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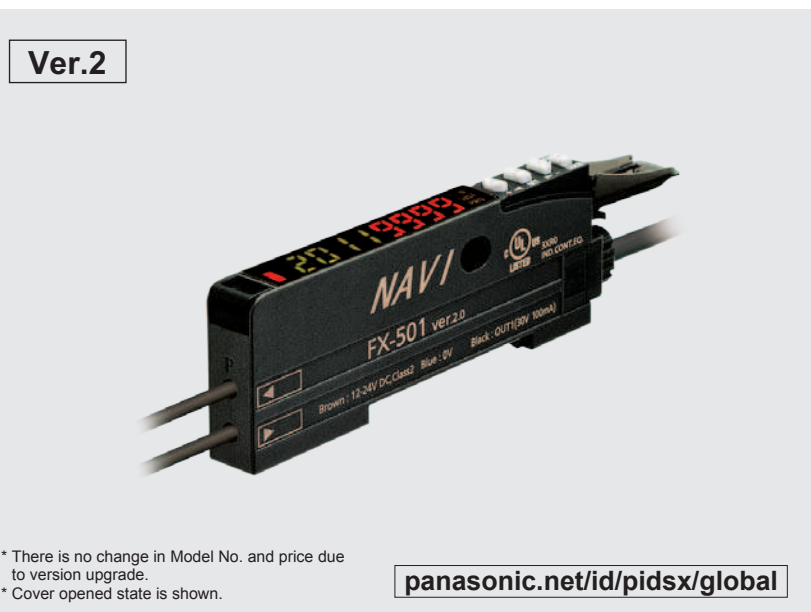
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Digital Fiber Sensor FX-500 SERIES Ver.2

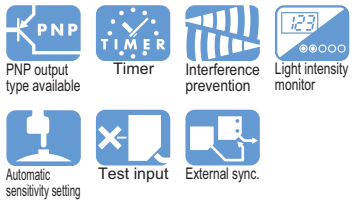
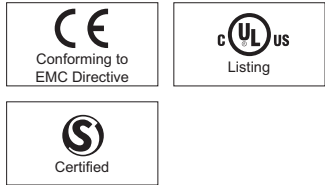
- FIBER SENSORS
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- PHOTOELECTRIC SENSORS
- MICRO PHOTOELECTRIC SENSORS
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- General terms and conditions..... F-7
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* There is no change in Model No. and price due to version upgrade.
* Cover opened state is shown.

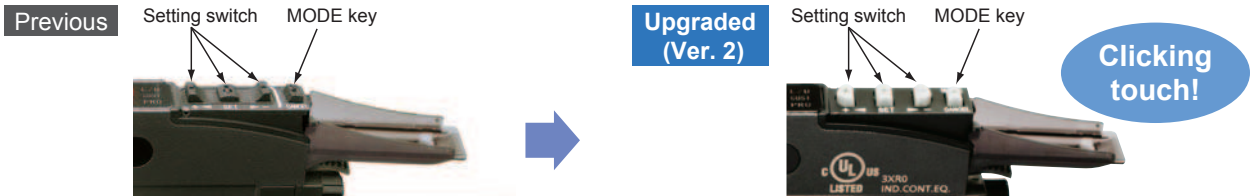
panasonic.net/id/pidsx/global



At the industry's leading edge

Improved the operability and visibility of the operation keys

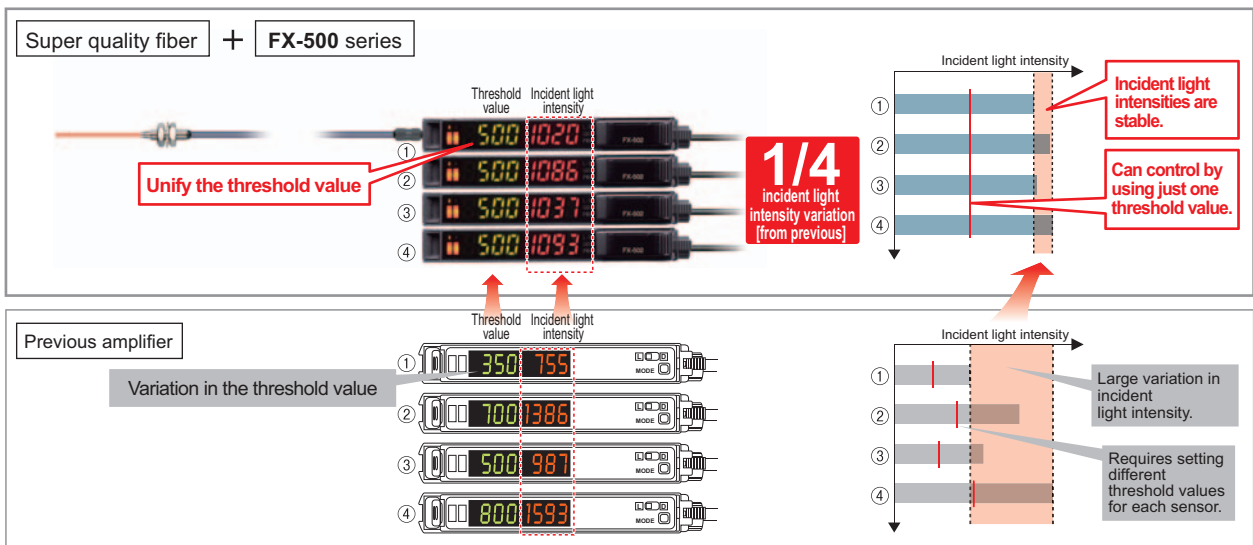
Operation keys (setting switch and MODE key) have been renewed to be easy to operate. Also, the color of the keys has been changed from black to light gray to achieve good visibility in dim light.



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!

Stable emission amount $\downarrow \pm 10$

Variation in emission amount of the fiber core is controlled down to less than $\pm 10\%$, achieving a stable detection.

- Beam axis deviation: Thru-beam type within $\pm 2^\circ$, Reflective type within $\pm 3^\circ$
- Beam axis centering precision: within $\pm 150\ \mu\text{m}$

$\phi 2.2\ \text{mm}$ $\phi 0.087\ \text{in}$ standard fiber

New material

Single core standard fiber with high flexibility

Previous

In general, high-flexibility types adopt a multi-fiber core, which may result in large variation in light emission.

Expanded temperature range

Ambient temperature [-40 to $+70^\circ\text{C}$ -40 to $+158^\circ\text{F}$ in previous model]

-55 to $+80^\circ\text{C}$
 -67 to $+176^\circ\text{F}$

1.2 times more than previous model

More flexible! **R4**

Bending radius [Previous model is R25 mm R0.984 in]

R4 mm
R0.157 in

1/6 of that of previous model

Integrated high-precision plug

The centering precision of the fiber core attached to the inserting plug is doubled. As the insertion precision is increased, the variation among units can be greatly suppressed.

- Centering precision: within $\pm 40\ \mu\text{m}$

More bendable!

Bending durability [Previous model is 1,000 times]

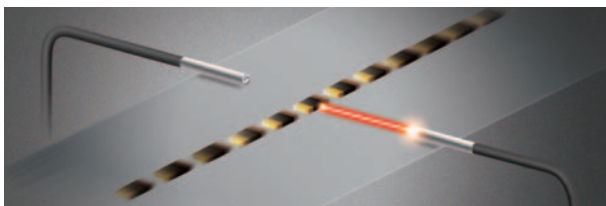
10 million times

10,000 times more than previous model

* Bending conditions
Bending radius: R10 mm R 0.394 in,
Reciprocating bending 180°

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.

Hyper HYPR mode incorporated

FX-500 in combination with small diameter fibers which can handle challenging detections, allows long sensing range.

Tough FX-500 HYPR mode FD-41

Previous FX-301 (LONG mode) FD-NFM2

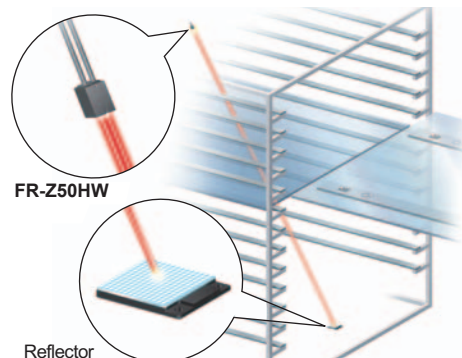
Max. 5.7 times! (Note) longer than the previous model

Note: When using FD-NFM2.

