

NEW

With Organic EL Display

Digital Fiber Sensor

FX-250 SERIES

CE

“Ease of use” evolves to the next generation.



Overwhelmingly easy to understand, Organic EL display

The clear, high-visibility flat panel ensures easy operation to reduce setting time and minimize setting errors. It contributes to improved efficiency on the production site.

Character display

The “Readable” setting screen offers improved ease of use.

Large output indicator

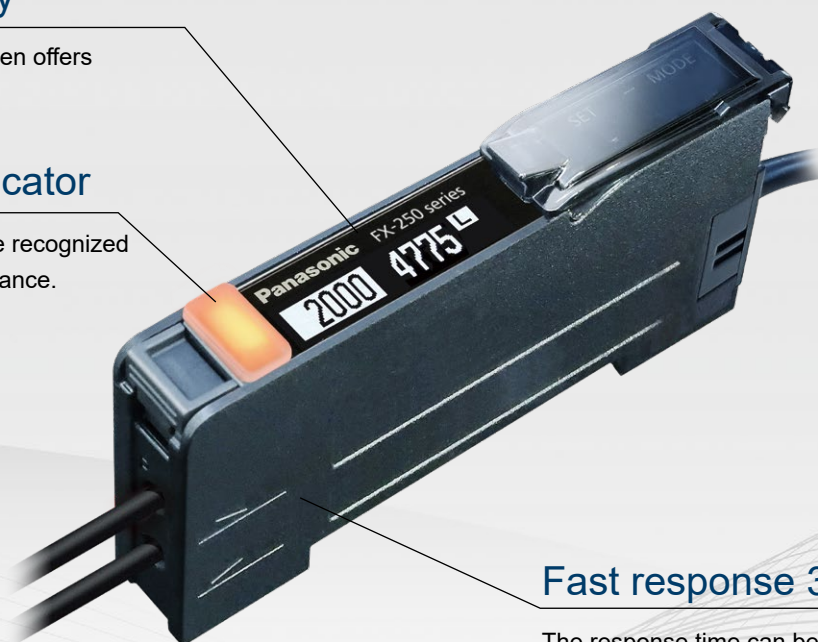
The ON / OFF status can be recognized at a glance even from a distance.



Conventional model



NEW FX-250 series



Fast response 35 μ s

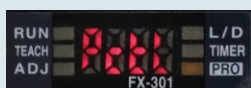
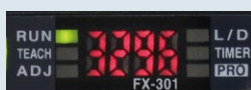
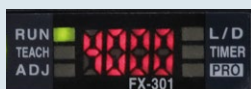
The response time can be selected from five patterns to enable flexible use in a wide range of applications.

Enables intuitive operation without referring to the manual

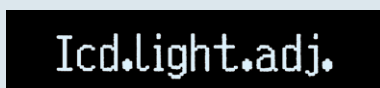
Reduces setting time

Minimizes setting errors

7-segment display



NEW FX-250 series



Improved digital display area

Sufficient incident light intensity is ensured even when a small-diameter fiber is used, thus contributing to stable sensing.

Dual display

The display shows threshold value and incident light intensity simultaneously.

Clear character display for at-a-glance understanding

Information is displayed in the language even first-time users can understand.

Compact body

The compact body can be easily mounted to small equipment and robotic hands with limited installation spaces.

Main unit size

W 10.0 × H 32.0 × D 67.5 mm W 0.394 × H 1.260 × D 2.657 in

NEW

FX-250 series

NEW

FX-250 series

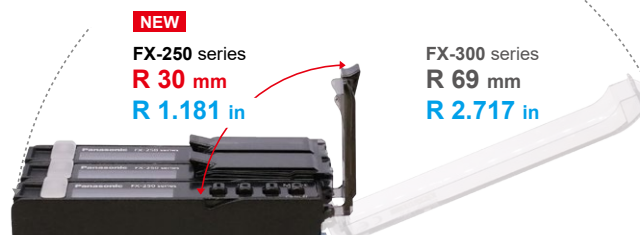
Conventional model

Conventional model



Space required for opening and closing the cover

The small cover requires a minimum space for opening and closing, thus enabling space-saving installation.



New function

Smart limit teaching

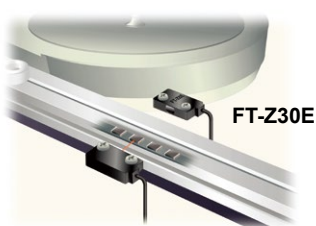
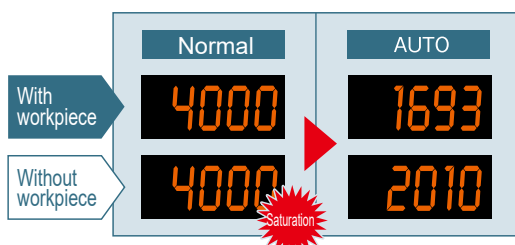
Simultaneous execution of teaching and circumvention of saturation

* Only when limit teaching is used

Teaching is executed only with two pushes of a button, and this also achieves circumvention of saturation simultaneously. There is no need for separate adjustment of the light emission amount, thus contributing to reduction of setting man-hours.

Before

In the event the emitted light was too strong and caused incident light saturation, the light emitting amount had to be adjusted before teaching is performed.



After

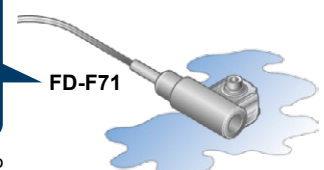
When limit teaching is executed under incident light saturation, circumvention of light saturation and setting of the threshold value is performed simultaneously. This adds extra convenience when using the thru-beam type to detect a very small object or transparent item.



* Only when limit teaching is used

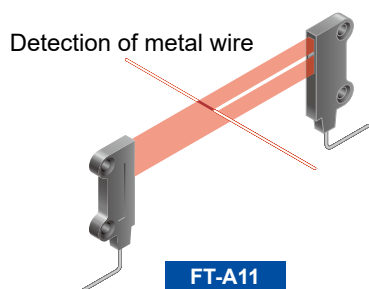
Recommended to use as an amplifier of **FD-F71** as well for liquid leak detection in semiconductor manufacturing machine.

* **FD-F71** receives the beam when there is no liquid present.

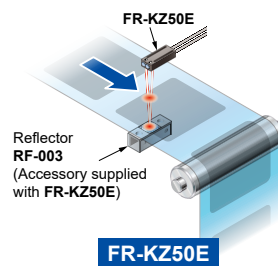


Incident light intensity adjustable in 100 increments

The incident light intensity can be varied in 100 steps to allow flexible and precise adjustment of incident light intensity even when the incident light becomes saturated due to installation in a close distance or during detection of a transparent or very small workpiece, thus realizing stable detection.

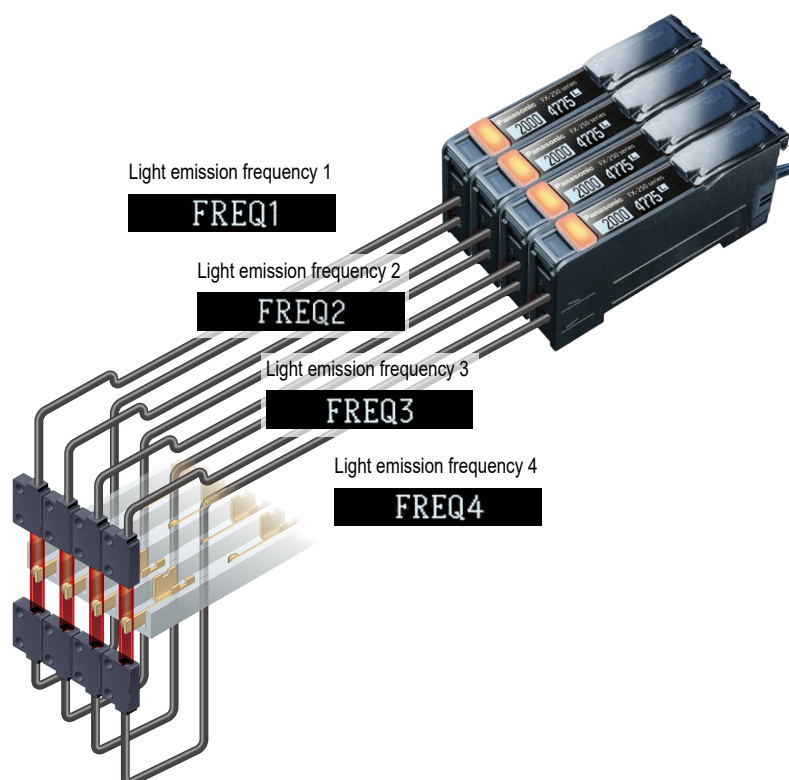


Detection of transparent sticker on transparent sheet



Alternate frequency interference prevention function

In the case the fibers are arranged side by side, mutual interference can be prevented by setting different light emission frequencies (4 settings).



* Response time varies depending on light emission frequencies.

* When the alternate frequency interference prevention function is used, up to four fiber head units can be mounted in contact with each other.

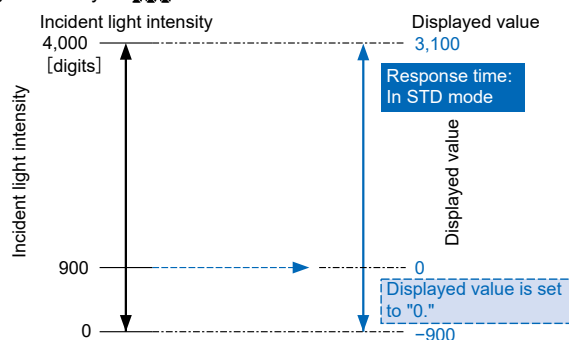
Zero-set function

When a reflective type fiber is used, offsetting the incident light intensity to "0" with no workpiece present enables confirmation of only the change caused by the detected object.

When multiple amplifiers are mounted side by side, all displayed values can be set to "0."

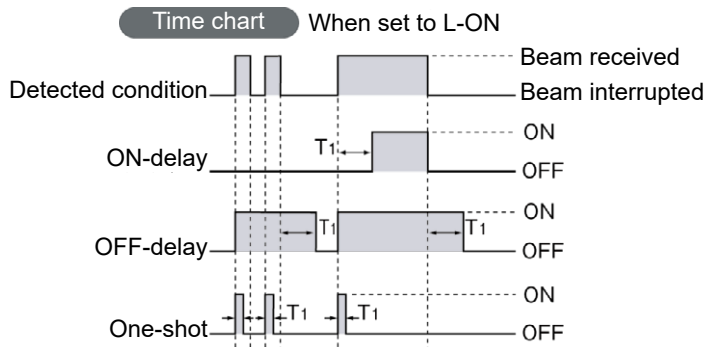


Example 1: Using the zero-set function when displayed incident light intensity is "999"



Equipped with three types of timer function

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



Timer period setting range: 1 to 9,999 ms, in 1-ms increments
(default setting: 1 ms)

Display and indicator can be set to OFF.

Since the digital display and large output indicator can stay turned off during use, the **FX-250** series is suitable for use with equipment that can be affected by light or heat.

Eco OFF (default setting)

The digital display dims when the unit is not operated for about 20 seconds.



Eco ON

The digital display dims when the unit is not operated for about 20 seconds. The digital display turns off when the unit is not operated for about 2 minutes.



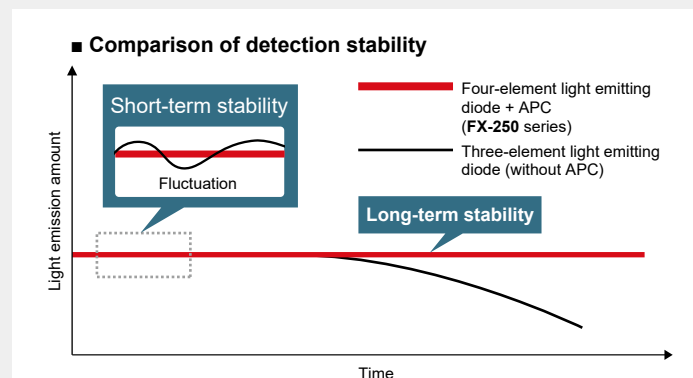
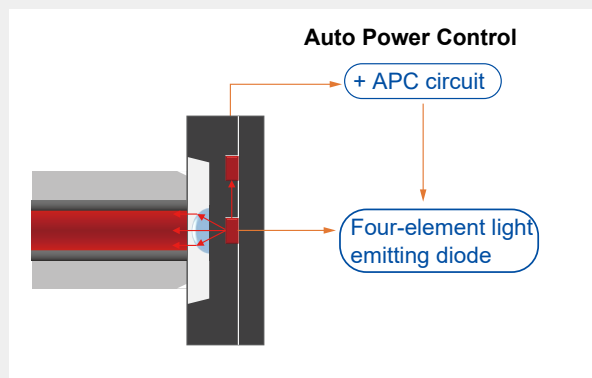
Eco FULL

The digital display dims when the unit is not operated for about 20 seconds. The digital display and output indicator turn off when the unit is not operated for about 2 minutes.



Stable detection over long periods and short periods Stabilization of light emission amount

The built-in APC circuit stabilizes the short-time fluctuation of the light emission amount at the time of power on and the four-element light emitting diode ensures stable emission over long periods.



■ APC circuit

When power is turned on or when the temperature changes, the sensor's light emission amount fluctuates and causes instability of output. To solve this problem, the APC circuit controls the light emission amount to ensure short-term emission stability.

■ Four-element light emitting diode

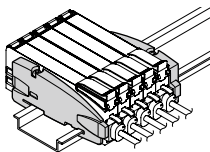
When a conventional LED operates for a long period of time, the LED becomes damaged due to heat or the light intensity decreases due to oxidation. The four-element light emitting diode suppresses degradation of the light emitting element to the maximum extent and ensures long-term emission stability.

