensity **H-02 mode**

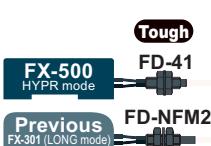


- Highly accurate detection while avoiding saturation **H-01 mode**



Note: When using FD-NFM2.

Max. 5.7 times! (Note)
longer than the previous model



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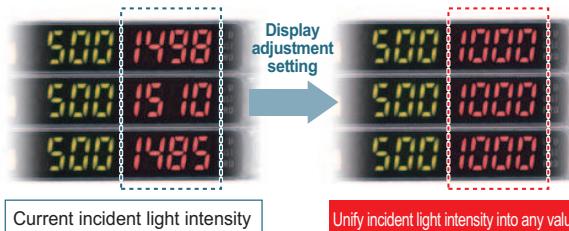
FX-500
FX-100
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FX-301-F7/ FX-301-F

FIBER SENSORS**LASER SENSORS****PHOTOELECTRIC SENSORS****MICRO PHOTOELECTRIC SENSORS****AREA SENSORS****LIGHT CURTAINS / SAFETY COMPONENTS****PRESSURE / FLOW SENSORS****INDUCTIVE PROXIMITY SENSORS****PARTICULAR USE SENSORS****SENSOR OPTIONS****SIMPLE WIRE-SAVING UNITS****WIRE-SAVING SYSTEMS****MEASUREMENT SENSORS****STATIC ELECTRICITY PREVENTION DEVICES****LASER MARKERS****PLC****HUMAN MACHINE INTERFACES****ENERGY CONSUMPTION VISUALIZATION COMPONENTS****FA COMPONENTS****MACHINE VISION SYSTEMS****UV CURING SYSTEMS****Flat display with wide viewing angle**

The large and high-contrast 7-segment display of high luminance provides clear visibility from a wide angle of view.

**Resolves variation in displayed incident light intensity
Display adjustment setting**

The variation in display can be adjusted to random values. This helps to define proper instruction in a work order.

**Stable detection over long and short periods
Stabilized emission amount**

The "four-chemical emitting element", which we are the first to incorporate to maintain a stable level of light emission, has now become an industry standard.

FX-500 series continues to adopt the same emitting element as well as the "APC (Auto Power Control) circuit" which improves stability in short periods such as when the power is turned on.

**Saves maintenance time
Threshold tracking function**

This function performs automatic setting to threshold value by checking the incident light intensity at desired intervals in order to follow the changes in the light amount resulting from changes in the environment over long periods (such as dust). This contributes to reduction in maintenance hours.

- Detect deterioration in light intensity (e.g. Useful in dusty environment)



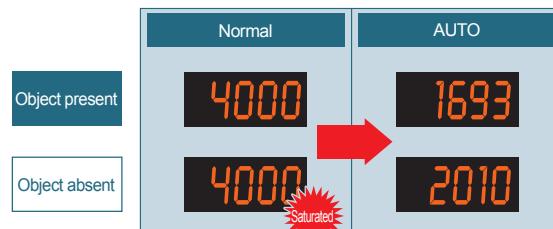
Self-diagnosis can be used with the threshold tracking function for added effectiveness.

**Suitable for preventative maintenance
Self-diagnosis output****FX-502(P)
FX-505(P)-C2**

FX-502(P) / 505(P)-C2 can set Output 2 as a self-diagnosis output. When the teaching of Output 1's threshold value is carried out, Output 2 is set concurrently with the setting randomly shifted by the amount of surplus of threshold value. Light intensity deterioration due to fiber breakage or dust accumulation can be notified as an alarm output.

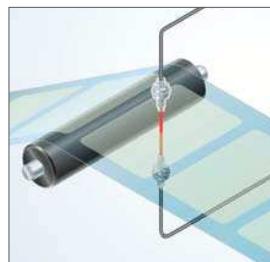
**Stable detection while being eco-friendly
Emission power & gain setting**

In cases when the incident light intensity is saturated, the light emitting amount can be adjusted to the optimal level by AUTO without changing the response time. This allows stable detection with an optimal S/N ratio and saves energy by controlling the emitting electric current.



Auto mode (AUTO) and 3-level manual mode (H / M / L [fine-adjustable]) are incorporated.