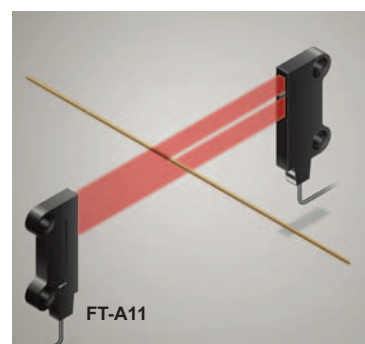
So accurate! Sharp detection with suppressed hysteresis

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**



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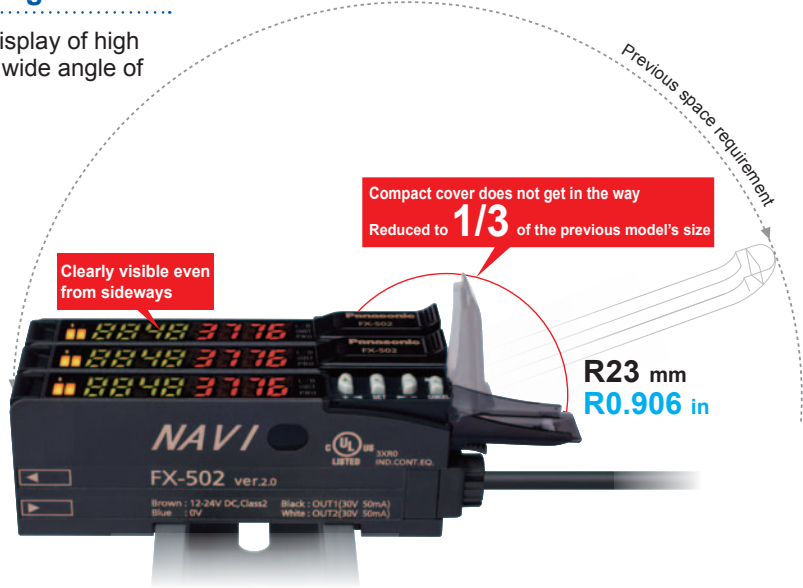
FX-301-F7/
FX-301-F

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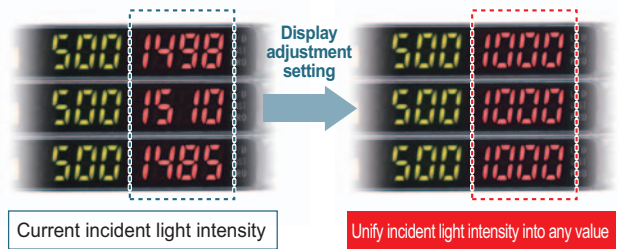
Flat display with wide viewing angle

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

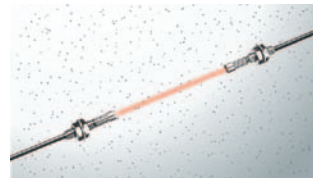
This function performs automatic setting to threshold value by checking the incident light intensity at desired intervals in order to follow the changes in the light amount resulting from changes in the environment over long periods (such as dust). This contributes to reduction in maintenance hours.

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.

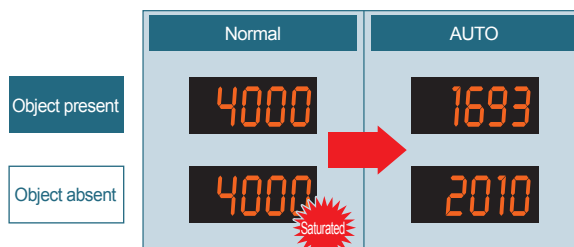
- Detect deterioration in light intensity (e.g. Useful in dusty environment)



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

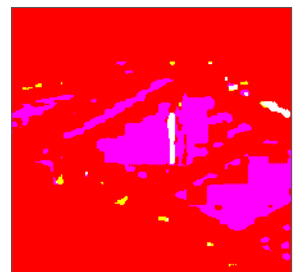
Stable detection while being eco-friendly Emission power & gain setting

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.

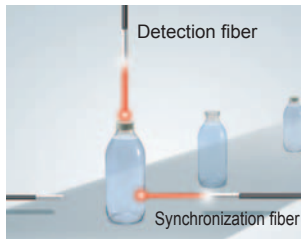
- Detecting a transparent sheet



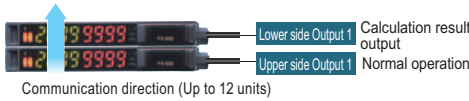
Built-in logic functions No PLC necessary, saving material and programming costs

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.



Calculation of two neighboring amplifiers



Calculation of two outputs in one amplifier **FX-502(P) / 505(P)-C2**

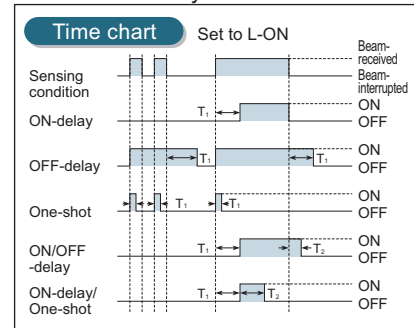


Calculation of one amplifier and external input **FX-502(P) / 505(P)-C2**



Equipped with 5 timer types

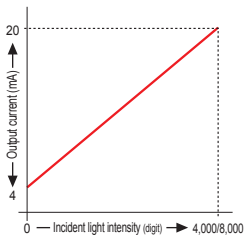
A wide variety of timer control operations can be carried out by fiber sensors only.



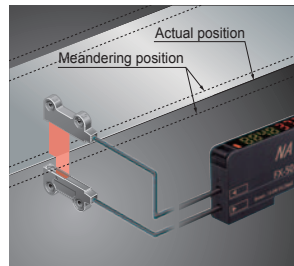
Timer period: 0.05 ms to 32 s
Output 1 has ON / OFF-delay and ON-delay / One-shot timers are available.

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.



Edge tracking of film or sheet



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

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**

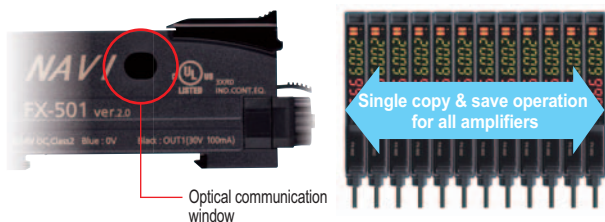
Work efficiency can be improved by operating via PLC output or other external signal. (FX-502(P) can operate via external signal when switching from Output 2 to external input.)

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)

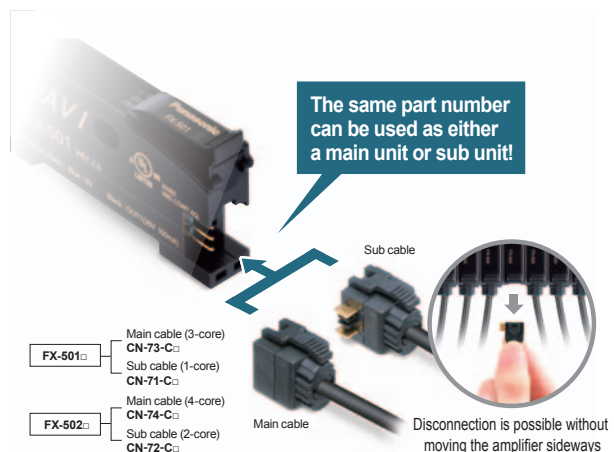
An optical communication function allows sensors to be adjusted simultaneously

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.



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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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	Incorporated
		FX-505P-C2		PNP open-collector transistor 2 outputs analog output	

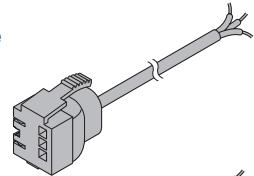
Quick-connection cables

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 Cable outer diameter: \varnothing 3.3 mm \varnothing 0.130 in
	CN-73-C2	Length: 2 m 6.562 ft	
	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 Cable outer diameter: \varnothing 3.3 mm \varnothing 0.130 in Connectable to a main cable up to 15 cables.
	CN-71-C2	Length: 2 m 6.562 ft	
	CN-71-C5	Length: 5 m 16.404 ft	

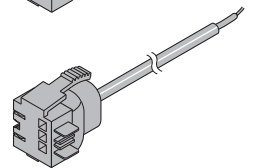
Main cable

- **CN-73-C□**



Sub cable

- **CN-71-C□**

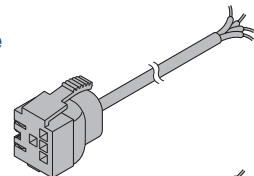


For FX-502(P) Quick-connection cable is not supplied with the amplifier. Please order it separately.

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 Cable outer diameter: \varnothing 3.3 mm \varnothing 0.130 in
	CN-74-C2	Length: 2 m 6.562 ft	
	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 Cable outer diameter: \varnothing 3.3 mm \varnothing 0.130 in Connectable to a main cable up to 15 cables.
	CN-72-C2	Length: 2 m 6.562 ft	
	CN-72-C5	Length: 5 m 16.404 ft	

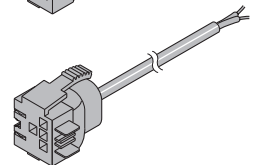
Main cable

- **CN-74-C□**



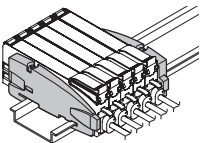
Sub cable

- **CN-72-C□**



End plates

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

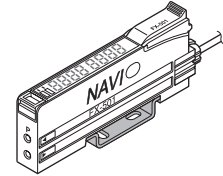
Appearance	Model No.	Description
	MS-DIN-E	When amplifiers are mounted in cascade, or when an amplifier moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when cascading multiple amplifiers together. Two pcs.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

OPTIONS

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

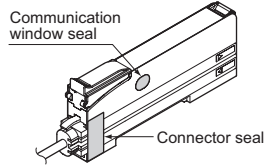
Amplifier mounting bracket

- MS-DIN-2



Accessory

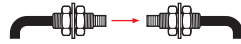
- **FX-MB1** (Amplifier protection seal)
10 sets of 2 communication window seals and 1 connector seal



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	U-LG LONG FAST H-SP						
Threaded	M3	Tough FT-30	R2 Bending durability	2 m	STD 400 15.748 HYPR 1,350 53.150	810 31.890 650 25.591 210 8.268 75 2.953	0.5	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	1					
Cylindrical	∅1.5	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	0.5					
	∅3	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	1					