ORDER GUIDE

Amplifier

Appearance	Model No.	Emitting element	Output
	FX-251-C2	Red LED	NPN open-collector transistor
	FX-251P-C2		PNP open-collector transistor

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

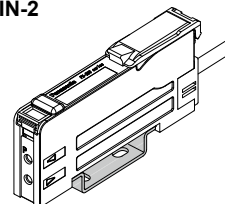
Appearance	Model No.	Description
	MS-DIN-E	When an amplifier moves depending on the way it is installed on a DIN rail, these end plates clamp amplifiers into place on both sides. Make sure to use end plates when connecting multiple amplifiers together. Two pcs. per set

OPTIONS

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

Amplifier mounting bracket

• **MS-DIN-2**



SPECIFICATIONS

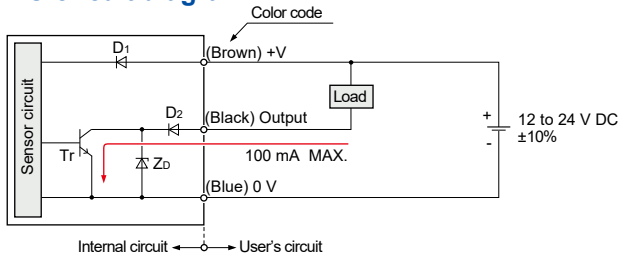
Item	Type	NPN output type	PNP output type
	Model No.	FX-251-C2	FX-251P-C2
Applicable regulations		CE Marking (EMC Directive, RoHS Directive)	
Supply voltage		12 to 24 V DC $\pm 10\%$ Ripple P-P 10% or less	
Power consumption		960 mW or less (current consumption 40 mA or less at 24 V supply voltage)	
Output		NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at maximum sink current)	PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 2 V or less (at maximum source current)
	Output operation	Switchable either Light-ON or Dark-ON	
	Short-circuit protection	Incorporated	
Response time		H-SPD: 35 μ s or less, FAST: 60 μ s or less, STD: 250 μ s or less, LONG: 2 ms or less, H-PWR: 24 ms or less, selectable	
Output indicator		Orange LED turns on when output is ON.	
Sensitivity setting		2-point teaching / Limit teaching / Full-auto teaching / Manual adjustment	
Threshold value adjustment function		Incorporated	
Incident light intensity adjustment function		Incorporated, max. 100 steps	
Incident light intensity display range		H-SPD / FAST / STD: 0 to 4,000, LONG / H-PWR: 0 to 9,999	
Digital display		White organic EL display	
Various settings		Shift amount setting (percentage, fixed value), display style setting, display inversion setting, ECO setting, zero-set function	
Timer function		OFF-delay timer / ON-delay timer / One-shot timer, switchable either effective or ineffective (setting range: 1 to 9,999 ms in 1-ms increments)	
Interference prevention function		Incorporated (4 selectable frequencies) (Note 2)	
Environmental resistance	Protection	IP40 (IEC)	
	Ambient temperature	-10 to +55 °C +14 to +131 °F (If 4 to 7 units close mounting: -10 to +50 °C +14 to +122 °F or if 8 to 16 units close mounting: -10 to +45 °C +14 to +113 °F) (No dew condensation or icing allowed), Storage: -20 to +70 °C -4 to +158 °F	
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
	Ambient illuminance	Incandescent light: 10,000 lx or less at the light-receiving face	
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure (Note 3)	
	Insulation resistance	20 M Ω or more, with 250 V DC megger between all supply terminals connected together and enclosure (Note 3)	
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm 0.030 in double amplitude (100 m/s ² max.) in X, Y and Z directions for two hours each (without power supply)	
	Shock resistance	98 m/s ² acceleration (10 G approx.) in X, Y and Z directions five times each (without power supply)	
Emitting element (modulation type)		Red LED (Peak emission wavelength: 660 nm 0.026 mil)	
Material		Enclosure, cover, switch: Polycarbonate	
Cable		0.2 mm ² 3-core cabtyre cable, 2 m 6.562 ft long	
Cable extension		Extension up to total 100 m 328.084 ft is possible with 0.3 mm ² , or more, cable. (however, supply voltage 24 V DC or more)	
Weight		Net weight: 55 g approx., Gross weight: 80 g approx.	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C **+73.4 °F**.
2) When the interference prevention function is used, set different light emission frequencies in the amplifiers for interference prevention.
3) The indicated voltage withstandability and insulation resistance values apply to the amplifier unit.

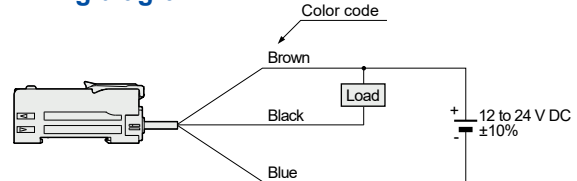
I/O CIRCUIT AND WIRING DIAGRAMS

FX-251-C2

I/O circuit diagram



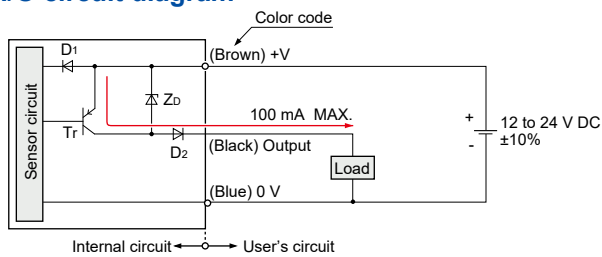
Wiring diagram



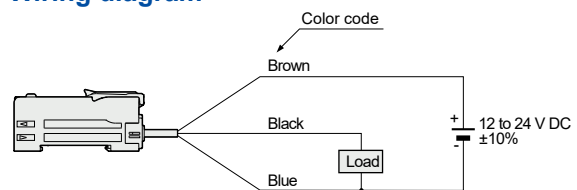
Symbols...D₁: Reverse supply polarity protection diode
D₂: Reverse output polarity protection diode
Z₀: Surge absorption zener diode
T_r: NPN output transistor

FX-251P-C2

I/O circuit diagram



Wiring diagram



Symbols...D₁: Reverse supply polarity protection diode
D₂: Reverse output polarity protection diode
Z₀: Surge absorption zener diode
T_r: PNP output transistor

PRECAUTIONS FOR PROPER USE

- This catalog is a guide to select a suitable product. Be sure to read installation instruction of the product prior to its use.



- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Wiring

- Make sure that the power supply is OFF while adding or removing the amplifiers.
- Note that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the product may get burnt or damaged.
- Note that short-circuit of the load or wrong wiring may burn or damage the product.
- Do not run the wires together with high-voltage lines or power lines, or put them in the same raceway. This can cause malfunction due to induction.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.

Refer to the installation instructions for details.

The installation instructions data can be downloaded from our website.

Others

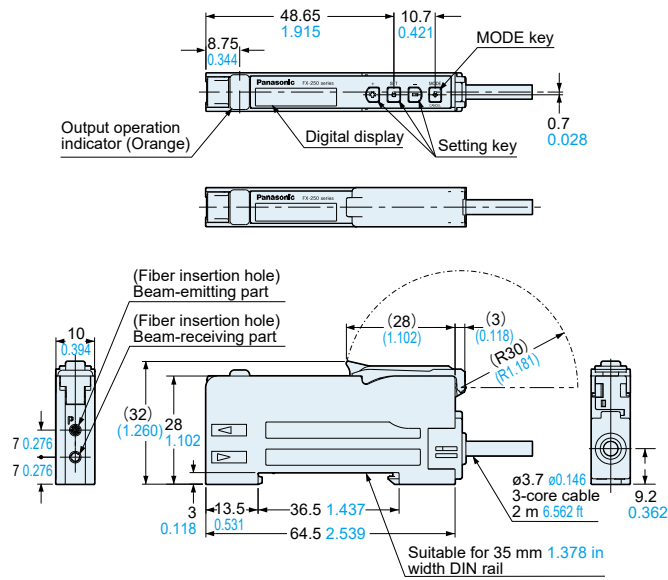
- This product has been developed / produced for industrial use only.
- The specification may not be satisfied in a strong magnetic field.
- Do not use during the initial transient time (the following time) after the power supply is switched ON.
H-SPD, FAST, STD: 0.5 sec., LONG, H-PWR: 1 sec.
- These sensors are only for indoor use.
- Avoid dust, dirt, and steam.
- Make sure that the product does not come in contact with oil, grease, organic solvents such as thinner, etc., strong acid or alkaline.
- This product cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify this product.
- This product adopts EEPROM. Settings cannot be done a million times or more because of the EEPROM's lifetime.
- The power input must meet the following requirements:
 - Be certified for its region of use
 - Have an output hold time of at least 20 ms
 - Have a rated output voltage of 12 to 24 V DC $\pm 10\%$ ripple P-P 10% or less and a current capacity of 0.5 A or more
 - If CE marking compliance is required, have SELV (Safety Extra Low Voltage)/PELV (Protective Extra Low Voltage) in accordance with the EMC Directive

DIMENSIONS (Unit: mm in)

For the external dimensions of the fibers and fiber options, refer to our website.
The CAD data can be downloaded from our website.

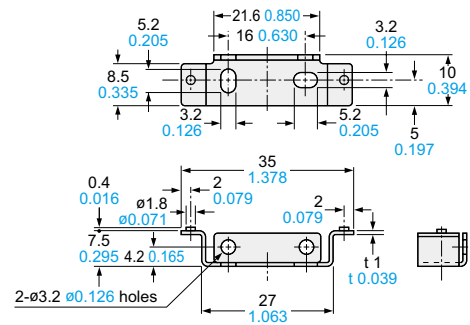
FX-251-C2 FX-251P-C2

Amplifier



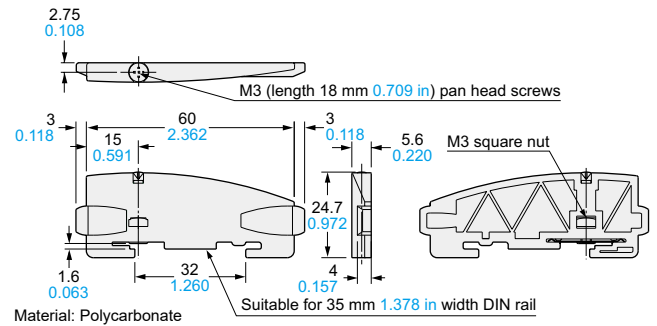
MS-DIN-2

Amplifier mounting bracket (Optional)



MS-DIN-E

End plate (Optional)

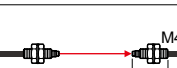
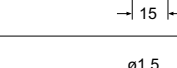
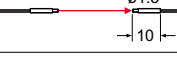
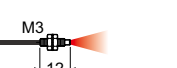
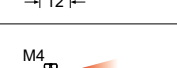
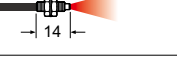
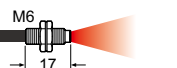


Tough : Refer to a fiber which possesses both unbreakable (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°) and more flexible (bending radius: R4 mm [R0.157 in](#) or less) features.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Super quality type

*Thru-beam type sensors are available as two pieces per set.

Type			Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 2)		Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Optical transmission loss	Protection	Ambient temp.
							FX-250 series	Other modes LONG FAST H-SPD					
Thru-beam	Threaded	M3		Tough Bending durability FT-30	R2	2 m (Note 3)	STD 400 15.748 H-PWR 1,350 53.150	650 25.591 210 8.268 75 2.953	ø0.5	150 μm / ±2°			
		M4		Tough Bending durability FT-40	R4		STD 1,200 47.244 H-PWR (Noise) 3,600 141.732	1,700 66.929 530 20.866 190 7.480	ø1				
	Cylindrical	ø1.5		Tough Bending durability FT-S20	R2		STD 400 15.748 H-PWR 1,350 53.150	650 25.591 210 8.268 75 2.953	ø0.5				
		ø3		Tough Bending durability FT-S30	R4		STD 1,200 47.244 H-PWR (Noise) 3,600 141.732	1,700 66.929 530 20.866 190 7.480	ø1				
Reflective	Threaded	M3		Tough Bending durability FD-30	R2	2 m (Note 3)	STD 160 6.299 H-PWR 600 23.622	250 9.843 80 3.150 25 0.984	—	150 μm / ±3°	±10 %	IP67	-55 to +80 °C
		M4		Tough Bending durability FD-40									
		M6		Tough Bending durability FD-60	R4		STD 520 20.472 H-PWR (Noise) 1,550 61.024	740 29.134 260 10.236 90 3.543					
	Cylindrical	ø3		Tough Bending durability FD-S30				STD 160 6.299 H-PWR 600 23.622					

- Notes: 1) The fiber cable length practically limits the sensing range.
2) The sensing range of reflective type is specified for white non-glossy paper.
3) It is not a free-cut type.

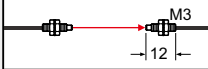
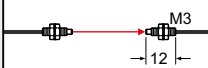
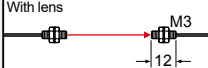
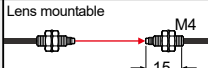
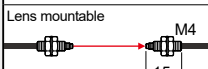
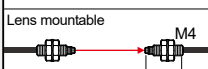
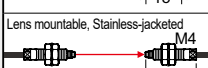
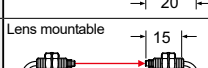
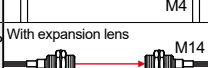
LIST OF FIBERS

Tough : Refer 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.

Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Threaded type

*Thru-beam type sensors are available as two pieces per 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.
						FX-250 series	Other modes	LONG FAST H-SPD				
Thru-beam Threaded	M3		Tough (Bending durability) FT-31	R2	 2 m	STD 315 12.402 H-PWR 1,350 53.150		550 21.654 210 8.268 70 2.756	ø0.5	150 μm / ±2°	IP67	-55 to +80 °C
			FT-31W	R1		STD 260 10.236 H-PWR 990 38.976		440 17.323 150 5.906 53 2.087		150 μm / ±3°		-40 to +60 °C
		With lens 	Tough (Bending durability) FT-32	R2		STD 3,000 118.110 H-PWR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 1,600 62.992 580 22.835		ø1.6	—	IP40	-40 to +70 °C
	Lens mountable 	(Bending durability) FT-43	R4	STD 1,400 55.118 H-PWR (Note 2) 3,600 141.732		2,100 82.677 770 30.315 240 9.449		ø1.5	150 μm / ±2°	IP67	-55 to +80 °C	
	Lens mountable 	Tough (Bending durability) FT-42		STD 1,130 44.488 H-PWR (Note 2) 3,600 141.732		1,600 62.992 530 20.866 190 7.480			150 μm / ±3°		-40 to +60 °C	
	Lens mountable 	FT-42W	R1	STD 800 31.496 H-PWR (Note 2) 3,300 129.921		1,400 55.118 490 19.291 160 6.299		ø1	150 μm / ±2°		-55 to +80 °C	
	Lens mountable, Stainless-jacketed 	FT-45X	R4	1 m	STD 1,200 47.244 H-PWR (Note 2) 1,600 62.992	1,600 62.992 (Note 2) 630 24.803 200 7.874			150 μm / ±2°		-40 to +60 °C	
	Elbow 	Tough (Bending durability) FT-R40		2 m	STD 930 36.614 H-PWR (Note 2) 3,600 141.732	1,500 59.055 500 19.685 160 6.299		ø10	—		-40 to +70 °C	
	M14 Long range	With expansion lens 		Tough (Bending durability) FT-140	 10 m	STD (Note 2) 19,600 771.654 H-PWR (Note 2) 19,600 771.654	19,600 771.654 (Note 2) 16,000 629.921 6,300 248.031				—	-40 to +70 °C

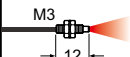
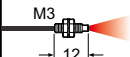
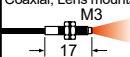
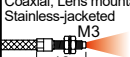
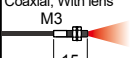
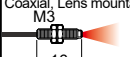
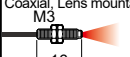
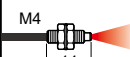
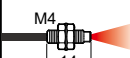
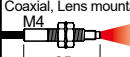
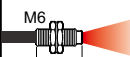
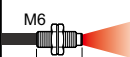
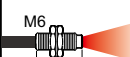
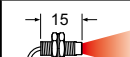
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