- Detecting a transparent sheet

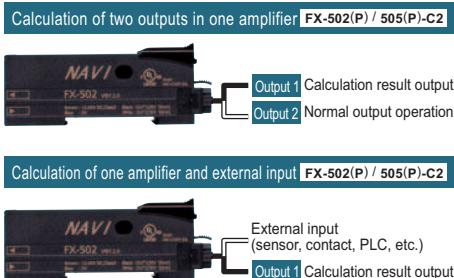
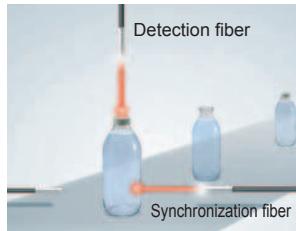


Built-in logic functions

No PLC necessary, saving material and programming costs

■ Logical calculation functions

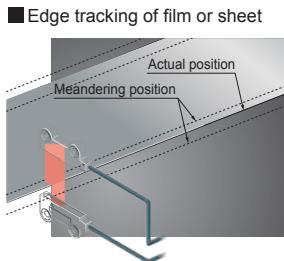
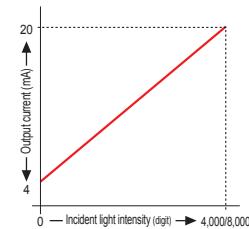
3 logical calculations (AND, OR, XOR) are available with fiber sensor only. 3 logical operations can be selected against Output 1. Additional controller is not required so both wire-saving and cost reduction can be achieved.



Analog output cable type

FX-505(P)-C2

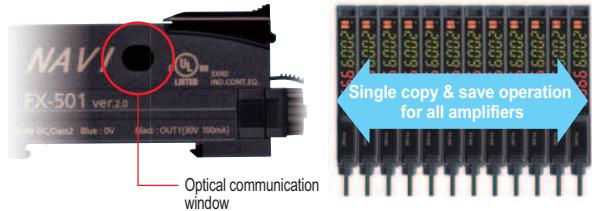
To monitor the sensing of objects, a 4 to 20 mA analog current is output in respond to the digital value of the incident light intensity.



The meandering path can be monitored as the light intensity changes.

An optical communication function allows sensors to be adjusted simultaneously

The data that is currently set can be copied and saved all at once for all amplifiers connected together from the right side thanks to the optical communication function. This greatly reduces troublesome setup tasks and makes setup much smoother.



Smooth setup changes by 8 data banks

The number of data banks used for saving the setup conditions of the amplifier is increased to eight. Setup conditions can be saved and loaded to make setup changes easy at a worksite where multiple models are manufactured.

Remote control improves work efficiency by external input

FX-502(P) FX-505(P)-C2

Work efficiency can be improved by operating via PLC output or other external signal.

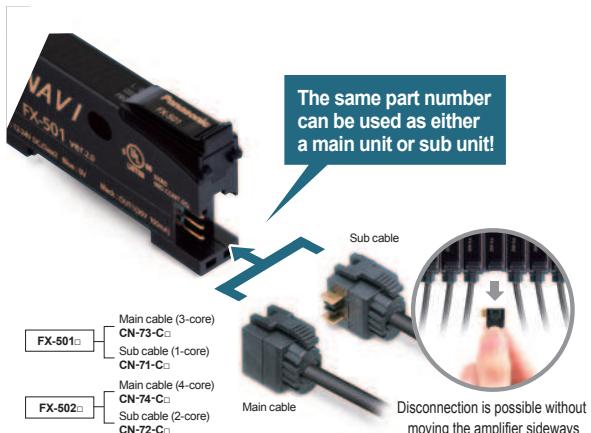
(FX-502(P) can operate via external signal when switching from Output 2 to external input.)

■ Functions operable by external input

Full-auto / Limit / 2-point teaching	Display adjustment setting
Data bank load / save	Logical calculation (self-unit only)
Emission halt	Copying function lock (self-unit only)

No need to specify a main unit or sub unit

All FX-500 amplifiers can be used as either a main unit or a sub unit. Just use a main cable or a sub cable to distinguish the two. This reduces the costs of inventory management.



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FX-311

FX-301-F7/ FX-301-F

ORDER GUIDE

Amplifiers

Quick-connection cable is not supplied with FX-501(P) and FX-502(P). Please order it separately.

Type	Appearance	Model No.	Emitting element	Output	External input
Standard type		FX-501	Red LED	NPN open-collector transistor	
		FX-501P		PNP open-collector transistor	
2-output type		FX-502		NPN open-collector transistor 2 outputs	Incorporated (Switchable with Output 2)
		FX-502P		PNP open-collector transistor 2 outputs	
Cable type		FX-505-C2		NPN open-collector transistor 2 outputs analog output	
		FX-505P-C2		PNP open-collector transistor 2 outputs analog output	Incorporated

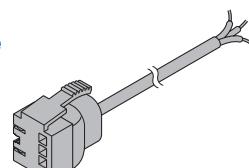
Quick-connection cables

For FX-501(P) Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable (3-core)	CN-73-C1	Length: 1 m 3.281 ft	0.2 mm ² 3-core cabtyre cable, with connector on one end
	CN-73-C2	Length: 2 m 6.562 ft	Cable outer diameter: ø3.3 mm ø0.130 in
	CN-73-C5	Length: 5 m 16.404 ft	
Sub cable (1-core)	CN-71-C1	Length: 1 m 3.281 ft	0.2 mm ² 1-core cabtyre cable, with connector on one end
	CN-71-C2	Length: 2 m 6.562 ft	Cable outer diameter: ø3.3 mm ø0.130 in
	CN-71-C5	Length: 5 m 16.404 ft	Connectable to a main cable up to 15 cables.