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	U-LG LONG FAST H-SP						
Threaded	M3	Tough FD-30	R2 Bending durability	2 m	STD 160 6.299 HYPR 600 23.622	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			STD 520 20.472 HYPR 1,550 61.024	900 35.433 740 29.134 260 10.236 90 3.543						P.60
	M6	Tough FD-60	R4 Bending durability		STD 160 6.299 HYPR 600 23.622	330 12.992 250 9.843 80 3.150 25 0.984						
Cylindrical	∅3	Tough FD-S30										

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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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	U-LG LONG FAST H-SP									
Threaded	M3	Tough FT-31	R2 Bending durability	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	ø0.5	150 µm / ±2°	IP67	-55 to +80 °C	P.51				
		FT-31W	R1		STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087									
	M4	Lens mountable	FT-43	R4 Bending durability	2 m	STD 1,400 55.118 HYPR (Note 2) 3,600 141.732	2,800 110.236 2,100 82.677 770 30.315 240 9.449	ø1.5	150 µm / ±2°	IP67		-55 to +80 °C			
		Lens mountable	Tough FT-42	R1		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								
		Lens mountable	FT-42W			R1	STD 800 31.496 HYPR 3,300 129.921				1,900 74.803 1,400 55.118 490 19.291 160 6.299				
		Lens mountable, Stainless-jacketed	FT-45X	R4			STD 1,200 47.244 HYPR (Note 2) 1,600 62.992				1,600 62.992 (Note 2) 1,600 62.992 (Note 2) 630 24.803 200 7.874		ø1	150 µm / ±2°	IP67
		Lens mountable	Tough FT-R40	R4		STD 930 36.614 HYPR (Note 2) 3,600 141.732	1,750 68.898 1,500 59.055 500 19.685 160 6.299				ø10				
		With expansion lens	Tough FT-140	Bending durability		STD (Note 2) 19,600 771.654 HYPR (Note 2) 19,600 771.654	19,600 771.654 (Note 2) 19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031						ø10	—	IP67
	Long range														

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.

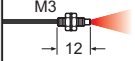
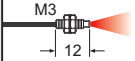
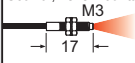
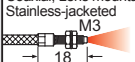
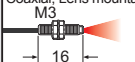



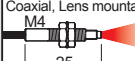

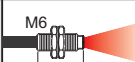
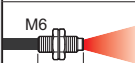
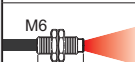
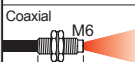
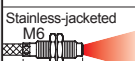
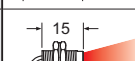
Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

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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	U-LG LONG FAST H-SP					
M3		Tough FD-31	R2 Bending durability	2 m	STD 125 4.921 HYPR 80 3.150 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 μm / ±3°	IP67	-55 to +80 °C	P.59	
		FD-31W	R1		STD 180 7.087 HYPR 140 5.512 45 1.772 12 0.472	180 7.087 140 5.512 45 1.772 12 0.472	—				-40 to +60 °C
		Tough FD-32G	R2 Bending durability	1 m (Note 3)	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	P.61	
		FD-32GX	R2		STD 200 7.874 HYPR 630 24.803	410 16.142 360 14.173 100 3.937 30 1.181	—				-40 to +70 °C
		FD-EG30	R4	500 mm	STD 48 1.890 HYPR 170 6.693	130 5.118 110 4.331 30 1.181 9 0.354	—	IP40	-40 to +70 °C	P.62	
		FD-EG31			STD 20 0.787 HYPR 85 3.346	45 1.772 35 1.378 12 0.472 3.5 0.138	—				-20 to +60 °C
	M4		Tough FD-41	R2 Bending durability	2 m	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
			FD-41W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—			
			Tough FD-42G	R2 Bending durability	2 m	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	P.60
			FD-42GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984	—			
		FD-62	R4 Bending durability	2 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°	IP67	-55 to +80 °C	P.60	
	Tough FD-61	R4	STD 450 17.717 HYPR 1,400 55.118		840 33.071 670 26.378 200 7.874 70 2.756	—	-40 to +60 °C				
	FD-61W	R1	2 m	STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772	—	IP40	-40 to +60 °C	P.61		
	Tough FD-61G	R4 Bending durability		STD 420 16.535 HYPR 1,100 43.307	800 31.496 650 25.591 200 7.874 60 2.362	—				-55 to +80 °C	
	FD-64X	R4	1 m	STD 280 11.024 HYPR 670 26.378	500 19.685 410 16.142 160 6.299 50 1.969	—	IP67	-55 to +80 °C	P.66		
	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°					

- 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.

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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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 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		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 	Cable-protection type Compatible with lens FT-R44Y	Tough NEW		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	ø1	IP67 (Note 3)		-55 to +80 °C	P.55
		Full-protection type FT-R60Y	Tough NEW		STD 720 28.346 HYPR (Note2) 3,600 141.732	1,600 62.992 1,100 43.307 430 16.929 130 5.118						

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	IP40	-55 to +80 °C	P.66
		FD-R32EG	R4		STD 45 1.772 HYPR 170 6.693	110 4.331 92 3.622 30 1.181 9 0.354				
	M4 	FD-R34EG	R4		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	
		FD-R33EG			STD 19 0.748 HYPR 84 3.307	44 1.732 33 1.299 11 0.433 3 0.118				
	M6 	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	—	IP67 (Note 3)	-55 to +80 °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 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 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	U-LG FAST LONG H-SP						
Cylindrical	ø1	Tough FT-S11	R2	500 mm	STD 90 3.543 HYPR 350 13.780	210 8.268 160 6.299 60 2.362 19 0.748	ø0.25	—	IP67	-55 to +80 °C	P.55	
	ø1.5	Tough FT-S21	R1	2 m	STD 315 12.402 HYPR 1,350 53.150	770 30.315 550 21.654 210 8.268 70 2.756	ø0.5	150 µm / ±2° 150 µm / ±3°				
		FT-S21W			STD 260 10.236 HYPR 990 38.976	590 23.228 440 17.323 150 5.906 53 2.087						
	ø2.5	With lens, Long sensing range ø2.5 FT-S32	R10	R1	2 m	STD 3,100 122.047 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,800 70.866 600 23.622	ø2	—	IP40		-40 to +70 °C
	ø3	FT-S31W	STD 800 31.496 HYPR 3,300 129.921			1,900 74.803 1,400 55.118 490 19.291 160 6.299						
	Ultra-small diameter	ø0.3	Narrow beam ø0.125mm Sleeve part cannot be bent. FT-E13	R2	1 m	STD 15 0.591 HYPR 52 2.047	30 1.181 24 0.945 8 0.315 2 0.079	ø0.125	—	IP67		-40 to +70 °C
Narrow beam ø0.25mm Sleeve part cannot be bent. FT-E23			STD 75 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512								
Side-view	ø4	Tough FT-V40	R4	2 m	STD 3,500 137.795 HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,400 94.488 850 33.465	ø2.5	—	IP50	-40 to +60 °C	P.56	

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 Free-cut	Sensing range (mm in) (Note 1, 2)		Beam axis position / Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG FAST LONG H-SP					
Cylindrical	ø1.5	Tough FD-S21	R2	1 m	STD 80 3.150 HYPR 190 7.480	130 5.118 110 4.331 37 1.457 11 0.433	—	IP40	-55 to +80 °C	P.66	
	ø3	Tough FD-S32	R4	2 m	STD 420 16.535 HYPR 1,200 47.244	790 31.102 660 25.984 220 8.661 75 2.953	150 µm / ±3°				
		FD-S32W	R1		STD 270 10.630 HYPR 900 35.433	630 24.803 430 16.929 150 5.906 45 1.772					
	ø3	Tough FD-S31	R2	2 m	STD 125 4.921 HYPR 515 20.276	290 11.417 220 8.661 80 3.150 25 0.984	150 µm / ±3°	IP67	-40 to +60 °C	-55 to +80 °C	P.67
		Coaxial FD-S33GW	R1		STD 150 5.906 HYPR 670 26.378	340 13.386 280 11.024 90 3.543 25 0.984					
	ø5.5	Metal-free FD-S60Y	Tough NEW	R4	2 m (Note 4)	STD 320 12.598 HYPR 600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	—	IP68G	-40 to +70 °C	
Ultra-small diameter	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	-40 to +70 °C	P.61
		ø3 ø0.63 Sleeve part cannot be bent. FD-E23			STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354					

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.