2) The fiber cable length practically limits the sensing range.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Threaded 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.	
						FX-250 series	Other modes	LONG FAST H-SPD				
Reflective	Threaded	M3	 M3 12	Tough (Bending durability) FD-31	R2	2 m	STD 125 4.921 H-PWR 515 20.276	220 8.661 80 3.150 25 0.984	150 μm / ±3°	IP67	-55 to +80 °C	
			 M3 12	FD-31W	R1		STD 80 3.150 H-PWR 330 12.992	140 5.512 45 1.772 12 0.472			-40 to +60 °C	
			 Coaxial, Lens mountable M3 17	Tough (Bending durability) FD-32G	R2		STD 200 7.874 H-PWR 650 25.591	270 10.630 95 3.740 27 1.063		—	IP40	-55 to +80 °C
			 Coaxial, Lens mountable, Stainless-jacketed M3 18	FD-32GX			STD 200 7.874 H-PWR 630 24.803	360 14.173 100 3.937 30 1.181				-55 to +80 °C
			 Coaxial, With lens M3 15	Tough (Bending durability) FD-34G			STD 90 3.543 H-PWR 330 12.992	135 5.305 49 1.929 15 0.591				-40 to +70 °C
		Ultra-small diameter	 Coaxial, Lens mountable M3 16	FD-EG30	R4	500 mm	STD 48 1.890 H-PWR 170 6.693	110 4.331 30 1.181 9 0.354	—	IP40	-20 to +60 °C	
			 Coaxial, Lens mountable M3 16	FD-EG31			STD 20 0.787 H-PWR 85 3.346	35 1.378 12 0.472 3.5 0.138			-20 to +60 °C	
		Threaded	M4	 M4 14	Tough (Bending durability) FD-41	R2	2 m	STD 125 4.921 H-PWR 515 20.276	220 8.661 80 3.150 25 0.984	150 μm / ±3°	IP67	-55 to +80 °C
				 M4 14	FD-41W	R1		STD 270 10.630 H-PWR 900 35.433	430 16.929 150 5.906 45 1.772			-40 to +60 °C
				 Coaxial, Lens mountable M4 25	Tough (Bending durability) FD-42G	R2		STD 200 7.874 H-PWR 650 25.591	270 10.630 95 3.740 27 1.063		IP40	-55 to +80 °C
	M6		 M6 17	(Bending durability) FD-62	R4	2 m	STD 520 20.472 H-PWR 1,500 59.055	940 37.008 340 13.386 110 4.331	150 μm / ±3°	IP67	-55 to +80 °C	
			 M6 17	Tough (Bending durability) FD-61			STD 450 17.717 H-PWR 1,400 55.118	670 26.378 200 7.874 70 2.756			-40 to +60 °C	
			 M6 17	FD-61W	R1		STD 270 10.630 H-PWR 900 35.433	430 16.929 150 5.906 45 1.772		—	IP40	-55 to +80 °C
			 Stainless-jacketed M6 22	FD-64X	R4		STD 280 11.024 H-PWR 670 26.378	410 16.142 160 6.299 50 1.969				-55 to +80 °C
	Elbow		 M6 15	Tough (Bending durability) FD-R60	R4	2 m	STD 290 11.417 H-PWR 1,100 43.307	550 21.654 190 7.480 65 2.559	150 μm / ±3°	IP67	-55 to +80 °C	

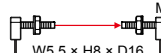
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for white non-glossy paper.
3) The allowable cutting range is 700 mm [27.559 in](#) from the end that the amplifier inserted.

LIST OF FIBERS

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Square head type

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 3)			Beam axis dia. (Fiber Core) (mm)	Protection	Ambient temp.	
						FX-250 series	Other modes	LONG FAST H-SPD				
Thru-beam	Square head	M3	 W5.5 × H8 × D16	Tough (Bending durability) FT-R31	R2	 2 m	STD 270 10.630 H-PWR 1,000 39.370	440 17.323 160 6.299 55 2.165	ø0.5	IP67	-55 to +80 °C	
		Lens mountable	Tough (Bending durability) FT-R43	R4	STD 720 28.346 H-PWR 3,000 118.110		1,100 43.307 430 16.929 130 5.118	ø1				
		Lens mountable (FX-LE2)	FT-R41W	R1	STD 800 31.496 H-PWR 3,200 125.984		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 H-PWR 3,600 141.732 (Note 2)				3,500 137.795 1,300 51.181 460 18.110	ø2.2
		Oil-resistant	Cable-protection type Lens mountable	Tough (Bending durability) FT-R44Y	R4		STD 720 28.346 H-PWR 3,000 118.110	1,100 43.307 430 16.929 130 5.118	ø1	IP67 (Note 4)	-55 to +80 °C	
		Oil-resistant	Full-protection type M6	Tough (Bending durability) FT-R60Y			STD 2,100 82.677 H-PWR 3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 1,260 49.606 400 15.748	ø3.5	IP68G		
Reflective	Square head	M3	Coaxial, Lens mountable	Tough (Bending durability) FD-R35G	R2	 2 m	STD 130 5.118 H-PWR 455 17.913	185 7.283 65 2.559 20 0.787	Emitter ø0.5	IP40	-55 to +80 °C	
			Coaxial, Lens mountable	FD-R32EG			STD 45 1.772 H-PWR 170 6.693	92 3.622 30 1.181 9 0.354	Emitter ø0.25		-40 to +70 °C	
			Coaxial, Lens mountable	FD-R34EG			R4	STD 138 1.496 H-PWR 130 5.118	70 2.756 23 0.906 7 0.276		Emitter ø0.175	-20 to +60 °C
			Coaxial, Lens mountable					FD-R33EG	STD 19 0.748 H-PWR 84 3.307		33 1.299 11 0.433 3 0.118	
			M4	 W7 × H9 × D13.5			Tough (Bending durability) FD-R41	R2	 2 m		STD 210 8.268 H-PWR 710 27.953	320 12.598 100 3.937 34 1.339
		Oil-resistant	Cable-protection type	Tough (Bending durability) FD-R61Y	R4	STD 280 11.024 H-PWR 990 38.976	435 17.126 160 6.299 50 1.969	—		IP67 (Note 4)		

- 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 sensing range of reflective type is specified for white non-glossy paper.
4) The fiber part is oil-resistant.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Cylindrical type

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 3)			Beam axis dia. (mm)	Beam axis position / Inclination of beam axis	Protection	Ambient temp.
					FX-250 series	Other models	LONG FAST H-SPD				
Thru-beam Cylindrical	ø1	Tough (Bending durability) FT-S11	R2	500 mm	STD 90 3.543 H-PWR 350 13.780		160 6.299 60 2.362 19 0.748	ø0.25	—	IP67	–55 to +80 °C
	ø1.5	Tough (Bending durability) FT-S21			STD 315 12.402 H-PWR 1,350 53.150		550 21.654 210 8.268 70 2.756	ø0.5	150 µm / ±2°		
	ø1.5	FT-S21W	R1		STD 260 10.236 H-PWR 990 38.976		440 17.323 150 5.906 53 2.087	ø0.5	150 µm / ±3°		–40 to +60 °C
	With lens	Tough (Bending durability) FT-S22		2 m	STD 450 17.717 H-PWR 1,500 59.055		730 28.740 250 9.843 90 3.543	ø0.7	—	IP40	–40 to +70 °C
	With lens, Long sensing range	(Bending durability) FT-S32	R10		STD 3,100 122.047 H-PWR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 1,800 70.866 600 23.622		ø2			
	ø3	FT-S31W	R1		STD 800 31.496 H-PWR 3,300 129.921		1,400 55.118 490 19.291 160 6.299	ø1	150 µm / ±3°		–40 to +60 °C
	Ultra-small diameter ø3	Tough (Bending durability) FT-E13	R2	1 m	STD 15 0.591 H-PWR 52 2.047		24 0.945 8 0.315 2 0.079	ø0.125	—	IP67	–40 to +70 °C
	Ultra-small diameter ø3	Tough (Bending durability) FT-E23			STD 75 2.953 H-PWR 270 10.630		125 4.921 42 1.654 13 0.512	ø0.25			
	Side-view ø4	Tough (Bending durability) FT-V40	R4	2 m	STD 3,500 137.795 H-PWR (Note 2) 3,600 141.732	3,600 141.732 (Note 2) 2,400 94.488 850 33.465		ø2.5		IP50	–40 to +60 °C
	ø1.5	Tough (Bending durability) FD-S23	R2	1 m	STD 46 1.811 H-PWR 130 5.118		65 2.559 20 0.787 7 0.276		—	IP40	–55 to +80 °C
Reflective Cylindrical	ø3	Tough (Bending durability) FD-S32	R4		STD 420 16.535 H-PWR 1,200 47.244		660 25.984 220 8.661 75 2.953		150 µm / ±3°		
	ø3	FD-S32W	R1		STD 270 10.630 H-PWR 900 35.433		430 16.929 150 5.906 45 1.772		—	IP67	–40 to +60 °C
	ø3	Tough (Bending durability) FD-S31	R2	2 m	STD 125 4.921 H-PWR 515 20.276		220 8.661 80 3.150 25 0.984		150 µm / ±3°		–55 to +80 °C
	Coaxial ø3	FD-S33GW	R1		STD 150 5.906 H-PWR 670 26.378		280 11.024 90 3.543 25 0.984		—	IP40	–40 to +60 °C
	Coaxial, With lens ø3	Tough (Bending durability) FD-S34G	R2		STD 90 3.543 H-PWR 330 12.992		135 5.305 49 1.929 15 0.591				–40 to +70 °C
	Ultra-small diameter ø1.5	FD-E13	R4	1 m	STD 12 0.472 H-PWR 50 1.969		25 0.984 7 0.276 2 0.079				–40 to +60 °C
	Ultra-small diameter ø3	FD-E23			STD 55 2.165 H-PWR 170 6.693		80 3.150 30 1.181 9 0.354				–40 to +70 °C

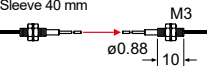
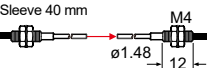
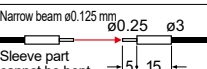
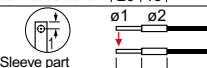
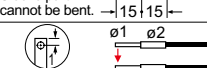
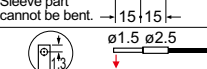
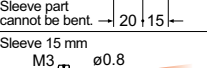
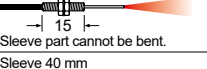
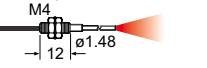
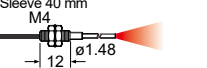
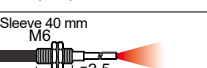
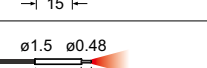
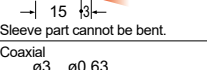
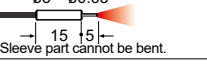
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The sensing range of reflective type is specified for white non-glossy paper.

LIST OF FIBERS

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Sleeve type

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length Free-cut	Sensing range (mm in) (Note 1, 4)		Beam axis dia. (mm)	Protection	Ambient temp.
					FX-250 series	Other modes LONG FAST H-SPD			
Thru-beam	Threaded	 FT-31S	R2 (Note 2)	 2 m	STD 315 12.402 H-PWR 1,220 48.031	550 21.654 195 7.677 63 2.480	ø0.5	IP67	-55 to +80 °C
		 FT-42S	R4 (Note 2)		STD 1,130 44.488 H-PWR (Note 3) 3,600 141.732	1,600 62.992 530 20.866 190 7.480	ø1		
	Cylindrical	 FT-E13	R2	 1 m	STD 15 0.591 H-PWR 52 2.047	24 0.945 8 0.315 2 0.079	ø0.125	IP30	-40 to +70 °C
					STD 75 2.953 H-PWR 270 10.630	125 4.921 42 1.654 13 0.512	ø0.25		
		 FT-V23	R4	 2 m	STD 450 17.717 H-PWR 1,800 70.866	880 34.646 280 11.024 90 3.543	ø0.75		
			R2		STD 240 9.449 H-PWR 900 35.433	480 18.898 140 5.512 45 1.772	ø0.5		
		 FT-V24W	R1		STD 110 4.331 H-PWR 380 14.961	200 7.874 60 2.362 20 0.787	ø0.5		
		 FT-V30	R4		STD 680 26.772 H-PWR 2,200 86.614	1,000 39.370 340 13.386 100 3.937	ø1.0		
	Threaded	 FD-EG30S	R4	 1 m	STD 50 1.969 H-PWR 170 6.693	80 3.150 30 1.181 9 0.354	—	IP40	-40 to +70 °C
		 FD-41S	R2 (Note 2)		STD 125 4.921 H-PWR 515 20.276	220 8.661 80 3.150 25 0.984			
		 FD-41SW	R1 (Note 2)		STD 80 3.150 H-PWR 330 12.992	140 5.512 45 1.772 12 0.472		IP67	-40 to +60 °C
		 FD-61S	R4 (Note 2)		STD 420 16.535 H-PWR 1,200 47.244	660 25.984 220 8.661 75 2.953			
Reflective	Cylindrical	 FD-E13	R4	 1 m	STD 12 0.472 H-PWR 50 1.969	25 0.984 7 0.276 2 0.079	—	IP40	-40 to +60 °C
		 FD-E23			STD 55 2.165 H-PWR 170 6.693	80 3.150 30 1.181 9 0.354			
	Side-view	 FD-V30	R2	 2 m	STD 65 2.559 H-PWR 240 9.449	120 4.724 35 1.378 14 0.551		IP30	-55 to +80 °C
		 FD-V30W	R1		STD 20 0.787 H-PWR 80 3.150	30 1.181 10 0.394 2 0.079			
		 FD-V50	R4		STD 120 4.724 H-PWR 370 14.567	210 8.268 75 2.953 25 0.984			

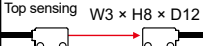
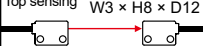
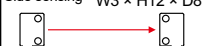
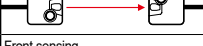
- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) Bending radius of sleeve part is R10 mm [R0.394 in](#) or more.
3) The fiber cable length practically limits the sensing range.
4) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Flat type

*Thru-beam type sensors are available as two pieces per set.

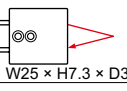
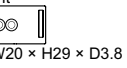
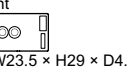
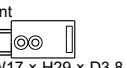
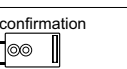
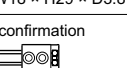
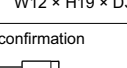
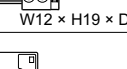
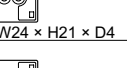
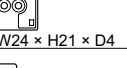
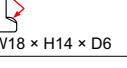
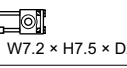
Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1, 3)		Beam axis dia. (mm)	Protection	Ambient temp.					
						FX-250 series	Other modes LONG FAST H-SPD								
Thru-beam	Flat	 W3 × H8 × D12	Tough  FT-Z30H		 2 m	STD  3,500 137.795 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 2,600 102.362 810 31.890	2 × 3	IP40	-40 to +60 °C					
		 W3 × H8 × D12	FT-Z30HW			STD  3,500 137.795 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 2,400 94.488 740 29.134								
		 W3 × H12 × D8	Tough  FT-Z30E			STD  3,500 137.795 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 2,000 78.740 630 24.803								
		 W3 × H12 × D8	FT-Z30EW			STD  3,400 133.858 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 1,200 47.244 410 16.142								
		 W8.5 × H12 × D3	Tough  FT-Z30			STD  2,100 82.677 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 1,200 47.244 410 16.142								
	With boss	 W8.5 × H12 × D3	FT-Z30W		 1 m	STD  1,500 59.055 H-PWR  3,600 141.732 (Note 2)	3,200 125.984 1,000 39.370 280 11.024	ø2	IP40						
		 W10 × H7 × D2	FT-Z20W			STD  620 24.409 H-PWR  1,600 62.992 (Note 2)	1,100 43.307 420 16.535 130 5.118				ø1.5				
		 W2 × H10 × D10	FT-Z20HBW			STD  260 10.236 H-PWR  1,100 43.307	570 22.441 180 7.087 55 2.165					ø0.5	IP67		
		 W14 × H7 × D3.5	FT-Z40W			STD  1,500 59.055 H-PWR  3,600 141.732 (Note 2)	2,300 90.551 900 35.433 290 11.417							ø1.5	IP40
		 W3.5 × H14 × D11	FT-Z40HBW			STD  800 31.496 H-PWR  3,300 129.921	1,400 55.118 490 19.291 160 6.299								
	Chemical-resistant	 W7 × H15 × D13	Tough  FT-Z802Y		 2 m	STD  3,100 122.047 H-PWR  3,600 141.732 (Note 2)	3,600 141.732 (Note 2) 1,900 74.803 470 18.504	ø3.7	IP68G						
Reflective	Flat	 W10 × H7 × D2	FD-Z20W		 1 m	STD  1 to 65 0.039 to 2.559 H-PWR  260 10.236	130 5.118 2 to 45 0.079 to 1.772 5 to 13 0.197 to 0.512	—	IP40	-40 to +60 °C					
		 W2 × H10 × D10	FD-Z20HBW			STD  2 to 85 0.079 to 3.346 H-PWR  1 to 340 0.039 to 13.386	1 to 180 0.039 to 7.087 2 to 55 0.079 to 2.165 3 to 15 0.118 to 0.591				IP67				
		 W14 × H7 × D3.5	FD-Z40W			STD  190 7.480 H-PWR  790 31.102	390 15.354 1 to 120 0.039 to 4.724 2 to 35 0.079 to 1.378					IP40			
		 W3.5 × H14 × D11	FD-Z40HBW			STD  260 10.236 H-PWR  760 29.921	470 18.504 1 to 160 0.039 to 6.299 2 to 50 0.079 to 1.969						IP67		
					 2 m										

- 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 sensing range of reflective type is specified for white non-glossy paper.
4) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, laws, and regulations.