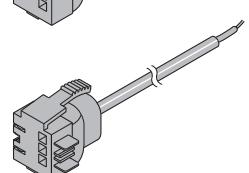
Main cable

- CN-73-C□



Sub cable

- CN-71-C□

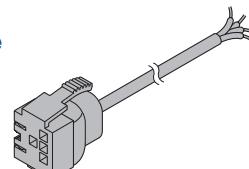


For FX-502(P) Quick-connection cable is not supplied with the amplifier. Please order it separately.

Type	Model No.	Description	
Main cable (4-core)	CN-74-C1	Length: 1 m 3.281 ft	0.2 mm ² 4-core cabtyre cable, with connector on one end
	CN-74-C2	Length: 2 m 6.562 ft	Cable outer diameter: ø3.3 mm ø0.130 in
	CN-74-C5	Length: 5 m 16.404 ft	
Sub cable (2-core)	CN-72-C1	Length: 1 m 3.281 ft	0.2 mm ² 2-core cabtyre cable, with connector on one end
	CN-72-C2	Length: 2 m 6.562 ft	Cable outer diameter: ø3.3 mm ø0.130 in
	CN-72-C5	Length: 5 m 16.404 ft	Connectable to a main cable up to 15 cables.

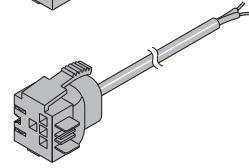
Main cable

- CN-74-C□

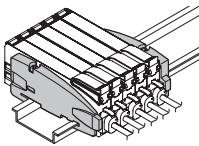


Sub cable

- CN-72-C□



End plates End plates are not supplied with the amplifier. Please order them separately when the amplifiers are mounted in cascade.

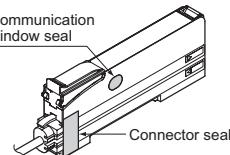
FX-500	Appearance	Model No.	Description
FX-100		MS-DIN-E	When amplifiers are mounted in cascade, or when an amplifier moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs. per set

■ OPTIONS

Designation	Model No.	Description
Amplifier mounting bracket	MS-DIN-2	Mounting bracket for amplifier

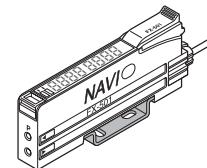
Accessory

- FX-MB1 (Amplifier protection seal)
10 sets of 2 communication window seals and 1 connector seal



Amplifier mounting bracket

- MS-DIN-2



■ LIST OF FIBERS

Super quality

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series							
Threaded	M3	Tough FT-30	R2 Bending durability	2 m	STD 400 15.748	810 31.890 650 25.591 210 8.268 75 2.953	ø0.5	150 µm / ±2°	±10 %	IP67	-55 to +80 °C	P.51
	M4	Tough FT-40	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	ø1					
	ø1.5	Tough FT-S20	R2 Bending durability		STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	ø0.5					P.55
	ø3	Tough FT-S30	R4 Bending durability		STD 1,200 47.244 HYPR (Note) 3,600 141.732	2,200 86.614 1,700 66.929 530 20.866 190 7.480	ø1					

Note: The fiber cable length practically limits the sensing range.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note)		Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.	Dimensions
					FX-500 series						
Threaded	M3	Tough FD-30	R2 Bending durability	2 m	STD 160 6.299	330 12.992 250 9.843 80 3.150 25 0.984	150 µm / ±3°	±10 %	IP67	-55 to +80 °C	P.59
	M4	Tough FD-40	R4 Bending durability		HYPR 600 23.622						
	M6	Tough FD-60	R4 Bending durability		STD 520 20.472 HYPR 1,550 61.024	900 35.433 740 29.134 260 10.236 90 3.543					P.60
	ø3	Tough FD-S30	R4 Bending durability		STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984					P.67

Note: The sensing range is specified for white non-glossy paper.