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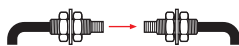
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LIST OF FIBERS

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 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 ø1.48 12	Tough FT-42S	R4 Bending durability (Note 3)		STD 1,130 44.488 HYPR 3,600 141.732	2,050 80.709 1,600 62.992 530 20.866 190 7.480	ø1				
Cylindrical	Ultra-small diameter ø3 Narrow beam ø0.125mm Sleeve part cannot be bent. ø0.25 ø3 15 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	IP67	-40 to +70 °C	P.52	
		Tough FT-E23	R4 Bending durability		STD 175 2.953 HYPR 270 10.630	160 6.299 125 4.921 42 1.654 13 0.512	ø0.25				
	Side-view ø2	Sleeve part cannot be bent. ø1 ø2 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
			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			
	Side-view ø2.5	Sleeve part cannot be bent. ø1.5 ø2.5 15 15	Tough FT-V24W	R1	2 m	STD 110 4.331 HYPR 380 14.961	230 9.055 200 7.874 60 2.362 20 0.787	ø0.5	IP30	-40 to +60 °C	P.56
			Tough FT-V30	R4 Bending durability		STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	ø1.0			
Side-view ø2.5	Sleeve part cannot be bent. ø1.5 ø2.5 20 15	Tough FT-V30	R4 Bending durability	2 m	STD 680 26.772 HYPR 2,200 86.614	1,200 47.244 1,000 39.370 340 13.386 100 3.937	ø1.0	IP30	-55 to +80 °C	P.56	

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	M3 Sleeve 15 mm 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 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	
		Tough FD-41SW	R1 (Note 3)		STD 80 3.150 HYPR 330 12.992	180 7.087 140 5.512 45 1.772 12 0.472				
	M6 Sleeve 40 mm 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	IP67	-55 to +80 °C	P.60	
Cylindrical	Ultra-small diameter ø1.5 ø0.48 15 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	
		FD-E23	R4		STD 55 2.165 HYPR 170 6.693	120 4.724 80 3.150 30 1.181 9 0.354				
	Side-view ø3	Small diameter ø3 ø0.63 15 15 Sleeve part cannot be bent.	Tough FD-V30	R2 Bending durability	2 m	STD 65 2.559 HYPR 240 9.449	130 5.118 120 4.724 35 1.378 14 0.551	IP30	-55 to +80 °C	P.67
			Tough FD-V30W	R1		STD 20 0.787 HYPR 80 3.150	40 1.575 30 1.181 10 0.394 2 0.079			
	Side-view ø5	Sleeve part cannot be bent. ø5 ø2 15 20	Tough FD-V50	R4 Bending durability	2 m	STD 120 4.724 HYPR 370 14.567	220 8.661 210 8.268 75 2.953 25 0.984	IP30	-55 to +80 °C	P.68

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.

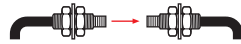
Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

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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 3,500 137.795	3,600 141.732 (Note 2)	2 × 3	IP40	-40 to +60 °C	P.57
	Top sensing W3 × H8 × D12	FT-Z30HW	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,600 102.362 810 31.890				
	Side sensing W3 × H12 × D8	Tough FT-Z30E	R2 Bending durability		STD 3,500 137.795	3,600 141.732 (Note 2)				
	Side sensing W3 × H12 × D8	FT-Z30EW	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,400 94.488 740 29.134				
	Front sensing W8.5 × H12 × D3	Tough FT-Z30	R2 Bending durability		STD 2,100 82.677	3,600 141.732 (Note 2)				
	Front sensing W8.5 × H12 × D3	FT-Z30W			HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 1,200 47.244 410 16.142				
	Front sensing W10 × H7 × D2	FT-Z20W			STD 620 24.409	1,500 59.055 1,100 43.307 420 16.535 130 5.118				
	Fiber bending type W2 × H10 × D10	FT-Z20HBW	R1		HYPR (Note 2) 1,600 62.992	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	3,300 129.921 2,300 90.551 900 35.433 290 11.417				
	Fiber bending type W3.5 × H14 × D11	FT-Z40HBW			HYPR (Note 2) 3,600 141.732	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.

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	150 5.906 130 5.118	IP40	-40 to +60 °C	P.68
	Fiber bending type W2 × H10 × D10	FD-Z20HBW			HYPR 260 10.236	2 to 45 0.079 to 1.772 5 to 13 0.197 to 0.512			
	Front sensing W14 × H7 × D3.5	FD-Z40W			STD 190 7.480	440 17.323 390 15.354			
	Fiber bending type W3.5 × H14 × D11	FD-Z40HBW			HYPR 790 31.102	1 to 120 0.039 to 4.724 2 to 35 0.079 to 1.378			
				☒ : 2 m	STD 260 10.236	540 21.260 470 18.504	IP67		
					HYPR 760 29.921	1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969	IP67		

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.

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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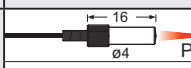
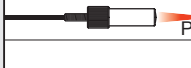

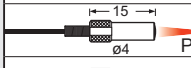
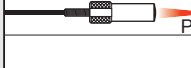

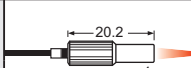
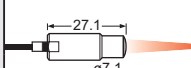
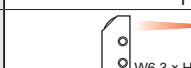
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Small spot

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		0.1 0.004	7 ±0.5 0.276 ±0.020	FX-MR6	-20 to +60 °C	FD-EG31	500 mm	R4	IP40	-20 to +60 °C	P.62				
		0.2 0.008				FD-EG30				-40 to +70 °C		P.61			
		0.4 0.016				Tough FD-42G	2 m	R2 Bending durability		-55 to +80 °C	P.60				
						FD-42GW		R1		-40 to +60 °C					
						Tough FD-32G	1 m	R2 Bending durability		-55 to +80 °C	P.59				
						FD-32GX		R2		-55 to +80 °C					
	Finest spot lens					0.15 0.006	7.5 ±0.5 0.295 ±0.020	FX-MR3		-40 to +70 °C	FD-EG31	500 mm	R4	-20 to +60 °C	P.62
						0.3 0.012					FD-EG30			-40 to +70 °C	
						0.5 0.020					Tough FD-42G	2 m	R2 Bending durability	-55 to +80 °C	P.60
											FD-42GW		R1	-40 to +60 °C	
Tough FD-32G			1 m	R2 Bending durability	-55 to +80 °C				P.59						
FD-32GX				R2	-55 to +80 °C										
Pinpoint spot lens			0.5 0.020	6 ±1 0.236 ±0.039	FX-MR1	-40 to +70 °C			Tough FD-42G		2 m	R2 Bending durability	-55 to +80 °C	P.60	
									FD-42GW			R1	-40 to +60 °C		
Zoom lens		0.7 to 2.0 0.028 to 0.079	18.5 to 43 approx. 0.728 to 1.693 approx.	FX-MR2	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability	-55 to +80 °C	P.60					
						FD-42GW		R1	-40 to +60 °C						
Zoom lens (Side-view type)		0.5 to 3.0 0.020 to 0.118	13 to 30 approx. 0.512 to 1.181 approx.	FX-MR5	-40 to +70 °C	Tough FD-42G	2 m	R2 Bending durability	-55 to +80 °C	P.60					
						FD-42GW		R1	-40 to +60 °C						

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

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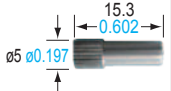










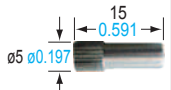
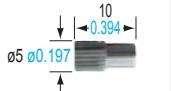
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Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm R0.394 in, reciprocating bending: 180°) and more flexible (bending radius: R4 mm R0.157 in or less) features.

LIST OF FIBERS

Small spot

Square head type M3, reflective type fiber & spot lens

Type	Spot diameter (mm in) (Note)	Distance to focal point (mm in) (Note)	Lens		Fiber		
			Shape (mm in) Dimensions	Model No.	Shape	Emitting fiber core (mm in)	Model No.
Finest spot lens	ø0.1 ø0.004 approx.	7 ±0.5 0.276 ±0.020		FX-MR7		ø0.125 ø0.005	FD-R33EG
	ø0.15 ø0.006 approx.					ø0.125 ø0.005	FD-EG31
	ø0.2 ø0.008 approx.					ø0.175 ø0.007	FD-R34EG
	ø0.4 ø0.016 approx.					ø0.25 ø0.010	FD-R32EG
		ø0.25 ø0.010	FD-EG30				
		ø0.5 ø0.020	FD-R31G				
		ø0.5 ø0.020	FD-32G				
		ø0.5 ø0.020	FD-32GX				
		ø0.5 ø0.020	FD-42G				
						ø0.5 ø0.020	FD-42GW
Type	Spot diameter (mm in) (Note)	Sensing range (mm in) (Note)	Lens		Applicable fibers		
			Shape (mm in)	Model No.	Emitting fiber core (mm in)	Model No.	
Zoom lens	ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to 1.181		FX-MR8	ø0.125 ø0.005	FD-R33EG, FD-EG31	
	ø0.4 to ø2.2 ø0.016 to ø0.087 approx.				ø0.175 ø0.007	FD-R34EG	
	ø0.5 to ø2.5 ø0.020 to ø0.098 approx.				ø0.25 ø0.010	FD-R32EG, FD-EG30	
	ø0.8 to ø3.5 ø0.031 to ø0.138 approx.				ø0.5 ø0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW	
Parallel light lens	ø4.0 ø0.157 approx.	0 to 30 0 to 1.181		FX-MR9	ø0.125 ø0.005	FD-R33EG, FD-EG31	
					ø0.175 ø0.007	FD-R34EG	
					ø0.25 ø0.010	FD-R32EG, FD-EG30	
					ø0.5 ø0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW	

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

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Narrow beam

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)	Inclination of beam axis	Protection	Ambient temp.	Dimensions	
					FX-500 series	U-LG LONG FAST H-SP						
Narrow beam Side-view	Aperture angle 2° 	Tough FT-KS40	R2	2 m	STD	3,600 141.732	3,600 141.732 (Note 2)	ø2.2	—	IP40	-40 to +60 °C	P.54
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
					STD	3,600 141.732	3,600 141.732 (Note 2)					
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
	Aperture angle 2° 	Tough FT-KV40	R1	2 m	STD	3,600 141.732	3,600 141.732 (Note 2)					
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
					STD	3,600 141.732	3,600 141.732 (Note 2)					
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
	Aperture angle 2° 	Tough FT-KV40W	R1	2 m	STD	3,600 141.732	3,600 141.732 (Note 2)					
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
					STD	3,600 141.732	3,600 141.732 (Note 2)					
					HYPR	3,600 141.732	3,600 141.732 (Note 2)					
Aperture angle 3° 1.5 × 2 	Tough FT-KV26	R2	2 m	STD	710 27.953	1,600 62.992						
				HYPR	2,500 98.425	1,200 47.244						
				STD	710 27.953	1,200 47.244						
				HYPR	2,500 98.425	440 17.323						

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.