LIST OF FIBERS

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Convergent 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.
					FX-250 series	Other modes	LONG FAST H-SPD		
Convergent reflective	Glass substrate detection	Mapping  W25 × H7.3 × D3.0	FD-L32H Bending durability R4	4 m	STD 0 to 56 0 to 2.205 H-PWR 0 to 110 0 to 4.331	0 to 74 1 to 38	0 to 2.913 0.039 to 1.496 Cannot use	IP40	-40 to +60 °C
		Alignment  W20 × H29 × D3.8	Tough Bending durability R2	3 m	STD 0 to 43 0 to 1.693 H-PWR 0 to 43 0 to 1.693	0 to 43 0 to 42 0 to 29	0 to 1.693 0 to 1.654 0 to 1.142		0 to +70 °C
		Alignment  W23.5 × H29 × D4.5	Tough Bending durability R4		STD 4 to 33 0.157 to 1.299 H-PWR 3 to 35 0.118 to 1.378	4 to 33 4 to 32 5 to 25	0.157 to 1.299 0.157 to 1.260 0.197 to 0.984		
		Alignment  W17 × H29 × D3.8	Tough Bending durability R2	2 m	STD 0 to 23 0 to 0.906 H-PWR 0 to 31 0 to 1.220	0 to 26 0 to 22 0 to 18	0 to 1.024 0 to 0.866 0 to 0.709		-20 to +70 °C
		Seating confirmation  W18 × H29 × D3.8	Tough Bending durability R2	3 m	STD 0 to 29 0 to 1.142 H-PWR 0 to 30 0 to 1.181	0 to 30 0 to 28 2 to 23	0 to 1.181 0 to 1.102 0.079 to 0.906		
		Seating confirmation  W12 × H19 × D3	R4	2 m	STD 0 to 9.5 0 to 0.374 H-PWR 0 to 11.5 0 to 0.453	0 to 10 0 to 9 0 to 8	0 to 0.394 0 to 0.354 0 to 0.315	IP40	-40 to +60 °C
		Seating confirmation  W12 × H19 × D3			STD 0 to 5 0 to 0.197 H-PWR 0 to 6 0 to 0.236	0 to 5.5 0 to 4.5 0 to 4	0 to 0.217 0 to 0.177 0 to 0.157		
		 W24 × H21 × D4	Tough Bending durability R2		STD 1.5 to 16 0.059 to 0.630 H-PWR 1 to 19 0.039 to 0.748	1 to 18 2 to 15 3 to 12	0.039 to 0.709 0.079 to 0.591 0.118 to 0.472		
		 W24 × H21 × D4	FD-L21W R1		STD 3 to 14 0.118 to 0.551 H-PWR 1.5 to 15 0.059 to 0.591	2 to 15 4 to 14 6.5 to 10	0.079 to 0.591 0.157 to 0.551 0.256 to 0.394		
	General purpose	 W18 × H14 × D6	Tough Bending durability R2		STD 0 to 23 0 to 0.906 H-PWR 0 to 45 0 to 1.772	0 to 32 2 to 15 5 to 9	0 to 1.260 0.079 to 0.591 0.197 to 0.354		-40 to +70 °C
	Ultra-small	 W7.2 × H7.5 × D2	FD-L12W R1	1 m	STD 0 to 8 0 to 0.315 H-PWR 0 to 14 0 to 0.551	0 to 12 0.5 to 7 0.5 to 4	0 to 0.472 0.020 to 0.276 0.020 to 0.157	IP30	-40 to +60 °C
		Wafer seating confirmation  W10 × H15 × D1.5	FD-L13H1 R10 NEW	2 m	STD 0 to 4 0 to 0.157 H-PWR 0 to 5 0 to 0.197	0 to 4 0 to 3.5 0 to 2	0 to 0.157 0 to 0.138 0 to 0.079		-40 to +100 °C

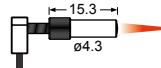
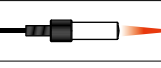
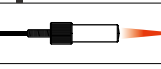
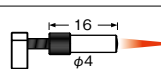
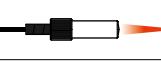
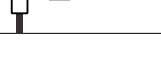
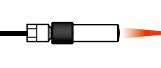
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The sensing range is specified for transparent glass 100 × 100 × t0.7 mm [3.937 × 3.937 × t0.028 in](#) (**FD-L32H**: R edge, **FD-L21** and **FD-L21W**: t2 mm [t0.079 in](#), **FD-L13H1**: 50 × 50 mm [1.969 × 1.969 in](#)) (**FD-L20H**: white non-glossy paper, **FD-L10**: silicon wafers 100 × 100 mm [3.937 × 3.937 in](#)).

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers						
				Model No.	Ambient temp.	Model No.	Fiber cable length  : Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.		
Finest spot lens		ø0.1 ø0.004 approx.	Distance to focal point 7 ±0.5 0.276 ±0.020	FX-MR7	-55 to +70 °C	FD-R33EG	500 mm	R4	IP40	-20 to +60 °C		
						FD-EG31						
		FD-R34EG				-40 to +70 °C						
		FD-R32EG										
		FD-EG30										
		Tough FD-R35G Bending durability				2 m	R2	-55 to +80 °C				
		Tough FD-42G Bending durability										
		Tough FD-32G Bending durability										
		ø0.4 ø0.016 approx.				Distance to focal point 7 ±0.5 0.276 ±0.020	FX-MR6	-20 to +60 °C		FD-32GX	 1 m (Note 3)	R2
			FD-R33EG	500mm	R4					-20 to +60 °C		
			FD-EG31									
			FD-R34EG								-40 to +70 °C	
		FD-R32EG										
		FD-EG30										
		ø0.4 ø0.016 approx.	Distance to focal point 7 ±0.5 0.276 ±0.020	FX-MR6	-20 to +60 °C	Tough FD-R35G Bending durability	2m	R2		-55 to +80 °C		
						Tough FD-42G Bending durability						
						Tough FD-32G Bending durability						
						FD-32GX	 1m (Note 3)					

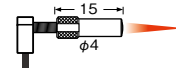
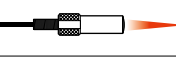
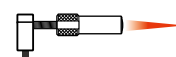
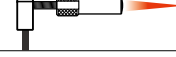
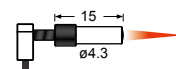
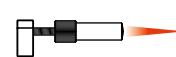
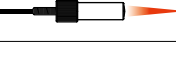
- Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-250** series.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 700 mm [27.559 in](#) from the end that the amplifier inserted.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length  : Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.
Finest spot lens		ø0.15 ø0.006 approx.	Distance to focal point 7.5 ±0.5 0.295 ±0.020	FX-MR3	-40 to +70 °C	FD-R33EG	500mm		IP40	-20 to +60 °C
						FD-EG31				
		FD-R34EG				-40 to +70 °C				
		FD-R32EG								
		FD-EG30				  FD-R35G				 2m
		  FD-42G								
		  FD-32G					 1m (Note 3)			
		FD-32GX								
Zoom lens		ø0.4 to ø2.0 ø0.016 to ø0.079 approx.	10 to 30 0.394 to 1.181	FX-MR8	-55 to +70 °C	FD-R33EG	500 mm		IP40	-20 to +60 °C
						FD-EG31				
		FD-R34EG				-40 to +70 °C				
		FD-R32EG								
		FD-EG30				  FD-R35G				 2 m
		  FD-32G								
		FD-32GX					 1 m (Note 3)			

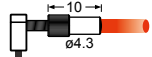
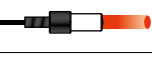
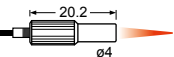
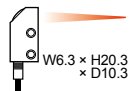
Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-250** series.
 2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
 3) The allowable cutting range is 700 mm [27.559 in](#) from the end that the amplifier inserted.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Small spot

Reflective type fiber & spot lens

Designation	Shape of head (mm)	Spot diameter (mm in) (Note 1)	Sensing range (mm in) (Note 1)	Lens		Applicable fibers				
				Model No.	Ambient temp.	Model No.	Fiber cable length  : Free-cut (Note 2)	Bending radius (mm)	Protection	Ambient temp.
Parallel light lens		ø4 ø0.157 approx.	0 to 30 0 to 1.181	FX-MR9	-55 to +70 °C	FD-R33EG	500 mm		IP40	-20 to +60 °C
	FD-EG31									
	FD-R34EG									
	FD-R32EG									
	FD-EG30									
						Tough  FD-R35G NEW	 2 m			-40 to +70 °C
						Tough  FD-42G				
						Tough  FD-32G				
	FD-32GX									
	 1 m (Note 3)									
Pinpoint spot lens		ø0.5 ø0.020	Distance to focal point 6 ±1 0.236 ±0.039	FX-MR1	-40 to +70 °C	Tough  FD-42G	 2 m			-55 to +80 °C
	Zoom lens			FX-MR2						
Zoom lens (Side-view type)		ø0.5 to ø3.0 ø0.020 to ø0.118 approx.	Distance to focal point 13 to 30 0.512 to 1.181 approx.	FX-MR5	-40 to +60 °C					

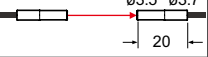
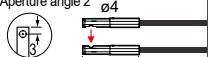
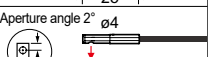
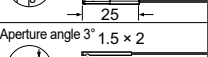
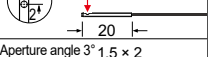
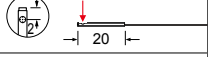
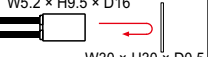
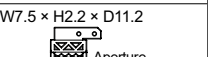
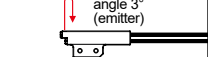
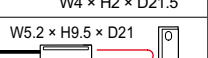
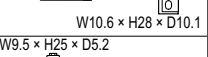
Notes: 1) Spot diameter, sensing range and distance to focal point are specified for **FX-250** series.
2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
3) The allowable cutting range is 700 mm [27.559 in](#) from the end that the amplifier inserted.

LIST OF FIBERS

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Narrow beam

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm in) (Note 1, 3, 4)		Beam axis dia. (mm)	Inclination of beam axis	Protection	Ambient temp.
						FX-250 series	Other modes LONG FAST H-SPD				
Thru-beam	Narrow beam Side-view	 Aperture angle 2° ø3.5 ø3.7 20 Tough (Bending durability) FT-KS40	R2	 2 m	STD (Note 2) 3,600 141.732 H-PWR (Note 2) 3,600 141.732 1,200 47.244	3,600 141.732 (Note 2) 3,600 141.732 (Note 2) 1,200 47.244	ø2.2	—	IP40	-40 to +80 °C	
		 Aperture angle 2° ø4 25 Tough (Bending durability) FT-KV40			STD (Note 2) 3,600 141.732 H-PWR (Note 2) 3,600 141.732 3,100 122.047 940 37.008	3,600 141.732 (Note 2) 3,100 122.047 (Note 2) 940 37.008	ø2.5	±0.8°			
		 Aperture angle 2° ø4 25 Tough (Bending durability) FT-KV40W	R1		STD (Note 2) 3,600 141.732 H-PWR (Note 2) 3,600 141.732 3,100 122.047 940 37.008	3,600 141.732 (Note 2) 3,100 122.047 (Note 2) 940 37.008	ø2.5	±0.8°		-40 to +60 °C	
		 Aperture angle 3° 1.5 × 2 20 Tough (Bending durability) FT-KV26	R2		STD (Note 2) 710 27.953 H-PWR (Note 2) 2,500 98.425 160 6.299	1,200 47.244 440 17.323 160 6.299	ø1	X ±1° Z ±0.5°	IP30	-40 to +80 °C	
	Heat-resistant narrow beam Side-view	 Aperture angle 3° 1.5 × 2 20 Tough (Bending durability) FT-KV26H1	R10		STD (Note 2) 630 24.803 H-PWR (Note 2) 2,200 86.614 390 15.354 135 5.315	1,070 42.126 390 15.354 135 5.315	ø1	X ±1° Z ±0.5°		-40 to +105 °C	
		 Aperture angle 2° ø4 25 Tough (Bending durability) FT-KV40H1 NEW			STD (Note 2) 3,600 141.732 H-PWR (Note 2) 3,600 141.732 2,780 109.449 930 36.614	3,600 141.732 (Note 2) 2,780 109.449 930 36.614	ø2.5	—			
Retroreflective	With polarizing filter	 W5.2 × H9.5 × D16 W30 × H30 × D0.5 Tough (Bending durability) FR-Z50HW	R1	 2 m	STD (Note 2) 100 to 990 3.937 to 38.976 H-PWR (Note 2) 100 to 1,900 3.937 to 74.803 100 to 780 3.937 to 30.709 100 to 490 3.937 to 19.291	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	
	Ultra-narrow beam	 W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5 Tough (Bending durability) FR-KZ22E	R2		STD 15 to 310 0.591 to 12.205 H-PWR 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	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 (Bending durability) FR-KZ50H			STD 20 to 300 0.787 to 11.811 H-PWR 20 to 1,000 0.787 to 39.370 20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874	20 to 400 0.787 to 15.748 20 to 200 0.787 to 7.874 20 to 200 0.787 to 7.874					
		Narrow beam Side sensing			 W9.5 × H25 × D5.2 W28 × H10.6 × D10.1 Tough (Bending durability) FR-KZ50E						
Reflective	Long range	 W5.2 × H9.5 × D16 FD-Z50HW	R1	 2 m	STD 10 to 650 0.394 to 25.591 H-PWR 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	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	—	—	IP40	-40 to +60 °C	

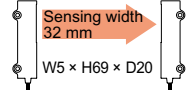
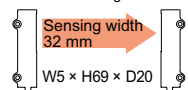
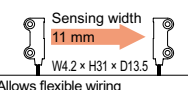
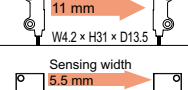
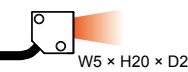
- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) The sensing range of retroreflective type is the possible setting range for the attached reflector. The fiber can detect an object less than setting range for the reflector. Refer to the next page for the sensing range when **FR-Z50HW** is used in combination with a reflector (optional).
4) The sensing range of reflective type is specified for white non-glossy paper.