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

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FX-100

FX-300

FX-410

FX-311

FX-301-F7/
FX-301-F

LIST OF FIBERS

Threaded type

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length [Free-cut]	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series						
Threaded	M3	FT-31	Tough R2	Bending durability	STD 315 12.402	550 21.654	770 30.315	ø0.5 150 µm / ±2°	-55 to +80 °C	P.51	
					HYPR 1,350 53.150	210 8.268	70 2.756				
		FT-31W	R1		STD 260 10.236	440 17.323	590 23.228		-40 to +60 °C		
					HYPR 990 38.976	150 5.906	53 2.087				
		FT-43	R4	2 m	STD 1,400 55.118	2,100 82.677	2,800 110.236	ø1.5 150 µm / ±2°	-55 to +80 °C		
					HYPR (Note 2) 3,600 141.732	770 30.315	190 7.480				
	M4	FT-42	Tough R2	Bending durability	STD 1,130 44.488	1,600 62.992	2,050 80.709			IP67	
					HYPR (Note 2) 3,600 141.732	530 20.866	1,400 55.118		-40 to +60 °C		
		FT-42W	R1		STD 800 31.496	1,900 74.803	490 19.291	ø1 150 µm / ±3°			
					HYPR (Note 2) 3,300 129.921	160 6.299	190 7.480				
		FT-45X	R4	1 m	STD 1,200 47.244	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	-55 to +80 °C	P.52	
Elbow		FT-R40	Tough R4	2 m	HYPR (Note 2) 1,600 62.992	630 24.803	200 7.874			P.54	
					STD 930 36.614	1,750 68.898	1,500 59.055				
					HYPR (Note 2) 3,600 141.732	500 19.685	160 6.299				
		FT-140	Tough	Bending durability	STD (Note 2) 19,600 771.654	19,600 771.654 (Note 2)	19,600 771.654 (Note 2)	ø10 —	-40 to +70 °C	P.51	
	M14				HYPR (Note 2) 19,600 771.654	16,000 629.921	6,300 248.031				

Notes: 1) Note 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 fiber cable length practically limits the sensing range.

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm **R0.394 in**, reciprocating bending: 180°) and more flexible (bending radius: R4 mm **R0.157 in** or less) features.

LIST OF FIBERS

Threaded type

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✖ : Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series					
M3	M3	Tough FD-31	R2 Bending durability	2 m	STD 125 4.921	290 11.417 220 8.661 80 3.150 25 0.984	150 µm / ±3°	IP67	-55 to +80 °C	P.59
	M3	FD-31W	R1		STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472	—		-40 to +60 °C	
	Coaxial, Lens mountable M3	Tough FD-32G	R2 Bending durability		STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	—	IP40	-55 to +80 °C	
	Coaxial, Lens mountable, Stainless-jacketed M3	FD-32GX	R2	1 m (Note 3)	STD 200 7.874 HYPR 630 24.803	410 16.142 360 14.173 100 3.937 30 1.181	—		-40 to +70 °C	P.61
	Coaxial, Lens mountable M3	FD-EG30	R4		STD 48 1.890 HYPR 170 6.693	130 5.118 110 4.331 30 1.181 9 0.354	—		-40 to +70 °C	
	Coaxial, Lens mountable M3	FD-EG31	R4	500 mm	STD 20 0.787 HYPR 185 3.346	45 1.772 35 1.378 12 0.472 3.5 0.138	—		-20 to +60 °C	P.62
	Ultra-small diameter				STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 µm / ±3°	IP67	-55 to +80 °C	P.59
Threaded	M4	Tough FD-41	R2 Bending durability	2 m	STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—	IP40	-55 to +80 °C	
	M4	FD-41W	R1		STD 200 7.874 HYPR 650 25.591	380 14.961 270 10.630 95 3.740 27 1.063	—		-40 to +60 °C	
	Coaxial, Lens mountable M4	Tough FD-42G	R2 Bending durability		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	—	IP67	-55 to +80 °C	
	Coaxial, Lens mountable M4	FD-42GW	R1	1 m	STD 520 20.472 HYPR 1,500 59.055	1,000 39.370 940 37.008 340 13.386 110 4.331	150 µm / ±3°		-40 to +60 °C	P.60
	M6	FD-62	R4 Bending durability		STD 450 17.717 HYPR 1,400 55.118	840 33.071 670 26.378 200 7.874 70 2.756	—	IP67	-55 to +80 °C	
M6	M6	Tough FD-61	R4 Bending durability	2 m	STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—		-40 to +60 °C	
	M6	FD-61W	R1		STD 420 16.535 HYPR 1,100 43.307	800 31.496 650 25.591 200 7.874 60 2.362	—	IP40	-55 to +80 °C	
	Coaxial M6	Tough FD-61G	R4 Bending durability		STD 280 11.024 HYPR 670 26.378	500 19.685 410 16.142 160 6.299 50 1.969	—		-55 to +80 °C	P.61
	Stainless-jacketed M6	FD-64X	R4	1 m	STD 290 11.417 HYPR 1,100 43.307	600 23.622 550 21.654 190 7.480 65 2.559	150 µm / ±3°	IP67	-55 to +80 °C	
	Elbow	Tough FD-R60	R4 Bending durability	2 m	STD 290 11.417 HYPR 1,100 43.307	600 23.622 550 21.654 190 7.480 65 2.559	150 µm / ±3°		-55 to +80 °C	P.66

Notes: 1) Note 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 sensing range is specified for white non-glossy paper.

3) The allowable cutting range is 700 mm 27.559 in from the end that the amplifier inserted.