Retroreflective 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			
With polarizing filter	W5.2 × H9.5 × D16 	FR-Z50HW	R1	2 m	STD 100 to 990 3.937 to 38.976	100 to 1,400 3.937 to 55.118	IP40	-25 to +55 °C	P.58
					HYPR 100 to 1,900 3.937 to 74.803	100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291			
Wafer mapping	W7.5 × H2.2 × D11.2 	Tough FR-KZ22E	R2	2 m	STD 15 to 310 0.591 to 12.205	15 to 460 0.591 to 18.110	IP30	-40 to +60 °C	
					HYPR 15 to 570 0.591 to 22.441	15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937			
Narrow beam Top sensing	W5.2 × H9.5 × D21 	Tough FR-KZ50H	R2	2 m	STD	20 to 300 0.787 to 11.811	IP30	-40 to +60 °C	
	Side sensing	W9.5 × H25 × D5.2 			Tough FR-KZ50E	HYPR			

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 the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. Refer to p.90 for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).

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			
Long range	W5.2 × H9.5 × D16 	FD-Z50HW	R1	2 m	STD 10 to 650 0.394 to 25.591	10 to 1,100 0.394 to 43.307	IP40	-40 to +60 °C	P.68
					HYPR 10 to 2,500 0.394 to 98.425	10 to 1,000 0.394 to 39.370 10 to 410 0.394 to 16.142 15 to 130 0.591 to 5.118			

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.

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

Wide beam

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				
Wide beam		Tough FT-A32	R2 Bending durability	✂️ 2 m	STD (Note 2) 3,600 141.732	3,600 141.732 (Note 2)	3.2 x 32	IP40	-40 to +60 °C	P.52
	Allows flexible wiring	FT-A32W	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,100 82.677				
		Tough FT-A11	R2 Bending durability		STD (Note 2) 3,600 141.732	3,600 141.732 (Note 2)				
	Allows flexible wiring	FT-A11W	R1		HYPR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 3,000 118.110				
Array		Tough FT-AL05	R2 Bending durability		STD 860 33.858	1,550 61.024 1,500 59.055 500 19.685	0.25 x 5.5		-55 to +80 °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 fiber cable length practically limits the sensing range.

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			
Wide beam		Tough FD-A16	R4 Bending durability	✂️ 2 m	STD 200 7.874	200 7.874	IP40	-40 to +60 °C	P.61
					HYPR Cannot use	140 5.512 75 2.953			
Array		Tough FD-AL11	R2 Bending durability		STD 320 12.598	530 20.866 510 20.079		-55 to +80 °C	
					HYPR 670 26.378	180 7.087 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.

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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Convergent reflective 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)		Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Glass substrate detection	 W25 × H7.3 × D30	FD-L32H	R4 Bending durability	4 m	STD 0 to 56 0 to 2.205 HYPR 0 to 110 0 to 4.331	0 to 87 0 to 3.425 0 to 74 0 to 2.913 1 to 38 0.039 to 1.496 Cannot use	IP40	-40 to +60 °C	P.66
	 W20 × H29 × D3.8	Tough FD-L30A	R2 Bending durability	3 m	STD 0 to 43 0 to 1.693 HYPR 0 to 43 0 to 1.693	0 to 43 0 to 1.693 0 to 43 0 to 1.693 0 to 42 0 to 1.654 0 to 29 0 to 1.142		0 to +70 °C	P.65
	 W23.5 × H29 × D4.5	Tough FD-L31A	R4 Bending durability	2 m	STD 4 to 33 0.157 to 1.299 HYPR 3 to 35 0.118 to 1.378	4 to 33 0.157 to 1.299 4 to 33 0.157 to 1.299 4 to 32 0.157 to 1.260 5 to 25 0.197 to 0.984		-20 to +70 °C	
	 W17 × H29 × D3.8	Tough FD-L22A	R2 Bending durability	3 m	STD 0 to 24 0 to 0.945 HYPR 0 to 31 0 to 1.220	0 to 28 0 to 1.102 0 to 27 0 to 1.063 0 to 24 0 to 0.945 0 to 18 0 to 0.709			
	 W18 × H29 × D3.8	Tough FD-L23	Bending durability	3 m	STD 0 to 29 0 to 1.142 HYPR 0 to 30 0 to 1.181	0 to 30 0 to 1.181 0 to 30 0 to 1.181 0 to 28 0 to 1.102 1.5 to 24 0.059 to 0.945			
	 W12 × H19 × D3	Tough FD-L11	R4 Bending durability	2 m	STD 0 to 9.5 0 to 0.374 HYPR 0 to 11.5 0 to 0.453	0 to 10.5 0 to 0.413 0 to 10 0 to 0.394 0 to 9 0 to 0.354 0 to 8 0 to 0.315		-40 to +60 °C	
	 W12 × H19 × D3	Tough FD-L10	Bending durability		STD 0 to 5 0 to 0.197 HYPR 0 to 6 0 to 0.236	0 to 5.5 0 to 0.217 0 to 5.5 0 to 0.217 0 to 4.5 0 to 0.177 0 to 4 0 to 0.157			
	 W24 × H21 × D4	Tough FD-L21	R2 Bending durability	2 m	STD 1.5 to 16 0.059 to 0.630 HYPR 1 to 19 0.039 to 0.748	1 to 18 0.039 to 0.709 1 to 18 0.039 to 0.709 2 to 15 0.079 to 0.591 3 to 12 0.118 to 0.472		-40 to +60 °C	
	 W24 × H21 × D4	FD-L21W	R1		STD 3 to 14 0.118 to 0.551 HYPR 1.5 to 15 0.059 to 0.591	2 to 15 0.079 to 0.591 2 to 15 0.079 to 0.591 4 to 14 0.157 to 0.551 6.5 to 10 0.256 to 0.394			
	General purpose	 W6 × H18 × D14	Tough FD-L20H	R2 Bending durability		STD 23 0.906 HYPR 45 1.772		35 1.378 32 1.260 2 to 15 0.079 to 0.591 5 to 9 0.197 to 0.354	-40 to +70 °C
Ultra-small	 W7.2 × H7.5 × D2	FD-L12W	R1	1 m	STD 8 0.315 HYPR 14 0.551	12.5 0.492 12 0.472 0.5 to 7 0.020 to 0.276 0.5 to 4 0.020 to 0.157	IP30	-40 to +60 °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 transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in (FD-L32H: R edge, FD-L21 and FD-L21W: t2 mm t0.079 in) (FD-L20H: white non-glossy paper, FD-L10: silicon wafers 100 × 100 mm 3.937 × 3.937 in).

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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

Retroreflective type

Retroreflective 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			
With polarizing filters	W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW	R1	2 m	STD 100 to 990 3.937 to 38.976	100 to 1,400 3.937 to 55.118 100 to 1,200 3.937 to 47.244 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	IP40	-25 to +55 °C	P.58
Water mapping	W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5	Tough FR-KZ22E	R2		STD 15 to 310 0.591 to 12.205	15 to 460 0.591 to 18.110 15 to 410 0.591 to 16.142 15 to 220 0.591 to 8.661 15 to 100 0.591 to 3.937	IP30	-40 to +60 °C	
Narrow beam Top sensing	W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough FR-KZ50H	Bending durability		STD 20 to 300 0.787 to 11.811	20 to 800 0.787 to 31.496 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874			
	Side sensing	W9.5 × H25 × D5.2 W28 × H10.6 × D10.1			Tough FR-KZ50E	HYPR 20 to 1,000 0.787 to 39.370			

- 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.
 The sensing range of **FR-KZ22E** is specified for the attached reflector.
 The sensing range of **FR-KZ50E** and **FR-KZ50H** is specified for the attached reflector **RF-003**.
 The sensing range of **FR-Z50HW** is specified for the **RF-13**.
- 2) The sensing range is the possible setting range for the attached reflector.
 The fiber can detect an object less than setting range for the reflector.
 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.

Sensing range when FR-Z50HW is used in combination with a reflector (optional)

Reflector model No.	Sensing range (mm in)						
	FX-500 series						
	HYPR	U-LG	LONG	STD	FAST	H-SP	
RF-230	100 to 19,000 3.937 to 748.030	100 to 8,000 3.937 to 314.960	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118	
RF-220	100 to 8,000 3.937 to 314.960	100 to 4,700 3.937 to 185.039	100 to 3,500 3.937 to 137.795	100 to 3,000 3.937 to 118.110	100 to 1,800 3.937 to 70.866	100 to 830 3.937 to 32.677	
RF-210	100 to 5,500 3.937 to 216.535	100 to 2,700 3.937 to 106.299	100 to 2,400 3.937 to 94.488	100 to 1,500 3.937 to 59.055	100 to 1,200 3.937 to 47.244	100 to 530 3.937 to 20.866	

Note: The sensing range is the possible setting range for the reflector. The fiber can detect an object less than 100 mm **3.937 in**. 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.