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Wide beam

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length ✂ : Free-cut	Sensing range (mm in) (Note 1, 4)			Beam axis dia. (mm)	Protection	Ambient temp.
					FX-250 series		Other modes			
Thru-beam	Wide beam	 Tough Bending durability FT-A32 (Note 2)	R2	 2 m	STD (Note 3) 3,600 141.732 H-PWR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 2,100 82.677	3.2 × 32	IP40	-40 to +60 °C	
		Allows flexible wiring  FT-A32W (Note 2)	R1		STD (Note 3) 3,600 141.732 H-PWR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 3,000 118.110			-40 to +55 °C	
		 Tough Bending durability FT-A11 (Note 2)	R2		STD (Note 3) 3,600 141.732 H-PWR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 1,100 43.307			-40 to +70 °C	
		Allows flexible wiring  FT-A11W (Note 2)	R1		STD (Note 3) 3,600 141.732 H-PWR (Note 3) 3,600 141.732	3,600 141.732 (Note 3) 3,600 141.732 (Note 3) 1,300 51.181			-40 to +55 °C	
	Array	 Tough Bending durability FT-AL05	R2		STD 860 33.858 H-PWR 2,300 90.551	1,500 59.055 500 19.685 170 6.693	0.25 × 5.5		-55 to +80 °C	
	Reflective	Wide beam	 Tough Bending durability FD-A16		R4	 2 m	STD 200 7.874 H-PWR 140 5.512 Cannot use		200 7.874 140 5.512 75 2.953	—
Array		 Tough Bending durability FD-AL12 NEW	R2	STD 270 10.630 H-PWR 670 26.378	420 16.535 150 5.906 50 1.969		-55 to +80 °C			

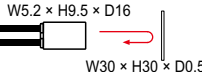
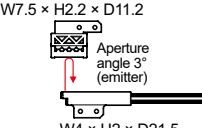
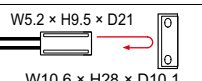
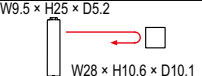
- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The slit mask (accessory) is sold separately. Refer to the last page for more details.
3) The fiber cable length practically limits the sensing range.
4) The sensing range of reflective type is specified for white non-glossy paper.

LIST OF FIBERS

Tough : Refer 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.

Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Retroreflective type

Type		Shape of fiber head (mm)	Model No.	Bend- ing radius (mm)	Fiber cable length  : Free-cut	Sensing range (mm ) (Note 1, 2)			Protection	Ambient temp.
						FX-250 series	Other modes	LONG FAST H-SPD		
Retroreflective	With polarizing filters	 W5.2 × H9.5 × D16 W30 × H30 × D0.5	FR-Z50HW		 2 m	STD  100 to 990 3.937 to 38.976 H-PWR  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	IP40	-25 to +55 °C	
	Ultra-narrow beam	 W7.5 × H2.2 × D11.2 Aperture angle 3° (emitter) W4 × H2 × D21.5	Tough  FR-KZ22E			STD  15 to 310 0.591 to 12.205 H-PWR  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	IP30	-40 to +60 °C	
	Narrow beam	Top sensing	 W5.2 × H9.5 × D21 W10.6 × H28 × D10.1	Tough  FR-KZ50H			STD  20 to 300 0.787 to 11.811 H-PWR  20 to 1,000 0.787 to 39.370			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						

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.

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

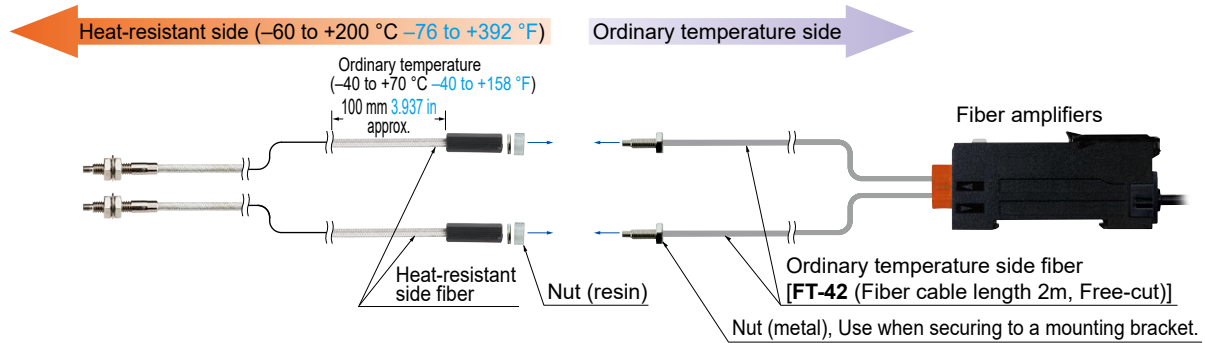
Reflector model No.	Sensing range (mm in)				
	FX-250 series				
	H-PWR	LONG	STD	FAST	H-SPD
RF-230	100 to 19,000 3.937 to 748.030	100 to 5,000 3.937 to 196.850	100 to 3,600 3.937 to 141.732	100 to 2,900 3.937 to 114.173	100 to 1,400 3.937 to 55.118
RF-220	100 to 8,000 3.937 to 314.960	100 to 3,500 3.937 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 2,400 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 : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

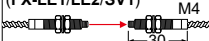
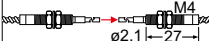
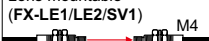
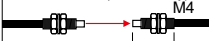
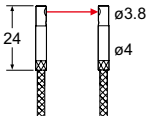
LIST OF FIBERS

<Heat-resistant joint fiber set contents>



Heat-resistant

*Thru-beam type sensors are available as two pieces per 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.
							FX-250 series	Other modes LONG FAST H-SPD		
Thru-beam	Heat-resistant	350 °C	 Lens mountable (FX-LE1/LE2/SV1) M4 30	FT-H35-M2	R25	2 m	STD 430 16.929 H-PWR 1,200 47.244	670 26.378 250 9.843 80 3.150	ø1.2	-60 to +350 °C
			 Sleeve 60 mm M4 ø2.1 27	FT-H35-M2S6						
		200 °C	 Allows flexible wiring Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20W-M1	R10	1 m	STD 470 18.504 H-PWR (Note 2) 1,600 62.992	840 33.071 300 11.811 90 3.543	ø0.8	-60 to +200 °C
			 Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-M1	R25					
		130 °C	 Lens mountable (FX-LE2 only) M4 16	FT-H13-FM2		✂ 2 m	STD 700 27.559 H-PWR 3,300 129.921	1,300 51.181 410 16.142 140 5.512	ø1.5	-60 to +130 °C
		Heat-resistant (joint)	200 °C	 Lens mountable (FX-LE1/LE2/SV1) M4 23	FT-H20-J20-S (Note 5)	Heat-resistant side R18 (Note 4)	✂ 200 mm (Note 3)	STD 470 18.504 H-PWR 1,600 62.992	790 31.102 300 11.811 90 3.543	ø1.2
	 M4 23			FT-H20-J30-S (Note 5)	✂ 300 mm (Note 3)					
	FT-H20-J50-S (Note 5)			✂ 500 mm (Note 3)	STD 600 23.622 H-PWR 2,100 82.677		980 38.583 390 15.354 120 4.724			
	Side-view 			FT-H20-VJ50-S (Note 5)						
	FT-H20-VJ80-S (Note 5)			✂ 800 mm (Note 3)						

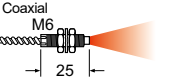
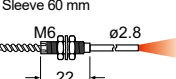
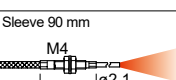
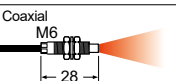
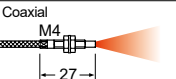
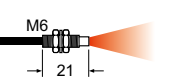
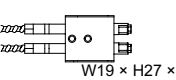
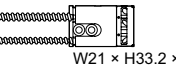
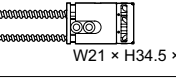
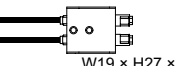
- Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.
2) The fiber cable length practically limits the sensing range.
3) Fiber length (fixed-length) for heat-resistant fiber side. Fiber length for ordinary temperature side is 2 m [6.562 ft](#) (free-cut).
4) Bending-resistant 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.

LIST OF FIBERS

Tough : Refer 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.

Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Heat-resistant

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.	
						FX-250 series	Other modes	LONG FAST H-SPD		
Reflective	Heat-resistant	Threaded		FD-H35-M2	R25	2 m	STD 260 10.236 H-PWR 720 28.346		460 18.110 150 5.906 45 1.772	-60 to +350 °C
				FD-H35-M2S6	Fiber R25 Sleeve R10					
				FD-H35-20S			STD 260 10.236 H-PWR 840 33.071		440 17.323 140 5.512 45 1.772	
		200 °C		FD-H20-M1	1 m	STD 330 12.992 H-PWR 840 33.071		500 19.685 200 7.874 55 2.165	-60 to +200 °C	
				FD-H20-21		STD 230 9.055 H-PWR 770 30.315		380 14.961 130 5.118 45 1.772		
		130 °C		FD-H13-FM2	✂ 2 m	STD 350 13.780 H-PWR 880 34.646		600 23.622 200 7.874 65 2.559	-60 to +130 °C	
	Glass substrate detection convergent reflective	300 °C		FD-H30-L32	R25	2 m	STD 0 to 17 0 to 0.669 H-PWR 0 to 40 0 to 1.575	0 to 25 0 to 0.984 0 to 12 0 to 0.472 1.5 to 6 0.059 to 0.236	-60 to +300 °C	
		250 °C		FD-H25-L43	3 m	STD 1.5 to 26 0.059 to 1.024 H-PWR 1 to 31 0.039 to 1.220	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)		
				FD-H25-L45		STD 5 to 42 0.197 to 1.654 H-PWR 4 to 43.5 0.157 to 1.713	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		FD-H18-L31	✂ 2 m	STD 0 to 16 0 to 0.630 H-PWR 0 to 60 0 to 2.362	0 to 24 0 to 0.945 0 to 13 0 to 0.512 2 to 6.5 0.079 to 0.256	-60 to +180 °C		

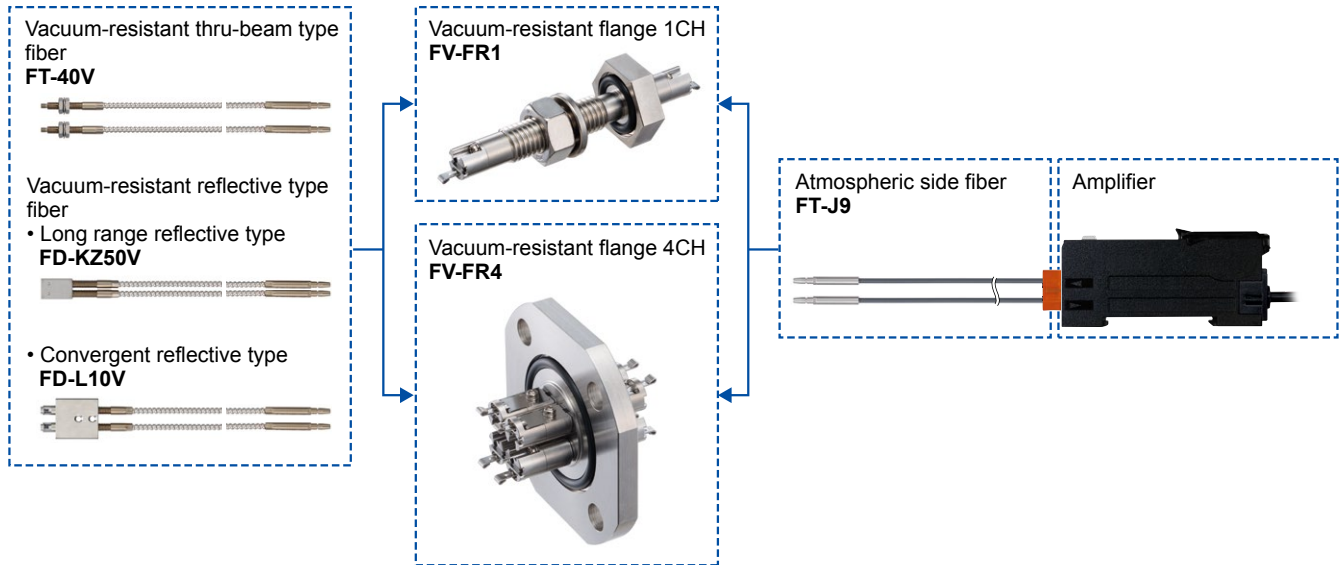
Notes: 1) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

2) The sensing range 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**).

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

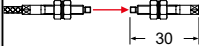
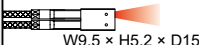
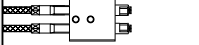
LIST OF FIBERS

<One-touch connection system compatible with 4CH / 1CH flange Vacuum-resistant fiber set contents>



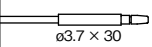
Vacuum-resistant (One-touch connection system compatible with 4CH / 1CH flange)

*Thru-beam type sensors are available as two pieces per set.

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 3)		Beam axis dia. (mm)	Ambient temp.
						FX-250 series	Other modes LONG FAST H-SPD		
Thru-beam	Vacuum-resistant	300 °C, Lens mountable (FV-LE1/SV1/SV2) 	FT-40V	R25	1 m (Note 2)	STD 270 10.630 H-PWR 1,000 39.370	470 18.504 160 6.299 55 2.165	ø1.3	-30 to +300 °C
Long range reflective		300 °C, Rectangular head 	FD-KZ50V			STD 20 to 200 0.787 to 7.874 H-PWR 5 to 500 0.197 to 19.685	15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772		
Convergent reflective		300 °C, Glass substrate detection 	FD-L10V		3 m (Note 2)	STD 0 to 8 0 to 0.315 H-PWR 0 to 18 0 to 0.709	0 to 10 0 to 0.394 0 to 5.5 0 to 0.217 1.5 to 3 0.059 to 0.118		

- Notes: 1) Atmospheric side fiber is optional and sold separately.
 2) This is not a "free-cut" type. We offer only semi-custom products in which the fiber length can be specified in 100 mm [3.937 in](#) increments. For details, please contact our sales office.
 3) The sensing range is the value for transparent glass 100 × 100 × t0.7 mm [3.937 × 3.937 × t0.028 in](#).
 4) Please refer to p.32 for lenses that can be installed on the FT-40V.

Atmospheric side (one pair set)

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Ambient temp.
Atmospheric side	 ø3.7 × 30	Tough Bending durability FT-J9	R4	 Free-cut 2 m (Note 1, 2)	-30 to +80 °C

- Notes: 1) We offer only semi-custom products in which the fiber length can be specified in 1 m [3.280 ft](#) increments. For details, please contact our sales office.
 2) Note that the sensing range of the free-cut type fiber may be reduced by 20 % max. depending upon how the fiber is cut.

LIST OF FIBERS

Tough : Refer 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.

Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

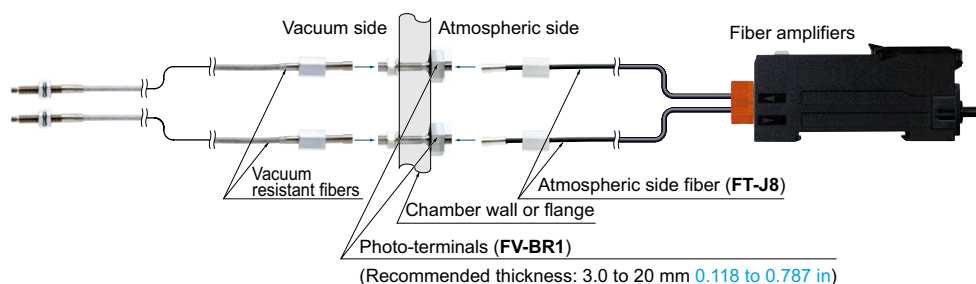
Vacuum-resistant flange

Designation	Model No.	Description																															
Vacuum-resistant flange 1CH	FV-FR1		Atmospheric side and vacuum side are isolated. Main specifications <table><tr><th>Model No.</th><th>FV-FR1</th><th>FV-FR4</th></tr><tr><th>Applicable fibers</th><td colspan="2">FT-40V, FD-KZ50V, FD-L10V, FT-J9</td></tr><tr><th>Leakage</th><td colspan="2">1.0 × 10⁻¹⁰ Pa·m³/s [He] or less (* Measured with a He detector)</td></tr><tr><th>Ambient temperature</th><td colspan="2">-30 to +120°C -22 to +248°F (Same for storage. Up to +40 °C +104°F when humidity is high. However, no dew condensation or icing allowed.</td></tr><tr><th>Ambient humidity</th><td colspan="2">35 to 85% RH (Same for storage)</td></tr><tr><th>Tightening torque</th><td>Nut: 14.7 N·m or less (M14 nut)</td><td>9.8 N·m or less (M8 screw)</td></tr><tr><th>Tensile strength</th><td colspan="2">20 N or less (Atmospheric / vacuum side fiber joint)</td></tr><tr><th>O-ring size</th><td>V15</td><td>V40</td></tr><tr><th>Weight</th><td>100 g approx.</td><td>410 g approx.</td></tr><tr><th>Material</th><td colspan="2">Main unit: Stainless steel (SUS303), Holding bracket: Stainless steel (SUS301), Fiber: Quartz glass, O-ring: Fluororubber</td></tr></table>	Model No.	FV-FR1	FV-FR4	Applicable fibers	FT-40V, FD-KZ50V, FD-L10V, FT-J9		Leakage	1.0 × 10 ⁻¹⁰ Pa·m ³ /s [He] or less (* Measured with a He detector)		Ambient temperature	-30 to +120°C -22 to +248°F (Same for storage. Up to +40 °C +104°F when humidity is high. However, no dew condensation or icing allowed.		Ambient humidity	35 to 85% RH (Same for storage)		Tightening torque	Nut: 14.7 N·m or less (M14 nut)	9.8 N·m or less (M8 screw)	Tensile strength	20 N or less (Atmospheric / vacuum side fiber joint)		O-ring size	V15	V40	Weight	100 g approx.	410 g approx.	Material	Main unit: Stainless steel (SUS303), Holding bracket: Stainless steel (SUS301), Fiber: Quartz glass, O-ring: Fluororubber	
Model No.	FV-FR1	FV-FR4																															
Applicable fibers	FT-40V, FD-KZ50V, FD-L10V, FT-J9																																
Leakage	1.0 × 10 ⁻¹⁰ Pa·m ³ /s [He] or less (* Measured with a He detector)																																
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Tensile strength	20 N or less (Atmospheric / vacuum side fiber joint)																																
O-ring size	V15	V40																															
Weight	100 g approx.	410 g approx.																															
Material	Main unit: Stainless steel (SUS303), Holding bracket: Stainless steel (SUS301), Fiber: Quartz glass, O-ring: Fluororubber																																
Vacuum-resistant flange 4CH	FV-FR4		Recommended thickness of vacuum chamber wall • For FV-FR1: 3.0 to 40.0 mm 0.118 to 1.575 in (Note 1) • For FV-FR4: 3.0 mm 0.118 in or more (Note 2)																														

Notes: 1) Confirm the wall thickness in advance since the **FV-FR1** cannot be installed to a vacuum chamber with a wall thickness outside the recommended thickness range.

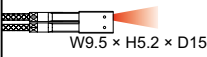
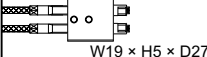
2) If the vacuum chamber wall is too thick, the **FV-FR4** may not be able to connect to the vacuum side fiber. In that case, connect the **FV-FR4** to the vacuum side fiber before the installation.

<Vacuum-resistant fiber set contents>



Vacuum-resistant

*Thru-beam type sensors are available as two pieces per set.

Type	Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length	Sensing range (mm in) (Note 3)			Beam axis dia. (mm)	Ambient temp.
					FX-250 series	Other modes	LONG FAST H-SPD		
Thru-beam	300 °C Lens mountable (FV-LE1/SV2) M4 	FT-H30-M1V-S (Note 1)	R18	1 m (Note 2)	STD 270 10.630 H-PWR 1,000 39.370		470 18.504 160 6.299 55 2.165	ø1.2	-30 to +300 °C
Reflective	300 °C, Rectangular head 	FD-H30-KZ1V-S (Note 1)			STD 20 to 200 0.787 to 7.874 H-PWR 5 to 500 0.197 to 19.685		15 to 270 0.591 to 10.630 20 to 120 0.787 to 4.724 20 to 45 0.787 to 1.772		
Convergent reflective	300 °C, Glass substrate detection 	FD-H30-L32V-S (Note 1)		3 m (Note 2)	STD 0 to 8 0 to 0.315 H-PWR 0 to 18 0 to 0.709		0 to 10 0 to 0.394 0 to 5.5 0 to 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) This is not a "free-cut" type.

3) The sensing range is the value for transparent glass 100 × 100 × t0.7 mm [3.937 × 3.937 × t0.028 in](#).

Tough : Refer 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.
Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

LIST OF FIBERS

Oil-resistant

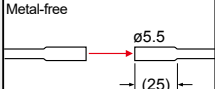
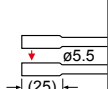
*Thru-beam type sensors are available as two pieces per set.

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.
						FX-250 series	Other modes	LONG FAST H-SPD			
Thru-beam	Oil-resistant	Full-protection type M6 W10 × H11 × D21.2	FT-R60Y Tough (Bending durability)	R4	2 m	STD 2,100 82.677 H-PWR 3,600 141.732 (Note 3)	3,600 1,260 400	141.732 (Note 3) 49.606 15.748	ø3.5	IP68G	-55 to +80 °C
		Cable-protection type Lens mountable M4 W7 × H9.5 × D15.5	FT-R44Y Tough (Bending durability)			STD 720 28.346 H-PWR 3,000 118.110		1,100 430 130	ø1	IP67 (Note 4)	
Reflective	Oil-resistant	Cable-protection type M6 W10 × H11 × D15.5	FD-R61Y Tough (Bending durability)			STD 280 11.024 H-PWR 990 38.976		435 160 50	—		

- 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 specified for white non-glossy paper.
3) The fiber cable length practically limits the sensing range.
4) The fiber part is oil-resistant.

Chemical-resistant

*Thru-beam type sensors are available as two pieces per 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.
						FX-250 series	Other modes	LONG FAST H-SPD			
Thru-beam	Chemical-resistant	Flat type	Tough   FT-Z802Y	 R4	 2 m	STD  3,100 122.047	3,600 1,900 470	141.732 (Note 3) 74.803 18.504	ø3.7	IP68G	0 to +60 °C
		H-PWR  3,600 141.732 (Note 3)									
	Cylindrical type	Metal-free	 FT-L80Y	R30	 2 m (Note 4)	STD  (Note 3) 3,600 141.732	3,600 2,800 920	141.732 (Note 3) 110.236 36.220	ø2.8		-40 to +70 °C
		H-PWR  3,600 141.732 (Note 3)									
		Side-view Metal-free				 FT-V80Y					
H-PWR  3,600 141.732 (Note 3)											
Reflective	Chemical-resistant	Cylindrical type	Tough   FD-S60Y	Protective tube R30 Fiber  R4	 2 m (Note 4)	STD  320 12.598 H-PWR  600 23.622	420 200 75	16.535 7.874 2.953	—		

- 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 specified for white non-glossy paper.
3) The fiber cable length practically limits the sensing range.
4) The allowable cutting range is 500 mm [19.685 in](#) from the end that the amplifier inserted.
5) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, laws, and regulations.

LIST OF FIBERS

Tough : Refer 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.

Bending durability : Refer to a fiber which possesses unbreakable bending-resistant feature (bending radius: R10 mm [R0.394 in](#), reciprocating bending: 180°).

Liquid leak / Liquid detection

Type		Shape of fiber head (mm)	Model No.	Bending radius (mm)	Fiber cable length : Free-cut	Description FX-250 series (STD mode)	Protection	Ambient temp.
Reflective type	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
		Liquid level sensing 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
		Liquid leak detection SEMI S2 compliant (Note 3) W20 × H30 × D10 	Tough Bending durability FD-F71	Protective tube R20 Fiber R2	5 m	Liquid leak detection Leak absent: Beam received, Leak present: Beam not received	IP67	-20 to +60 °C
	Pipe-mountable type	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
		Liquid level sensing 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 Array fiber W6.5 × H28.3 × D17	Tough Bending durability FD-FA93	R4		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
Thru-beam type	Liquid sensing	SEMI S2 compliant (Note 3) W23 × H20 × D17	Tough Bending durability FT-F93	Protective tube R20 Fiber R2		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		-40 to +60 °C

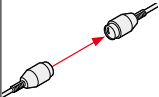
Notes: 1) The allowable cutting range is 1,000 mm [39.370 in](#) from the end that the amplifier inserted.

2) Liquid inflow prevention joint, protective tube extension joint, fiber mounting joint is available.

3) The design takes into account the environmental testing required by SEMI S2. To ensure that the final system complies with the standards, you must design and use it in accordance with relevant standards, laws, and regulations.

FIBER OPTIONS

Lens (For thru-beam type fiber)

Designation		Model No.	Description																																																																																																																																																				
For thru-beam type fiber	Expansion lens (Note 1)	FX-LE1		Increases the sensing range by 5 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 3) • Beam dia: ø3.6 mm ø0.142 in Sensing range (mm in) [Lens on both sides]																																																																																																																																																			
				<table><tr><th colspan="2">Amplifier</th><th colspan="5">FX-250 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>H-PWR</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SPD</th></tr><tr><td rowspan="2">FT-43</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>1,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>62.992</td></tr><tr><td rowspan="2">FT-42 FT-42W</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>2,200</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>86.614</td></tr><tr><td>FT-45X</td><td></td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,500</td></tr><tr><td></td><td></td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>59.055</td></tr><tr><td>FT-R40</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>1,900</td></tr><tr><td></td><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>74.803</td></tr><tr><td rowspan="2">FT-R43 FT-R44Y</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>1,900</td><td>670</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>74.803</td><td>26.378</td></tr><tr><td>FT-H35-M2</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,300</td><td>1,400</td></tr><tr><td></td><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>129.921</td><td>55.118</td></tr><tr><td>FT-H20W-M1</td><td></td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td><td>850</td></tr><tr><td></td><td></td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>33.465</td></tr><tr><td>FT-H20-M1</td><td></td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,200</td></tr><tr><td></td><td></td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>47.244</td></tr><tr><td rowspan="3">FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S</td><td></td><td>3,600</td><td>3,500</td><td>2,000</td><td>1,600</td><td>500</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>137.795</td><td>78.740</td><td>62.992</td><td>19.685</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Amplifier		FX-250 series					Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD	FT-43		3,600	3,600	3,600	3,600	1,600		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	62.992	FT-42 FT-42W		3,600	3,600	3,600	3,600	2,200		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	86.614	FT-45X		1,600	1,600	1,600	1,600	1,500			62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	59.055	FT-R40		3,600	3,600	3,600	3,600	1,900			141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	74.803	FT-R43 FT-R44Y		3,600	3,600	3,600	1,900	670		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	74.803	26.378	FT-H35-M2		3,600	3,600	3,600	3,300	1,400			141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	129.921	55.118	FT-H20W-M1		1,600	1,600	1,600	1,600	850			62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	33.465	FT-H20-M1		1,600	1,600	1,600	1,600	1,200			62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	47.244	FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S		3,600	3,500	2,000	1,600	500		141.732 (Note 2)	137.795	78.740	62.992	19.685						
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FT-R43 FT-R44Y		3,600	3,600	3,600	1,900	670																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	74.803	26.378																																																																																																																																																	
FT-H35-M2		3,600	3,600	3,600	3,300	1,400																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	129.921	55.118																																																																																																																																																	
FT-H20W-M1		1,600	1,600	1,600	1,600	850																																																																																																																																																	
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FT-H20-M1		1,600	1,600	1,600	1,600	1,200																																																																																																																																																	
		62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	47.244																																																																																																																																																	
FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S		3,600	3,500	2,000	1,600	500																																																																																																																																																	
		141.732 (Note 2)	137.795	78.740	62.992	19.685																																																																																																																																																	
Super-expansion lens (Note 1)	FX-LE2		Tremendously increases the sensing range with large diameter lenses. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 3) • Beam dia: ø9.8 mm ø0.386 in Sensing range (mm in) [Lens on both sides]																																																																																																																																																				
			<table><tr><th colspan="2">Amplifier</th><th colspan="5">FX-250 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>H-PWR</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SPD</th></tr><tr><td rowspan="2">FT-43 FT-42 FT-42W</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td>FT-45X</td><td></td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td></tr><tr><td></td><td></td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td></tr><tr><td>FT-R40</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td rowspan="2">FT-R41W FT-R43 FT-R44Y</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td>FT-H35-M2</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td rowspan="2">FT-H20W-M1 FT-H20-M1</td><td></td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td><td>1,600</td></tr><tr><td></td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td><td>62.992 (Note 2)</td></tr><tr><td>FT-H13-FM2</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td rowspan="3">FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S</td><td></td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td><td>3,600</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td><td>141.732 (Note 2)</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Amplifier		FX-250 series					Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD	FT-43 FT-42 FT-42W		3,600	3,600	3,600	3,600	3,600		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	FT-45X		1,600	1,600	1,600	1,600	1,600			62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	FT-R40		3,600	3,600	3,600	3,600	3,600			141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	FT-R41W FT-R43 FT-R44Y		3,600	3,600	3,600	3,600	3,600		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	FT-H35-M2		3,600	3,600	3,600	3,600	3,600			141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	FT-H20W-M1 FT-H20-M1		1,600	1,600	1,600	1,600	1,600		62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	FT-H13-FM2		3,600	3,600	3,600	3,600	3,600			141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S		3,600	3,600	3,600	3,600	3,600		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																					
			Amplifier		FX-250 series																																																																																																																																																		
			Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD																																																																																																																																														
			FT-43 FT-42 FT-42W		3,600	3,600	3,600	3,600	3,600																																																																																																																																														
					141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																																																																																																																																														
			FT-45X		1,600	1,600	1,600	1,600	1,600																																																																																																																																														
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			FT-R40		3,600	3,600	3,600	3,600	3,600																																																																																																																																														
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FT-R41W FT-R43 FT-R44Y		3,600	3,600	3,600	3,600	3,600																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																																																																																																																																																	
FT-H35-M2		3,600	3,600	3,600	3,600	3,600																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																																																																																																																																																	
FT-H20W-M1 FT-H20-M1		1,600	1,600	1,600	1,600	1,600																																																																																																																																																	
		62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)	62.992 (Note 2)																																																																																																																																																	
FT-H13-FM2		3,600	3,600	3,600	3,600	3,600																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																																																																																																																																																	
FT-H20-J50-S FT-H20-J30-S FT-H20-J20-S		3,600	3,600	3,600	3,600	3,600																																																																																																																																																	
		141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)	141.732 (Note 2)																																																																																																																																																	

Notes: 1) Be careful sure to use it only after you have adjusted it sufficiently when installing the thru-beam type fiber equipped with the expansion lens, as the beam envelope becomes narrow and alignment is difficult.
2) The fiber cable length practically limits the sensing range.
3) Refer to **LIST OF FIBERS** (p.10~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

Lens (For thru-beam type fiber)

Designation		Model No.	Description							
For thru-beam type fiber	Side-view lens	FX-SV1		Beam axis is bent by 90°.						
				• Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 1)						
				• Beam dia: ø2.8 mm ø0.110 in						
				Sensing range (mm in) [Lens on both sides]						
				Amplifier		FX-250 series				
				Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD
				FT-43		3,600 141.732 (Note 2)	2,600 102.362	1,700 66.929	970 38.189	310 12.205
				FT-42		3,600 141.732 (Note 2)	3,600 141.732 (Note 2)	2,100 82.677	1,150 45.276	370 14.567
				FT-42W		3,600 141.732 (Note 2)	2,700 106.299	1,800 70.866	990 38.976	320 12.598
				FT-45X		1,600 62.992 (Note 2)	1,600 62.992 (Note 2)	1,400 55.118	800 31.496	210 8.268
				FT-R43		3,200 125.984	1,300 51.181	950 37.402	510 20.079	160 6.299
				FT-R44Y		3,200 125.984	1,300 51.181	950 37.402	510 20.079	160 6.299
				FT-H35-M2		3,500 137.795	1,200 47.244	780 30.709	500 19.685	150 5.906
				FT-H20W-M1		1,600 62.992 (Note 2)	1,500 59.055	950 37.402	560 22.047	190 7.480
FT-H20-M1		1,600 62.992 (Note 2)	1,300 51.181	780 30.709	500 19.685	150 5.906				
FT-H20-J50-S		1,600 62.992 (Note 2)	740 29.134	450 17.717	290 11.417	80 3.150				
FT-H20-J30-S										
FT-H20-J20-S										

Notes: 1) Refer to [LIST OF FIBERS](#) (p.10~) for the ambient temperature of fibers to be used in combination.