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LIST OF FIBERS

Square head type

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP					
Square head	M3	Tough FT-R31	R2 Bending durability	2m	STD 270 10.630 HYPR 1,000 39.370	580 22.835 440 17.323 160 6.299 55 2.165	ø0.5	IP67	-55 to +80 °C	P.54	
	Lens mountable	Tough FT-R43	R4 Bending durability		STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118					
	M4	FT-R41W	R1 2m	2m	STD 800 31.496 HYPR 3,200 125.984	1,800 70.866 1,400 55.118 460 18.110 150 5.906	ø1	IP40	-40 to +60 °C		
	With expansion lens	FT-R42W			STD 2,200 86.614 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,500 137.795 1,300 51.181 460 18.110					
	M6	Tough NEW FT-R44Y	R4 Bending durability	2m	STD 720 28.346 HYPR 3,000 118.110	1,600 62.992 1,100 43.307 430 16.929 130 5.118	ø1	IP67 (Note 3)	-55 to +80 °C		
	Full-protection type	Tough NEW FT-R60Y	STD 2,100 82.677 HYPR (Note2) 3,600 141.732		3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,260 49.606 400 15.748						

Notes: 1) Note 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 fiber cable length practically limits the sensing range.

3) The fiber part is oil-resistant.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	Dimensions		
					FX-500 series	U-LG LONG FAST H-SP						
Square head	M3	Tough FD-R31G	R2 Bending durability	2m	STD 170 6.693 HYPR 530 20.866	310 12.205 260 10.236 85 3.346 27 1.063	Emitter ø0.5	IP67	-55 to +80 °C	P.66		
	Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R32EG	R4 500mm		STD 45 1.772 HYPR 170 6.693	110 4.331 92 3.622 30 1.181 9 0.354						
	Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R34EG			STD 38 1.496 HYPR 130 5.118	90 3.543 70 2.756 23 0.906 7 0.276	Emitter ø0.175	IP40	-40 to +70 °C			
	Coaxial, Lens mountable M3 W5.5×H8×D16	FD-R33EG			STD 19 0.748 HYPR 84 3.307	44 1.732 33 1.299 11 0.433 3 0.118						
	M4	Tough FD-R41	R2 Bending durability	2m	STD 210 8.268 HYPR 710 27.953	430 16.929 320 12.598 100 3.937 34 1.339	ø0.75	IP67	-20 to +60 °C			
	Cable-protection type M6 W7×H9×D13.5	Tough NEW FD-R61Y	R4 Bending durability		STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969						

Notes: 1) Note 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 sensing range is specified for white non-glossy paper.

3) The fiber part is oil-resistant.

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Cylindrical type

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length [X : Free-cut]	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions
					FX-500 series						
Cylindrical	ø1	Tough FT-S11	R2	500 mm	STD 90 3.543	210 8.268	ø0.25	—	IP67	-55 to +80 °C	P.55
	ø1.5	Tough FT-S21	Bending durability		HYPR 350 13.780	160 6.299 60 2.362 19 0.748					
	ø1.5	FT-S21W	R1		STD 315 12.402	770 30.315	ø0.5	150 µm / ±2°			
	ø1.5	FT-S21W	R1		HYPR 1,350 53.150	550 21.654 210 8.268 70 2.756					
	ø2.5	FT-S32	R10		STD 260 10.236	590 23.228	150 µm / ±3°				
	ø2.5	FT-S32	Bending durability	2 m	HYPR 990 38.976	440 17.323 150 5.906 53 2.087					
	ø3	FT-S31W	R1		STD 3,100 122.047	3,600 141.732 (Note 2)	ø2	—	IP40	-40 to +70 °C	
	ø3	FT-S31W	R1		HYPR (Note 2) 3,600 141.732	1,800 70.866 600 23.622					
	ø3	Tough FT-E13	R2		STD 15 0.591	1,900 74.803	ø1	150 µm / ±3°	IP67	-40 to +60 °C	
	ø3	Tough FT-E23	Bending durability		HYPR 52 2.047	1,400 55.118 490 19.291 160 6.299					
Side-view	ø4	Tough FT-V40	R4	2 m	STD 75 2.953	30 1.181 24 0.945 8 0.315 2 0.079	ø0.125	—	IP67	-40 to +70 °C	P.52
	ø4	Tough FT-V40	Bending durability		HYPR 1270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	ø0.25	—			
	ø4	Tough FT-V40	R4	2 m	STD 3,500 137.795	3,600 141.732 (Note 2)	ø2.5	—	IP50	-40 to +60 °C	
	ø4	Tough FT-V40	Bending durability		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,400 94.488 850 33.465					