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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Chemical / oil-resistant

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				
Oil-resistant Square head type	M4 Cable-protection type Compatible with lens W7 × H9.5 × D15.5	Tough NEW FT-R44Y	R4 Bending durability	2 m	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 4)	-55 to +80 °C	P.55
	M6 Full-protection type W10 × H11 × D21.2	Tough NEW FT-R60Y	R4 Bending durability	2 m	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	ø3.5		-55 to +80 °C	
Chemical-resistant Cylindrical type	Flat type Easy mounting • Rectangular head SEMI S2 compliant W7 × H15 × D13 Metal-free	Tough FT-Z802Y	R4 Bending durability	2 m	STD 3,100 122.047 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,900 74.803 470 18.504	ø3.7	IP68G	0 to +60 °C	P.57
	Heat-resistant 115 °C Metal-free	FT-HL80Y	R30 Bending durability	2 m (Note 3)	STD (Note2) 3,600 141.732 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,300 90.551 740 29.134			-40 to +115 °C	P.53
	Metal-free	FT-L80Y			STD (Note2) 3,600 141.732 HYPR (Note2) 3,600 141.732	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 2,800 110.236 920 36.220			-40 to +70 °C	P.54
	Side-view Metal-free	FT-V80Y			STD 1,300 51.181 HYPR (Note2) 3,600 141.732	2,800 110.236 2,200 86.614 800 31.496 240 9.449			ø2.8	P.56

- 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 allowable cutting range is 500 mm 19.685 in from the end that the amplifier inserted.
 4) 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. (mm)	Protection	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP				
Oil-resistant Square head type	M6 Cable-protection type W10 × H11 × D15.5	Tough NEW FD-R61Y	R4 Bending durability	2 m	STD 280 11.024 HYPR 990 38.976	610 24.016 435 17.126 160 6.299 50 1.969	—	IP67 (Note 3)	-55 to +80 °C	P.66
Chemical-resistant Cylindrical type	Metal-free ø5.5 -(16)-	Tough NEW FD-S60Y	R4 Bending durability	2 m (Note 4)	STD 320 12.598 HYPR 600 23.622	590 23.228 420 16.535 200 7.874 75 2.953	—	IP68G	-40 to +70 °C	P.67

- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending on how the fiber is cut.
 2) The sensing range is specified for white, non-glossy paper.
 3) The fiber part is oil-resistant.
 4) The allowable cutting range is 500 mm 19.685 in from the end that is inserted to the amplifier.

- FX-500
- FX-100
- FX-300
- FX-410
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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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Heat-resistant

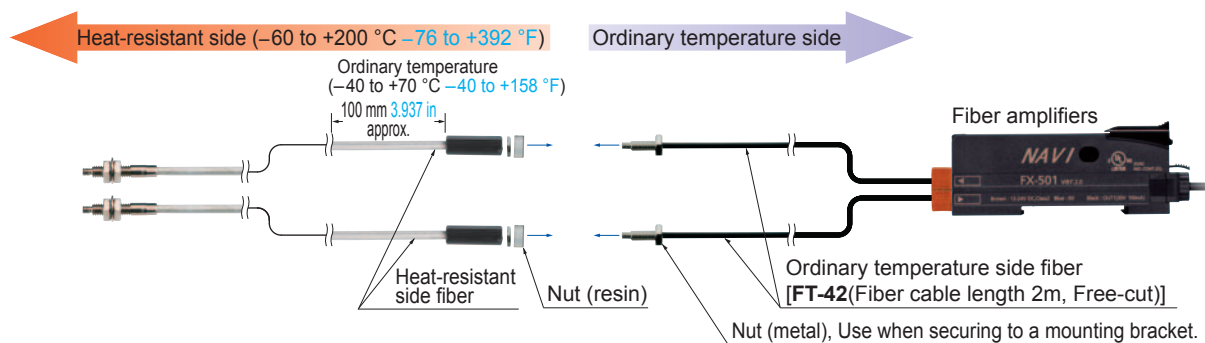
Thru-beam type (one pair set)



Type	Heat-resistant temp.	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)	Ambient temp.	Dimensions		
						FX-500 series	U-LG LONG FAST H-SP					
Heat-resistant	350 °C	Lens mountable (FX-LE1/LE2/SV1) 	FT-H35-M2	R25	2 m	STD 430 16.929	880 34.646 670 26.378 250 9.843 80 3.150	ø1.2	-60 to +350 °C	P.53		
		Sleeve 60 mm 	FT-H35-M2S6	Fiber R25 Sleeve R10		HYPR 1,200 47.244						
	200 °C	Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) 	FT-H20W-M1	R10	1 m	STD 470 18.504 HYPR (Note 2) 1,600 62.992	1,000 39.370 840 33.071 300 11.811 90 3.543	ø0.8	-60 to +200 °C			
		Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-M1	R25		STD 540 21.260 HYPR (Note 2) 1,600 62.992					1,300 51.181 960 37.795 330 12.992 110 4.331	ø1.2
130 °C	Lens mountable (FX-LE2 only) 	FT-H13-FM2	R25	✂️ 2 m	STD 700 27.559 HYPR 1,300 129.921	1,900 74.803 1,300 51.181 410 16.142 140 5.512	ø1.5	-60 to +130 °C	P.52			
Heat-resistant (joint)	200 °C	Lens mountable (FX-LE1/LE2/SV1) 	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	✂️ 200 mm (Note 3)	STD 470 18.504 HYPR 1,600 62.992	1,000 39.370 790 31.102 300 11.811 90 3.543	ø1.2	-60 to +200 °C	P.53		
			FT-H20-J30-S (Note 5)		✂️ 300 mm (Note 3)							
			FT-H20-J50-S (Note 5)		✂️ 500 mm (Note 3)							
		Side-view 	FT-H20-VJ50-S (Note 5)		✂️ 800 mm (Note 3)						STD 600 23.622 HYPR 2,100 82.677	1,300 51.181 980 38.583 390 15.354 120 4.724
			FT-H20-VJ80-S (Note 5)									

- 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) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m 6.562 ft (free-cut).
 4) Bending durable fiber R4 mm R0.157 in or more for ordinary temperature side.
 5) Heat-resistant joint fibers and ordinary-temperature fibers (FT-42) are sold as a set.

Heat-resistant joint fiber set contents



Model No. when ordering individually as spare parts

- Heat-resistant side fiber **one pair set**
FT-H20-J20, FT-H20-J30, FT-H20-J50, FT-H20-VJ50, FT-H20-VJ80
- Ordinary temperature side fiber **one pair set**
FT-42

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Heat-resistant

Reflective type



Type	Heat-resistant temp.	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂️: Free-cut	Sensing range (mm in) (Note 1, 2)		Ambient temp.	Dimensions			
						FX-500 series	U-LG LONG FAST H-SP					
Heat-resistant	350 °C	Coaxial M6 25	FD-H35-M2	R25	2 m	STD 260 10.236	540 21.260 460 18.110	-60 to +350 °C	P.64			
		Sleeve 60 mm M6 ø2.8 22	FD-H35-M2S6	Fiber R25 Sleeve R10		HYPR 720 28.346	150 5.906 45 1.772					
		Sleeve 90 mm M4 ø2.1 27	FD-H35-20S			STD 260 10.236	550 21.654 440 17.323					
		200 °C	Coaxial M6 28	FD-H20-M1	R25	1 m	HYPR 840 33.071			550 21.654 500 19.685 200 7.874 55 2.165	-60 to +200 °C	P.63
			Coaxial M4 27	FD-H20-21			STD 230 9.055			500 19.685 380 14.961 130 5.118 45 1.772		
		130 °C	Coaxial M6 21	FD-H13-FM2	R25	✂️ 2 m	STD 350 13.780			640 25.197 600 23.622 200 7.874 65 2.559	-60 to +130 °C	
	Glass substrate detection convergent reflective	300 °C	W19 × H27 × D5	FD-H30-L32	R25	2 m	STD 17 0.669	30 1.181 25 0.984 12 0.472	-60 to +300 °C	P.64		
			W21 × H33.2 × D5	FD-H25-L43			HYPR 40 1.575	1.5 to 6 0.059 to 0.236				
		250 °C	W21 × H34.5 × D5	FD-H25-L45		3 m	STD 1.5 to 26 0.059 to 1.024	1 to 30 0.039 to 1.181 1 to 28 0.039 to 1.102 1.5 to 24 0.059 to 0.945 2 to 18 0.079 to 0.709	-20 to +250 °C (Ordinary temp. side: -20 to +70 °C)	P.63		
			W21 × H34.5 × D5	FD-H25-L45			HYPR 1 to 31 0.039 to 1.220	4 to 43 0.157 to 1.693 4.5 to 43 0.177 to 1.693 5 to 40 0.197 to 1.575 6.5 to 34 0.256 to 1.339				
180 °C	W19 × H27 × D5	FD-H18-L31	R25	✂️ 2 m	STD 16 0.630	32 1.260 24 0.945 13 0.512	-60 to +180 °C					
		W19 × H27 × D5	FD-H18-L31			HYPR 60 2.362	2 to 6.5 0.079 to 0.256					

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 of reflective type is the value for white non-glossy paper (50 × 50 mm **1.969 × 1.969 in** glass substrate for **FD-H30-L32** and **FD-H18-L31**, transparent glass 100 × 100 × t0.7 mm **3.937 × 3.937 × t0.028 in** for **FD-H25-L43** and **FD-H25-L45**).