2) The fiber cable length practically limits the sensing range.

FIBER OPTIONS

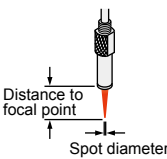
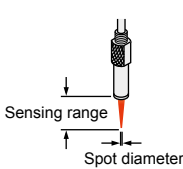
Vacuum-resistant lens (For thru-beam type fiber)

Designation		Model No.	Description																																												
For thru-beam type fiber	Vacuum-resistant expansion lens (Note 1)	FV-LE1		Increases the sensing range 4 times or more. • Ambient temperature: -60 to +350 °C -76 to +662 °F (Note 5) • Beam axis dia: ø3.6 mm ø0.142 in Sensing range (mm in) [Lens on both sides] (Note 3, 4) <table><tr><th colspan="2">Amplifier</th><th colspan="5">FX-250 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>H-PWR</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SPD</th></tr><tr><td rowspan="2">FT-40V</td><td></td><td>1,800 (Note 2)</td><td>1,800 (Note 2)</td><td>1,500</td><td>900</td><td>370</td></tr><tr><td></td><td>70.866</td><td>70.866</td><td>59.055</td><td>35.433</td><td>14.567</td></tr><tr><td rowspan="2">FT-H30-M1V-S</td><td></td><td>3,600 (Note 2)</td><td>3,400</td><td>1,500</td><td>900</td><td>370</td></tr><tr><td></td><td>141.732</td><td>133.858</td><td>59.055</td><td>35.433</td><td>14.567</td></tr></table>				Amplifier		FX-250 series					Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD	FT-40V		1,800 (Note 2)	1,800 (Note 2)	1,500	900	370		70.866	70.866	59.055	35.433	14.567	FT-H30-M1V-S		3,600 (Note 2)	3,400	1,500	900	370		141.732	133.858	59.055	35.433	14.567
	Amplifier		FX-250 series																																												
	Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD																																								
FT-40V		1,800 (Note 2)	1,800 (Note 2)	1,500	900	370																																									
		70.866	70.866	59.055	35.433	14.567																																									
FT-H30-M1V-S		3,600 (Note 2)	3,400	1,500	900	370																																									
		141.732	133.858	59.055	35.433	14.567																																									
	Vacuum-resistant compact side-view lens (Note 1)	FV-SV1		Beam axis is bent by 90°. • Ambient temperature: -30 to +300 °C -22 to +572 °F (Note 5) • Beam axis dia: ø3 mm ø0.118 in Sensing range (mm in) [Lens on both sides] (Note 3, 4) <table><tr><th colspan="2">Amplifier</th><th colspan="5">FX-250 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>H-PWR</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SPD</th></tr><tr><td rowspan="2">FT-40V</td><td></td><td>1,800 (Note 2)</td><td>700</td><td>450</td><td>290</td><td>90</td></tr><tr><td></td><td>70.866</td><td>27.559</td><td>17.717</td><td>11.417</td><td>3.543</td></tr><tr><td rowspan="2">FT-H30-M1V-S</td><td></td><td>1,800</td><td>700</td><td>450</td><td>290</td><td>90</td></tr><tr><td></td><td>70.866</td><td>27.559</td><td>17.717</td><td>11.417</td><td>3.543</td></tr></table>				Amplifier		FX-250 series					Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD	FT-40V		1,800 (Note 2)	700	450	290	90		70.866	27.559	17.717	11.417	3.543	FT-H30-M1V-S		1,800	700	450	290	90		70.866	27.559	17.717	11.417	3.543
Amplifier		FX-250 series																																													
Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD																																									
FT-40V		1,800 (Note 2)	700	450	290	90																																									
		70.866	27.559	17.717	11.417	3.543																																									
FT-H30-M1V-S		1,800	700	450	290	90																																									
		70.866	27.559	17.717	11.417	3.543																																									
	Vacuum-resistant side-view lens (Note 1)	FV-SV2		Beam axis is bent by 90°. • Ambient temperature: -60 to +300 °C -76 to +572 °F (Note 5) • Beam axis dia: ø3.7 mm ø0.146 in Sensing range (mm in) [Lens on both sides] (Note 3, 4) <table><tr><th colspan="2">Amplifier</th><th colspan="5">FX-250 series</th></tr><tr><th>Fiber</th><th>Mode</th><th>H-PWR</th><th>LONG</th><th>STD</th><th>FAST</th><th>H-SPD</th></tr><tr><td rowspan="2">FT-40V</td><td></td><td>1,800 (Note 2)</td><td>1,800 (Note 2)</td><td>1,500</td><td>900</td><td>370</td></tr><tr><td></td><td>70.866</td><td>70.866</td><td>59.055</td><td>35.433</td><td>14.567</td></tr><tr><td rowspan="2">FT-H30-M1V-S</td><td></td><td>3,600</td><td>3,400</td><td>1,500</td><td>900</td><td>370</td></tr><tr><td></td><td>141.732 (Note 2)</td><td>133.858</td><td>59.055</td><td>35.433</td><td>14.567</td></tr></table>				Amplifier		FX-250 series					Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD	FT-40V		1,800 (Note 2)	1,800 (Note 2)	1,500	900	370		70.866	70.866	59.055	35.433	14.567	FT-H30-M1V-S		3,600	3,400	1,500	900	370		141.732 (Note 2)	133.858	59.055	35.433	14.567
Amplifier		FX-250 series																																													
Fiber	Mode	H-PWR	LONG	STD	FAST	H-SPD																																									
FT-40V		1,800 (Note 2)	1,800 (Note 2)	1,500	900	370																																									
		70.866	70.866	59.055	35.433	14.567																																									
FT-H30-M1V-S		3,600	3,400	1,500	900	370																																									
		141.732 (Note 2)	133.858	59.055	35.433	14.567																																									

- Notes: 1) Be careful when installing the thru-beam type fiber equipped with the lens, as the beam envelope becomes narrow and alignment is difficult.
 2) The fiber cable length practically limits the sensing range.
 3) The fiber cable length for the **FT-40V** is 1 m **3.281 ft**. The sensing ranges take into account the length of the **FT-J9** atmospheric side fiber.
 4) The fiber cable length for the **FT-H30-M1V-S** is 1 m **3.281 ft**. The sensing ranges in H-PWR and LONG of **FX-250** series are specified considering the length of the **FT-J8** atmospheric side fiber.
 5) Refer to **LIST OF FIBERS** (p.10~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

Lens (For reflective type fiber)

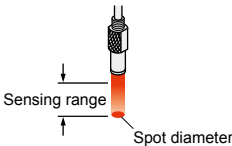
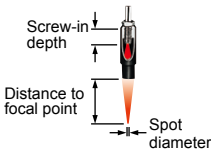
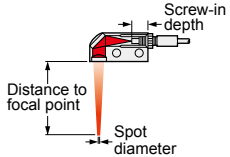
Designation	Model No.	Description														
For reflective type fiber	Finest spot lens	FX-MR7	 Extremely fine spot of $\phi 0.1$ mm $\phi 0.004$ in approx. achieved. - Applicable fibers: FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R35G, FD-42G, FD-32G, FD-32GX - Ambient temperature: -55 to $+70$ °C $+67$ to $+158$ °F (Note)	Sensing range for FX-250 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG FD-EG31</td><td rowspan="4">7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\phi 0.1$ mm approx. $\phi 0.004$ in approx.</td></tr><tr><td>FD-R34EG</td><td>$\phi 0.15$ mm approx. $\phi 0.006$ in approx.</td></tr><tr><td>FD-R32EG FD-EG30</td><td>$\phi 0.2$ mm approx. $\phi 0.008$ in approx.</td></tr><tr><td>FD-R35G FD-42G FD-32G/32GX</td><td>$\phi 0.4$ mm approx. $\phi 0.016$ in approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-R33EG FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\phi 0.1$ mm approx. $\phi 0.004$ in approx.	FD-R34EG	$\phi 0.15$ mm approx. $\phi 0.006$ in approx.	FD-R32EG FD-EG30	$\phi 0.2$ mm approx. $\phi 0.008$ in approx.	FD-R35G FD-42G FD-32G/32GX	$\phi 0.4$ mm approx. $\phi 0.016$ in approx.
		Fiber model No.	Distance to focal point	Spot diameter												
		FD-R33EG FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\phi 0.1$ mm approx. $\phi 0.004$ in approx.												
FD-R34EG	$\phi 0.15$ mm approx. $\phi 0.006$ in approx.															
FD-R32EG FD-EG30	$\phi 0.2$ mm approx. $\phi 0.008$ in approx.															
FD-R35G FD-42G FD-32G/32GX	$\phi 0.4$ mm approx. $\phi 0.016$ in approx.															
FX-MR6	Extremely fine spot of $\phi 0.1$ mm $\phi 0.004$ in approx. achieved. - Applicable fibers: FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R35G, FD-42G, FD-32G, FD-32GX - Ambient temperature: -20 to $+60$ °C -4 to $+140$ °F (Note)	Sensing range for FX-250 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG FD-EG31</td><td rowspan="4">7 ± 0.5 mm 0.276 ± 0.020 in</td><td>$\phi 0.1$ mm approx. $\phi 0.004$ in approx.</td></tr><tr><td>FD-R34EG</td><td>$\phi 0.15$ mm approx. $\phi 0.006$ in approx.</td></tr><tr><td>FD-R32EG FD-EG30</td><td>$\phi 0.2$ mm approx. $\phi 0.008$ in approx.</td></tr><tr><td>FD-R35G FD-42G FD-32G/32GX</td><td>$\phi 0.4$ mm approx. $\phi 0.016$ in approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-R33EG FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\phi 0.1$ mm approx. $\phi 0.004$ in approx.	FD-R34EG	$\phi 0.15$ mm approx. $\phi 0.006$ in approx.	FD-R32EG FD-EG30	$\phi 0.2$ mm approx. $\phi 0.008$ in approx.	FD-R35G FD-42G FD-32G/32GX	$\phi 0.4$ mm approx. $\phi 0.016$ in approx.		
Fiber model No.	Distance to focal point	Spot diameter														
FD-R33EG FD-EG31	7 ± 0.5 mm 0.276 ± 0.020 in	$\phi 0.1$ mm approx. $\phi 0.004$ in approx.														
FD-R34EG		$\phi 0.15$ mm approx. $\phi 0.006$ in approx.														
FD-R32EG FD-EG30		$\phi 0.2$ mm approx. $\phi 0.008$ in approx.														
FD-R35G FD-42G FD-32G/32GX		$\phi 0.4$ mm approx. $\phi 0.016$ in approx.														
FX-MR3	Extremely fine spot of $\phi 0.15$ mm $\phi 0.006$ in approx. achieved. - Applicable fibers: FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R35G, FD-42G, FD-32G, FD-32GX - Ambient temperature: -40 to $+70$ °C -40 to $+158$ °F (Note)	Sensing range for FX-250 series <table><tr><th>Fiber model No.</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>FD-R33EG FD-EG31</td><td rowspan="4">7.5 ± 0.5 mm 0.295 ± 0.020 in</td><td>$\phi 0.15$ mm approx. $\phi 0.006$ in approx.</td></tr><tr><td>FD-R34EG</td><td>$\phi 0.2$ mm approx. $\phi 0.008$ in approx.</td></tr><tr><td>FD-R32EG FD-EG30</td><td>$\phi 0.3$ mm approx. $\phi 0.012$ in approx.</td></tr><tr><td>FD-R35G FD-42G FD-32G/32GX</td><td>$\phi 0.5$ mm approx. $\phi 0.020$ in approx.</td></tr></table>	Fiber model No.	Distance to focal point	Spot diameter	FD-R33EG FD-EG31	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\phi 0.15$ mm approx. $\phi 0.006$ in approx.	FD-R34EG	$\phi 0.2$ mm approx. $\phi 0.008$ in approx.	FD-R32EG FD-EG30	$\phi 0.3$ mm approx. $\phi 0.012$ in approx.	FD-R35G FD-42G FD-32G/32GX	$\phi 0.5$ mm approx. $\phi 0.020$ in approx.		
Fiber model No.	Distance to focal point	Spot diameter														
FD-R33EG FD-EG31	7.5 ± 0.5 mm 0.295 ± 0.020 in	$\phi 0.15$ mm approx. $\phi 0.006$ in approx.														
FD-R34EG		$\phi 0.2$ mm approx. $\phi 0.008$ in approx.														
FD-R32EG FD-EG30		$\phi 0.3$ mm approx. $\phi 0.012$ in approx.														
FD-R35G FD-42G FD-32G/32GX		$\phi 0.5$ mm approx. $\phi 0.020$ in approx.														
Zoom lens	FX-MR8	 The spot diameter is adjustable according to how much the fiber is screwed in. - Applicable fibers: FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R35G, FD-32G, FD-32GX - Ambient temperature: -55 to $+70$ °C $+67$ to $+158$ °F (Note)	Sensing range for FX-250 series <table><tr><th>Fiber model No.</th><th>Sensing range</th><th>Spot diameter</th></tr><tr><td>FD-R33EG FD-EG31</td><td rowspan="4">10 to 30 mm 0.394 to 1.181 in</td><td>$\phi 0.4$ to $\phi 2.0$ mm approx. $\phi 0.016$ to $\phi 0.079$ in approx.</td></tr><tr><td>FD-R34EG</td><td>$\phi 0.4$ to $\phi 2.2$ mm approx. $\phi 0.016$ to $\phi 0.087$ in approx.</td></tr><tr><td>FD-R32EG FD-EG30</td><td>$\phi 0.5$ to $\phi 2.5$ mm approx. $\phi 0.020$ to $\phi 0.098$ in approx.</td></tr><tr><td>FD-R35G FD-32G/32GX</td><td>$\phi 0.8$ to $\phi 3.5$ mm approx. $\phi 0.031$ to $\phi 0.138$ in approx.</td></tr></table>	Fiber model No.	Sensing range	Spot diameter	FD-R33EG FD-EG31	10 to 30 mm 0.394 to 1.181 in	$\phi 0.4$ to $\phi 2.0$ mm approx. $\phi 0.016$ to $\phi 0.079$ in approx.	FD-R34EG	$\phi 0.4$ to $\phi 2.2$ mm approx. $\phi 0.016$ to $\phi 0.087$ in approx.	FD-R32EG FD-EG30	$\phi 0.5$ to $\phi 2.5$ mm approx. $\phi 0.020$ to $\phi 0.098$ in approx.	FD-R35G FD-32G/32GX	$\phi 0.8$ to $\phi 3.5$ mm approx. $\phi 0.031$ to $\phi 0.138$ in approx.	
Fiber model No.	Sensing range	Spot diameter														
FD-R33EG FD-EG31	10 to 30 mm 0.394 to 1.181 in	$\phi 0.4$ to $\phi 2.0$ mm approx. $\phi 0.016$ to $\phi 0.079$ in approx.														
FD-R34EG		$\phi 0.4$ to $\phi 2.2$ mm approx. $\phi 0.016$ to $\phi 0.087$ in approx.														
FD-R32EG FD-EG30		$\phi 0.5$ to $\phi 2.5$ mm approx. $\phi 0.020$ to $\phi 0.098$ in approx.														
FD-R35G FD-32G/32GX		$\phi 0.8$ to $\phi 3.5$ mm approx. $\phi 0.031$ to $\phi 0.138$ in approx.														