Notes: 1) Note 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 fiber cable length practically limits the sensing range.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length [X : Free-cut]	Sensing range (mm in) (Note 1, 2)		Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series						
Cylindrical	ø1.5	Tough FD-S21	R2	1 m	STD 80 3.150	130 5.118	—	IP40	-55 to +80 °C	P.66	
	ø3	Tough FD-S32	R4		Bending durability	HYPR 190 7.480					
	ø3	FD-S32W	R1			STD 420 16.535	790 31.102	150 µm / ±3°	IP67		
	ø3	FD-S32W	R1			HYPR 1,200 47.244	660 25.984 220 8.661 75 2.953				
	ø3	Tough FD-S31	R2		Bending durability	STD 270 10.630	630 24.803	—			
	ø3	FD-S31	R2	2 m	Bending durability	HYPR 900 35.433	430 16.929 150 5.906 45 1.772	150 µm / ±3°			
	ø3	FD-S31	R2		Bending durability	STD 125 4.921	290 11.417	—			
	ø3	FD-S31	R2		Bending durability	HYPR 515 20.276	220 8.661 80 3.150 25 0.984	150 µm / ±3°			
	ø3	FD-S33GW	R1			STD 150 5.906	340 13.386	—	IP40	-40 to +60 °C	
	ø3	FD-S33GW	R1			HYPR 670 26.378	280 11.024 90 3.543 25 0.984				
Ultra-small diameter	ø5.5	Tough NEW FD-S60Y	R4	2 m (Note 4)	Protective tube R30 mm Fiber	STD 320 12.598	590 23.228	—	IP68G	-40 to +70 °C	P.67
	ø1.5	FD-E13	R4			HYPR 600 23.622	420 16.535 200 7.874 75 2.953				
	ø1.5	FD-E13	R4	1 m		STD 12 0.472	29 1.142	—	IP40	-40 to +60 °C	
	ø3	FD-E23	R4			HYPR 50 1.969	25 0.984 7 0.276 2 0.079			-40 to +70 °C	
Ultra-small diameter	ø3	FD-E23	R4			STD 55 2.165	120 4.724	—	IP40	-40 to +60 °C	P.61
	ø3	FD-E23	R4			HYPR 170 6.693	80 3.150 30 1.181 9 0.354			-40 to +70 °C	

Notes: 1) Note 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 sensing range is specified for white non-glossy paper.

3) The allowable cutting range is 500 mm 19.685 in from the end that is inserted to the amplifier.

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Sleeve

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✖ : Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP					
Threaded	M3	Sleeve 40mm M3 Ø0.88 → 10 ←	Tough FT-31S	R2 Bending durability (Note 3)	2 m	STD 315 12.402 HYPR 1,220 48.031	740 29.134 550 21.654 195 7.677 63 2.480	Ø0.5	IP67	-55 to +80 °C	P.51
	M4	Sleeve 40mm M4 Ø1.48 → 12 ←	Tough FT-42S	R4 Bending durability (Note 3)		STD 1,130 44.488 HYPR (Note 2) 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	Ø1			
	Ø3	Narrow beam Ø125mm Ø0.25 → Ø3 ← Sleeve part cannot be bent. → 5 15 ←	Tough FT-E13	R2 Bending durability	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	Ø0.125		-40 to +70 °C	P.52
	Ø3	Narrow beam Ø25mm Ø0.4 → Ø3 ← Sleeve part cannot be bent. → 5 15 ←	Tough FT-E23	R2 Bending durability		STD 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	Ø0.25			
Cylindrical	Ø1	Ø1 Ø2 Sleeve part cannot be bent. → 20 15 ←	Tough FT-V23	R4 Bending durability	2 m	STD 450 17.717 HYPR 1,800 70.866	1,000 39.370 880 34.646 280 11.024 90 3.543	Ø0.75	IP30	-55 to +80 °C	P.55
	Ø2	Ø1 Ø2 Sleeve part cannot be bent. → 15 15 ←	Tough FT-V25	R2 Bending durability		STD 240 9.449 HYPR 900 35.433	550 21.654 480 18.898 140 5.512 45 1.772	Ø0.5			
	Ø2.5	Ø1 Ø2 Sleeve part cannot be bent. → 15 15 ←	FT-V24W	R1		STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	Ø0.5		-40 to +60 °C	P.56
	Ø2.5	Ø1.5 Ø2.5 Sleeve part cannot be bent. → 20 15 ←	Tough FT-V30	R4 Bending durability	2 m	STD 680 26.772 HYPR 12,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	Ø1.0			
	Ø2.5	Ø1.5 Ø2.5 Sleeve part cannot be bent. → 20 15 ←	FT-V30	R1		STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	Ø0.5		-55 to +80 °C	P.56
	Ø2.5	Ø1.5 Ø2.5 Sleeve part cannot be bent. → 20 15 ←	FT-V30	R4 Bending durability		STD 680 26.772 HYPR 12,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	Ø1.0			

Notes: 1) Note 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 fiber cable length practically limits the sensing range. 3) Bending radius of sleeve part is R10 mm R0.394 in or more.

Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✖ : Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions		
					FX-500 series	U-LG LONG FAST H-SP					
Threaded	Ultra-small diameter M3	Sleeve 15 mm M3 Ø0.8 → 15 ← Sleeve part cannot be bent.	FD-EG30S	R4	1 m	STD 50 1.969 HYPR 170 6.693	110 4.331 80 3.150 30 1.181 9 0.354	IP40	-40 to +70 °C	P.62	
	M4	Sleeve 40 mm M4 Ø1.48 → 12 ←	Tough FD-41S	R2 Bending durability (Note 3)		STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	IP67	-55 to +80 °C	P.59	
	M4	Sleeve 40 mm M4 Ø1.48 → 12 ←	FD-41SW	R1 (Note 3)	2 m	STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472		-40 to +60 °C		
	M6	Sleeve 40 mm M6 Ø2.5 → 15 ←	Tough FD-61S	R4 Bending durability (Note 3)		STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953		-55 to +80 °C	P.60	
Cylindrical	Ø1.5	Ø1.5 Ø0.48 Sleeve part cannot be bent.	FD-E13	R4	1 m	STD 12 0.472 HYPR 50 1.969	29 1.142 25 0.984 7 0.276 2 0.079	IP40	-40 to +60 °C	P.61	
	Ø3	Ø3 Ø0.63 Sleeve part cannot be bent.	FD-E23	R4		STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354		-40 to +70 °C		
	Ø3	Small diameter Ø3 Ø1.5 → 15 ← Sleeve part cannot be bent.	Tough FD-V30	R2 Bending durability		STD 65 2.559 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551				
	Ø5	Ø5 Ø2 → 15 ← Ø3 Ø1.5 → 20 ← Sleeve part cannot be bent.	FD-V30W	R1	2 m	STD 20 0.787 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079	IP30	-40 to +60 °C	P.67	
	Ø5	Ø5 Ø2 → 15 ← Ø3 Ø1.5 → 20 ← Sleeve part cannot be bent.	Tough FD-V50	R4 Bending durability		STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984		-55 to +80 °C	P.68	
	Ø5	Ø5 Ø2 → 15 ← Ø3 Ø1.5 → 20 ← Sleeve part cannot be bent.	FD-V50	R4 Bending durability		STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984				

Notes: 1) Note 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 sensing range is specified for white non-glossy paper. 3) Bending radius of sleeve part is R10 mm R0.394 in or more.

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Flat type

Thru-beam type (one pair set)



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✖ : Free-cut	Sensing range (mm in) (Note 1)		Beam axis dia. (mm)	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP					
Flat	Top sensing W3 × H8 × D12	Tough FT-Z30H	R2 Bending durability	2 m	STD 3,500 141.732 (Note 2) HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,600 102.362 810 31.890	2 × 3	IP40	P.57	-40 to +60 °C	
	Top sensing W3 × H8 × D12	FT-Z30HW	R1		STD 3,500 141.732 (Note 2) HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 740 29.134					
	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2 Bending durability		STD 3,400 141.732 (Note 2) HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803					
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		STD 3,400 133.858 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,000 78.740 630 24.803					
	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2 Bending durability		STD 2,100 82.677 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244 410 16.142					
	Front sensing W8.5 × H12 × D3	FT-Z30W	R1		STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 3,200 125.984 1,000 39.370 280 11.024					
	Front sensing W10 × H7 × D2	FT-Z20W			STD 620 24.409 HYPR (Note 2) 1,600 62.992	1,500 59.055 1,100 43.307 420 16.535 130 5.118		IP67	P.56	-40 to +60 °C	
	Fiber bending type W2 × H10 × D10	FT-Z20HBW			STD 260 10.236 HYPR (Note 2) 1,100 43.307	670 26.378 570 22.441 180 7.087 55 2.165					
	Front sensing W14 × H7 × D3.5	FT-Z40W			STD 1,500 59.055 HYPR (Note 2) 3,600 141.732	3,300 129.921 2,300 90.551 900 35.433 290 11.417					
	Fiber bending type W3.5 × H14 × D11	FT-Z40HBW			STD 800 31.496 HYPR (Note 2) 3,300 129.921	1,900 74.803 1,400 55.118 490 19.291 160 6.299					

Notes: 1) Note 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 fiber cable length practically limits the sensing range.