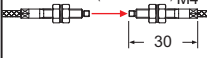
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LIST OF FIBERS

Vacuum-resistant

Thru-beam type (one pair set)

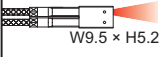
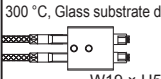


Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)		Beam axis dia. (mm)	Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP			
Vacuum-resistant Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M4 	FT-H30-M1V-S (Note)	R18	1 m	STD 270 10.630 HYPR 1,000 39.370	590 23.228 470 18.504 160 6.299 55 2.165	ø1.2	-30 to +300 °C	P.53

Note: Sold as a set comprising vacuum type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8).

Reflective type

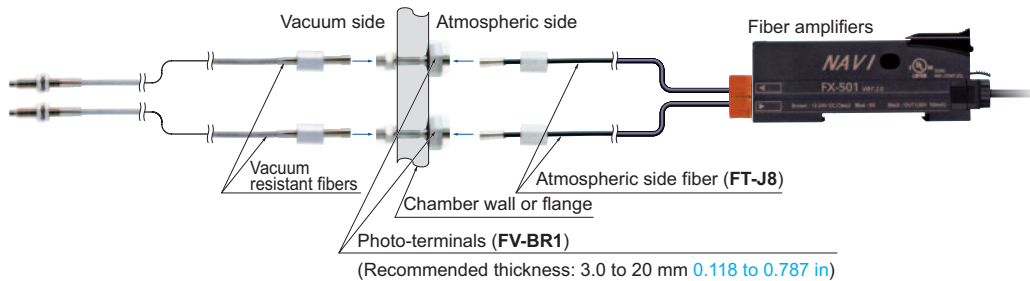


Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in)(Note 2)		Ambient temp.	Dimensions
					FX-500 series	U-LG LONG FAST H-SP		
Vacuum-resistant	300 °C, Rectangular head  W9.5 × H5.2 × D15	FD-H30-KZ1V-S (Note 1)	R18	1 m	STD 20 to 200 0.787 to 7.874 HYPR 5 to 500 0.197 to 19.685	10 to 340 0.394 to 13.386 15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772	-30 to +300 °C	P.64
	300 °C, Glass substrate detection  W19 × H5 × D27	FD-H30-L32V-S (Note 1)		3 m	STD 8 0.315 HYPR 18 0.709	12 0.472 10 0.394 5.5 0.217 1.5 to 3 0.059 to 0.118		

Notes: 1) Sold as a set comprising vacuum type fiber + photo-terminal (FV-BR1) + fiber at atmospheric side (FT-J8).

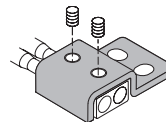
2) The sensing range of reflective type is the value for transparent glass 100 × 100 × t0.7 mm 3.937 × 3.937 × t0.028 in.

Vacuum-resistant fiber set contents



Model No. when ordering individually as spare parts

- Vacuum resistant fiber
FT-H30-M1V (one pair set)
FD-H30-KZ1V
FD-H30-L32V
- Photo-terminal
FV-BR1 (one pair set)
- Atmospheric side fiber
FT-J8 (one pair set)
- Mounting bracket for **FD-H30-KZ1V(-S)**
MS-FD-2



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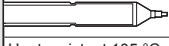
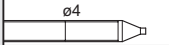
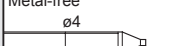
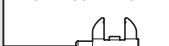


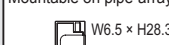

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FX-301-F

LIST OF FIBERS

Liquid leak / Liquid detection

Reflective type / Thru-beam type

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂: Free-cut	Description FX-500 series (STD mode)	Protection	Ambient temp.	Dimensions		
Contact type	Liquid level sensing	Heat resistant 125 °C Fluorine resin coating ø6 	FD-F8Y	Protective tube R40 Fiber R15	✂ 2 m (Note 1)	ø6 mm ø0.236 in Protective tube: Fluorine resin, length 1,000 mm 39.370 in (not cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received	IP68	-40 to +125 °C	P.62	
		Heat resistant 105 °C Fluorine resin coating Metal-free ø4 	FD-HF40Y (Note 2)	Protective tube R20 Fiber R10	✂ 2 m	ø4 mm ø0.157 in Protective tube: Fluorine resin, length 500 mm 19.685 in (cuttable) Liquid surface not contacted: Beam received, Liquid surface contacted: Beam not received	IP68G	-40 to +105 °C	P.64	
		Heat resistant 70 °C Fluorine resin coating throughout the fiber Metal-free ø4 	FD-F41Y (Note 2)							
Pipe-mountable type	Liquid leak detection	SEMI S2 compliant W20 × H30 × D10 	Tough FD-F71	R4 Bending durability	✂ 5 m	Liquid leak detection Leak absent: Beam received, Leak present: Beam interrupted Compatible amplifier: FX500 series only	IP67	-20 to +60 °C		
		Liquid level sensing	Standard W25 × H13 × D20 	FD-F41	R10	✂ 2 m	Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PVC (vinyl chloride), fluorine resin, polycarbonate, acrylic, glass, wall thickness 1 to 3 mm 0.039 to 0.118 in] Liquid absent: Beam received, Liquid present: Beam not received	—	-40 to +100 °C	P.62
			For 1 mm thick PFA pipe W25 × H13 × D20 	FD-F4			Applicable pipe diameter: Outer dia. ø6 to ø26 mm ø0.236 to ø1.024 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in] Liquid absent: Beam received, Liquid present: Beam not received			
Liquid sensing	Mountable on pipe-array fiber W6.5 × H28.3 × D17 	Tough FD-FA93	R4 Bending durability	✂ 2 m	Applicable pipe diameter: Outer dia. ø8 mm ø0.315 in or more transparent pipe (When used with the tying bands: ø8 to ø80 mm ø0.315 to ø3.150 in) [PFA (fluorine resin), including translucent] Liquid absent: Beam received, Liquid present: Beam not received	IP40	-40 to +70 °C	P.52		
	SEMI S2 compliant W23 × H20 × D17 	Tough FT-F93	Protective tube R20 Fiber R2 Bending durability		Applicable pipe diameter: Outer dia. ø3 to ø10 mm ø0.118 to ø0.394 in transparent pipe [PFA (fluorine resin) or equivalently transparent pipe, wall thickness 0.3 to 1 mm 0.012 to 0.039 in] Liquid absent: Beam not received, Liquid present: Beam received Compatible amplifier: FX500 series only					

Notes: 1) The allowable cutting range is 1,000 mm **39.370 in** from the end that the amplifier inserted.
2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available.

Designation	Model No.	Description	
Liquid inflow prevention joint (Note)	MS-FX-01Y	Applicable fibers	FD-HF40Y FD-F41Y
Protective tube extension joint (Note)	MS-FX-02Y		
Fiber mounting joint (Note)	MS-FX-03Y		

Note: The joint internal ferrule (**MS-FX-YF**) is available as a spare part. A distorted ferrule may result in leakage.

Liquid inflow prevention joint

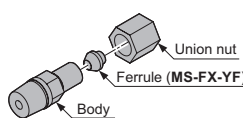
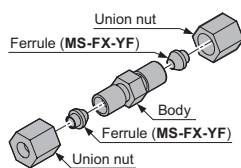
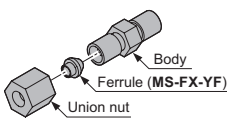
Protective tube extension joint

Fiber mounting joint

• **MS-FX-01Y**

• **MS-FX-02Y**

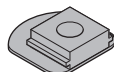
• **MS-FX-03Y**



Accessories for additional supply

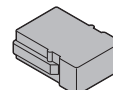
• **MS-FD-F7-1**

(SUS mounting bracket for **FD-F71**)



• **MS-FD-F7-2**

(PVC mounting bracket for **FD-F71**)

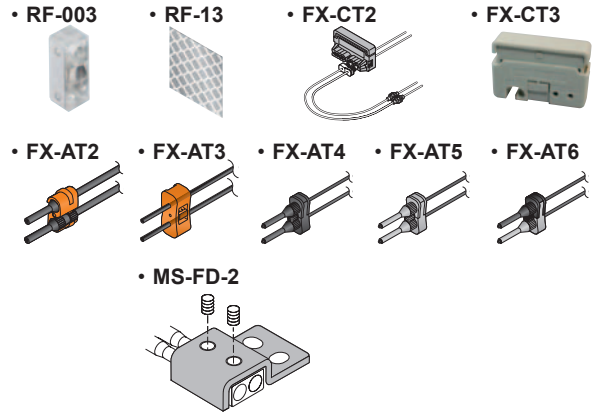


Tough : Refers to a fiber which possesses both unbreakable (bending radius: R10 mm **R0.394 in**, reciprocating bending: 180°) and more flexible (bending radius: R4 mm **R0.157 in** or less) features.