Note: Refer to [LIST OF FIBERS](#) (p.12~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

Lens (For reflective type fiber)

For reflective type fiber

Designation	Model No.	Description														
Parallel light lens	FX-MR9		Long-range parallel light - Applicable fibers: FD-R33EG, FD-EG31, FD-R34EG, FD-R32EG, FD-EG30, FD-R35G, FD-42G, FD-32G, FD-32GX - Ambient temperature: -55 to +70 °C +67 to +158 °F (Note)	Sensing range for FX-250 series												
				<table><tr><th>Fiber model No.</th><th>Sensing range</th><th>Spot diameter</th></tr><tr><td>FD-R33EG FD-EG31</td><td rowspan="5">0 to 30 mm 0.394 to 1.181 in</td><td rowspan="5">ø4.0 mm approx. ø0.157 in approx.</td></tr><tr><td>FD-R34EG</td></tr><tr><td>FD-R32EG FD-EG30</td></tr><tr><td>FD-R35G FD-42G FD-32G/32GX</td></tr></table>	Fiber model No.	Sensing range	Spot diameter	FD-R33EG FD-EG31	0 to 30 mm 0.394 to 1.181 in	ø4.0 mm approx. ø0.157 in approx.	FD-R34EG	FD-R32EG FD-EG30	FD-R35G FD-42G FD-32G/32GX			
				Fiber model No.	Sensing range	Spot diameter										
				FD-R33EG FD-EG31	0 to 30 mm 0.394 to 1.181 in	ø4.0 mm approx. ø0.157 in approx.										
				FD-R34EG												
FD-R32EG FD-EG30																
FD-R35G FD-42G FD-32G/32GX																
Pinpoint spot lens	FX-MR1		Pinpoint spot of ø0.5 mm ø0.020 in. Enables detection of minute objects or small marks. - Distance to focal point: 6 ± 1 mm 0.236 ± 0.039 in - Applicable fibers: FD-42G - Ambient temperature: -40 to +70 °C -40 to +158 °F (Note)													
Zoom lens	FX-MR2		The spot diameter is adjustable from ø0.7 to ø2 mm ø0.028 to ø0.079 in according to how much the fiber is screwed in. - Applicable fibers: FD-42G - Ambient temperature: -40 to +70 °C -40 to +158 °F (Note) - Accessory: MS-EX3 (mounting bracket)	Sensing range for FX-250 series												
				<table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>7 mm 0.276 in</td><td>18.5 mm approx. 0.728 in approx.</td><td>ø0.7 mm approx. ø0.028 in approx.</td></tr><tr><td>12 mm 0.472 in</td><td>27 mm approx. 1.063 in approx.</td><td>ø1.2 mm approx. ø0.047 in approx.</td></tr><tr><td>14 mm 0.551 in</td><td>43 mm approx. 1.693 in approx.</td><td>ø2.0 mm approx. ø0.079 in approx.</td></tr></table>	Screw-in depth	Distance to focal point	Spot diameter	7 mm 0.276 in	18.5 mm approx. 0.728 in approx.	ø0.7 mm approx. ø0.028 in approx.	12 mm 0.472 in	27 mm approx. 1.063 in approx.	ø1.2 mm approx. ø0.047 in approx.	14 mm 0.551 in	43 mm approx. 1.693 in approx.	ø2.0 mm approx. ø0.079 in approx.
				Screw-in depth	Distance to focal point	Spot diameter										
				7 mm 0.276 in	18.5 mm approx. 0.728 in approx.	ø0.7 mm approx. ø0.028 in approx.										
12 mm 0.472 in	27 mm approx. 1.063 in approx.	ø1.2 mm approx. ø0.047 in approx.														
14 mm 0.551 in	43 mm approx. 1.693 in approx.	ø2.0 mm approx. ø0.079 in approx.														
Zoom lens (side-view type)	FX-MR5		FX-MR2 is converted into a side-view type and can be mounted in a very small space. - Applicable fibers: FD-42G - Ambient temperature: -40 to +60 °C -40 to +140 °F (Note)	Sensing range for FX-250 series												
				<table><tr><th>Screw-in depth</th><th>Distance to focal point</th><th>Spot diameter</th></tr><tr><td>8 mm 0.315 in</td><td>13 mm approx. 0.512 in approx.</td><td>ø0.5 mm approx. ø0.020 in approx.</td></tr><tr><td>10 mm 0.394 in</td><td>15 mm approx. 0.591 in approx.</td><td>ø0.8 mm approx. ø0.031 in approx.</td></tr><tr><td>14 mm 0.551 in</td><td>30 mm approx. 1.181 in approx.</td><td>ø3.0 mm approx. ø0.118 in approx.</td></tr></table>	Screw-in depth	Distance to focal point	Spot diameter	8 mm 0.315 in	13 mm approx. 0.512 in approx.	ø0.5 mm approx. ø0.020 in approx.	10 mm 0.394 in	15 mm approx. 0.591 in approx.	ø0.8 mm approx. ø0.031 in approx.	14 mm 0.551 in	30 mm approx. 1.181 in approx.	ø3.0 mm approx. ø0.118 in approx.
				Screw-in depth	Distance to focal point	Spot diameter										
				8 mm 0.315 in	13 mm approx. 0.512 in approx.	ø0.5 mm approx. ø0.020 in approx.										
10 mm 0.394 in	15 mm approx. 0.591 in approx.	ø0.8 mm approx. ø0.031 in approx.														
14 mm 0.551 in	30 mm approx. 1.181 in approx.	ø3.0 mm approx. ø0.118 in approx.														

Note: Refer to [LIST OF FIBERS](#) (p.12~) for the ambient temperature of fibers to be used in combination.

FIBER OPTIONS

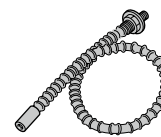
Others

Designation	Model No.	Description					
Protective tube for thru-beam type fiber	FTP-500 (0.5 m 1.640 ft)	For M4 thread	Applicable fibers	FT-42 FT-42S FT-42W	FT-43 FT-H13-FM2	The protective tube, made of non-corrosive stainless steel, protects the inner fiber cable from any external forces.	
	FTP-1000 (1 m 3.281 ft)						
	FTP-1500 (1.5 m 4.921 ft)	For M3 thread		FT-31 FT-31S FT-31W	FD-31 FD-31W		
	FTP-N500 (0.5 m 1.640 ft)						
	FTP-N1000 (1 m 3.281 ft)						
	FTP-N1500 (1.5 m 4.921 ft)						
Protective tube for reflective type fiber	FDP-500 (0.5 m 1.640 ft)	For M6 thread		FD-61 FD-61S FD-61W	FD-62 FD-H13-FM2		
	FDP-1000 (1 m 3.281 ft)						
	FDP-1500 (1.5 m 4.921 ft)	For M4 thread			FD-41 FD-41W		FD-41S FD-41SW
	FDP-N500 (0.5 m 1.640 ft)						
	FDP-N1000 (1 m 3.281 ft)						
	FDP-N1500 (1.5 m 4.921 ft)						
Universal sensor mounting stand	MS-AJ1-F	Horizontal mounting type		Mounting stand assembly for fiber (For M3, M4 or M6 threaded head fiber)			
	MS-AJ2-F	Vertical mounting type					
Liquid inflow prevention joint (Note)	MS-FX-01Y	Applicable fibers	FD-HF40Y	This joint suppresses false operations due to liquid slip-in from the top of the protective tube.			
Protective tube extension joint (Note)	MS-FX-02Y			The protective tube can be extended.			
Fiber mounting joint (Note)	MS-FX-03Y			The joint is used for mounting fibers on a tank.			
Single core holder	FX-AT15A	The incident light intensity may vary when using a multi-core fiber or a thin type sharp bending fiber. This holder suppresses the variation in the incident light intensity. (Brown)					
Reflector	RF-210	Used with FR-Z50HW. Refer to p.23 for the sensing range of FR-Z50HW to be used in combination.					
	RF-220						
	RF-230						

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

Protective tube

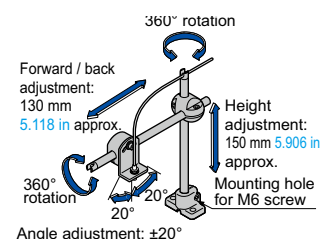
- FTP-□
- FDP-□



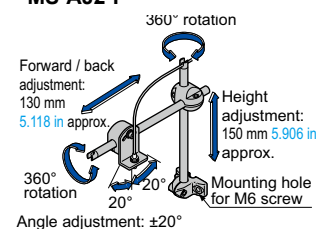
Universal sensor mounting stand

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

- MS-AJ1-F



- MS-AJ2-F



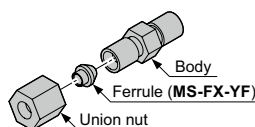
Single core holder

- FX-AT15A



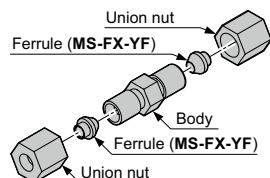
Liquid inflow prevention joint

- MS-FX-01Y



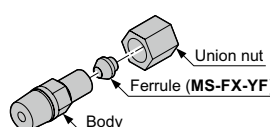
Protective tube extension joint

- MS-FX-02Y



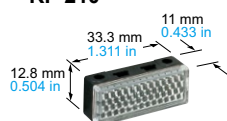
Fiber mounting joint

- MS-FX-03Y

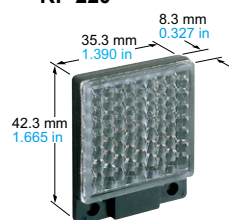


Reflector

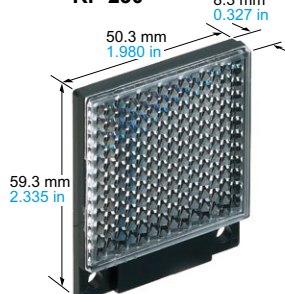
- RF-210



- RF-220



- RF-230

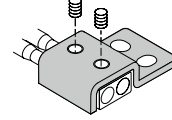


Model No. when ordering heat-resistant fibers individually as spare parts

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

Model No. when ordering vacuum-resistant fibers 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)
- Fiber at atmospheric side
FT-J8 (one pair set)
- Mouting bracket for **FD-KZ50V** / **FD-H30-KZ1V(-S)**
MS-FD-2



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 $\phi 1\text{mm}$ $\phi 0.039\text{ in}$ / $\phi 1.3\text{mm}$ $\phi 0.051\text{ in}$ fiber cable / $\phi 4\text{mm}$ $\phi 0.157\text{ in}$ protective tube)
- FX-CT4** (Fiber cutter for $\phi 2\text{mm}$ $\phi 0.079\text{ in}$ fiber cable / $\phi 4\text{mm}$ $\phi 0.157\text{ in}$ protective tube)
- FX-AT2** (Attachment for fixed-length fiber, Orange)
- FX-AT3** (Attachment for $\phi 2.2\text{ mm}$ $\phi 0.087\text{ in}$ fiber, Clear orange)
- FX-AT4** (Attachment for $\phi 1\text{ mm}$ $\phi 0.039\text{ in}$ fiber, Black)
- FX-AT5** (Attachment for $\phi 1.3\text{ mm}$ $\phi 0.051\text{ in}$ fiber, Gray)
- FX-AT6** (Attachment for $\phi 1\text{ mm}$ $\phi 0.039\text{ in}$ / $\phi 1.3\text{ mm}$ $\phi 0.051\text{ in}$ mixed fiber, Black / Gray)
- FX-AT4G1** (Gland single for $\phi 1\text{ mm}$ $\phi 0.039\text{ in}$ fiber, Black)
- FX-AT5G1** (Gland single for $\phi 1.3\text{ mm}$ $\phi 0.051\text{ in}$ fiber, Gray)
- FX-AT6G1** (Gland single for $\phi 1\text{ mm}$ $\phi 0.039\text{ in}$ / $\phi 1.3\text{ mm}$ $\phi 0.051\text{ in}$ mixed fiber, Black / Gray)
- FX-SL1** (Slit mask for **FT-A11** / **FT-A11W** (one pair set), slit size: $0.5 \times 12\text{ mm}$ $0.020 \times 0.472\text{ in}$)
- FX-SL2** (Slit mask for **FT-A11** / **FT-A11W** (one pair set), slit size: $1 \times 12\text{ mm}$ $0.039 \times 0.472\text{ in}$)
- FX-SL3** (Slit mask for **FT-A32** / **FT-A32W** (one pair set), slit size: $0.5 \times 33\text{ mm}$ $0.020 \times 1.299\text{ in}$)
- MS-FD-2** (Fiber mounting bracket)
- MS-FD-F7-1** (SUS mounting bracket for **FD-F71**)
- MS-FD-F7-2** (PVC mounting bracket for **FD-F71**)

• RF-003



• RF-13



• FX-CT2



• FX-CT3



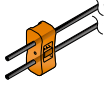
• FX-CT4



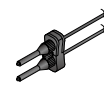
• FX-AT2



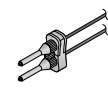
• FX-AT3



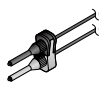
• FX-AT4



• FX-AT5



• FX-AT6



• FX-AT4G1



• FX-AT5G1



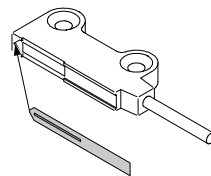
• FX-AT6G1



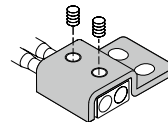
• FX-SL1

• FX-SL2

• FX-SL3

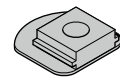


• MS-FD-2



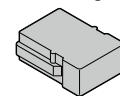
• MS-FD-F7-1

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



• MS-FD-F7-2

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



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