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Reflective type



Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✖ : Free-cut	Sensing range (mm in) (Note 1, 2)		Protection	Ambient temp.	Dimensions		
					FX-500 series	U-LG LONG FAST H-SP					
Flat	Front sensing W10 × H7 × D2	FD-Z20W	R1	1 m	STD 1 to 65 0.039 to 2.559 HYPR 260 10.236	150 5.906 130 5.118 2 to 45 0.079 to 1.772 5 to 13 0.197 to 0.512	IP40	P.68	-40 to +60 °C		
	Fiber bending type W2 × H10 × D10	FD-Z20HBW			STD 2 to 85 0.079 to 3.346 HYPR 1 to 340 0.039 to 13.386	1 to 210 0.039 to 8.268 1 to 180 0.039 to 7.087 2 to 55 0.079 to 2.165 3 to 15 0.118 to 0.591					
	Front sensing W14 × H7 × D3.5	FD-Z40W		2 m	STD 190 7.480 HYPR 790 31.102	440 17.323 390 15.354 1 to 120 0.039 to 4.724 2 to 35 0.079 to 1.378	IP40				
	Fiber bending type W3.5 × H14 × D11	FD-Z40HBW			STD 260 10.236 HYPR 760 29.921	540 21.260 470 18.504 1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969					

Notes: 1) Note 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 sensing range is specified for white non-glossy paper.

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Fibers

Fiber Amplifiers

FX-500

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FX-300

FX-410

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FX-301-F

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Small spot

High precision fiber & spot lens

Designation	Shape of head (mm) Dimensions	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Applicable fibers					
				Model No.	Ambient temp.	Model No.	Fiber cable length : Free-cut	Bending radius (mm)	Protection	Ambient temp.	Dimensions
Finest spot lens		$\varnothing 0.1 \text{ } \varnothing 0.004$	7 ± 0.5 0.276 ± 0.020	FX-MR6	$-20 \text{ to } +60^\circ\text{C}$	FD-EG31	500 mm		IP40	$-20 \text{ to } +60^\circ\text{C}$	P.62
		$\varnothing 0.2 \text{ } \varnothing 0.008$				FD-EG30					
		$\varnothing 0.4 \text{ } \varnothing 0.016$				Tough FD-42G	2 m		$-40 \text{ to } +70^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.61
		$\varnothing 0.4 \text{ } \varnothing 0.016$				FD-42GW					
		$\varnothing 0.4 \text{ } \varnothing 0.016$				Tough FD-32G	1 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +60^\circ\text{C}$	P.60
		$\varnothing 0.4 \text{ } \varnothing 0.016$				FD-32GX					
		$\varnothing 0.15 \text{ } \varnothing 0.006$	7.5 ± 0.5 0.295 ± 0.020	FX-MR3	$-40 \text{ to } +70^\circ\text{C}$	FD-EG31	500 mm		IP40	$-20 \text{ to } +60^\circ\text{C}$	P.62
		$\varnothing 0.3 \text{ } \varnothing 0.012$				FD-EG30					
		$\varnothing 0.5 \text{ } \varnothing 0.020$				Tough FD-42G	2 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.60
		$\varnothing 0.5 \text{ } \varnothing 0.020$				FD-42GW					
		$\varnothing 0.5 \text{ } \varnothing 0.020$				Tough FD-32G	1 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.59
		$\varnothing 0.5 \text{ } \varnothing 0.020$				FD-32GX					
Pinpoint spot lens		$\varnothing 0.5 \text{ } \varnothing 0.020$	6 ± 1 0.236 ± 0.039	FX-MR1	$-40 \text{ to } +70^\circ\text{C}$	Tough FD-42G	2 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.60
		$\varnothing 0.5 \text{ } \varnothing 0.020$				FD-42GW					
		$\varnothing 0.5 \text{ } \varnothing 0.020$				Tough FD-42G					
Zoom lens		$\varnothing 0.7 \text{ to } \varnothing 2.0$ $0.028 \text{ to } 0.079$	$18.5 \text{ to } 43 \text{ approx.}$ $0.728 \text{ to } 1.693 \text{ approx.}$	FX-MR2	$-40 \text{ to } +70^\circ\text{C}$	Tough FD-42G	2 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.60
		$\varnothing 0.7 \text{ to } \varnothing 2.0$ $0.028 \text{ to } 0.079$				FD-42GW					
Zoom lens (Side-view type)		$\varnothing 0.5 \text{ to } \varnothing 3.0$ $0.020 \text{ to } 0.118$	$13 \text{ to } 30 \text{ approx.}$ $0.512 \text{ to } 1.181 \text{ approx.}$	FX-MR5	$-40 \text{ to } +70^\circ\text{C}$	Tough FD-42G	2 m		$-40 \text{ to } +60^\circ\text{C}$	$-55 \text{ to } +80^\circ\text{C}$	P.59
		$\varnothing 0.5 \text{ to } \varnothing 3.0$ $0.020 \text{ to } 0.118$				FD-42GW					

Note: Spot diameter, distance to focal point and sensing range are specified for FX-500 series.

Selection Guide
Fibers
Fiber Amplifiers

FX-500
FX-100
FX-300
FX-410
FX-311
FX-301-F7/ FX-301-F

Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm 0.394 in , reciprocating bending: 180°) and more flexible (bending radius: R4 mm 0.157 in or less) features.