LIST OF FIBERS

Model No. when ordering accessories additionally


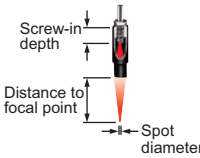

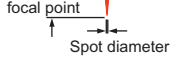
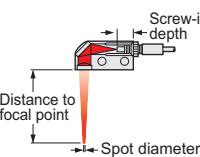
- **RF-003** (Reflector for **FR-KZ50E/KZ50H**)
- **RF-13** (Reflective tape for **FR-Z50HW**)
- **FX-CT2** (Fiber cutter)
- **FX-CT3** (Fiber cutter for **FD-H40Y/F41Y**)
- **FX-AT2** (Attachment for fixed-length fiber, Orange)
- **FX-AT3** (Attachment for $\varnothing 2.2$ mm $\varnothing 0.087$ in fiber, Clear orange)
- **FX-AT4** (Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in fiber, Black)
- **FX-AT5** (Attachment for $\varnothing 1.3$ mm $\varnothing 0.051$ in fiber, Gray)
- **FX-AT6** (Attachment for $\varnothing 1$ mm $\varnothing 0.039$ in / $\varnothing 1.3$ mm $\varnothing 0.051$ in)
(mixed fiber, Black / Gray)
- **MS-FD-2** (Fiber mounting bracket)



FIBER OPTIONS

Refer to p.69~ for details of lens dimensions.

Lens (For reflective type fiber)

Designation	Model No.	Description												
For reflective type fiber	Pinpoint spot lens FX-MR1	 <p>Pinpoint spot of $\varnothing 0.5$ mm $\varnothing 0.020$ in. Enables detection of minute objects or small marks.</p> <ul style="list-style-type: none"> • Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) 												
	Zoom lens FX-MR2	 <p>The spot diameter is adjustable from $\varnothing 0.7$ to $\varnothing 2$ mm $\varnothing 0.028$ to $\varnothing 0.079$ in according to how much the fiber is screwed in.</p> <ul style="list-style-type: none"> • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) • Accessory: MS-EX3 (mounting bracket) <table border="1"> <caption>Sensing range for FX-500 series</caption> <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>$\varnothing 0.7$ mm</td> </tr> <tr> <td>12 mm</td> <td>27 mm approx.</td> <td>$\varnothing 1.2$ mm</td> </tr> <tr> <td>14 mm</td> <td>43 mm approx.</td> <td>$\varnothing 2.0$ mm</td> </tr> </tbody> </table>	Screw-in depth	Distance to focal point	Spot diameter	7 mm	18.5 mm approx.	$\varnothing 0.7$ mm	12 mm	27 mm approx.	$\varnothing 1.2$ mm	14 mm	43 mm approx.	$\varnothing 2.0$ mm
	Screw-in depth	Distance to focal point	Spot diameter											
	7 mm	18.5 mm approx.	$\varnothing 0.7$ mm											
	12 mm	27 mm approx.	$\varnothing 1.2$ mm											
14 mm	43 mm approx.	$\varnothing 2.0$ mm												
Finest spot lens FX-MR3	 <p>Extremely fine spot of $\varnothing 0.15$ mm $\varnothing 0.006$ in approx. achieved.</p> <ul style="list-style-type: none"> • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) <table border="1"> <caption>Sensing range for FX-500 series</caption> <thead> <tr> <th>Fiber model No.</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>FD-EG31</td> <td>7.5 ± 0.5 mm</td> <td>$\varnothing 0.15$ mm approx.</td> </tr> <tr> <td>FD-EG30</td> <td>7.5 ± 0.5 mm</td> <td>$\varnothing 0.3$ mm approx.</td> </tr> <tr> <td>FD-42G/42GW FD-32G/32GX</td> <td>7.5 ± 0.5 mm</td> <td>$\varnothing 0.5$ mm approx.</td> </tr> </tbody> </table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7.5 ± 0.5 mm	$\varnothing 0.15$ mm approx.	FD-EG30	7.5 ± 0.5 mm	$\varnothing 0.3$ mm approx.	FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm	$\varnothing 0.5$ mm approx.	
Fiber model No.	Distance to focal point	Spot diameter												
FD-EG31	7.5 ± 0.5 mm	$\varnothing 0.15$ mm approx.												
FD-EG30	7.5 ± 0.5 mm	$\varnothing 0.3$ mm approx.												
FD-42G/42GW FD-32G/32GX	7.5 ± 0.5 mm	$\varnothing 0.5$ mm approx.												
Finest spot lens FX-MR6	 <p>Extremely fine spot of $\varnothing 0.1$ mm $\varnothing 0.004$ in approx. achieved.</p> <ul style="list-style-type: none"> • Applicable fibers: FD-EG31, FD-EG30, FD-42G, FD-42GW, FD-32G, FD-32GX • Ambient temperature: -20 to $+60$ °C -4 to $+140$ °F (Note) <table border="1"> <caption>Sensing range for FX-500 series</caption> <thead> <tr> <th>Fiber model No.</th> <th>Distance to focal point</th> <th>Spot diameter</th> </tr> </thead> <tbody> <tr> <td>FD-EG31</td> <td>7 ± 0.5 mm</td> <td>$\varnothing 0.1$ mm approx.</td> </tr> <tr> <td>FD-EG30</td> <td>7 ± 0.5 mm</td> <td>$\varnothing 0.2$ mm approx.</td> </tr> <tr> <td>FD-42G/42GW FD-32G/32GX</td> <td>7 ± 0.5 mm</td> <td>$\varnothing 0.4$ mm approx.</td> </tr> </tbody> </table>	Fiber model No.	Distance to focal point	Spot diameter	FD-EG31	7 ± 0.5 mm	$\varnothing 0.1$ mm approx.	FD-EG30	7 ± 0.5 mm	$\varnothing 0.2$ mm approx.	FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm	$\varnothing 0.4$ mm approx.	
Fiber model No.	Distance to focal point	Spot diameter												
FD-EG31	7 ± 0.5 mm	$\varnothing 0.1$ mm approx.												
FD-EG30	7 ± 0.5 mm	$\varnothing 0.2$ mm approx.												
FD-42G/42GW FD-32G/32GX	7 ± 0.5 mm	$\varnothing 0.4$ mm approx.												
Zoom lens (side-view type) FX-MR5	 <p>FX-MR2 is converted into a side-view type and can be mounted in a very small space.</p> <ul style="list-style-type: none"> • Applicable fibers: FD-42G, FD-42GW • Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note) <table border="1"> <caption>Sensing range for FX-500 series</caption> <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>$\varnothing 0.5$ mm</td> </tr> <tr> <td>10 mm</td> <td>15 mm approx.</td> <td>$\varnothing 0.8$ mm</td> </tr> <tr> <td>14 mm</td> <td>30 mm approx.</td> <td>$\varnothing 3.0$ mm</td> </tr> </tbody> </table>	Screw-in depth	Distance to focal point	Spot diameter	8 mm	13 mm approx.	$\varnothing 0.5$ mm	10 mm	15 mm approx.	$\varnothing 0.8$ mm	14 mm	30 mm approx.	$\varnothing 3.0$ mm	
Screw-in depth	Distance to focal point	Spot diameter												
8 mm	13 mm approx.	$\varnothing 0.5$ mm												
10 mm	15 mm approx.	$\varnothing 0.8$ mm												
14 mm	30 mm approx.	$\varnothing 3.0$ mm												

Note: Refer to p.80 or p.85 for the ambient temperature of fibers to be used in combination.

FIBER SENSORS

LASER SENSORS

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MICRO PHOTO-ELECTRIC SENSORS

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FX-100

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FX-410

FX-311

FX-301-F7/

FX-301-F

FIBER OPTIONS

Refer to p.69~ for details of lens dimensions.

Lens (For square head M3 reflective fiber)

Type		Spot diameter (mm in)(Note)	Distance to focal point (mm in)(Note)	Lens		Fiber		
				Shape (mm in)	Model No.	Shape	Emitting fiber core (mm in)	Model No.
For Square head M3 reflective fiber	Finest spot lens	ø0.1 ø0.004 approx.	7 ± 0.5 0.276 ± 0.020	ø5 ø0.197	FX-MR7		ø0.125 ø0.005	FD-R33EG
		ø0.15 ø0.006 approx.				ø0.125 ø0.005	FD-EG31	
		ø0.2 ø0.008 approx.				ø0.175 ø0.007	FD-R34EG	
		ø0.4 ø0.016 approx.				ø0.25 ø0.010	FD-R32EG	
ø0.25 ø0.010	FD-EG30							
ø0.5 ø0.020	FD-R31G							
ø0.5 ø0.020	FD-32G							
						ø0.5 ø0.020	FD-32GX	
						ø0.5 ø0.020	FD-42G	
						ø0.5 ø0.020	FD-42GW	

Type		Spot diameter (mm in)(Note)	Sensing range (mm in)(Note)	Lens		Applicable fibers	
				Shape (mm in)	Model No.	Emitting fiber core (mm in)	Model No.
For Square head M3 reflective fiber	Zoom lens	ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to 1.181	ø5 ø0.197	FX-MR8	ø0.125 ø0.005	FD-R33EG, FD-EG31
		ø0.4 to ø2.2 ø0.016 to ø0.087 approx.				ø0.175 ø0.007	FD-R34EG
		ø0.5 to ø2.5 ø0.020 to ø0.098 approx.				ø0.25 ø0.010	FD-R32EG, FD-EG30
		ø0.8 to ø3.5 ø0.031 to ø0.138 approx.				ø0.5 ø0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW
PLC	Parallel light lens	ø4.0 ø0.157 approx.	0 to 30 0 to 1.181	ø5 ø0.197	FX-MR9	ø0.125 ø0.005	FD-R33EG, FD-EG31
						ø0.175 ø0.007	FD-R34EG
						ø0.25 ø0.010	FD-R32EG, FD-EG30
						ø0.5 ø0.020	FD-R31G, FD-32G, FD-32GX, FD-42G, FD-42GW

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

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FX-301-F